



agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

ALGOA BAY SEA-BASED AQUACULTURE DEVELOPMENT ZONE

BASIC ASSESSMENT PROCESS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998)



Draft Basic Assessment Report July 2019



ANCHOR
research & monitoring

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NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998
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Draft Basic Assessment Report

July 2019

Report Prepared for:
Department of Agriculture, Forestry & Fisheries

Report Prepared by:



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PROJECT DETAILS

Objective	Application for Environmental Authorisation in terms of the National Environmental Management Act, 1998 (Act No 107 of 1998)
Applicant	Department of Agriculture, Forestry & Fisheries
Environmental Assessment Practitioner (EAP)	Vera Massie under supervision of Dr Barry Clark from Anchor Research & Monitoring (Pty) Ltd
Anchor Project Name	Algoa Bay Sea-based Aquaculture Development Zone Basic Assessment Process
Anchor Project Number	1808
Report name	Algoa Bay Sea-based Aquaculture Development Zone, Basic Assessment Process in Terms of the National Environmental Management Act, 1998 (Act No. 107 Of 1998) - Draft Basic Assessment Report
Status	Application phase
Application submission date	To be confirmed
Competent Authority Reference	Not currently assigned
Case Officer	Not currently assigned

OVERVIEW OF PROJECT OUTPUTS BASIC ASSESSMENT REPORT AND APPENDICES

Basic Assessment Report (BAR)	Pre-Application BAR – Released for comment between 28 March and 30 April 2019 Draft BAR - Current Final BAR – To be completed after application-phase public participation period
Appendix A	Environmental Management Programme (EMPr)
Appendix B	Details of EAP, Expertise and Declaration
Appendix C	Details of Specialists, Expertise and Declaration
Appendix D	Specialist studies: <ol style="list-style-type: none"> 1. Benthic Mapping Assessment for the Proposed Algoa Bay Sea-based Aquaculture Development Zone (Dawson <i>et al.</i> 2019) 2. Dispersion Modelling Study for the Proposed Algoa Bay Sea-based Aquaculture Development Zone (Wright <i>et al.</i> 2019) 3. Marine Specialist Study 2019 (Hutchings <i>et al.</i> 2019) 4. Maritime Underwater Heritage Specialist Study (Gribble 2019) 5. Comparative Assessments for the Development of the Proposed Sea-based Aquaculture Development Zone Located within Algoa Bay in the Eastern Cape in South Africa (Rhodes University August 2016) <ol style="list-style-type: none"> a. Socio-economic Report b. Ecological Report c. Feasibility study
Appendix E	Background Information Document
Appendix F	Stakeholder Consultation Report

NOTE:

In response to stakeholder comments, the pre-application Basic Assessment Report (BAR) (Anchor Report 1808/1) was updated at the end of the pre-application commenting period (28 March – 30 April 2019) to produce the Draft BAR.

All changes to the content in the Draft BAR are underlined for easier reference. A Stakeholder Consultation Report, reflecting stakeholder comments received during the pre-application stakeholder engagement process and responses by Anchor, specialists and DAFF, is included in Appendix F.

COMPLIANCE CHECKLIST

Regulation 326 of NEMA, Appendix 1 Section 3: “Scope of assessment and content of basic assessment reports”

The following table is included as a guide for stakeholders and officials reviewing this report during the commenting and decision-making period. The table below contains the minimum requirements for a Basic Assessment Report as detailed in Sub-section (1) and guides the reader to the relevant Chapter/Sections/Appendices where specific aspects are detailed.

Sub-section	Requirement	Chapter/Section/Appendix reference
(a)	Details of – (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae;	Section 3.5.1 and Appendix B
(b)	The location of the activity, including: (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; (iii) where the required information in items (i) and (ii) is not available, the (iv) coordinates of the boundary of the property or properties;	Section 3.5
(c)	A plan which locates the proposed activity or activities applied for as well as associated structures and infrastructure at an appropriate scale; or, if it is— (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Section 4.5
(d)	A description of the scope of the proposed activity, including— (i) all listed and specified activities triggered and being applied for; and (ii) a description of the activities to be undertaken including associated structures and infrastructure	Section 5.2 and Chapter 4
(e)	A description of the policy and legislative context within which the development is proposed including— (i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and (ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;	Chapter 4 and Chapter 7
(f)	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Chapter 6
(g)	A motivation for the preferred site, activity and technology alternative;	To be completed
(h)	A full description of the process followed to reach the proposed preferred alternative within the site, including – (i) details of all the alternatives considered (ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 4.5, Appendix F, Chapter 9, Chapter 10, Chapter 11, Chapter 2

Sub-section	Requirement	Chapter/Section/ Appendix reference
	<ul style="list-style-type: none"> (iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them (iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts— <ul style="list-style-type: none"> a. can be reversed; b. may cause irreplaceable loss of resources; and c. can be avoided, managed or mitigated; (vi) the methodology used in determining and ranking the nature, significance, (vii) consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives; (viii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (ix) the possible mitigation measures that could be applied and level of residual risk; (x) the outcome of the site selection matrix; (xi) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and (xii) a concluding statement indicating the preferred alternatives, including preferred location of the activity; 	
(i)	<p>A full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including—</p> <ul style="list-style-type: none"> (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures; 	Section 10.2
(j)	<p>An assessment of each identified potentially significant impact and risk, including—</p> <ul style="list-style-type: none"> (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of <ul style="list-style-type: none"> (i) resources; and (ii) the degree to which the impact and risk can be avoided, managed or mitigated; 	Chapter 10
(k)	<p>Where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report;</p>	Section 10.3
(l)	<p>An environmental impact statement which contains—</p> <ul style="list-style-type: none"> (i) a summary of the key findings of the environmental impact assessment; 	Chapter 2

Sub-section	Requirement	Chapter/Section/Appendix reference
	(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	
(m)	Based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the EMPr;	Section 10.3
(n)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Chapter 2
(o)	A description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Chapter 10 (detailed for each impact category)
(p)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Chapter 2
(q)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	N/A
(r)	An undertaking under oath or affirmation by the EAP in relation to – (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties;	Appendix B
(s)	Where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	N/A
(t)	Any specific information that may be required by the competent authority; and	N/A
(u)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A

ANCHOR RESEARCH & MONITORING (PTY) LTD

Organisational Background

Anchor Research & Monitoring is part of the Anchor Environmental group of companies. We are based in Cape Town, South Africa, and have a core staff of sixteen professionals with tertiary level qualifications in environmental science and management. We offer ecological and economic expertise to inform management and decision making regarding the use and conservation of natural resources. Our main areas of focus are marine, estuarine and freshwater ecosystems, terrestrial, ecosystems, ecosystem services, livelihoods and socio-economics, resource economics, conservation policy, strategy and planning, natural resource management, environmental management and environmental flows. Our work includes ecological and socio-economic research and baseline studies, environmental impact assessments, environmental management plans and environmental flow assessments. We are experienced in ecological sampling methods, social survey methods, statistics and econometrics, ecological-economic modelling, geographic information systems as well as stakeholder coordination, engagement and maintaining of stakeholder relations.

We see the bigger picture and simplify complex problems to provide rational and pragmatic solutions. Our staff are associates of the University of Cape Town and have produced more than 500 technical reports and we have published over 100 scientific papers and regularly participate in international conferences. We have worked on projects throughout southern and eastern Africa. We have our own library of over 1000 books and reports and 6500 published papers, as well as access to the University of Cape Town's library services. We are strong in project management and draw from an excellent network of proven specialists as required.

Relevant Experience

We have considerable experience in the aquaculture sector, including our involvement in drafting legislation, baseline monitoring, environmental impact assessment, stakeholder consultation, application for environmental authorisation, substantive amendment of existing environmental authorisation, and long-term monitoring of the marine environment at impacted precincts.

Aquaculture projects completed recently include two basic assessment processes pertaining to aquaculture projects. Diamond Coast Aquaculture (Pty) Ltd obtained environmental authorisation on 12 December 2018 for the expansion of their existing land-based aquaculture facility just outside of Kleinsee. No objections were submitted during the appeals phase. Port Nolloth Sea Farms Ranching (Pty) Ltd ranches abalone in the Northern Cape Concession Area NC 3 and requires an abalone holding and processing facility to support the abalone ranching business. Environmental authorisation was granted on 28 March 2019 and no objections were submitted during the appeal phase.

We have completed a number of other projects for the South African aquaculture and fisheries sector (e.g. Atlantic Salmon, Southern Cross Salmon, Kleinsee Mariculture, Abagold Ltd, Port Nolloth Seafarms, Viking Fishing, and Molapong Aquaculture). In 2013, Anchor assisted the Department of Environmental Affairs and Development Planning (DEADP) in drafting national standards for the

abalone and trout farming industries. The long-term monitoring study in Saldanha Bay and Langebaan Lagoon (annual State of the Bay Report since 2008) annually updates an elaborate section on the aquaculture sector and marine ecological impacts in Saldanha Bay. Refer to the Curricula Vitae of Dr Barry Clark, Vera Massie, Dr Kenneth Hutchings, Erika Brown, Dr Megan Laird, Amy Wright, Jessica Dawson and Songezo Mtsokoba for details on these and other projects (Appendix B and C).

The proposed structure and composition of the project team is summarised in the table below. All key areas of expertise required for the assignment are encompassed by the qualifications and experience of the project team members including project management, environmental management within the context of marine biodiversity, aquaculture sector, GIS/Spatial planning, experience in the field, and stakeholder consultation. A brief overview of the company (Anchor Environmental) is provided below along with profiles for the core team members. Curricula Vitae for each of the core team members is included in Appendix B and C of the Basic Assessment Report.

Table 1 Professional Anchor staff to be deployed on the project.

Name of Staff	Area of Expertise	Position Assigned	Task Assigned
Barry Clark	Marine and coastal ecology, natural resource management, Environmental Management,	Project manager	Supervision of deliverables
Vera Massie	Environmental Management, environmental legislation, marine biology, invasion biology, stakeholder consultation	Project coordinator and principal EAP	Overall coordination, execution of deliverables, stakeholder consultation, training of junior staff
Ken Hutchings	Aquaculture, fisheries and marine ecology	Marine ecology and aquaculture specialist	Reviewer of marine biology and ecology related aspects. Supervision of Benthic Habitat Mapping and Dispersion modelling studies.
Erika Brown	Geographic Information Systems – Mapping and Conservation Planning	GIS specialist	Produce maps for the BAR
Megan Laird	Marine and coastal ecology, impact assessment	Marine ecology specialist study	Assistance with the marine specialist impact assessment.
Amy Wright	Marine and coastal ecology, impact assessment, dispersion and carrying capacity modelling	Dispersion and carrying capacity modelling	Dispersion modelling, assistance with the marine specialist impact assessment, project description
Jessica Dawson	Estuarine and benthic ecology, taxonomy	Benthic community analyses and description	Benthic mapping report
Songezo Mtsokoba	Laboratory technician, environmental management	Junior staff, expand skills in environmental management	Support and skills development during all phases of the project.

Summary profiles

Dr Barry Clark

Dr Barry Clark has twenty-one years' experience in estuarine, freshwater, terrestrial and marine biological research and consulting. He has worked as a scientific researcher, lecturer and consultant and has experience in tropical, subtropical and temperate ecosystems. He is presently Director of an Environmental Consultancy firm (Anchor Environmental Consultants) and Research Associate at the University of Cape Town. As a consultant he has been concerned primarily with conservation planning, monitoring and assessment of human impacts on freshwater, estuarine, terrestrial and marine ecosystems, aquaculture and fisheries. Dr Clark is the author of 27 scientific publications in class A scientific journals as well as numerous scientific reports and popular articles in the free press. Geographically, his main area of expertise is southern Africa (South Africa, Lesotho, Namibia, Mozambique, Tanzania, Seychelles, Mauritius and Angola), but he also has working experience from elsewhere in Africa (Cote d'Ivoire, Ghana, Nigeria, Liberia), the Middle East (UAE) and Europe (Azerbaijan).

Vera Massie

Vera earned degrees in marine biology, environmental management and conservation biology from the University of Cape Town. Her training has equipped her to consult on research projects incorporating the maintenance and conservation of marine and estuarine ecosystems. She also consults on the biophysical, socio-economic and legal aspects in the assessment of human impacts on coastal and terrestrial environments in the temperate and tropical regions of South Africa. Working at Anchor Environmental Consultants, she has gained experience in drafting environmental legislation, preparing guidelines and developing frameworks to facilitate successful implementation of legislation. Many of her projects involve the monitoring and evaluation of compliance with environmental laws and their associated regulations across varying economic sectors.

Dr Kenneth Hutchings

Dr Hutchings has research and consulting experience in the fields of fisheries management, mariculture, estuarine research and management, marine and estuarine spatial planning, marine impact assessment, research and conservation strategy development, fishery socio-economic surveys and analyses, biological sampling and life-history analyses of fish (age and growth, reproduction, mortality, migration, diet, ecology), taxonomic methodology, population genetics, fisheries modelling, marine ecotoxicity trials, trace metal pollution and physico-chemical, ecological and biodiversity surveys of marine, estuarine and freshwater habitats. Dr Hutchings is experienced in developing estuarine and coastal management plans and in conducting public participation processes. Dr Hutchings is a research associate of the University of Cape Town's Marine Research Institute. He has excellent verbal and writing communication skills, is competent with most software packages used in scientific research and consulting projects.

He has published 17 scientific papers and compiled more than 50 consulting reports. Dr Hutchings is comfortable working as part of a team in both a leadership and mentoring position or as a team member. Dr Hutchings has participated in international collaborative studies in Angola, Tanzania, Namibia, Sierra Leone and Mauritius and has visited and participated in fisheries in Mozambique, Madagascar, Seychelles, New Zealand and Belize. He was actively involved in commercial fishing around Cape Town for 14 years, has practical experience in several sectors and has good

understanding of most commercial fishing methods (line, spear, pole, gill net, trammel, net, beach seine net, trap, longline, trawl and purse-seine). He has personally collected scientific data for the demersal trawl and longline hake fisheries, designed, implemented and managed fishery observer training programmes for line, longline, lobster trap and demersal trawl fisheries. He has project managed and completed two, three-year contract research projects for the South African Department of Environmental Affairs and Tourism (Marine and Coastal Management) and numerous consulting projects for state and private sector clients.

Erika Brown

Erika has a natural passion for marine environments having spent most of her free time in childhood on or in the Chesapeake Bay and its tributaries. As a young adult her interests lead her to coastal upwelling environments in Northern California and Alaska where she studied at San Francisco State University and gained work experience with the Department of Fish and Game, California and the United States Geological Survey, BSO, Alaska, in the field and in cartography/GIS related projects. It was during this time that her interest in marine micro- organisms and large-scale oceanographic processes was piqued and prompted her MSc. work in Southern Ocean phytoplankton ecology and carbon sequestration at the University of Cape Town. All the while, her connection to upwelling systems was sustained and her knowledge of southern Africa fisheries and MPA management bolstered through a research assistant position at the Marine Research Institute, UCT and various capacity building projects whilst studying. A permanent resident of South Africa, her current work at Anchor Environmental is a composite of marine mapping and spatial planning, invertebrate taxonomy, quantitative data analysis and scientific writing to guide marine conservation and more sustainable coastal and offshore economic development in southern Africa.

Dr Megan Laird

Dr Megan Laird is a senior consultant at Anchor Environmental Consultants (Pty) Ltd. with four years of experience in managing a broad range of marine and coastal projects in South Africa and Namibia. These include marine and coastal specialist studies for Environmental Impacts Assessments (EIAs) and long-term marine and estuarine environmental monitoring studies. She has also acquired skills in the modelling of effluent that is discharged into the marine environment from land-based sources. She earned degrees in zoology and ecology (BSc, BSc-Honours) and marine biology (PhD) from the University of Cape Town. Dr Laird is the author of numerous scientific publications, consulting reports and popular articles in the free press.

Amy Wright

Amy has earned an MSc degree in biological sciences and BSc. Hons degrees in marine biology and applied biology from the University of Cape Town. Her training has equipped her to consult on research projects incorporating the maintenance and conservation of marine and estuarine ecosystems. Her interests include fisheries management, systems ecology and taxonomy. Amy specialises in fluid dynamic modelling of effluent into both freshwater and marine systems to inform water regulatory guideline compliance and pipeline design. Many of her projects involve monitoring and evaluation, across varying economic sectors. She also conducts biophysical and socio-economic aspects in the assessment of human impacts on temperate and tropical coastal regions of South Africa, is involved in monitoring program development as well as data collection, data management and analysis, and has worked as an invertebrate taxonomist for the De Beers Marine Namibia and the NAMDEB Diamond Corporation Environmental Monitoring Programmes. She is the author of two

scientific publications in class A scientific journals as well as numerous popular articles in the free press.

Jessica Dawson

Jessica will shortly submit her PhD in estuarine ecology at the University of Cape Town, where she completed her MSc and Honours degrees in Zoology/Biological Sciences, and a BSc in Marine Biology and Oceanography. Her training included the taxonomic description of three new species and ecological studies on the impact of target species on their environments. This has equipped her to interpret community data and assist in monitoring and biological assessment reports. She is the author of four scientific publications in peer reviewed journals.

Songezo Mtsokoba

Songezo earned a National Diploma and BTech in environmental management from the Cape Peninsula University of Technology. His training equipped him to understand various aspects of the environment and to identify significant impacts on the environment and human health. Working at Anchor Environmental Consultants, he has gained experience in the field of environmental management. Furthermore, as a laboratory technician and field assistant, he gained specialised skills, which include sediment particle size distribution analysis using a Horiba Laser Particle Size Analyser. More recently he has been undergoing training in benthic macrofauna taxonomy. He regularly provides assistance in the field for marine, estuarine and coastal environmental baseline and monitoring projects required to ensure compliance with environmental laws and their associated regulations across varying economic sectors.

MARITIME HERITAGE ASSESSMENT: ACO ASSOCIATES CC

Anchor appointed John Gribble from ACO Associates cc to conduct the Maritime Heritage Assessment as part of the Basic Assessment process for the proposed sea-based Aquaculture Development Zone in Algoa Bay. A summary profile for John Gribble is included below. His CV is enclosed in Appendix 5 of the Maritime Heritage Impact Assessment study in Appendix D of this BAR.

John Gribble has nearly 30 years of combined archaeological and heritage management experience. After completing my postgraduate studies, which were focussed on the vernacular architecture of the West Coast, and a period of freelance archaeological work in South Africa and abroad, he joined the National Monuments Council (NMC) (now the South African Heritage Resources Agency (SAHRA)) in 1994. As the Heritage Officer: the Boland he was involved in day to day historical building control and heritage resources management across the region. In 1996 he became the NMC's first full-time maritime archaeologist in which role was responsible for the management and protection of underwater cultural heritage in South Africa under the National Monuments Act, and subsequently under the National Heritage Resources Act.

In 2005 he moved to the UK to join Wessex Archaeology, one of the UK's biggest archaeological consultancies, as a project manager in its Coastal and Marine Section. In 2009 he joined Fugro EMU Limited, a marine geosurvey company based in Southampton to set up their maritime archaeological

section. He then spent a year at TUV SUD PMSS, an international renewable energy consultancy based in Romsey, where he again provided maritime archaeological consultancy services to principally the offshore renewable and marine aggregate industries.

In August 2012 he set up Sea Change Heritage Consultants Limited, a maritime archaeological consultancy. Sea Change provides archaeological services to a range of UK maritime sectors, including marine aggregates and offshore renewable energy. It also actively pursues opportunities to raise public awareness and understanding of underwater cultural heritage through educational and research projects and programmes, including some projects being developed in South Africa.

Projects include specialist archaeological consultancy for more than 15 offshore renewable energy projects and more than a dozen offshore aggregate extraction licence areas.

In addition to managing numerous UK development-driven archaeological projects, he has also been involved in important strategic work which developed guidance and best practice for the offshore industry with respect to the marine historic environment. This has included the principal authorship of two historic environment guidance documents for COWRIE and the UK renewable energy sector, and the development of the archaeological elements of the first Regional Environmental Assessments for the UK marine aggregates industry. In 2013-14 he was lead author and project co-ordinator on the Impact Review for the United Kingdom of the 2001 UNESCO Convention on the Protection of the Underwater Cultural Heritage. In 2016 he was co-author of a Historic England / Crown Estate / British Marine Aggregate Producers Association funded review of marine historic environment best practice guidance for the UK offshore aggregate industry.

He returned to South African in mid-2014 where he was re-appointed to his earlier post at SAHRA: Manager of the Maritime and Underwater Cultural Heritage Unit. In July 2016 he was also appointed Acting Manager of SAHRA's Archaeology, Palaeontology and Meteorites Unit.

He left SAHRA in September 2017 to join ACO Associates as Senior Archaeologist and Consultant.

He has been a member of the ICOMOS International Committee for Underwater Cultural Heritage since 2000 and has served as a member of its Bureau since 2009. He is currently the secretary of the Committee.

He has been a member of the Association of Southern African Professional Archaeologists for more than twenty years and is accredited by ASAPA's CRM section. He has been a member of the UK's Chartered Institute for Archaeologist's (CIfA) since 2005, and served on the committee of its Maritime Affairs Group between 2008 and 2010. Since 2010 he has been a member of the UK's Joint Nautical Archaeology Policy Committee.

He is currently a member of the Advisory Board of the George Washington University / Iziko Museums of South Africa / South African Heritage Resources Agency / Smithsonian Institution 'Southern African Slave Wrecks Project' and serve on the Heritage Western Cape Archaeology, Palaeontology and Meteorites Committee.

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GLOSSARY

Alien	An organism occurring outside its natural past or present range and dispersal potential including any parts of the organism that might survive and subsequently reproduce (organisms whose dispersal is caused by human action).
Anaerobic conditions	The absence of molecular oxygen or air
Bathymetry	The measured depth of water in oceans, seas, or lakes
Bioaccumulation	The process where the chemical concentration in an aquatic organism achieves a level that exceeds that in the water as a result of chemical uptake through all routes of chemical exposure (e.g. dietary absorption, transport across the respiratory surface, dermal absorption).
Bioconcentration	The intake and retention of a substance in an organism entirely by respiration from water in aquatic ecosystems or from air in terrestrial organisms.
Biomagnification	Synonym: bioamplification or biological magnification. The increasing concentration of a substance, such as a toxic chemical, in the tissues of organisms at successively higher levels in a food chain.
Biosecurity	A set of preventive measures designed to reduce the risk of transmission of infectious diseases, quarantined pests, invasive alien species, and living modified organisms.
Chemical oxygen demand	A measure of the capacity of water to consume oxygen during the decomposition of organic matter and the oxidation of inorganic chemicals such as Ammonia and nitrite.
Chlorophyll	The green pigment found in the chloroplasts of higher plants and in cells of photosynthetic microorganisms (e.g. photosynthetic bacteria), which is primarily involved in absorbing light energy for photosynthesis.
Coliforms	Gram-negative, non-spore-forming, oxidase-negative, rod-shaped facultative anaerobic bacteria that ferment lactose (with β -galactosidase) to acid and gas within 24– 48h at $36\pm 2^{\circ}\text{C}$. Not specific indicators of faecal pollution.
Cumulative impacts	The impacts which combine from different projects and which result in significant change, which is larger than the sum of all the impacts.
Endemic	Organisms restricted to a specified region or locality.
Enterococci and faecal streptococci	Enterococci and faecal streptococci both refer to vaguely defined groups of Gram-positive spherical bacteria, some of which are members of the natural flora of various environments. Because of the limited specificity of tests commonly used for these groups, they can, for all practical purposes be considered to be the same.
Environmental Management Programme	A programme for managing potential impacts identified during the approval process.

<i>Escherichia coli</i>	Member of the group of faecal coliform bacteria. It is highly specific to the faeces of warm-blooded animals and cannot multiply in any natural water environment.
Euphotic zone	In a water body, the layer closer to the surface that receives enough light for photosynthesis to occur.
Exotic	See definition of 'Alien'
Fallowing	To make fallow for agriculture purposes. Fallow: land that has undergone ploughing and harrowing and has been left unseeded for one or more growing seasons.
Fauna	General term for all of the animals found in a particular location.
Flagellum	Plural flagella or flagellums. In protists, a long, whip like membrane-enclosed organelle used for locomotion or feeding. In bacteria, a long, whip like proteinaceous appendage, used for locomotion.
Flora	General term for all of the plant life found in a particular location.
Interested and Affected Parties	All stakeholders that have an interest in and/or are affected by the proposed development.
Introduction	Direct or indirect movement of an organism within its past or present range to a range outside its distribution potential.
Invasive	Alien organisms that have naturalised in a new area and are expanding their range.
Invertebrate	An animal that has no backbone or spinal column and therefore does not belong to the subphylum Vertebrata of the phylum Chordata
Macrobenthos	Benthic organisms that are big enough to be seen with the naked eye.
Microbial indicator organisms	Micro-organisms that may not pose a major human health risk, but that are indicative of the presence of human pathogens.
Mixing zone	A mixing zone is an administrative construct which defines a limited area or volume of the receiving water where the initial dilution of a discharge is allowed to occur, until the water quality standards are met. In practice, it may occur within the near-field or far-field of a hydrodynamic mixing process and therefore depends on source, ambient, and regulatory constraints.
Native	An organism occurring within its natural past or present range and dispersal potential (organisms whose dispersal is independent of human intervention).
Phytoplankton	Mostly microscopic, single-celled photosynthetic organisms that live suspended in water. Like land plants, they take up carbon dioxide, make carbohydrates using light energy, and release oxygen.

Species	Is defined in terms of the National Environmental Management: Biodiversity Act (Act No 10 of 2004), which means a kind of animal, plant or other organism that does not normally interbreed with individuals of another kind, and includes any subspecies, cultivar, variety, geographic race, strain, hybrid or geographically separate population.
Stormwater	Rain that washes off driveways, parking lots, roads, yards, rooftops, and other hard surfaces and is carried away through a system of pipes that is separate from the sewerage system. Stormwater is not treated and is often highly polluted.
Turbidity	The cloudiness or haziness of a fluid caused by large numbers of individual organic and/or inorganic particles that are generally invisible to the naked eye, similar to smoke in air. The measurement of turbidity is a key test of water quality.
Upwelling	A process that is induced by offshore winds transporting coastal surface water offshore, which is replaced by rising deep, cold and nutrient-rich water.
Zooplankton	Plankton that is of animal origin.

ABBREVIATIONS

ADZ	Aquaculture Development Zone
ABYC	Algoa Bay Yacht Club
BA	Basic Assessment
BAR	Basic Assessment Report
BBBEE	Broad-Based Black Economic Empowerment
CDC	Coega Development Corporation
COD	Chemical Oxygen Demand
CWDP	Coastal Waters Discharge Permit
DAFF	Department of Agriculture Forestry and Fisheries
DEA	Department of Environmental Affairs
DEA:O&C	Department of Environmental Affairs Branch: Oceans & Coasts
DEADP	Department of Environmental Affairs and Development Planning
DEAT	Department of Environmental Affairs and Tourism
DEDT	Department of Economic Development and Tourism
DM	District Municipality
DIN	Dissolved Inorganic Nitrogen
DIP	Dissolved Inorganic Phosphate
DO	Dissolved oxygen
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
I&AP	Interested and Affected Party
	National Environmental Management: Integrated Coastal Management
ICMA	Act (Act 24 of 2008)
IDP	Integrated Development Plan
IDZ	Industrial Development Zone
LM	Local Municipality
MCM	Marine Coastal Management
MLRA	Marine Living Resources Act (Act 18 of 1998)
MPA	Marine Protected Area
MSPA	Marine Spatial Planning Act (Act 16 of 2019)
NEM: WA	National Environmental Management: Waste Act (Act 59 of 2008)
	National Environmental Management: Biodiversity Act (Act No 10 of
NEM:BA	2004)

NEM:PAA	National Environmental Management: Protected Areas Act (Act 57 of 2003)
NEMA	National Environmental Management Act (Act 107 of 1998)
NHRA	National Heritage Resources Act
NM	Nautical Mile
NMBM	Nelson Mandela Bay Municipality
RMZ	Recommended Mixing Zone
SAHRA	South African Heritage Resources Agency
SAMSA	South African Maritime Safety Authority
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SEZ	Special Economic Zone
SoE	State owned Enterprise
TSS	Total Suspended Solids
U.S.	United States
UNFAO	United Nations Food and Agriculture Organisation
VIA	Visual Impact Assessment
VRM	Visual Resource Management Africa CC
WWTW	Wastewater Treatment Works

1 INTRODUCTION

The Department of Agriculture, Forestry and Fisheries (DAFF), as the lead agent for aquaculture management and development in South Africa, intends to establish and manage a sea-based Aquaculture Development Zone (ADZ) in Algoa Bay in the Eastern Cape. DAFF recently successfully established the first sea-based ADZ in Saldanha Bay in the Western Cape and has received an Environmental Authorisation for a land based ADZ in the Eastern Cape at Qolora. A Sea-based ADZ typically consists of a selection of designated precincts that provide opportunities for existing aquaculture operations to expand and new ones to be established. ADZs are intended to boost investor confidence by providing 'investment ready' platforms with strategic environmental approvals and management policies already in place, allowing commercial aquaculture operations to be set up without the need for lengthy, complex and expensive approval processes. It is anticipated that an ADZ will create incentives for industry growth, provide marine aquaculture services and enhance consumer confidence. An ADZ can provide economic benefits to the local community through job creation and regional economic diversification.

Aquaculture is one of the sectors that form part of Operation Phakisa under the Ocean's Economy in South Africa. Operation Phakisa is an initiative of the South African government which aims to implement priority economic and social programmes better, faster and more effectively. Operation Phakisa was launched by the President of the Republic in October 2014. The sector offers significant potential for rural development, especially for marginalised coastal communities. The proposed development will provide employment opportunities for the local and regional communities.

In 2009 a Strategic Environmental Assessment (SEA) was undertaken for the entire South African coastline to identify suitable aquaculture precincts. In this assessment the Eastern Cape was highlighted as an area holding potential for the establishment of ADZs. As part of a finer-scale SEA undertaken by DAFF in 2011, two precincts, namely Algoa 1 (original extent near Summerstrand) and 5 (opposite the Addo Elephant National Park) were identified as the most promising options for establishment of an ADZ in this area. Environmental Authorisation (EA) was granted for Algoa 1 Option 1 on 9 July 2014 following a lengthy Environmental Impact Assessment (EIA) process, which was initiated in 2010. During the appeals process that followed the positive decision, a total of twenty-eight (28) substantive appeals were lodged against the decision. In response, the Minister of Environmental Affairs issued a decision on the Appeal suspending the EA to allow for further studies to be undertaken. In the same year, DAFF withdrew the original application for environmental authorisation.

In mid-2016, DAFF commissioned three comparative assessments, including a detailed feasibility study (Britz & Sauer 2016b), a socio-economic assessment (Britz *et al.* 2016) and a marine ecological assessment (Britz & Sauer 2016a) for finfish farming at Algoa 1 and 5 (these three studies have been included as stand-alone documents in Appendix D of this Basic Assessment Report). The economic feasibility study (Britz and Sauer 2016b) found that conditions at Algoa 5 were sub-optimal for economic aquaculture and mitigation measures would be impractical or uneconomic to implement, which renders the proposed site not economically competitive. Furthermore, Algoa 5 was located in the middle of the recently promulgated Addo Marine Protected Area (MPA). For the reasons described above, Algoa 5 was screened out and has not been taken forward as a potential precinct in the current Basic Assessment process.

For Algoa 1 (original extent), Britz & Sauer (2016b) found that economic conditions for finfish aquaculture was marginal with limited mitigation possible. Notwithstanding, Algoa 1 has been taken forward into the current Basic Assessment process. DAFF has submitted a new application for the development of the ADZ for which a Basic Assessment process is required in terms of the 2014 EIA Regulations (as amended in 2017) of the National Environmental Management Act (Act 107 of 1998) (this application). DAFF intends for the ADZ to accommodate finfish as well as bivalve culture (oysters/mussels) within a combination of precincts.

The precincts considered in this Basic Assessment process include one precinct from the previous process (Algoa 1), and two new precincts, designated as Algoa 6 and 7 (Figure 1). During the 2010-2014 application and the pre-application stakeholder consultation processes undertaken in March/April 2019 as part of this new EA process, I&APs expressed concern regarding the southern part of Algoa 1 (Option 2), which overlaps with a possible squid breeding area targeted by chokka squid fishery. As breeding areas provide for the best catches, it was recognised that the establishment of a fish farm in the same area could potentially have a significant, quantifiable impact on the local squid industry. DAFF therefore elected to exclude the southern portion of Algoa 1 from the application process as this was identified as the most effective mitigation measure to mitigate this potential impact. The remaining Algoa 1 area is referred to as 'Algoa 1 Option 1' in the Draft BAR (See Section 3.5.1 for more information).

Furthermore, the pre-application stakeholder consultation process and revised impact assessment demonstrated that for *finfish* farming at Algoa 1 Option 1, the perceived higher risk of shark attacks alone could potentially have a profound impact on the local economy (note that this is not the case for bivalve farming). It has been demonstrated that there are few mitigation measures available to influence the perception of water sport participants. Furthermore, the beaches and marine environment near Algoa 1 Option 1 precinct constitute the main area where water sport events and activities take place in Algoa Bay (i.e. sensitive environment). Thus, in the absence of a detailed, quantitative socio-economic study, it was decided that a precautionary approach should be applied and the impact significance rating for the **negative impact on the economy of Port Elizabeth** after mitigation was raised from medium to **high** (Table 37). Based on the results of the impact assessments, comments received on the pre-application Basic Assessment Report and recommendations by the EAP, DAFF no longer intends to apply for finfish farming at Algoa 1 Option 1 and is applying for bivalve culture (oyster and mussels) only at this site.

Algoa 6, situated near the Port Elizabeth Harbour, was identified but screened out in the scoping phase of the original EIA (2010-2014) which focussed only on finfish culture, and has now been put forward as a potential site for bivalve production in this new (2019) application process. Algoa 7 is a new precinct located directly in front of the Ngqura harbour that has been identified as a potential site for finfish culture. Prior to the start of the project, DAFF undertook a feasibility assessment with key stakeholders in which Algoa 7 was found to be suitable in terms of water depth, shipping traffic, and accessibility (i.e. financial considerations) and position relative to the promulgated Addo MPA (Figure 1). Note that this site is considerably closer to the Port of Ngqura than Algoa 5 (which was screened out in the comparative assessment) and hence operational constraints and costs and associated with this site are likely to be considerably lower than for the latter site.

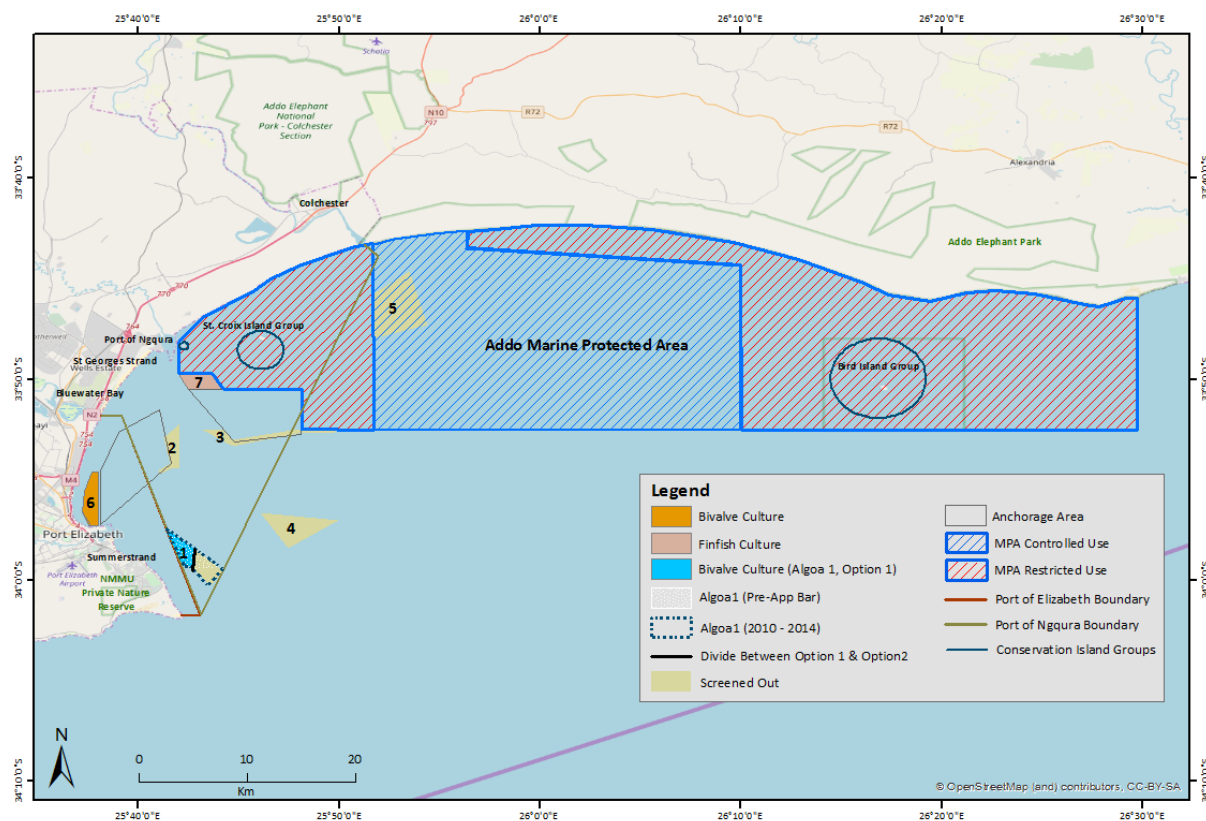


Figure 1 Precincts considered during the 2010-2014 and current application for environmental authorisation for a sea-based Aquaculture Development Zone in Algoa Bay, Eastern Cape. Precincts 2, 3, 4 and 5 were found to be unfeasible and were screened out. The southern portion of Algoa 1 (Option 2) has been screened out to reduce impacts on the chokka squid fishing industry. Precincts 1 Option 1, 6 and 7 constitute feasible sites and have been considered during the present Basic Assessment process.

In this BA process, environmental impacts of *finfish* culture were assessed for Algoa 1 Option 1 and Algoa 7. Impacts of *bivalve* culture were assessed for Algoa 1 Option 1 and Algoa 6 (Figure 1). DAFF is seeking to promote bivalves as well as finfish farming in Algoa Bay. Rather than considering each of the three sites (Algoa 1 Option 1, 6 and 7) in isolation, three alternative configurations of precincts, Options A, B and C, as outlined in Table 2, are being considered in this Basic Assessment process. Potential environmental impacts associated with each of these options have been assessed in this Basic Assessment Report.

Based on the revised significance of negative economic impacts linked to finfish farming at Algoa 1 Option 1 from 'medium' to 'high' after implementation of mitigation measures, DAFF has revised its priorities in respect of mariculture in Algoa Bay and would now like to nominate Option B (bivalve farming at Algoa 1 Option 1, bivalve farming at Algoa 6 and finfish farming at Algoa 7) as the preferred Alternative Option (Table 2).

It is important to note that the BAR needs to clearly define the applicant's (DAFF) and EAP's preferred Alternative Options (these may differ). It follows that although DAFF has revised its priorities in respect of mariculture in Algoa Bay, this Basic Assessment Report assesses all three economically feasible Alternative Options as shown in (Table 2).

Table 2 Proposed alternative options to be assessed in the Basic Assessment process for the proposed Algoa Bay Aquaculture Development Zone.

Alternative options	<u>Algoa 1 Option 1 (Summerstrand site)</u> Size: 312 ha	<u>Algoa 6 (Port Elizabeth Harbour site)</u> Size: 479 ha	<u>Algoa 7 (Nggura Harbour site)</u> Size: 355 ha
A	Finfish & bivalves	Bivalves	Finfish
B (DAFF preferred)	Bivalves	Bivalves	Finfish
C	X	Bivalves	Finfish
D (No-go option)	X	X	X

DAFF appointed Anchor Research & Monitoring (Pty) Ltd (Anchor) to undertake the Basic Assessment (BA) process for the proposed Aquaculture Development Zone in terms of the National Environmental Management Act 107 of 1998, as amended (NEMA). DAFF intends to follow a precautionary approach and motivate for a phased production prior to expanding to full scale production.

The purpose of this Draft Basic Assessment Report (BAR) is to:

- (1) Describe the process to be followed (focussing on the public participation process and specialist studies);
- (2) Describe the affected environment;
- (3) Describe the proposed project;
- (4) Present the findings of the impact assessment; and
- (5) To recommend how the development concept should be adjusted to mitigate the identified impacts.

This Draft BAR describes and assesses potential environmental impacts associated with each of the three precincts (Algoa 1 Option 1, 6, and 7) individually first, and subsequently in combination in the form of alternate options as they have been configured for this EIA process (i.e. Option A, B and C) together with the No-Go option (Alternative D) (Table 2).

The pre-application BAR was released to the public on 28 March 2019 and was subjected to a 30-day commenting period where 180 comments were submitted by Interested and Affected Parties (I&APs). The outcomes of the preliminary stakeholder consultation process (including a summary) are captured in the standalone Stakeholder Consultation Report in Appendix F of the BAR. Reference to the outcomes of the pre-application stakeholder process are made in this document where appropriate.

Substantive changes to the BAR (not only as a result of the stakeholder process) are underlined in this document and changes are listed for reference below:

- **Based on the revised significance of negative economic impacts linked to finfish farming at Algoa 1 Option 1 from 'medium' to 'high' after implementation of mitigation measures, DAFF has revised its priorities in respect of mariculture in Algoa Bay and would now like to nominate Option B (bivalve farming at Algoa 1 Option 1, bivalve farming at Algoa 6 and finfish farming at Algoa 7) as the preferred Alternative Option (Table 2).**
- Algoa 1 has been further reduced to Option 1 and is referred to as Algoa 1 Option 1.
- The Addo MPA was promulgated on 23 May 2019. Algoa 7 was included within the controlled zone of the MPA in the original draft gazette notice (published on 3 February 2016) but was excised from the MPA in final version. All maps and written content have been amended accordingly in the Draft BAR. The impact assessment has been moved from the marine specialist study to the socio-economic study.
- GIS maps have replaced Google Earth maps and have been updated with newer information where required.
- An explanation as to why land-based aquaculture is not considered as an alternative technology in this application for environmental authorisation has been added (Section 4 and Table 13).
- Some information in the summary of the dispersion modelling results in the BAR and marine specialist study were incorrect and have been corrected in this version (Table 12).
- The description of the proposed sites has been updated (Section 3.5)
- Additional legislation in Chapter 5:
 - Aquaculture Development Bill (Section 5.9)
 - Marine Spatial Planning Act (Act 16 of 2018) (Section 5.10)
 - Information on Coastal Management Programmes in terms of the National Environmental Management: Integrated Coastal Management Act (Act 24 of 2003)
- Substantive changes have been made to the 'Need and Desirability' Chapter 6.
- Chapter 7 -Environmental Risks to the ADZ
 - Some changes have been made to the description of Harmful Algal Blooms (Section 8.1)
- Chapter 8 - Description of the Affected Environment
 - A section was added on biodiversity importance and conservation status of the marine environment, including a sensitivity map (Section 9.2.6)
 - Major changes were made to the description of affected user groups of the study site, including:
 - The description of recreational user groups (Section 9.5.2.1) was updated.
 - A new section was added to describe the various competitive sport events, lifesaving and festivals that are held in Port Elizabeth (Section 9.5.2.2)
 - Section 9.5.2.6 was updated to include a description of the existing oyster farm Zwembesi Farms (Pty) Ltd located in Algoa 6.
- Chapter 9 – Environmental Impact Assessment
 - Amendments have been made to the visual aesthetics impact assessment for Algoa 1 Option 1 (Section 10.4.1.1)

- Major amendments have been made to the socio-economic impact assessment. More detail is provided in the introduction to Section 10.5.
- During the pre-application stakeholder process, the diving industry provided updated coordinates of dive sites, which indicate that contrary to the information obtained in 2012/13, a low profile reef is likely to be present near the centre of Algoa 1 Option 1, at an approximate depth of 25-29 m (refer to Benthic Habitat mapping study in Appendix D of the BAR, Dawson *et al.* 2019). According to Louis van Aardt (owner of Prodiver, *pers. comm.* June 2019), this flat reef protrudes 1-1.5 m above the ocean floor and is home to a thriving reef community dominated by basket starfish and soft coral (octopuses can also be found there). Reef is regarded as a sensitive receptor and 200 m radius buffer around the position S33°58. 620; E25°42.223 is therefore recommended in the updated Marine Specialist Study (Appendix D, Hutchings *et al.* 2019). To mitigate impacts on the diving industry, the socio-economic impact assessment recommends that access is maintained to the site. This results in the reduction of Algoa 1 Option 1 to 284 ha.
- Chapter 10 – Environmental impact statement. This Chapter was moved to the beginning of the BAR document. Changes to reflect the Draft BAR and recommendation of the EAP.

This Chapter should be read together with Chapter 2 (Environmental Impact Statement), which summarises the outcomes of the Basic Assessment process to date. Chapter 2 also provides key recommendations by the specialists and the Environmental Assessment Practitioner, which should be considered by the Competent Authority during the decision-making process.

2 ENVIRONMENTAL IMPACT STATEMENT

DAFF is mandated to enable aquaculture development in South Africa, and as such intends to declare an Aquaculture Development Zone (ADZ) comprising up to three separate precincts within Algoa Bay where bivalves and finfish can be farmed. This **BAR** describes and assesses potential environmental impacts associated with each of the three precincts (Algoa 1 Option 1, 6, and 7) (Figure 2) individually first, and subsequently in combination in the form of alternate options as they have been configured for this EIA process (i.e. Option A, B and C) together with the No-Go option (Alternative D) (Table 3).

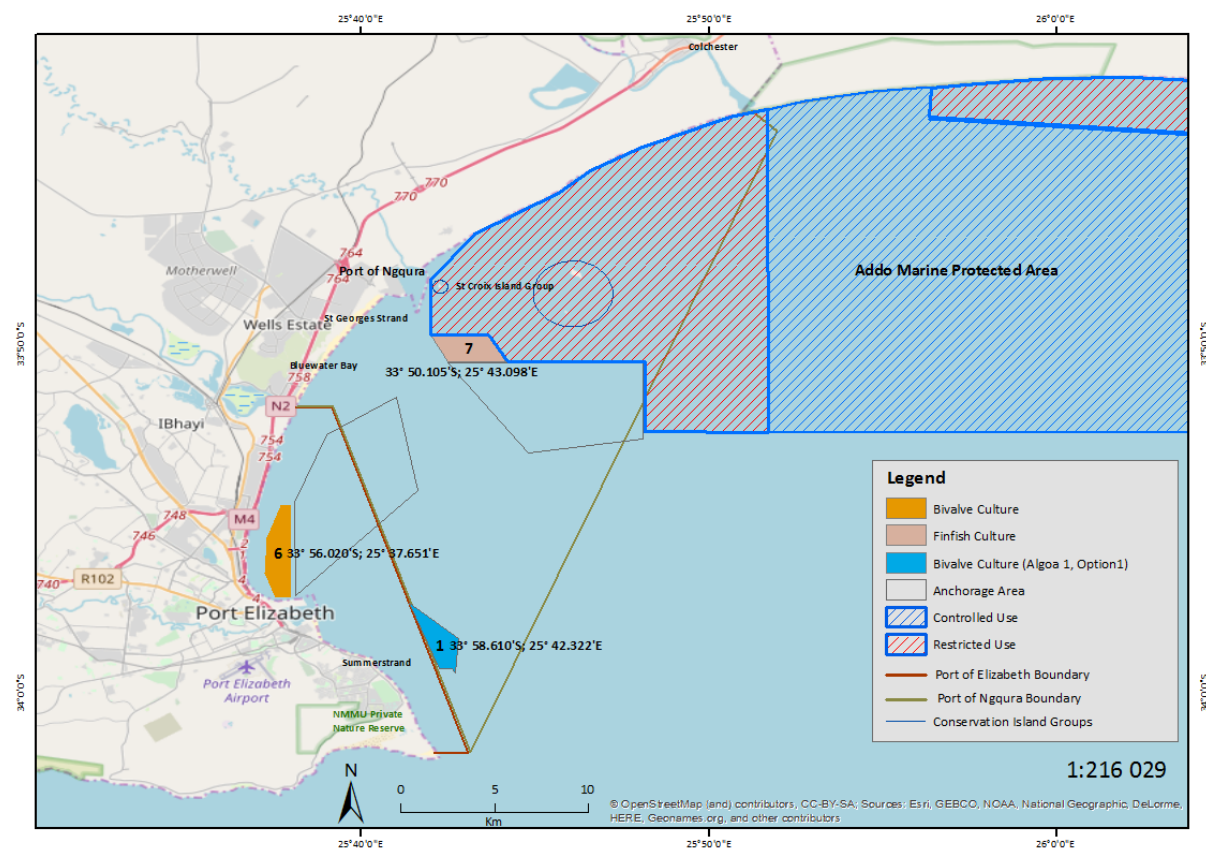


Figure 2 Precincts considered during the 2019 application for environmental authorisation for a sea-based Aquaculture Development Zone in Algoa Bay, Eastern Cape. Precincts 1 (Option 1), 6 and 7 constitute economically feasible precincts and have been considered during the present Basic Assessment process.

Table 3 Alternative options of precinct combinations involving Algoa 1 Option 1, 6 and 7 considered in the Basic Assessment process for the proposed sea-based Algoa Bay Aquaculture Development Zone.

Alternative options	Algoa 1 <u>Option 1</u> (Summerstrand site) Size: 312 ha	Algoa 6 (Port Elizabeth Harbour site) Size: 479 ha	Algoa 7 (Ngqura Harbour site) Size: 355 ha
A	Finfish & bivalves	Bivalves	Finfish
B (DAFF preferred)	Bivalves	Bivalves	Finfish
C	X	Bivalves	Finfish
D (No-go option)	X	X	X

Positive and negative impacts can be rated as insignificant, very low, low, medium, high and very high, before and after benefit enhancing or mitigation measures are implemented. A summary of the environmental impacts assessed for each precinct (Algoa 1 Option 1, 6 and 7) are shown for the construction (CP) (Table 4) and the operation (OP) (Table 5 to Table 8) phases of the proposed development. Potential impacts are denoted by first listing the phase of the development (i.e. CP = Construction Phase; OP = Operational phase) followed by the impact category. Impacts are numbered consecutively and separately for the construction and operational phases:

- ME = Marine Ecology
- VA = Visual and aesthetic
- SE = Socio-economic
- UMH = Underwater and Maritime Heritage Resources

Table 4 Summary of potential impacts for the construction of the proposed Aquaculture Development Zone in Algoa Bay without and with mitigation. CP stands for Construction Phase. The following codes are used for the various impact types: ME = Marine Ecology, SE = Socio-economic. **Note: impacts are described and rated separately for Algoa 1 Option 1, 6 and 7 where these differ, or together where there are no differences.**

Impact description		Mitigation	Consequence	Probability	Confidence	Significance before mitigation	Significance after mitigation
CP-ME 1	Disturbance of subtidal habitat (-ve): All precincts	Before	Low	Definite	High	LOW	
		After	Very Low	Definite	High		VERY LOW
CP-SE 1	Investment in the local, regional and national economy for Algoa Bay (+ve): All precincts	Before	Medium	Possible	Medium	LOW	
		After	Medium	Possible	Medium		LOW
CP-SE 2	Increased employment, income and skills development (+ve): All precincts	Before	Low	Possible	Low	VERY LOW	
		After	Medium	Possible	Low		LOW
UMH 1	Impacts on Submerged Prehistoric Heritage Resources (-ve): All precincts	Before	Low	Improbable	Low	VERY LOW	
		After	N/A	N/A	N/A		N/A
UMH 2	Impacts on Maritime Archaeological Resources (-ve): <i>Algoa 1 Option 1 & 7</i>	Before	Low	Possible	Low	VERY LOW	
		After	Very Low	Improbable	Low		INSIGNIFICANT
	Impacts on Maritime Archaeological Resources (-ve): <i>Algoa 6</i>	Before	Low	Probable	Low	LOW	
		After	Very Low	Improbable	Low		INSIGNIFICANT

Table 5 Summary of potential impacts of finfish culture on marine ecology (denoted ME) for the operation of the proposed Aquaculture Development Zone in Algoa Bay without and with mitigation. OP stands for Operation Phase. Note: impacts are described and rated separately for Algoa 1 Option and 7 where these differ, or together where there are no differences.

Impact description		Mitigation	Consequence	Probability	Confidence	Significance before mitigation	Significance after mitigation
OP-ME 1	Disease and parasite transmission to wild fish stocks (may be reversible) (-ve): <u>Algoa 1 Option 1 & 7</u>	Before	Very High	Definite	High	VERY HIGH	
		After	High	Probable	Medium		HIGH
OP-ME 2	Organic waste discharge impacting on the water column and benthic environment (long-term but reversible) (-ve): <u>Algoa 1 Option 1 & 7</u>	Before	High	Definite	High	HIGH	
		After	Medium	Definite	Medium		MEDIUM
OP-ME 3	Genetic interactions with wild stocks with escapees (long-term but reversible) (-ve): <u>Algoa 1 Option 1 & 7</u>	Before	Very High	Possible	Low	HIGH	
		After	Medium	Improbable	Low		LOW
OP-ME 4	Use of chemical therapeutants and antifoulants (long-term but reversible) (-ve): <u>Algoa 1 Option 1</u>	Before	Medium	Probable	Medium	MEDIUM	
		After	Low	Probable	Low		LOW
	Use of chemical therapeutants and antifoulants (long-term but reversible) (-ve): <u>Algoa 7</u>	Before	High	Probable	Medium	HIGH	
		After	Low	Probable	Low		MEDIUM
OP-ME 5a	Accidental entanglement of cetaceans in mariculture infrastructure (long-term but reversible) (-ve): <u>Algoa 1 Option 1 & 7</u>	Before	Medium	Probable	Medium	MEDIUM	
		After	Medium	Possible	Low		LOW
OP-ME 5b	Possible impacts on cetaceans resulting from alterations in habitat use or migration patterns (long-term but reversible) (-ve): <u>Algoa 1 Option 1 & 7</u>	Before	Low	Probable	Medium	LOW	
		After	Low	Probable	Low		LOW
OP-ME 6	Piscivorous marine animals interfering with finfish cage culture operations (long-term but reversible) (-ve): <u>Algoa 1 Option 1</u>	Before	Medium	Probable	Medium	MEDIUM	
		After	Low	Probable	Low		LOW
	Piscivorous marine animals interfering with finfish cage culture operations (long-term but reversible) (-ve): <u>Algoa 7</u>	Before	High	Probable	Medium	HIGH	
		After	Medium	Probable	Low		MEDIUM

Table 6 Summary of potential impacts of *bivalve culture* on marine ecology (denoted ME) for the *operation* of the proposed Aquaculture Development Zone in Algoa Bay without and with mitigation. OP stands for Operation Phase. Note: impacts are described and rated separately for Algoa 1 Option 1 and 6 where these differ, or together where there are no differences.

Impact description		Mitigation	Consequence	Probability	Confidence	Significance before mitigation	Significance after mitigation
OP-ME 7a	Introduction of alien bivalve species (Mediterranean mussel <i>Mytilus galloprovincialis</i>) to the wild (unlikely to be reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	Before	Low	Improbable	Medium	VERY LOW	
		After	N/A	N/A	N/A		N/A
OP-ME 7b	Introduction of alien bivalve species (Pacific oyster <i>Crassostrea gigas</i>) to the wild (unlikely to be reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	Before	High	Possible	Medium	MEDIUM	
		After	Medium	Possible	Medium		LOW
OP-ME 8	Introduction of alien fouling species to the wild and provision of habitat to alien fouling species (unlikely to be reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	Before	Medium	Definite	Medium	MEDIUM	
		After	Low	Probable	Medium		LOW
OP-ME 9	Disease and parasite transmission to wild bivalve stocks (may be reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	Before	Very High	Definite	High	HIGH	
		After	Medium	Possible	Medium		LOW
OP-ME 10	Organic pollution and habitat modification (long-term but reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	Before	High	Possible	High	MEDIUM	
		After	Medium	Possible	Medium		LOW
OP-ME 11	Genetic interactions of wild stocks from bivalve mariculture (long-term but reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	None required	Low	Improbable	Medium	VERY LOW	
OP-ME 12a	Accidental entanglement of cetaceans in bivalve mariculture infrastructure (long-term but reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	Before	Medium	Probable	Medium	MEDIUM	
		After	Medium	Possible	Low		LOW
OP-ME 12b	Possible impacts on cetaceans resulting from alterations in habitat use or migration patterns (long-term but reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	Before	Low	Probable	Medium	LOW	
		After	Low	Probable	Low		LOW

Table 7 Summary of potential impacts of *finfish and bivalve culture* on the seascape character (denoted VA) for the operation of the proposed Aquaculture Development Zone in Algoa Bay without and with mitigation. OP stands for Operation Phase.

Impact description		Mitigation	Consequence	Probability	Confidence	Significance before mitigation	Significance after mitigation
OP-VA 1a	Negative impact on seascape character (long-term but reversible) (-ve) by <i>finfish culture</i> : Algoa 1 <u>Option 1</u>	Before	High	Definite	Low	HIGH	
		After	High	Definite	Low		HIGH
OP-VA 1a	Negative impact on seascape character (long-term but reversible) (-ve) by <i>bivalve culture</i> : Algoa 1 <u>Option 1</u>	Before	Medium	Definite	Low	MEDIUM	
		After	Low	Definite	Low		LOW
OP-VE 1b	Negative impact on seascape character (long-term but reversible) (-ve) by <i>bivalve culture</i> : Algoa 6	Before	Low	Definite	Medium	LOW	
		After	Low	Possible	Medium		VERY LOW
OP-VE 1c	Negative impact on seascape character (long-term but reversible) (-ve) by <i>finfish culture</i> : Algoa 7	Before	Low	Definite	Medium	LOW	
		After	Low	Possible	Medium		VERY LOW

Table 8 Summary of potential impacts by *finfish and bivalve culture* on the socio-economic environment (denoted SE) for the operation of the proposed Aquaculture Development Zone in Algoa Bay without and with benefit enhancing measures/mitigation. OP stands for Operation Phase. Note: impacts are described and rated separately for Algoa 1 Option 1, 6 and 7 where these differ, or together where there are no differences.

Impact description		Mitigation	Consequence	Probability	Confidence	Significance before mitigation	Significance after mitigation
OP -SE 1a	Investment in the local, regional and national economy (long-term but reversible) (+ve) for <i>finfish culture</i> : Algoa 1 <u>Option 1 & 7</u>	Before	High	Possible	High	MEDIUM	
		After	High	Possible	High		MEDIUM
OP -SE 1b	Investment in the local, regional and national economy (long-term but reversible) (+ve) for <i>bivalve culture</i> : Algoa 1 <u>Option 1</u>	Before	High	Probable	High	HIGH	
		After	High	Definite	High		HIGH
OP -SE 1b	Investment in the local, regional and national economy (long-term but reversible) (+ve) for <i>bivalve culture</i> : Algoa 6	Before	High	Possible	High	MEDIUM	
		After	High	Definite	High		HIGH

Impact description		Mitigation	Consequence	Probability	Confidence	Significance before mitigation	Significance after mitigation
OP-SE 2a	New employment, income and skills development (long-term but reversible) (+ve) for <i>finfish</i> culture: Algoa 1 <u>Option 1</u> & 7	Before	High	Possible	Medium	MEDIUM	
		After	High	Possible	Medium		MEDIUM
OP-SE 2b	New employment, income and skills development (long-term but reversible) (+ve) for <i>bivalve</i> culture: Algoa 1 <u>Option 1</u>	Before	High	Probable	High	HIGH	
		After	High	Probable	High		HIGH
	New employment, income and skills development (long-term but reversible) (+ve) for <i>bivalve</i> culture: Algoa 6	Before	High	Possible	High	MEDIUM	
		After	High	Probable	High		HIGH
OP-SE 3	Impacts on existing mariculture activities (+ve): all precincts and both culture types)	Before	Medium	Probable	Medium	MEDIUM	
		After	N/A	N/A	N/A		N/A
OP-SE 4a	Impacts on water sport participants (excluding SCUBA diving) (long-term but reversible) (-ve) by <i>finfish</i> culture: Algoa 1 <u>Option 1</u>	Before	High	Probable	Medium	HIGH	
		After	Medium	Probable	Medium		MEDIUM
	Impacts on water sport participants (excluding SCUBA diving) (long-term but reversible) (-ve) by <i>finfish</i> culture: Algoa 7	Before	Medium	Possible	Medium	LOW	
		After	Medium	Possible	Medium		LOW
OP-SE 4b	Impacts on water sport participants (excluding SCUBA diving) (long-term but reversible) (-ve) by <i>bivalve</i> culture: Algoa 1 <u>Option 1</u>	Before	Medium	Possible	Medium	LOW	
		After	Low	Improbable	Medium		VERY LOW
	Impacts on water sport participants (excluding SCUBA diving) (long-term but reversible) (-ve) by <i>bivalve</i> culture: Algoa 6	Before	Low	Improbable	Medium	VERY LOW	
		After	Low	Improbable	Medium		VERY LOW
OP-SE 5	Impacts on SCUBA diving activities (long-term but reversible) (-ve) by <i>finfish</i> culture: Algoa 1 <u>Option 1</u>	Before	Medium	Probable	Medium	MEDIUM	
		After	Low	Possible	Medium		LOW
	Impacts on SCUBA diving activities (long-term but reversible) (-ve) by <i>finfish</i> culture: Algoa 7	Before	Low	Possible	Medium	VERY LOW	
		After	Low	Possible	Medium		VERY LOW

Impact description		Mitigation	Consequence	Probability	Confidence	Significance before mitigation	Significance after mitigation
	Impacts on SCUBA diving activities (long-term but reversible) (-ve) by <i>bivalve</i> culture: Algoa 1 <u>Option 1</u>	Before	Low	Probable	Medium	LOW	
		After	Low	Possible	Medium		VERY LOW
OP-SE6	Impact on Port Elizabeth’s economy (long-term may be irreversible) (-ve) by <i>finfish</i> culture: Algoa 1 <u>Option 1</u>	Before	High	Definite	Medium	HIGH	
		After	High	Definite	Medium		HIGH
	Impact on Port Elizabeth’s economy (long-term but reversible) (-ve) by <i>finfish</i> culture: Algoa 7	Before	Low	Probable	Medium	LOW	
		After	Low	Probable	Medium		LOW
	Impact on Port Elizabeth’s economy (long-term but reversible) (-ve) by <i>bivalve</i> culture: Algoa 1 <u>Option 1</u>	Before	Low	Definite	Medium	LOW	
		After	Low	Definite	Medium		LOW
Impact on Port Elizabeth’s economy (long-term but reversible) (-ve) by <i>bivalve</i> culture: Algoa 6	Before	Low	Improbable	Medium	VERY LOW		
	After	Low	Improbable	Medium		VERY LOW	
OP-SE 7	Impact of income leakage on local economic development of the area (long-term but reversible) (-ve) by <i>finfish</i> culture: Algoa 1 <u>Option 1</u> & 7	Before	High	Probable	Medium	HIGH	
		After	Medium	Probable	Medium		MEDIUM
	Impact of income leakage on local economic development of the area (long-term but reversible) (-ve) by <i>bivalve</i> culture: Algoa 1 <u>Option 1</u> & 6	Before	Medium	Probable	Medium	MEDIUM	
		After	Low	Probable	Medium		LOW
OP-SE 8a	Risk of collision between vessels and aquaculture farms as a result of drifting ships from the chokka squid sanctuary zone (long-term but reversible) (-ve) by <i>bivalve</i> and <i>finfish</i> culture: Algoa 1 <u>Option 1</u>	Before	Low	Possible	Medium	VERY LOW	
		After	Low	Possible	Medium		VERY LOW
	Risk of collision between vessels and aquaculture farms as a result of drifting ships from the anchorage area (long-term but reversible) (-ve) by <i>bivalve</i> and <i>finfish</i> culture: Algoa 6	Before	Low	Possible	Medium	VERY LOW	
		After	Low	Improbable	Medium		VERY LOW

Impact description		Mitigation	Consequence	Probability	Confidence	Significance before mitigation	Significance after mitigation
	Risk of collision between vessels and aquaculture farms as a result of drifting ships from the anchorage area (long-term but reversible) (-ve) by <i>bivalve</i> and <i>finfish</i> culture: Algoa 7	Before	Low	Probable	High	LOW	
		After	Low	Possible	Medium		VERY LOW
OP-SE 8b	Impact on vessel navigation routes (long-term but reversible) (-ve) by <i>bivalve</i> and <i>finfish</i> culture: All precincts	Before	Medium	Possible	High	LOW	
		After	Medium	Improbable	High		LOW
OP-SE 9	Impact on local fisheries (long-term but reversible) (-ve) by <i>bivalve</i> and <i>finfish</i> culture: Algoa 1 <u>Option 1</u>	Before	Medium	Probable	Medium	MEDIUM	
		After	N/A	N/A	N/A		N/A
	Impact on local fisheries (long-term but reversible) (-ve) by <i>bivalve</i> and <i>finfish</i> culture: Algoa 7	Before	Medium	Probable	Medium	MEDIUM	
		After	N/A	N/A	N/A		N/A
Impact on local fisheries (long-term but reversible) (-ve) by <i>bivalve</i> and <i>finfish</i> culture: Algoa 6	Before	Low	Probable	Medium	LOW		
	After	N/A	N/A	N/A		N/A	
OP-SE10	Impact on land-based infrastructure (long-term but reversible) (-ve) by <i>bivalve</i> and <i>finfish</i> culture: All precincts	Before	Medium	Definite	Medium	MEDIUM	
		After	Low	Definite	Medium		LOW
OP SE11a	Impact on coastal real estate for (long-term but reversible) (-ve) by <i>finfish</i> culture: Algoa 1 <u>Option 1</u>	Before	High	Possible	Low	MEDIUM	
		After	High	Possible	Low		MEDIUM
OP SE11b	Impact on coastal real estate (long-term but reversible) (-ve) by <i>bivalve</i> culture: Algoa 1 <u>Option 1</u>	Before	Medium	Possible	Low	LOW	
		After	Low	Possible	Low		VERY LOW
	Impact on coastal real estate (long-term but reversible) (-ve) by <i>bivalve</i> culture: Algoa 6	Before	Low	Possible	Low	VERY LOW	
		After	Low	Possible	Low		VERY LOW
OP SE12	Increased risk of bird strikes affecting aircrafts landing at and departing from the Port	Before	Low	Improbable	Medium	VERY LOW	

Impact description		Mitigation	Consequence	Probability	Confidence	Significance before mitigation	Significance after mitigation
	Elizabeth International Airport (long-term but reversible) (-ve) by <i>bivalve</i> and <i>finfish</i> culture: All precincts	After	Very low	Improbable	Medium		INSIGNIFICANT
OP SE13	Impacts on the Addo Elephant Marine Protected Area (irreversible) (-ve): Algoa 7	None	Medium	Definite	High	MEDIUM	
		N/A	N/A	N/A	N/A	N/A	N/A

The outcomes of the impact assessments for Algoa 1 Option 1, 6 and 7 for finfish and bivalve culture (as shown in the summary tables above) were summed for each alternative option (after mitigation). Positive impacts (or benefits) cannot cancel out negative impacts and therefore have to be assessed separately (Table 9 and Table 10 respectively). Positive impacts are limited to socio-economic benefits arising from new employment opportunities, business opportunity and skills development in the aquaculture sector.

Furthermore, note that in Option A, both finfish and bivalve culture are proposed for Algoa 1 Option 1, however, these impacts are not additive and therefore the impact scoring for the best/worst case scenario was considered for positive and negative impacts respectively.

Positive impacts

After benefit enhancing measures, Option A and B have the same number of high, medium and low positive impacts on the socio-economic environment (Table 9). Option C excludes Algoa 1 Option 1, which means that less area will be available for mariculture and therefore the benefits will be lower when compared to option A and B. While in isolation, Option A and B appear to be more socio-economically beneficial, the proposed development will only contribute to a net positive impact on the economy as a whole if the established and growing tourism and water sport industries of Port Elizabeth is not (or minimally) negatively impacted. With regards to negative socio-economic impacts, the impact assessment clearly demonstrates that Option A has a much higher impact than Option B (Table 49). Most noticeably, the negative economic impact after mitigation has been rated as 'high' for finfish culture at Algoa 1 Option 1. This is discussed in more detail below.

Table 9 Comparison of the sum of positive (i.e. socio-economic) impact significance of alternative options A, B, C and D for the proposed sea-based Algoa Bay Aquaculture Development Zone (after mitigation). In Option A, both finfish and bivalve culture are proposed for Algoa 1 Option 1, however, these impacts are not additive and therefore the impact scoring for the best case scenario (i.e. finfish only) was considered. Note that Algoa 1 refers to Algoa 1 Option 1 in this table.

Impact significance after mitigation	Alternative Options			
	A Algoa 1: finfish and bivalves Algoa 6: bivalves Algoa 7: finfish	B Algoa 1: bivalves Algoa 6: bivalves Algoa 7: finfish	C Algoa 6: bivalves Algoa 7: finfish	D No-go
High	4	4	2	0
Medium	5	5	4	0
Low	0	0	0	0
Very low	0	0	0	0
Insignificant	0	0	0	0
Total	4	4	2	0

Negative impacts

Option C would involve bivalve farming at Algoa 6 and finfish farming at Algoa 7, excluding Algoa 1 Option 1 altogether and is the most favourable option in terms of negative impacts on the environment. This Alternative has a total of 40 negative impact ratings, of which most are considered low after mitigation measures have been implemented (Table 10). A moderate number of medium negative impact ratings and only one high negative impact rating makes Option C the most environmentally acceptable option aside from the No-go option (Option D). The comparatively low environmental impact is mostly attributable to the exclusion of an entire site (Algoa 1 Option 1). Alternative Option C covers the smallest area and therefore has the lowest aquaculture development potential.

Option A and B have 68 and 60 negative impact ratings respectively, as both options include Algoa 1 Option 1 as a precinct, although Option B only allows bivalve culture at this precinct. The exclusion of finfish from Algoa 1 makes Option B generally more environmentally favourable with only one 'high', eight 'medium' and more 'very low' negative ratings than Option A. This difference can be ascribed to fact that bivalve culture is not likely to attract sharks, has a lower visual impact and contributes less to water quality deterioration than finfish culture. Consequently, the negative economic impact rating for Option B is considerably lower than Option A.

Table 10 Comparison of the sum of negative impact significance of alternative options A, B, C and D for the proposed sea-based Algoa Bay Aquaculture Development Zone (after mitigation). In Option A, both finfish and bivalve culture are proposed for Algoa 1, however, these impacts are not additive and therefore, the impact scoring for the worst-case scenario (i.e. finfish only) was considered. Note that Algoa 1 refers to Algoa 1 Option 1 in this table.

Impact significance after mitigation	Alternative Options			
	A Algoa 1: finfish and bivalves Algoa 6: bivalves Algoa 7: finfish	B Algoa 1: bivalves Algoa 6: bivalves Algoa 7: finfish	C Algoa 6: bivalves Algoa 7: finfish	D No-go
High	4	1	1	0
Medium	12	8	7	0
Low	34	30	18	0
Very low	12	15	10	0
Insignificant	6	6	4	0
Total	68	60	40	0

During the pre-application stakeholder process, the diving industry provided updated coordinates of dive sites, which indicates that contrary to the information obtained in 2012/13, a low-profile reef is likely to be present near the centre of Algoa 1 Option 1, at an approximate depth of 25-29 m (refer to Benthic Habitat mapping study in Appendix D of the BAR, Dawson *et al.* 2019). According to Louis van Aardt (owner of Prodrive, *pers. comm.* June 2019), this flat reef protrudes 1-1.5 m above the ocean floor and is home to a thriving reef community dominated by basket starfish and soft coral (octopuses can also be found there). Reef is regarded as a sensitive receptor and 200 m radius buffer around the position S33°58. 620; E25°42.223 is therefore recommended in the updated Marine Specialist Study (Appendix D, Hutchings *et al.* 2019). Although this reef was not detected during the single beam echosounder bathymetry survey undertaken in 2012, the 200 m buffer is regarded as conservative, as survey lines were spaced 100 m apart, indicating that the reef is unlikely to extend more than 50 m in either direction from the identified position.

The buffered reef area would have to be excluded from the ADZ as per exclusionary criteria applied in the original Strategic Environmental Assessment (Hutchings *et al.* 2011). Furthermore, access to the Basket Star dive site should be maintained to reduce impacts on the diving industry. This condition would be applicable to both, finfish and bivalve farming at Algoa1 Option 1 and would therefore be required for Alternative Options A and B.

Option A is the most farming intensive alternative option with the highest environmental impact (positive and negative). Under this alternative, both finfish and bivalve can be farmed at Algoa 1 Option 1, bivalve at Algoa 6, and finfish at Algoa 7. The review of the 28 appeals and public perception survey (Hosking, 2016) Britz *et al.* (2016) confirmed that the socio-economic cost to the tourism and recreation sectors of **finfish farming at Algoa 1 Option 1** constitutes a real, but unquantified concern. A detailed costing of the socio-economic impact of the ADZ was not conducted as part of the 2016 assessment, and instead, a social choice trade-off survey was undertaken. The survey attempted to

gauge whether the external costs (negative social and economic impacts on the tourism and conservation value and others) outweigh the income and employment benefits that could be gained as socially attractive elements. In their study, Britz *et al.* (2016) found that a R230 million social income gain would be required to compensate for ecological impact in Algoa Bay, while a R595 million social income gain would be required to compensate for deterioration of visibility in the water column for SCUBA diving. It must be noted that the study did not establish the potential *social income gain* for the proposed development to compare the social income gain required to the predicted gain (i.e. establish whether the development would result in a *social net gain*). Instead, the study provided a realistic projection of the production potential of the sites, income, costing, and job opportunities.

Britz *et al.* 2016 concluded that (page 25): “it is entirely appropriate that the social choice be partly informed by social preference, and not only with reference to expert opinion.” Furthermore, the expert opinion in the final feasibility study by Britz and Sauer (2016) concluded that “For Algoa 1, the socio-economic feasibility [of finfish farming] was ranked ‘moderately feasible’ for most indicators (Table 7). The unquantified socio-economic costs and trade-offs associated with the ‘tourism and recreation’ economy were, however, ranked as a ‘very low feasibility’.

It has become apparent that the perceived higher risk of shark attacks alone could potentially have a profound impact on the local economy. Although some of the aspects can be mitigated by implementing measures recommended in the marine ecology, visual and heritage studies, *there are few effective mitigation measures available to influence the perception of water sport participants.* Furthermore, the beaches and marine environment near Algoa 1 Option 1 precinct constitute the main area where water sport events and activities take place (i.e. sensitive environment).

The tourism potential of Port Elizabeth and its surrounding environment is still largely untapped and has a vast future potential that is in line with global tourism market trends (international tourism expert Prof. Ernie Heath in Tourism Tattler 2018). Port Elizabeth is also an industrial hub and the two very different economic goals contrast each other with every new development that constitutes a deterrent to tourism and water sport. Finfish farming at Algoa 1 Option 1 is highly likely to significantly and cumulatively contribute toward deterring tourism and water sport in Port Elizabeth.

In comparison to finfish culture, bivalve culture is unlikely to attract sharks and stakeholders do not seem to associate bivalve culture with an increased risk of shark attacks. However, Algoa 1 Option 1 will be competing for sea-space with diving operators and yachting event routes around Algoa 1 Option 1, which may have to be adjusted with potential financial implications (no mitigation available). Marine ecological and visual impacts could have knock-on effects on the economy; these are, however, much lower when compared to finfish farming and specialist recommendations appear to effectively mitigate against economic losses (the significance of this impact was rated as **low** after implementation of mitigation measures).

The feasibility study for dusky kob and Atlantic salmon prepared by Advance Africa Management Services (DAFF 2017b) provided compelling evidence that demonstrated the need for social and political support to ensure that an aquaculture project is successfully implemented.

The pre-application stakeholder consultation process has demonstrated that public perception regarding the socio-economic impacts associated with finfish farming at Algoa 1 Option 1 have not changed since the 2010-2014 EIA process (refer to Stakeholder Consultation Report in Appendix F of the BAR). Should Environmental Authorisation for the Aquaculture Development Zone be granted, DAFF would need public support, the support from the local and district municipalities (that currently focus on tourism as a significant source of income), as well as from the Provincial Department of Environmental Affairs to ensure successful implementation of this project.

Algoa 7 is included in all Alternative Options (with exception to the No-go alternative D). This site lies adjacent to the recently promulgated Addo Marine Protected Area (MPA). The predicted medium and high significance impacts on marine vertebrates, particularly on sea birds, seals, sharks and cetaceans associated with the St Croix and Bird islands, as well as the position on relative to the recently promulgated Addo MPA (thus contrary to conservation objectives) requires that a risk adverse, precautionary and adaptive management approach be adopted for finfish farming at this site.

Based on the revised significance of negative economic impacts linked to finfish farming at Algoa 1 Option 1 from 'medium' to 'high' after implementation of mitigation measures, DAFF has revised its priorities in respect of mariculture in Algoa Bay and would now like to nominate Option B (bivalve farming at Algoa 1 Option 1, bivalve farming at Algoa 6 and finfish farming at Algoa 7) as the preferred Alternative Option (Table 2).

Recommendations

South Africa's coastline is very exposed and there are few suitable precincts for sea-based aquaculture and Algoa Bay was identified as a potential site in the Strategic Environmental Assessment (SEA) conducted in 2011. Based on the available information commercial *bivalve* farming at Algoa 1 Option 1 and Algoa 6 is a desirable use of the sea space within Algoa Bay provided that the mitigation measures recommended in this impact assessment are implemented. The desirability of *finfish* farming in Algoa Bay is unpacked in more detail below.

The outcomes of the social preference study, the expert opinion as stated above, as well as the comments provided by the public to date (which are mostly congruent with the Britz *et al.* 2016 study), have guided the EAP in concluding that ***finfish* culture at Algoa 1 Option 1 has the potential to cause significant economic losses in the tourism and water sports sectors of Port Elizabeth** (the impact was rated as **high** after the implementation of mitigation measures), with potentially significant knock-on effects on existing job opportunities. The city would also run the risk of losing its status as the "Water Sport Capital" of Africa as a number of sport events would likely be moved or stopped. The pre-application stakeholder consultation process demonstrated that *finfish farming* at Algoa 1 Option 1 (Summerstrand) lacks social support from the Port Elizabeth community.

The Marine Ecological Specialist Study (Appendix D of the BAR) found that *finfish* farming at Algoa 7 could have significant residual marine ecological impacts after the implementation of mitigation measures as this site is situated adjacent to the recently promulgated Addo Marine Protected Area and St Croix Island Group. A precautionary approach with diligent environmental monitoring would be required to minimise residual risks.

At the same time, additional employment opportunities in the Port Elizabeth area are desperately needed and the proposed project has the potential to create new employment opportunities and boost local economic growth.

Overall, the environmental impact assessment shows that Alternative Option B, which proposes bivalve farming at Algoa 1 Option 1 (Summerstrand site) and Algoa 6 (PE Harbour site), as well as finfish farming at Algoa 7 (Ngqura Harbour site), constitutes the best practicable environmental option for Algoa Bay. Alternative Option B has a greater potential with regards to job creation when compared to Alternative Option C (excludes Algoa 1 Option 1 from the ADZ), while also ensuring that user conflicts with the existing tourism and water sport sectors are significantly reduced when compared to Alternative Option A, which proposes finfish farming at Algoa 1 Option 1.

The proposed Alternative Option B has therefore the potential to address the socio-economic need for new employment opportunities and economic growth in the Port Elizabeth area while also minimising conflict with the local tourism industry and water sport activities

Based on the information available to date and the impact assessment conducted in the Draft BAR, the EAP supports DAFF's application for environmental authorisation for the preferred Option B (i.e. no finfish farming at Algoa 1 Option 1), provided that rigorous environmental monitoring is conducted and the implementation of the ADZ is overseen by a well organised management structure involving key government bodies (see more information on the proposed approach below). Furthermore, the recently identified reef near the centre of Algoa 1 Option 1 must be excluded from the ADZ as recommended in the marine specialist study in Appendix D of the BAR (Hutchings *et al.* 2019) and the socio-economic impact assessment (Section 10.5 in this BAR) (Figure 3). Updated coordinates for Algoa 1 Option 1 are shown in Table 11.

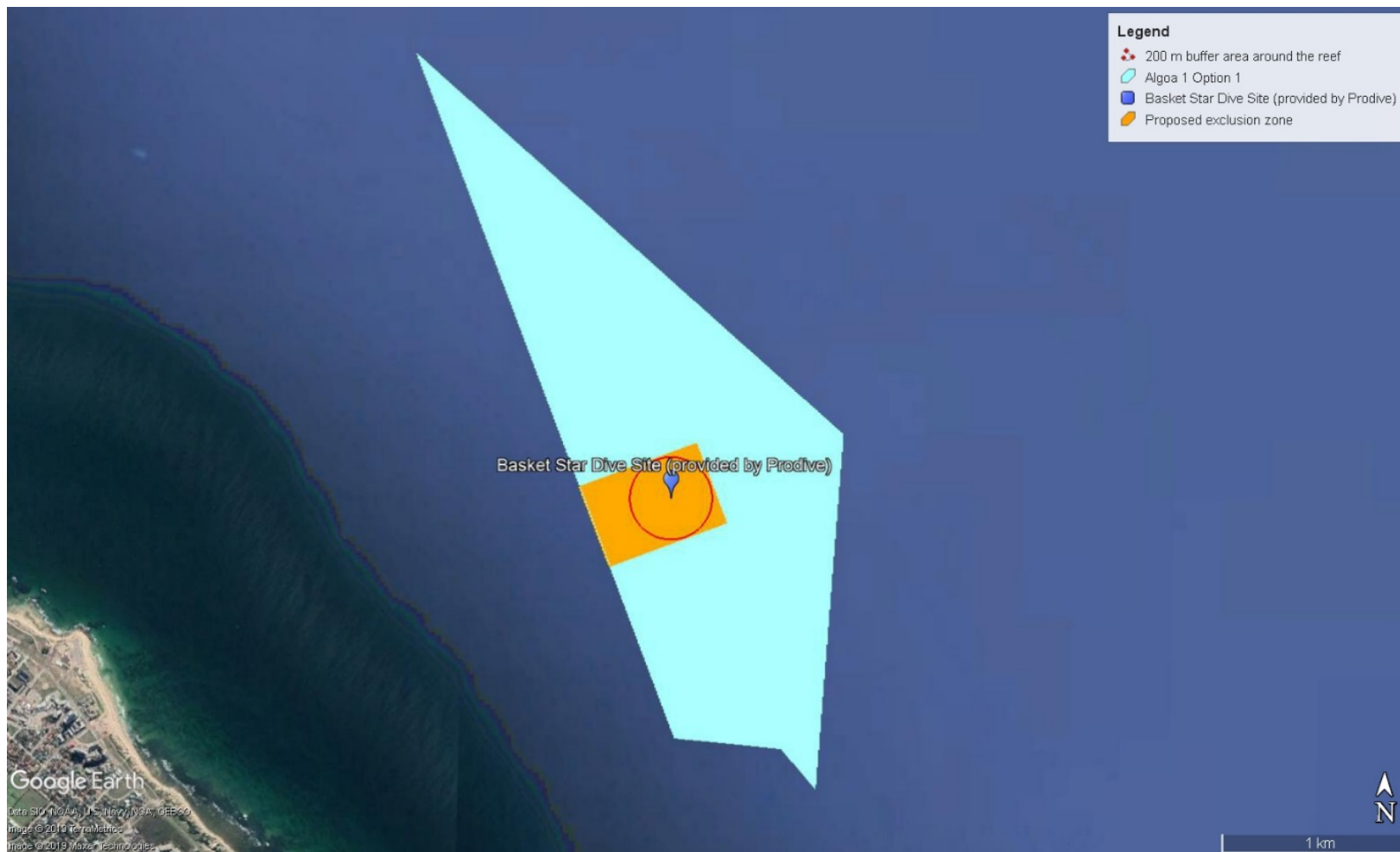


Figure 3 Basket star dive site identified by Prodiver near the centre of Algoa 1 Option 1 and recommended buffer and access zone to be excluded from the proposed Aquaculture Development Zone. The area to be excluded is 27.6 ha in size.

Table 11 Summary of the preferred Alternative Option B. This Alternative is the preferred option of the Department of Agriculture, Forestry and Fisheries and has been identified as the best practicable environmental option for Algoa Bay by the appointed Environmental Assessment Practitioner.

Site name	Location name	Geographic coordinates (WGS 1984)	Size (ha)	Culture type	Projected job creation and positive impact on GDP (significance rating after mitigation)	Sensitive receptors (greater than medium significant negative impacts after mitigation have been listed individually)
Algoa 1 Option 1	Summer-strand	Centre: 33° 58.610'S; 25° 42.322'E Corner points, clockwise from the northwest corner: 33° 57.440'S; 25° 41.311'E 33° 58.452'S; 25° 42.781'E 33° 59.409'S; 25° 42.726'E 33° 59.283'S; 25° 42.630'E 33° 59.296'S; 25° 42.224'E Excised Area as per recommendations in the marine ecology and socio-economic studies: 33° 58.811'S; 25° 42.025'E 33° 58.685'S; 25° 42.407'E 33° 58.468'S; 25° 42.302'E 33° 58.593'S; 25° 41.921'E	312 – Excised area 27.6 ha = 285.3 ha	Bivalve	Impact on GDP: High Employment opportunities assuming mussel to oyster ratio of 70:30 (direct and indirect): 900 Impact = High	<i>Marine Ecological impacts:</i> The residual impact of all impact types were rated as either low All impacts of bivalve farming are considered low after implementation of mitigation measures <i>Visual aesthetics:</i> Low <i>Socio-economic impacts:</i> The residual impact of all impact types were rated as either low, very low or insignificant. <i>Heritage resources:</i> Insignificant (only applicable to the construction phase)
Algoa 6	Port Elizabeth Harbour	Centre: 33° 56.020'S; 25° 37.651'E Corner points, clockwise from the northwest corner: 33° 54.624'S; 25° 37.668'E 33° 54.619'S; 25° 37.979'E 33° 57.258'S; 25° 37.998'E 33° 57.256'S; 25° 37.519'E 33° 56.571'S; 25° 37.210'E 33° 55.551'S; 25° 37.272'E	479	Bivalve	Impact on GDP: High Employment opportunities (direct and indirect): 2 240 Impact = High	<i>Marine Ecological impacts:</i> The residual impact of all impact types were rated as either low <i>Visual aesthetics:</i> Very low <i>Socio-economic impacts:</i> The residual impact of all impact types were rated as either low, very low or insignificant. <i>Heritage resources:</i> Insignificant (only applicable to the construction phase)
Algoa 7	Ngqura Harbour	Centre: 33° 50.105'S; 25° 43.098'E Corner points, clockwise from the northwest corner: 33° 50.105'S; 25° 43.098'E 33° 49.722'S; 25° 41.996'E 33° 49.717'S; 25° 43.652'E 33° 50.472'S; 25° 44.148'E 33° 50.468'S; 25° 42.497'E	355	FInfish	Impact on GDP: Medium Employment opportunities (direct and indirect): 160 jobs Impact = Medium	<i>Marine Ecological impacts:</i> <ul style="list-style-type: none"> • Disease and parasite transmission to wild fish stocks = High • Organic waste discharge impacting on the water column and benthic environment = Medium • Use of chemical therapeutants and antifoulants = Medium

Site name	Location name	Geographic coordinates (WGS 1984)	Size (ha)	Culture type	Projected job creation and positive impact on GDP (significance rating after mitigation)	Sensitive receptors (greater than medium significant negative impacts after mitigation have been listed individually)
						<ul style="list-style-type: none"> • Piscivorous marine animals interfering with finfish cage culture operations = Medium <p><i>Visual aesthetics:</i> Very low</p> <p><i>Socio-economic impacts:</i></p> <ul style="list-style-type: none"> • Negative impact of income leakage on local economic development =Medium • The residual impact of all other impact types were rated as either low, very low or insignificant. <p><i>Heritage resources:</i> Insignificant (only applicable to the construction phase)</p>

A comprehensive Environmental Management Programme (EMPr), which includes the conditions of the overarching ADZ EMPr, would have to be developed and implemented for each aquaculture farm within the ADZ. This EMPr would have to include independent monitoring of a wide range of indicators that will enable detection and quantification any of the environmental impacts described in this Basic Assessment Report and would have to specify thresholds of potential concern (TPCs) that require remedial action. The development of the ADZ should be phased in such a way that cumulative impacts can be detected as they arise, and appropriate adaptive management implemented.

It is recommended that no more than three *finfish* operators should be approved for an initial pilot phase, with a total annual production for the ADZ not exceeding 1 000 tonnes in the first year. Should monitoring reveal acceptable impacts as defined by the environmental quality objectives, indicators and performance measures, the individual operators may be permitted to increase production to full commercial scale over a three-year period, provided resource quality objectives are maintained. The carrying capacity estimates for *Seriola lalandi* and *Argyrosomus sp.* as recommended in Wright *et al.* (2019) should be verified for Algoa 7 by means of environmental monitoring.

The implementation of a phased approach, where expansion to maximum carrying capacity scale is only pursued if environmental impacts are acceptable, would be overseen by the ADZ Management Committee (AMC) (see EMPr in Appendix A for more details on the proposed management approach). This management structure is being successfully employed to monitor implementation of the Saldanha Bay Aquaculture Development Zone, and thus provides proof of concept for this approach.

It is recommended that the AMC committee comprise at least of DAFF, DEA (Oceans and Coasts / Biodiversity Branches), DEDEAT (Eastern Cape Provincial Department of Economic Development, Environmental Affairs and Tourism), the Nelson Mandela Bay Municipality and Transnet National Ports Authority. The AMC would play a coordinating and supervising role and ensure compliance with the EMPr throughout all phases of aquaculture farming in the ADZ. Furthermore, a Consultative Forum (CF) that includes the aquaculture operator, other relevant government departments, authorities and relevant local/public interest organisations must also be set-up to review environmental monitoring data and advise on management and recommend measures.

In terms of the Oceans Economy component of Operation Phakisa, the South African government has committed to undertaking Marine Spatial Planning (MSP) under Initiative 10 of Phakisa's "Marine Governance and Protection Services Delivery Area". The Marine Spatial Planning Act (Act 16 of 2018) (MSPA) was promulgated on 6 May 2019. The objectives of MSPA are to 'promote sustainable economic opportunities which contribute to the development of the ocean economy through coordinated and facilitated good ocean governance'. A well-managed, participatory and effective marine spatial planning process can contribute towards integrating and balancing the provision of ocean ecosystem services without compromising the ecological integrity of our marine ecosystems on which such services depend. Regulations defining the requirements for approving area-specific marine spatial plans in terms of this Act are yet to be promulgated. The Marine Spatial Planning framework has been published and provides a substantial description of the process that is to be followed in South African marine waters.

The Department of Environmental Affairs is currently developing a Marine Spatial Plan for Algoa Bay in terms of the MSPA. Although this plan will not be approved in terms of the MSPA prior to the submission of this application, decisions regarding development in the marine domain are to be made with co-operative governance processes in mind, taking account of MSP legislation. This means that all marine activities in the Bay, including land-based activities, must be located and conducted in a manner that will not impact on other government departments' mandates.

3 BACKGROUND

Aquaculture is defined as the propagation, improvement, rearing, regular stocking, feeding or protection from predators and harvesting of aquatic organisms (plant and animal) in controlled or selected aquatic environments (fresh, sea or brackish waters, on land or at sea) for any commercial, subsistence, recreational or other public or private purposes (DEA&T 2007, South African Aquaculture Development Bill 2018).

Unlike with 'capture fisheries', which entail the harvesting of aquatic organisms from the natural environment in which no attempt has been made to manage, or otherwise influence the organisms by containment, feeding or application of any husbandry technique, aquaculture involves some form of intervention in the rearing process to enhance production i.e. regular stocking, feeding and protection from predators.

Due to a growing interest in aquaculture, the Provincial Department of Economic Development, Environmental Affairs and Tourism in the Eastern Cape Province (DEDEAT) published an Introduction to Aquaculture in the Eastern Cape (Hinrichsen 2008) in which it is stated that the global harvest of natural aquatic resources for food, protein, oils and other materials has reached capacity and has already caused a collapse in the stocks of various species, habitat loss and pollution. Nevertheless, the demand for these aquatic resources is increasing and controlled aquaculture production has the potential to meet this demand in a responsible manner.

Marine aquaculture, or mariculture is the process of cultivating and harvesting sea-based aquatic organisms. Marine aquaculture includes the commercial farming of all marine organisms such as finfish (or true fish), shellfish (abalone, mussels, prawns) and seaweed.

3.1 History of marine aquaculture in South Africa

Over the past 30 years aquaculture has developed into a global industry with over 100 countries engaging in the production of more than 250 different species of finfish, shellfish, crustaceans and aquatic plants (DEAT 2007).

The Food and Agriculture Organisation (FAO) of the United Nations Fisheries and Aquaculture Department regularly publishes Global Aquaculture Production Statistics online. According to the newly released data, world marine aquaculture production of food fish was 59 million tonnes in 2016, of which Africa contributed only 0.28% of the total production (167 000 t). The estimated value of food fish farmed in the marine environment is USD 101 million (FAO 2018BA), which compares favourably to 79.3 million tons of wild marine fish caught globally in 2016.

Commercial marine aquaculture in South Africa started in the 1980's with the establishment of oyster, mussel and prawn farming. Abalone farming was developed in the 1990s and is now the most valuable resource of the sector. South Africa is regarded as the top producing country of farmed abalone. DAFF annually compiles, analyses and interprets aquaculture production data, which is published in the Annual Aquaculture Yearbook. The most recent Yearbook was published in 2016 and contains the production data for 2015 (DAFF 2016).

During 2015, species cultivated in the marine sector included abalone (*Haliotis midae*), pacific oyster (*Crassostrea gigas*), mussels (*Mytilus galloprovincialis*, *Chromomytilus meridionalis*), dusky kob (*Argyrosomus japonicus*), and seaweed (*Ulva spp*, *Gracilaria spp*).

In 2015, the total South African marine aquaculture production was 3592 tonnes, where mussels (1758.44 tons) contributed most to production, followed by abalone (1479.22 tons) and then oysters (276.85 tons). Finfish contributed the least to production in the marine sector. In 2015, the Eastern Cape was home to approximately 38% of South Africa's aquaculture producers (13 out of a total of 34) and has been identified as having significant marine aquaculture potential. The coastline is well known for the harvest of natural marine resources and possesses the potential for the development of a strong marine and freshwater aquaculture sector.

3.2 Finfish farming

Finfish are animals with a skull and in most cases a backbone, that have gills throughout their life and whose limbs, if any, are in the shape of fins. The development of modern sea cage finfish farming which began in the 1970s, occurred largely due to the growth of the salmon farming industry in countries with glaciated coastlines (e.g. Scotland, Norway, British Columbia, Chile) (Clark *et al.* 2013). The number of finfish species used in marine cage culture internationally has since grown dramatically and now includes salmon, tuna, flatfish, kingfish, bream, Sciaenids (e.g. sea bass) and a host of other species grown in a variety of cage culture systems (Staniford 2002).

Although some sea cage farming operations rely on wild caught stock e.g. southern and northern bluefin tuna farms (located largely in Australia and the Mediterranean, respectively), most farms use finfish fingerlings that are obtained from land based hatcheries, where brood stock, egg and larvae husbandry can be carried out under controlled conditions. Fingerlings are stocked into sea cages at species- and environmentally specific optimal sizes and densities, are fed, usually with commercially available protein and lipid rich dry food, treated for diseases and parasites, graded, and harvested at a size that results in the maximum economic return. Marine ecological impacts of finfish cage farming have been well documented and reported in international literature (e.g. see: Stickney & McVey 2002, Staniford 2002). These impacts include (but are not limited to) organic pollution from finfish sea cages, genetic changes and disease transfer to wild finfish stocks, interactions with mammals (including entanglement) and chemical pollution. These impacts are assessed in detail in the marine specialist study in Appendix D of this BAR (Hutchings *et al.* 2019) and have been summarised in Chapter 10 of this document alongside potential visual, socio-economic and heritage resources impacts.

3.3 Shellfish farming

The global production of bivalves has grown from around 1 million tonnes in 1950 to 16.1 million tonnes in 2015 (FOA 2018), with just over half of the volume derived from aquaculture production (McKindsey *et al.* 2011). Bivalve aquaculture accounts for roughly 27% of global aquaculture production and provided approximately 13% of the total seafood produced for human consumption worldwide in 2006 (FOA 2009).

Bivalves are filter feeders, which means that they extract phytoplankton and small organic particles from the water column (also referred to as extractive species). Phytoplankton removal and faeces excretion to the benthos (i.e. nutrient cycling) are critically important to maintain healthy ecosystems (Nakamura and Kerciku, 2000). Land-based aquaculture systems are increasingly growing oysters in multi-trophic aquaculture systems, which combine fed aquaculture (i.e. finfish and abalone) with inorganic extractive (seaweed) and organic extractive (oysters, sea cucumbers and sea urchins) aquaculture to create balanced systems for environmental remediation (biomitigation), economic stability (improved output, lower cost, product diversification and risk reduction) and social acceptability (better management practices). Similarly, sea-based Integrated Multi-Trophic Aquaculture (IMTA) has the potential to transform waste products into valuable co-products. Currently, the open nature of the ocean and variability in local oceanographic conditions (currents direction and strength) pose a challenge to this new and rapidly evolving aquaculture concept (Buck *et al.* 2018).

The rapid growth of the industry has raised concerns about the ecological and physico-chemical impacts of aquaculture on local environment (Black 2001) and numerous studies have been conducted to help better understand the ecological role played by culturing activities (Davenport *et al.* 2003; Holmer *et al.* 2008, National Research Council 2010). Ecological studies of bivalve aquaculture have identified three primary ways that bivalve culture can impact the ecosystem: 1) material processes – the consumption of food and production of waste, 2) physical structure – the introduction of artificial substrate in the form of structures and anchoring, and the introduction of the aquaculture species itself, and 3) pulse disturbances – as result of harvesting efforts (Dumbauld *et al.* 2009). Suspended ropes or baskets on longlines or rafts, the method commonly used for bivalve mariculture in South African, reduces the impacts of pulse disturbance because harvesting and maintenance is conducted from boats which ensures that there is no additional physical contact with the benthos. This off-bottom method is, however, more susceptible to biofouling (Shumway & Whitlatch 2011). The impacts of this can be mitigated by appropriate planning and management, which if conducted with enough regularity, can prevent biofouling species from significantly altering the benthic community (Forrest *et al.* 2009). Many studies have focused on the role of bivalve biodeposition to changes in the benthos. These largely report that impacts are localised and negligible by comparison to other aquaculture activities, such as finfish cages (Forrest *et al.* 2009). Marine ecological impacts are assessed in detail in the marine specialist study in Appendix D of this BAR (Hutchings *et al.* 2019) and have been summarised in Chapter 10 of this document alongside potential visual, socio-economic and heritage resources impacts.

Although sheltered when compared to Algoa 1 Option 1 (Summerstrand site) and 7 (Ngqura Harbour site), Algoa 6 (PE Harbour site) experiences regular wind driven surface ‘chop’ and occasionally swell conditions not suitable for *current* mussel culture methods unless the ropes are suspended 6-7 metres below the surface, which prevents mussels from being dislodged. Algoa 6 is too shallow to implement this mitigation measure (~10 m depth), and hence is not well suited for mussel farming. In contrast, oysters are farmed in baskets and Zwembesi Farms successfully adjusted their farming equipment to withstand oceanographic conditions at Algoa 6. Algoa 1 Option 1 is suitable for both mussel and oyster farming due to sufficient water depth (~40 m). Zwembesi Farms indicated that pathogens originating from land-based effluent discharges assimilated by oysters at sea are purged (removed) within two weeks of uptake and that currently, grown oysters at sea in Algoa 6 need to be held in controlled land-based facilities before sale to ensure that the product is fit for consumption (compliance with

international food safety standards is confirmed by weekly food safety tests). Land-based facilities are expensive and limited, therefore the addition of Algoa 1 Option 1 would enable oyster growers to utilise cleaner water 2 km offshore for the grow out phase and reduce the risk of pollution delaying the release of the product onto the market (Simon Burton, Zwembesi Farms (Pty) Ltd, pers. communication June 2019).

3.4 Project applicant

The Department of Agriculture, Forestry & Fisheries (DAFF) is responsible for overseeing and supporting South Africa's agricultural and aquaculture sector (freshwater and seawater aquaculture alike), as well as ensuring access to sufficient, safe and nutritious food by the country's population. Among other mandates and responsibilities, the Branch Fisheries Management is responsible for developing a sustainable and competitive aquaculture sector that will contribute meaningfully to job creation, economic development, sustainable livelihood, food security, rural development and transformation in South Africa.

Aquaculture is one of the sectors which form part of Operation Phakisa under the Ocean's Economy in South Africa. Operation Phakisa is an initiative of the South African government which aims to implement priority economic and social programmes better, faster and more effectively. Operation Phakisa was launched by the President of the Republic in October 2014. The DAFF is the lead department for the Oceans Economy Aquaculture focus area and its deliverables. The Lab concluded that South Africa's aquaculture sector has a high growth potential due to an increasing demand of fish products. Moreover, the capture fisheries yield has been plateauing over the past decade while aquaculture continues to grow over 7% per annum.

As the lead agent for aquaculture management and development in South Africa, DAFF intends to establish and manage a sea-based Aquaculture Development Zone (ADZ) in Algoa Bay located in the Eastern Cape. It must be noted, however, that DAFF intends to develop both sea-based and land-based aquaculture sectors. Land-based aquaculture is therefore not considered an alternative to sea-based aquaculture in this application as DAFF has separate initiatives for the development of this sector.

3.5 Identification of potential ADZ sites in Algoa Bay

Algoa Bay is located on the south eastern coast of South Africa. Port Elizabeth is the largest city in the region and is the economic hub for Algoa Bay. Algoa Bay is one of the few protected bays along the South African coast explaining the preference by a great number of different users (e.g. line fishing, squid fishing, small boating activities, recreational fishing, scuba diving etc.) who make use of the Bay. Furthermore, Algoa Bay is recognised as an important marine biodiversity area due to the islands that are home to important colonies of sea birds and large number of reefs and variety of benthic habitat types (Dorrington *et al.* 2018). The recently promulgated Addo Marine Protected Area (MPA) covers 108 050 ha, incorporating the shores of the Addo Elephant National Park, the St Croix island group and Bird Island in the eastern part of the bay. As a result, Algoa Bay has a relatively high level of user conflict.

Originally three marine aquaculture (mariculture) precincts were identified for finfish culture in Algoa Bay in the 2011 Strategic Environmental Assessment (SEA) (Clark *et al.* 2011) (Figure 4). In the SEA, site selections were considered using the following exclusionary criteria:

- **Distance from a suitable port.** A suitable port is considered one which is able to accommodate a 15m work boat and falls within 20 km of the proposed site. A greater distance, or the lack of a port to accommodate such a vessel eliminated a location;
- **Water depth.** A balance between the minimum required water depth for flushing waste (international standards are at least 5 m below the bottom of the cage) and the increasing cost of mooring in deeper water. To make it economically viable, it was considered that inshore cages should have a water depth between 20 and 60 m and offshore cages between 30 and 150 m. All shallower or deeper were excluded;
- **Water temperature.** Optimal growth of likely SA species (kob, yellowtail, grunter) trading off against parasite / disease prevalence. Locations where temperature fluctuations are known, or water is too cold or hot for line fish were eliminated;
- **Upwelling cells.** Upwelling can create temperature shocks which negatively affects growth and health of a cultured stock. As such, the known locations for such upwelling cells were eliminated;
- **Exposure to waves.** Extreme sea conditions can damage cages and decrease the service frequency of the facility. Areas with high wave action exposure were thus eliminated;
- **Turbidity and pollutants associated with river mouths.** Outflow from river mouths could potentially deform cages and damage moorings, and rivers that carry high pollutant concentrations could be hazardous for fish. As such, the locations of such river mouths were buffered and excluded as suitable locations;
- **Harmful algal blooms.** Algal blooms which occur frequently and for long periods can impact on the survival, growth rate and health of cultured stock. The known locations of such blooms were therefore excluded as potentially suitable areas;
- **Reef areas and sensitive marine habitats.** Reefs and sensitive habitats, especially rocky areas, can be severely impacted by cultured operations. As such, these habitats were excluded from the site selection options. Sandy substrates have less diversity and are less sensitive to impacts from waste and mooring;
- **Marine Protected Areas (MPA's).** MPA's fulfil conservation, research and socio-economic roles and should remain as pristine as possible. Proclaimed MPAs were therefore mapped and an ADZ was only considered in proximity to an MPA if the MPA Managers Forum agreed to exclude the area from the (proposed) MPA;
- **Archaeologically important shipwrecks.** Mooring and anchoring required for fish farms may damage archaeologically important precincts. Unfortunately, due to their heritage / cultural value, the location of most shipwrecks was not disclosed to the public and could therefore not be mapped. Known wrecks were however considered and excluded from the project locations. Reefs pose a navigation risk, which means that a higher number of historically important shipwrecks could occur in these areas. Excluding reef habitat from the potential precincts may mitigate impact on archaeologically important shipwrecks.
- **Existing commercial activities.** To minimise user conflict, no precincts were placed in known fishing, mining and shipping precincts.

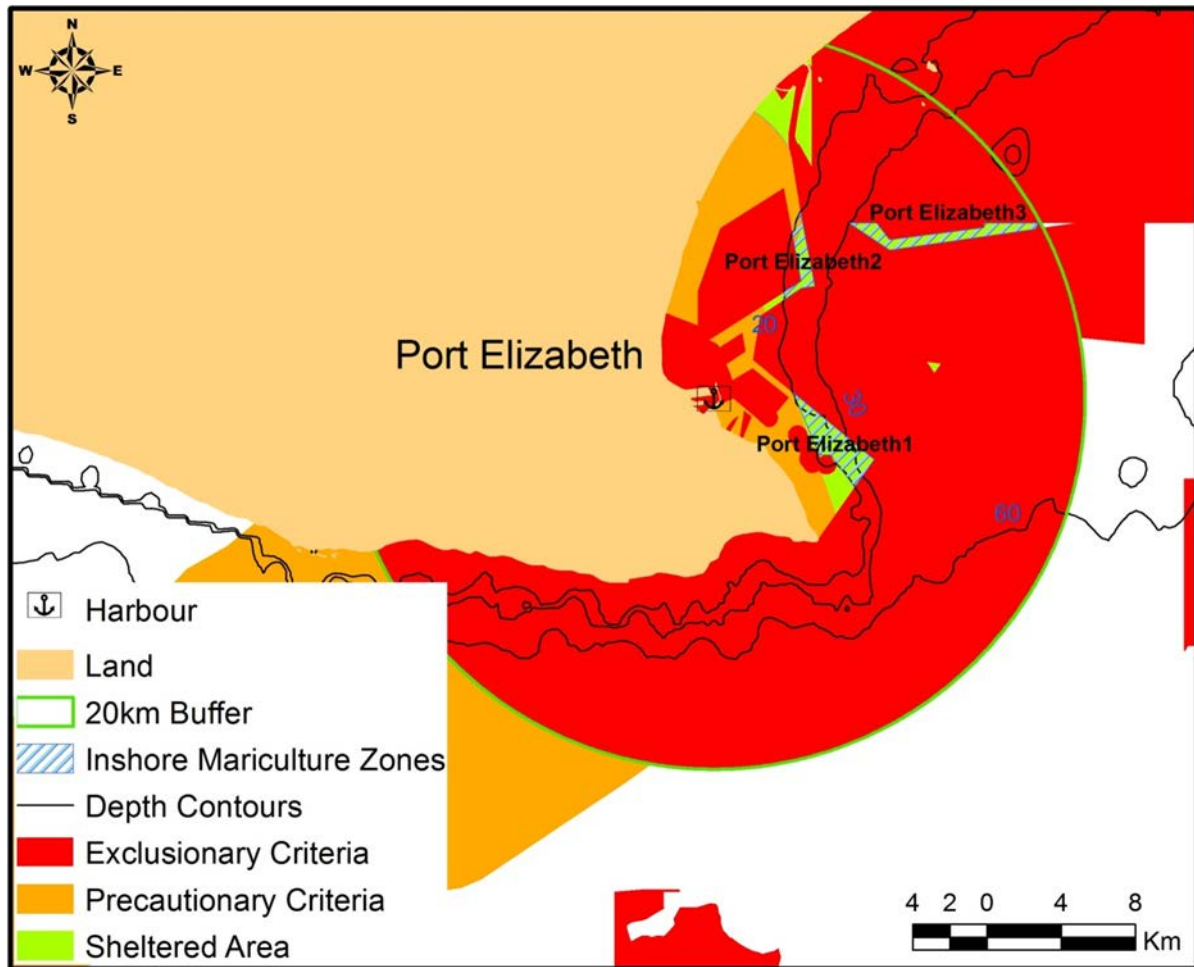


Figure 4 Areas that met the site selection criteria for potential finfish aquaculture development zone using inshore cage technology within a 20 km radius of Port Elizabeth and Coega harbours (Source: Clark *et al.* 2011).

The original SEA was conducted for the entire South African coastline and a finer scale SEA was required to ensure a sound site selection process to identify sites to be taken forward into the EIA process (2010-2014). Indeed, precincts Algoa 2 and 3 (named Port Elizabeth 2 and 3 in Figure 4) were screened out from the EIA process as they were found to lie within an area with very high shipping traffic. Although highly preferred from an environmental perspective, the sites fell under the jurisdiction of the Port of Ngqura and the potential for collision of vessels with aquaculture farms in this area was considered a fatal flaw (note that the remainder of Algoa 3 that extends beyond the jurisdictional area would have been too small to constitute a viable ADZ site) (CapeEAPrac 2012) (Figure 5).

Two additional potential finfish precincts, namely Algoa 4 and 6, were subsequently identified, briefly assessed and screened out (See Figure 5). Algoa 4 was found to be environmentally less suitable in terms of wave exposure and water depth (as a result of this site being situated further offshore), which would have required more sophisticated and expensive equipment to achieve the same objectives as the other precincts. Algoa 6 was screened out for finfish culture due to insufficient water depth for waste dispersion below the cages.

Finally, Algoa 1 (original extent) was identified as the preferred alternative, although with a reduced footprint when compared to the area identified during 2011 SEA (Clark *et al.* 2011) (Figure 4 and Figure 5). Algoa 5 was identified as a potential finfish site later on and was taken forward into the impact assessment process as the alternative site to Algoa 1 (original extent) (Figure 5). Environmental Authorisation (EA) was granted for Algoa 1 Option 1 on 9 July 2014 (to be expanded into the southern portion/Option 2 should socio-economic and marine monitoring outcomes support expansion).

A total of twenty-eight (28) substantive appeals were lodged against the decision to grant EA for finfish farming at Algoa 1 Option 1. In response, the Minister of Environmental Affairs issued a decision on the Appeal suspending the EA to allow for further studies to be undertaken. In mid-2016, DAFF commissioned three comparative assessments, including a detailed feasibility study, a socio-economic assessment and a marine ecological assessment for Algoa 1 and 5.

The economic feasibility study conducted by Britz and Sauer (2016b) found that conditions at Algoa 1 were marginal for economic aquaculture and limited mitigation was possible. Algoa 1 was found to be not economically competitive and therefore economic feasibility was found to be low (average score of 2.2/5) (Britz and Sauer 2016b).

Furthermore, Britz and Sauer (2016b) found that conditions at Algoa 5 are sub-optimal for economic aquaculture and mitigation measures would be impractical or uneconomic to implement, which rendered the proposed site not economically competitive. The closest port, Port of Ngqura, is located approximately 15 km west of Algoa 5, which imposes a severe operational constraint on servicing cages at Algoa 5. For salmon farming, 10 km from port is regarded as a maximum feasible travel distance from port for daily feeding (Britz *et al.* 2016). Combined with severe wind and swell exposure, very large vessels would be required to safely service the cages and to meet requirements for daily feeding and maintenance.

Establishment of a small harbour development at Sundays River could potentially assist in meeting these requirements, but larger vessels required for cage servicing would not be able to operate out of the Sunday's estuary. The requirement for larger vessels would add dramatically to the capital costs for Algoa 5 rendering the return on investment sub-economic (Britz and Sauer 2016b). Furthermore, Algoa 5 is located near the middle of the recently promulgated Addo MPA. For the reasons described above, Algoa 5 was screened out and has not been taken forward as a potential precinct in the current Basic Assessment process.

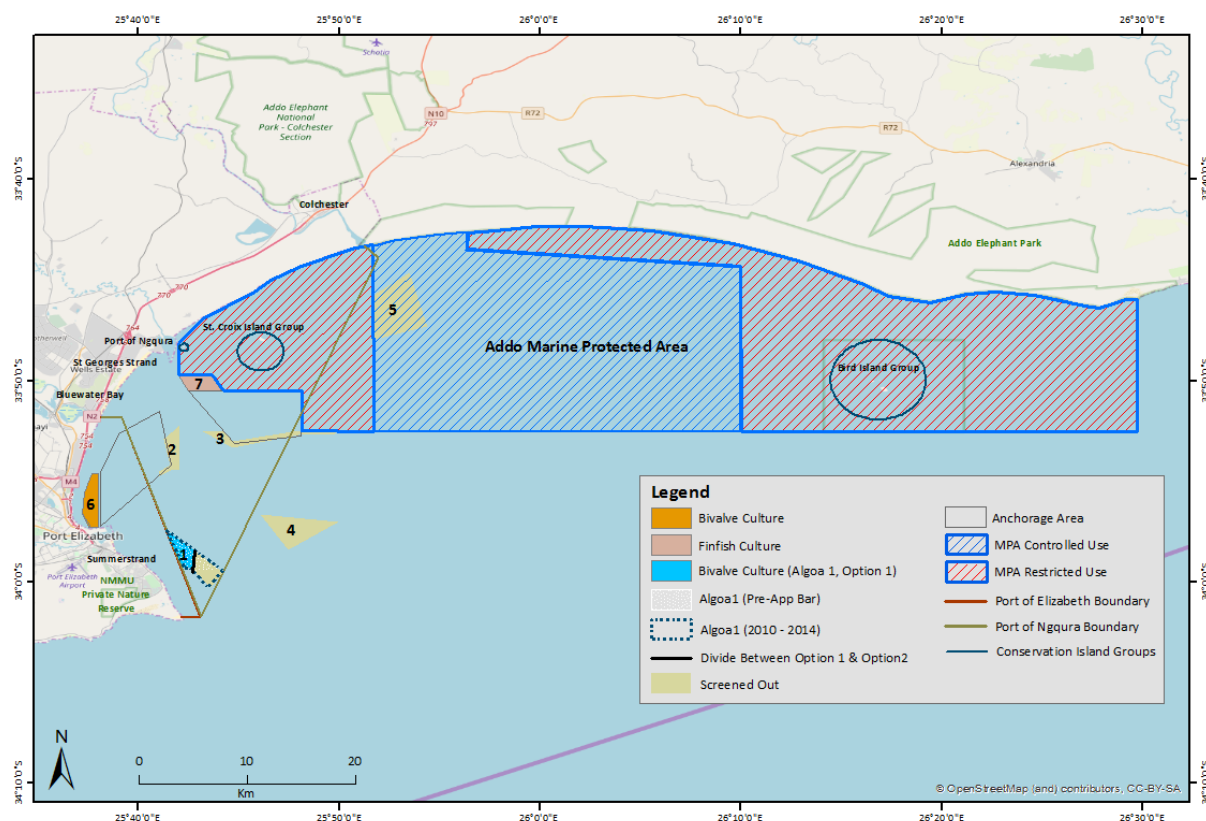


Figure 5 Precincts considered during the previous and current application for environmental authorisation for a sea-based Aquaculture Development Zone in Algoa Bay, Eastern Cape. Precincts 2, 3, 4 and 5 were found to be unfeasible and were screened out. The southern portion of Algoa 1 (Option 2) has been screened out to reduce impacts on the chokka squid fishing industry. Precincts 1 Option 1, 6 and 7 constitute economically feasible precincts and have been considered during the present Basic Assessment process.

Following the completion of the comparative assessments for Algoa 1 and 5, DAFF elected to withdraw the original application for environmental authorisation and has elected to submit a new application for the development of the ADZ for which a Basic Assessment process is required in terms of the 2014 EIA Regulations (as amended) promulgated in terms of the National Environmental Management Act (Act 107 of 1998). DAFF intends for the ADZ to accommodate finfish as well as bivalve culture (oysters/mussels) within a combination of precincts.

The precincts considered in this new application include one precinct from the previous process (Algoa 1 Option 1), and two new precincts, designated as Algoa 6 and 7 (Figure 1). Algoa 6, situated near the Port Elizabeth Harbour, was identified but screened out in the scoping study of the original EIA (2010-

2014) which focussed only on finfish culture, and is now been put forward as a potential site for bivalve production in this new (2019) application process. Algoa 7 is a new precinct located directly in front of the Ngqura harbour that has been identified as a potential site for finfish. Prior to the start of this project, DAFF undertook a feasibility assessment involving key stakeholders, in which it was found to be suitable in terms of water depth, shipping traffic, and accessibility (i.e. financial considerations) and proximity to the recently promulgated Addo MPA.

In this BA process, environmental impacts of finfish culture were assessed for Algoa 1 Option 1 and Algoa 7. Impacts of bivalve culture were assessed for Algoa 1 Option 1 and Algoa 6.

Each of the precincts that are being taken forward into the environmental impact assessment process is described in more detail below. It is important to note that DAFF is seeking to promote farming of both bivalves and finfish in Algoa Bay and therefore the approach to choosing alternatives has changed from considering individual precincts as alternatives to each other (i.e. the previous process chose Algoa 5 as an alternative to Algoa 1 (original extent)) to considering a combination of precincts and species as alternative options. This is discussed in more detail in Section 4.5, which elaborates on the approach taken in choosing alternatives (site, technology, species etc.) for this Basic Assessment process.

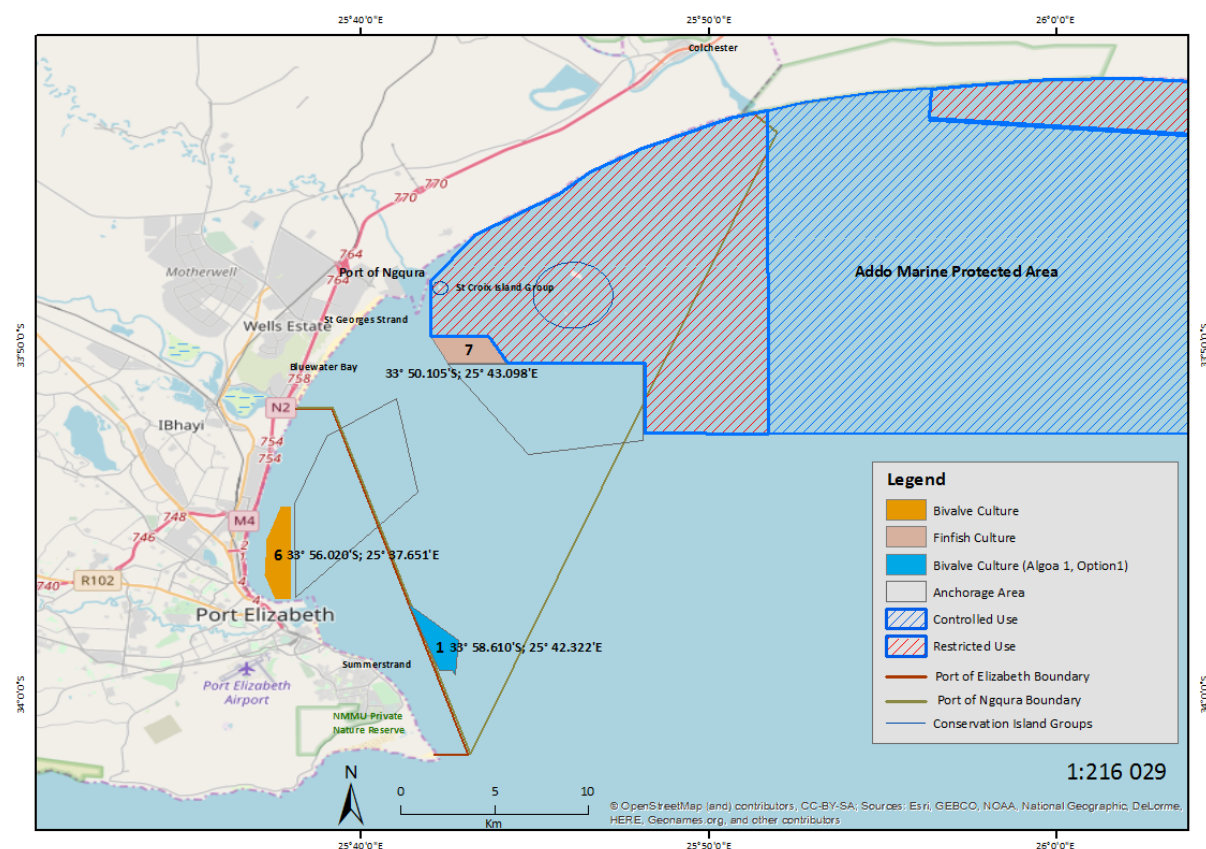


Figure 6 Precincts considered during the 2019 application for environmental authorisation for a sea-based Aquaculture Development Zone in Algoa Bay, Eastern Cape. Precincts 1 (Option 1), 6 and 7 constitute economically feasible precincts and have been considered during the present Basic Assessment process.

3.5.1 Algoa 1 Option 1 (Summerstrand Site)

Algoa 1 Option 1 has been identified as a potential site for bivalve and/or finfish culture. The site measures approximately 312 ha and lies approximately 2 km offshore from the popular beaches of the southern suburbs of Port Elizabeth (King's Beach, Humewood Beach, Hobie Beach, and Pollock Beach).

The original Algoa 1 extent (689 ha) (Figure 5) was identified in the initial SEA study of 2011 (Clark et al. 2011) as the best option due to its proximity to Port Elizabeth Harbour (<5 km) and relatively low wave energy conditions. Marine, visual and social-economic specialists identified potentially significant negative impacts on other users and the environment should the entire original extent of Algoa 1 be developed. Algoa 1 was therefore divided into two segments - Option 1 (north) and Option 2 (south) (see Figure 5). Environmental Authorisation was granted for pilot scale finfish farming at Algoa 1 Option 1 in July 2014, with the understanding that while quantifiable impacts on the commercial chokka squid industry were avoided during the pilot phase, negative visual, marine ecological, and unquantified economic impacts could still occur as a result of Algoa Option 1. The 2014 Environmental Authorisation was intended for the pilot scale project at Algoa 1 Option 1 and the authorisation would have been extended to Option 2 upon submission of evidence that socio-economic impacts would have been acceptable.

The pre-application BAR considered the original extent of Algoa 1 with a reduced footprint (Algoa 1 Option 1 and part of Option 2, Figure 5). However, DAFF has decided to exclude the entire southern portion of Algoa 1 from the ADZ and the BAR has been amended accordingly. The coordinates delineating the centre and boundaries of Algoa 1 Option 1 are shown below.

Centre geographic coordinates (WGS 1984): 33° 58.610'S; 25° 42.322'E

Geographic coordinates (WGS 1984) of corner points, clockwise from the northwest corner are listed below:

33° 57.440'S; 25° 41.311'E

33° 58.452'S; 25° 42.781'E

33° 59.409'S; 25° 42.726'E

33° 59.283'S; 25° 42.630'E

33° 59.296'S; 25° 42.224'E

3.5.2 Algoa 6 (Port Elizabeth Harbour Site)

Algoa 6 has been identified as a potential site for bivalve culture. The site measures approximately 479 ha and is located in water ranging in depth from 5-12 m. This site is situated adjacent to the Port Elizabeth harbour wall and extends parallel to the shoreline for approximately 4.8 km. This site is not suitable for finfish farming as it is too shallow for adequate dispersal of waste from finfish cages. Algoa 6 is, however, suitable for bivalve farming.

The immediate coastal area is characterised by urban industrial development and a mostly modified shoreline fringed by railway tracks and the Settlers Highway (M4). During the previous EIA, stakeholders indicated support for Algoa 6 due to much reduced conflict with other user groups when compared to Algoa 1 (recreational, fisheries, tourism activities and conservation). Economic feasibility of this site is considered good for bivalve aquaculture. The coordinates delineating the centre and boundaries of Algoa 6 are shown below.

Centre geographic coordinates (WGS 1984): 33° 56.020'S; 25° 37.651'E

Geographic coordinates (WGS 1984) of corner points, clockwise from the northwest corner are listed below:

33° 54.624'S; 25° 37.668'E
33° 54.619'S; 25° 37.979'E
33° 57.258'S; 25° 37.998'E
33° 57.256'S; 25° 37.519'E
33° 56.571'S; 25° 37.210'E
33° 55.551'S; 25° 37.272'E

3.5.3 Algoa 7 (Ngqura Harbour site)

Algoa 7 has been identified as a potential site for finfish culture. This site measures 355 ha in size and is positioned approximately 3 km offshore from the Ngqura harbour. Algoa 7 is not expected to impact significantly on shipping traffic. This site lies adjacent to the recently promulgated Addo Marine Protected Area (MPA) and a precautionary as well as risk adverse approach should be applied as the operation of an aquaculture farm is in direct conflict with conservation goals of the MPA. The coordinates delineating the centre and boundaries of Algoa 7 are shown below.

Centre geographic coordinates (WGS 1984): 33° 50.105'S; 25° 43.098'E

Geographic coordinates (WGS 1984) of corner points, clockwise from the northwest corner are listed below:

33° 49.722'S; 25° 41.996'E
33° 49.717'S; 25° 43.652'E
33° 50.472'S; 25° 44.148'E
33° 50.468'S; 25° 42.497'E

4 PROJECT DESCRIPTION

Aquaculture is defined as the propagation, improvement, rearing, regular stocking, feeding or protection from predators and harvesting of aquatic organisms (plant and animal) in controlled or selected aquatic environments (fresh, sea or brackish waters, on land or at sea) for any commercial, subsistence, recreational or other public or private purposes (DEA&T 2007, South African Aquaculture Development Bill 2018). Marine aquaculture, or mariculture, is the process of cultivating and harvesting sea-based aquatic organisms. Marine aquaculture includes the commercial farming and ranching of all marine organisms such as finfish, shellfish (i.e. abalone, mussels, prawns) and seaweed. Operations generally involve some form of intervention in the rearing process to enhance production (i.e. regular stocking, feeding, and protection from predators).

DAFF intends to promote land-based and sea-based aquaculture in Algoa Bay. The land-based ADZ at the Coega Industrial Development Zone (IDZ) was authorised by the Department of Environmental Affairs on 7 February 2018 and currently accommodates aquaculture production facilities and processing facilities. The proposed Aquaculture Development Zone (ADZ) in this application is sea-based, which means that marine organisms are reared in the sea. However, the sea-based facility will rely on hatcheries and holding facilities at the land-based ADZ at the Coega IDZ.

Land-based facilities for farming and processing of fish/bivalves are therefore not included in this application for Environmental Authorisation. Separate Environmental Authorisations would have to be obtained by individual operators or their service providers if land-based activities fall outside the scope of the Coega ADZ Environmental Authorisation and for activities triggering listed activities as specified in the EIA Regulations.

Due to its sea-based location, the project does not have any water, sewage, waste, and electricity requirements. These aspects have therefore not been discussed in this Basic Assessment Report.

4.1 Site description

Algoa Bay is located on the south eastern coast of South Africa. Port Elizabeth is the largest city in the area and is South Africa's second oldest city. Port Elizabeth represents the commercial capital of the Eastern Cape. Port Elizabeth is a major seaport, with the most significant ore loading facilities in the southern hemisphere. Industrial activities have lately shifted towards Coega where a Special Economic Zone (SEZ) was established in 1999. The Coega Development Corporation (CDC), a state-owned enterprise (SoE), is mandated to develop and operate the 9 003 hectares. Situated on the shores of Algoa Bay the area also has a thriving tourist economy based on activities such as scuba diving, game fishing charters, marine ecotourism (e.g. whale watching, bird watching), surfing and kiteboarding with many popular scenic beaches. A detailed description of the receiving environment is included in Chapter 9. Due to the high diversity of habitats, marine organisms and seabirds in Algoa Bay (several of which are of conservation concern), significant biodiversity importance is attributed to many areas in the Bay (Chalmers 2012) (Figure 23). The St Croix Reserve and Bird Island MPA off Woody Cape make a significant contribution to biodiversity conservation, particularly for birds and offshore island habitat (Barnes 1998, Chalmers 2012). Algoa Bay is situated within the recently established and revised Ecological and Biologically Sensitive Area (EBSA) that spans the Sardinia Bay

MPA to the Amathole MPA by the Marine Spatial Management and Governance Programme (MARISMA) team as part of a suite of such areas along the South African Coastline in terms of the Convention on Biodiversity (UNEP 2014, 2015).

4.2 Proposed infrastructure, layout plan and carrying capacity

4.2.1 Finfish culture

A finfish farm producing in the region of 3 000 tons per year, would require approximately 35 cages, holding approximately 85 tons of fish each (these figures are based on the I&J proposal to farm yellowtail and kabeljou and will vary depending on the species farmed) (CCA Environmental 2008). The sea floor footprint of a farm this size would be about 20-50 ha depending on the mooring system, but to allow for boat access between cages and fallowing of sites, an area of around 70 ha per operator would be required (See examples in Figure 7 and Figure 8).

This suggests that should the ADZ be fully developed, Algoa 1 Option 1 could theoretically accommodate four commercial scale finfish farms with a total production of ~15 000 tons per annum. This exceeds the average annual total South African line fish catch by 1-3 times (Griffiths 2000), and full development of these sites would therefore be reliant on producers accessing new markets for farmed finfish. It is uncertain that this scale of development will be sustainable both from an environmental impact perspective and from an industry functionality/economic perspective.

The previous EIA (Hutchings *et al.* 2013) therefore adopted a precautionary approach and recommended a much lower initial scale development with no more than three fish cage farms authorized to scale production up from pilot phase (maximum 1000 tons/ precinct) to full commercial viability (three farms producing a total of 9 000 tons per precinct) over a four year period, providing that environmental quality objectives were maintained. Increased global demand for seafood and market changes, however, may well have reduced the volume required for commercial viability e.g. the recent development of an export market for South African yellowtail suggests that this figure of commercial viability (3000 t per farm) is probably now an overestimate.

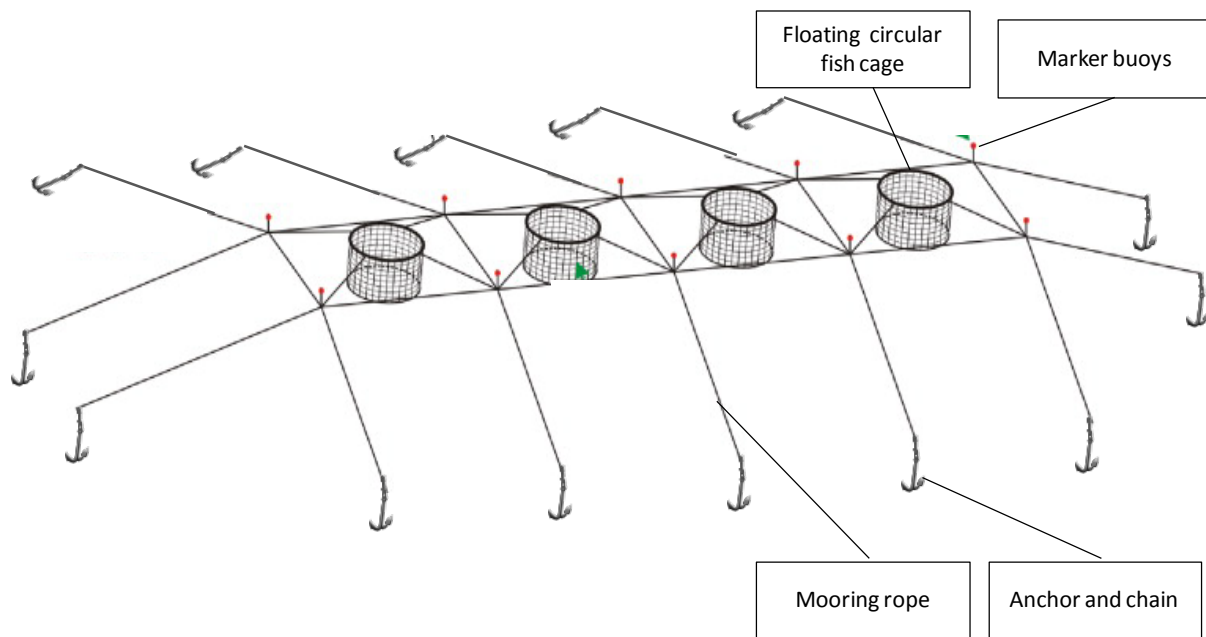


Figure 7 Example of a finfish sea cage mooring system, showing larger size of sea-floor footprint compared to the sea surface footprint.



Figure 8 Finfish cage structures and servicing vessel (Source: Shutterstock).

In this current EIA process a dispersion modelling study was undertaken to estimate carrying capacity and inform the assessment of potential impacts (Wright *et al.* 2019). Two species specific models were developed for the two potential finfish precincts (Algoa 1 and 7) - yellowtail (*Seriola lalandi*), and meagre (*Argyrosomus regius*). Both species are widely studied and widely farmed mariculture species around the world, and good baseline and life history data are therefore available in the existing literature for these species. Meagre is a species similar to South African kob (e.g. *Argyrosomus*

japonicas and *A. inodorus*) and represents a good proxy for the farming of indigenous kob species in Algoa Bay. In line with the precautionary approach recommended by Cape EAPrac (2013), three scenarios (i.e. various stocking options) were investigated, ranging from a lower initial scale development of 1000 t to maximum estimated commercial viability for the whole ADZ (9 000 t).

Model results indicate that both Algoa 1 and Algoa 7 have acceptable dispersion potential and water quality standards are predicted to be met within the ADZ boundaries (Wright *et al.* 2019). However, the carrying capacity of a site is intrinsically linked to its size – a larger ADZ will inherently present more space for mariculture. Therefore, it is perhaps more useful to consider the annual production capacity of a site as a whole, while also taking into consideration strategies to minimise environmental impact.

Carrying capacity was estimated on the premise that:

1. the benthic fauna beneath the farm site must not be allowed to disappear due to accumulation of organic material;
2. the water quality in the net pens must be kept high; and,
3. the water quality in the areas surrounding the farm must not deteriorate.

The estimated maximum carrying capacities for each of the two proposed precincts are summarized in Table 12 below. Note that Wright *et al.* 2019 modelled the carrying capacity for the extent of Algoa 1 as shown in the pre-application BAR (i.e. Option 1 and part of Option 2). This footprint has since been reduced by 40%. The carrying capacity for this site cannot be estimated by reducing the original amount proportionally and would have to be re-modelled for Algoa 1 Option 1 should finfish farming be pursued at Algoa 1 Option 1 (although it is important to consider that DAFF has submitted an application for Alternative Option B, which excludes finfish farming from Algoa 1 Option 1).

Table 12 Summary of dispersion modelling results as per Wright *et al.* (2019) showing carrying capacities for Algoa 1 (pre-application BAR extent) and 7 for two species, namely *Seriola lalandi* and *Argyrosomus regius*. Note that either *S. lalandi* OR *A. regius* can be maintained at each site at the carrying capacities indicated.

Precinct	Species	Total annual production per ADZ precinct
Algoa 1	<i>Seriola lalandi</i>	3 252
	<i>Argyrosomus regius</i>	4 911
Algoa 7	<i>Seriola lalandi</i>	3 555
	<i>Argyrosomus regius</i>	4 947

These results do not account for disease control. Alviál *et al.* (2012) recommended a minimum 2.5 km buffers zone be implemented to prevent disease transferral between farms. Should this buffer zone be implemented, Algoa 1 Option 1 and 7 each have the capacity for one farm of either *S. lalandi*, or *A. regius*.

4.2.2 Bivalve culture

Bivalves (oysters and mussels) can be farmed on longlines or mussel rafts. Longlines comprise of a surface rope with floats, which are moored at each end to fix the line in position. The production ropes for mussels or oyster racks are then suspended from the surface rope. Alternatively, rafts for mussel culture can be deployed, which consist of a floating top structure moored to the seabed from which mussel ropes are suspended. Illustrative photographs of mussel and oyster longlines are shown in Figure 9 to Figure 12.

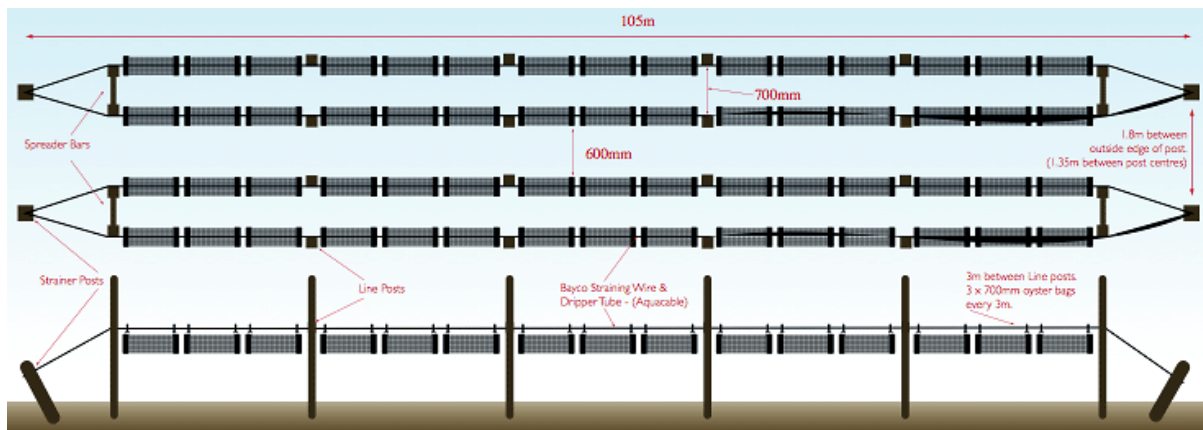


Figure 9 Adjustable Longline Oyster System (Source: <http://www.bstoysters.com/products/farm-layout>).

Figure 10 Oyster longlines in Saldanha Bay, South Africa (Photo taken in 2019).



Figure 11 Oyster long-lines at Algoa 6 (PE Harbour site, Zwembesi Farms (Pty) Ltd.). View from Mount Croix neighbourhood in Port Elizabeth.



Figure 12 Mussel long-line culture in Saldanha Bay. (Source: Department of Agriculture, Forestry and Fisheries).

4.3 Species considered in the impact assessment

4.3.1 Finfish farming

The development of modern sea cage finfish farming in the 1970s occurred largely due to the growth of the salmon farming industry in countries with glaciated coastlines such as Scotland, Norway, British Columbia and Chile (Hutchings *et al.* 2013a). The number of finfish species used in marine cage culture has increased substantially over the last three decades with salmon, tuna, flatfish, kingfish, bream, Sciaenids (white sea bass, red drum) and a host of other species grown in a variety of cage culture systems (Staniford 2002). Although some sea cage farming operations rely on wild caught stock (e.g. southern and northern bluefin tuna farms located in Australia and the Mediterranean, respectively), most farms use finfish fingerlings that are obtained from land based hatcheries, where brood stock, egg, and larvae husbandry can be carried out under controlled conditions. Fingerlings are stocked into sea cages at optimal sizes and densities, fed with commercially available protein and lipid rich dry food, treated for diseases and parasites, graded, and harvested at a size that results in the maximum economic return. Several species of the genus *Seriola* are used in aquaculture internationally, mostly Japanese amberjack (*S. quinqueradiata*) that is farmed in Japan and Korea (Hutchings *et al.* 2013b). *Seriola lalandi* has been farmed in sea cages in Australia since 2001 with a production of ~ 3300 tons in 2007/8 and has been trialled in Chile and New Zealand (Poortenaar *et al.* 2003, Frenandes and Tanner 2008, Moran *et al.* 2009). Dusky kob (*Argyrosomus japonicus*) has been farmed in Australia where it is locally known as Mulloway, while the congeneric, *A. regius*, is extensively farmed in the Mediterranean, with an estimated production of 15 000 tons recorded in 2010 (FAO 2012).

Around 250 species of fish are landed by South African line fisheries, although only about a dozen account for more than 90% of the catch (Mann 2000). Given that a domestic market *al.*ready exists for popular linefish species, these are preferable for cage culture in a pioneering industry. Dusky kob are large, predatory teleost fishes of the family Sciaenidae that are widely distributed in estuaries and nearshore subtropical and temperate coastal waters less than 100 m water depth in the Pacific and Indian Oceans. In South Africa, the species occurs from the Cape of Good Hope to northern KwaZulu-Natal where they are targeted by commercial and recreational fishers. Sciaenids worldwide have been demonstrated to be prone to overfishing and dusky kob are overfished in South Africa and Australia. This species has many attributes that make them suitable for aquaculture: they are euryhaline (able to tolerate a wide range of salinities), eurythermal (able to tolerate a wide range of temperatures) and hypoxia tolerant (able to tolerate oxygen deficiencies). Their life histories also make them favourable as they are a gregarious, relatively fast growing, highly fecund, and are easily reproduced in captivity.

Yellowtail (*Seriola lalandi*) has a non-equatorial distribution and is found around Australia, New Zealand, India, and from British Columbia to Chile. In South Africa, this species occurs from the west coast to southern KwaZulu-Natal and frequents both shoreline habitats as well as deep pelagic waters. Yellowtail appear to be well suited to marine aquaculture, as it grows fast, has a good yield, are particularly robust, and grows well in sea cage production systems. Commercial culture of *S. lalandi* commenced in Australia in 1998 and the farming industry has since undergone rapid expansion. Grow-out to market size (3 – 5+ kg) is conducted in sea cages with a total culture production of currently estimated at 1 000 tonnes.

Research and development into the suitability of three species for sea cage culture has already occurred within Algoa Bay; namely yellowtail (*Seriola lalandi*), dusky kob (*Argyrosomus japonicus*) and

silver kob (*Argyrosomus inodorus*) (Nel and Winter 2008 & 2009). The Department of Science and Technology (DST) Eastern Cape Sea Cage Finfish Farming Pilot Project was initiated in 2007 by the DST, the Stellenbosch University Aquaculture Division, and Irvin and Johnson Limited (I&J) to determine the technical, environmental and financial feasibility of farming indigenous marine finfish species in South Africa. The project commenced in November 2007 with the installation of four HDPE surface gravity type fish cages moored in an anchor-based grid in the lee of Port Elizabeth Harbour. Dusky kob, silver kob and yellowtail were grown over a 30-month period. The project achieved promising yellowtail growth results with some fish reaching 1.5 kilograms in 14 months. The results obtained for both kob species were disappointing, with dusky kob only reaching an average size of 549 grams in 19 months and silver kob reaching an average size of 550 grams in 22 months (Nel and Winter 2008 & 2009). The unavailability of yellowtail fingerlings prevented the successful implementation of the continuation phase of the DST Eastern Cape Sea Cage Finfish Farming Pilot Project which was abandoned in 2011. The production system equipment used by the project were sold to Viking Aquaculture in October 2016 and has subsequently been installed in Saldanha Bay for a sea trout pilot project. The initial phase of the project (2007 – 2010) showed that HDPE surface gravity type cages can be deployed and utilised for sea cage aquaculture at selected nearshore sites along the South African coastline. From a species perspective, the initial phase of the project showed that yellowtail has significant potential for commercial aquaculture in the country. The fish produced by the pilot project was sold to South Africa's premier retailer, indicating a high level of market potential for yellowtail.

The DST Eastern Cape Sea Cage Finfish Farming Project led to the implementation of a dusky kob sea cage project in Richards Bay in August 2015 and the development of a similar project in Mozambique. The DST and Stellenbosch University KZN Aquaculture Development Project was a collaborative undertaking between DST, DAFF and the University to determine the technical, environmental and financial feasibility of farming dusky kob in sea cages in Richards Bay, KwaZulu-Natal. Production commenced in August 2015 with the stocking of 25 000 dusky kob fingerlings and had a standing stock of about 25 tonnes in 2017. Of the two species, yellowtail appears to be the more suitable for aquaculture as it grows significantly faster than dusky kob, has a lower optimum culture temperature and will potentially obtain higher prices in export markets (Stellenbosch University 2017).

Several other indigenous fish species are also under consideration; yellowfin tuna (*Thunnus albacares*), East Coast Sole (*Austroglossus pectoralis*), geelbek (*Atractoscion aequidens*), spotted grunter (*Pomadasys commersonnii*) and several sparids including white steenbras (*Lithognathus lithognathus*), white stumpnose (*Rhabdosargus globiceps*) and red roman (*Chrysoblephus laticeps*) (DEA 2013, Government Gazette No. 36145).

Algoa Bay falls within the distributions of all of the above-mentioned indigenous species, indicating that the environmental conditions are, at times, suitable (Hutchings *et al.* 2013a). The presence of local wild populations does not, however, confirm suitability of a species for sea cage culture as cages restrict the natural movement of the stocked species, restricting behavioural responses to variable oceanographic conditions. For example, Sciaenids stocked in the Algoa Bay sea cage trials experienced low growth rates and became susceptible to parasites, presumably partly in response to sudden drops in water temperature (G Le Roux, Stellenbosch University, personal communication). Telemetry studies on dusky kob within Algoa Bay have revealed population specific movement responses to changes in water temperature with individual fish displaying site fidelity to estuaries that are used as refugia during periods of low sea water temperature (P Cowley, SAIAB, personal communication).

Research and development into the suitability of different species for cage culture in South Africa is ongoing, which may identify additional candidate species. Diversification of species for use in local sea cage culture will depend on research and development around stock husbandry (including viable hatchery techniques), suitability of species to caged conditions, suitability of cages for local sea conditions, and the development of receptive markets. High value species for which sea cage culture techniques have been established and an international market demand already exists (e.g. yellowtail, yellowfin tuna), could prove to be the most economically viable.

The sustainable aquaculture policy does not rule out the use of alien species (Government gazette No 30263, pg. 13). The Alien and Invasive Species Regulations, 2014 (AIS Regulations) published in terms of the National Environmental Management: Biodiversity Act (Act No 10 of 2004) (NEMBA) are concerned with the responsible introduction of new alien species and the management of existing alien and invasive species in South Africa. For new introductions, the AIS Regulations prescribe when and how risk assessments must be conducted.

Atlantic salmon *Salmo salar* is exempt in terms of the AIS Regulations as this species had already been introduced into South Africa at the time when the Regulations were promulgated. Experimental salmon farming has taken place at Gansbaai and sea trout are currently undergoing trials by Molapong Aquaculture (Pty) Ltd in Saldanha Bay. The warm temperate waters of Algoa Bay however, are not suitable for many cooler water species (e.g. salmon, trout, flounder and plaice) that were initially the mainstay of finfish sea cage culture internationally, nor consistently warm enough for more recently researched tropical species (such as cobia). Risks of disease and parasite introduction, or the establishment of an invasive alien fish species, are generally considered lower if indigenous species are cultured, although disease transmission between local wild stocks and farmed fish and *vice versa* is more likely when local species are farmed. This EIA therefore only considers potential impacts of farming indigenous fin fish species. Should future fish farm operators wish to farm alien fish species, a separate risk and impact assessment will need to be conducted.

4.3.2 Shellfish farming

The exotic Pacific oyster (*Crassostrea gigas*) and the native Cape Rock Oyster (*Striostrea margaritacea*) are currently cultivated in South Africa. The Pacific oyster *C. gigas* (also accepted as *Magallana gigas*) is an estuarine oyster native to Japan and South East Asia, although it has been shown to survive on rocky shores in sheltered waters of up to 40 m depth and may attach to the shells of other animals. The optimum salinity for these oysters is between 20 and 25 parts per thousand (ppt or ppt), although the species can occur (but not breed) at salinities below 10 ppt and will survive salinities in excess of 35 ppt. Gametogenesis (the production of sperm and eggs) occurs at around 10°C and salinities of between 15 and 32 ppt. Spawning generally follows at temperatures above 20°C. The Pacific Oyster was introduced to the Knysna Estuary for farming in the 1950s and since then has been farmed in the Kowie and Swartkops estuaries as well as at three offshore sites; Algoa Bay, Saldanha Bay and Alexander Bay (Robinson *et al.* 2005).

Initially, *C. gigas* was not considered an invasive threat as the oysters seemed unable to reproduce and settle successfully under the local environmental conditions; however, farmed populations have been reported to have spread from the site of introduction to nearby estuaries (Robinson *et al.* 2005). Using DNA sequencing, Robinson *et al.* (2005) confirmed the presence of three naturalised populations in the Breede, Knysna and Goukou estuaries. The highest densities of approximately 184 000 individuals were found in the Breede Estuary (Robinson *et al.* 2005).

The species under consideration for mariculture in Algoa 1 Option 1 and Algoa 6 include the Pacific oyster (*C. gigas*), the Mediterranean mussel (*Mytilus galloprovincialis*) and indigenous mussels such as brown mussel *Perna perna* and black mussel *Choromytilus meridionalis*. The Mediterranean mussel is already established in Algoa Bay (see Dawson *et al.* 2019), and therefore the specific risks of alien invasive introduction of the species to the Bay is negligible. However, wild populations of the Pacific oyster *C. gigas* outside of the existing culture area have not yet been detected in Algoa Bay, although it is a known invasive in South Africa, introduced to the Knysna Estuary in the 1950's.

C. gigas is classified as a category 2 invasive marine invertebrate species in terms of the 2016 Alien and Invasive Species (AIS) Regulations promulgated under the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA). For this category of invasive species, a permit is generally required to undertake any of the activities listed in terms of NEMBA. However, the AIS regulations exempt the operators from requiring a permit for *C. gigas* in Algoa Bay as shown in Figure 13 (landwards of a straight boundary line with endpoints at the GPS coordinates 33°51'24.82''S 25°38'11.01''E and 33°59'20.68''S 25°40'26.31''E). All activities, except for the introduction of live specimens into the country, involving *C. gigas* in the area shown in Figure 13 are exempt in this area, provided the operator has a valid Permit from the DAFF. Note that *C. gigas* farming would require a permit at Algoa 1 Option 1.

Oyster spat is currently imported into South Africa (mainly from Namibia) and individual operators planning to farm oysters at both Algoa 1 Option 1 and Algoa 6 would therefore be required to apply for a permit in terms of Section 71(1) of NEMBA should Environmental Authorisation be granted. The application process is therefore not conducted in parallel. The impact of invasive species farming has been assessed as part of the Basic Assessment process in the marine specialist study in Appendix D of the BAR.

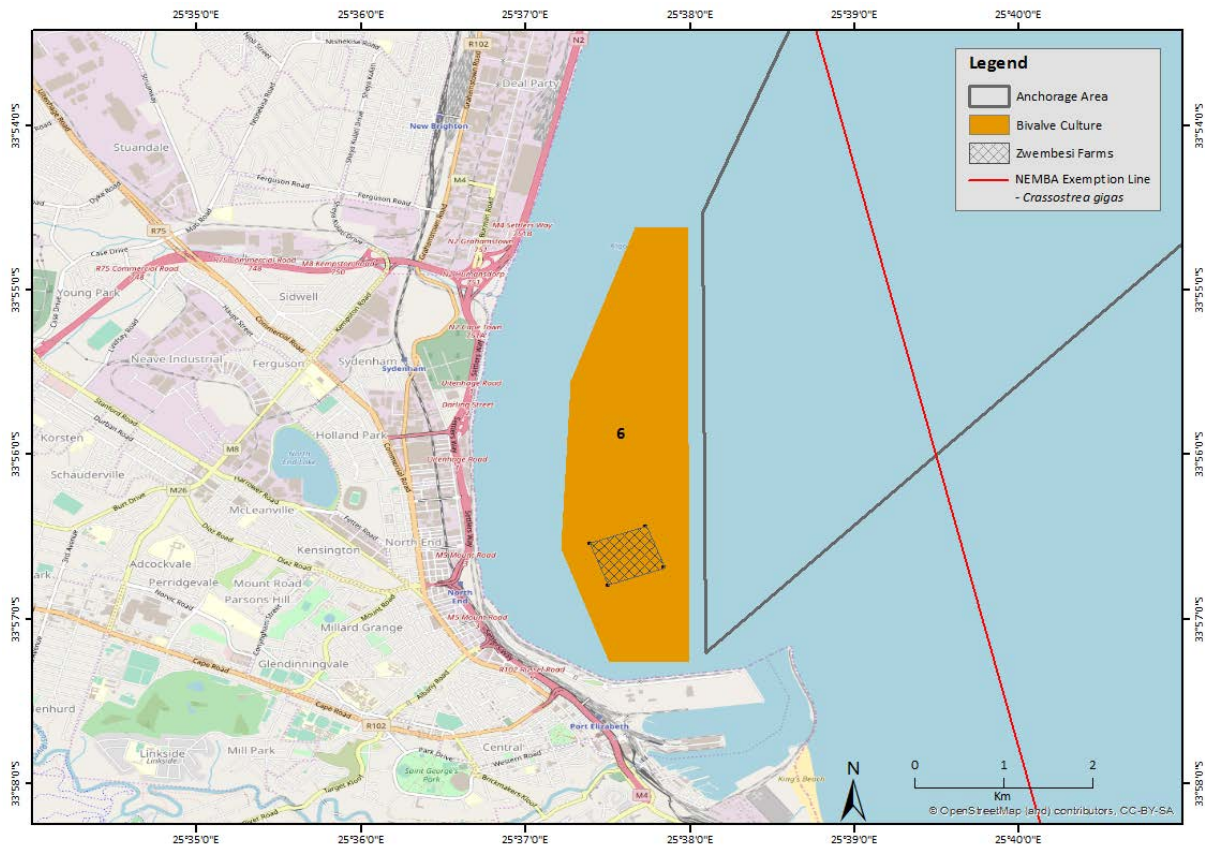


Figure 13 Existing Oyster farms in Algoa Bay and area that is exempted for the farming of *Crassostrea gigas* in terms of the 2016 Alien and Invasive Species (AIS) Regulations promulgated under the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA). The area extends landward of the red line. Note, however, that the importing of live specimens is not exempted in this area.

The Mediterranean mussel is also a listed, Category 2 Invasive Marine Invertebrate Species. In terms of Notice 3 of the Alien and Invasive Regulations, aquaculture facilities are exempted from requiring a Permit for all restricted activities except for restricted activities a, f, g, and k in Notice 1, which means:

- Importing into the Republic, including introducing from the sea, any specimen of a listed invasive species.
- Spreading or allowing the spread of any specimen of a listed invasive species.
- Releasing any specimen of a listed invasive species.
- The introduction of a specimen of an alien or a listed invasive species to offshore islands.

Mussels are not actively seeded onto ropes and no additional specimens are therefore introduced into the marine environment. The ropes will be left to be colonised by naturally occurring offshore mussel larvae pools (part of the mussel life history is spent offshore). Larvae pools are carried inshore by (1) upwelling-related circulation, (2) internal tidal waves and bores, (3) the local diurnal (or diel) sea breeze, and (4) waves and ocean swell (Pfaff 2015). None of the above-listed restricted activities are applicable to sea-based mussel farming and a permit in terms of Section 71(1) of NEMBA would therefore not be required. The impacts of alien bivalves have been assessed in the Marine Specialist Study in Appendix D Section 4.1.5.2.1.

4.4 Overview of the project development cycle

Many international assistance institutions distinguish between five stages in the cycle of existence of a project, namely, identification, preparation, appraisal and agreement, implementation, and monitoring and evaluation (Insull and Nash 1990). Individual operators will first enter the pilot phase to establish feasibility, environmental impacts and scalability of the finfish and bivalve projects. Only then will the project enter full scale production. The project development cycle is illustrated in Figure 14.

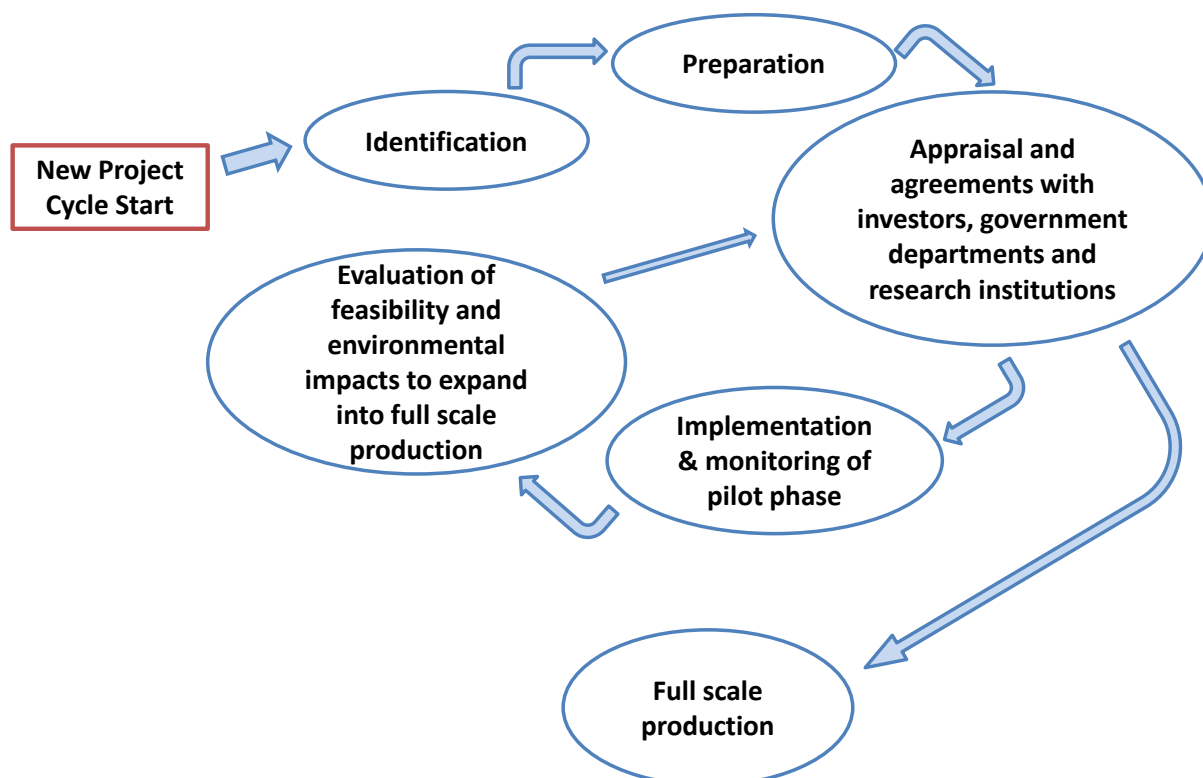


Figure 14 Schematic of the project cycle for the proposed sea-based Aquaculture Development Zone in Algoa Bay, Eastern Cape.

4.5 Description of alternatives

The EIA process requires the consideration of Alternatives when assessing activities. According to the Guideline on Alternatives (DEA&DP 2013) alternatives are identified as: “different means of meeting the general purpose and requirements of the activity, which may include alternatives to: (a) the property on which, or location where it is proposed to undertake the activity; (b) the type of activity to be undertaken; (c) the design or layout of the activity; (d) the technology to be used in the activity or process alternatives; (e) the operational aspects of the activity; and (f) the option of not implementing the activity”. Table 13 shows which of the above-listed alternative types were considered in this Basic Assessment process.

Table 13 Applicability of alternative types to the proposed Aquaculture Development Zone in Algoa Bay (alternatives as defined in the Guideline on Alternatives published by the Department of Environmental Affairs & Development Planning in 2013).

Type of Alternative	Application to Algoa Bay Marine Aquaculture Development
Location	Three precincts are considered for inclusion in the Algoa Bay ADZ. During the previous and current EIA processes, a total of seven precincts have been considered for aquaculture in the ADZ. DAFF proposes to farm both bivalves and finfish in Algoa Bay and therefore the approach to choosing alternatives has changed from considering individual precincts as alternatives to each other (i.e. the previous process chose Algoa 5 as an alternative to Algoa 1 (original extent)) to considering combination of precincts as alternative options.
Type of activity	The proposed activities include bivalve and finfish farming alternatives. DAFF intends to include both activities in the application for environmental authorisation and therefore these two activities were not considered as alternatives of each other. However, Algoa 1 <u>Option 1</u> is suitable for both finfish and bivalve and therefore three options have been considered for this precinct, namely: (1) finfish and bivalve (2) bivalve only; and (3) no farming.
Design or Layout	Designs and layouts are only expected to be finalised once the Applicant identifies and signs agreements with a concessionaire. Designs of fish cages are mostly generic and design alternative should not necessarily affect or change the outcome of the EIA investigation. Different materials have cost implications and are not included in this process. No alternatives for design or layout were considered.
Technology	The technology required to construct and operate a marine aquaculture facility is mostly standardised i.e. it complies with industry norms whereby a cage with access and work areas are required. Furthermore, specific materials used are industry and cost driven and will be implemented by individual operators. <u>DAFF intends to promote land-based and sea-based aquaculture in Algoa Bay. The land-based ADZ at the Coega Industrial Development Zone (IDZ) was authorised by the Department of Environmental Affairs on 7 February 2018. The proposed Aquaculture Development Zone (ADZ) is sea-based, which means that marine organisms are reared in the sea. Land-based facilities for farming of fish and bivalves are therefore not considered as an alternative technology.</u> No alternatives were therefore considered.
Operational Aspects	Operation of a marine aquaculture facility must comply with basic management actions and mitigations, but operation of such a facility is dependent on whichever concessionaire is chosen to operate on the site. No operational aspects are thus considered as alternatives, however operational monitoring must be implemented at all cost.
“No-Go Option”	This option must always be considered as a baseline against which the other alternatives are measured and refers to not continuing with the activity. The No Go option in this case is not undertaking the marine aquaculture development.

Taking the above into consideration, it can thus be concluded that location and type of activity alternatives could be introduced into the BA process for the proposed Algoa Bay ADZ development. It is important to note that DAFF is seeking to promote farming of both bivalves and finfish in Algoa Bay and therefore the approach to choosing alternatives has changed from considering individual precincts as alternatives to each other (i.e. the previous process chose Algoa 5 as an alternative to Algoa 1 (original extent)) to considering a combination of precincts as alternative options. Each of the precincts taken forward into the impact assessment process is described in more detail in Sections 3.5.1-3.5.3. The proposed combinations of alternative options, which were assessed in the Draft BAR are shown in Table 14.

Table 14 Alternative options of precinct combinations involving Algoa 1 Option 1, 6 and 7 considered in the Basic Assessment process for the proposed Algoa Bay Aquaculture Development Zone.

Alternative options	Algoa 1 <u>Option 1</u> (<u>Summerstrand site</u>) Size: 312 ha	Algoa 6 (<u>Port Elizabeth Harbour site</u>) Size: 479 ha	Algoa 7 (<u>Ngqura Harbour site</u>) Size: 355 ha
A	Finfish & bivalves	Bivalves	Finfish
B (DAFF preferred)	Bivalves	Bivalves	Finfish
C	X	Bivalves	Finfish
D (No-go option)	X	X	X

The environmental impacts of various farming intensity levels in Algoa Bay are assessed by way of three options. **Option A** includes both finfish and bivalve culture at Algoa 1 Option 1. This option would allow for finfish farming at two precincts. Furthermore, this option would offer a protected environment as a nursery site for bivalves (Algoa 6) as well as a clean, comparatively unpolluted environment as a bivalve grow-out site (Algoa 1 Option 1). **Option B** includes only one site for finfish farming (Algoa 7) but provides the same opportunities to bivalve farmers as Option A. **Option C** excludes Algoa 1 Option 1 altogether and limits bivalve culture to Algoa 6.

The **Status Quo Alternative** proposes that the Algoa Bay ADZ does not go ahead. The Eastern Cape coast is one of the few areas along the entire South African coastline considered suitable for marine based aquaculture. Therefore the 'No-go/Status Quo' alternative will eliminate the potential associated with the area, which will result in the loss of potential benefits associated with the aquaculture industry, as well as the opportunity to meet growing seafood product demand. Not establishing the ADZ will leave only current fishing production methods to supply the growing demand for seafood products. The sustainability of these methods is questionable in the long term, and the negative impact on wild stocks has been flagged by DAFF as a critical concern. Irrespective of the potential positive impacts, several negative impacts are associated with developing an ADZ and as such, the No-Go option must be considered as the status quo against which the alternative options must be measured.

The **Draft BAR** describes and assesses environmental impacts related to each precinct and alternative combinations in Chapter 10 and provides a summary of impacts and an impact statement for the three combinations of precincts in Section 2.

5 LEGAL & PROCESS REQUIREMENTS

The current assessment is being undertaken in terms of the **National Environmental Management Act (Act 107 of 1998)** (NEMA). This Act makes provision for the identification and assessment of activities that are potentially detrimental to the environment and which require authorisation from the competent authority (in this case, the national Department of Environmental Affairs, DEA) based on the findings of an EIA. More detail on the environmental authorisation process is provided in Section 5.2 below.

A number of other laws, regulations and guidelines are also relevant to this project and are briefly outlined below (note that only relevant legislation has been included in this chapter). Most importantly, the Constitution provides the foundation for many of the applicable laws and regulations (Section 5.1). These environmental requirements are not intended to be definitive or exhaustive but serve to highlight key environmental legislation and responsibilities only.

5.1 The Constitution of the Republic of South Africa

Chapter 2 of the Constitution of the Republic of South Africa (Act 108 of 1996) - The Bill of Rights Section 24 states that everyone has the right to an environment that is not harmful to their health or wellbeing; and to have the environment protected for the benefit of present and future generations. Reasonable measures must be implemented to protect the environment. This includes preventing pollution and promoting conservation and environmentally sustainable development, while promoting justifiable social and economic development.

Conservation of resources and promotion of sustainable and renewable resources fulfil the requirements of the Constitution.

5.2 The National Environmental Management Act (Act 107 of 1998)

Sections 24 and 44 of NEMA make provision for the promulgation of regulations that identify activities which may not commence without an Environmental Authorisation issued by the competent authority, in this case, the National Department of Environmental Affairs (DEA). The 2014 EIA Regulations promulgated in terms of NEMA (as amended by Government Notice R326 in 2017), govern the process, methodologies, and requirements for the undertaking of EIAs in support of EA applications. The EIA Regulations are accompanied by Listing Notices (LN) 1-3 (R327, R325 and R324) that list activities requiring an EA.

The EIA Regulations provide for two alternative authorisation processes depending on the type of activity that is proposed. A Basic Assessment (BA) process is required for projects associated with limited environmental impacts as defined in LN 1 and 3. In contrast, a Scoping and Environmental Impact Reporting process (S&EIR, also referred to as an EIA) is required to obtain EA for project with large scale, greater environmental impacts (defined in LN 2).

Anchor has determined that the proposed project triggers a number of activities listed in LN1 and LN3 of the 2014 EIA Regulations (as amended) and that an application for EA should follow the Basic Assessment process.

Before commencing with the project, the proponent (DAFF) is required to appoint an independent Environmental Assessment Practitioner (EAP) to undertake a Basic Assessment process and to obtain EA in terms of NEMA from the DEA. Regulations 19 and 20 of the EIA Regulations contain the detailed approach to the BA process. The BA process aims to identify and assess all potential environmental impacts (negative and positive). The Basic Assessment Report (BAR) should recommend how potential negative impacts should be effectively mitigated and how benefits can be enhanced. A marine impact specialist study will be undertaken to inform the BAR.

The listed activities associated with the proposed development, as stipulation under 2014 Regulations R327 and R324 (as amended in 2017) are presented in Table 15.

Before any of the listed activities can be undertaken, Environmental Authorisation (EA) must be obtained from the relevant authority, in this case the National Department of Environmental Affairs (DEA). Should authorisation be given for these activities, any concessionaires operating under the EA must comply with the conditions and requirements contained in it. In the event that any other activities not authorised are required, an additional assessment must be undertaken, and the relevant approvals obtained.

The Environmental Management Programme (EMPr) is also being drafted in terms of NEMA Section 28 General Duty of Care. The EMPr stipulates strict monitoring protocols to ensure that any identified impacts are being managed will be implemented.

Table 15 Listed activities in Listing Notice 1 (R327) promulgated in terms of the National Environmental Management Act (Act 107 of 1998) associated with the proposed Aquaculture Development Zone in Algoa Bay, Eastern Cape.

Listed activity as described in Listing Notice 1 (R 327)	Description of the project activity
7. The development and related operation of facilities, infrastructure or structures for aquaculture of sea-based cage culture of finfish, crustaceans, reptiles, amphibians, molluscs, echinoderms and aquatic plants, where the facility, infrastructure or structures will have a production output exceeding 50 000 kg per annum (wet weight).	Production output for finfish is proposed as a phased approach, commencing with a pilot scale for 1000 tons/annum and potentially expanding over a period of 3-5 years to carrying capacity (species and location-specific). Expansion would be subject to positive monitoring results from the pilot scale and consent from the AMC.
15. The development of structures in the coastal public property where the development footprint is bigger than 50 square metres, excluding— (Exclusions are not applicable)	Structures associated with the fish cages, bivalve structures and boat mooring facilities. The total ADZ area will exceed 50 square metres in coastal public property.
17. Development- (i) in the sea; [...] in respect of- [...] (e) infrastructure or structures with a development footprint of 50 square metres or more.	Individual operators will moor the finfish cages and bivalve farming structures to the seafloor. The combined footprint is likely to exceed 50 square metres.
19A. The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from – [...] (iv) the sea; (Exclusions are not applicable)	Individual operators will moor the finfish cages and bivalve farming structures to the seafloor. The combined volume to be deposited on the sea floor exceeds 5 cubic metres.
42. The expansion and related operation of facilities, infrastructure or structures for aquaculture of sea-based cage culture of finfish, crustaceans, reptiles, amphibians, molluscs, echinoderms and aquatic plants where the annual production output of such facility, infrastructure or structures will be increased by 50 000 kg (wet weight) or more.	There is an existing oyster farming facility (Zwembesi Farms, Knysna Oyster Company (Pty) Ltd), which will be expanded as part of the ADZ.
54. The expansion of facilities- (i) in the sea; [...] in respect of- [...] (e) infrastructure with a development footprint of 50 square metres or more.	There is an existing oyster farming facility (Zwembesi Farms, Knysna Oyster Company (Pty) Ltd), which will be expanded as part of the ADZ.
67. Phased activities for all activities— (i) listed in this Notice, which commenced on or after the effective date of this Notice or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices; excluding the following activities listed in this Notice – (Exclusions applicable to Activities 17 and 54) [...] where any phase of the activity was below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold.	The proposed development will occur in stages, where individual operators will contribute to the expansion of the ADZ as a whole.

5.3 National Environmental Management: Protected Areas Act (Act 57 of 2003)

NEMPAA was enacted to regulate the system of protected areas in South Africa and to provide for their management. Any commercial activity carried out in a protected area (which include marine protected areas and sensitive estuaries) requires the written authorisation of the management authority, which will usually be SANParks or a provincial conservation authority. Although SANParks objected to the Algoa 5 ADZ in the 28 appeals, the Department of Environmental Affairs nonetheless made provision for an aquaculture area of 1000 ha within the proposed MPA (DEA, 2016) and excised Algoa 7 from the recently promulgated Addo Marine Protected Area (MPA) (promulgated on 28 May 2019).

5.4 National Environmental Management: Biodiversity Act (Act 10 of 2004)

This Act controls the management and conservation of South African biodiversity within the framework of NEMA. Amongst others, it deals with the protection of species and ecosystems that warrant national protection, as well as the sustainable use of indigenous biological resources. Sections 52 & 53 of this Act specifically make provision for the protection of critically endangered, endangered, vulnerable and protected ecosystems that have undergone, or have a risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention through threatening processes.

The NEMBA also controls the undertaking of restricted activities involving alien and invasive species. Restricted activities include but are not limited to the holding, controlling, breeding, and importing exporting of alien and invasive species for mariculture.

DAFF has excluded alien finfish species from the application for environmental authorisation. The only alien species applied for are the Mediterranean mussel *Mytilus galloprovincialis* and Pacific oyster *Crassostrea gigas*, which are regulated by the Alien and Invasive Species Regulations promulgated in terms of NEMBA. A permit in terms of NEMBA Section 71(1) would be required for farming the Pacific oyster. Sea-based Mediterranean mussel farming takes advantage of the naturally occurring offshore mussel larvae pools (part of the mussel life history is spent offshore) and no additional specimens are introduced into the marine environment. This farming technique is therefore not considered a restricted activity that requires a permit in terms of Section 71(1). More information is provided in Section 4.3.2.

5.5 National Environmental Management: Integrated Coastal Management Act (Act 24 of 2008)

The Act aims to establish a system of integrated coastal and estuarine management in the Republic, including norms, standards and policies, in order to promote the conservation of the coastal environment, and maintain the natural attributes of coastal landscapes and seascapes, and to ensure that development and the use of natural resources within the coastal zone is socially and economically justifiable and ecologically sustainable; to define rights and duties in relation to coastal areas; to determine the responsibilities of organs of state in relation to coastal areas; to prohibit incineration at sea; to control dumping at sea, pollution in the coastal zone, inappropriate development of the coastal environment and other adverse effects on the coastal environment; to give effect to South Africa's international obligations in relation to coastal matters; and to provide for matters connected therewith.

The ICMA is applicable to the Algoa Bay Marine Aquaculture development in that activities associated with waste and land use may require permits and lease agreements.

Coastal use permits in terms of Section 65 of the National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008) (as amended in 2014) (ICMA) will be required a list of activities requiring such a permit has been published in the Government Gazette. No such list has been promulgated yet and we anticipate that a coastal use permit is not required. Instead, a Seashore Lease Agreement in terms of the Seashore Amendment Act (Act 190 of 1993) may be required (Section 5.8).

The national Department of Environmental Affairs Branch: Oceans and Coasts (DEA: O&C) has been included in this EIA process as a relevant state department. Any permits or agreements must be obtained from the department by individual operators.

The ICMA provides for the drafting of Coastal Management Programmes (CMP) with the purpose to provide a framework for the sustainable, equitable, co-operative and collaborative management of South Africa's coastal zone. In Chapter 6 the ICMA provides for the development of national, provincial and municipal CMPs and provides for the co-ordination and alignment thereof.

The first CMP for the Nelson Mandela Bay Municipality was published in June 2008 (SRK 2008) and was updated by CEN Integrated Environmental Management Unit in May 2015. The latest revision of the NMBM has not been gazetted to date.

The first-generation CMP identified the following five management themes:

- Governance and policy;
- Our national asset;
- Coastal planning and development;
- Natural resource management; and
- Pollution control and waste management

Within the theme coastal planning and development, Objective 18 stated that new, sustainable coast-related industries with the potential to promote NMBM's economic growth should be investigated and, if feasible, encouraged. New mariculture activities were included in this objective. The approach

to defining management goals changed in the revised CMP (CEN 2015) where, in line with the 2014 provincial CMP, nine priority areas for implementation were identified by stakeholders:

- Natural resource management: sustainable harvesting of natural resources, preservation of natural, cultural and built environments, rehabilitation and restoration, management of protected and other natural areas.
- Pollution control: air, water, solid waste, sewage
- Safety and security
- Recreation and eco-tourism: open space areas, trails, Blue Flag beaches, safe swimming, signage, maintenance of facilities and infrastructure
- Policing and compliance monitoring
- Education and awareness
- Sustainable development planning: facilities management and maintenance, service delivery, open space management, stakeholder participation in development plans, management of impacts
- Funding and capacity building
- Coastal access: beaches, launch sites, water sports

The priority areas identified by stakeholders were grouped into broad priority areas with input from specialists:

- **Natural resource management:** this refers to the protection of the coastal zone as our 'national asset' and sustainable harvesting of coastal resources. The 'national asset' includes the natural environment and its resources, landscapes, ecological processes, and important cultural/archaeological/historical features
- **Coastal pollution:** the location and nature of potential sources of pollution in the immediate catchment of each segment is described and assessed to assign a general pollution 'risk level'. The location of known water quality monitoring points in the NMBM is also provided, with an indication of what variables are measured and who the responsible agent is.
- **Coastal development:** In the context of this program, coastal development broadly refers to a description of existing development and municipal maintenance activities in the coastal zone, and a synthesis of approved spatial planning and guideline documents relevant to the area. The concept of coastal development is extended to include structures and infrastructure that are used for tourism and recreational activities in the coastal zone, as well as current recreational activities.

Management recommendations for the coastal zone applicable to mariculture in the entire NMBM as well as in Segments 2 and 6-10 (note that the coastal zone was divided into 20 segments) are shown in Table 16. Note that many of the Implementation strategies are applicable to the proposed sea-based Aquaculture Development Zone. For example, mariculture requires good water quality and Implementation Strategies to fight Coastal Pollution are paramount in ensuring successful implementation of the proposed development. At the same time, the proposed development impacts on implementation strategies addressing coastal water quality, growth of eco-tourism, and non-consumptive recreational activities. Only those implementation strategies that specifically mention mariculture have been included here.

Table 16 **Management recommendations for the coastal zone applicable to sea-based mariculture in the entire Nelson Mandela Bay Municipality and for specific segments. Note that many of the Implementation strategies are indirectly applicable to the proposed sea-based Aquaculture Development Zone. Only those that mention mariculture have been included here.**

Priority Area	Segment	Recommendation/Implementation Strategy	Priority rating and timeframe	Responsible agent(s)	Participating/Supporting agent(s)	Indicator
Natural Resource Management	General	B15. Establish co-ordinated monitoring initiatives to allow early detection of potential invasive marine species. Monitoring programs should be focused in the vicinity of mariculture facilities, offshore oil and gas infrastructure, ports and harbours.	Medium priority (will become high priority when aquaculture developments proceed) Medium term	SANBI, DAFF, DEDEAT, NMBM	TNPA, developers, CDC, SANParks	Identification of monitoring areas and agents Integrated monitoring plan developed Report on monitoring on a quarterly basis to CMF Monitoring reports made available on information portal
		B17. Locate mariculture on land, or in the event of finfish cage culture in ocean areas that have sufficient depth and flushing rates to minimise habitat impacts (to be determined in project-specific EIAs via hydrodynamic modelling). Mariculture should be avoided in biodiversity priority areas including Critical Biodiversity Areas, Marine Protected Areas, Estuaries, Fresh Water Ecosystem Priority Areas (including estuaries), critically endangered and endangered ecosystems and other sensitive biodiversity areas	High priority At time of planning mariculture facility	DAFF, DEDEAT, NMBM	EAPs, specialists	Monitor and participate in EIAs. Availability of EIAs for comment advertised on information portal
		B18. Mariculture species should be selected by giving full consideration to the potential impacts on indigenous species, ecosystems and fisheries	High priority At time of planning mariculture facility	DAFF, DEDEAT, NMBM, SANBI	EAPs, specialists	Monitor and participate in EIAs. Availability of EIAs for comment advertised on information portal
		B20. Strengthen collaboration between DEA, DAFF, DEDEAT and the NMBM around the management, sustainable use and conservation of marine ecosystems. Encourage participation of representatives from these departments at the CMF	High priority Invite representatives to CMF: Short term	DAFF, DEA, DEDEAT, NMBM		Representatives of all departments invited to CMF
Natural resource management and Coastal Pollution	6,7	Based on land use types in the segment, the pollution risk is rated as medium to high. Several agents are monitoring water quality at different points in the catchment – i.e. DWS, NMBM Public Health, NMBM Infrastructure and Engineering, and NMBM Trade Effluent). An integrated pollution monitoring network needs to be established and implemented to determine impacts on the near shore marine environment. The	Medium term	DWS to facilitate.	DEA (Oceans and Coasts), NMBM, TNPA, TPT	Not provided.

Priority Area	Segment	Recommendation/Implementation Strategy	Priority rating and timeframe	Responsible agent(s)	Participating/Supporting agent(s)	Indicator
		area is used for mariculture (i.e. in the Port Elizabeth port designated mariculture zone) and subsistence fishing is done in the area, therefore maintenance of good water quality is important. This can be a collaborative exercise where responsibility and budget is shared, but information is centralized and preferably hosted on an NMBM website. Information should be reported to the CMF.				

5.6 National Heritage Resources Act (Act 25 of 1999)

The protection and management of South Africa's heritage resources are controlled by the National Heritage Resources Act (Act No. 25 of 1999) (NHRA). The NHRA reflects the tripartite (national/provincial/local) nature of public administration under the South African Constitution and makes provision for the devolution of cultural heritage management to the appropriate, competent level of government. Because national government is responsible for the management of the seabed below the high-water mark, however, the management of maritime and underwater cultural heritage resources under the NHRA does not devolve to provincial or local heritage resources authorities but remains the responsibility of the national agency, SAHRA.

The NHRA gives legal definition to the range and extent of South Africa's heritage resources. According to Section 2(xvi) of the Act a heritage resource is "any place or object of cultural significance". This means that the object or place has aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

In terms of the definitions provided in Section 2 of the NHRA, maritime and underwater cultural heritage can include the following sites and/or material relevant to this assessment:

- material remains of human activity which are in a state of disuse and are in or on land [which includes land under water] and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures (Section 2(ii));
- wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation (Section 2(ii)); and
- Any movable property of cultural significance which may be protected in terms of any provisions of the NHRA, including any archaeological artefact or paleontological specimen (Section 2(xxix)).

Of the heritage resource types protected by the NHRA, the marine aquaculture operations have the potential to impact the following:

- submerged pre-colonial archaeological sites and materials; and
- maritime and underwater cultural heritage sites and material, which are principally historical shipwrecks.

As per the definitions provided above, these cultural heritage resources are protected by the NHRA and a permit from SAHRA is required to destroy, damage, excavate, alter, deface or otherwise disturb any such site or material.

It is also important to be aware that in terms of Section 35(2) of the NHRA, all archaeological objects and paleontological material is the property of the State and must, where recovered from a site, be lodged with an appropriate museum or other public institution.

Section 38 of the NHRA requires that any person who intends to undertake certain categories of development must notify the relevant heritage agencies and furnish details of the location, nature and extent of the proposed development. Section 38 also makes provision for the assessment of heritage impacts as part of an EIA process.

As the proposed development is undergoing an Environmental Authorisation (EA) application process in terms of NEMA, it is incumbent on the developer to establish whether a Heritage Impact Assessment (HIA) needs to be completed as per section 38(3) and 38(8) of the National Heritage Resources Act, Act 25 of 1999 (NHRA). If required such an HIA would include an underwater maritime study and any other applicable heritage components. The HIA would be conducted as part of the EA Application in terms of NEMA and the 2017 NEMA EIA Regulations.

The proposed project will affect the surface environment of the ocean more so than the sea bottom. The disturbance on the seabed will be associated with mooring/anchoring mechanism for the cages. Anchor appointed ACO Associates cc to conduct a desktop Maritime and Underwater Cultural Heritage Study as the Maritime and Underwater Cultural Heritage (MUCH) Unit at SAHRA indicated that such a study would likely to be requested. A summary of the HIA has been included in this BAR and the specialist study has been included as a standalone document in Appendix D.

5.7 Marine Living Resources Act (Act 18 of 1998)

The Marine Living Resources Act (Act 18 of 1998) recognises the need to utilise marine living resources in order to achieve economic growth, human resource development, capacity building within fisheries and mariculture branches, and employment creation. Exploitation of marine resources should occur sustainably within the development objectives of the national government. The Department of Agriculture, Forestry and Fisheries is the competent authority for the MLRA.

Most importantly, the Act prohibits the undertaking of marine aquaculture or the operation of a fish processing establishment unless a right has first been obtained from the Minister of Agriculture, Forestry and Fisheries. Once a right is obtained application must be made for a permit. While a marine aquaculture right is valid for 15 years the permit is only issued for one year. The rights or permits may be suspended if conditions are not being adhered to or if the right or permit is not being used effectively (DAFF 2013).

Regulations in terms of the Act also require permits for specific activities related to aquaculture, including but not limited to (DAFF 2013):

- possession, selling, import and export of fish and aquatic plants
- prohibition is placed on controlling or being in possession of specimens of specified species below a certain size (exemptions can be obtained)
- use of abalone and oysters in commercial operations
- outright prohibition on any use of certain fish species
- collection of brood stock from wild stocks
- permit for erection of structures in the sea

5.8 Sea-Shore Amendment Act (Act 190 of 1993)

The Sea-Shore Amendment Act 1993 (No. 190 of 1993) prohibits the erection of buildings and structures and the laying of pipes below the high-water mark on the seashore or in the sea without a lease in terms of the Act. In 2014, the Seashore Act was repealed with regards to the functions and powers of the Minister, but not with regards to the functions and powers of Provincial Departments. Coastal Lease Agreements are issued by the provinces (different institutions and processes). Recognising that this provincial level system has to be repealed by a consolidated national system in terms of ICMA (See Section 5.5), the provinces were assigned the responsibility to repeal the applicable sections of the Seashore Act once a replacement system is in place and effective. None of the provinces have repealed the Seashore Act and hence, coastal lease agreements are still issued via existing administrative processes.

Coastal use permits in terms of Section 65 of the National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008) (as amended in 2014) (ICMA) will be required a list of activities requiring such a permit has been published in the Government Gazette. No such list has been promulgated yet and we anticipate that a coastal use permit is not required.

5.9 Aquaculture Development Bill

The current legislative regime regulating the aquaculture sector in South Africa is fragmented, leading to investor and producer frustration because of long delays in project implementation and uncertainty. The National Aquaculture Policy Framework (the Policy) was approved by Cabinet in 2013. The Policy identified the need to develop a dedicated Aquaculture Act to regulate both the marine and freshwater aquaculture sectors. During the Oceans Economy initiative, Operation Phakisa in August 2014, the Aquaculture Lab identified the need to fast track the drafting of the Aquaculture Development Bill as this is a key deliverable upon which the implementation of most initiatives depends. DAFF obtained Cabinet approval for the Aquaculture Development Bill on 18 May 2018, which is currently being considered by Parliament. The proposed Aquaculture Bill, amongst other things makes provision for the establishment of pro-aquaculture development institutional arrangements i.e. National and Provincial Aquaculture Intergovernmental Forum; Interdepartmental Authorisations Committee, Aquaculture Development Zones and Aquaculture Development Fund. The Aquaculture Development Bill provides for integrated regulation of both marine and freshwater aquaculture and brings clarity, security and certainty to this growing sector.

5.10 Marine Spatial Planning Act (Act 16 of 2018)

In terms of the Oceans Economy component of Operation Phakisa, the South African government has committed to undertaking Marine Spatial Planning (MSP) under Initiative 10 of Phakisa's "Marine Governance and Protection Services Delivery Area". The Marine Spatial Planning Act (Act 16 of 2018) (MSPA) was promulgated on 6 May 2019. The objectives of MSPA are to 'promote sustainable economic opportunities which contribute to the development of the ocean economy through coordinated and facilitated good ocean governance'.

A well-managed, participatory and effective marine spatial planning process can contribute towards integrating and balancing the provision of ocean ecosystem services without compromising the ecological integrity of our marine ecosystems on which such services depend.

Any activities requiring any right, permit, permission, licence or any other authorisation issued in terms of any other law must be consistent with the approved marine area plans (Section 3 of the Act). Regulations defining the requirements for approving area-specific marine spatial plans in terms of this Act are yet to be promulgated. The Marine Spatial Planning framework has been published and provides a substantial description of the process that is to be followed in South African marine waters.

Due to the high diversity of habitats, marine organisms and seabirds (several of which are of conservation concern) and substantial body of biophysical data, Algoa Bay represents the ideal planning region for a case study for the first South African Marine Area Plan (Dorrington *et al.* 2018). The Marine Spatial Planning (MSP) research group of the Nelson Mandela University is currently developing a Marine Spatial Plan for Algoa Bay. Although this plan will not be approved in terms of the MSPA prior to the submission of this application, decisions regarding development in the marine domain are to be made with co-operative governance processes in mind, guided by abiding to MSP legislation. This means that all marine activities in the Bay, including land-based activities, must be located and conducted in a manner that will not impact on other government departments' mandates.

5.11 Other relevant legislation and guidelines

Apart from the above-mentioned related key Legislation, a host of national legislation is also regarded as relevant to the development of sea-based ADZ, including:

- The Maritime Zones Act (Act No 15 of 1994)
- Sea-Shore Amendment Act (Act 190 of 1993)
- Agricultural Pests Act (Act 36 of 1983)
- Development Facilitation Act (Act 67 of 1995)
- Fertilizers, Farm Feeds, Agriculture Remedies and Stock Remedies Act (Act 36 of 1947)
- The Animal Diseases Act (Act 35 of 1984)
- The Genetically Modified Organisms Act (Act 15 of 1997)
- The Animal Improvement Act (Act 62 of 1998)
- The Sea Birds and Seals Protection Act (Act 46 of 1973)
- The Health Act (Act 63 of 1977)
- The Medicines and Related Substances Control Act (Act 101 of 1965)
- The Foodstuffs, Cosmetics and Disinfectants Act (Act 54 of 1972)
- The Water Services Act (Act 108 of 1997)
- The National Regulator for Compulsory Specifications Act (Act 5 of 2008); and
- Standards Act (Act 8 of 2008)

These numerous pieces of legislation are not integrated and are managed by a range of different regulatory bodies. A review of all the applicable legislation was beyond the scope of the Basic Assessment Report. DAFF, as the lead agent for the development and management of the aquaculture sector in South Africa, published the first edition of the “Legal Guide for the Aquaculture Sector in South Africa” in 2013 (DAFF 2013). All operational specific permits and licenses must be obtained by the individual operators before commencement of any activities.

The following environmental Regulations and Guidelines were considered as background to this application:

- Brownlie S (2005). Guideline for involving biodiversity specialists in EIA processes. Department Environmental Affairs & Development Planning.
- DWA (2001). Generic public participation guideline. Department of Water Affairs and Forestry.
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6 NEED AND DESIRABILITY OF THE ACTIVITY

In terms of the EIA Regulations, when considering an application, the competent authority must take into consideration “the need for and desirability of the activity” (among other relevant aspects) (DEA 2017). The EIA Regulations and appendices specify that the basic assessment report (BAR), scoping report and environmental impact report (S&EIR) must provide a motivation for the need for and desirability for the proposed development within the context of the preferred location. The exhaustive list of questions that should be answered throughout the Basic Assessment process and by means of the Environmental Impact Assessment (including specialist studies where required) provided in the 2017 Guideline do not lend themselves for a concise summary chapter on the need and desirability of the proposed activity. The EAP is, however, confident that the BAR answers the questions contained in the 2017 Guidelines.

The Guideline on Need and Desirability published by DEA&DP in 2010 provides a useful set of questions, which allow the EAP to summarise the outcome of the BA process in relation to the Need and Desirability of the proposed project. The concept of need and desirability can be explained in terms of its two components where need refers to time, and desirability refers to place. The questions pertaining to both NEED and DESIRABILITY, as specified in the Guideline, are answered below.

6.1 Need (Timing)

Aquaculture is the fastest growing form of food production in the world and a significant source of protein for people in many countries. Globally, nearly half the fish consumed by humans is produced by fish farms. This worldwide trend toward aquaculture production is expected to continue. At the same time, the demand for safe, healthy seafood is also expected to grow (California Green Solutions, 2011). Over the past decade, the surging demand for fish and fishery products has mainly been met by aquaculture production, as capture fisheries have been rather stagnant or even declining in some countries (United Nations, 2010). Notwithstanding the growth in the consumption of fish and food in general and the positive long-term trends in nutritional standards, under-nutrition (including inadequate levels of consumption of protein-rich food of animal origin) remains a huge and persistent problem.

The long-term forecast for the demand for food remains positive, driven by population growth and urbanization. In particular, demand for fish products is expected to continue to rise in the coming decades. However, future increases in per capita fish consumption will depend on the availability of fishery products. Major increases in fish food production are forecasted to come from aquaculture, while production from capture fisheries stagnates. Considering the population forecasts, an additional 27 million tonnes of production will be needed in 2030 to maintain the present level of per capita consumption (United Nations, 2010). Future demand will, however, be determined by a complex interaction of several factors and elements. The global food sectors, including the fishery sector, will have to face several challenges stemming from demographic, dietary, climatic and economic changes, including reduced reliance on fossil energy and increasing constraints on other natural resources. As the world's population continues to grow, lack of fresh water and space means that terrestrial agriculture is unlikely to be able to meet food demand. Freshwater aquaculture, which is largely confined to the tropics, is expanding, but its reliance on fresh water may limit long-term

growth. Fishing catches have been declining globally for two decades. Environmentally responsible aquaculture holds the potential to contribute towards alleviating pressure on wild fish stocks (Stotz 2000).

The pre-application BAR Chapter on the Need and Desirability of the proposed development stated that the proposed sea-based ADZ could contribute directly towards food security (i.e. the product will be consumed by poor communities). However, as discussed by Britz *et al.* (2016), this is not a likely outcome of the proposed project. Feed for aquaculture is primarily made from anchovies, (sardine stocks have been largely depleted) which are high volume, low quality fish and the project is therefore more accurately described as one to convert low (market) value wild fish into high (market) value finfish. The end consumer of high market value fish, mussels or oysters will not be communities for whom food security needs to be improved. Accordingly, the original socio-economic impact assessment by Bloom (2013) had been amended to exclude the positive impact of improved food security in the pre-application BAR. Anchovies are not currently contributing to food security in South Africa and finfish farming would therefore not exacerbate the problem of food security.

The proposed project could, however, indirectly improve food security by providing job opportunities and contributing to the local and regional economy. Furthermore, the proposed project could contribute to import substitution and therefore create local opportunities instead of purchasing products where socio economic impacts are realised elsewhere. (although this benefit is incumbent on ensuring that existing and planned projects and plans related to the tourism industry are not impacted negatively). A report from the Department of Science and Technology suggests that in many parts of Africa, aquaculture offers strategic entry points for short and long-term investment opportunities to contribute to food security (refer to the above paragraph for limitations regarding this benefit), improve health, women's economic empowerment and local enterprise development for the poor (Department of Science and Technology, 2011a).

It is clear from emerging trends worldwide, which are also applicable to South Africa, that aquaculture (including marine finfish culture) could positively contribute to addressing the following:

- Increasing demand for fish products in the coming decades as a result of continued growth in the world population;
- Major increases in fish food production are forecasted to come from aquaculture;
- Lack of fresh water and space; and
- Marine aquaculture holds potential for sustained growth due to declining fishing catches;

Several questions must be answered in assessing the need of the proposed activity in the Algoa Bay area:

1. Is the proposed development in line with the projects and programmes identified as priorities within the Integrated Development Plan for the Nelson Mandela Bay Municipality?

The Nelson Mandela Bay Metropolitan Municipality IDP (2017-2022) presents 6 pillars, which form the foundations on which the Municipality's developmental priorities are hinged:

1. Well-run city
2. Opportunity city
3. Safe city

4. Inclusive city
5. Caring city
6. Forward thinking city

The Opportunity City is envisioned to deliver on well-planned initiatives to enable and cultivate job creation and economic opportunity, develop competitive advantage, and ensure access to skills. The objectives are to:

- Grow and diversify the local economy through the attraction of new investment, skills development and facilitation of an enabling environment for small business growth and job creation; and
- Facilitate and promote infrastructure led growth, development and tourism.
- Executing existing and designing and implementing new projects that competitively differentiate Nelson Mandela Bay as a destination city for business, tourism and investment – including through strategic partnerships.
- Developing an effective integrated public transport system that promotes access to opportunity through mobility.

The relevant Key Performance Indicators (KPIs) are listed below:

- KPI 63: Number of new agroprocessing firms/companies established within the NMBM
- KPI 65: Decrease percentage youth unemployment
- KPI 67: Increase the number of industrial areas targeted for upgrade and revitalisation
- KPI 68: Facilitate exports contracts within the NMBM
- KPI 69: Percentage contribution to the GDP of key Economic Clusters targeted for development as per the NMBM Economic Growth and Development Plan
- KPI 70: Increase the number of SMMEs supported through the SMME Support Centre and Enterprise Development Policy turning a profit within business plan stipulated timeframe

Mariculture industry in Algoa Bay has the ability to stimulate economic development and create jobs at the local level. The mariculture industry is labour intensive and the pilot marine finfish project in Algoa Bay has generated interest from the local aquaculture industry. The project aims at creating employment and human capital development opportunities. The resultant BEE opportunities will also create additional wealth and job opportunities.

The mariculture finfish operation could provide additional skills and up-skilling opportunities to persons that would either like to obtain employment in the future or persons that are already working in the fishing industry that could be up-skilled. An opportunity exists to invest in the finfish mariculture once the pilot operation has provided an indication of the viability and feasibility of a finfish farm in Algoa Bay.

Given the envisaged growth in the aquaculture industry and the BEE opportunities, finance from the Agriculture Strategic Business Unit (SBU) of the Industrial Development Corporation (IDC) and incentives from the Department of Trade and Industry (DTI) may be available to assist with the establishment of finfish mariculture ventures in Algoa Bay.

Small businesses could position themselves to support the operations of a finfish mariculture operation, provide services and products required to establish and operate the fish farm, and also benefit from the downstream opportunities that are presented by the development of a sustainable finfish farm in Algoa Bay.

The proposed ADZ could therefore contribute to the meeting of the above-listed KPIs. The proposed development is therefore in line with the projects and programmes identified in the IDP **on condition** that the mariculture industry develops organically without unfair and/or negative impacts on other priority projects/programmes.

Recreational activities (water sports and events, SCUBA diving, sailing) and therefore the existing, tourism dependent local economy could potentially be impacted by the proposed development, especially concerning finfish farming at Algoa 1 Option 1 (Summerstrand site). Based on the choice modelling study conducted by Britz *et al.* (2016) and feedback from stakeholders thus far, it appears that potential ecological impacts and the perception of an increased risk of shark attacks occurring (whether this risk is real or not) were identified as the most important issues of concern relating to the proposed development. While mitigation measures have been recommended for negative visual and marine ecological impacts, few or no meaningful mitigation measures are available for some of the other aspects (perceived increased risk of shark attack, loss of fishing grounds and area utilised for sailing) other than site reduction of and omitting finfish farming at Algoa 1 Option 1 (Summerstrand site). The perceived higher risk of shark attacks alone could potentially have a profound direct impact on the local economy, should the Ironman Event (and other events) be moved to a different location (Ironman Organisers indicated during the appeal phase that the event would be moved should finfish cages be installed at Algoa 1 Option 1). Furthermore, this impact could potentially be irreversible and occur during the pilot phase (Section 9.5.2.3).

2. Should the development occur here at this point in time?

Apart from Algoa 6, Algoa 1 Option 1 and 7 are already fairly congested with other coastal uses including recreational activities, commercial fishery and conservation initiatives (recently promulgated Addo MPA). The South African coastline has limited sheltered environments which accommodate sea-based aquaculture, eco-tourism and water sport activities such as long-distance swimming and scuba diving. As described above, the proposed Alternative Option A (finfish and bivalve culture at Algoa 1 Option 1) conflicts with other uses. It should be noted, however, that sea-based mariculture in and of itself should not be seen as mutually exclusive with existing activities as site selection, changes in management/operations for all activities can allow for symbiotic relationships.

3. Does the community/area need the activity and the associated land use concerned?

The Scoping and Environmental Impact Reporting (S&EIR) process conducted between 2010 and 2014 as well as the pre-application process of the current application demonstrated that certain sectors within the local community oppose the proposal mostly due to potential conflict with existing industries and conservation initiatives specifically with reference to finfish farming at Algoa 1 Option 1 (Summerstrand site). It is therefore to be expected that these entities will not agree with the need for this activity. Finfish farming at Algoa 1 Option 1 has the potential to irreversibly impact on existing economic activities relating to tourism and recreational use of the Port Elizabeth beach front area (refer to socio-economic impact assessment). This impact could occur during the pilot phase and a

phased approach is therefore not appropriate in mitigating negative economic impacts. The need for finfish farming at Algoa 1 Option 1 is therefore questionable.

However, the proposed activity has the potential to provide benefits in terms of skills-based employment opportunities, contribution to GDP, small business development and local community development, provided that negative marine ecological and economic impacts on existing tourism and water sport related activities are minimised. Marine ecological impacts can, to some extent, be effectively mitigated by implementing the measures provided in the Marine Specialist Study in Appendix D of the BAR. Alternative Option B, which excludes finfish farming, but includes bivalve farming at Algoa 1 Option 1, has the potential to balance the socio-economic need for employment opportunities in the Port Elizabeth area by reducing the conflict with the local tourism industry and water sport activities.

4. Are the necessary services with adequate capacity currently available?

Port Elizabeth and the Ngqura Industrial Development Zone have sufficient capacity for fish processing and product manufacturing facilities at the very least for the pilot phase. The proximity of two major ports, Port Elizabeth and Ngqura Harbours is critical in servicing and managing the Aquaculture Development Zone. The proposed development is a sea-based activity and has no electricity and water requirements.

5. Is this development provided for in the infrastructure planning of the municipality?

This development is initiated by the National Department of Agriculture, Forestry and Fisheries (DAFF) and will be funded by concessionaires and is therefore not provided for in the infrastructure planning of the municipalities (metropolitan, local and district).

6. Is this project part of a national programme to address an issue of national concern or importance?

The National Aquaculture Strategic Framework (2012) indicates that aquaculture development is a priority of government. The Government recognises the opportunities presented by aquaculture and is committed to creating appropriate platforms for access to and optimal utilisation of available resources and existing infrastructure to facilitate new economic activity to create opportunities for wealth creation and gainful employment whilst ensuring the government's key overriding constitutional obligation for an equitable society is upheld. The vision for the South African aquaculture sector is to develop and grow a sustainable and competitive aquaculture sector that meaningfully contributes to transformation, wealth creation and employment through a diversity of production systems that produces safe, nutritious and affordable food while ensuring the environmental services required for securing its future. The mission is to maximise socio-economic opportunities and benefits from aquaculture through meaningful transformation and being a regional leader. The policy covers 16 strategic issues to create an ambient environment for aquaculture to flourish:

- Developmental focus
- Legislation and regulatory framework
- Financial Services & incentives
- Access to land and water
- Availability of and access to inputs

- Culture based fisheries
- Training, education and capacity building and research
- Technology transfer
- Extension and sector outreach services
- Aquatic animal health management
- Information systems
- Product quality, safety and diversification
- Gender, youth and disability
- Marketing and trade
- Monitoring, control and evaluation

It is essential that these issues are considered holistically and that all stakeholders that could provide input in the establishment of finfish mariculture operations be considered. The value chain for the development of the finfish mariculture is therefore a fundamental premise to understand the linkages and interactions between the requirements and role-players.

Operation Phakisa was initiated in August 2013 (“phakisa” meaning “hurry up” in Sesotho. The name highlights the urgency of delivery). This operation is meant to address national key priority areas such as poverty, crime and unemployment. A study of the economic potential of South Africa’s oceans indicated that the immense potential of this untapped resource has not been fully taken advantage of. The oceans have the potential to contribute up to 177 billion rand to the gross domestic product (GDP) and create just over one million jobs by 2033. Aquaculture is one of four critical areas to explore and further unlock the potential of South Africa’s vast coastline.

The Aquaculture work stream has underlined the high growth potential of South Africa’s aquaculture sector due to increasing demand for fish. While aquaculture contributes to almost half of the global fish supply, it contributes less than 1% of South Africa’s fish supply. The sector offers significant potential for rural development, especially for marginalised coastal communities.

6.2 Desirability (place)

The individual benefits of a project overstate the true benefits if the project diminishes benefits elsewhere in the area. The economic desirability is therefore essential to determine whether the proposed development compliments economic planning as reflected in spatial development planning. It is not sufficient that the development results in some positive spin-offs if it is not compatible with planning guidance designed to maximise the overall economic potential of an area. Regulatory Policy and Guidelines are central to economic development planning and are prepared in order to guide overall development of an industry or a sub-industry in a direction that local and provincial authorities see as desirable. In order to provide some context, the Nelson Mandela Bay IDP and various related strategic frameworks, policies, guidelines and sector development plans are considered as a premise for further assessment.

Several questions must be answered in assessing the desirability of the proposed activity:

1. Is the development the best practicable environmental option for this site?

South Africa's coastline is very exposed and there are few suitable precincts for sea-based aquaculture. Certain areas in Algoa Bay were identified as suitable in the Strategic Environmental Assessment (SEA) conducted in 2011.

Based on the available information commercial *bivalve farming* at Algoa 1 Option 1 and Algoa 6 is a desirable use of the sea space within Algoa Bay provided that the mitigation measures recommended in this impact assessment are implemented.

The Marine Ecological Specialist Study (Appendix D of the BAR) found that *finfish farming* at Algoa 7 could have significant residual marine ecological impacts after the implementation of mitigation measures as this site is situated adjacent to the recently promulgated Addo Marine Protected Area and St Croix Island Group. A precautionary approach with diligent environmental monitoring would be required to minimise residual risks. *Finfish farming* at Algoa 1 Option 1 (Summerstrand) lacks social support from the Port Elizabeth community due to the economic risk this activity could have on the existing tourism and water sports industries, with potential knock-on effects on existing jobs.

At the same time, additional employment opportunities in the Port Elizabeth area are desperately needed and the proposed project has the potential to create new employment opportunities and boost local economic growth.

Overall, the environmental impact assessment shows that Alternative Option B, which proposes *bivalve farming* at Algoa 1 Option 1 (Summerstrand site) and Algoa 6 (PE Harbour site), as well as *finfish farming* at Algoa 7 (Ngqura Harbour site), constitutes the best practicable environmental option for Algoa Bay. Alternative Option B has a greater potential with regards to job creation when compared to Alternative Option C (excludes Algoa 1 Option 1 from the ADZ), while also ensuring that user conflicts with the existing tourism and water sport sectors are significantly reduced when compared to Alternative Option A, which proposes *finfish farming* at Algoa 1 Option 1.

The proposed Alternative Option B has therefore the potential to address the socio-economic need for new employment opportunities and economic growth in the Port Elizabeth area while also minimising conflict with the local tourism industry and water sport activities.

2. Would the approval of this application compromise the integrity of the existing approved and credible municipal IDP and SDF?

Both the IDP and SDF support the potential for sustainable job creation, sustainable environmental resources, and sustainable economic development. The proposed project has the potential to contribute towards the development of the aquaculture sector in the municipality. This is however incumbent on the mariculture industry developing organically without unfair and/or negative impacts on other priority projects/programmes. The socio-economic impact assessment and specialist studies compiled by Britz *et al.* (2016) indicate that *finfish farming* at Algoa 1 Option 1 has the potential to irreversibly impact on existing economic activities relating to tourism and recreational use of the Port Elizabeth beach front area due to a perceived risk of increased shark attacks (refer to socio-economic impact assessment). This impact could occur during the pilot phase and a phased approach is therefore not appropriate in mitigating negative economic impacts. Furthermore, the southern part

of Algoa 1 (Option 2) overlaps with important squid fishing grounds, which would constitute an irreversible impact (squid nurseries are sensitive to increased turbidity and finfish cages may cause long-term impact on the nursery site itself). The only effective mitigation constitutes site reduction (i.e. exclude southern portion) and change in activity to exclude finfish farming at Algoa 1 Option 1.

3. Would the approval of this application compromise the integrity of the existing approved environmental management priorities for the area?

The original Strategic Environmental Assessment for finfish farming along South Africa's coastline considered various factors, including sensitive environments (Hutchings *et al.* 2011). For example, reef habitat and Marine Protected Areas (MPAs) (proposed and promulgated) constituted exclusionary selection criteria.

During the pre-application stakeholder process, the diving industry provided updated coordinates of dive sites, which indicates that contrary to the information obtained in 2012/13, a low-profile reef is likely to be present near the centre of Algoa 1 Option 1, at an approximate depth of 25-29 m. According to Louis van Aardt (owner of Prodiver, *pers. comm.* June 2019), this flat reef protrudes 1-1.5 m above the ocean floor and is home to a thriving reef community dominated by basket starfish and soft coral (octopuses can also be found there). Reef is regarded as a sensitive receptor and an appropriate buffer (200 m radius around the position S33 58. 620; E25 42. 223) excising this area from Algoa 1 must implemented as an essential mitigation measure for ADZ authorization at this site. Although this reef was not detected during the single beam echo-sounder bathymetry survey undertaken in 2012, the 200 m buffer is regarded as conservative, as survey lines were spaced 100 m apart, indicating that the reef is unlikely to extend more than 50 m in either direction from the identified position.

Algoa 5 (Central Addo MPA site) and Algoa 7 (Ngqura Harbour), which were situated within the then proposed Addo MPA (now promulgated boundary excludes Algoa 7) were selected by DAFF subsequently to the Strategic Environmental Assessment. Although Algoa 5 was screened out due to very low economic feasibility, Algoa 7 is situated adjacent to the recently promulgated Addo MPA and lies closer to the protected St Croix Island group than the other proposed ADZ precincts (Algoa 1 Option 1 and 6). It should, however, be noted that the site also lies adjacent to the shipping channel leading to the industrial Ngqura Harbour, as well as north of the Transnet anchorage area and dredge spoil disposal site. A bathymetry survey conducted in 2018 did not detect any reef at Algoa 7 and benthic sampling confirmed the presence of sandy substrate (Benthic mapping study in Appendix D of the BAR, Dawson *et al.* 2019). Impact significance ratings in the marine impact assessment were therefore derived by taking cognisance of sensitive habitats and species surrounding the proposed ADZ sites.

Impacts on benthic habitats tends to be localised to the area under the cages (usually suspended solids settle within 200 m of the finfish cages) and the critically endangered reef systems adjacent to Algoa 1 Option 1 should not be impacted by finfish culture provided that responsible impact management is implemented. Bivalves are extractive organisms (filter feeder extracting plankton from the water column) and are not fed, producing much less waste than finfish. However, bad environmental practice could lead to the deposition of fouling material and excess bivalves on the seafloor (the EMPr requires that biological material is disposed of on land). Should Environmental Authorisation be

granted, marine monitoring during the operational phase would be required in terms of the legally binding Environmental Management Programme, through which the benthic impact footprint must be determined. The impact on benthic habitats were assessed in the Marine Specialist Study in Appendix D of the pre-application BAR Section 4.1.5.1.2. The impact assessment ratings consider the presence of sensitive habitats adjacent to the proposed sites (medium after mitigation).

The Sustainable Seas Trust (SST) is a Non-Profit Organisation (NPO) and science-based organisation that works to protect Africa's marine resources for the benefit of all who live on the continent (SST 2019). SST was appointed by the global coordinating body for Hope Spots (Mission Blue) to develop South African Hope Spots. Hope Spots are marine areas of ecological and biodiversity significance around the world. This global project was started by world-renowned oceanographer Dr Sylvia Earle to unite global efforts to protect the sea by raising public awareness, access and support for a worldwide network of marine protected areas (SST 2019). Algoa Bay was declared a Hope Spot in 2014 (NMBM 2019a). Although the Hope Spot does not constitute a legislated management priority, an impact on the biodiversity of Algoa Bay can be expected, especially at Algoa 7, which lies adjacent to the proclaimed Addo MPA and in proximity to the Bird Island groups.

Blue Flag is a global accreditation system for beaches that meet excellence in safety, amenities, cleanliness and environmental standards. To date, more than 47 countries are participating in this programme. South Africa was the first country outside Europe to be granted Blue Flag accreditation and Blue Flag beaches have been managed by the Wildlife and Environment Society of South Africa (WESSA) in partnership with participating coastal municipalities (WESSA 2019). The primary goal of Blue Flag is to promote environmental management of our coastline and coastal waters to help tourism growth and development (NMBM 2019b). Algoa Bay has three Blue Flag beaches, namely, Kings Beach, Humewood Beach and Hobie Beach, which are all located approximately 2 km inshore from the proposed Algoa 1 Option 1 site (Figure 38). During the pre-application stakeholder process, 54 stakeholders expressed concern regarding water quality deterioration as a result of finfish farming and 28 of these stakeholders explicitly feared that the Blue Flag status could be lost to the city as a result. WESSA, as the management body of Blue Flag status in South Africa, was one of the stakeholders who were concerned that the Blue Flag status could be lost. This is however not a risk for the reasons outlined below.

Water quality requirement criteria to maintain blue flag status include (<http://beachawards.ie/blue-flag/blue-flag-beach-criteria/>):

- A. The beach must fully comply with the water quality sampling and frequency requirements of the Blue Flag programme. (not impacted)
- B. The beach must fully comply with the standards and requirements for water quality analysis. (not impacted)
- C. No industrial, wastewater or sewage-related discharges should affect the beach area.
- D. The beach must comply with the Blue Flag requirements for the microbiological parameters *E. coli* and intestinal enterococci.
- E. The beach must comply with Blue Flag requirements for physical and chemical parameters

Human health concerns in the marine environment are generally related to microorganisms such as bacteria, viruses and parasites. Contaminated water can be ingested during contact sports and result

in gastrointestinal illnesses. *Escherichia coli* and Enterococci are generally used as indicators for the presence of these harmful microorganisms. **It is important to note that finfish farms are not a source of bacteria, viruses and parasites that could harm humans. Harmful microorganisms are excreted by warm-blooded animals (e.g. cow, pig, ostrich, humans) and are washed into the sea via rivers, or land-based outfall pipelines or stormwater drains.**

Although some chemicals used in aquaculture can harm biota living near or under the cages (mainly finfish and invertebrates), chemicals used in finfish aquaculture are not known to affect human health in contact recreation. The concern lies more with bioaccumulation of chemicals in the food chain of the natural environment and effects on the organism itself and the consumer. Administration of drugs and application of antifouling chemicals are strictly controlled by biosecurity protocols (in accordance with international guidelines and national regulatory requirements).

Anchor conducted a Dispersion Modelling study for finfish farming at Algoa 1 (pre-application BAR extent) and 7, which shows that receiving water quality guidelines for the marine environment are likely to be met on the boundary of the Algoa 1 and 7 sites. Note that the report, however, confirms that the finfish cages will contribute to the total nutrient loading in Algoa Bay.

Uneaten food and faeces are negatively buoyant (sink) and begin settling as soon as they enter the water column, usually within 200 m of the cages (Mead *et al.* 2009). Settling of waste below and around the cages is generally considered to be the main concern associated with organic pollution from finfish cages. For this reason, dispersion modelling was conducted for finfish farming at Algoa 1 and 7, which determined the carrying capacity for farmed finfish in an area based on the requirement that waste accumulation under the cages is not harmful to the benthic communities. Water depth, current speed and quantities of waste output are critical in understanding how much fish can be sustainably produced within an area. The sustainable amount of fish that can be produced at Algoa 1 as per the pre-application BAR was estimated around 3-5 thousand tons per annum, depending on the type of fish farmed (refer to the Dispersion Modelling study in Appendix D of the BAR for more detail). With regards to feed, Martinez-Porches and Martinez-Cordova (2012) state that finfish are fast swimmers and consume feed within minutes. It would be in the best interest of the farmer to ensure that feed is not washed out of the cage as feed is the highest running cost of a finfish farm. Mitigation measures proposed in the impact assessment include implementation of sustainable feeding practices, which should minimise the settling of excess feed. After defecation, water circulation and fish activity within cages will naturally lead to fragmentation of particles. Excess feed and faeces particles are then dispersed by currents and will settle at variable rates (and therefore, at different distances from the farm, depending on particle size) on the sea floor around the finfish cages where they are broken down by bacteria. The proposed Algoa 1 Option 1 site is situated more than 3 km offshore from the Blue Flag status beaches and it is unlikely that a significant amount of waste will remain in the water column at the beaches.

In summary, (i) finfish farms are not a source of harmful bacteria and viruses, (ii) chemical pollution from finfish cages is not known to impact humans as a result of recreational activities, (iii) nutrient input from the finfish farm is significant, but not likely to cause nuisance algae growth on the beaches, and (iv) uneaten food and faeces/organic waste are not expected to wash up on the beaches situated more than 3 km from the Algoa 1 Option 1. Therefore, the Blue Flag status of Port Elizabeth's beaches should remain unimpacted. There is no evidence confirming that finfish cage farming in an area with

high dispersion potential such as the Algoa 1 Option 1 site could lead to beach pollution (there is no evidence available for this to occur in sheltered waters either).

4. Do location factors favour this land use at this place?

South Africa's coastline is very exposed and there are few suitable precincts for sea-based aquaculture. The 2011 SEA (Hutchings *et al.* 2011) confirmed that the preferred locations are favourable compared to vast areas along the South African coastline that are not suitable for this activity. Proximity to two big harbours (Port Elizabeth and Ngqura) is a key requirement for economic feasibility (farm maintenance).

5. How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas?

Algoa 7 (Ngqura Harbour site) lies adjacent to the recently promulgated Addo Marine Protected Area (MPA) and a precautionary, as well as risk adverse approach should be applied as the operation of an aquaculture farm is in direct conflict with conservation goals of the MPA. Algoa 1 Option 1 (Summerstrand site) lies adjacent to critically endangered reef (NBA 2011). Marine ecological impacts must be monitored as per the Environmental Management Programme to establish efficacy of mitigation measures, to detect and mitigate unexpected impacts.

The archaeological evidence for a hominin presence in the Algoa Bay region in the Earlier, Middle and Later Stone Age is plentiful. There is thus the potential for the preservation within current seabed sediments of Algoa Bay of pre-colonial archaeological sites and material. At least 310 shipwrecks have occurred in Algoa Bay since the early 1500s, with the majority dating to the 19th century and linked to the colonial settlement of the region. While Algoa 1 Option 1 (Summerstrand site) and 7 (Ngqura site) both have relatively few wrecks known to have occurred in their vicinity, Algoa 6 (PE Harbour site) is located in the area of Algoa Bay with the highest concentration of recorded historical shipwrecks. Mitigation measures proposed in the Maritime Heritage Resources assessment must be implemented in accordance with the requirements of the Environmental Management Programme to avoid the irreversible loss of heritage resources.

6. How will the development impact on people's health and wellbeing?

Recreational activities (water sports, SCUBA diving, sailing) could potentially be impacted by the proposed development, especially concerning finfish farming at Algoa 1 Option 1 (Summerstrand site). Based on the choice modelling study conducted by Britz *et al.* 2016 and feedback from stakeholders thus far, it appears that the perception of an increased risk of shark attacks occurring (whether this risk is real or not) constitutes one of the most important disturbing aspects of the proposed development. Reduced enjoyment of recreational activities could impact on recreational participant's physical health and wellbeing.

7. Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?

The proposed ADZ will result in unacceptable opportunity costs to competing industries and the receiving environment without mitigation and at maximum scale (Alternative Option A). Alternative Option B in conjunction with successful implementation of recommended mitigation measures,

monitoring and implementation in a phased approach could avoid reaching levels of unacceptable opportunity costs.

User conflicts related to recreation and commercial fishing within the proposed ADZ precincts are primarily applicable to finfish farming at Algoa 1 Option 1 (Summerstrand site). The pre-application public participation process demonstrated that support from affected parties is currently lacking for this site due to real but unquantified socio-economic impacts associated with finfish farming (refer to the Stakeholder Consultation Report in Appendix F of the BAR for more information on the types of comments received). Care must be taken to avoid unwanted conflict with existing marine and tourist enterprises to avoid unacceptable opportunity cost. While mitigation measures have been recommended for negative visual and marine ecological impacts, the perceived higher risk of shark attacks cannot be mitigated and could potentially have a profound direct negative impact on the local economy, should the Ironman Event (and other events) be moved to a different location. Ironman Organisers indicated during the 2013 appeal phase and during the pre-application process that the event would be moved should finfish cages be installed at Algoa 1 Option 1. Furthermore, this impact could potentially be irreversible and occur during the pilot phase.

8. Will the proposed land use result in unacceptable cumulative impacts?

Negative socio-economic cumulative impacts:

a) The local tourism industry, recreational activities and businesses relying on tourism and general beach utilisation could be directly and indirectly impacted by the proposed sea-based ADZ in Algoa Bay. The tourism potential of Port Elizabeth and its surrounding environment is still largely untapped and has a vast future potential that is in line with global tourism market trends (international tourism expert Prof. Ernie Heath in Tourism Tattler 2018). Port Elizabeth is also an industrial hub and the two very different economic goals contrast each other with every new development that constitutes a deterrent to tourism and water sport. Particularly finfish farming at Algoa 1 Option 1 is highly likely to significantly contribute toward deterring tourism and water sport in Port Elizabeth. Comparatively, bivalve farming at Algoa 1 Option 1 and 6, as well as finfish farming at Algoa 7 are likely to have a lower cumulative effect. Furthermore, South Africa is currently experiencing slow economic growth and tourism is an important sector for Port Elizabeth, providing many job opportunities to the local community.

b) the overall contribution to reducing available fishing grounds is probably low for the following reasons:

- (1) the small size of the proposed ADZ compared to the extent of fishing grounds
- (2) DAFF has decided to exclude the southern portion of Algoa 1 (Option 2) from the application process.
- (3) Algoa 6 site does not compete in the market space (bivalve farming only); and
- (4) the exclusion of Algoa 7 from the proposed MPA specifically for aquaculture (i.e. the area would have been restricted to wild capture fisheries regardless)

Negative marine ecological impacts:

(a) Dispersion modelling results for finfish farming at Algoa 1 (pre-application extent) and 7 predict dissolved inorganic nitrogen (DIN) inputs for farming 3 000 t of yellowtail in Algoa Bay to be in the order of 10% of the total current anthropogenic input of DIN (Wright *et al.* 2019). Recent research suggests that Algoa Bay is already stressed from anthropogenic nutrient loading and additional

nutrient inputs from fin fish cage farming would therefore constitute a significant cumulative impact (Lemeley *et al.* 2019).

(b) Algoa 7 (Ngqura harbour site) lies adjacent to the recently promulgated Addo Marine Protected Area (MPA). Finfish farming at this precinct could contribute to the cumulative impacts on biodiversity and fish stocks protected by this MPA (mainly as a result of disease transfer and impact on the genetic characteristics of wild stocks). Existing impacts include effluent discharges from land-based facilities, harbour activities, including dredge spoil dumping within the anchorage area south of Algoa 7, ship to ship bunkering with regular oil spills and general shipping traffic. SANParks expressed concern during the pre-application stakeholder consultation phase regarding potential cumulative risk of fuel spillage to the islands and seabird breeding habitats as a result of collision risk. Collision of a ship with the aquaculture infrastructure is unlikely to result in a hydrocarbon spill, as the aquaculture infrastructure is much more likely to be damaged than the ship itself. Navigation impediment could lead to a ship grounding but given the proximity of the sites to the ports and availability of tugs, this impact is highly unlikely to be realised. Furthermore, a hydrocarbon spill would constitute a secondary impact to the collision risk already assessed in Section 9.5.2.4. The impact on navigation is considered to be of low significance before and after the implementation of mitigation measures.

This EMPr must require independent monitoring of sufficient indicators in order to detect and quantify any of the environmental impacts described in this Basic Assessment Report and Appendices and must specify thresholds of concern requiring remedial action. The development of the ADZ should be phased in so that cumulative impacts can be detected as they arise, and adaptive management implemented.

7 POLICY AND PLANNING

The decision to investigate South Africa's marine aquaculture capacity is based on national policy and informed by on-going strategic planning undertaken by the national Department of Agriculture, Forestry and Fisheries (DAFF) and the Department of Environmental Affairs (DEA). In 2013, DAFF promulgated the National Aquaculture Strategic Framework Policy, which identifies the establishment of ADZ as a key strategy to develop aquaculture.

Various policies and guidelines have been developed dealing with marine aquaculture, their known impacts (including direct, indirect and cumulative), the processes of how they should be investigated, as well as recommendations of how such should be managed to avoid unwanted negative results/impacts.

The fact that marine aquaculture is being considered at Government level is proof of a strategic approach to this industry. The main policies and guidelines include:

- Policy and Guidelines for Fin Fish Farming, Marine Aquaculture experiments and Pilot Projects in SA (DEAT 2006, 2007)
- Guidelines for Mariculture Ranching in South Africa (DEAT 2006, 2007)
- Marine Aquaculture Sector Development Plan 2006, 2007
- Policy for the development of a Sustainable Marine Aquaculture Sector in South Africa. (DEAT 2007)
- Strategic Environmental Assessment (SEA) (DEAT 2009)
- Strategic Environmental Assessment – Identification of potential marine aquaculture development zones for finfish cage culture (DAFF 2011)
- Environmental Integrity Framework for Marine Aquaculture (DAFF 2012)
- National Environmental Management Act (Act 107 of 1998): Environmental Impact Assessment Guideline for Aquaculture (DEA 2013)
- National Aquaculture Strategic Framework Policy (DAFF 2013)
- Aquaculture Development Bill (2018)

Notwithstanding the research already undertaken as a result of the above projects, the marine aquaculture industry and Authorities require first-hand experience to implement and test the recommendations and management objectives. It is therefore vital that implementation and operation of future marine aquaculture projects be monitored closely to determine to what extent the industry can regulate itself. The above policy and guideline documents all refer to the importance of compliance and monitoring as safe keep measures for marine aquaculture. Thus, it will only be through rigorous control of the industry, that long-term results and the potential success of the activity will become known.

The overriding strategy, on which this proposal is being touted, is the protection of wild fish stocks, the sustainability of the fishing industry in South Africa and the need to provide food security for an ever-growing population.

8 ENVIRONMENTAL RISKS TO THE ADZ

Marine aquaculture relies on good water quality to comply with national and international food safety standards for the aquaculture products produced. Overall, the final fish product is less sensitive to environmental pollution than bivalves. Bivalves are filter feeders and easily assimilate and bioaccumulate pollutants or harmful algae, that are toxic to humans, directly from the environment. Bivalves also assimilate microbes (viruses, bacteria and parasites) if present in the water column.

This chapter briefly describes the main pollution sources, which could potentially reduce viability of the proposed Aquaculture Development Zone. DAFF has internally assessed the need and desirability of declaring the ADZ in Algoa Bay Area. Public comments received to date have highlighted numerous risks to aquaculture in Algoa Bay. Many of these were highlighted in the previous EIR process and DAFF is aware of the challenges facing future aquaculture developments in Algoa Bay (the same challenges are faced by land-based facilities). DAFF has nonetheless decided to proceed with the application for environmental authorisation. The sections below highlight the potential risks to the development, but do not form part of the impact assessment, which assesses the impacts of the development on the environment and not *vice versa*.

8.1 Harmful Algal Blooms in Algoa Bay

An algal bloom is defined as the rapid growth or accumulation of algae in aquatic ecosystems. *Harmful algal blooms (HAB)* are excessive algal blooms which can harm the ecosystem or are composed of phytoplankton known to naturally produce bio-toxins. HABs, are often incorrectly referred to as ‘red tide’. Not all HABs are caused by red pigmented algae, not all red tides are harmful and the phenomenon itself has nothing to do with the tides.

The following content has been extracted from the Final socio-economic report compiled by Britz *et al.* (2016) and has been modified where required to include the potential effects of HABs on bivalve culture in Algoa Bay.

Algal blooms are caused by excessive amounts of nitrates, phosphates, and other nutrients entering an aquatic ecosystem (Biology Dictionary 2018). In the marine environment, strong offshore winds can trigger an upwelling event where cold, nutrient rich bottom water is transported to the surface. Upwelling events are characteristic of western boundary currents and occur mostly on South Africa’s west coast. However, Algoa Bay can experience intense, intermittent upwelling events, the frequencies of which may change with the progression of climate change.

As these algae grow, out-competed plants die off and become food for the bacteria that decompose them. With this increased food availability, the bacteria also experience explosive growth, rapidly using up all the oxygen in the water until many fish and aquatic insects can no longer survive. The end result of an algal bloom within a confined area and limited flushing is an oxygen depleted zone (Biology Dictionary 2018). In the marine environment, assimilation of effluent is much more effective than in freshwater bodies and therefore discharges from sewage treatment plants and storm water run-off do not typically result in a widespread HAB, such as those observed as a result of environmental conditions, but can cause acute HABs in the area of outflow (see reference to Lemley *et al.* 2019 below).

HABs can negatively impact bivalve culture, as the algal toxins bioaccumulate in bivalve tissue and are harmful to the consumer. Although oysters purge HAB toxins within 10 to 14 days, mussels can hold these toxins for up to four months. Bivalve farms must be closed until toxins measured in bivalve flesh fall below strict national and international Food Safety Standards. To date, the existing Zwembesi Oyster Farm situated at Algoa 6 has not lost any stock due to HABs although the farm was closed due to HABs in December 2017, which represents the only closure due to HABs in 20 years (Simon Burton, Zwembesi Oyster Farm (Pty) Ltd, pers. comm. June 2019). However, the now defunct Marine Growers Abalone farm next to the present Ngqura Harbour suffered heavy stock losses during two dinoflagellate (species not identified) blooms in January 2000 and again in January 2001 (Muller, 2001).

The main concern for finfish farming is associated with low oxygen levels following an algal bloom event and/or the damage to finfish gills as a result of clogging or abrasion (some algae species in the diatom group have spines) followed by irritation and mucous production. More information is provided below.

A recent publication by Lemley *et al.* (2019) attribute the increased observation of eutrophic symptoms in Algoa Bay, including harmful algal blooms (e.g. *Heterosigma akashiwo* and *Lingulodinium polyedrum*) and hypoxia (<2 mg^l⁻¹ oxygen) at least in part to anthropogenic nutrient loading from land based sources (e.g. wastewater treatment works, storm water outfalls). *L. polyedrum* blooms are associated with periods of warm water (>20°C) and calm wind conditions, which are likely to become more prevalent in Algoa Bay as marine warm water events are on the increase globally and in South Africa. Warm water events are of particular concern within the bay as they appear to persist for longer than outside the bay due to the bay circulation pattern (Bornman and Goshen, 2016).

During the severe HAB event of the dinoflagellate *Lingulodinium polyedrum* in early 2014, the South African Environmental Observation Network performed invaluable monitoring of oxygen, chlorophyll, cell density and temperature. The HAB bloom conditions resulted in extremely altered water quality which is considered a high risk to aquaculture production. The cell density of the dinoflagellates reached 29,000 cells per ml producing 200% oxygen supersaturation (12mg/l) in the surface waters as a result of photosynthetic activity. The night-time oxygen levels were not measured, but a severe drop in oxygen level would be expected due to cellular respiration. A HAB bloom in Mexico during which 200% oxygen supersaturation (12mg/l) was recorded in the daytime had a night-time minimum of 4mg/l (Gocke *et al.*, 1990). The decaying Algoa Bay bloom resulted in low oxygen conditions (<2mg/l) towards 20 m and deeper.

Lingulodinium polyedrum is a *thecate dinoflagellate* that produces yessotoxins. The effect of these toxins on fish is unknown but they have been shown to bioaccumulate in shellfish and are toxic to mice. Whilst there may not be a proven toxic effect on fish, salmon subjected to a 3-week sitting bloom of *Neoceratium spp* showed histological cell damage to the liver indicative of hypoxia and exposure to toxic phytoplankton. This population of fish struggled to return to normal feeding post the event and as such rapidly declined in condition (A. Irish, Senior Biologist, The Scottish Salmon Company, pers. comm., September 2016).

The effects of an HAB bloom on kob in cage culture have not been observed but could have potentially severe sub-lethal and lethal effects. It is unlikely that the daytime oxygen super-saturation will result

in negative effects on the fish, however, the low oxygen levels (of the order 4 mg/l) at night would be stressful i.e. affecting feeding, growth and making the fish more vulnerable to disease. Wild fish would actively seek water with higher oxygen levels and farmed fish show the same instinct and can display “burrowing” behaviour causing extensive physical damage to the face which can lead to osmoregulatory failure or secondary infection. While the low oxygen (<2mg/l) at 20m depth would be below the fish cages (10-15m depth), if the water column turned over moving the deoxygenated bottom water up to the cages, mass fish mortalities could occur. The effect of exceptionally high algal cell density on the gills of the target species is not known, however, in other species HAB cells have been known to cause clogging, irritation and mucous production. Whilst not spined like many other thecate dinoflagellates, the armoured plates of *Lingulodinium polyedrum* will cause a degree of abrasion on gill tissue. This would lead to significant proliferation and hyperplasia of the gill tissue, compromising the respiratory process. Prolonged exposure to this challenge would exacerbate the damage (A. Irish, Senior Biologist, The Scottish Salmon Company, pers. comm., September 2016). The recent extended (December 2013-March 2014) HAB event of the dinoflagellate *Lingulodinium polyedrum* along the East coast and in Algoa Bay is of particular concern for the viability of cage aquaculture.

There are a number of *in situ* bloom mitigation measures that have been considered by the mariculture sector, which include aeration and oxygenation, airlift pumping, moving fish pens away from blooms, perimeter skirts, ozone treatment and other methods (Anderson *et al.* 2001). However, most of these mitigation measures involve expensive technology and successful mitigation is certainly not guaranteed. Pre-emptive harvesting of finfish stock prior to occurrence of a major HAB event is considered by some to be a mitigation means, although an effective early warning system must be in place. Furthermore, marketing large volumes of fish on short notice is difficult (Anderson *et al.* 2001).



Figure 15 Red tide bloom in Port Elizabeth during January 2014. Humewood Beach (Above) and satellite image of the bloom (Courtesy Dr G Pitcher, DAFF).

8.2 Dredging in the Port of Ngqura

Dredging of the seabed is performed worldwide in order to expand and deepen existing harbours/ports or to maintain navigation channels and harbour entrances where sediment accumulates through natural and human-induced sedimentation (Erftemeijer & Lewis 2006). Aside from dredging itself, dredged material may be suspended during transport to the surface, overflow from barges or leaking pipelines, during transport to dump precincts and during disposal of dredged material (Jensen & Mogensen 2000 in Erftemeijer & Lewis 2006). Dredging has been touted as one of the most common anthropogenic disturbance of the marine environment (Bonvicini Pagliai *et al.* 1985).

The Ngqura harbour is currently under development and there is a good prospect of further port development and capital dredging that may have an impact on the proposed aquaculture activities. The TNPA is planning to dredge 190 000 m³ and 50 000 m³ in February and 140 000 m³ in March 2019 (*Pers. comm.* Mandilakhe Mdodana, TNPA).

The original EIA that was done for the port development included a sediment modelling study which looked at impacts of the dredging and dredge spoil disposal (Transnet 2014a). The modelling results show that there is no risk from dredging in the port to Algoa 7 (Figure 16). However, there is some risk associated with dredge spoil disposal to Algoa 7 if the TNPA intends to continue using the same disposal site for maintenance dredging and port expansion. The northern boundary of the current disposal site is situated only 1 km to the east of Algoa 7 (Figure 18).

The modelling results shown in Figure 16 show that suspended sediment concentrations exceed the threshold value of 10 mg/l, for roughly 2-5 days per season. Suspended sediment concentrations will exceed the threshold value of 20 mg/l only within the confines of the dredge spoil disposal area and Figure 17. These values are suggested guidelines below which ecological impacts are unlikely to occur in sensitive areas within the Bay (Steffani *et al.* 2003). Therefore, it is unlikely that this activity will affect the surface turbidity within the proposed finfish ADZ. In addition, there is no equivocal evidence that these activities will have significant effects on benthic communities (Transnet 2014b)

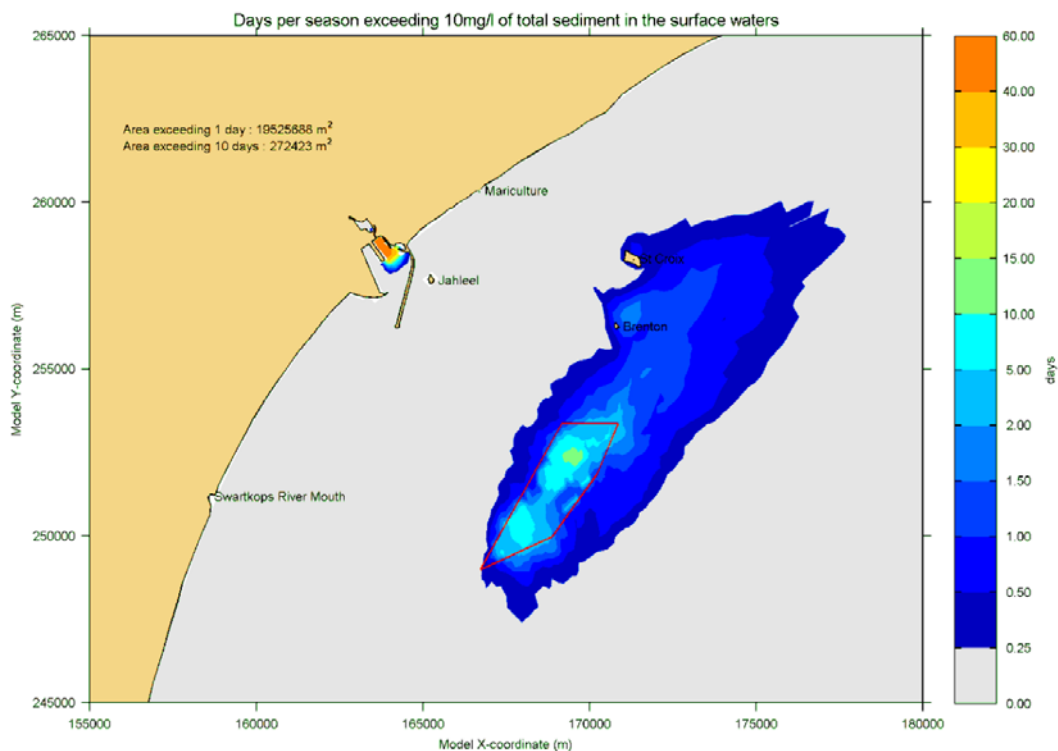


Figure 16 Number of days per season that a suspended sediment concentration threshold of 10 mg/L is exceeded in the in the harbour and above the disposal site. (Source: Chapter 7 Transnet Marine Infrastructure EIA report 2014).

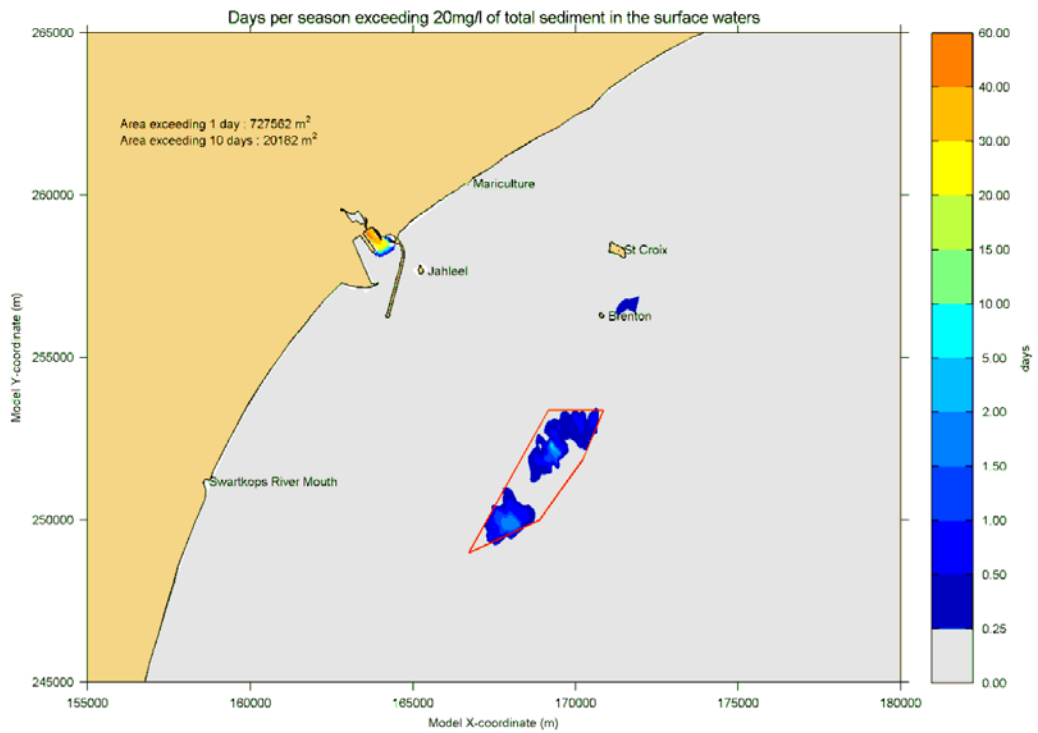


Figure 17 Modelled effects of dredge spoil dumping showing the number of days per season that suspended solids concentration threshold of 20 mg/l is exceeded in surface waters in the harbour and above the disposal site. (Source: Chapter 7 Transnet Marine Infrastructure EIA report 2014).



Figure 18 Location of the dredge disposal site for the Port of Ngqura in relation to the proposed sea-based Algoa Aquaculture Development Zone Algoa 7.

8.3 Ship to ship offshore bunkering activities

Ship-to-ship bunkering is the transfer of fuel from in port supplier ship to the bunkers of larger vessels - ultimately the equivalent of petrol stations at sea. Currently, within Algoa Bay, two companies are licensed to conduct bunkering operations, however an additional two applications are being considered for licensing (personal contact with Dr. Lorien Pichegru). Unplanned events or accidents during the re-fuelling may result in the loss of hydrocarbons and can have potentially significant impacts on the marine environment. Accidental, or non-routine, discharges of hydrocarbons may include the accidental loss of fuel during refuelling or from vessel collisions. Indeed, offshore bunkering operations resulted in a 200-400 L fuel spill on 6 July 2019 near the Port of Ngqura (classified as a Tier 1 spill) and to date SANParks has removed over 80 penguins from Bird Island and St Croix Island have been removed and are currently being rehabilitated (Algoa Bay Hopespot Facebook Page).

Any release of liquid hydrocarbons has the potential for direct, indirect and cumulative effects on the marine environment. Spilled fuel can have toxic and/or smothering effects on organisms in the path of a spill, with coastlines being particularly vulnerable. These effects include physical oiling and toxicity impacts to marine fauna and flora, localised mortality of plankton (particularly copepods), pelagic eggs and fish larvae, and habitat loss or contamination (CSIR 1998b; Perry 2005). Spills can also have socio-economic implications if fisheries and coastal tourism (among others) are disrupted.

Various factors determine the impacts of oil released into the marine environment. The physical properties and chemical composition of the oil, local weather and sea state conditions and currents greatly influence the transport and fate of the released product (Pulfrich 2015). The magnitude of coastal impacts related to such spill events are also dependent on the location (inshore/offshore) and amount of hydrocarbons spilled i.e. large volumes spilled in close proximity to the coast, as would be the case for bunker operations conducted in Algoa Bay, would have a greater impact than smaller amounts spilled offshore. The physical properties that affect the behaviour and persistence of oil spilled at sea are specific gravity, distillation characteristics, viscosity and pour point, all of which are dependent on the composition of the oil (e.g. the amount of asphaltenes, resins and waxes). Spilled oil undergoes physical and chemical changes (collectively termed 'weathering'), which in combination with its physical transport determine the spatial extent of oil contamination and the degree to which the environment will be exposed to the toxic constituents of the released product (Pulfrich, 2015). As soon as oil is spilled, various weathering processes (Figure 19) begin breaking down the oil. Although the individual processes may act simultaneously, their relative importance varies with time (Figure 20). Whereas spreading, evaporation, dispersion, emulsification and dissolution are most important during the early stages of a spill, the ultimate fate of oil is determined by the longer-term processes of oxidation, sedimentation and biodegradation (Pulfrich 2015).

Any discharge into the Bay may affect both natural fish populations and the cultured fish within the ADZ cages and while free fish will be able to avoid a large spill, the fish within the ADZ will not be able to escape and will suffer greatly. Impacts on juvenile and adult fish can be lethal, as gills may become coated with oil. Sub-lethal and long-term effects can include disruption of physiological mechanisms, reduced tolerance to stress, and incorporation of carcinogens into the food chain (Thomson *et al.* 2000). The result of which would cause severe decrease in overall production rates of any farm within the vicinity of the spill. Offshore bunkering occurs in proximity to Algoa 6 and 7 and these precincts are seen to be at higher risk than Algoa 1 Option 1 and 5.

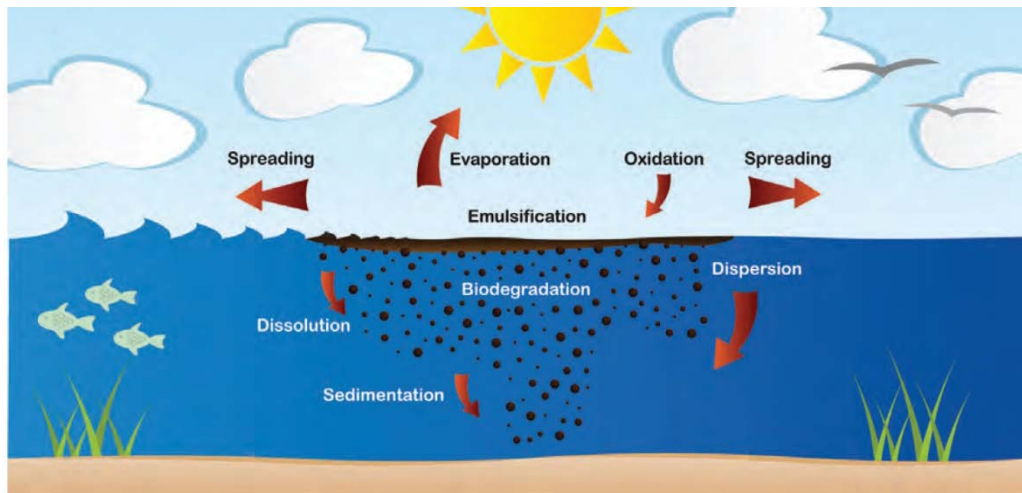


Figure 19 Weathering processes acting on oil at sea. Some of these processes no longer apply when oil is stranded on the shoreline. Source: ITOPF.

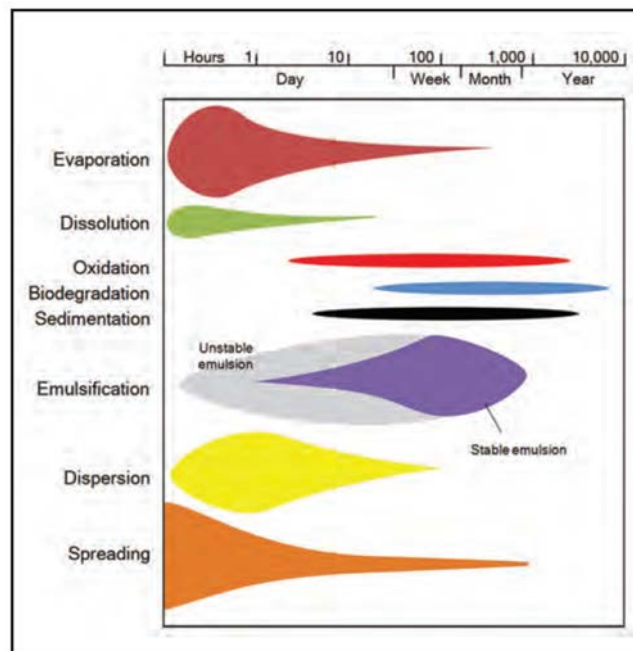


Figure 20 Relative importance of weathering processes on a crude oil spill with time; the width of each band indicates the importance of each process. Source: ITOPF.

8.4 Land-based effluent disposal into Algoa Bay

8.4.1 Legislative context for pollution control

Contemporary coastal water management strategies around the world focus on maintaining or achieving receiving water quality such that the water body remains or becomes fit for other designated uses. Designated uses of the marine environment include aquaculture, recreational use, industrial use, as well as the protection of biodiversity and ecosystem functioning. Guideline limits for mariculture are much more stringent than recreational guideline limits and levels of compliance for mariculture are much lower than for recreational use.

This goal-oriented management approach arose from the recognition that enforcing end of the pipe effluent limits in the absence of an established context (i.e. not recognising the assimilative capacity and requirements of receiving environments) would reach a point where water bodies would only be marginally fit for their recognised uses. This management approach is referred to as the Receiving Water Quality (RWQ) framework (Anchor 2015) and most countries have adopted this framework. These countries have developed water quality guidelines for a variety of uses, which include target values for a range of contaminants that must be met in the receiving environment. Furthermore, in some countries (currently excluding South Africa) Water Quality Guidelines (WQG) are legislated standards and are legal requirements to be met by every user/outfall. Although the importance of managing water quality through the RWQ framework is undisputed, the degree to which this is implemented differs widely between countries.

With the promulgation of the National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008) (ICMA) (as amended), responsibility for regulating land-derived effluent discharges into coastal waters was transferred to the Department of Environmental Affairs (DEA). In terms of Section 69 of ICMA, no person is permitted to discharge effluent originating from a source on land into coastal waters except in terms of a GDA or a Coastal Waters Discharge Permit (CWDP). Exemptions were issued to proponents who, at the time of promulgation, were discharging effluent into coastal waters in terms of permits issued under the NWA, provided that the effluent was treated to meet the General and Special Standard (Government Gazette No. 20526, 8 October 1999). These users were required to apply for a CWDP within three years of promulgation of the ICMA; however, not all operations that discharge wastewater into the sea have done so. New operators wishing to discharge effluent to coastal waters are required to apply for a CWDP before commencing and are also required to comply with the applicable WQG. Applications for CWDP are expected to include data on contaminant levels in the effluent to be discharged, as well as results of dilution and dispersion model studies. These models are required to estimate the worst-case scenario and indicate maximum expected levels for the same contaminants at the edge of the Recommended Mixing Zone (RMZ). These levels are expected to comply with published guideline levels as defined by other existing, or potential, beneficial uses of the receiving environment.

The DEA is currently in the process of developing a permitting system for such effluent discharges and for this purpose, the Assessment Framework for the Management of Effluent from Land Based Sources Discharged to the Marine Environment was recently developed (Anchor 2015). This framework recognises that discharges differ in effluent characteristics (volume and quality) and discharge locality (i.e. biophysical conditions, use of the receiving environment), which ultimately determines the risk that a particular discharge poses to the receiving environment. It was recommended that the

potential scope of a GDA, the level of assessment during the application process for a CWDP, as well as licensing conditions should be based entirely on the environmental risk posed by a particular effluent. Accordingly, the guidelines provide a framework within which an effluent can be characterised (effluent components and properties) and potential impacts assessed within the context of the receiving environment (i.e. sensitive versus robust receiving environments).

In March 2018 the DEA: O&C published Draft Regulations for comment. The new draft regulations seek to provide an administrative framework to implement Section 69 of the ICMA and stipulate timeframes, renewal application processes, applicable fees and information to be submitted as part of an application for a CWDP. The regulations have not yet been promulgated.

To date, no CWDPs have been issued to companies discharging effluent into Algoa Bay and three applications are currently pending. A list of these and other relevant information has been included in Table 3.4, and their locations relative to Algoa 1 Option 1, 6, and 7 are shown in Figure 21. Lemley *et al.* (2019) provides figures for annual loads of dissolved inorganic nitrogen (DIN) and dissolved inorganic phosphate (DIP) entering the coastal waters of Algoa Bay from land-based sources as 8.7×10^5 and 1.4×10^5 kg, respectively. Considering the worst-case scenario, mariculture operations in Algoa Bay are predicted to input less than 10% of the 870 000 kg DIN currently entering Algoa Bay from land-based sources (Wright *et al.* 2019). This does constitute a significant cumulative impact of nutrient loading into Algoa Bay that is already regarded as showing eutrophic symptoms due to anthropogenic pollution (Lemley *et al.* 2019).

Table 17 Pending applications for Coastal Waters Discharge Permit and issued permits for effluent discharges into Algoa Bay.

Applicant	Status	Type of discharge	Impact level
Coega Development Corporation	Application submitted and reference number has been issued – information for decision-making is to be submitted to the DEA: O&C	Industrial and Aquaculture	High
Cape Recife Wastewater Treatment Works	Application submitted - information for decision-making is to be submitted to the DEA: O&C	Sewage, industrial, stormwater	High
Fish Water Flat Wastewater Treatment Works	Application submitted - information for decision-making is to be submitted to the DEA: O&C	Sewage, industrial, stormwater	High
Drift Sands Wastewater Treatment Works	Application submitted - information for decision-making is to be submitted to the DEA: O&C	Sewage, industrial, stormwater	High

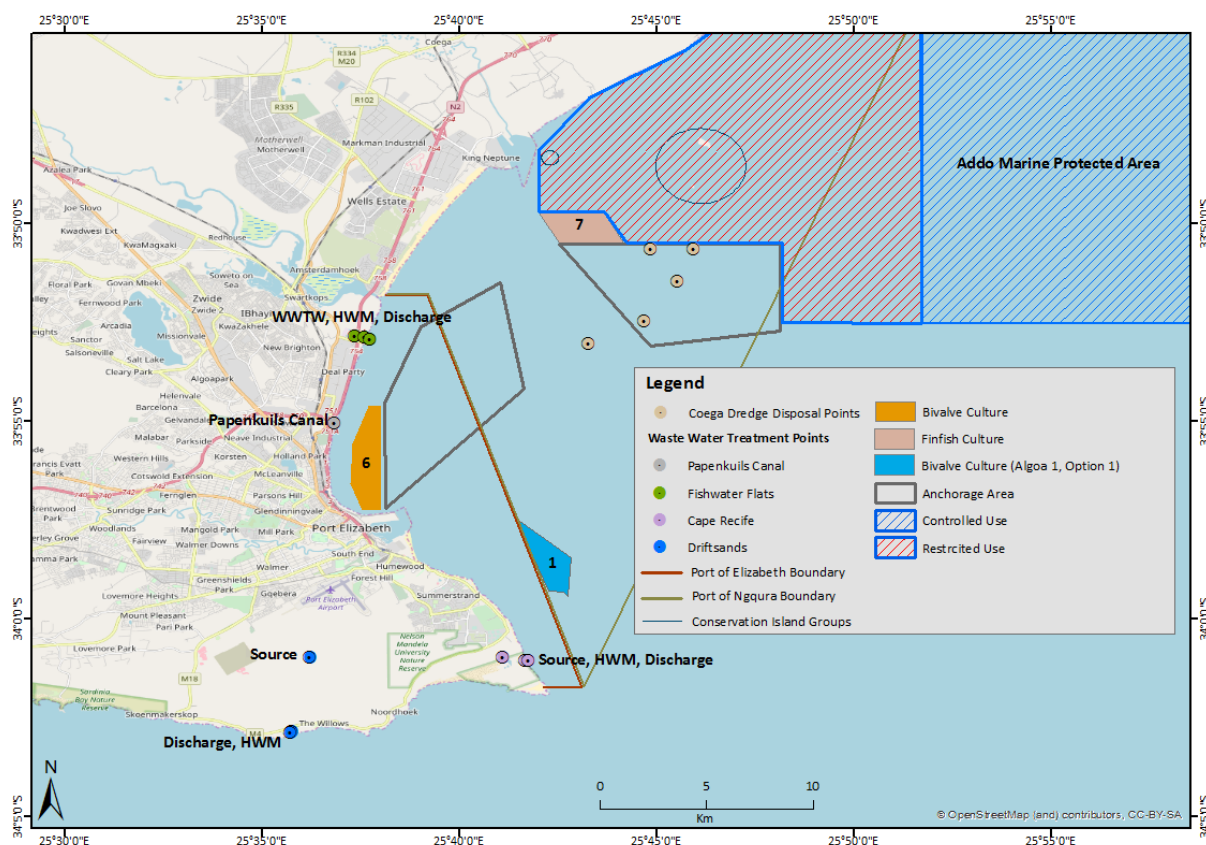


Figure 21 Locations of effluent discharges and dredge spoil dumping sites in Algoa Bay relative to Algoa 1 Option 1, 6, and 7 precincts of the proposed sea-based Aquaculture Development Zone in Algoa Bay.

8.4.2 Coega Industrial Development Zone Marine Pipeline Servitude

The Coega Development Corporation (CDC) has proposed the construction of an integrated common user marine pipeline servitude within the Coega Industrial Development Zone (IDZ) to enable numerous investors to make use of seawater for factory processes (Laird and Clark 2016). Discharge of cooling water, seawater for mariculture activities and desalination wastewater needs to be facilitated; while treated domestic wastewater and industrial effluents are likely to be discharged in the future.

Anchor assessed the suitability of the potential effluent discharge precincts as part of the EIA for the marine pipeline servitude based on likely impacts of predicted effluent dilutions on the marine environment, marine users and aquaculture water quality requirements. Subtidal pipelines (below the sea surface) and surface canals were both assessed for outfall design options based on predicted effluent volume and buoyancy (Laird and Clark 2016). Subsequently, the CDC commissioned PRDW Africa to conduct further modelling on more options, which was concluded in 2017. It is unclear when the CDC will submit a final effluent outfall design and modelling study in support of their CWDP application. Depending on where the effluent will be discharged, Algoa 7 may be impacted by the pipeline servitude, considering that Algoa 7 is situated approximately 4 km from the Ngqura harbour and that the effluent can be classified as a high impact effluent type (high volume and likely of poor water quality).

It is recommended that DAFF engages with the CDC to find the best environmental solution that would accommodate various users of Algoa Bay.

8.4.3 Wastewater treatment works

Sewage is by far the most important waste product discharged into rivers, estuaries and coastal waters worldwide. However, sewage is not the only organic constituent of wastewater, received by sewage treatment plants, other degradable organic wastes, which can result in nutrient loading, include:

- Agricultural waste
- Food processing wastes (e.g. from fish factories and slaughterhouses)
- Brewing and distillery wastes
- Paper pulp mill wastes
- Chemical industry wastes
- Oil spillages

Bivalves filter feed and thereby assimilate heavy metals and bacteria and other pathogens into their tissue from the water column. If international food safety limits are exceeded, the mussel or oyster product is no longer safe for consumption, which introduces a risk factor when a bivalve farm is situated near a pollution source. Bivalve farmers are required to regularly test the organisms as part of the food safety monitoring programme implemented by the National Regulator for Compulsory Specifications and the Department of Agriculture, Forestry and Fisheries.

Wild fish are known to have high heavy metal content due to biomagnification (the tendency of pollutants to concentrate as they move from one trophic level to the next). Farmed fish, however, will be fed fish pellets and will not be taking up pollutants from the receiving environment.

There are three wastewater treatment works (WWTW) in Port Elizabeth, namely the Fishwater Flats, Cape Recife and Driftsands WWTWs. The Fishwater Flats WWTW outfall is situated close to Algoa 6, however, modelling results for this outfall are currently not available. The Cape Recife WWTW is currently in the process of being upgraded. The modelling report prepared by Hutchings *et al.* 2016 shows that under worst case scenario water quality guidelines are likely to be met approximately 1 km south of Algoa 1 Option 1 (Figure 22). The plume should therefore not affect mariculture activities at Algoa 1 Option 1. The Drift Sands WWTW is situated 10 km west of Cape Recife and does not pose a risk to Algoa 1 Option 1.

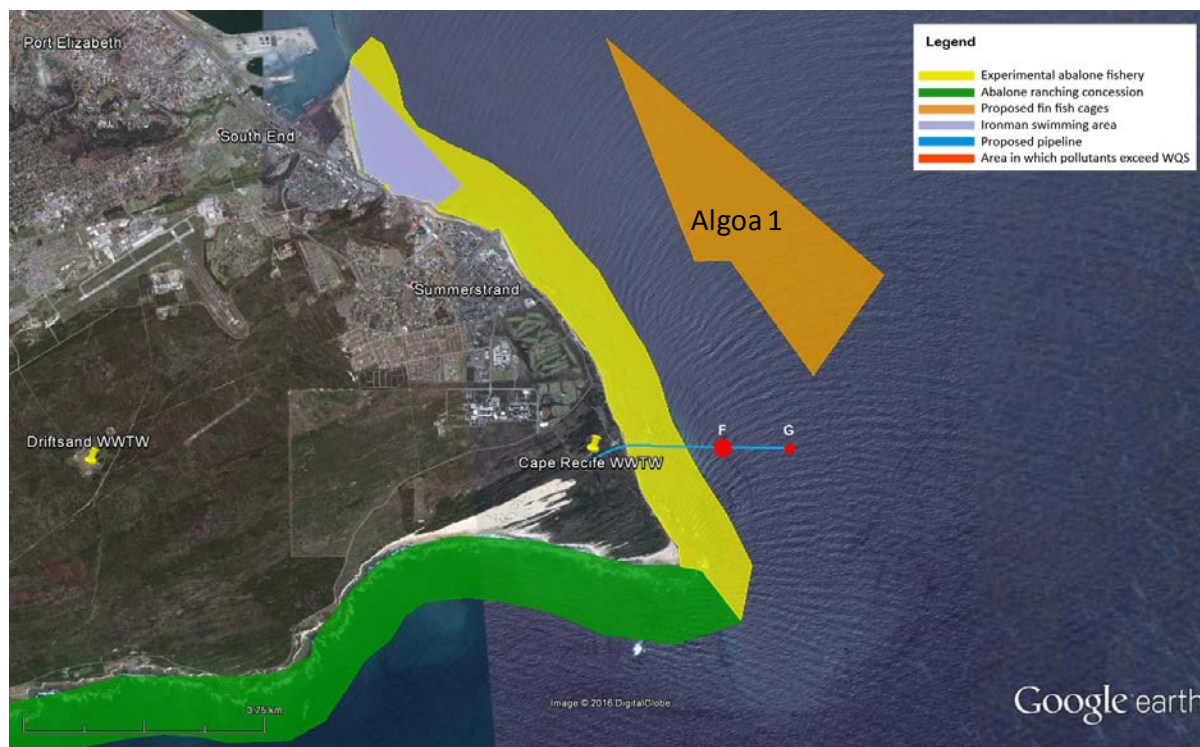


Figure 22 The expected footprint of contaminants modelled in the worst case scenario is shown by a red circle for both Outfall F and Outfall G of the proposed upgrades to the Cape Recife Wastewater Treatment Plant. At the edge of the red circles, contaminants are likely to have become sufficiently diluted to meet water quality guidelines (Hutchings *et al.* 2016). The outfall pipeline is shown relative to the Algoa 1 original extent precinct of the proposed sea-based Aquaculture Development Zone.

8.4.4 Reducing wastewater discharges into Algoa Bay

Disposal of wastewater is a major problem in coastal environments. Sewage and industrial effluent are arguably the most important waste discharged into Algoa Bay in terms of potential impact on the proposed ADZ. With the ongoing drought in the Eastern and Western Cape, however, industry and local municipalities are coming together to investigate the feasibility of reclaiming freshwater from treated sewage. Most commonly, treated sewage is used to irrigate sports fields and golf courses although some industries further treat the water for use in industrial processes. In Saldanha Bay, Arcelor Mittal now represents the highest consumer of treated wastewater from the Saldanha Bay Wastewater Treatment Works. Arcelor Mittal constructed a Reverse Osmosis plant, which treats wastewater such that it can be used for cooling steel production equipment (Clark *et al.* 2018).

Major infrastructural changes are required for the re-cycling of treated sewage and are associated with significant initial as well as ongoing fiscal investments. Budgetary constraints experienced by local municipalities are significant, and a public-private partnership is likely to be required to ensure successful implementation. Considering that the aquaculture industry is developing fast in the Eastern Cape, it is recommended that DAFF engages with the local municipality, the Coega Development Corporation and potential businesses to find ways to reuse the wastewater that would otherwise be discharged into the coastal environment.

9 DESCRIPTION OF THE AFFECTED ENVIRONMENT

9.1 Site context

The proposed activity is sea-based and therefore a property description has not been included in this Basic Assessment Report. Boats used for the maintenance of the ADZ will be launching from the Port Elizabeth and Coega harbours. Land-based storage and processing facilities are not included in this Basic Assessment process and are therefore not included in the description of the site.

A more detailed account of the marine ecology and maritime underwater heritage resources can be found in the specialist studies contained in Appendix D.

9.2 Marine and coastal environment

9.2.1 Oceanography

The waters off the Eastern Cape coast are warm-temperate with average sea surface temperatures of 17-22°C (Goschen and Schumann 1988, Schumann *et al.* 2005). The south-flowing Agulhas Current is the dominant oceanic-scale feature and typically flows along the coast at approximately 1 m/s on average (Grundlingh and Lutjeharms 1979, Ross 1988). Several hundred kilometres to the north east of Port Elizabeth near East London, the current moves away from the shore as the continental shelf begins to widen (Dingle *et al.* 1987). This generally results in the inshore waters being markedly cooler, by a few degrees compared with the Agulhas Current water further offshore (Goschen and Schumann 1988).

The movement offshore of the Agulhas current in the vicinity of East London creates shear edge features such as eddies which may periodically circulate warm water inshore near Port Elizabeth (Stone, 1988). As a result of these Agulhas shear edge features, water temperature can vary over short temporal scales along the Eastern Cape Coast, particularly in the vicinity of St Francis and Port Elizabeth.

Another source of temperature variability and a characteristic of the Eastern Cape coast are upwelling events (Beckley 1983, Schumann 1999, Schumann *et al.* 1988, Churchill 1995, Goschen & Schumann 1995). This phenomenon is caused by wind driven currents particularly during easterly winds (Churchill 1995). Upwelling cells are prominent adjacent to many of the rocky headlands, particularly off Cape Recife and Cape Padrone and may move into Algoa Bay (Schumann *et al.* 1982, Beckley 1983, Churchill 1995, Goschen and Schumann 1995, Goschen *et al.* 2012). Although not as frequent or as severe as those upwelling events on the west coast, wind-driven upwelling has been responsible for fish kills, and water as cold as 6 °C has been recorded in the area (Ross 1988).

Recent research has revealed that several aspects of the Agulhas Current hydrodynamics bring cold, deeper water onto the shelf that may then be brought to the surface by offshore or alongshore winds; and that upwelling events are associated with increased frequency of coastal trapped waves (CTWs), although the links between upwelling and CTWs are unknown (Goschen *et al.* 2012).

Yearly average minimum temperatures are found in winter of 14-15°C and maximum average temperatures in summer of 20-22°C (Beckley 1983 & 1988, Schumann *et al.* 2005). Temperature variation in Algoa Bay is high and typically ranges between 11°C in winter and 27°C in summer (Beckley 1983 & 1988). A strong thermocline is evident in summer in water deeper than 15 m characterised by fairly intense gradients of up to 3°C/m, whereas in winter conditions are homogenous (Schumann *et al.* 2005).

Salinity remains relatively constant within Algoa Bay and close to natural oceanic water for the region of 35.2 ppt (Schumann *et al.* 1988). However, close to the mouth of the Swartkops River and at the New Brighton Pier outfall, salinity as low as 34.7 ppt has been measured, although it remains only in the top 5 m of water and does not penetrate deeper (Schumann *et al.* 2005).

9.2.2 Wind and wave climate

Schumann *et al.* (1991) found the wind to vary across Algoa Bay, and that prevailing wind directions in Algoa Bay are parallel to the large-scale orientation of the coastline, namely west-south westerly and east-north easterly. Schuman & Martin (1991) reported that the westerly component of wind dominated in speed and frequency throughout the year, while the easterly component of wind varies considerably between seasons. Both north easterly and south westerly winds reached a maximum in speed and frequency during October and November and a minimum during May, June and July. The maximum average wind speed was 4 m/s for NE winds and 4.7 m/s for SW winds during October.

Wave direction is predominantly from the south west with swells of less than 2 m being most common and occurring approximately 80% of the time (MacLachlan 1983). However, an important percentage of waves in excess of 3 m emanate from the south west, generated by storms in the Southern Ocean. Most of Algoa Bay is protected from these swells by the rocky headland at Cape Recife, despite some degree of refraction (Ross 1988, Goschen and Schumann 2011). Nevertheless, maximum wave heights of 6 m have been recorded along the surf zone of Algoa Bay by MacLachlan (1983), possibly from easterly swell, and Council for Scientific and Industrial Research (CSIR, 1987) buoy-data have recorded wave heights of between 0.5-5.0 m (87% of waves between 1-3 m) in summer and between 1.0-6.5 m in winter approaching the Bay at Cape Recife.

9.2.3 Subtidal habitats

Relative to sandy habitats, reefs are scarce in Algoa Bay. On shallow subtidal reefs (<10 m), algae, grazers and filter feeders are the most prolific fauna. Dominant algae consist mainly of red foliose species, especially *Plocamium spp.* The ascidian *Pyura stolonifera* is also abundant (Beckley, 1988). Cape oysters, particularly in areas prone to periodic sanding are prevalent. Abalone *Haliotis midae* are an important species occurring on shallow subtidal reefs, particularly on algae dominated reefs. The large predatory whelk *Charonia lampas* is also frequently encountered, particularly on deeper reefs.

Deeper reefs below 10 m are characterised by exceptionally high levels of diversity and dominated by many species of filter feeders, particularly colonial ascidians, sponges, sea fans, soft corals, hydroids

and bryozoans (Wooldridge & Coetzee 1998). Sponges and ascidians are especially diverse on subtidal reefs in the region and are particularly poorly studied. Sea fans (*Leptogorgia palma*, *Eunicella albicans*, *E. papillosa* and *E. tricornata*) are common in the area as is the purple soft coral *Alcyonium fauri*. Bryozoans become more abundant with depth due to their fragile structure as do feather stars, two species of which, namely *Comanthus wahlbergi* and *Tropiometra carinata* occur in the area.

A study conducted on nearshore subtidal macrobenthic communities, at a depth of 10 m along the western shore of the bay, reported a diversity of 174 and 187 species, during summer sampling seasons in 2008 and 2009 respectively (Masikane 2011). In addition, it has recently been suggested that the invertebrate diversity within the Bay may be extraordinarily high and include several previously undescribed taxa (Dorrington 2018).

9.2.4 Birds

The islands of Algoa Bay are home to many endangered, vulnerable and near-threatened birds including breeding colonies of African penguins (Crawford *et al.* 1990; Barnes 1998), Cape gannet (Crawford, 1997b; Barnes, 1998), African black oystercatchers (Martin 1997), Roseate tern (*Sterna dougallii*, Randall *et al.* 1991; Crawford, 1997a), Cape Cormorant (Cooper *et al.* 1982) and winter visiting Antarctic terns (Williams, 1997). The African penguin colony at St Croix Island is the largest in the world (Pichegru *et al.* 2010).

9.2.5 Fish, sharks and marine mammals

Algoa bay has high diversity of fish species, the distribution of which depends on the habitats they favour. Characteristic fishes found on the deeper reefs include Panga (*Pterogymnus laniarius*), Piggy grunter (*Pomadourus olivaceum*), Santer (*Cheimerius nufar*), Carpenter (*Argyrozona argyrozona*), Fransdam (*Boopsoidea inornata*), Roman (*Chrysoblephus laticeps*), Dageraad (*Chrysoblephus cristiceps*), Yellowbelly rockcod (*Epinephelus marginatus*), Steentjie (*Spondylisoma emarginatum*) and white musselcracker (*Sparadon durbanensis*) (Smale & Buxton 1998; Chalmers 2012).

Six species of cetaceans are regularly seen in Algoa Bay; these include southern right whales (*Eubalaena australis*), humpback whales (*Megaptera novaeangliae*), Bryde's whales (*Balaenoptera brydei*), Indian Ocean bottlenose dolphins (*Tursiops aduncus*), Indo-Pacific humpback dolphins (*Sousa chinensis*), and longbeaked common dolphins (*Delphinus capensis*) (Saayman *et al.* 1972, Karczmarski *et al.* 2000, Reisinger & Karczmarski 2009, Melly 2011).

Algoa Bay is the eastern most distribution of the Cape fur seal and breeding takes place on Black Rocks (Mills & Hes, 1997). The presence of this breeding colony may act as an important factor for the aggregation of Great white sharks (*Carcharodon carcharias*), which are known to target seal breeding colonies as feeding grounds (Kock *et al.* 2013, Hewitt *et al.* 2018). While a range of sizes of white sharks can be found around Seal Island, the inshore areas of Algoa Bay are home to the greatest proportion of young-of-year sharks (Dicken & Booth 2013).

9.2.6 **Biodiversity Importance and Conservation Status**

Due to the high diversity of habitats, marine organisms and seabirds in Algoa Bay (several of which are of conservation concern), significant biodiversity importance is attributed to many areas in the Bay (Chalmers 2012) (Figure 23). The St Croix Reserve and Bird Island MPA off Woody Cape make a significant contribution to biodiversity conservation, particularly for birds and offshore island habitat (Barnes 1998, Chalmers 2012). However, large areas with high biodiversity conservation importance are afforded no protection.

The National Protected Areas Expansion Plan (SANBI 2009) proposed an MPA in Algoa Bay, which would adjoin the Greater Addo Elephant National Park (GAENP) and improve biodiversity conservation considerably. The Addo MPA was promulgated on 28 May 2019 and is the first MPA in South Africa to incorporate a bay environment, exposed rocky headlands and offshore islands (Figure 24).

The Marine Protected Area consists of four coastal zones comprised of three inshore controlled and one inshore restricted zone. Four offshore zones include two controlled and restricted zones. Estuaries are also included in the Addo MPA with one controlled and one restricted zone.

All sites are situated in Vulnerable ecosystem. Algoa 1 Option 1 (Summerstrand site) lies adjacent to confirmed, critically endangered 'Bell Buoy' reef (NBA 2011) (Figure 24), which is a popular diving spot in Algoa Bay. A description of Algoa Bay's reefs is included in Section 3.3.3. Although categorised as critically endangered, the southern portion of Algoa 6 is unlikely to contribute toward conservation of a sheltered sandy bottom habitat type (no reef is present at this site). The environment at Algoa 6 is highly modified due to the construction of the Port of Port Elizabeth, as well as the ongoing beach erosion prevention in the lee of the harbour wall.

Additionally, Algoa Bay is located within the recently established and revised Ecological and Biologically Sensitive Area (EBSA) that spans the Sardinia Bay MPA to the Amathole MPA by the Marine Spatial Management and Governance Programme (MARISMA) team as part of a suite of such areas along the South African Coastline in terms of the Convention on Biodiversity (UNEP 2014, 2015). According to the online EBSA Portal ([https://cmr.mandela.ac.za/EBSA-Portal/South-Africa/Algoa-to-Amathole-\(Offshore-of-Port-Elizabeth\)](https://cmr.mandela.ac.za/EBSA-Portal/South-Africa/Algoa-to-Amathole-(Offshore-of-Port-Elizabeth))), this EBSA encompasses possibly the biggest single collection of significant and special marine features in all of South Africa that also jointly support key ecological processes, including important land-sea connections. Consequently, this EBSA includes spawning areas, nursery areas and key transport pathways for demersal and pelagic fish. In turn this supports a myriad of top predators, including shark and seabird breeding and foraging areas. Given the regional oceanography, Critically Endangered leatherback and Near Threatened loggerhead turtles migrate through the EBSA between their nesting and foraging grounds, with hatchlings of both species also passing through during their dispersal from the nesting beaches. Green turtles have also been sighted in the area. Further, the EBSA includes 36 ecosystem types, 18 of which are threatened and a further seven that are Near Threatened. Sensitive features and species include submarine canyons, steep shelf edge, deep reefs, outer shelf and shelf edge gravels, and reef-building cold-water corals. It also contains several key biodiversity features, like the Critically Endangered localised endemic estuarine pipefish.

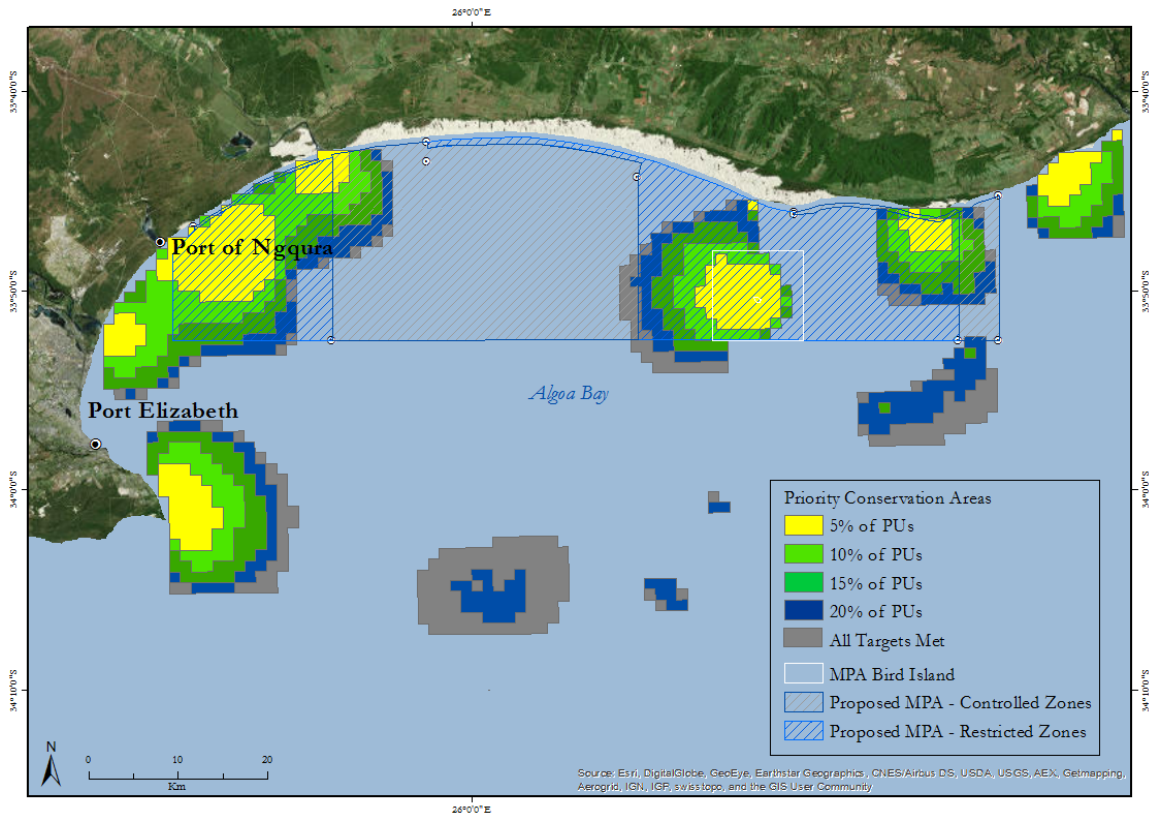


Figure 23 Priority conservation areas within Algoa Bay (Data source: Chalmers, 2012). (PU means Planning Unit).

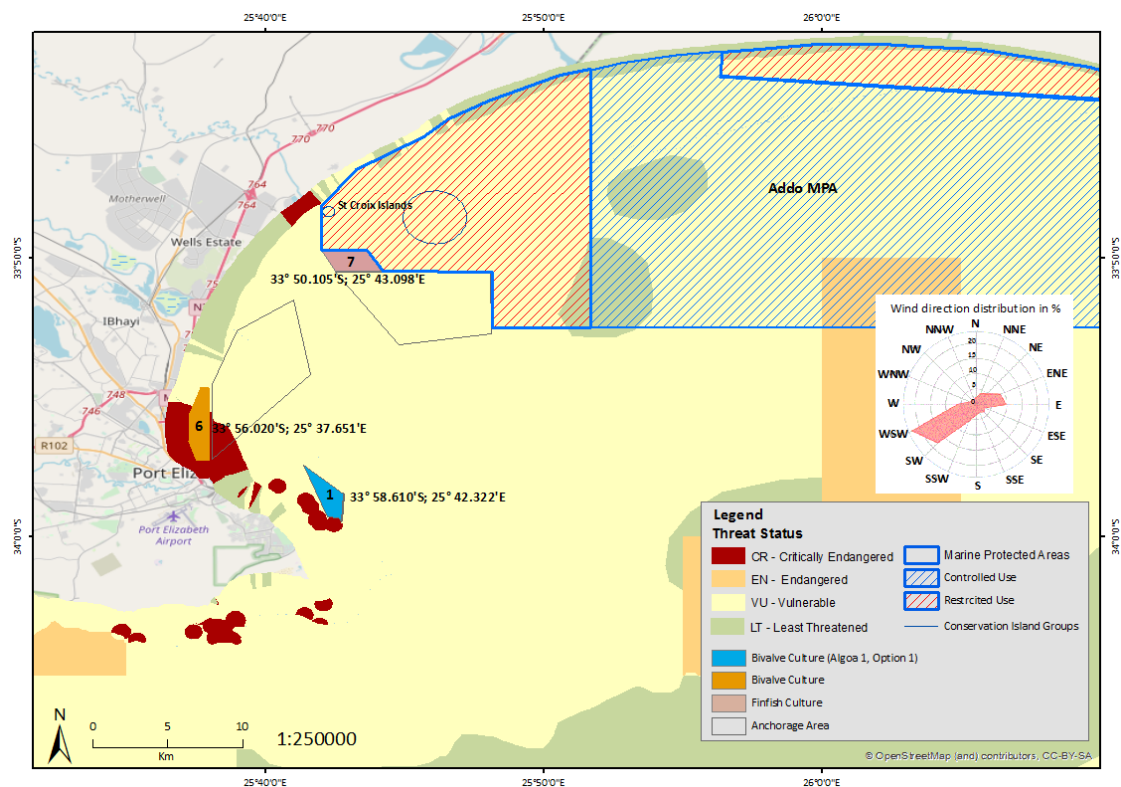


Figure 24 Extent of recently promulgated Addo MPA and marine threat status of Algoa Bay (NBA 2011) relative to the proposed sea-based Aquaculture Development Zone precincts 1 (Option 1), 6 and 7.

9.3 Landscape and seascape context

The landscape context is important for the determination of potential visual impacts that could arise from the proposed development. Port Elizabeth is the largest city in the area and is South Africa's second oldest city. Port Elizabeth represents the commercial capital of the Eastern Cape. Port Elizabeth is a major seaport, with the most significant ore loading facilities in the southern hemisphere. Industrial activities have lately shifted towards Coega, situated 15 km northeast of Port Elizabeth, where a Special Economic Zone (SEZ) was established in 1999. The Coega Development Corporation (CDC), a state-owned enterprise (SoE), is mandated to develop and operate the 9 003 hectares. The Coega Industrial Development Zone provides back-of-port facilities and infrastructure to the adjacent deep-water Port of Ngqura. The depth of the channel and its location in the protected Nelson Mandela Bay make it one of the best positioned deep-water ports on the South African coast (Coega Development Corporation 2018).

The predominant landscape character of the land and sea is industrial (harbour, industrial activities and freight shipping) and constitutes a strong contrast when compared to the beautiful beaches stretching along the coastline of Algoa Bay. Situated on the shores of Algoa Bay the area also has a thriving tourist economy based on activities such as scuba diving, game fishing charters, surfing and kiteboarding with many popular scenic beaches. The Cape Recife Nature Reserve, which is located on the peninsular of Algoa Bay, has a strong wilderness sense of place.

The proposed Algoa 1 Option 1 (Summerstrand) finfish and bivalve culture site is located 2.2 km offshore from Summerstrand, which is an upmarket residential area and a popular holiday destination. Despite its proximity to the Port Elizabeth harbour, the sense of place is certainly not industrial. The site lies approximately 4 km from the Nelson Mandela University (NMU) Private Nature Reserve and the Cape Recife Nature Reserve, which contribute to a natural aesthetic setting.

The proposed inshore bivalve culturing site, Algoa 6, is situated adjacent to the Port of Port Elizabeth harbour wall and extends north parallel to the shoreline for approximately 4.8 km. The immediate coastal area is characterised by urban industrial development and a mostly modified shoreline fringed by railway tracks and the Settlers Highway (M4).

The proposed Algoa 7 finfish culture site is located 3 km offshore from the Port of Ngqura adjacent to the recently promulgated Addo MPA. The site lies immediately north of a TNPA Anchorage area and to the east of the shipping lane providing access to the Port of Ngqura. The sense of place is generally determined by anchored and passing ships and the nearby industrial harbour.

9.4 Underwater Cultural Heritage

South Africa has a rich and diverse underwater cultural heritage. Strategically located on the historical trade route between Europe and the East, South Africa's rugged and dangerous coastline has witnessed more than its fair share of shipwrecks and maritime dramas in the last 500 years. At least 2400 vessels are known to have sunk, grounded, or been wrecked, abandoned or scuttled in South African waters since the early 1500s. This doesn't include the as yet unproven potential for shipwrecks and other sites that relate to pre-European, Indian Ocean maritime exploration, trade and interactions along the South African east coast.

In addition to historical shipwrecks, the record of South Africa's long association with the sea is much broader and extends far back into prehistory. This element of our maritime and underwater cultural heritage is represented around the South African coast by thousands of pre-colonial shell middens and large numbers of tidal fish traps, which reflect prehistoric human exploitation of marine resources since the Middle Stone Age, more than 150,000 years ago. Another, until recently, largely unacknowledged and unexplored aspect of our maritime and underwater cultural heritage are pre-colonial terrestrial archaeological sites and palaeolandscapes which are now inundated by the sea.

The proposed project will affect the surface environment of the ocean more so than the sea bottom. The disturbance on the seabed will be associated with mooring/anchoring mechanism for the cages. Anchor appointed ACO Associates cc to conduct a desktop Maritime and Underwater Cultural Heritage Study as the Maritime and Underwater Cultural Heritage (MUCH) Unit at SAHRA indicated that such a study would likely to be requested. A summary of the HIA has been included in this BAR and the specialist study has been included as a standalone document in Appendix D.

9.4.1 Submerged prehistory of Algoa Bay

There have, to date, been no specific studies of the submerged prehistory of Algoa Bay. However, the archaeological evidence for a hominin presence in the Algoa Bay region in the Earlier, Middle and Later Stone Age is plentiful. Earlier and Middle Stone Age lithic material has been found in the in the Sundays River Valley, while at the important site of Amanzi Springs, 40 km north of the Port Elizabeth near Addo, Earlier Stone Age artefacts are found in situ with well-preserved plant and faunal remains within spring sediments (Deacon, 1970).

There is Later Stone Age archaeological material preserved in caves and rock shelters, such as Melkhoutboom Cave, in the Cape Fold Belt Mountain surrounding Port Elizabeth (see Deacon and Deacon, 1963; Deacon, 1976; Binneman, 1997) and large numbers of coastal shell middens have been reported at Humewood, St. George's Strand and the Coega River Mouth (Rudner, 1968).

Most recently, Binneman and Webley (1997) reported thirteen shell middens and stone tool scatters about 500 m east of the Coega River mouth in the archaeological assessment carried out for the development of maritime infrastructure for the Port of Ngqura. Importantly, some of this archaeological material was recorded in secondary context in the gravels from older river terraces along the banks of the Coega River – a context reminiscent of the Table Bay finds referred to earlier.

The presence in Algoa Bay of a late Quaternary of consolidated, calcareous aeolianite, known as the Nahoon Formation, which was deposited during sea level regressions associated with the last two glacial periods is also important to note. The Nahoon Formation outcrops between Plettenberg Bay and East London and is known to preserve vertebrate trackways, estimated to be approximately 124 000 years old, which include the footprints of a young human child in the sandstone at Nahoon Point north of East London in 1964 (Roberts, 2008). Where Nahoon Formation outcrops survive below the current sea level, there is the potential for them to preserve further trackways and also archaeological material.

The rivers that currently feed into Algoa Bay would, during times of lower sea level in the past, have flowed across the exposed floor of the bay and are likely to have been an activity and resource focus

for hominins. As in Algoa Bay and elsewhere in the world, there is thus the potential for the preservation within current seabed sediments of Algoa Bay of pre-colonial archaeological sites and material.

9.4.2 Maritime history and shipwrecks of Algoa Bay

Port Elizabeth owes its foundation, and Algoa Bay its position as South Africa's second port to the arrival in 1820 of 5000 British immigrants, brought to the eastern Cape as part of a government scheme to strengthen the eastern boundary of the colony. The bulk of these settlers were landed on the beach next to the Baakens River and below Fort Frederick (Ingpen, 1979; Ingg 1986). With people came trade and commerce and Algoa Bay soon became a busy port providing a link for the eastern Cape with Cape Town and England, with wool becoming the major export (Ingpen, 1979; Turner, 1988; Knox-Johnston, 1989).

Algoa Bay is a wide, relatively shallow (<70 m), eastward-facing bay whose crenulate shape is the result of the dominant swell from the south-west. The bay is not a natural harbour but is nevertheless a safe anchorage for much of the year because the dominant winds are from the southwest, with an increase in the frequency of winds with an easterly component during the summer months. The strongest winds occur during October and November and it was these south-easterly gales which historically decimated shipping in the bay (Ingg, 1986; Schumann *et al.*, 2005).

The assessment by the specialist appointed for this Basic Assessment Report (Gribble 2019) found that at least 310 shipwrecks have occurred in Algoa Bay since the early 1500s, with the majority dating to the 19th century and linked to the colonial settlement of the region. While Algoa 1 Option 1 and 7 both have relatively few wrecks known to have occurred in their vicinity, Algoa 6 is located in the area of Algoa Bay with the highest concentration of recorded historical shipwrecks. This was the area, in the most protected portion of the bay, where the historical landing place was situated adjacent to the Baakens River mouth, where, as a result, the anchorage was located directly offshore and where the early shipping-related infrastructure development took place in Algoa Bay.

The assessment also found that records of a further 147 shipping casualties described only as "Algoa Bay" or "Port Elizabeth", which could be located anywhere in the bay should also be considered in relation to the development of aquaculture in all three proposed areas, are. The bulk of these wrecks are likely to occur in the vicinity of the modern harbour and North End, around Algoa 6, given the centrality of that portion of the bay to historical shipping activity. The potential presence of these wrecks must be taken into account in respect of the development of all three proposed aquaculture areas.

9.5 Socio-economic character

Algoa Bay's over 100 km of breath-taking coastline boasts a perfect combination of warm water and protected beaches. Algoa Bay is a large log-spiral bay, anchored by rocky headlands at Cape Recife in the south east, and Woody Cape and the Bird Island group in the northeast. The relatively large Zwartkops and Sundays Rivers and the much smaller Papenkuils and Coega Rivers discharge into the bay (CSIR, 2007). Algoa Bay (also known as Nelson Mandela Bay), is a favoured draw card for beach and water sport enthusiasts and is fast becoming known as South Africa's water sport capital as it offers activities and water sport events (e.g. Ironman) throughout the year. Algoa Bay is regarded as one of the best sailing venues in the world, while scuba diving is of world-class quality with beautiful reefs, shipwrecks, fish and colourful coral species.

Port Elizabeth is also considered the eastern gateway to the Garden Route, as well as the main access point to a wide range of tourism spots, including two National Parks (Addo Elephant National Park and Tsitsikamma National Park), a number of private game reserves (e.g. Shamwari Game Reserve, Amakhala Nature Reserve), Wilderness Areas (e.g. Baviaanskloof and Groendal) as well as cities along the Garden Route.

Consequently, Port Elizabeth represents a local and international tourism hub, with significant contributions to the local economy (formal and informal).

A Waterfront at Port Elizabeth Harbour is planned to enhance the appeal of Port Elizabeth to tourists. While heavy industry (e.g. Manganese ore export) will be moved to Ngqura harbour, Transnet envisions that the port will still operate as a service-driven harbour with added arts and recreational landmarks and attractions. This means that ship hull cleaning, rig repair, ship repair and export activities will still occur in the harbour (i.e. mixed-use harbour).

Of the proposed sites, Algoa 1 Option 1 has the greatest user conflict when compared to Algoa 6 and Algoa 7. The Strategic Environmental Assessment conducted in 2011 for finfish culture along the South African coastline (Hutchings *et al.* 2011) predates but pre-empts the Marine Spatial Planning Act (Act 16 of 2018) (MSPA), which was promulgated on 6 May 2019. In terms of the MSPA, any activities requiring a right, permit, permission, licence or any other authorisation issued in terms of any other law must be consistent with the approved marine area plans (Section 3 of the Act). Regulations defining the requirements for approving area-specific marine spatial plans in terms of this Act are yet to be promulgated. The Marine Spatial Planning framework has, however, been published and provides a substantial description of the process that is to be followed in South African marine waters. Due to the high diversity of habitats, marine organisms and seabirds (several of which are of conservation concern) and substantial body of biophysical data, Algoa Bay represents the ideal planning region for a case study for the first South African Marine Area Plan (Dorrington *et al.* 2018). The Marine Spatial Planning (MSP) research group of the Nelson Mandela University is currently developing a Marine Spatial Plan for Algoa Bay. Although this plan will not be approved in terms of the MSPA prior to submission of this application, decisions regarding development in the marine domain are to be made with co-operative governance processes in mind, guided by abiding to MSP legislation. This means that all marine activities in the Bay, including land-based activities, must be located and conducted in a manner that will not impact on other government departments' mandates.

The Addo MPA along the middle eastern section of the bay was promulgated on 28 May 2019 (Figure 24). The Marine Protected Area consists of four coastal zones comprised of three inshore controlled and one inshore restricted zone. Four offshore zones include two controlled and restricted zones. Estuaries are also included in the Addo MPA with one controlled and one restricted zone (Figure 24).

Algoa Bay was declared a Hope Spot in 2014 (NMBM 2019a) and conservation-oriented residents are passionate about the preservation of Algoa Bay. Algoa Bay has three Blue Flag beaches, namely, Kings Beach, Humewood Beach and Hobie Beach, which are all located approximately 2 km inshore from the proposed Algoa 1 Option 1 site (Figure 38). Despite concerns expressed by stakeholders over water quality deterioration as a result of finfish farming, specialists are of the opinion that the Blue Flag beaches should not be compromised (refer to Section 6.2 for more information).

Algoa Bay serves as the entrance to two ports nestled along the coast within the bay, namely Port Elizabeth and a new port at Ngqura (Coega) a mere 20 km away. Agriculture and farming have always played an important role in the port's activities, principally deciduous and citrus fruit and the annual wool crop. More recently, containers have assumed a prominent role in the fortunes of the harbour, with Port Elizabeth serving its local industrial base and offering an alternate port of call to container ships whenever the Durban or Cape Town container terminals are congested. Other principal products handled at the harbour include manganese ore, which is railed from the Northern Cape, and petroleum products that are imported from other South African ports. The motor industry has long been an important industrial activity for the Eastern Cape and the port plays a leading role in this regard, boasting a large open-area car terminal. The fishing industry also makes extensive use of the port. There are no major ship repair facilities, but a slipway is available for fishing vessel repair. Passenger ships usually make use of one of the fruit terminal berths when calling at Port Elizabeth. The South African Navy has established a naval station at Port Elizabeth but does not maintain any ships there. In future, some of the port's present commercial activity may be lost to the port of Ngqura (Coega), although the car terminal and possibly the container terminal will remain intact.

The entrance channel to Port Elizabeth is maintained at a depth of -14.5 m Chart Datum and has a generous width of 310 m. Limitations on vessels using the port are 11 m draught for passenger and dry cargo vessels, 11.2 m for container ships, 12.1 m for ore carriers and 9.6 m for tankers, all according to berthing. Deeper vessels may be accommodated with the permission of the harbour master. Tug assistance and pilotage is compulsory. Ships may anchor outside the port in Algoa Bay provided the approaches to the entrance channel are kept clear. Port Elizabeth's main features are the container terminal, fruit terminal and manganese terminal. The container terminal has a capacity in excess of 375,000 TEUs and has the advantage of being able to load railway trains directly under the gantry cranes, without containers having to be double handled, thus speeding up delivery to inland destinations. A full range of ships chandelling and stevedoring as well as other support services is available (Transnet, 2011a).

The deep-sea port of Ngqura, which began commercial ship operations (containers) in October 2009, lies some 20 km northeast of Port Elizabeth at the mouth of the Coega River in Algoa Bay. An Industrial Development Zone, known as the Coega IDZ, has been developed over the 12 000 ha site in the area including the river and port, with a 4 500 ha core development immediately identified. The IDZ will serve as a primary location for new industrial development for export driven industries.

The deep-water Ngqura port serves post-Panamax dry and liquid bulkers and the new generation of cellular container ships. The port consists of a main eastern breakwater, 2.7 km in length extending into Algoa Bay to a maximum water depth of 18 metres, and a secondary western breakwater 1.125 km in length.

9.5.1 Demographic and economic profile

This socio-demographic profile of the study area is based on data from the 2011 National Population Census Survey, available on the Statistics South Africa website (<http://www.statssa.gov.za>).

The proposed Algoa Bay Aquaculture Development Zone is located closest to the Nelson Mandela Bay Municipality on the south-eastern coast of Africa in the Eastern Cape. Formed in 2001 as an administrative area, the Nelson Mandela Bay Metropolitan Municipality covers Port Elizabeth, the neighbouring towns of Uitenhage and Despatch, and the surrounding agricultural areas. It is one of eight Category A (i.e. metropolitan) municipalities in South Africa, with a population of 1 152 115 in 324 292 households (StatsSA 2011). Of the population, 552 994 (48%) are male and 599 121 (52%) are female.

As per the 2011 Census (StatsSA 2011), 60.1% of respondents described themselves as black African, 23.6% coloured, 14.4% white and 1.1% Indian/Asian. IsiXhosa is spoken by 53.2% of the residents as their mother tongue, followed by Afrikaans (28.9%) and English (13.3%). The 2011 census showed that 39.3% of the population had some primary education, while 15% had completed secondary and 2.7% had some form of higher education. The population is comprised of 25.5% young people (0–14 years) 37.1% youth (15–35 years) 31.4% adults (36–64 years) and 6% elderly (65+ years).

The overall unemployment rate in the Nelson Mandela Bay Municipality was 36.6% in 2011, compared to 46.4% in 2001 and 36.3% in 1996. Youth unemployment rate was at 47.3% in 2011.

The average household income per annum was R105 602 in 2011 (up from R53 904 per annum in 2001). The Municipality contributes up to 44% of the provincial Eastern Cape GDP (<http://www.nelsonmandelabay.gov.za/Business>). The majority of households within the Nelson Mandela Bay Municipality have access to services (i.e. water, electricity, sanitation, and refuse removal), and the Municipality consistently has the highest percentage of households with access to flush/ chemical toilets (89.4%) and lowest percentage with no access to a toilet (1.9%), compared to other local municipalities in the Eastern Cape.

The GDP growth rate for the Nelson Mandela Bay Municipality was 2.1% in 2010 and the GDP per capita R 52 147 (as per the Eastern Cape Socio Economic Consultative Council). The largest economic sectors in the Nelson Mandela Metro are manufacturing, finance, community services and transport. Community services, trade and manufacturing sectors are the sectors that create the most

employment in the metro. The Coega Industrial Development Zone (IDZ) is a multibillion-dollar industrial development complex adjacent to the deep-water Port of Ngqura in the Nelson Mandela Bay Municipality, customized for heavy, medium and light industries. StatsSA (2018) highlights the unique developmental opportunities presented by the municipality having two ports (Port Elizabeth Harbour and Ngqura) to “establish a strong and vibrant maritime sector”.

9.5.2 Affected user groups

Marine user groups can be broadly defined as recreational or commercial. Recreational marine activities that are most likely to be affected by the proposed ADZ include recreational boat (skiboat) fishing, recreational scuba diving and yacht sailing. Other recreational marine activities such as open water swimming, surfing, surf skiing, kayaking, as well as wind and kite surfing that may be affected are also considered. Data on the spatial extent of the potentially affected recreational marine activities identified above were sourced from literature (guidebooks etc) and from comment and data made available by interested and affected parties (I&APs) during the public participation phases of the previous and current EIA processes. The degree of spatial overlap of the identified activities with the potential ADZ is then assessed and qualified.

Several commercial marine activities take place within the broader Algoa Bay region; these include shipping, marine ecotourism, and a range of commercial fisheries. Mining and gas exploration may also take place within Algoa Bay in the future. This section was initially compiled by Anchor Environmental in July 2013 and has been integrated into this Basic Assessment Report and has been updated where required. The socio-economic impact assessment in this Basic Assessment Report assesses potential impacts on these user groups (Section 10.4).

9.5.2.1 Recreational user groups

Non-motorised water sports and bathing

Water sports such as surfing, kite boarding, surf-ski paddling, stand up paddle boarding, open water swimming and sea kayaking have seen significant growth in Nelson Mandela Bay over recent years. The closest point to land of Algoa 1 Option 1 is over 2 km and the popular swimming and water sport beaches off Summerstrand are approximately 3.5 km away. Algoa 7 lies approximately 4.8 km offshore from the popular St Georges Strand and Wellington Estate which are popular bathing beaches and recreational facilities. Mariculture developments at Algoa 1 Option 1, 6 and 7 is unlikely to affect non -motorized recreational marine users in terms of sea space, despite the popularity of these activities in the Algoa Bay area. These activities mostly take place within 1 km of the coast as shown in the proposed beach aquatic safety zone (Figure 25). Algoa 6 is situated very close to the shore overlapping with the existing TNPA allocated mariculture area (SRK 2008) and there are no recreational beaches or facilities nearby.

I&APs are very concerned that finfish farming at Algoa 1 Option 1 and, to a lesser extent, Algoa 7 could pose a risk to these user groups. Water sports people are at risk of being bitten by a shark anywhere along South Africa's coastline (the probability of a shark bite incident increases with both the density of sharks and the density of water users, and the probability of an incident occurring in a popular water sports area such as Port Elizabeth is relatively higher than in remote areas with few water users). It is probable that marine predators, such as sharks, will be attracted to finfish cages that may appear to be a source of food. Indeed, monitoring of fish cage trials previously undertaken in Algoa Bay did record increases in fish diversity and abundance under cages stocked with fish and an incident where two ragged tooth sharks successfully entered a fish cage (Nel and Winter 2008). Despite this, these authors stated that the fish cages "do not seem to present a great attraction for cetaceans, pinnipeds or sharks".

Nonetheless, sandbar sharks in Hawaii exhibit site fidelity in the vicinity of fish cages, whilst tiger sharks although transient, may repeatedly visit fish cages (Papastamatiou *et al.* 2010). White sharks have been documented entering fish cages to prey on captured stock (Galaz & De Maddalena 2004). An Australian study has shown changes (increases in residency time) in white shark behaviour where a food reward was realized from shark cage diving operations at the North Neptune Islands, but this effect was localized (Bruce & Bradford 2011). In contrast, a study in False Bay South Africa found little evidence of conditioning of white sharks around Seal Island in response to low level (three operators) cage diving operations (operating permit conditions and chumming practices did, however, differ between the two countries) (LaRoche *et al.* 2007). Research by the leading South African shark scientists has shown that positive conditioning can only arise if white sharks gain significant and predictable food rewards (Johnson and Kock 2006: South Africa's White Shark cage-diving industry -is their cause for concern?).

Anti-predator nets are specifically designed to exclude large predators from entering the fish cages (and getting a food reward) and these are routinely used by fish farm operators as such predators are clearly attracted to the cages in the first place. Effective anti-predator nets lower the likelihood of sharks receiving a food reward from within a fish cage, but wild (and escaped fish) are known to concentrate around the outside of fish cage infrastructure that operate as Fish Attractant Devices (FADs). These fish, or uneaten food sinking out of the cages, may serve to be a suitable and regular food reward to alter distributional and behavioural patterns of wild marine predators.

Marine predators are thought to locate food sources by following cues (olfactory, audio, and electrical) up the concentration gradient. Theoretically therefore, a perceived food source (e.g. fin fish farm) 2 km offshore should attract predators away from the coastal areas utilized by water sports people. This may occur providing the food cues are detectable at such a distance (this is unknown and dependent on prevailing oceanographic conditions and species-specific physiology). This does not imply that risk of a shark bite incident will be lower in the inshore recreational areas; indeed, should the fish cages increase residency times of large sharks in the broader region (e.g. western Algoa Bay), the occurrence of sharks may well increase at the bathing beaches. It is clear that there is a high degree of uncertainty as to possible changes in the risk of shark bite incident to non-motorized marine water users should fish farms be developed in Algoa Bay (Alison Kock, City of Cape Town Shark spotters programme, personal communication).

This is due to a lack of data and understanding of the site and species specific and individual shark behavioural responses to such a development. Recent research suggests that the inshore areas of Algoa bay are an important nursery area for white sharks (Dicken and Booth 2013). The only conceivable way to address this is with extensive monitoring of shark movement patterns both at the ADZ precincts, and at the popular bathing beaches inshore, before and after the stocking of cages. Baseline data would have to extend for at least 12 months to cover seasonal variation in shark movement patterns (preferably longer to include inter-annual variation). Acoustic tracking of white sharks and other large shark species (e.g. bull sharks) is currently under way both within Algoa Bay and elsewhere off the SA coast (including research currently underway by researchers at Bayworld funded by the Nelson Mandela Metropole).

Continuation and expanding of these research programmes to include acoustic receivers at the proposed ADZ precincts and the popular bathing beaches is a potential monitoring method that could be utilized. The decision-making authorities should, however, also consider the ethical issue of monitoring large shark movements in response to a fish farm development when there is a high degree of uncertainty regarding the threat to human bather safety associated with the development.

I&APs also raised concerns about water deterioration as a result of finfish farming (mostly relating to Algoa 1 Option 1). It is important to note that:

1. Finfish farms are not a source of harmful bacteria and viruses to humans;
2. Chemical pollution from finfish cages is not known to impact humans as a result of recreational activities;
3. Nutrient input from the finfish farm is significant, but not likely to cause nuisance algae growth on the beaches; and
4. Uneaten food and faeces/organic waste are not expected to wash up on the beaches situated more than 3 km from the Algoa 1 Option 1.

Human health concerns in the marine environment are generally related to microorganisms such as bacteria, viruses and parasites. Contaminated water can be ingested during contact sports and result in gastrointestinal illnesses. *Escherichia coli* and Enterococci are generally used as indicators for the presence of these harmful microorganisms. It is important to note that finfish farms are not a source of bacteria, viruses and parasites that could harm humans. Harmful microorganisms are excreted by warm-blooded animals (e.g. cow, pig, ostrich, humans) and are washed into the sea via rivers, or land-based outfall pipelines or stormwater drains.

Although some chemicals used in aquaculture can harm biota living near or under the cages (mainly finfish and invertebrates), chemicals used in finfish aquaculture are not known to affect human health in contact recreation. The concern lies more with bioaccumulation of chemicals in the food chain of the natural environment and effects on the organism itself and the consumer. Administration of drugs and application of antifouling chemicals are strictly controlled by biosecurity protocols (in accordance with international guidelines and national regulatory requirements).

Anchor conducted a Dispersion Modelling study for finfish farming at Algoa 1 (pre-application extent) (and 7), which shows that receiving water quality guidelines for the marine environment are likely to be met on the boundary of the Algoa 1 and 7 sites. Note that the report, however, confirms that the finfish cages will contribute to the total nutrient loading in Algoa Bay.

Uneaten food and faeces are negatively buoyant (sink) and begin settling as soon as they enter the water column, usually within 200 m of the cages (Mead *et al.* 2009). Settling of waste below and around the cages is generally considered to be the main concern associated with organic pollution from finfish cages. For this reason, dispersion modelling was conducted for finfish farming at Algoa 1 and 7, which determined the carrying capacity for farmed finfish in an area based on the requirement that waste accumulation under the cages is not harmful to the benthic communities. Water depth, current speed and quantities of waste output are critical in understanding how much fish can be sustainably produced within an area. The sustainable amount of fish that can be produced at Algoa 1 as per the pre-application BAR was estimated around 3-5 thousand tons per annum, depending on the type of fish farmed (refer to the Dispersion Modelling study in Appendix D of the BAR for more detail). With regards to feed, Martinez-Porches and Martinez-Cordova (2012) state that finfish are fast swimmers and consume feed within minutes. It would be in the best interest of the farmer to ensure that feed is not washed out of the cage as feed is the highest running cost of a finfish farm. Mitigation measures proposed in the impact assessment include implementation of sustainable feeding practices, which should minimise the settling of excess feed. After defecation, water circulation and fish activity within cages will naturally lead to fragmentation of particles. Excess feed and faeces particles are then dispersed by currents and will settle at variable rates (and therefore, at different distances from the farm, depending on particle size) on the sea floor around the finfish cages where they are broken down by bacteria. The proposed Algoa 1 Option 1 site is situated more than 3 km offshore from the Blue Flag status beaches and it is unlikely that a significant amount of waste will remain in the water column at the beaches.

The above information indicates that the Blue Flag status of Port Elizabeth's beaches should remain unimpacted. There appears to be no evidence confirming that finfish cage farming in an area with high dispersion potential such as the Algoa 1 Option 1 (and Algoa 7) site could lead to beach pollution (there is no evidence available for this to occur in sheltered waters either), which is congruent with the statement that suspended particles usually settle within 200 m of the finfish farm (Mead *et al.* 2009).

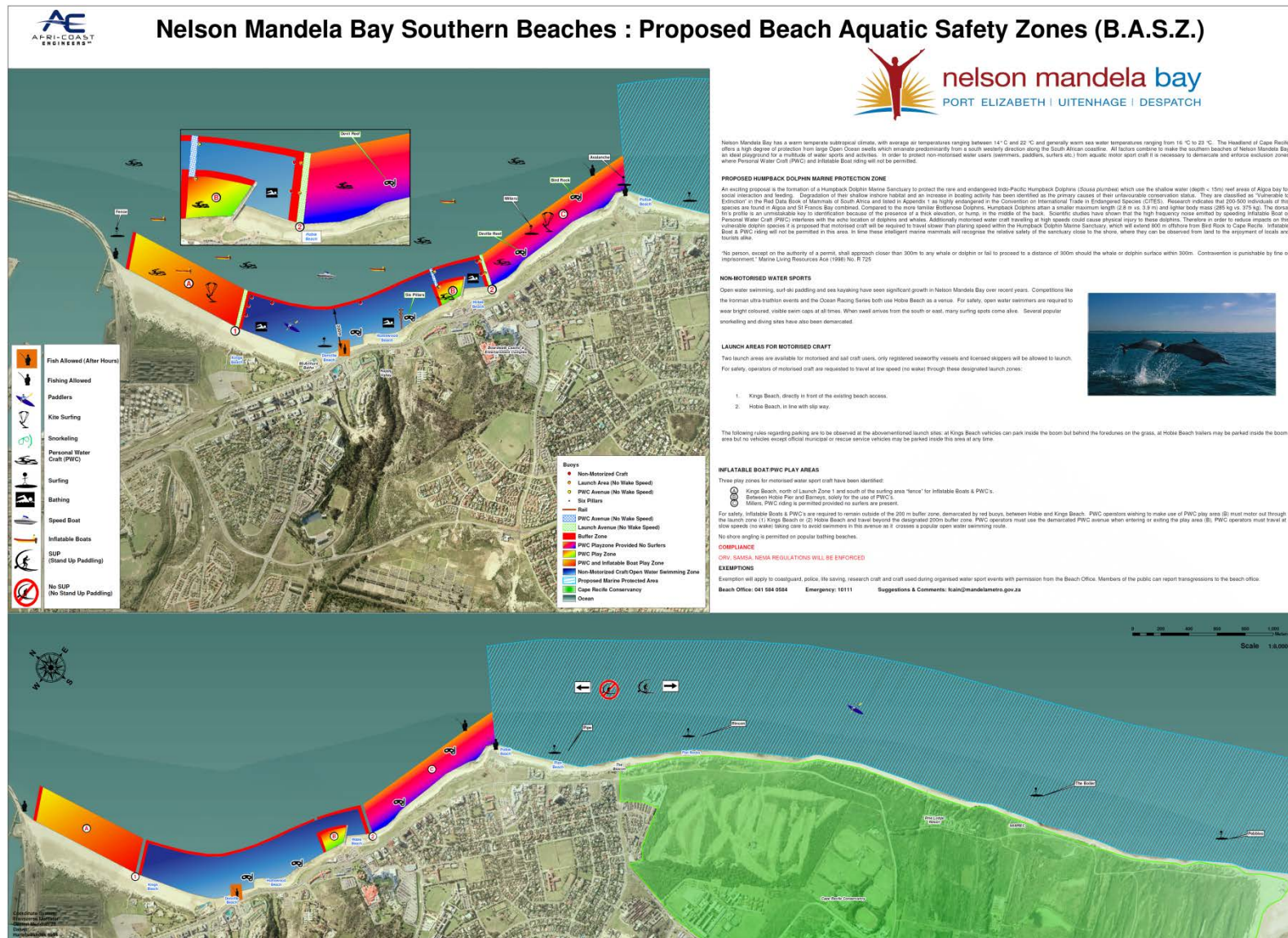


Figure 25 Proposed Beach aquatic safety zones and marine recreational areas for the Summerstrand beaches (adjacent to Algoa 1 Option 1).

Yachting

Algoa Bay Yacht Club (ABYC) was established approximately 54 years ago. The club now includes a large clubhouse and marina with ~130 yachts moored within the Port of Port Elizabeth. ABYC has been host to many national and international sailing events including the long running Algoa Bay week regatta (<http://abyc.co.za>). Competitive sailing and social Wednesday evening sailing takes place every week throughout the sailing season.

During the scoping phase of the previous EIA process, a meeting with the ABYC was held on 12 May 2012. It was pointed out that yacht sailing within Algoa Bay takes place across a large area between Cape Recife and the Sundays River mouth. The extent was confirmed by the Honorary Secretary of the ABYC in June 2019 (pers. comm. 2019) (Figure 26).

Algoa 1 Option 1 and Algoa 7 are situated in the main sailing area, while Algoa 6 overlaps with a small area near the Port Elizabeth harbour wall. Mariculture could pose a navigational hazard to yachts. To minimize this hazard, mariculture infrastructure would have to be clearly marked on charts and by navigational markers as required by the South African Maritime Safety Authority.

Port Elizabeth frequently hosts national and international sailing events. Spectators gather at Pollock and Hobie beaches to watch the start of the events, which is a key factor in event sponsorship. Due to the reef system inshore of Algoa 1 Option 1 the route can only be diverted offshore (approximately 6 km), thereby moving the event out of spectator's sight. National and international yachting events that have been held to date are described in more detail in Section 9.5.2.2. The ABYC anticipates that, should an aquaculture farm (finfish or bivalve) be placed at Algoa 1 Option 1, international events would no longer be held in Port Elizabeth due to (1) the navigational hazard in rougher sea conditions and (2) the loss of area most important for event spectators (pers. comm. 2019 Rodney Idris Hon Secretary, Algoa Bay Yacht Club).

It is acknowledged that yachting may be affected by ADZ development within Algoa Bay. However, the relatively large area utilized by yachts within Algoa Bay, mitigation measures available to reduce navigation hazards, and relatively small proposed ADZ areas, means that recreational yachting activities should not be mutually exclusive with the proposed ADZ. However, the loss of international yachting events would likely only be prevented if Algoa 1 Option 1 is excluded from the ADZ (i.e. Alternative Option C).



Figure 26 Regular yacht sailing area within Algoa Bay (source: Arthur Rump, Algoa Bay Yacht Club, extent confirmed by Rodney Idris, Honorary Secretary in 2019). (Map updated from Hutchings *et al.* 2013a).

Scuba diving

Recreational scuba diving is a popular activity within Algoa bay and at least four dive shops located within Port Elizabeth supply training and equipment. Recreational scuba divers registered as I&APs during the project scoping of the 2010-2014 EIA process and supplied locations of 18 popular diving spots (mostly reefs) in the Algoa Bay area. None of these originally supplied 18 precincts overlapped with Algoa 1 (original extent) (and screened out Algoa 5). During the current BA process, Prodiver provided updated coordinates, which indicates that contrary to the information obtained in 2012/2013, a low-profile reef is likely to be present near the centre of Algoa 1 Option 1 (Figure 28), at an approximate depth of 25-29 m. According to Louis van Aardt (owner of Prodiver, *pers. comm.* June 2019) protrudes 1-1.5 m above the ocean floor and is home to a thriving reef community dominated by basket starfish and soft coral (octopuses can also be found there). The benthic mapping and marine specialist studies in Appendix D of the BAR (Dawson *et al.* 2019; Hutchings *et al.* 2019) have been updated to include this new information (revised impact assessment and mitigation measures).

Basket Star is the only suitable deep diving site used by Prodiver (and potentially other industry members) to train advanced divers. Prodiver has indicated that this dive site cannot be replaced and that the loss of this site may economically impact their business.

Seven of the dive sites provided by Prodiver are situated 500-1000 m from the border of Algoa 1 Option 1 (Figure 28). Only one dive site, namely PenguinBai is situated 850 m southeast of the Algoa 7 (Nggura Harbour) site (Figure 29).

Stakeholders expressed concerns that waste originating from finfish farms could reduce visibility and smother nearby reefs, rendering these precincts no longer attractive for SCUBA tourists. Several annual dive events also occur in this area, which are detailed in Section 9.5.2.2.

Modelling of waste (nutrient and chemical) dispersal from a proposed fish farm at Mossel Bay (an area with similar current speeds to Algoa Bay) was conducted by Mead *et al.* (2009). Suspended solids were expected to sink to the sea floor within 200 m of the cages (Mead *et al.* 2009). This study did indicate that elevated levels of dissolved nutrients would likely occur up to 2 km from the fish cages, with nitrate (ammonia is typically excreted by fish, this is broken down into nitrites and nitrates) levels expected to be above background concentrations 8 - 12km from the site under certain oceanographic conditions (Mead *et al.* 2009).

The hydrodynamic modelling undertaken for this study (Wright *et al.* 2019) showed, however, that receiving water quality guidelines for the marine environment are likely to be met on the boundary of the Algoa 1 and 7 sites. Note that the report, however, confirms that the finfish cages will contribute to the total nutrient loading in Algoa Bay. The presence of elevated nutrients/suspended solids is usually attributed to a reduction in the clarity of water, i.e. light penetration or visibility. Suspended solids usually remain in suspension in the water column since their density is similar to that of seawater and turbulence in the water column. Under calmer conditions, solids may settle out from the water column and be deposited onto the substratum. Increased nutrients within the water column, which can stimulate phytoplankton growth, can also result in lowered light penetration due to the presence of a bloom. In addition, there may be a risk of hypoxic bottom water as production settles to the benthos. When the suspended solids concentration is elevated above background levels, it may have an impact on the ecosystem as a whole and/or on individual species. For example, the conditions for seaweeds and kelp to grow may be altered because of reduced light attenuation from greater suspended solids in the water column. Conversely, reduced nutrient availability in the water column may occur through adsorption and subsequent sedimentation of settleable solids. At high concentrations, suspended solids may cause abrasion or clogging of sensitive organs such as gills, which in turn, results in stress and increased disease susceptibility.

Given that the study did not take cumulative effects into account, it is recommended that a precautionary principle be followed for finfish farming. In addition, should any therapeutic or antifouling chemicals used in fish cage culture operations reach the reefs at concentrations that are still effective (the Mead *et al.* 2009 study assumed a similar dispersal rate and distance as for dissolved nutrients), this would probably cause further deleterious impacts on diving reef communities. The Wright *et al.* (2019) study did not consider the dispersion or impacts of antifouling chemicals. The impacts of bivalve farming on adjacent reef communities are expected to be lower than those for finfish farming.



Figure 27 Reef environment around Algoa 1 Option 1. (Source: ProDive, 2019).



Figure 28 Popular recreational SCUBA dive precincts within Algoa Bay relative to the location of the Algoa 1 Option 1 (Summerstrand) site of the proposed sea-based Aquaculture Development Zone (Dive site positions provided by Prodiver Port Elizabeth, June 2019).



Figure 29 Popular recreational SCUBA dive precincts within Algoa Bay relative to the location of the Algoa 7 (Ngqura Harbour) site of the proposed sea-based Aquaculture Development Zone (Dive site positions provided by Prodiver Port Elizabeth, June 2019).

Recreational skiboat linefishing

A recreational ski boat fishing club, (Port Elizabeth Deep Sea Angling Club) operates out of Port Elizabeth harbour and the Noordhoek skiboat club has a slipway some 6 km west of Cape Recife. The Swartkops and Sundays estuaries are also used by a few recreational fishing vessels to access the sea, but these are not legally registered launch precincts. Recreational boat fishing takes place throughout Algoa bay. Chalmers (2012) estimated annual recreational ski boat fishing effort in the Algoa Bay at 2 118 boat days. Most vessels carried an average of ~4 crew and a resultant 61 074 angler hours of recreational linefishing effort takes place annually with an estimated retained catch of ~21 000 fish from 26 different species (Chalmers 2012). Geelbek, santer, and silver kob dominated the catches in the western sector of the bay (Chalmers 2012).

Should the ADZ be declared “no go” areas this would result in a loss of available fishing ground to the recreational boat fishery. All of the proposed ADZ straddle areas reported by Chalmers (2012) as having both high and relatively low recreational ski boat fishing effort (Figure 30). At Algoa 1 Option 1, most of the skiboat fishing effort appears to take place inshore of the precinct and Algoa 7 is situated in an area with very low fishing effort. Algoa 6 in contrast overlaps with a significant portion of important inshore skiboat fishing grounds (Figure 30).

However, bathymetry surveys have indicated no reef habitat (Algoa 1 Option 1, 6 and 7) around which targeted line fish (and fishers) aggregate (see description of affected marine environment). Recreational boat line-fishers would therefore appear to be little affected by loss of fishing ground should the ADZ be declared off limits. Navigational impacts are however anticipated as fishing vessel skippers may have to alter their desired course to and from the fishing grounds to avoid fish farm

infrastructure, particularly in the case of Algoa 1 Option 1 which is situated between popular fishing areas and the port of Port Elizabeth entrance (Figure 30). These impacts are assessed in the socio-economic impact assessment of this report.

The significance of potential impacts relating to disease and parasite transmission and genetic interactions with wild fish stocks and fisheries are dealt with in the marine ecology impact assessment.

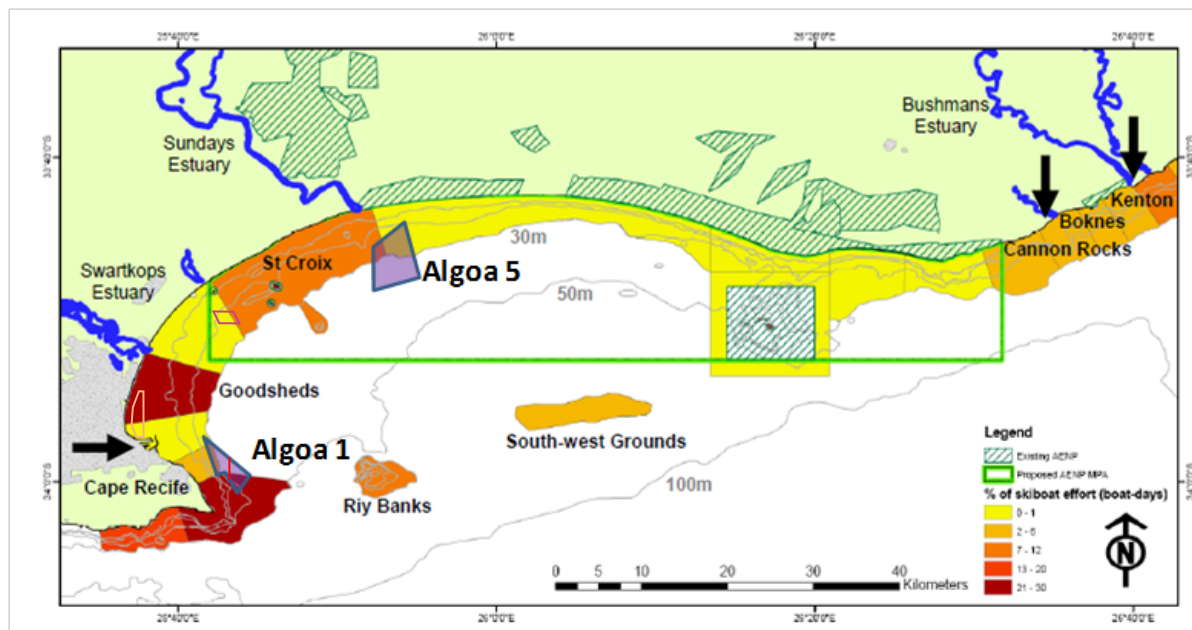


Figure 30 Estimated distribution of recreational boat line fishing effort throughout Algoa Bay (Source: Chalmers 2012) and position of the proposed ADZ precincts (Hutchings *et al.* 2013a). Note that Algoa 5 is no longer considered for the current Basic Assessment process and that Algoa 1 (original extent) has been reduced to Option 1 (north of the red line). Algoa 6 (Port Elizabeth Harbour) and Algoa 7 (Ngqura Harbour) precincts are also shown on the map (not to scale).

9.5.2.2 Competitive water sport events, lifesaving and festivals

In addition to the social recreational value of Algoa Bay as described in Section 9.5.2.1, a number of major water sport events take place on and off the popular beaches west of the Port Elizabeth Harbour and are economically important to the region. The events are described below and their location relative to Algoa 1 Option 1 are shown in Figure 31.

Ironman ultra-triathlon: The annual Ironman African Championship South Africa is a triathlon event (swim, cycle and run), which attracts 2000 competitors and many international visitors to Port Elizabeth. The swimming route starts at Hobie Beach and is 3.8 km long. Athletes head out parallel to the pier at Hobie Beach, turn left after 300 m, continue parallel to the beach past Humewood Beach and all the way to Kings Beach before turning and heading back towards Hobie Beach (Figure 31).

Jendamark Nelson Mandela Bay Bell Buoy Challenge: This event forms part of the Open Water World Tour, which is the first International circuit created for all swimmers. The OWWT gives participants the opportunity to become pro swimmers for one day. The race is a challenging 5 km long ocean

swim, starting at Pollock Beach, heads out to the Bell Buoy, which lies 600 m to the east of Algoa 1 Option 1, and returns to Pollock beach (Figure 31).

Nelson Mandela Bay Splash Festival: This annual festival takes place over the Easter Weekend at Hobie Beach. Among other entertainment, the festival offers SA Beach Volleyball, the National Jet Ski Race, and Pro Wrestling.

City Lodge Hotels' 3 Beaches Challenge: Pollock Beach, Hobie Beach, Humewood Beach and Kings Beach are all stops on the City Lodge 3 Beaches Challenge established in 2012. This event includes exciting team and individual races along the stunning Port Elizabeth beachfront for open water swimmers, ocean paddlers, lifesavers and runners. The event starts and finishes outside the Summerstrand Lifesaving Club and consists of 3 stages:

Stage 1 – 1.6 km from Pollock Beach to Hobie Beach

Stage 2 – 0.8 km from Hobie Beach to Humewood Beach

Stage 3 – 1.1 km from Humewood Beach to Kings Beach

Stage 4 – Run 3 km from Kings Beach to Pollock Beach

Summer Triathlon Series: The Eastern Cape's premier annual summer triathlon series is open to all, regardless of experience in triathlon, level of skill, athletic ability or fitness. The event is held in December at Pollock Beach.

City Surf Pro: The Nelson Mandela Bay Surf Pro is an internationally rated surfing event that is the first of four stops within the City Surf Series. International surfers from around the world as well as aspiring professional South African surfers compete in the event which is sanctioned by the national federation of the sport - Surfing South Africa (SSA) and the World Surf League (WSL). The 2019 event will take place at 'Pipe' located off Pollock Beach.

aQuellé Ocean Racing Series: The aQuellé Ocean Racing Series started in January 2006 is unique to Nelson Mandela Bay and is one of the largest family beach events in Africa, attracting 600 participants fortnightly to Hobie Beach. Throughout summer, hundreds of like-minded people participate in walking, running and ocean swimming (400 m, 1 km, 2 km and 3 km) race events held on Sundays.

Lifesaving competitions: Lifesaving South Africa (LSA) is a South African organisation that promotes water safety and provides surf rescue services. LSA is a founding member organisation of the International Life Saving Federation and a member of Royal Life Saving Society (ILSF 2019). Lifesaving South Africa members are volunteers and they patrol a majority of the South African coastline and beaches in addition to the inland resorts, and public events that are held during holidays and weekends. LSA's main aims are the protection of bathers from drowning in water related incidents, as well as lifesaving and lifesaving sport. Lifesaving South Africa is a registered member of the supreme sports body in the country, the South African Sports Confederation and Olympic Committee (SASCOC) as well as the national Department of Sports and Recreation (SRSA).

Lifesaving South Africa organises national competitions such as the South African Lifesaving Surf National Championships that involves various lifesaving events, including sea, board and beach competitions. LSA also sends representative teams to compete in international competitions that take place every two years. The annual South Africa Lifesaving National Championships in 2018 and 2019 were held at Kings Beach.

International Yachting Volvo Ocean Race: The Nelson Mandela Bay Municipality has tendered to host the 2021-22 Ocean Race Edition. The Bay is one of two South African cities that have been shortlisted in the bid to host the African leg of one of the international stop-overs of the prestigious yacht race, scheduled to take place late in 2021 (News24, 2019).

National and international Hobie 16 Championships: Several Hobie 16 championship events have been held off Hobie Beach in Port Elizabeth. In 2005 the Chevrolet Hobie World Championships saw international focus on Port Elizabeth's Hobie Beach. Subsequently, the national championships took place in 2012 and 2018.

Mirror Worlds Championships: Port Elizabeth hosted the 2007 Mirror Worlds Championships. The Mirror is the World's most popular double handed sailing dinghy.

Annual diving events that occur in Algoa Bay:

- Padi Women's Diving Day (international event)
- Scubapro Dive Festival – National Festival promoting diving in Port Elizabeth
- PADI World Ocean Day – Reef Clean Up (international event)

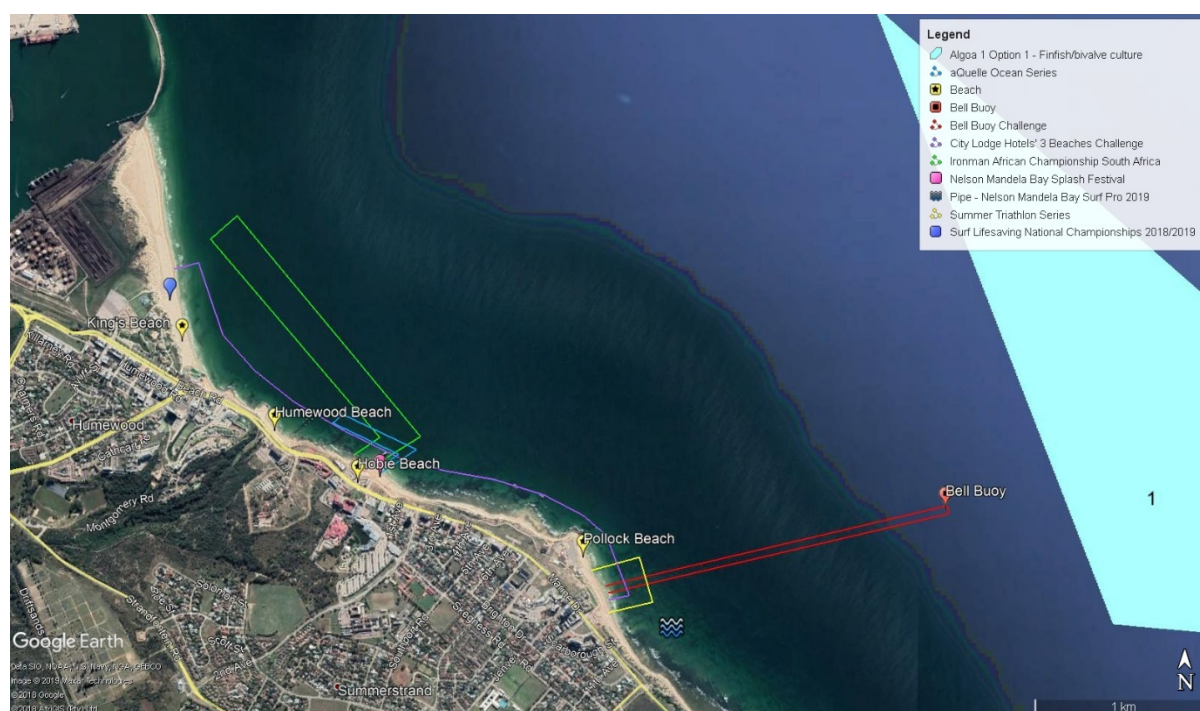


Figure 31 Location of competitive water sport events, lifesaving and festivals in Port Elizabeth relative to the Algoa 1 Option 1 (Summerstrand) site of the proposed sea-based Aquaculture Development Zone in Algoa Bay.

9.5.2.3 Marine ecotourism

Island, Sea & Sundowner Cruises enable one to see Cape fur seals, numerous sea birds, surrounding shipwrecks and sometimes even pods of whales and dolphins. The St Croix Island Marine Reserve is home to one of the larger breeding colonies of endangered African Penguins in South Africa, Cape fur

seals and whales (<http://www.nmbt.co.za>). Marine ecotourism focuses on the conservation worthy aspects of Algoa Bay. Algoa Bay is one of the few places in South Africa where the terrestrial Big 5, can be seen together with the Great White Shark and Great Whales (the seasonal Humpback and Southern Right whales) making up the Big 7.

9.5.2.4 Commercial fishing

Four commercial fisheries operate within Algoa bay and may potentially be affected by the proposed ADZ namely: small pelagic, traditional linefish, squid and shark longline. A description of each of these fisheries sourced from Turpie *et al.* (2012) and area of operation relative to the proposed ADZ is provided below. Algoa 7 (Ngqura Harbour site) lies adjacent to the restricted area of the recently promulgated Addo MPA. It should be noted that this portion would have been lost to commercial and recreational fishing regardless as without the proposal by DAFF to set this area aside for aquaculture DEA Oceans and Coast would have included this portion in the MPA. Algoa 7 therefore does not contribute cumulatively to the loss of commercial fishing grounds.

Small pelagic

The small pelagic purse-seine fishery targets shoals of small pelagic fish that occur near the surface at night. Once the shoal is located, a net is set around it in a large circle, which hangs from the surface like a circular curtain, and then the bottom of the net is drawn together using a footrope. Fish are pumped from the net into the hold of the boat, where they are kept chilled before being transferred directly into the onshore factory for processing. The boats tend to fish overnight, landing their catches in the early mornings.

The small pelagic fishery in South Africa originated in St Helena Bay on the west coast, originally targeting sardine (pilchard) *Sardinops sagax* and horse mackerel *Trachurus trachurus capensis* (Sauer *et al.* 2003a). These resources declined after 1962 due to overfishing, and mesh sizes were reduced to target the smaller anchovy *Engraulis encrasicolus*, which became dominant in catches for two decades. Sardines have subsequently recovered to a large extent. The fishery also exploits the red-eye round herring *Etrumeus whiteheadi*; and the chub mackerel, *Scomber japonicas*, is a valuable by-catch species. The fishery is managed through quota allocations in the form of TACs for adult sardine, for anchovy and for sardine by-catch. Pilchard is the only targeted species in Algoa Bay, with some incidental by-catch of horse mackerel and chub mackerel, as well as maasbanker.

Concern for declining populations of penguins (and to some degree gannets) on nesting Islands in Algoa Bay led to two experimental area closures for the pelagic fishing industry in recent years. Namely a 20 km radius around St Croix Island and a 5 km radius closure around the Rij Banks was implemented in January 2009 for a three-year period (Pichegru *et al.* 2010, 2011). This restriction has now been lifted, but a similar size (10.799 NM radius) pelagic fishing exclusion area is now in place around Bird Island (2012 permit conditions DAFF).

While the small pelagics purse-seine fishery is still concentrated on the west coast, it has spread to the south coast, centred around Mossel Bay and Port Elizabeth. About 4-5 boats are based in Port Elizabeth, and 1-2 in Port St Francis, but the Mossel Bay boats sometimes move eastwards to fish in the Algoa Bay area, so that one can get up to 10 boats operating in the area. Likewise, the Port

Elizabeth-based boats sometimes fish further west. In those situations, fish might be offloaded at the nearest port and trucked back to the processing plants.

In the Algoa Bay area, boats typically depart in the early evening to search for fish but will try to only purse seine the fish as close to the following morning to maximise fish quality (minimise time in the hold). Port Elizabeth boats can travel as far as Plettenberg Bay, though seldom go that far. Location is decided on the basis of communication between vessels and skipper's local knowledge. The viable range is reported to extend from Bird Island in the east to Jeffrey's Bay in the west, with the cost of diesel as well as concerns about deterioration of the fish on board being the limiting factors. In a westerly wind, fishing tends to be in the east.

Westerly winds exceeding 15 knots, and strong south easterly winds curtail fishing activity entirely, since the rolling action of the ship affects fish quality. Skippers also look for larger sized fish since these fetch better prices, so might target the last location where good catches were made but will not target the same area if smaller fish were caught there the day before. Fishing takes place all year as far as possible (limited by TAC), but activity is influenced by market demand.

The spatial distribution in effort and catch in the small pelagic fishery is shown in Figure 32. However, average effort and catch gives a somewhat distorted view of reality, as there is considerable interannual variability in the spatial location of fishing effort. Since the fish are highly mobile, fishing grounds may change quite radically from year to year. In terms of average annual effort and catch, the two proposed ADZ lie within reporting grid blocks that account for a very small proportion of the national catch and effort, but approximately 12% of the Eastern Cape annual average. Although this may appear to be a significant overlap with important Eastern Cape fishing grounds, the proposed ADZ areas only cover a small portion of the reporting grids, and given the mobility of the target species, the fishery should still have access to the shoals as they move away from the ADZ.

Proclamation of either or both the proposed ADZ within Algoa Bay would appear to have a minor effect on the Algoa Bay small pelagic fishery in terms of loss of fishing grounds. Should any future finfish cage operation use frozen fish food at any stage of production however, there is a small but potentially highly significant risk of disease introduction that could decimate small pelagic stocks. A pilchard herpes virus, thought to be introduced via frozen pilchards imported for direct use in tuna fish cages, (this has never been confirmed, an introduction via ballast water is also a possible explanation, but given the apparent origin of the outbreak in the tuna farming centre of southern Australia, the former appears more likely), spread through Australian and New Zealand pilchard stocks in 1995 and 1998-99. This caused pilchard mortalities of up to 70% resulting in huge economic losses to the fishing industry and associated ecosystem level impacts (Crockford *et al.* 2005, Whittington *et al.* 2005). It should be noted that South African commercial fisheries already import and use frozen bait. The impact of disease transfer on wild stock is considered in the marine specialist study and is not repeated in the socio-economic section as it is assumed that the socio-economic impact would be directly linked to the loss of stocks.

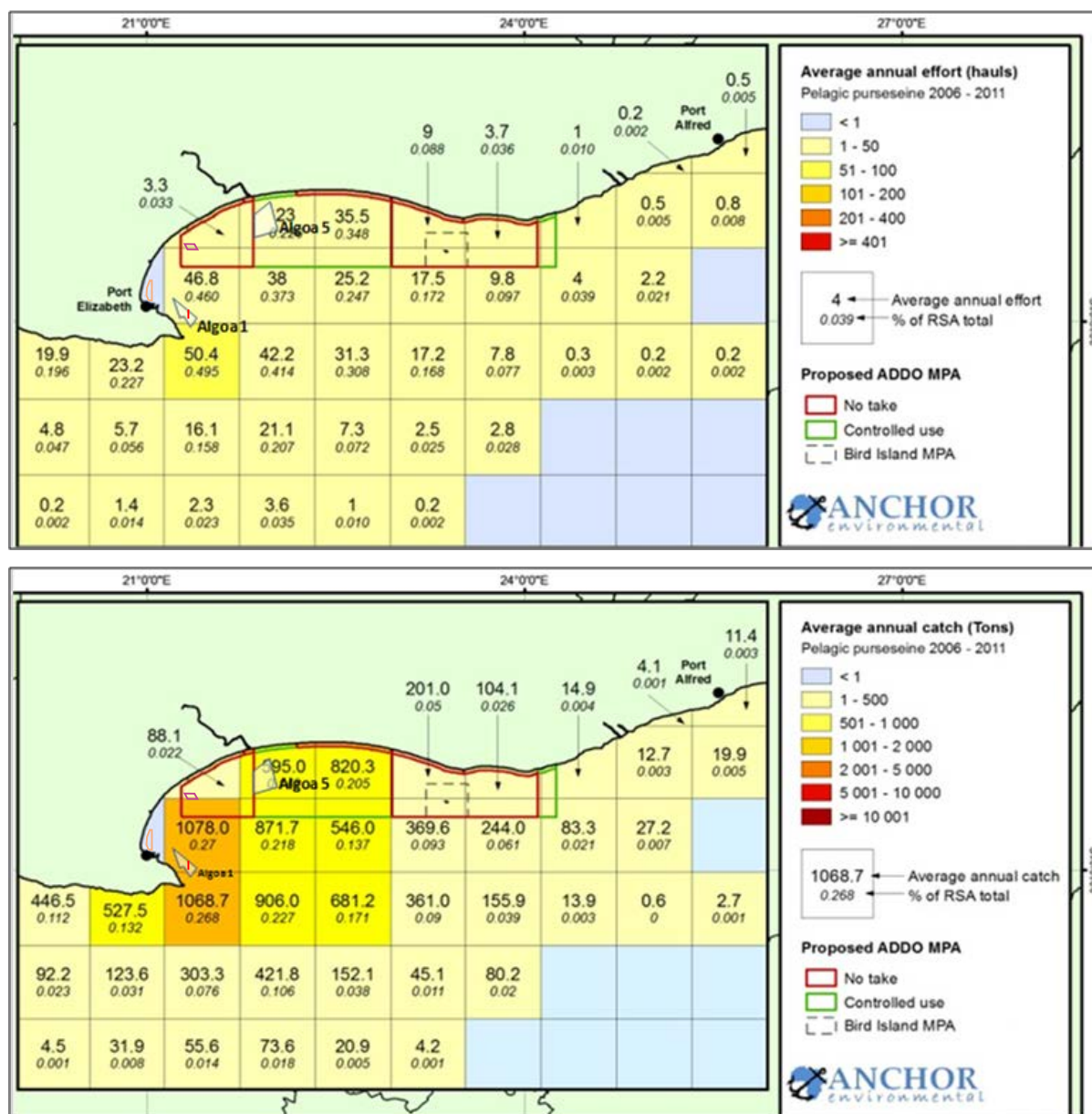


Figure 32 Average annual effort (top) and catch (bottom) in the small pelagic sector in the Algoa Bay area 2006-2009 and the positions of the proposed ADZ precincts (Data source : DAFF) (Hutchings *et al.* 2013a). Note that Algoa 5 is no longer considered for the current Basic Assessment process and that Algoa 1 (original extent) has been reduced to Option 1 (north of the red line). Algoa 6 (Port Elizabeth Harbour) and Algoa 7 (Ngqura Harbour) precincts are also shown on the map (not to scale).

Squid jig fishery

Squid *Loligo vulgaris reynaudii* was historically targeted by a (mostly foreign) demersal trawl fishery and landed as by-catch in the South African inshore trawl fishery. A dedicated jig fishery for squid was initiated in 1984 (DEAT: MCM 2005), and the landed catch is now worth more than R180 million per year. The jig fishery first concentrated in the area between Plettenberg Bay and Port Elizabeth, though it now ranges further east as far as the Wild Coast. Squid fishing in the early part of the fishery was from boats that range from small ski-boats to deck boats of about 20 m length, though the latter have come to dominate the fleet (Sauer *et al.* 2003a).

The boats are equipped with powerful lights for night fishing and blast freezers. The fishery operates in depths of 20 – 120 m, though mostly in the shallower waters (see below), where adult squid are targeted in spawning aggregations.

The squid jig fishery usually produces in the order of 6-7 000 tons per annum, though catches of up to 12 000 tons have been recorded in the past. Squid by-catch in the demersal trawl fishery fluctuates between 200-600 tons annually. Squid only live for two years, and there is substantial interannual variability in stock abundance (reportedly amongst the highest for all South African fisheries) that is linked to a variety of influencing factors. There is a high level of uncertainty regarding the status of the squid stock, with initial estimates (Roel & Butterworth 2000) suggesting that effort levels at the time (~3.6 million man hours per annum) were unsustainable and were placing the resource at a high risk (~90%) of collapse. Assumptions implicit in this assessment included the contention that jig-fishing has a negative impact on recruitment, invoked to account for the decline in trawl CPUE observed at the time that the jig fishery commenced. Subsequent refinements of the model by Glazer & Butterworth (2006) allowed them to conclude that spawning success is not strongly affected by jig fishing activity and that current levels of effort (around 3 million man hours per annum) and even higher levels of effort may in fact be sustainable, although further increases above current effort levels do still carry a high estimated risk of stock-collapse.

The squid jig fishery is currently regulated by means of total applied effort (TAE), which limits the number of vessels and crew allowed. The fishery currently comprises 88 rights holders. Since 1988, the fishery has been closed once a year for four weeks in an attempt to counter the effects of “creeping effort” associated with increases in vessel efficiency and catch technology. The closed season corresponds with the peak spawning season for this species, and generally occurs around the month of November (Glazer & Butterworth 2006). All of squid caught in the jig fishery is exported, mostly to Europe. The only squid sold locally is from the trawl by-catch. In all, the squid fishery provides employment for approximately 3 500 people, including land-based personnel (Roel 1998, Roel & Butterworth 2000).

Larger boats (>12m) are able to range as far as squid are distributed. Smaller vessels based in Port Elizabeth (about 15% of the fleet) can range from the Gamtoos River to Bird Island. Fishing location is chosen on the basis of communication with the fleet about current catch rate, checking existing marks, and skipper knowledge. The decision of where to fish is also influenced by weather and season. Boats must shelter when winds are >25 knots. In strong easterly winds the boats typically fish the Tsitsikamma area, but they fish anywhere in a westerly wind provided the swell is not too big (<4m). In winter, fishing is mostly on sea anchor in deep areas (100-200 m), whereas in summer fishing is mainly on nests in 20-60 m depth.

A typical trip lasts three weeks, with duration determined by crew morale, freezer capacity and catch rates. If catches are too slow to be economically viable (due to operating costs and the requirements for paying minimum wages) then the boats come into port and tie up. The boats are all freezer boats, and food and fuel are not limiting factors for trip length. Fishing is typically close to port, so it is not difficult to turn around trips quickly. If the catch rate drops below the estimated breakeven rate for a 3-week trip, then the boats will remain in port. Fishing decisions are subject to the MPAs at Sardinia, Bird Island and Tsitsikamma, closed seasons, and range is restricted by SAMSA regulations to 40 NM or 200 NM limit. There is also a crew limit (TAE).

The distribution of effort and catch for the squid jig fishery in the Algoa bay area for the period 2006-2011 is shown in Figure 32. Algoa 1 Option 1 clearly overlaps with an important squid fishing ground with nearly 8% of the entire South African average annual effort and just over 1% of the average annual catch report from the grid block that overlaps the proposed ADZ. The discrepancy between effort and catch in this catch reporting block is largely due to the fact that vessels shelter from SW winds in the lee of Cape Recife, even during times when catches may be poor. Discussions with industry members suggests that the southern half of the proposed Algoa 1 (Option 2) is an important squid fishing ground and the industry would be strongly opposed to exclusion from this area (Figure 33). The ADZ could be resized by “trimming” the southern half of the proposed site and this would remove much overlap with the important squid fishing ground.

The comments provided by industry members are likely to be valid now, as a recent review of the offshore fisheries demonstrated that the analysis unit within which Algoa 1 Option 1 is situated (Figure 33) is still considered a priority squid fishing area (Stewart Norman, Capricorn Marine Environmental (Pty) Ltd, pers. comm. June 2019. Note that the final report is currently not available and a reference for this report has been included as a footnote¹). A priority squid fishing area represents the top 10% of South Africa’s average annual catch. Furthermore, Algoa 1 Option 2 is still being utilised as a refuge area during high seas (George Borman, Quintax 151 CC - Squid and Hake Handline, pers. comment June 2019). Algoa 6 (PE Harbour site) and 7 do not overlap with significant squid fishing grounds (Figure 33). DAFF has therefore decided to exclude the southern portion of Algoa 1 (Option 2) from the application process (See Section 3.5.1 for more information).

¹ S.J. Norman¹, S.J. Wilkinson, D.W. Japp, J. Reed and K.J Sink. 2018. A Review and Strengthening of Spatial Management of South Africa’s Offshore Fisheries. Capricorn Marine Environmental (Pty) Ltd. South African National Biodiversity Institute. Prepared under contract to the Responsible Fisheries Alliance and the Centre for Environmental Rights.

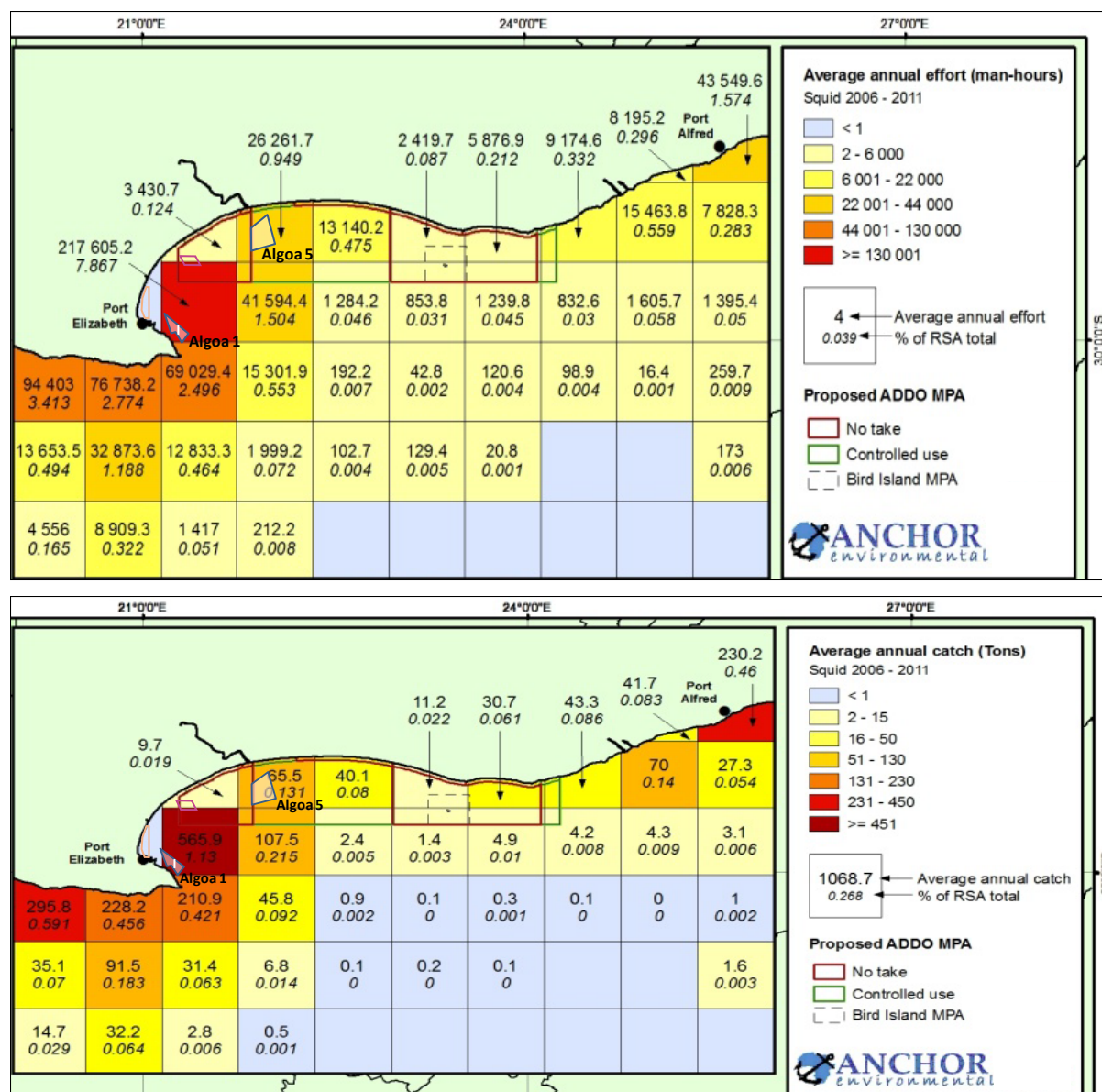


Figure 33 Reported annual average catch and effort by the squid jig fishery in relation to the proposed ADZ within Algoa Bay, 2006-2011 (Data source: DAFF) (Hutchings *et al.* 2013a). Note that Algoa 5 is no longer considered for the current Basic Assessment process and that Algoa 1 (original extent) has been reduced to Option 1 (north of the white line). Algoa 6 (Port Elizabeth Harbour) and Algoa 7 (Ngqura Harbour) precincts are also shown on the map (not to scale).

Traditional line fishery

The South African commercial line fishery dates back to the 1500s (Thompson 1913). It is a boat-based fishery in which fish are caught on lines with no more than 10 baited hooks per line. The fishery thus operates inshore where fish are accessible on day or short overnight trips and in water shallow enough to be caught using manual labour with hand lines or rods and reels. By the late 1980’s, the majority of vessels were highly mobile, trailable ski-boats that could follow aggregations of shoaling species such as yellowtail, snoek, geelbek and kob. When these aggregations occur far from the fishers’ base, the boats are driven up to launch precincts closer to the fishing grounds, though this practice is more common in the Western Cape than in the Eastern Cape.

By the end of the 1990s there were approximately 3 000 fishing boats ranging from 3 m dinghies to 15 m deck boats carrying a total of around 3000 crew were involved in the commercial line fishery (Griffiths 2000, Mann 2000). This multispecies fishery landed about 250 species, although only about 20 were commercially important (Lamberth & Joubert 1999).

Despite its long history, lack of data has severely hindered the management of the fishery (Griffiths 2000). It was only in the 1980's and 1990's that life history studies and basic stock assessments were conducted for some of the more important linefish stocks (Mann 2000). A management framework that included a comprehensive suite of regulations was introduced in 1985, including revised minimum size limits equal to sizes at maturity (when known), daily bag limits, closed seasons, commercial fishing bans for certain species and the capping of the commercial effort at the 1984 level. These regulations were updated in 1992, but due to the continued lack of biological data, were still largely based on perceived vulnerability to exploitation (Mann 2000). Griffiths (2000) analysed fishery data over a 100-year period and found that in spite of technological advances over this period, declines in catch rate were indicative of severe overexploitation (i.e. 75-99%). Angler surveys and stock assessments in the 1990's also suggested that the current line fish management framework was failing to provide adequate protection for line fish stocks (Attwood and Bennett 1995, Brouwer *et al.* 1997, Griffiths 1997a, b, Griffiths 2000, Griffiths *et al.* 1999, Mann *et al.* 1997, Sauer *et al.* 1997). This led to the development of a new Line fish Management Protocol (LMP) that uses stock data or trends in catch composition and catch rate to determine management actions (Griffiths *et al.* 1999). Apart from fast growing species such as snoek and yellowtail, most commercially exploited line fishes are thought to have been depleted to dangerously low levels (DEAT 2005a). The Minister of Environmental affairs and Tourism declared an environmental emergency in the traditional line fishery in December 2000 and restricted the number of vessels and fishers in the commercial fishery, as well as bag and size limits for commercial and recreational line fishers. The commercial line fishery was split into three regional management zones, restricting the movement of vessels from one region to the next within the 2006-2013 long-term rights allocation.

Since 1985, all commercial line fish permit holders have had to submit catch returns to the National Marine Linefish System (NMLS) database. Although there are some problems with underreporting (Attwood and Farquhar 1999, Brouwer *et al.* 1997, Griffiths 2000, Mann *et al.* 1997, Sauer *et al.* 1997), these data provide a fair reflection of major trends (Penney 1997), are reliable in terms of CPUE and catch composition (Griffiths 2000, Attwood & Farquhar 1999), and can provide a useful basis for study of the fishery.

Until 2003 the commercial fleet was large (~3 000 vessels nationally) with a large number of part-time participants who typically had other fishing interests or alternative sources of income. The mobility of the fleet was also not restricted. After 2003 the number of licensed vessels in the commercial fleet were diminished to about a tenth of their former numbers. However, effective effort has not diminished to the same degree, since the ski boats have since become larger, with longer travel ranges, and have the ability to handle rougher weather. They are also now mostly operated and crewed by full time professional line fishers. Along with these changes, operating costs (particularly fuel and bait) have increased dramatically since 2003.

A total of 422 long-term traditional line fish rights have been issued in South Africa (valid January 2014 to 31 December 2020), of which 62 licences have been issued for management zone B (Cape Infanta

to Port St Johns). Of these, about 25 vessels operate in the Algoa Bay area. With an average of 8 crew, the total crew employed is about 200, and these crew each support on average 5 people.

Within the Algoa Bay area, line fishers target mainly reef fish (silverfish, red roman, santer, and red stumpnose), which are the mainstay in that they are consistent if not necessarily always the most abundant, followed by geelbek, yellowtail and kob when available. Fishers are constrained in terms of what species they can target, and by bag and size limits as defined by a species list attached to their permit conditions. A traditional line fishing rights holder who also holds a hake handline right may not activate both rights on the same day.

In the Eastern Cape, the decision to fish is not influenced by market conditions. Fishing effort is primarily limited by weather and sea conditions. Because the boats are small, ski boats go out when the wind is less than 15 knots. They are also affected by currents. Fishing takes place throughout the year but there is some seasonality in catches. Ski boats do not have any means of preservation on board and typically go out for about 12 hours if fish are biting (by day or night). Overnight trips are becoming more common to make catches. The range of the boats is limited to 40 NM out to sea (by SAMSA certification), and the actual distance travelled is influenced by safety and fuel concerns. Chukkies may take ice and stay out for two to four days and are thus also able to fish further afield. Fishing location is chosen based on recent fishing experience and the skippers' local knowledge, and apart from distance offshore is only constrained by MPAs (Bird Island MPA in Algoa Bay, Tsitsikamma west of Port St Francis).

Total catch in the traditional line fishery within the Algoa Bay region has averaged just over 500 tons per year during the period 2006 – 2010. The catch has been dominated by three species – geelbek, carpenter and kob, with geelbek making up 45% of catches and more than half of total landed value. The current landed value of the average annual catch is in the order of R12 million.

The fishery has changed considerably over time, however. In the long-term catch composition data (1985-2010) for the Algoa Bay area, reef-associated fish species (mostly Sparids) accounted for about 32% of the total line-fish catch. It must be noted that for much of this period (1985-2004) catches of hake and snoek were included, thus down weighting the contribution of reef fish in the catch composition. These species (hake and snoek) are no longer available to the line fishery, as after 2004, the hake handline fishery was managed as a separate sector and the official policy of reducing effort cross subsidization between sectors effectively removed the freezer boat (squid fishery) component of the line fishing fleet, largely reducing snoek catches that were historically made by these vessels offshore of Tsitsikamma. During the period 1985-2005, the average catches in the same area were 1252 tons per year on average (numbers of fishing rights were reduced in 2004), and the catch was dominated by carpenter, hake and kob, with geelbek only making up 10% (Figure 34).

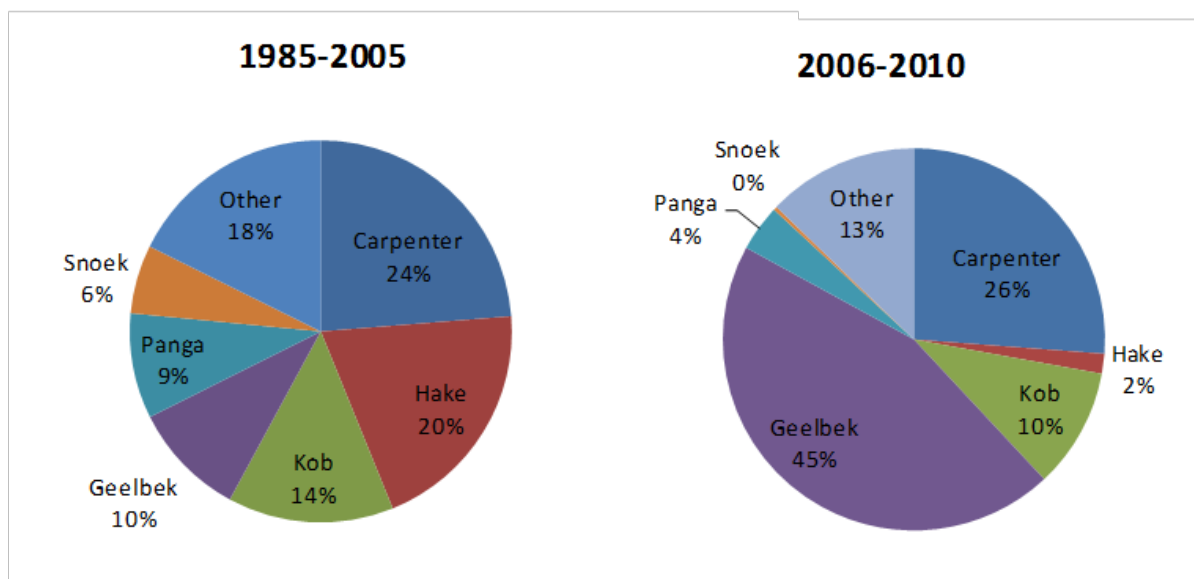


Figure 34 Change in the composition of line fish catches in the Algoa bay area after 2006 (source Turpie *et al.* 2012).

Effort and catch data were drawn from the National Marine Linefish System (NMLS) database for the period 2006 to 2011. Data from before 2006 do not provide a good reflection of the fishery as it is at present, as those catches included handline hake. Also, when hake were targeted there was no fishing inshore between Sundays Rivers and Bird Island, but that area is now an important fishing area. Post 2006 data is also better since the long-term rights allocation in 2006 impacted the fishery. Prior to analysis, all trips where exclusively squid were reported were excluded as were tuna pole fishing trips. According to the fishers, the last two years are probably the most representative.

Spatial mapping of effort and catches in the line fishery is less accurate than in other sectors, because of the logbook method employed by fishers, which is to describe location in relation to numbered sections along the coast and estimated distance offshore. No bearings are given, and no GPS data are recorded by the fishers with which to calibrate these estimates. This means that in plotting the data, estimates of the bearings have to be made. These are done very coarsely as due east, south or southeast of the coast (for the coast east of Cape Agulhas). Our estimates of spatial patterns differ slightly from those of Chalmers (2012) because of differences in assumptions, and in both studies, these plots differ from the VMS data, which show effort to hug the coastline. Thus for example, fishing effort at the Rij banks appears to be only on the northern half, but in reality is more centred on the banks, and much of the fishing effort west of the point is probably closer inshore.

The overall plot of effort clearly shows the limited range of the traditional line fishing boats, and in the Algoa Bay area, effort by the Port Elizabeth based boats ranges mainly within the area up to the Sundays River and Rij banks, as well as around the point to the west of Cape Recife, whereas effort by the Port Alfred-based boats ranges westwards to Bird Island, where fishing is to the north and south of the Bird Island MPA (Figure 35).

In total, only 2-3% of the average annual reported catch and effort for the Algoa Bay area is for grid blocks that include the proposed ADZ. Given that the ADZ includes no reef substratum, it appears that they will have little negative effect on the commercial line fishery in terms of loss of fishing ground.

The same concerns about the possible introduction of diseases or genetic interactions with wild stocks by cultured fish (many potential cultured species are also targets of the linefishery, and their overexploited status makes the small populations particularly vulnerable to these impacts), as expressed for the recreational skiboat fishery above, are also valid for the commercial linefishery.

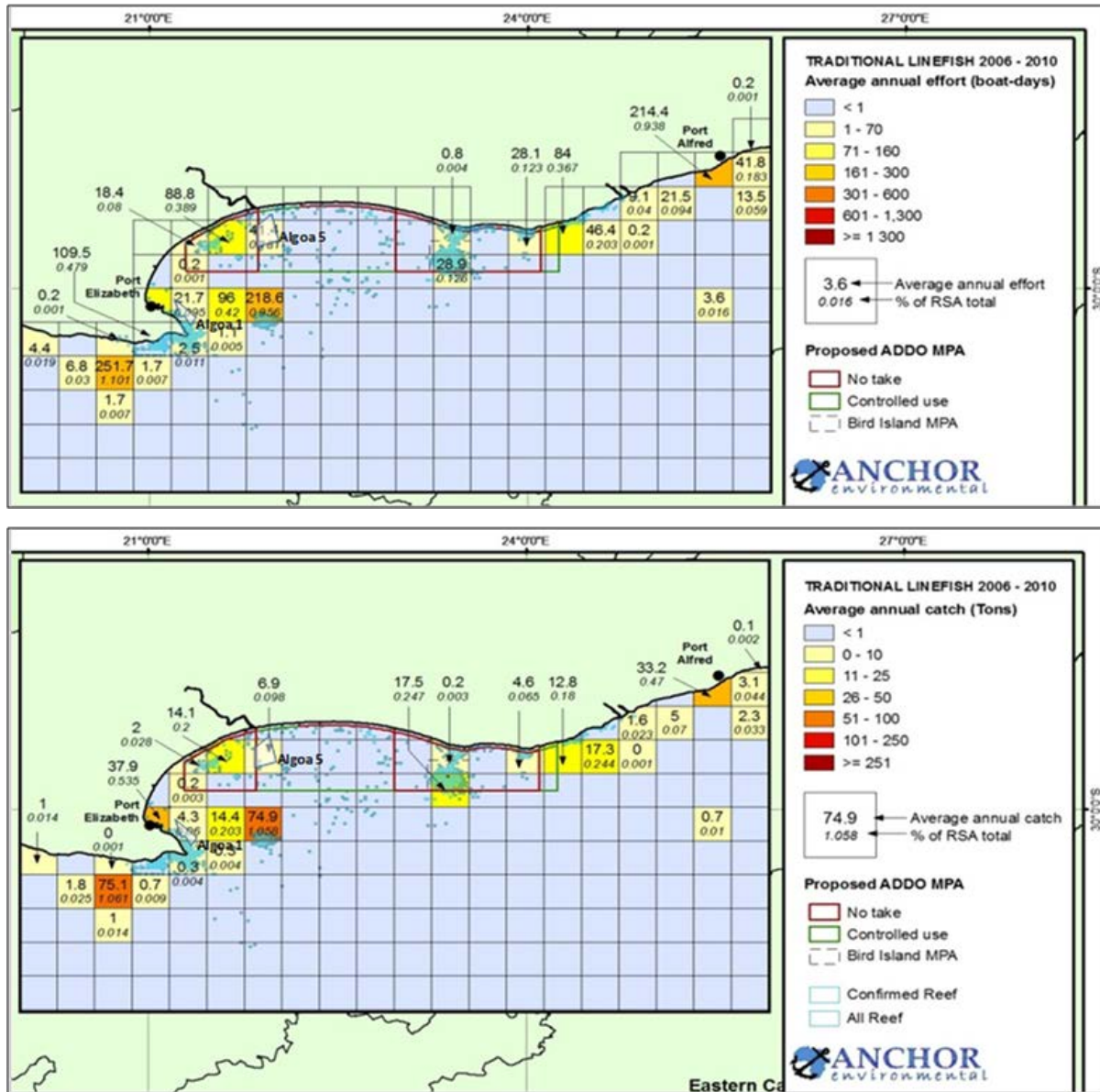


Figure 35 Average annual linefish effort (top) and catch (bottom) over the period 2006-2010 in relation to the proposed ADZ within Algoa Bay (Hutchings *et al.* 2013a). Note that Algoa 5 is no longer considered for the current Basic Assessment process and that Algoa 1 (original extent) has been reduced to Option 1 (northern portion). Algoa 6 (Port Elizabeth Harbour) and Algoa 7 (Ngqura Harbour) precincts are not shown on the map.

Shark longline

Demersal sharks in South Africa are either targeted directly or caught as by-catch, with the bulk of the catches being taken by the traditional linefishery, the inshore trawl fisheries, and the demersal shark longline fishery (Da Silva and Bürgener 2007). Longline permits for the directed catching of sharks were first issued in 1991 (Crawford *et al.* 1993 in Da Silva and Bürgener 2007). At this time, more than 30 longline permits were issued to target shark (pelagic and demersal species combined). Many of the permit holders did not make use of these permits (due to interests in other fisheries) or sought to use their permits to exploit loopholes in the legislation to catch other species. As a result, the numbers of demersal shark longline permits were reduced to 11 in 2004 and finally 6 permits in 2005, when the decision was made to include catches of pelagic sharks with the pelagic tuna and swordfish sector. Demersal shark longlining then started to focus increasingly on three species – soup-fin shark *Galeorhinus galeus* common smooth-hound sharks *Mustelus mustelus* and bronze whaler sharks *Carcharhinus brachyurus* – which now dominate the catches. In the Algoa Bay area, the fishery targets smooth hound, soupfin, smooth hammerhead *Sphyrna zygaena*, bronze whaler, blacktip *Carcharhinus limbatus*, dusky *Carcharhinus obscurus* and cow sharks *Notorynchus cepedianus*.

Currently, demersal shark longlining is restricted to coastal waters (up to 100 m depth) and are permitted to fish up as far as East London, using longlines with up to 3 000 hooks. Vessels are tracked by a Vessel Monitoring System (VMS) and all landings are independently monitored, and skippers are required to complete logbooks per longline set. There is generic reporting of skates and carcharhinids. The demersal shark longline fishery constitutes of six rights holders. One of these operates in the Algoa Bay area, using a single vessel.

This operator fishes year-round, but some species (dusky, blacktip, bronze whalers and hammerheads) are reportedly more common in summer. Fishing is possible in winds of up to 25 knots. Wind direction influences the choice of where to fish – prevailing winds mean that fishing is more in the west during winter, and in the east (Sundays to Port Alfred) during summer. The time spent at sea is limited by the need to maintain the quality of fish, which is kept on ice. About three trips are undertaken per month, and vessels stay out for up to 9 days at a stretch. Boats do not stay on the same fishing grounds for long periods of time. Fishing is usually close to shore, as that is where the sharks are most abundant. Distance travelled is also influenced by the fact that the boat must return to port to offload, thus the easterly limit for the Port Elizabeth-based fishery is East London and the westerly limit around Mossel Bay.

Algoa 1 Option 1 and 7 overlap with areas where the shark longline operator is active with ~10% of the average annual reported catch and effort taking place within grid blocks that overlap with the proposed ADZ (Figure 36). A small portion of the northern Algoa 6 overlaps with a shark long-line fishing area of low importance.

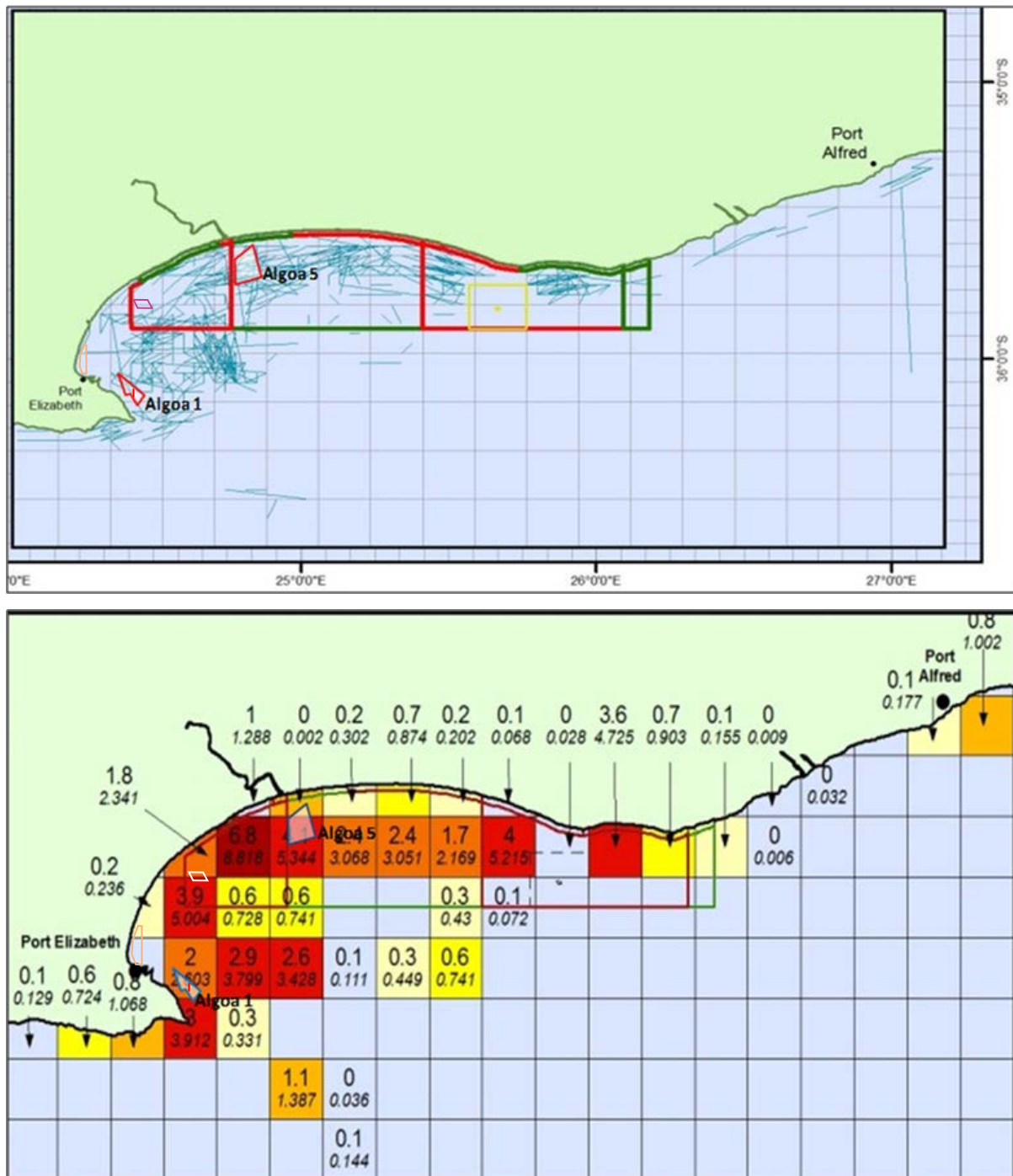


Figure 36 Reported shark long line sets (top) and average annual catch (bottom) made by the Port Elizabeth based shark long line operator over the period 2006-2012. The recently approved Addo MPA (although as per proposed boundary, not gazetted boundary) is also shown (Data source: DAFF) (Hutchings *et al.* 2013a). Note that Alcoa 5 is no longer considered for the current Basic Assessment process and that Alcoa 1 (original extent) has been reduced to Option 1 (north of the red line). Alcoa 6 (Port Elizabeth Harbour) and Alcoa 7 (Ngqura Harbour) precincts are also shown on the map (not to scale).

9.5.2.5 *Shipping and industry*

The following section has been sourced from (Bloom 2013). Algoa Bay serves as the entrance to two ports nestled along the coast within the bay, namely Port Elizabeth and a new port at Ngqura (Coega) 20 km away. Agriculture and farming have always played an important role in the port's activities, principally deciduous and citrus fruit and the annual wool crop. More recently, container shipping has assumed a prominent role in the fortunes of the harbour, with Port Elizabeth serving its local industrial base and offering an alternate port of call to container ships whenever the Durban or Cape Town container terminals are congested. Other principal products handled at the harbour include manganese ore, which is railed from the Northern Cape, and petroleum products, which are imported from other South African ports. The motor industry has long been an important industrial activity for the Eastern Cape and the port plays a leading role in this regard, boasting a large open-area car terminal.

The fishing industry also makes extensive use of Port Elizabeth. There are no major ship repair facilities, but a slipway is available for fishing vessel repair. Passenger ships usually make use of one of the fruit terminal berths when calling at Port Elizabeth. The South African Navy has established a naval station at Port Elizabeth but does not maintain any ships there. In future, some of the port's present commercial activity may be lost to the port of Ngqura (Coega), although the car terminal and possibly the container terminal will remain intact.

The entrance channel to Port Elizabeth is maintained at a depth of -14.5 m Chart Datum and has a generous width of 310 m. Limitations on vessels using the port are 11 m draught for passenger and dry cargo vessels, 11.2 m for container ships, 12.1 m for ore carriers and 9.6 m for tankers, all according to berthing. Deeper vessels may be accommodated with the permission of the harbour master. Tug assistance and pilotage is compulsory. Ships may anchor outside the port in Algoa Bay provided the approaches to the entrance channel are kept clear.

Port Elizabeth's main features are the container terminal, fruit terminal and manganese terminal. The container terminal has a capacity in excess of 375 000 TEUs and has the advantage of being able to load railway trains directly under the gantry cranes, without containers having to be double handled, thus speeding up delivery to inland destinations. A full range of ship chandelling and stevedoring as well as other support services is available (Transnet, 2011a/b).

The deep-sea port of Ngqura, which began commercial ship operations (containers) in October 2009, lies some 20 km northeast of Port Elizabeth at the mouth of the Coega River. An Industrial Development Zone (IDZ), known as the Coega IDZ, has been developed over the 12 000 ha site in the area including the river and port, with a 4 500 ha core development. The IDZ will serve as a primary location for new industrial development for export-driven industries.

The deep-water Ngqura port serves post-Panamax dry and liquid bulkers and the new generation of cellular container ships. The port consists of a main eastern breakwater, 2.7 km in length, extending into Algoa Bay to a maximum water depth of 18 metres, and a secondary western breakwater 1.125 km in length.

9.5.2.6 *Marine aquaculture (sea-based and land-based)*

A number of mariculture activities have occurred in Algoa Bay and at the Port Elizabeth harbour. Zwembesi Farms (Pty) Ltd (Knysna Oyster Company) is one of the oldest and largest oyster producers in South Africa producing 100 tons annually with the view to harvest 140 tons this year (pers. comm. Simon Burton – Knysna Oyster Company 2019). Zwembesi Farms has been operating in Algoa Bay since 1998 and the farm falls within the southern portion of the proposed ADZ Algoa 6 (PE Harbour) site (Figure 37 and Figure 11). Zwembesi Farms employ 33 permanent staff on the farm and at the oyster bar and distribution centres in Cape Town and a further 20 temporary staff at the export packing facility. Zwembesi Farms also offers scenic boat cruises to their farm where tourists can learn about oyster cultivation and harvesting of oysters, as well as the work done at the Zwembesi farm specifically. The cruise then journeys on to the Port Elizabeth beachfront, where participants are treated to six deliciously fresh oysters (Experience Days 2019). No other sea-based aquaculture activities currently occur in Algoa Bay.

Mariculture projects that were operational in the past include fish-breeding projects – the reasons for their demise were unknown to participants in the primary discussions. One of these was managed by NMU and the other by Irvin & Johnson Ltd (I&J). An on-land fish-breeding project was supposed to be developed as a black empowerment project, but did not produce the expected outcomes (Anton Viljoen, Garry Scholtz, John Allen). Two Oceans Oyster Farm briefly farmed oysters north of Zwembesi Farms but were unable to achieve the yield required for a viable farm.

The Department of Science and Technology - in partnership with Irvin & Johnson Ltd - conducted a 2-year pilot project to ascertain the commercial, technical and environmental viability of sea-based cages for breeding three indigenous and overfished South African line-fish species, namely dusky kob (*Argyrosomus japonicus*), silver kob (*Argyrosomus inodorus*) and yellowtail (*Seriola lalandi*). Fish that reached 1 kg were sold through an uptake agreement with I&J. Four HDPE cages were deployed 1 km offshore near the Port Elizabeth harbour, which is relatively sheltered from the wind. In December 2007, 40 000 dusky kob fingerlings with an average mass of 8 g were added to one of the cages. The successful introduction of kob was followed in January 2008 by the introduction of 18 000 yellowtail fingerlings (average weight of 5 g) in the second sea cage. Both cages were equipped with locally produced predator nets together with an inside net; all nets are weighted to maintain the cage structure of the nets in the water. Fish sampling after the third production month indicated an average weight of 74.73 g for kob and 17.57 g for yellowtail, compared to the respective target weight of 53.32 g and 15 g respectively (Department of Science and Technology, 2011a). The insight gained from this pilot project is hoped to assist with the development of a commercially viable model that would benefit the public and offer some BEE opportunities.

NMU undertook independent environmental monitoring and reported regularly to DAFF. No significant impact was detected. No whale or dolphin entanglements were observed, only one seal incident, two ragged tooth sharks breached the netting and were removed without harm, and one tern breached the bird netting. The only incident of disease involved dusky kob, which were treated with hydrogen peroxide.

At the conclusion of the pilot project in July 2010, the cages and mooring system were removed. The second phase for yellowtail was not realised due to the lack of fingerling availability and the project was closed in 2013 (pers. comm. G le Roux, Stellenbosch University 2018).

The Coega Development Corporation (CDC) is currently in the process of developing a 440 ha land-based aquaculture development zone (ADZ) in Zone 10 of the Coega Industrial Development Zone (IDZ) (Wolmarans M and Schroeder W. 2017). The overall purpose of the project is to establish an 'investment ready' platform for planned commercial aquaculture operations to establish within the Coega IDZ without having to obtain Environmental Authorisation (EA). The EA for the project was granted in February 2018 (CDC 2018).

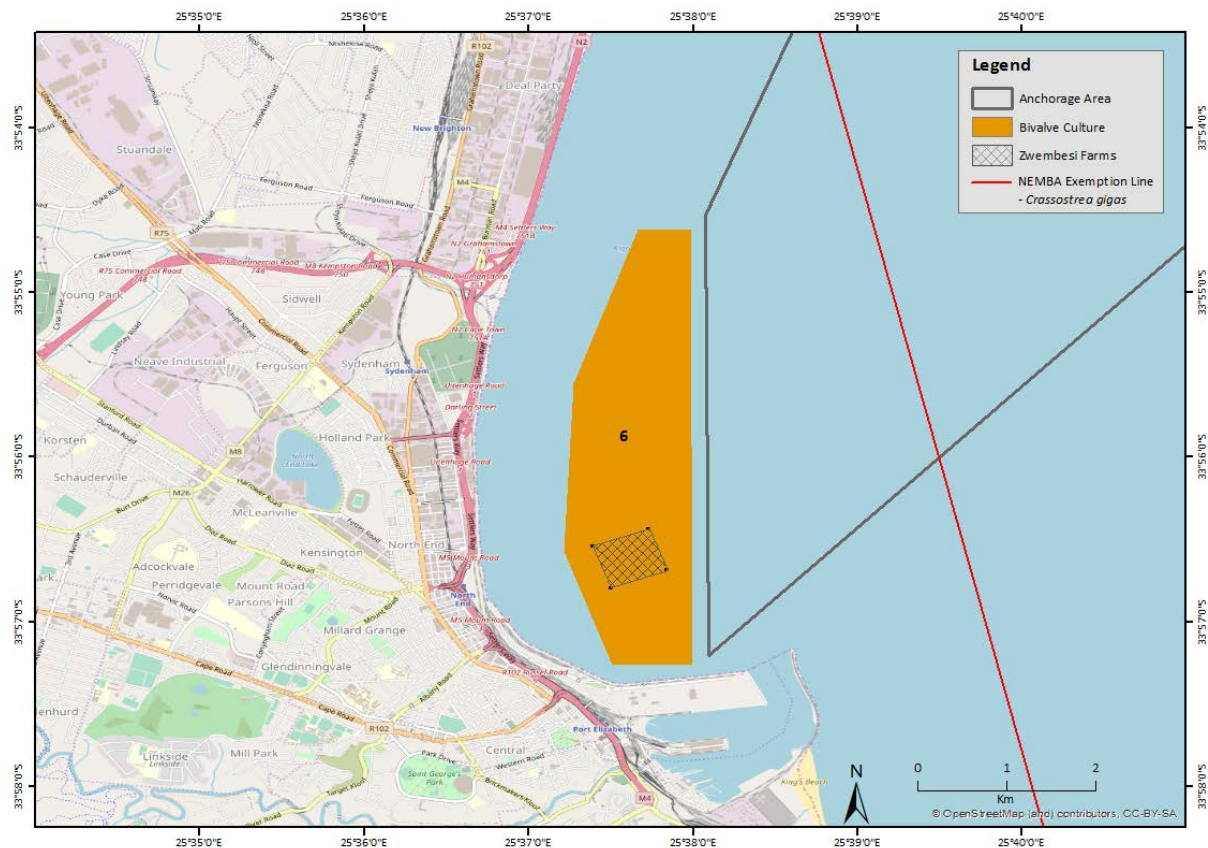


Figure 37 Existing Oyster farms in Algoa Bay and area that is exempted for the farming of *Crassostrea gigas* in terms of the 2016 Alien and Invasive Species (AIS) Regulations promulgated under the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA). The area extends landward of the red line.

9.5.2.7 Airports Company South Africa (ACSA) Port Elizabeth

According to the Airports Company South Africa (ACSA) Port Elizabeth the proposed Aquaculture Development Zone overlaps with the flight path of aircrafts landing at and departing from the Port Elizabeth International Airport. ACSA is concerned that aquaculture farms may attract birds and their aggregation would pose a risk to aircraft navigation. The ACSA submitted an appeal to the Environmental Authorisation that had been granted for Algoa 1 Option 1. Algoa Bay and the associated protected islands provide shelter, feeding and breeding habitats for numerous sea bird species (non-migratory mainly). Piscivorous, *low-flying* sea birds could be attracted to large concentrations of fish and food in sea cages at Algoa 1 Option 1 and 7 and include sea gulls, gannets, cormorants and terns. However, *high-flying, migratory* birds are the main concerns with regards to aircraft collisions and aquaculture should not constitute a risk to aircraft navigation. This impact has been assessed in Section 10.5.2.12.

10 ENVIRONMENTAL IMPACT ASSESSMENT

10.1 Introduction

An environmental impact assessment assesses the positive and negative environmental consequences of a proposed development. The National Environmental Management Act (Act 107 of 1998) (NEMA) defines the environment as “the surroundings within which humans exist and that are made up of:

- (i) The land, water and atmosphere of the earth;
- (ii) Micro-organisms, plant and animal life;
- (iii) Any part or combination of (i) and (ii) and the inter-relationship among and between them; and
- (iv) The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being”.

The Department of Agriculture, Forestry and Fisheries (DAFF) intends to develop an Aquaculture Development Zone (ADZ) in Algoa Bay, Eastern Cape. Three potential precincts have been identified and will be considered in this impact assessment, namely Algoa 1 Option 1 (Summerstrand), 6 (PE Harbour) and 7 (Ngqura Harbour). Please refer to Chapter 4 for detailed project and site descriptions and site maps for the proposed areas.

Based on the knowledge and professional experience of the environmental assessment practitioner regarding the nature of the proposed development and associated receiving environment, the following key potential environmental impacts – positive and negative – were identified:

- Negative impacts on the marine environment;
- Negative impacts on visual and aesthetic characteristics of the area; and
- Positive and negative impacts on the socio-economic environment (e.g. employment, revenue generation, negative impacts on existing tourism activities and businesses, real estate value);
- Negative impacts on maritime heritage resources

This basic assessment process includes the following specialist studies:

- Marine specialist study conducted by Anchor Research & Monitoring (Pty) Ltd;
- Maritime and Underwater Heritage Impact Assessment conducted by ACO Associates (cc)

Both reports are appended as standalone documents to this Basic Assessment Report (Appendix D). The key findings from these specialist studies have been integrated into this Chapter.

The marine specialist impact assessment for Algoa 1 Option 1, 6 and 7 was compiled based on:

1. The marine baseline study (Porter *et al.* 2012) and impact assessment (Hutchings *et al.* 2013) conducted by Anchor as part of the previous EIA process;
2. A comparative review of these studies by Britz & Sauer (2016a) for Algoa 1 (and 5) (Appendix D); and
3. Benthic habitat mapping and dispersion modelling studies that Anchor completed for DAFF in November 2018 Dawson *et al.* (2019) and Wright *et al.* (2019) (Appendix D).

Visual Resource Management Africa CC (VRM) Africa was appointed by CapeEAPrac to conduct the Visual Baseline and Impact Assessment for Algoa 1 (original extent) and 5 during the previous EIA process (Stead *et al.* 2013). The impact assessment and other applicable sections of the Final Visual Impact Assessment (VIA) study produced by VRM in July 2013 have been integrated into this Chapter and have been updated where required. The results of this study are not repeated in full here, and the reader is encouraged to consult the Final Visual Specialist Study compiled by Stead (2013) for any further details.

Where the views of ships and other industrial and traffic activities are seen within the context of a harbour environment, the sense of place is unlikely to be impacted significantly by the proposed aquaculture development. This is applicable to Algoa 6 and 7, which are situated within the harbour environment of the Ports of Elizabeth and Ngqura respectively. These precincts are therefore not considered to be situated in visually sensitive areas (refer to Section 9.3) and a specialist study was not conducted for these additional precincts.

The socio-economic baseline study for the Algoa Bay area and the impact assessments for Algoa 1 (original extent and various options) (and 5) compiled by socio-economic specialist Professor Bloom during the previous EIA process (Bloom 2012 and 2013) constitute the starting point of the impact assessment process for the current application for environmental authorisation. Furthermore, the comparative review study for Algoa 1 (and 5) compiled by Britz *et al.* in 2016 are considered carefully in this current basic assessment process and have been included as a standalone document in Appendix (D). The impact assessment for Algoa 7 (the new site) is likely to be very similar when compared to Algoa 5 (which was assessed by specialists in the previous EIA process but is no longer considered in this BA process), which lies only 15 km to the east of Algoa 7. The inshore bivalve culture site, Algoa 6, is located within an industrial setting of Port Elizabeth and user conflict is limited to slight overlap with some fishing activities. Additional socio-economic specialist studies were therefore not conducted to complete the impact assessments for Algoa 6 and 7.

Impacts on maritime heritage resources may be caused by mooring the finfish cage, oyster long-lines and mussel rafts to the seafloor. Note that during the previous EIA process, the South African Heritage Resources Agency (SAHRA) did not request a specialist study due to the large area considered for the ADZ, but indicated instead that individual operators would be required to conduct an underwater survey for the specific areas chosen within the ADZ prior to commencement of the operational phase. A specialist desktop Underwater and Maritime Heritage Impact Assessment was, however, conducted for this BA process and the results and recommendations have been integrated into this BAR.

The specialist studies from the previous and current EIA processes contributed to the detailed site and project descriptions presented in Chapters 4 and 9, which were used to determine the significance of potential environmental impacts associated with each individual precinct. This information was then collated to choose the most favourable combination of precincts to take forward in the application process as the preferred alternative for the project. Potential impacts are denoted by first listing the phase of the development (i.e. CP = Construction Phase; OP = Operational phase) followed by the impact category. Impacts are numbered consecutively and separately for the construction and operational phases:

- ME = Marine Ecology
- VA = Visual and aesthetic
- SE = Socio-economic
- UMH = Underwater and Maritime Heritage Resources

10.2 Approach and Methodology

The assessment of impacts was based on specialists' expertise, Anchor Environmental's professional judgement, field observations and desk-top analysis.

The significance of all potential impacts that would result from the proposed project is determined in order to assist decision-makers. The **significance** of an impact is defined as a combination of the **consequence** of the impact occurring and the **probability** that the impact will occur. The significance of each identified impact was thus rated according to the methodology set out below:

Step 1 – Determine the **consequence** rating for the impact by determining the score for each of the three criteria (A-C) listed below and then **adding** them. The rationale for assigning a specific rating, and comments on the degree to which the impact may cause irreplaceable loss of resources and be irreversible, must be included in the narrative accompanying the impact rating:

Rating	Definition of Rating	Score
A. Extent – the area over which the impact will be experienced		
Local	Confined to project or study area or part thereof (e.g. limits of the concession area)	1
Regional	The region (e.g. the whole of Namaqualand coast)	2
(Inter) national	South African land and waters and beyond	3
B. Intensity – the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered	3

C. Duration – the time frame for which the impact will be experienced and its reversibility

Short-term	Up to 2 years	1
Medium-term	2 to 15 years	2
Long-term	More than 15 years (state whether impact is irreversible)	3

The combined score of these three criteria corresponds to a **Consequence Rating**, as follows:

Combined Score (A+B+C)	3 – 4	5	6	7	8 – 9
Consequence Rating	Very low	Low	Medium	High	Very high

Example 1:

Extent	Intensity	Duration	Consequence
Regional 2	Medium 2	Long-term 3	High 7

Step 2 – Assess the probability of the impact occurring according to the following definitions:

Probability– the likelihood of the impact occurring

Improbable	< 40% chance of occurring
Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

Example 2:

Extent	Intensity	Duration	Consequence	Probability
Regional 2	Medium 2	Long-term 3	High 7	Probable

Step 3 – Determine the overall significance of the impact as a combination of the consequence and probability ratings, as set out below:

		Probability			
		Improbable	Possible	Probable	Definite
Consequence	Very Low	INSIGNIFICANT	INSIGNIFICANT	VERY LOW	VERY LOW
	Low	VERY LOW	VERY LOW	LOW	LOW
	Medium	LOW	LOW	MEDIUM	MEDIUM
	High	MEDIUM	MEDIUM	HIGH	HIGH
	Very High	HIGH	HIGH	VERY HIGH	VERY HIGH

Example 3:

Extent	Intensity	Duration	Consequence	Probability	Significance
Regional 2	Medium 2	Long-term 3	High 7	Probable	HIGH

Step 4 – Note the **status** of the impact (i.e. will the effect of the impact be negative or positive?)

Example 4:

Extent	Intensity	Duration	Consequence	Probability	Significance	Status
Regional 2	Medium 2	Long-term 3	High 7	Probable	HIGH	– ve

Step 5 – State the level of **confidence** in the assessment of the impact (high, medium or low).

Impacts are also considered in terms of their status (positive or negative impact) and the confidence in the ascribed impact significance rating. The prescribed system for considering impacts status and confidence (in assessment) is laid out in the table below. Depending on the data available, a higher level of confidence may be attached to the assessment of some impacts than others. For example, if the assessment is based on extrapolated data, this may reduce the confidence level to low, noting that further ground-truthing is required to improve this.

Confidence rating	
Status of impact	+ ve (beneficial) or – ve (cost)
Confidence of assessment	Low, Medium or High

Example 5:

Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Regional 2	Medium 2	Long-term 3	High 7	Probable	HIGH	– ve	High

The significance rating of impacts is considered by decision-makers, as shown below. Note, this method does not apply to minor impacts which can be logically grouped into a single assessment.

INSIGNIFICANT: the potential impact is negligible and **will not** have an influence on the decision regarding the proposed activity.

VERY LOW: the potential impact is very small and **should not** have any meaningful influence on the decision regarding the proposed activity.

LOW: the potential impact **may not** have any meaningful influence on the decision regarding the proposed activity.

MEDIUM: the potential impact **should** influence the decision regarding the proposed activity.

HIGH: the potential impact **will** affect a decision regarding the proposed activity.

VERY HIGH: The proposed activity should only be approved under special circumstances.

Step 6 – Identify and describe practical **mitigation** and **optimisation** measures that can be implemented effectively to reduce or enhance the significance of the impact. Mitigation and optimisation measures must be described as either:

- **Essential:** must be implemented and are non-negotiable; and
- **Best Practice:** must be shown to have been considered and sound reasons provided by the proponent if not implemented.

Essential mitigation and optimisation measures must be inserted into the completed impact assessment table. The impact should be re-assessed with mitigation, by following Steps 1-5 again to demonstrate how the extent, intensity, duration and/or probability change after implementation of the proposed mitigation measures.

Example 6: A completed impact assessment table

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional 2	Medium 2	Long-term 3	High 7	Probable	HIGH	-ve	High
Essential mitigation measures: xxxxx xxxxx								
With mitigation	Local 1	Low 1	Long-term 3	Low 5	Improbable	VERY LOW	-ve	High

Step 7 – Prepare a summary table of all impact significance ratings as follows:

Impact	Consequence	Probability	Significance	Status	Confidence
Impact 1: XXXX	Medium	Improbable	LOW	-ve	High
With Mitigation	Low	Improbable	VERY LOW		High
Impact 2: XXXX	Very Low	Definite	VERY LOW	-ve	Medium
With Mitigation:	<i>Not applicable</i>				

Indicate whether the proposed development alternatives are environmentally suitable or unsuitable in terms of the respective impacts assessed by the relevant specialist and the environmentally preferred alternative.

10.3 Marine ecological impacts

The proposed sea-based Aquaculture Development Zone has a wide range of potential impacts on the marine environment. Anchor conducted a marine specialist study to assess the impacts on the marine environment and recommend mitigation measures. The full specialist report is included in Appendix D of the Basic Assessment Report (Hutchings *et al.* 2019).

Information and data collected and analysed by the marine specialists during the previous and current EIA processes (Hutchings *et al.* 2013a/b, Dawson *et al.* 2019 and Wright *et al.* 2019) and the findings of the comparative socio-economic feasibility study compiled by the Rhodes University in 2016 (Britz *et al.* 2016a/b and Britz and Sauer 2016)² informed this marine ecological impact assessment. Existing information was reviewed and updated using available desktop information pertaining to the nature of the marine environment, the aquaculture industry and potential impact and mitigation measures where required. The Terms of Reference for the marine ecological specialist study are as follows:

1. A summary description of the receiving environment highlighting sensitive and significant habitats, fauna and flora including maps with locations of sensitive/significant features and habitats;
2. A summary of the findings of the dispersion modelling study and the benthic habitat mapping study;
3. A recommendation of species to consider for the ADZ;
4. Description and assessment of potential impacts associated with the operation of the ADZ;
5. A site recommendation considering the preferred as well as the alternative sites from an ecological perspective; and
6. Recommendations on measures to be adopted/implemented that are expected to mitigate negative impacts on the ecology of the area.

This marine specialist study describes and assesses potential environmental impacts associated with each of the three precincts (Algoa 1 Option 1, 6, and 7) individually first, and subsequently in combination in the form of alternate options as they have been configured for this EIA process (i.e. Option A, B and C, see table above) together with the No-Go option (Alternative D).

² Britz *et al.* 2016a/b and Britz and Sauer 2016, Dawson *et al.* 2019, and Wright *et al.* 2019 have been included as standalone reports in Appendix D of this Basic Assessment Report.

10.3.1 Impact assessment summary for Algoa 1 Option 1, 6 and 7

The tables below summarise the impacts that may be experienced during the construction and operational phases of the project for finfish mariculture in Algoa 1 Option 1 and 7, and bivalve mariculture in Algoa 1 Option 1 and 6, before and after mitigation (Table 18 to Table 20). The installation of the finfish cages and bivalve longlines, and rafts is very swift, and the only impact identified for this phase was the disturbance of subtidal habitat, which was rated **low** and **very low** without and with mitigation measures respectively. Fourteen impact types were identified during the operational phase.

Two impacts either did not require mitigation due to low significance, or because there was no feasible mitigation possible. Six impacts were rated **very high** or **high** before mitigation, but only one impact was rated **high** post mitigation (rated **very high** before mitigation). Eight impacts were rated **medium** before mitigation, but all of these were rated **low** post mitigation. Four impacts were rated **low** or before mitigation, most of which were rated **very low** post mitigation. Overall post mitigation, one **high**, four **medium** and 13 **low** impacts remained.

Table 18 Summary of potential marine ecology impacts for the construction of the proposed ADZ mariculture development (finfish and shellfish) in Algoa Bay.

Impact description		Mitigation	Consequence	Probability	Confidence	Significance before mitigation	Significance after mitigation
CP-ME 1	Disturbance of subtidal habitat (-ve)	Before	Low	Definite	High	LOW	
		After	Very Low	Definite	High		VERY LOW

Table 19 Summary of potential impacts of *finfish culture* on marine ecology (denoted ME) for the *operation* of the proposed Aquaculture Development Zone in Algoa Bay without and with mitigation. OP stands for Operational Phase.

Impact description		Mitigation	Consequence	Probability	Confidence	Significance before mitigation	Significance after mitigation
OP-ME 1	Disease and parasite transmission to wild fish stocks (may be reversible) (-ve): <u>Algoa 1 Option 1 & 7</u>	Before	Very High	Definite	High	VERY HIGH	
		After	High	Probable	Medium		HIGH
OP-ME 2	Organic waste discharge impacting on the water column and benthic environment (long-term but reversible) (-ve): <u>Algoa 1 Option 1 & 7</u>	Before	High	Definite	High	HIGH	
		After	Medium	Definite	Medium		MEDIUM
OP-ME 3	Genetic interactions with wild stocks with escapees (long-term but reversible) (-ve): <u>Algoa 1 Option 1 & 7</u>	Before	Very High	Possible	Low	HIGH	
		After	Medium	Improbable	Low		LOW
OP-ME 4	Use of chemical therapeutants and antifoulants (long-term but reversible) (-ve): <u>Algoa 1 Option 1</u>	Before	Medium	Probable	Medium	MEDIUM	
		After	Low	Probable	Low		LOW
	Use of chemical therapeutants and antifoulants (long-term but reversible) (-ve): <u>Algoa 7</u>	Before	High	Probable	Medium	HIGH	
		After	Low	Probable	Low		MEDIUM
OP-ME 5a	Accidental entanglement of cetaceans in mariculture infrastructure (long-term but reversible) (-ve): <u>Algoa 1 Option 1 & 7</u>	Before	Medium	Probable	Medium	MEDIUM	
		After	Medium	Possible	Low		LOW
OP-ME 5b	Possible impacts on cetaceans resulting from alterations in habitat use or migration patterns (long-term but reversible) (-ve): <u>Algoa 1 Option 1 & 7</u>	Before	Low	Probable	Medium	LOW	
		After	Low	Probable	Low		LOW
OP-ME 6	Piscivorous marine animals interfering with finfish cage culture operations (long-term but reversible) (-ve): <u>Algoa 1 Option 1</u>	Before	Medium	Probable	Medium	MEDIUM	
		After	Low	Probable	Low		LOW
	Piscivorous marine animals interfering with finfish cage culture operations (long-term but reversible) (-ve): <u>Algoa 7</u>	Before	High	Probable	Medium	HIGH	
		After	Medium	Probable	Low		MEDIUM

Table 20 Summary of potential impacts of *bivalve culture* on marine ecology (denoted ME) for the *operation* of the proposed Aquaculture Development Zone in Algoa Bay without and with mitigation. OP stands for Operational Phase.

Impact description		Mitigation	Consequence	Probability	Confidence	Significance before mitigation	Significance after mitigation
OP-ME 7a	Introduction of alien bivalve species (Mediterranean mussel <i>Mytilus galloprovincialis</i>) to the wild (unlikely to be reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	Before	Low	Improbable	Medium	VERY LOW	
		After	N/A	N/A	N/A		N/A
OP-ME 7b	Introduction of alien bivalve species (Pacific oyster <i>Crassostrea gigas</i>) to the wild (unlikely to be reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	Before	High	Possible	Medium	MEDIUM	
		After	Medium	Possible	Medium		LOW
OP-ME 8	Introduction of alien fouling species to the wild and provision of habitat to alien fouling species (unlikely to be reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	Before	Medium	Definite	Medium	MEDIUM	
		After	Low	Probable	Medium		LOW
OP-ME 9	Disease and parasite transmission to wild bivalve stocks (may be reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	Before	Very High	Definite	High	HIGH	
		After	Medium	Possible	Medium		LOW
OP-ME 10	Organic pollution and habitat modification (long-term but reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	Before	High	Possible	High	MEDIUM	
		After	Medium	Possible	Medium		LOW
OP-ME 11	Genetic interactions of wild stocks from bivalve mariculture (long-term but reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	None required	Low	Improbable	Medium	VERY LOW	
OP-ME 12a	Accidental entanglement of cetaceans in bivalve mariculture infrastructure (long-term but reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	Before	Medium	Probable	Medium	MEDIUM	
		After	Medium	Possible	Low		LOW
OP-ME 12b	Possible impacts on cetaceans resulting from alterations in habitat use or migration patterns (long-term but reversible) (-ve): Algoa 1 <u>Option 1</u> & 6	Before	Low	Probable	Medium	LOW	
		After	Low	Probable	Low		LOW

Due to the presence of sea bird and seal colonies and the anticipated increase in abundance of wild fish and other biota in the Addo MPA, the use of chemical therapeutants and antifoulants, genetic interactions with wild stocks and interactions with piscivorous marine animals (cetaceans sharks, seabirds) with finfish cage culture operations are ranked as having a higher negative impact on the marine environment at Algoa 7 compared to Algoa 1 Option 1 although not all the impacts are rated as high.

10.3.2 Impact significance of alternative options A, B, C and D

DAFF is seeking to promote farming of both bivalves and finfish in Algoa Bay and therefore three combinations of precincts have been considered as alternatives in the Basic Assessment process. These three options allow for varying degrees of farming intensities by excluding finfish farming at Algoa 1 Option 1 (Option B) or excluding Algoa 1 Option 1 as a whole (Option C).

Assessing the four proposed development alternatives (A, B, C and D as shown in Table 21) in terms of the number of medium and high significance impacts, favours alternatives B and C over alternative A (see table below). This is simply a result of more mariculture development having more impacts (i.e. having two fish farming sites with a greater total number of cages and higher biomass of farmed fish versus only one). Decision making authorities must, however, be cognisant of the fact that this development is likely to result in a number of moderately significant impacts after mitigation even for the smaller scale of development in options B and C.

The Status Quo Alternative (i.e. Option D) proposes that the Algoa Bay ADZ does not go ahead. This would mean that the negative impacts on biodiversity and conservation efforts in Algoa Bay will not be realised. Impact levels as currently observed will be continued.

Table 21 Comparison of the sum of negative impact significance of alternative options A, B, C and D for the proposed sea-based Algoa Bay Aquaculture Development Zone on marine ecology (after mitigation). In Option A, both finfish and bivalve culture are proposed for Algoa 1 Option 1, however, these impacts are not additive and therefore the impact scoring for the worst-case scenario (i.e. finfish) was considered. Note that 'Algoa 1' refers to Algoa 1 Option 1 in the table.

Impact significance after mitigation	Alternative Options			
	A Algoa 1: finfish and bivalves Algoa 6: bivalves Algoa 7: finfish	B Algoa 1: bivalves Algoa 6: bivalves Algoa 7: finfish	C Algoa 6: bivalves Algoa 7: finfish	D No Go
High	2	1	1	0
Medium	5	4	4	0
Low	23	18	10	0
Very low	0	0	0	0
Insignificant	0	0	0	0

10.3.3 Recommendations

Due to the impact level observed even after mitigation and the inclusion of Algoa 7 (MPA site) in options A, B and C, it is recommended that no more than three fin fish operators should be approved for an initial pilot phase, with a total annual production for the ADZ not exceeding 1 000 tonnes in the first year. Should monitoring reveal acceptable impacts as defined by the environmental quality objectives, indicators and performance measures, operators should be permitted to increase production from pilot phase to full commercial scale (not exceeding the carrying capacity at each site for *Seriola lalandi* and *Argyrosomus* sp. as recommended in Wright *et al.* 2019) over at least a three year period, provided that resource quality objectives are maintained.

Furthermore, the specialist study recommends the following mitigation measures:

- Cages should not be moored over long lived biogenic habitats (i.e. potential reef area identified within Algoa 1 Option 1 should be excluded) and ensuring minimal movement of moorings during operation or maintenance to keep impact footprint to a minimum;
- A biosecurity management plan should provide mitigation measures to (1) reduce the likelihood of escape occurring; (2) ensure comprehensive training of staff; (3) monitor stock comprehensively for disease and/parasites as part of a formalised stock health monitoring programme and take necessary action to eliminate pathogens through the use of therapeutic chemicals or improved farm management (lowest effective dose); (4) locate cages stocked with different cohorts of the same species as far apart as possible (no less than 100 m).
- If possible, different species should be stocked in cages successively, and stocking option and cage set up recommendations as outlined in the dispersion modelling report should be implemented. Site selection should be influenced by dispersion potential (i.e. well-flushed, deep and productive areas). A comprehensive sediment and water quality monitoring program to determine intensity of impacts should be developed and implemented prior to the operational phase.
- Genetic compatibility between wild and cultured stock by implementing the “Genetic Best Practice Management Guidelines for Marine Finfish Hatcheries” developed by DAFF and ensure adequate genetic monitoring.
- Suitable predator nets and visual deterrents should be installed and maintained. A protocol for dealing with problem piscivores in conjunction with experts and officials should be developed.
- South African oyster hatcheries should ideally be developed to reduce the reliance on spat import, and hence the risk of non -intentional introduction of associated alien species. The cleaning of biofouled infrastructure (ropes etc.) must be conducted in such a way as to minimise deposition to the seafloor beneath the farms (i.e. biofouling must be collected as deposited at a suitable onshore disposal facility). Routine surveillance on and around marine farm structures, associated vessels and infrastructure must be undertaken for indications of non-native fouling species. If spat import cannot be avoided, culture facilities should only be permitted to use spat sourced from biosecure certified hatcheries and/or quarantine facilities. (This is a standard import requirement).

In conclusion, the impact assessment of the alternative options provided by the applicant show that Option C has the lowest overall impact on marine ecology. However, the competent authority must

consider that there are a number of moderately significant impacts and at least one highly significant negative impact after mitigation for all options. The impact significance of the proposed development on conservation objectives (protection of biota and ecosystem functioning), has been ranked as medium and there are no feasible mitigation measures that could reduce this impact. A comprehensive, operator-specific Environmental Management Programme (EMPr), which includes the conditions of the overarching ADZ EMPr must be developed and implemented for each aquaculture farm within the ADZ. This EMPr must require independent monitoring of sufficient indicators in order to detect and quantify any of the environmental impacts described in this Basic Assessment Report and must specify thresholds of concern which require remedial action. The development of the ADZ should be phased in so that cumulative impacts can be detected as they arise, and rigorous adaptive management implemented.

10.4 Visual aesthetics

Visual impacts are defined as, “The effect of an aspect of the development on a specified component of the visual, aesthetic or scenic environment within a defined time and space” (Oberholzer B. 2005). As identified in this definition, ‘landscapes are considerably more than just the visual perception of a combination of landform, vegetation cover and buildings, as they embody the history, land use, human culture, wildlife and seasonal changes to an area’ (U.K IEMA 2002). These elements combine to produce distinctive local character that will affect the way in which the landscape is valued and perceived.

A visual impact assessment (or VIA) is the analysis of the potential visual impacts to the landscape and landscape views resulting from a proposed development or land management action. Visual impact is determined through the subjective assessment of sensitivity of the visual receptors (i.e. residents, outdoor recreational users) and the magnitude (scale) of the change in view. The proposed development is sea-based and landscape views that may be impacted therefore include the views from land looking out to sea.

Visual Resource Management Africa CC (VRM) Africa was appointed by CapeEAPrac to conduct the Visual Baseline and Impact Assessment for Algoa 1 (original extent) and 5 during the previous EIA process (Stead *et al.* 2013). The impact assessment and other applicable sections of the Final Visual Impact Assessment (VIA) study produced by VRM in July 2013 have been integrated into the section below and have been updated where required. The results of this study are not repeated in full here, and the reader is encouraged to consult the Final Visual Specialist Study compiled by Stead (2013) for any further details.

Where the views of ships and other industrial and traffic activities are seen within the context of a harbour environment, the sense of place is unlikely to be impacted significantly by the proposed aquaculture development. This is applicable to Algoa 6 and 7, which are situated within the harbour environment of the Ports of Elizabeth and Ngqura respectively. These precincts are therefore not considered to be situated in visually sensitive areas (refer to Section 9.3) and a specialist study was not conducted for these additional precincts.

The proposed ADZ includes the culture of bivalves and finfish. Examples of finfish cages and longlines used for mussel and oyster culture are shown in the project description in Chapter 4. The project components which may cause a visual impact and potentially change the sense of place include, floating structures (including buoys and cages), maintenance vessels and lights at night. Floating structures will protrude out of the water by a maximum of 10 m (on average 2 m), while lights at night are limited to 5 m above sea level (Stead *et al.* 2013).

The view catchment area is the geographic area from which the project site and associated structures would be visible. Visibility is often reduced due to screening by existing trees and buildings. Stead (2013) determined that Algoa 1 (original extent) would be highly visible due to its location in the open ocean where numerous receptors would be exposed to the proposed development. Algoa 6 and 7 are therefore considered to have high visibility as well.

However, although visibility is high for all precincts, visual receptors differ significantly between the precincts. Visual receptors are defined by the United States Bureau of Land Management as the people located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. The following receptors and landscape features were identified in the viewshed of the proposed ADZ precincts:

Algoa 1 (equally applicable to Option 1):

- Marine Drive and Beach Road
- Beach users
- Main hotels along Marine Drive
- Diving and yachting activities within the bay
- Cape Recife Nature Reserve

Algoa 6:

- Settlers Highway
- Residential views within central Port Elizabeth close to the R102

Algoa 7:

- Diving and yachting activities within the bay
- Marine ecotourism

The visual receptors are shown in relation to each site in Figure 38 to Figure 40. The impact on the landscape character for each site is assessed in this impact assessment. Due to the swift installation of the cages and longlines, impacts during the construction are of very short duration and have not been assessed separately.

10.4.1 Potential impact OP-VA1: Negative impact on seascape character

Due to the flat sea surrounding the site, the extent of the impact caused by the project would be high for all precincts, even though the height of the proposed project is limited to 2 m (bivalve farms are even lower). The project would be long-term and large in scale if the project is viable and scalable. The intensity of the visual impact would vary depending on the culture type (bivalve culture has a lower intensity when compared to finfish culture), location of the site, the size and location of the farms within the boundary of the proposed development area (i.e. depending on how many farms will be established within one site). For finfish, visual surface area infrastructure is approximately 7% of the total sea floor infrastructure area i.e. where 210 ha infrastructure is located on the sea floor only 15 ha will be visible on the surface and where 63 ha infrastructure is located on the sea floor only 4.5 ha will be visible on the surface. Location in close proximity to diving or yachting receptors, as well as locations in front of the beach front, would result in higher levels of visual impact at Algoa 1 and subsequently, high significance given the importance of tourism for the city of Port Elizabeth. Each precinct was assessed separately for the impact that it may have on landscape character. However, DAFF proposes to farm both bivalves and finfish in Algoa Bay and therefore three combinations of precincts have been considered as alternatives in the Basic Assessment process. The impact significance of alternative options A-D was then assessed in Section 10.4.3.

10.4.1.1 Algoa 1 Option 1

Algoa 1 Option 1 is situated within view of the following receptors (Figure 38):

- Marine Drive and Beach Road
- Beach users
- Main hotels along Marine Drive
- Diving and yachting activities within the bay
- Cape Recife Nature Reserve

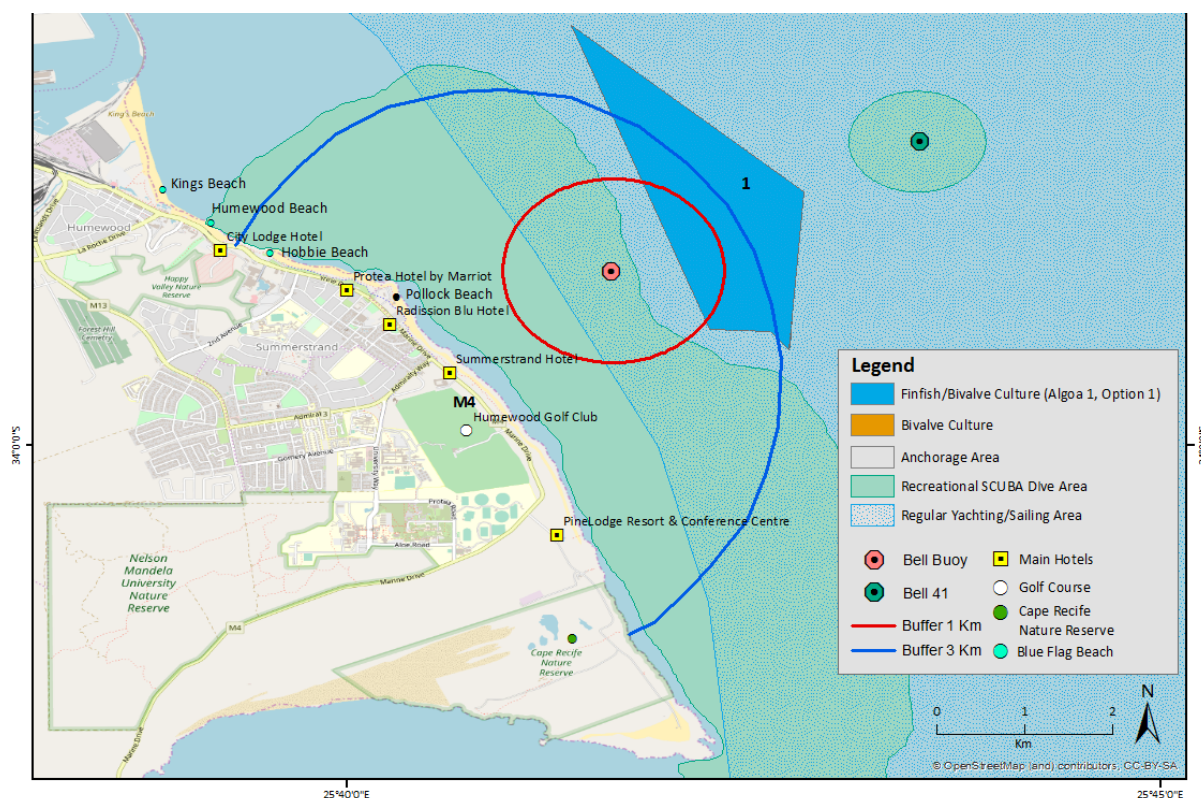


Figure 38 Visual receptors for Algoa 1 Option 1 site of the proposed sea-based Aquaculture Development Zone in Algoa Bay, Eastern Cape.

Finfish farming uses cages, which protrude approximately 2 m above the water surface and are likely to be highly visible from visual receptors at Algoa 1 Option 1, resulting in a high impact without the implementation of mitigation measures. Visual Resource Management South Africa recommended in their VIA (Stead *et al.* 2013) that Algoa 1 (original extent) could accommodate three finfish operators at 70 ha each, provided that they would be located within the southern or central portion of Algoa 1 (original extent) to reduce visibility (Figure 39). Furthermore, a 3 km buffer around the beach front and a 1 km buffer around the Bell Buoy was recommended (Figure 39) as the latter is a key point related to historic yachting regattas, power boat and swimming races related to the Port Elizabeth beach front tourism. The importance of this buoy for the regattas and races relates to proximity of the beach front spectators which is a key factor in event sponsorship. This mitigation measure was in direct conflict with mitigation measures proposed to avoid the quantifiable impact on the chokka squid industry, as it was recommended that the southern section be excluded from the ADZ (see Section 10.5.2.9). The pre-application BAR considered the original extent of Algoa 1 with a reduced footprint (Algoa 1 Option 1 and part of Option 2, Figure 5). However, DAFF has decided to exclude the entire southern portion of Algoa 1 from the ADZ, reducing the precinct to Option 1. Consequently, the proposed buffer zones for spectators become an infeasible mitigation measure as the remaining area would be too small for the proposed development (Figure 38).

Furthermore, it should be noted that the Algoa Bay Yacht Club (ABYC) has indicated that due to the reef system inshore of Algoa 1 Option 1 the route can only be diverted offshore (approximately 6 km), thereby moving the event out of spectator's sight. The ABYC anticipates that, should an aquaculture

farm (finfish or bivalve) be placed at Algoa 1 Option 1, international events would no longer be held in Port Elizabeth due to (1) the navigational hazard in rougher sea conditions and (2) the loss of area most important for event spectators (*pers. comm.* 2019 Rodney Idris Hon Secretary, Algoa Bay Yacht Club).

Consequently, the original impact assessment for Algoa 1 Option 1 was revised and it was concluded that the remaining mitigation measures are not sufficient to reduce the visual impact of *finfish* farming to medium and therefore remain **high** after mitigation (Table 22).

Bivalves (oysters and mussels) can be farmed on longlines or mussel rafts. Longlines comprise of a surface rope with floats, which are moored at each end to fix the line in position. The production ropes for mussels or oyster racks are then suspended from the surface rope (infrastructure illustrations are shown in Section 4.3.2). It should be noted that oceanographic conditions in Algoa Bay are comparatively rough and rafts are currently not considered a feasible technology for mussel farming (Barend Stander, Atlantic Royal, *pers. comm.* 2019).

Visual impact of long-lines suspended by buoys can be mitigated well by ensuring that colourful buoys are only used for safety purposes. The visual buffers recommended for *finfish* farming in the original visual specialist study (Stead *et al.* 2013) would likely not be required for long-line *bivalve* farming and with the implementation of other mitigation measures. The visual impact of current technology used for bivalve farming would therefore be considered medium before and **low** after the implementation of mitigation measures.

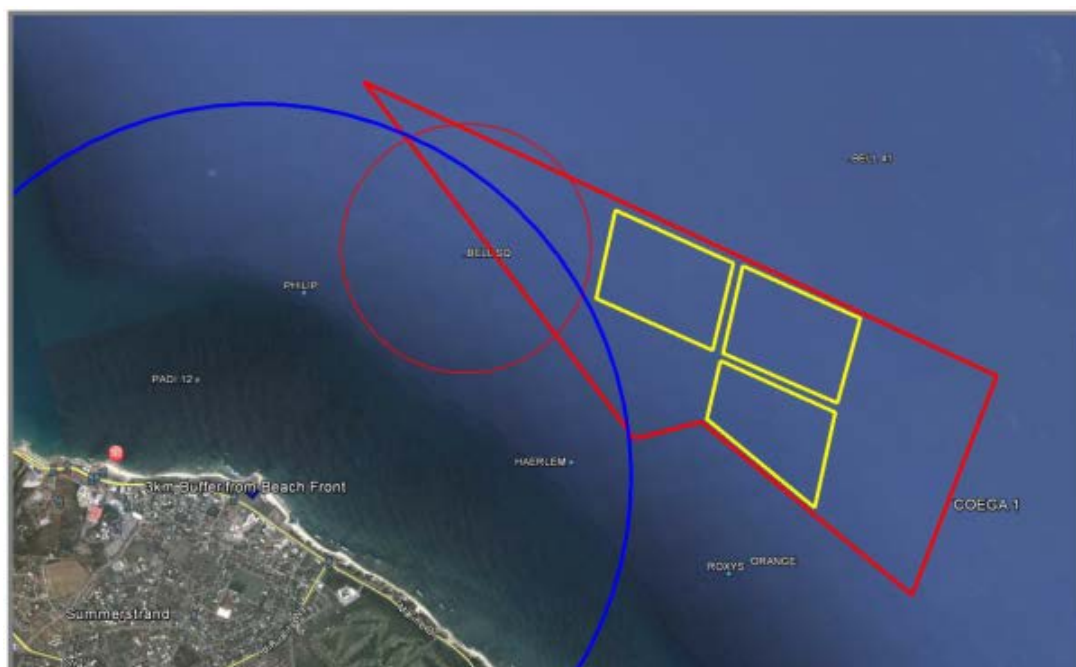


Figure 39 Recommended approximate location of 3 x 70 Ha (sea floor area) fin fish cages in Algoa 1 (original extent) area with a three kilometre exclusion zone buffer from the beach front (blue circle) and a one kilometre buffer exclusion zone buffer around Bell Buoy (Bell SQ) indicated as a red circle (Source Stead *et al.* 2013).

Table 22 OP-VA1a –Negative impact on seascape character resulting from finfish and bivalve culture at Algoa 1 Option 1. Note finfish and bivalve culture are assessed separately in this table. Impact significance after mitigation is shown in the last two rows.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Finfish	Local (1)	High (3)	Long-term (3)	High (7)	Definite	HIGH	-ve	Low
Bivalve	Local (1)	Medium (2)	Long-term (3)	Medium (6)	Definite	MEDIUM	-ve	Low
Essential mitigation measures:								
<ul style="list-style-type: none"> • Use grey based hues for all project components (rafts, cages, barrels, buoys/flotation devices) visible above the surface of the water as far as possible. • Ensure project components are of a similar style and scale to promote visual cohesiveness. • Utilise the minimum number of safety / warning buoys as far as possible. Only demarcate the corner points of each precinct and the minimum interval distance along the precinct boundary to meet Ports Authority (Transnet) safety requirements. • Maintain all project infrastructure in good working order. • Lights at night should be safety dependent. 								
Finfish	Local (1)	High (3)	Long-term (3)	High (7)	Definite	HIGH	-ve	Low
Bivalve	Local (1)	Low (1)	Long-term (3)	Low (5)	Definite	LOW	-ve	Low

10.4.1.2 Algoa 6

Algoa 6 is situated within the Port Elizabeth harbour within an industrial context. The only visual receptors for this site are the Settlers Highway, which hugs the coastline at the site. This road is, however, also situated landward of the railway and is not a known scenic route. The bivalve site will likely also be visible from central Port Elizabeth, although only within close range of the R 102. In most areas, the views are blocked by other residential houses and industrial buildings (Figure 40). Furthermore, Zwembesi Farms (oyster farm) currently operate within the proposed footprint and Transnet has set this area aside for mariculture (Refer to Section 9.5.2.6 for more background information).

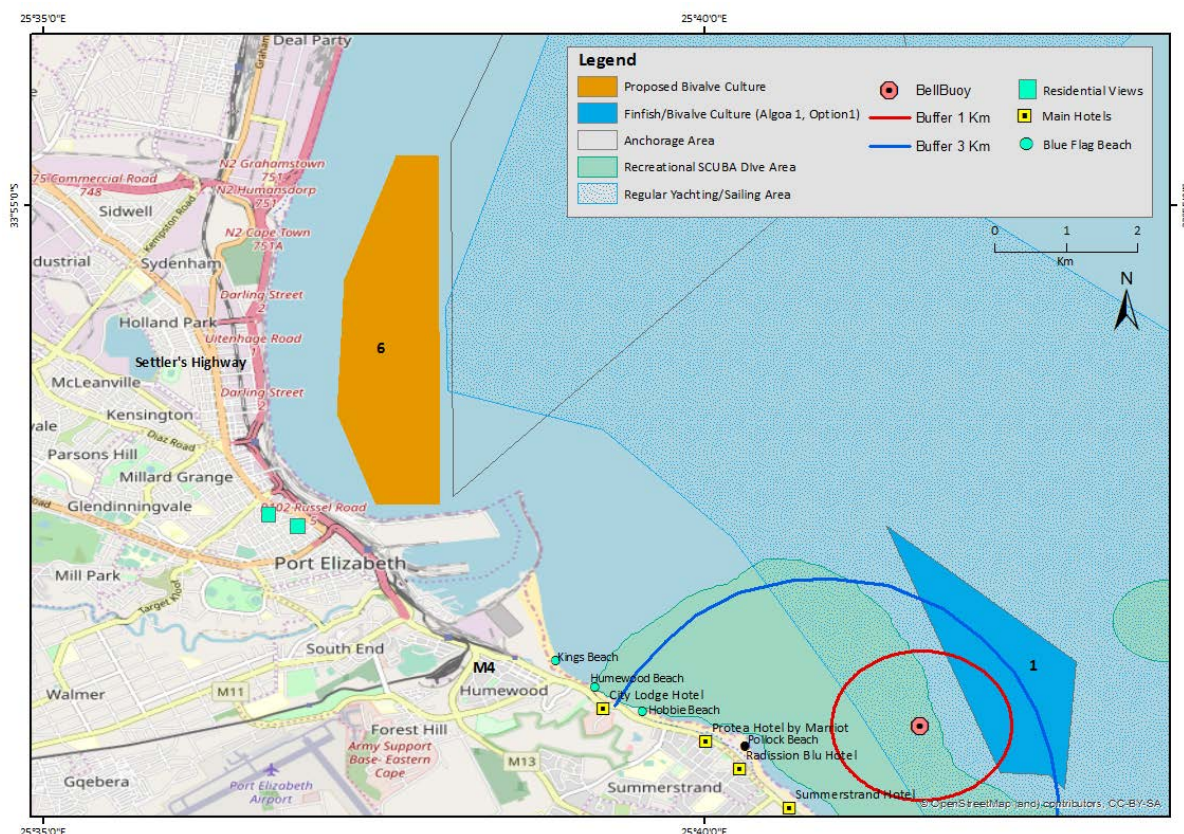


Figure 40 Visual receptors for Algoa 6 precincts of the proposed sea-based Aquaculture Development Zone in Algoa Bay, Eastern Cape.

Longlines for oyster culture are comprised of straight lines in the water accentuated with buoys (see description and images in Section 4.2). Mitigation measures include various methods to ensure the blending of the structures into the background as much as possible. No buffers of restriction in size are recommended for Algoa 6. With mitigation measures, the impact of Algoa 6 on the landscape character is **very low**.

Table 23 OP-VA1b –Negative impact on seascape character resulting from bivalve culture at Algoa 6.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local (1)	Low (1)	Long-term (3)	Low (5)	Definite	LOW	- ve	Medium
Essential mitigation measures:								
With mitigation	Local (1)	Low (1)	Long-term (3)	Low (5)	Possible	VERY LOW	- ve	Medium

10.4.1.3 Algoa 7

Algoa 7 is situated approximately 3 km from the Port of Ngqura adjacent to the shipping channel leading into the harbour and immediately north of an anchorage area. Algoa 7 is situated within the main yachting route in Algoa Bay. Ecotourism and diving activities also take place in this area, although less frequent than compared to Algoa 1 Option 1. Due to the remoteness of the site in terms of access by receptors, the intensity of the visual impact would be **low** without, and **very low** with mitigation.

Table 24 OP-VA1c –Negative impact on seascape character resulting from finfish culture at Algoa 7.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local (1)	Low (1)	Long-term (3)	Low (5)	Definite	LOW	- ve	Medium
Essential mitigation measures:								
<ul style="list-style-type: none"> Use grey based hues for all project components (cages, barrels, buoys/flotation devices) visible above the surface of the water as far as possible. Ensure project components are of a similar style and scale to promote visual cohesiveness. Utilise the minimum number of safety / warning buoys as far as possible. Only demarcate the corner points of each precinct and the minimum interval distance along the precinct boundary to meet Ports Authority (Transnet) safety requirements. Maintain all project infrastructure in good working order 								
With mitigation	Local (1)	Low (1)	Long-term (3)	Low (5)	Possible	VERY LOW	- ve	Medium

10.4.2 Cumulative impacts

Cumulative environmental effects can be defined as effects on the environment which are caused by the combined results of past, current and future activities. Algoa Bay is currently not an established sea-based large-scale marine culture site. Passing and anchored ships as well as squid fishing vessel lights by night are part of the current seascape at all precincts. Consequently, the proposed activity would constitute the first *permanent* disturbance to the seascape vistas at Algoa 1 Option 1 and the incremental cumulative impact would be considered high for the visual receptors at this precinct.

Zwembesi Farms at Algoa 6 is the only existing sea-based aquaculture venture in Algoa Bay approximately 1 km from the shore within an area zoned for aquaculture. Additional aquaculture infrastructure, if realised for the entire precinct, would become a permanent landscape feature, which is likely to blend into the industrial character of the harbour environment. The cumulative impact would therefore be of low significance.

Although the infrastructure would constitute a new visual impact type on the seascape at Algoa 7, cumulatively, the proposed project is unlikely to contribute significantly to the already existing harbour character of the seascape in the area.

10.4.3 Impact significance of alternative options

DAFF is seeking to promote farming of both bivalves and finfish in Algoa Bay and therefore three combinations of precincts have been considered as alternatives in the Basic Assessment process (Table 25). These three options allow for varying degrees of farming intensities by excluding finfish farming at Algoa 1 Option 1 (Option B) or excluding Algoa 1 Option 1 as a whole (Option C). After mitigation, Option A has the highest impact on the sea-scape character of Algoa Bay (high impact at Algoa 1 Option 1 for finfish farming), followed by Option B and Option C (Table 25). To reduce the visual impact of finfish farming at Algoa 1 (original extent), the visual specialists recommended buffer zones around the Summerstrand area that would reduce the Algoa 1 Option 1 to a very small area. Considering that DAFF has reduced the precinct extent to the northern section (i.e. Option 1), the buffer zones no longer constitute a viable mitigation measure and have been removed from this impact assessment. Consequently, the visual impact of finfish farming at Algoa 1 Option 1 remained high after mitigation. The visual impact of the ADZ is therefore greatly reduced for Option B.

The Status Quo Alternative (or No-go option D) proposes that the Algoa Bay Marine Aquaculture development does not go ahead. The seascape will remain the same at all precincts, which would be considered a positive outcome for the visual receptors at Algoa 1 Option 1. In contrast, not much would be gained by pursuing the No-go option for the Algoa 6 and 7 precincts due to the low number of visual receptors and existing industrial and harbour seascape character. The 'No-go/Status Quo' alternative will limit the potential associated with the area as a whole for implementing sea-based aquaculture as there are only a limited number of areas along the South African coastal considered potentially suitable for this activity.

Table 25 Comparison of the sum of impact significance of alternative options A, B, C and D for the proposed sea-based Algoa Bay Aquaculture Development Zone on the seascape character (negative impact after mitigation). In Option A, both finfish and bivalve culture are proposed for Algoa 1 Option 1, however, these impacts are not additive and therefore the impact scoring for the worst-case scenario, i.e. finfish farming was considered.

Impact significance after mitigation	Alternative Options			
	A Algoa 1: finfish and bivalves Algoa 6: bivalves Algoa 7: finfish	B Algoa 1: bivalves Algoa 6: bivalves Algoa 7: finfish	C Algoa 6: bivalves Algoa 7: finfish	D No Go
High	1	0	0	0
Medium	0	0	0	0
Low	0	1	0	0
Very low	2	2	2	0
Insignificant	0	0	0	0

10.5 Socio-economic impacts

Social impacts can be defined as, “The consequences to human populations of any public or private actions (including policies, programmes, plans and/or projects) that alter the ways in which people live, work, play, relate to one another, organise to meet their needs and generally live and cope as members of society”. These impacts manifest at various levels, including at the individual level, family or household level, community, organisation or societal level. Some social impacts are experienced as a physical reality, while other social impacts are perceptual or emotional (Vanclay 2003). The issue of social impacts is complicated by the way in which different people from different cultural, ethnic, religious and educational backgrounds view the world. This is referred to as the “social construct of reality”. The social construct of reality informs people’s worldview and the way in which they react to changes (Barbour 2007).

A Social Impact Assessment is the process of analysing (predicting, evaluating and reflecting) and managing the intended and unintended consequences on the human environment of planned interventions (policies, programmes, plans and projects) and any social change processes invoked by those interventions so as to bring about a more sustainable and equitable biophysical and human environment (Vanclay, 2003).

The Terms of Reference for the study were to:

- Integrate, into the impact assessment, the findings of the socio-economic baseline study and specialist study conducted by Bloom (2012,2013) for the previous EIA process;
- Integrate, into the impact assessment, the findings of the comparative socio-economic feasibility study compiled by the Rhodes University in 2016 (Britz *et al.* 2016a/b and Britz and Sauer 2016) (Appendix D)
- Integrate literature, internet resources, previous studies and information provided by stakeholders relating to the socio-economic environment of the study area to update the existing impact socio-economic baseline and assessment where necessary;
- Assess the significance of the socio-economic impacts using the Anchor’s impact rating methodology;
- Identify mitigation measures for the reduction of the significance of negative impacts (and enhancement of benefits) and re-rate the impact significance assuming the effective implementation of mitigation measures.

In this context it must be noted, specifically with regards to social impacts, that:

- These impacts are not easily measured objectively and therefore often need to be inferred rather than measured. A combination of insight into social processes in general and knowledge of the community under study are important to draw valid inferences;
- Social impacts are often multifaceted and inter-connected and therefore not easily disaggregated into separate impacts;
- Communities are dynamic and in a continual process of change. The proposed ADZ in Algoa Bay is one factor contributing to such change, but it is often difficult to identify when an impact is attributable to the project or to other factors (or a combination thereof); and
- Human beings are naturally continuously adapting to changes in their environment, including project impacts. As such these impacts change in significance for those affected.

The socio-economic baseline study for the Algoa Bay area and the impact assessments for Algoa 1 (original extent) (and 5) compiled by socio-economic specialist Professor Bloom during the previous EIA process (Bloom 2012 and 2013) provided the starting point for the impact assessment process for the current application for environmental authorisation.

Following the suspension of the environmental authorisation in 2014 as a result of the 28 appeals submitted by stakeholders, DAFF commissioned Rhodes University to conduct a comparative feasibility study for Algoa 1 (original extent) and 5, which was informed by a survey of public perception of the social trade-offs associated with the ADZ and input by economic and aquaculture industry specialists. Aquaculture industry specialists, Messrs Willem Schoonbee and Gavin Johnson, provided a perspective on the economic viability of a cage aquaculture operation in Algoa Bay based on industry benchmarks. This included a market perspective, operational considerations, cost estimates, revenue, employment and a high-level financial model. The standalone reports produced by the Rhodes University are included in Appendix D of this BAR.

Any additional information that arose from the comparative review studies compiled by Britz *et al.* in 2016 is also considered in this current impact assessment for Algoa 1 Option 1.

The pre-application stakeholder consultation process conducted from 28 April – 30 March 2019 confirmed that I&APs concerns and objections to Algoa 1 Option 1 have not changed since the survey of public perception of the social trade-offs associated with the ADZ was conducted in 2016 (Britz *et al.* 2016). Algoa 7 (the new site) is expected to have very similar socio-economic impacts when compared to Algoa 5 (screened out and not considered in this assessment) due to the fact that it is also situated adjacent to the recently promulgated Addo Marine Protected Area (MPA). The inshore bivalve culture site, Algoa 6, is located adjacent to an industrial neighbourhood of Port Elizabeth and stakeholders indicated during the previous impact assessment process that the inshore site would be preferred due to limited user conflict (Bloom 2013). Algoa 6 was excluded from the previous application process as it is not suitable for finfish farming, however, this site is suitable for bivalve culture and is therefore considered for this application for environmental authorisation. Considering the perceptions summarised above and the proximity of Algoa 7 to Algoa 5 (screened out), a further socio-economic specialist study was not undertaken for the impact assessment conducted for Algoa 6 and 7 in this BA process.

In the previous EIA process, socio-economic impacts were identified and assessed in the socio-economic baseline study and specialist impact assessment conducted by Bloom (2012, 2013) as well as by Anchor (2012, 2013) as part of the marine specialist study. The marine specialist study assessed socio-economic impacts related to the marine environment, including:

- Safety of recreational water sport participants
- Impacts on recreational SCUBA divers
- Impacts on yacht sailing and recreational boat anglers
- Impacts on commercial squid and longline shark fisheries

The assessment of the above impacts was removed from the marine specialist study and integrated into the socio-economic assessment. Some overlap occurred with the Bloom (2013) socio-economic impact assessment, which considered:

- (1) Specialist tourism and recreational activities
- (2) Marine Protected Areas
- (3) Vessel navigation routes
- (4) Pollution of marine environment
- (5) Existing marine aquaculture activities
- (6) Impact on local fishing industry
- (7) Contribution to national food security
- (8) Land-based infrastructure
- (9) Real estate values
- (10) Contribution to GDP
- (11) New employment opportunities
- (12) Skills development
- (13) Provision of goods and services by local businesses (leakages)
- (14) Small businesses, individual and informal sector development
- (15) Local community development

The following amendments were made to the original list provided by Bloom (2013):

- The focus of the impact assessment pertaining to specialist tourism and recreational activities (Point 1 in the list) was modified to more clearly assess the economic impact of the proposed development with a focus on tourism and businesses relying on a thriving water sport capital.
- The user conflict impact concerned with the recently promulgated Addo MPA (Point 2 in the list) is covered in detail in the marine specialist study and is not repeated here. This user conflict is concerned with the potential impacts that finfish farming could have on the ecological health of the MPA by means of pollution and the introduction of parasites and diseases as well as alien invasive species.
- The impact on vessel navigation route was expanded to include potential collision of anchored vessels with the aquaculture farm (reference to anchorage areas and Algoa 1 Option 2 (i.e. southern portion) as a shelter from strong winds and high seas for the chokka squid fishing industry).
- Pollution of the marine environment (4) was primarily addressed in the marine specialist study and was not repeated in the socio-economic impact assessment as a standalone assessment. Many stakeholders raised concerns about water deterioration as a result of finfish farming (mostly relating to Algoa 1 Option 1) impacting on recreational activities and the Blue Flag status of Port Elizabeth's beaches. It is important to note that:
 1. Finfish farms are not a known source of bacteria and viruses that are harmful to humans;
 2. Chemical pollution from finfish cages is not known to impact humans as a result of recreational activities;
 3. Nutrient input from the finfish farm is significant, but not likely to cause nuisance algae growth on the beaches; and
 4. Uneaten food and faeces/organic waste are not expected to wash up on the beaches situated more than 3 km from the Algoa 1 Option 1.

The above information (more information has been included in Section 9.5.2.1) indicates that water quality near the beaches is highly unlikely to be negatively impacted by proposed

mariculture activities and recreational activities as well as the Blue Flag status of Port Elizabeth's beaches should remain unimpacted provided that mitigation measures applicable to marine pollution are effectively implemented. Water quality impacts on recreational activities have therefore not been assessed as a stand-alone impact.

- The impact on the commercial fisheries (6) was addressed in both, the socio-economic and marine ecological reports. In reassessing the impact, the current BAR took cognisance of the rationale and outcome of both studies.
- Anchor agrees with Britz *et al.* 2016 (Appendix D of the BAR), that the project is unlikely to contribute towards food security (7), especially for underprivileged communities. Feed for aquaculture is primarily made from anchovies and other small pelagic species such as red eye and lantern fish which, in South Africa are high volume, low quality (from a human consumption perspective) fisheries and the project is therefore more accurately described as one that converts low (market) value wild fish into high (market) value farmed finfish. The end consumer of high market value fish, mussels or oysters will not be communities for whom food security is an issue. Accordingly, the current BAR was amended to exclude food security as a positive impact. Bivalve culture may be more pertinent in contributing to food security due to low food input requirements of these species and proven viability of current farms and projected economic feasibility in South Africa (Advance Africa Management Services 2017). However, it must be noted that much of the cultured bivalve is exported to other countries, which makes the industry viable and therefore constitutes a limited source of protein to South African previously disadvantaged communities. However, additional finfish farms will contribute to the establishment and growth of the South African aquaculture industry, which in turn will provide employment opportunities and therefore constitute a potential income for poor communities, thereby indirectly contributing to food security. The impact on new employment opportunities and contribution to national GDP was assessed separately and the indirect impact on food security was therefore not assessed here.
- The positive impact on skills development (12) was included in the assessment of impact on new employment opportunities.
- A key focus of Government policy is to prioritise entrepreneurship and the advancement of Small, Medium and Micro-sized Enterprises (SMMEs) as the catalyst to achieving economic growth and development in South Africa (DTI 2019). Promoting SMMEs as part of the proposed ADZ (Point 14 in the list) would constitute a 'benefit enhancing measure' to increase the positive impact on the local, regional and national economy, rather than representing an impact on its own and has therefore been removed from the socio-economic impact assessment.
- Local community development is a broad term and the emphasis of the original socio-economic impact assessment by Bloom (2013) appears to be focused on economic contributions, small business development, skill development and employment opportunities. These aspects are, however, already covered in OP-SE1 and OP-SE2 dealing with the contribution towards the economy and employment/skill development opportunities respectively. Although aquaculture could contribute to the development and upliftment of communities in the Algoa Bay area in other ways, it is currently not possible to foresee how engaged and financially committed individual operators are likely to be in facilitating community development. The assessment of this impact has therefore been removed from this BAR.

According to the Airports Company South Africa (ACSA) Port Elizabeth the proposed Aquaculture Development Zone overlaps with the flight path of aircrafts landing at and departing from the Port Elizabeth International Airport. ACSA is concerned that aquaculture farms may attract birds and their aggregation would increase the risk of birds colliding with aircrafts, posing a hazard to navigation. This impact was assessed in OP-SE12 Section 10.5.2.12.

Some stakeholders were concerned about fishy smells being emitted from the proposed ADZ. However, aquaculture farming generally does not generate smells that are atypical of the marine environment. The Environmental Management Programme (EMPr) in Appendix F makes provision for a complaint register. The EMPr requires that air emissions are minimised and requires corrective action if complaints about unpleasant odours are received. Air pollution was therefore not assessed as a stand-alone impact.

Relevant sections of the baseline and impact assessment reports of 2012/2013 (socio-economic and marine specialist studies) have been integrated into this impact assessment and have been updated where required.

10.5.1 Assessment of impacts: construction phase

Two potential socio-economic impacts were identified during the construction phase:

- CP-SE1: Investment in the local, regional and national economy; and
- CP-SE2: Increased employment, income and skills development.

The impacts are considered to be the same for Algoa 1 Option 1, 6 and 7 and the precincts have therefore not been assessed separately.

10.5.1.1 Potential impact CP-SE1: Investment in the local, regional and national economy

Farms will be commissioned over time, in response to market demand and available funding and as such, investment is likely to occur in stages. The impact assessment for the construction phase assumes that the ADZ precincts will be developed to their full capacity. The total capital investment required for a 3000 t per annum commercial scale cob or yellow-tail farm is estimated at R38.5 million (Britz *et al.* 2016). Note that investment cost is applicable to *one farm* and may differ if calculated for other species.

The capital investment for the facility during the construction phase is unknown but is thought to be close to the total capital investment value due to the fact that construction is not very labour intensive and that most of the investment will lie with the purchase of the equipment. The total capital investment for a single 500 t per annum mussel project or a 200 t per annum oyster longline production facility is estimated at R22 and R20 million respectively.

The total maximum amount of bivalve that is projected to be farmed in Saldanha Bay ADZ per hectare per annum is 8.13 t (SRK Consulting 2017). Due to lower productivity on the east coast when compared to the west coast, this may represent an overestimate of the maximum that can be produced in a less productive marine environment such as Algoa Bay. The Feasibility Study for Oyster

and Mussel Aquaculture in South Africa (DAFF 2017) indicated that lower growth rates were observed in Pacific oyster nurseries in Algoa Bay when compared to Saldanha Bay due to less reliable supply of phytoplankton available in the water column. Although unlikely, Algoa 6 could produce a maximum of 4000 t per annum on 495 ha.

The extent of the economic investment is deemed national, as materials and expertise required during construction are likely to be sourced from outside the Eastern Cape. Specialised equipment is likely to be sourced from abroad, which would dilute the benefit accruing locally. The significance of this benefit has been rated as **low** without and with the implementation of benefit-enhancing measures.

Table 26 CP-SE1 – Investment in the local, regional and national economy for Algoa Bay. All precincts have a similar impact and have been assessed together.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	National (3)	Low (1)	Medium (2)	Medium (6)	Possible	LOW	+ ve	Medium
Benefit-enhancing measures:								
<ul style="list-style-type: none"> Procure goods and services from local, provincial or South African suppliers as far as possible, giving preference to Black Economic Empowerment (BEE) suppliers. Procure ancillary services for goods and services purchased overseas from South African companies as far as possible (e.g. installation, customisation and maintenance). 								
With mitigation	National (3)	Low (1)	Medium (2)	Medium (6)	Possible	LOW	+ ve	Medium

Cumulative Impact

The investment into the local, regional and national economy will cumulatively contribute toward the economic success of the aquaculture sector.

10.5.1.2 Potential impact CP-SE2: New employment, income and skills development

The development of fish farms will contribute towards the creation of direct and indirect employment opportunities for people with different types and levels of skills.

The number of direct employment opportunities created during the construction phase is unknown. Direct employment is expected to be relatively small, as the installation of mariculture structures is quick and simple. While construction employment will be temporary, workers have the opportunity to improve their economic prospects in the longer term if they take full advantage of the income, experience and skills transferred to them through the project. Aquaculture farms will be commissioned sequentially, and construction will therefore occur over the medium term.

The ADZ development will also create or sustain indirect employment at suppliers of materials and other services. It is not possible to quantify indirect employment and income that will be generated by the project during the construction phase, but it is likely to be relatively limited. The extent of the

benefit is deemed local, as the majority of construction workers and skills are likely to be procured within the local community. Note that when assessing this impact, the scoring of the extent is reversed, as it is more favourable to employ people locally given the high unemployment levels in this region. The intensity of the benefit is considered low, as the number of jobs created is relatively low, extending over the medium term.

The benefit is assessed to be of **very low** (positive) significance without and **low** with the implementation of mitigation (Table 27).

Table 27 CP-SE2 – New employment, income and skills development. All precincts have the same impact and have been assessed together. Note that when assessing this impact, the scoring of the extent is reversed, as it is more favourable to employ people locally given the high unemployment levels in this region.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional (2)	Low (1)	Medium-term (2)	Low (5)	Possible	VERY LOW	+ ve	Low
Benefit enhancing measures:								
<ul style="list-style-type: none"> Use local and regional labour (Nelson Mandela Bay Municipality, Sarah Baartman District Municipality). Preferentially employ previously disadvantaged individuals. 								
With mitigation	Local (3)	Low (1)	Medium-term (2)	Medium (6)	Possible	LOW	+ ve	Low

Cumulative impact

The proposed ADZ will contribute positively and cumulatively to the job market. During the construction phase contributions are likely to be insignificant though.

10.5.2 Assessment of impacts: operation phase

A number of potential impacts were identified for the operation phase of the proposed Aquaculture Development Zone and are listed below:

- OP-SE1: Investment in the local, regional and national economy (positive)
- OP-SE2: New employment opportunities, household income and skills development (positive)
- OP-SE3: Existing land-based and sea-based marine aquaculture activities (positive)
- OP-SE4: Recreational sport participants (excluding SCUBA diving) (negative)
- OP-SE5: Recreational SCUBA diving activities (negative)
- OP-SE6: Negative economic impact on Port Elizabeth – with a focus on the existing tourism industry and businesses relying on the water sporting industry (negative)
- OP-SE7: Provision of goods and services by local businesses (leakages) (negative)
- OP-SE8: Collision of vessels with aquaculture farms (Vessel navigation routes, anchorage areas and general boat traffic) (negative)
- OP-SE9: Commercial fishing industries (i.e. squid fisheries/recreational/commercial fisheries) (negative)
- OP-SE10: Pressure on infrastructure (land-based infrastructure (harbours/fishing factories/road infrastructure) (negative)
- OP-SE11: Impact on coastal real estate due to aesthetic nature of views and sense of place (negative)
- OP-SE12: Increased risk of bird strikes affecting aircraft landing at and departing from the Port Elizabeth International Airport (negative)

10.5.2.1 Potential impact OP-SE1: Investment in the local, regional and national economy (contribution to GDP)

Should an ADZ be approved for Algoa Bay, farms will be commissioned over time, in response to market demand and available funding and investment which is likely to occur in stages. The impact assessment for the operation phase assumes that the ADZ precincts will in time be developed to their full capacity. The total capital investment required for a 3000 t per annum commercial scale kob or yellow-tail farm is estimated at R154.5 million (Britz *et al.* 2016). Note that investment cost is applicable to *one farm* and may differ if calculated for other species or for multiple farms. Model results indicate that all recommended carrying capacity tonnages for Algoa 7 for both species under consideration (yellowtail *Seriola lalandi* and meagre *Argyrosomus regius*) exceed the required 1 000 t per annum (new data indicates that finfish farms can be commercially viable at 1 000 t per annum. Refer to Section 3.2), with total projected biomass production of ~3 500 t and ~5 000 t per annum for *S. lalandi* OR *A. regius* respectively. Note that Wright *et al.* 2019 modelled the carrying capacity for the extent of Algoa 1 as shown in the pre-application BAR (i.e. Option 1 and part of Option 2). This footprint has since been reduced by 40%. The carrying capacity for this site cannot be estimated by reducing the original amount proportionally and would have to be re-modelled for Algoa 1 Option 1 should finfish farming be pursued at Algoa 1 Option 1 (although it is important to consider that DAFF has submitted an application for Alternative Option B, which excludes finfish farming from Algoa 1 Option 1).

The total capital investment for a single, financially viable farm producing 500 t per annum mussel project or a 200 t per annum oyster longline production facility is estimated at R22 and R20 million respectively. The capital investment includes infrastructure and requirements for land-based facilities (Advance Africa Management Services 2017³).

The development of small enterprises associated with the fish farms should fundamentally focus on two aspects, i.e.

- A commitment to procure services from small businesses within the Algoa Bay area or from other areas within the NMB Municipal area or the Eastern Cape; and
- The establishment of mechanisms that would enable the creation of small business opportunities linked to the establishment and operational components of the fish farms.

The need for developing small businesses in the mariculture industry is re-affirmed by the necessity to form alliances with business organisations, which would ensure that the Government's development objectives for mariculture development coincide with those of the community and the private sector.

During establishment and after the full development of the ADZ, the procurement of goods and services should provide additional opportunities for local suppliers to act as vendors. The use of local expertise for the development of small businesses is essential. Examples of small business opportunities emanating from the backward linkages provided by the fish farms include maintenance and various support services required by farming activities (e.g. supply and manufacture of infrastructure and vessel components, feed, harvesting, processing and preservation of catch components and inputs etc.).

Project and private expenditure are likely to take place in the region and the extent of the benefit is therefore considered regional for both aquaculture types (finfish and bivalve) and all precincts. The intensity of the benefit is considered medium, as revenue is likely to be volatile, over the long-term (applicable to both aquaculture types and all precincts).

The probability rating of the original Bloom (2013) study for finfish culture was amended for the current application process. It is argued that the probability of this impact occurring should be changed from 'definite' to 'possible'. The known market for indigenous South African marine fish such as kob and yellowtail is of the order of 1000-2000 tons per annum and the international market export prospects for farmed product of these species are currently not positive. The economic feasibility of Algoa 1 Option 1 (and therefore Algoa 7) was ranked 'low', due to the suboptimal environmental conditions and limited market demand conditions (Britz and Sauer 2016).

With regards to bivalve farming, industry indicated during the pre-application consultation process that illegal effluent spills, sewerage pump failures, burst pipelines and contamination following heavy rain could cause forced intermittent closures of bivalve farms at Algoa 6 (Appendix F Stakeholder Consultation Report). It was recommended that the relevant authorities (municipality, DWS, Environmental Affairs, TNPA, etc) would need to take steps to minimize effluent pollution in the bay

³ Advance Africa Management Services conducted a Feasibility Study of Oyster and Mussels Aquaculture in South Africa on behalf of DAFF. The study was published in June 2017.

as well as implementing an ‘early warning’ system to warn affected parties of spills before large-scale bivalve culture could take place successfully at Algoa 6. It follows that the probability of the positive economic impact being realised for bivalve culture at Algoa 1 Option 1 and 6 was rated as ‘probable’ and ‘possible’ respectively prior to the implementation of benefit enhancing measures. After the implementation of benefit enhancing measures, the impact was rated as **high**.

The confidence in the impact assessment was rated as high as these numbers are based on feasibility studies conducted by specialists and modelling of potential carrying capacity of Algoa 1 and 7 (Advance Africa Management Services 2017, Britz *et al.* 2016, Wright *et al.* 2019). The overall significance rating is medium for finfish farming at Algoa 1 and 7 and high for bivalve farming at Algoa 1 and 6 after mitigation. The impact is long-term but reversible (Table 28 and Table 29).

Table 28 OP-SE1a – Investment in the local, regional and national economy applicable to *finfish* farming at Algoa 1 Option 1, and 7. The impact assessment for both precincts is the same and was therefore assessed together.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Algoa 1 <u>Option 1</u> & 7	Regional (2)	Medium (2)	Long-term (3)	High (7)	Possible	MEDIUM	+ ve	High
Benefit enhancing measures:								
<ul style="list-style-type: none"> • Use local and regional labour (Nelson Mandela Bay Municipality, Sarah Baartman District Municipality). • Preferentially employ previously disadvantaged individuals. • Develop a strategy to engage local businesses and communities. • Procure services from small businesses within the Algoa Bay area or from other areas within the NMB Municipal area or the Eastern Cape as far as possible. 								
Algoa 1 <u>Option 1</u> & 7	Regional (2)	Medium (2)	Long-term (3)	High (7)	Possible	MEDIUM	+ ve	High

Table 29 OP-SE1b – Investment in the local, regional and national economy applicable to *bivalve* farming at Algoa 1 Option 1 and 6.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Algoa 1 <u>Option 1</u>	Regional (2)	Medium (2)	Long-term (3)	High (7)	Probable	HIGH	+ ve	High
Algoa 6	Regional (2)	Medium (2)	Long-term (3)	High (7)	Possible	MEDIUM	+ ve	High
Benefit enhancing measures:								
<ul style="list-style-type: none"> • Use local and regional labour (Nelson Mandela Bay Municipality, Sarah Baartman District Municipality). • Preferentially employ previously disadvantaged individuals. • Develop a strategy to engage local businesses and communities. • Procure services from small businesses within the Algoa Bay area or from other areas within the NMB Municipal area or the Eastern Cape as far as possible. • Bivalve farming at Algoa 6: minimise effluent pollution in the bay as well as implementing an ‘early warning’ system to warn affected parties of spills. 								
Algoa 1 <u>Option 1</u> & 6	Regional (2)	Medium (2)	Long-term (3)	High (7)	Definite	HIGH	+ ve	High

Cumulative Impact

Sustainable economic growth requires that most of the human and other resources be met from internal supply. This type of approach contributes to the retention of income within the economy, leads to further induced investment and multiplied increases in income from the spending of wages and salaries of persons from the NMB area associated with the fish farms. More mariculture projects will increase the demand for goods and services, which will support the development of local businesses and ensure acceptable levels of sustainability. As the mariculture sector increases in scale, the cost of feed and other supporting services are likely to decrease, which would benefit the sector as a whole. The investment into the local, regional and national economy will cumulatively contribute toward the economic success of the aquaculture sector.

However, the proposed development will only contribute to a net positive impact on the economy as a whole if the established and growing tourism industry of Port Elizabeth is not negatively impacted (Section 9.5.2 provides detail on the existing industry). The potential negative economic impact on Port Elizabeth is assessed in Section 10.5.2.3. Negative economic impacts are a knock-on effect from visual impacts, water quality impacts, possible changes in behaviour of ocean predators (and perceived increased risk of shark attacks), ecosystem degradation etc. An overall positive economic impact associated with the ADZ is therefore incumbent on preventing excessive, negative knock-on effects on existing industries. The various impacts that could have a knock-on effect have been assessed in the Basic Assessment Report and mitigation measures are provided (essential and recommended). These mitigation measures are included in the Environmental Management Programme (EMPr, Appendix A of the BAR), which, should Environmental Authorisation be granted, become a legally binding document to be implemented by the Department of Agriculture, Forestry and Fisheries.

It must, however, be noted that based on the choice modelling study conducted by Britz *et al.* (2016) and feedback from stakeholders thus far, it appears that the perception of an increased risk of shark attacks occurring (whether this risk is real or not) was identified as one of the most important disturbing aspects of the proposed development. While mitigation measures have been recommended for negative visual and marine ecological impacts, no meaningful mitigation measures are available to reduce the perceived increased risk of shark attack. The perceived higher risk of shark attacks alone could potentially have a profound direct negative impact on the local economy, should the Ironman Event (and other events) be moved to a different location (Ironman Organisers indicated during the 2014 appeal phase and during the pre-application commenting period of the current BA process that the event would be moved to a different location should finfish farms be developed at Algoa 1 Option 1). Furthermore, this impact could potentially be irreversible and occur during the pilot phase (Section 9.5.2.3). The perceived increased risk of shark attack is mostly applicable to finfish farming at Algoa 1 Option 1 and could most likely be effectively reduced in Alternative Option B (no finfish at Algoa 1 Option 1) or Option C (Algoa 1 Option 1 excluded from ADZ).

Alternative Option C is likely to have a cumulatively positive impact on the economy in the area as all socio-economic impacts associated with Algoa 1 Option 1 would be avoided. Alternative Option B (no finfish farming at Algoa 1 Option 1) could potentially have a higher positive cumulative impact, than Alternative Option C, however, impacts of bivalve farming at Algoa 1 Option 1 on sailing competitions (Section) and impacts on the sense of place (Section 10.4.1.1) may still be a concern (low impact

significance after the implementation of mitigation measures. Alternative Option A (finfish and bivalve culture at Algoa 1 Option 1) has a high unquantified, but real risk of negatively impacting on existing industries with a potentially irreversible, negative cumulative effect (Section 10.5.2.6).

10.5.2.2 Potential impact OP-SE2: New employment opportunities, income and skills development

Collapse of key stocks and subsequent reductions in access rights and/or fishing quotas has been blamed for many direct and indirect job losses throughout the South African fishing industry, including the NMB area. Management interventions to optimize the potential social and economic benefits of marine resources continue to be constrained, primarily by institutional capacity (Kleinschmidt *et al.* 2010). The reduced fishing quotas along most of the South African coastline together with the declining fish supply have resulted in a high level of unemployment among Algoa Bay residents with experience in the fishing industries. The seasonality of the traditional fishing sector also creates many problems, as there is often no alternative employment for those without any other skills. This could be addressed through aquaculture projects as the different links in the value chain could provide source of income and employment all year round in an area with few employment alternatives for people with skills limited to marine capture fisheries and associated activities.

Mariculture typically requires a high degree of input in terms of local manpower and ancillary services, which could provide greater job security for the local community, especially where other opportunities and entrepreneurial enterprise are limited. International trends indicated an average employment multiplier of at least 1.1 jobs linked to every fishing job (Burbridge *et al.* 2001). Although most of the actual fishing activities are done by men, women play a significant role in the fish processing (59% of all jobs), resulting in approximately 31% of all jobs in mariculture. The expansion of mariculture in areas where there are few alternatives for job creation can make a significant contribution towards job creation and improving the quality of people's lives. This is of particular importance if the new opportunities are available close to traditional fishing ports where unemployment among former fishermen prevails. There are a number of people residing in the Algoa Bay area that are (semi)skilled in the fishing industry that could be employed by the fish farms and associated activities.

Unskilled, semi-skilled and skilled employment opportunities would include (but are not limited to) skippers, divers, farm maintenance staff, fish processing facility staff, aquaculture consultants, food safety technicians, aquatic animal health vets, and environmental officers. Services could include boat maintenance, infrastructure manufacturing (cages, nets, moorings etc.), repairs and commercial diving.

In the pre-application BAR, the impacts of bivalve and finfish culture on creating employment opportunities were assessed together, however, the culture types were separated in the Draft BAR, given the new information obtained during the pre-application public participation phase. It has been established that the intensity of the impact and the probability of the impact being realised differ for the two culture types.

Finfish farming

The original rating of the extent was revised from 'local' to 'regional', as it is likely that employees would be sourced from the District Municipal Area.

The original intensity impact rating for finfish culture provided by Bloom (2013) was amended for the current application process for the following reasons:

1. Britz *et al.* (2016) found that the number of jobs projected for finfish culture in the original Bloom (2013) study was speculative and unrealistically high;
2. Algoa 1 is no longer considered in its entirety for the application for Environmental Authorisation and has been reduced to the northern portion (i.e. Algoa 1 Option 1) (See Section 3.5.1 for more information). It follows that the original carrying capacity for finfish culture at Algoa 1 is no longer applicable (size reduction from 522 ha to 312 ha). It is estimated that one farm with the capacity to produce 1 000 t finfish per year could possibly be accommodated at this site.
3. Alvial *et al.* (2012) recommended a minimum 2.5 km buffer zone to be implemented to prevent disease transfer between farms. Should this buffer zone be implemented, Algoa 1 Option 1 and 7 each have the capacity for one farm of either *Seriola lalandi* or *Argyrosomus regius*.

The intensity impact rating for the current process was therefore amended from 'high' to 'medium' for finfish culture at both sites. The review by Britz *et al.* (2016) suggested that direct employment in the production component of an offshore finfish farm in Algoa Bay is expected to roughly 50 employees for a 1000t/annum pilot scale operation (1 employee per 20 ton) and 80 employees for a 3000t/annum commercial unit (1 employee per 37.5 tons) (Britz *et al.* 2016).

Based on the numerical modelling results approximately 3000 – 4000 t of finfish can be produced per site per year (Wright *et al.* 2019). Note, however, that Algoa 1 is no longer considered in its entirety for the application for Environmental Authorisation and has been reduced to the northern portion (i.e. Algoa 1 Option 1) (See Section 3.5.1 for more information), reducing the potential number of employment opportunities from 80 to 50.

This means that finfish farming at Algoa 1 Option 1 and 7 would have the potential to create approximately 50 and 80 direct job opportunities respectively.

Further employment opportunities could present themselves in services and value adding, with the most significant the increase in processing workers within Fish Processing Establishments to absorb the extra fish production for the region. The actual number of employment opportunities is difficult to estimate as the existing industries in the region will most likely be able to meet the demand for services in an initial marine aquaculture development phase. Service industries will scale with the development of the sector and success from the first commercial operator will signal whether the industry has a viable future. Services could include boat maintenance, net manufacturing and repairs and commercial diving. Initially however, most services required for a pilot scale operation could be supplied by existing businesses. A figure of one direct on-farm employee to one service sector employee has been suggested as an approximation of indirect jobs (Britz 2014). It is therefore estimated that finfish culture in Algoa Bay could potentially create 260 additional direct and indirect job opportunities.

The probability rating of the original Bloom (2013) study for finfish culture was also amended for the current application process. It is argued that the probability of this impact occurring should be changed from 'definite' to 'possible' since this benefit would only be realised if the farms prove to be viable and are expanded to full capacity (also refer to Section 10.5.1.1). The probability of this impact occurring is dependent on the economic impact being realised and the probability was considered 'possible' before and after benefit enhancing measures as there are no meaningful mitigation measures available to improve economic viability (Section 10.5.1.1).

The impact significance rating after implementation of benefit enhancing measures is rated as **medium** (Table 30). Although these new employment opportunity numbers are based on feasibility studies conducted by specialists (Advance Africa Management Services 2017, Britz *et al.* 2016), commercial finfish farming is still being developed in South Africa. The confidence in the impact rating was therefore rated as medium. Benefit enhancing measures include those recommended for OP-SE1, as well as ensuring that local and previously disadvantaged individuals are hired and upskilled. There are a number of people residing in the Algoa Bay area that are (semi)skilled in the fishing industry that could be employed by the fish farms and associated activities.

Table 30 OP-SE2a – **New employment opportunities, income and skills development for finfish culture at the proposed Algoa Bay sea-based Aquaculture Development Zone. Precincts 1&7 have the same impact and have been assessed together.**

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Algoa 1 Option 1&7	Regional (2)	Medium (2)	Long-term (3)	High (7)	Possible	MEDIUM	+ ve	Medium
Benefit enhancing measures:								
<ul style="list-style-type: none"> • Use local and regional labour (Nelson Mandela Bay Municipality, Sarah Baartman District Municipality). • Preferentially employ previously disadvantaged individuals. • Where non-local specialist staff is required, implement a training programme to up skill local labour to assume these positions over a period of five years. 								
Algoa 1 Option 1&7	Regional (2)	Medium (2)	Long-term (3)	High (7)	Possible	MEDIUM	+ ve	Medium

Bivalve culture

The original rating (pre-application BAR) of the extent was revised from 'local' to 'regional', as it is likely that employees would be sourced from the District Municipal Area.

The Feasibility Study of Oyster and Mussels Aquaculture (Advance Africa Management Services 2017) estimated that an oyster and mussel facility would employ approximately 34 and 40 people during the operational phase (this number includes processing of the product).

The potential additional job opportunities associated with bivalve culture in Algoa Bay were revised based on new information obtained during the pre-application public participation phase from the existing Zwembesi Farms (Pty) Ltd. (Zwembesi). Mussel farming is currently not feasible at Algoa 6 due to insufficient water depth (refer to Section 3.3 for more information). Furthermore, Algoa 1 is

no longer considered in its entirety for the application for Environmental Authorisation but has been reduced to the northern portion (i.e. Algoa 1 Option 1) (See Section 3.5.1 for more information).

Algoa 6: Zwembesi currently leases 6% of the Algoa 6 precinct (i.e. 27.7 ha) and produces 100 t of oysters per year on 13 ha, with the intention to produce 140 t in 2019 on 15 ha. Zwembesi is expected to produce over 200 t per year on 27.5 ha. Zwembesi currently employs 26 permanent staff on the farm, as well as seven permanent staff at the oyster bar and distribution centres in Cape Town and a further 20 temporary staff at the export packing facility (Simon Burton, Zwembesi Farms (Pty) Ltd, comment provided during the pre-application phase, Appendix F of the BAR). At full production, Zwembesi is expected to employ 50 permanent staff and 20 temporary staff.

Based on the information provided above, Algoa 6 (479 ha, including Zwembesi Farms) could potentially accommodate 16 additional oyster farms, which would provide an additional 800 permanent and 320 temporary jobs.

Algoa 1 Option 1: The Final Basic Assessment Report and Environmental Authorisation for the Saldanha ADZ (SRK Consulting 2017) calculated total ungraded bivalve production from mussel densities of 13.25 t/ha/year and oyster densities of 1.5 t/ha/year based on a mussel: oyster ratio of 70:30 (Probyn *et al.* 2015⁴). Note that the existing oyster farm seeds part-grown oysters (i.e. > 25 mm in length) rather than seeding spat (5-25 mm), which reduces the grow out time from 18 months to 7 months. Consequently, production tonnage at Zwembesi is significantly higher than the recommended tonnage for Saldanha Bay with 8 t/ha/year. Spat requires a smaller basket mesh size, which cannot withstand oceanographic conditions at Algoa 6 (also applicable to Algoa 1 Option 1), although efforts to advance technology is ongoing (Simon Burton, Zwembesi Farms (Pty) Ltd, *pers. comm.* June 2019). For this reason, potential employment opportunities for oyster culture and mussel culture were calculated based on the figures provided by Zwembesi Farms and the Final Basic Assessment Report for the Saldanha ADZ respectively.

Assuming that a mussel: oyster ratio of 70 : 30 is implemented at Algoa 1 Option 1 (areal ratio as per SRK Consulting 2017), 218 ha would be allocated to mussels and 94 ha allocated to oyster farming. Using the figures provided by Zwembesi Farms, this would mean that oyster culture on 94 ha at Algoa 1 Option 1 would allow for the development of three additional farms with 150 permanent and 60 temporary employment opportunities. A viable mussel farm requires an annual production of 500 t (Advance Africa Management Services 2017). At the estimated mussel density of 13.24 t/ha/year (SRK Consulting 2017), one mussel farm would occupy 38 ha at Algoa 1 Option 1. Therefore, 70% or 218 ha of this site could potentially support six mussel farms, creating 240 job opportunities (40 jobs per viable farm as cited in Advance Africa Management Services 2017).

In summary, based on the scenario described above, the following number of direct job opportunities could be created by bivalve farming in Algoa Bay:

- Algoa 1 Option 1: 450 (areal mussel to oyster ration of 70:30)
- Algoa 6: 1 120 (oyster culture only)

⁴ Calculation based on high Production Carrying Capacity (PCC) and high Ecological Carrying Capacity (ECC) scenario. The Environmental Authorisation for the Saldanha Bay ADZ specified a total ungraded bivalve production tonnage of

Valderrama et al. (2010) estimated the average employment multiplier (i.e. number of indirect jobs generated by each direct job) for aquaculture in Sub-Saharan Africa as 1.4. Britz (2014) more recently estimated that for sea-based finfish farming, one service sector employment opportunity would be created for each direct on farm employment opportunity. In total, bivalve culture at the Algoa Bay ADZ would have the potential to create between 3 140 and 3 768 direct and indirect job opportunities.

The bivalve farming industry is already established in Algoa Bay and South Africa as a whole (Zwembesi Farms) (see Section 10.5.2.1 for more information). Considering that Algoa 1 Option 1 does not have water quality issues when compared to Algoa 6, the probability of this impact occurring is rated as 'probable' and 'possible' respectively. The positive impact of new employment opportunities as a result of bivalve farming at Algoa 1 Option 1 and 6 was rated as **high** after the implementation of benefit enhancing measures (Table 30).

Table 31 **OP-SE2b – New employment opportunities, income and skills development for bivalve culture at the proposed Algoa Bay sea-based Aquaculture Development Zone.**

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Algoa 1 Option 1	Regional (2)	Medium (2)	Long-term (3)	High (7)	Probable	HIGH	+ ve	High
Algoa 6	Regional (2)	Medium (2)	Long-term (3)	High (7)	Possible	MEDIUM	+ ve	High
Benefit enhancing measures:								
<ul style="list-style-type: none"> • Use local and regional (Nelson Mandela Bay Municipality, Sarah Baartman District Municipality). • Preferentially employ previously disadvantaged individuals. • Where non-local specialist staff is required, implement a training programme to up skill local labour to assume these positions over a period of five years. • Bivalve farming at Algoa 6: minimise effluent pollution in the bay as well as implementing an 'early warning' system to warn affected parties of spills. 								
With mitigation	Regional (2)	Medium (2)	Long-term (3)	High (7)	Probable	HIGH	+ ve	Low

Cumulative impacts

It must be carefully considered that the impact of new employment opportunities did not take into consideration the potential job losses as a result of negative impacts on the tourism industry as described and assessed in Section 10.5.2.3. Job losses are a knock-on effect from visual impacts, water quality impacts, change in behaviour of ocean predators (and perceived increased risk of shark attacks), ecosystem degradation etc. Net job creation associated with the ADZ is therefore incumbent on preventing knock-on effects on existing jobs. The various impacts that could have a knock-on effect have been assessed in the Basic Assessment Report and mitigation measures are provided (essential and recommended). These mitigation measures are included in the Environmental Management Programme (EMPr, Appendix A of the BAR), which, should Environmental Authorisation be granted, become a legally binding document to be implemented by the Department of Agriculture, Forestry and Fisheries.

It must, however, be noted that based on the choice modelling study conducted by Britz *et al.* (2016) and feedback from stakeholders thus far, it appears that the perception of an increased risk of shark attacks occurring (whether this risk is real or not) remains one of the most important issues of concern relating to the proposed development. While mitigation measures have been recommended for negative visual and marine ecological impacts, no meaningful mitigation measures are available to reduce the perceived increased risk of shark attack. The perceived higher risk of shark attacks alone could potentially have a profound direct impact on the local economy, should the Ironman Event (and other events) be moved to a different location (Ironman Organisers indicated during the appeal phase that the event would be moved should finfish cages be installed at Algoa 1 Option 1). Furthermore, this impact could potentially be irreversible and occur during the pilot phase (Section 9.5.2.3). The perceived increased risk of shark attack is mostly applicable to finfish farming at Algoa 1 Option 1 and could most likely be effectively reduced in Alternative Option B (no finfish at Algoa 1 Option 1) or Option C (Algoa 1 Option 1 excluded from ADZ).

Alternative Option C is likely to have a net positive cumulative impact on employment in the area as all socio-economic impacts associated with Algoa 1 Option 1 would be avoided. Alternative Option B (no finfish farming at Algoa 1 Option 1) could potentially have a higher net positive cumulative impact, when compared to Alternative Option C, however, impacts of bivalve farming at Algoa 1 Option 1 on sailing competitions (Section 10.5.2.3) and impacts on the sense of place (Section 10.4.1.1) may still be a concern (low impact significance after the implementation of mitigation measures). Alternative Option A (finfish and bivalve culture at Algoa 1 Option 1) has a high unquantified, but real risk of impacting on existing employment in the tourism and hospitality industries with a potentially irreversible, negative cumulative effect (Section 10.5.2.6).

10.5.2.3 Potential impact OP-SE3: Existing land-based and sea-based marine aquaculture activities

Cumulatively, sea-based aquaculture farms could potentially contribute to the nutrient loading in the bay, which, in turn would adversely impact existing marine aquaculture production (note that finfish farming has a greater impact when compared to bivalve farming). Water quality deterioration (i.e. nutrient loading) is assessed in detail in the marine ecology impact assessment and it is assumed that the impact of water quality deterioration on the ecosystem would be representative of the impact to the marine aquaculture activity. This assessment of this impact is therefore not repeated here.

Existing mariculture activities in the Algoa Bay area could also benefit from the proposed ADZ, which could assist in the development of a local and export market for a variety of species and generate critical mass and economies of scale for this sub-sector. Aquaculture is the fastest growing form of food production in the world and a significant source of protein for people in many countries. The demand for fish products is expected to continue rising in the coming decades, with an additional 27 million tonnes of production being needed in 2030 to maintain the present level of per capita consumption (United Nations 2010). The development of new fish farms will therefore contribute towards the growing demand.

The development of additional aquaculture facilities has the potential to contribute towards the establishment of a viable mariculture subsector in South Africa and the positive impact would be equal

for bivalve and finfish culture and are not specific to the precincts. The impact has therefore been assessed for all sites and both culture types in one impact table (Table 32).

Most of the current finfish farming to date were isolated pilot-scale studies, with a great need for an integrated industry that could work together to ensure that the full potential thereof is realised in future. Through the development of specialized aquaculture technology, farming process can be improved to ensure the production of high-quality products in a cost-effective manner.

Algoa 1 Option 1 is suitable for both mussel and oyster farming due to sufficient water depth (~ 40 m). Zwembesi Oyster Farms indicated that pathogens assimilated by oysters are purged within two weeks of uptake and currently, grown oysters are held in controlled land-based facilities until the product is fit for consumption. Algoa 1 Option 1 would enable oyster growers to utilise cleaner water for the grow out phase and reduce the risk of pollution delaying the release of the product on the market.

The positive impact on existing mariculture activities was rated as **medium**. A cooperative approach linked to the fish farms would ensure that other existing mariculture projects are not considering the proposed fish farms as a threat, but rather an opportunity to support their own endeavours.

Table 32 OP-SE3 – Positive impacts on existing mariculture activities without and with mitigation measures by Algoa Bay Aquaculture Development Zone precincts 1 Option 1, 6 and 7. The potential benefit affects all precincts and culture types equally and is therefore considered the same for all precincts.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional (2)	Low (1)	Long-term (3)	Medium (6)	Probable	MEDIUM	+ ve	Medium
Benefit enhancing measures:								
<ul style="list-style-type: none"> None identified 								

Cumulative impacts

If well managed, finfish farms will contribute to critical mass and economies of scale in support of mariculture activities in the area, in particular skills development, feed production, processing and storage facilities and other related infrastructure. Bivalve farming is already established in South Africa and will contribute to the existing local and export markets.

10.5.2.4 Potential impact OP-SE4: Recreational water sport participants (excluding SCUBA diving)

Algoa Bay is home to a number of beaches that are located southeast of the Port Elizabeth harbour. The popular Hobie Beach in the vicinity of Shark Rock Pier and the Boardwalk, is a favourite for swimming, sunbathing and body surfing, and the venue for the annual "Splash Festival", beach volleyball and world boardsailing championships. Pollock Beach is favoured by surfers because of its excellent waves, whilst Humewood Beach is ideal for families. Hobie Beach and Pollock Beach are

located a bit further away from the harbour in probably the most popular tourism areas. More information on non-motorised sport activities is provided in Section 9.5.2.1.

Port Elizabeth also offers various adventure and sport activities, including national and international sporting events (Section 9.5.2.2). Labelled as the "Water Sport Capital" of Africa, Port Elizabeth offers surf lifesaving, rubber ducking, jet-skiing, canoeing, surfing, open water swimming, paragliding and power-boating events on a regular basis.

Competition for recreational sea-space

Water sports such as surfing, kite boarding, surf-ski paddling, stand up paddle boarding, open water swimming and sea kayaking have seen significant growth in Nelson Mandela Bay over recent years. The closest point to land of Algoa 1 Option 1 is over 2 km and the popular swimming and water sport beaches off Summerstrand are approximately 3.5 km distant. Algoa 7 lies approximately 4.8 km offshore from the popular St Georges Strand and Wellington Estate which are popular bathing beaches and recreational facilities.

Except for the Bell Buoy Challenge, Mariculture developments at Algoa 1 Option 1, 6 and 7 is unlikely to affect non-motorized recreational marine users in terms of sea space, despite the popularity of these activities in the Algoa Bay area. These activities mostly take place within 1 km of the coast as shown in the proposed beach aquatic safety zone (Figure 25). Algoa 6 is situated very close to the shore overlapping with the existing TNPA allocated mariculture area (SRK 2008) and there are no recreational beaches or facilities nearby.

Concerns over increased risk of shark attacks occurring as a result of finfish farming

Forty percent of stakeholders who provided comment expressed concern over the increased risk of shark attacks occurring, sometimes explicitly stating that they would no longer participate in water sports should a finfish farm be placed at Algoa 1 Option 1, and to a lesser extent at Algoa 7 (refer to the Stakeholder Consultation Report in Appendix F of the BAR). Note that this concern is not applicable to bivalve farming at Algoa 1 Option 1 and 6.

Algoa Bay is the eastern most distribution of the Cape fur seal and breeding takes place on Black Rocks (Mills & Hes, 1997). The presence of this breeding colony may act as an important factor for the aggregation of Great white sharks (*Carcharodon carcharias*), which are known to target seal breeding colonies as feeding grounds (Kock *et al.* 2013, Hewitt *et al.* 2018). While a range of sizes of white sharks can be found around Seal Island, the inshore areas of Algoa Bay are home to the greatest proportion of young-of-year sharks (Dicken & Booth 2013)". Although finfish cages have the potential to attract sharks, data on the influence of fish cages on large shark behaviour is scarce. They are undoubtedly attracted to fish cages at times, but the risk to bathers and swimmers is unknown. This issue is discussed at some length in the "Description of the affected environment" in Section 9.5.2.1.

The marine specialist study assesses the impact of the development on shark populations (predators in general) and recommends the installation of predator nets, which prevents sharks from gaining access to the cages. Monitoring of shark movements and investigating the possibility of a shark spotter programme would constitute further mitigation measures. It should also be noted that it is in the farmer's best interest to prevent predators (predatory fish including sharks, cetaceans, seals and birds) from gaining access to the cages as stock losses would significantly impact their business.

Research by the leading South African shark scientists has shown that positive conditioning can only arise if white sharks gain significant and predictable food rewards (Johnson and Kock 2006).

It is, however, important to note that no meaningful mitigation measures are available to reduce the perceived increased risk of shark attack. The perceived (whether the actual risk is higher or not) higher risk of shark attacks occurring could potentially reduce participation in water sports activities, especially in the recreational area at Algoa 1 Option 1. This impact is expected to occur during the pilot phase of the project as the mere presence of finfish cages (not the number thereof) will affect the decision of stakeholders to continue or start participating in water sport. It is expected that the visibility of a finfish farm from the shoreline influences the intensity of the impact.

Furthermore, the decision to continue any of the sport events described in Section 9.5.2.2 lies with one entity, i.e. the event organiser. Should the event organiser feel that the risk of a shark attack occurring is too high, it is likely that the event will be stopped, or moved to a different location, further reducing water sport participants utilising the beaches around Algoa 1 Option 1.

Aquaculture structures at Algoa 1 Option 1 could impact wave quality at popular surf spots

The surfing community provided comment during the previous EIA process, stating that the predominant surfing swells for the bay's beaches are those occurring from a W-SW direction, which refract around Cape Recife into the bay. It was claimed that the position of the farm would significantly impact on the size and quality of the swells reaching the premier surf spots, with the aquaculture infrastructure dissipating swell size. The cages and long-lines (bivalve culture) are flexible and float and should not dissipate swell noticeably (as for example a near-shore reef would do, which are present inshore of Algoa 1 Option 1 site). However, this impact cannot be ruled out with certainty.

Water quality concerns associated with finfish farming

Thirty percent of stakeholders who provided comment during the pre-application consultation phase expressed concern that finfish farming could impact recreational activities (refer to the Stakeholder Consultation Report in Appendix F of the BAR). Most of these comments were applicable to the proximity of Algoa 1 Option 1 to the popular beaches of Port Elizabeth. Concerns included:

- Human health will be impacted by diseases and chemicals used in finfish farming
- The Blue flag status of Port Elizabeth's beaches will be impacted
- Feed and faeces will wash up on the beaches

In assessing the impact on recreational participants, it is important to note that (please refer to Section 9.5.2.1 for more information):

1. Finfish farms are not known to be a source of bacteria and viruses that are harmful to humans;
2. Chemical pollution from finfish cages is not known to impact humans as a result of recreational activities;
3. Nutrient input from the finfish farm is significant, but not likely to cause nuisance algae growth on the beaches; and
4. Uneaten food and faeces/organic waste are not expected to wash up on the beaches situated more than 3 km from the Algoa 1 Option 1.

It is not anticipated that the Blue Flag status of Port Elizabeth's beaches will be impacted by the proposed development. There appears to be no evidence confirming that finfish cage farming in an

area with high dispersion potential such as the Algoa 1 Option 1 (and Algoa 7) site could lead beach pollution (there is no evidence available for this to occur in sheltered waters either), which is congruent with the statement that suspended particles usually settle within 200 m of the finfish farm (Mead *et al.* 2009). Finfish farms would be required to adhere to the conditions of the Environmental Management Programme, which prescribes mitigation measures for minimising impacts on the water column.

Impact assessment

Given the above information, the impact on recreational water sport participants was rated based on (1) competition for sea space, (2) water quality concerns, (3) potential impact on wave quality and size at popular surf spots, and, (4) in the absence of quantitative information regarding the actual increased risk of shark attacks occurring, perceived risk of increased shark attacks (note that the latter is only applicable to finfish farming). The impact was rated separately for finfish and bivalve farming.

Finfish farming: Ironman organisers indicated during the 2014 appeal phase and during the pre-application commenting period of the current BA process, that the event would be moved should finfish cages be installed at Algoa 1 Option 1). Consequently, the scale of the impact remains 'local', as larger events attracting participants from beyond Port Elizabeth are likely to continue competing at a different location. This impact could potentially be irreversible due to the role of perception in influencing people's behaviour. Furthermore, Port Elizabeth constitutes a sensitive environment as water sport and beach recreation contribute to people's physical and mental health, community development and pride in the 'water sport capital' of South Africa. Finally, a multitude of sport events could be either moved or stopped as a result of finfish farming at Algoa 1 Option 1. Due to the above reasoning, the intensity of the impact has been increased from 'medium' to 'high'. Furthermore, the continuation of sporting events and festivals in Port Elizabeth is dependent on decisions made by a few entities. The probability of this impact occurring was therefore revised from 'possible' to 'probable', changing the impact significance rating for finfish farming at Algoa 1 Option 1 from 'low' to **high** before and **medium** after mitigation.(Table 33). No sporting events occur on the beaches at Algoa 7 and the intensity of the impact will therefore be lower than for Algoa 1 Option 1. The probability of the impact occurring is also comparatively lower. The impact significant for finfish farming at Algoa 7 is therefore **low**. Based on the comments submitted thus far and the results of the socio-economic specialist study (Britz *et al.* 2016, Appendix D of the BAR), the confidence in this rating is 'medium'.

Bivalve farming: Bivalve culture is much less likely to attract sharks when compared to finfish cages and the impact significance was therefore assessed separately. Bivalve culture could potentially impact on the Bell Buoy Challenge open water swimming event, due to its proximity (650 m) to Algoa 1 Option 1 and safety concerns regarding participants and aquaculture maintenance vessels. A safety protocol could be developed with the relevant stakeholders to ensure that the Bell Buoy open water swimming event continues to take place. The impact rating for bivalve farming at Algoa 1 Option 1 should therefore be **very low** after the implementation of mitigation measures (Table 34). Based on the comments submitted thus far and the results of the socio-economic specialist study (Britz *et al.* 2016, Appendix D of the BAR), the confidence in this rating is 'medium'.

Table 33 CP-SE4a – Assessment of negative impacts on water sport participants without and with mitigation measures for *finfish* culture at Algoa Bay Aquaculture Development Zone precincts 1 and 7.

Site	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Algoa 1 <u>Option 1</u>	Local (1)	High (3)	Long-term (3)	High (6)	Probable	HIGH	- ve	Medium
Algoa 7	Local (1)	Medium (2)	Long-term (3)	Medium (5)	Possible	LOW	- ve	Medium
Essential mitigation measures:								
<ul style="list-style-type: none"> • Monitor large shark movement patterns before and after ADZ development as per recommended EMPr monitoring components. • <u>Investigate the possibility of implementing a shark spotter program</u> • <u>Mitigation measures applicable to maintaining water quality (i.e. stocking densities, feeding regimes)</u> • <u>Develop a safety protocol for the Bell Buoy Challenge open water swimming event to prevent accidents involving participants and aquaculture maintenance vessels. Operators must avoid maintenance activities for the duration of the race.</u> 								
Algoa 1 <u>Option 1</u>	Local (1)	Medium (2)	Long-term (3)	Medium (6)	Probable	MEDIUM	- ve	Medium
Algoa 7	Local (1)	Medium (2)	Long-term (3)	Medium (5)	Possible	LOW	- ve	Medium

Table 34 CP-SE4b – Assessment of negative impacts on water sport recreational activities without and with mitigation measures for *bivalve* culture at Algoa Bay Aquaculture Development Zone precincts 1 and 6.

Site	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Algoa 1 <u>Option 1</u>	Local (1)	Medium (2)	Long-term (3)	Medium (6)	Possible	LOW	- ve	Medium
Algoa 6	Local (1)	Low (1)	Long-term (3)	Low (5)	Improbable	VERY LOW	- ve	Medium
Essential mitigation measures:								
<ul style="list-style-type: none"> • <u>Develop a safety protocol for the Bell Buoy Challenge open water swimming event to prevent accidents involving participants and aquaculture maintenance vessels. Operators must avoid maintenance activities for the duration of the race.</u> 								
Algoa 1 <u>Option 1</u>	Local (1)	Low (1)	Long-term (3)	Low (5)	Improbable	VERY LOW	- ve	Medium
Algoa 6	Local (1)	Low (1)	Long-term (3)	Low (5)	Improbable	VERY LOW	- ve	Medium

10.5.2.5 Potential impact OP-SE5: Recreational SCUBA diving activities

Recreational scuba diving is a popular activity within Algoa bay and at least four dive shops located within Port Elizabeth supply training and equipment. During the current BA process, Prodiver provided updated coordinates, which indicates that contrary to information obtained in 2012/2013, a low-profile reef is likely to be present near the centre of Algoa 1 Option 1 (Figure 28) at an approximate depth of 25-29 m. According to Louis van Aardt (owner of Prodiver, pers. comm. June 2019), this dive site (Basket Star) is the only suitable deep diving site used by Prodiver (and potentially other industry members) to train advanced divers. Prodiver has indicated that this dive site cannot be replaced and that the loss of this site may economically impact their business. Seven of the other dive sites provided by Prodiver are situated 500-1000 m from the border of Algoa 1 Option 1 (Figure 28). Several annual dive events also occur in this area, which are detailed in Section 9.5.2.2.

The presence of elevated nutrients/suspended solids is usually attributed to a reduction in the clarity of water, i.e. light penetration or visibility. If marine ecological impacts are not mitigated adequately, nutrient loading and particulate matter could smother nearby reefs, rendering these precincts no longer attractive for SCUBA tourists. However, model results for *finfish* farming indicate that both Algoa 1 Option 1 and Algoa 7 have acceptable dispersion potential and water quality standards are predicted to be met within the ADZ boundaries (Wright *et al.* 2019). Nutrient loading is likely to be significantly lower for bivalve farms as bivalves produce less waste (solid and nutrients) when compared to finfish.

The main SCUBA diving company in Port Elizabeth (Prodiver) expressed concern that the resident Tooth Sharks that represent a “huge draw card for divers worldwide” could leave the reefs to spend more time near the finfish cages in search of food. At the same time, Prodiver also expressed concerns regarding general increased presence of sharks impacting on diver safety. Research by the leading South African shark scientists has shown that positive conditioning can only arise if white sharks gain significant and predictable food rewards (Johnson and Kock 2006). Note that this concern is not applicable to bivalve farming. The marine specialist study assesses the impact of the development on shark populations (predators in general) and recommends the installation of predator nets, which prevents sharks from gaining access to the cages. Monitoring of shark movements would constitute further mitigation measures. It should also be noted that it is in the farmer's best interest to prevent predators (predatory fish including sharks, cetaceans, seals and birds) from gaining access to the cages as stock losses would significantly impact their business.

Algoa 1 Option 1 lies adjacent to many very popular diving sites and new information indicates that without mitigation measures Prodiver (and other operators) would lose a valuable deep diving site for advanced students. The probability of this impact occurring was therefore increased from ‘possible’ to ‘probable’ for both culture types. Consequently, the impact significance for *finfish* farming at Algoa 1 Option 1 was increased from ‘low’ to **medium** before mitigation measures (Table 35).

Together with other mitigation measures recommended in the marine specialist study, maintaining access to the Basket Star dive site at Algoa 1 Option 1 (Figure 41) reduces the impact at this site to **low** for finfish farming and to **very low** for bivalve farming.

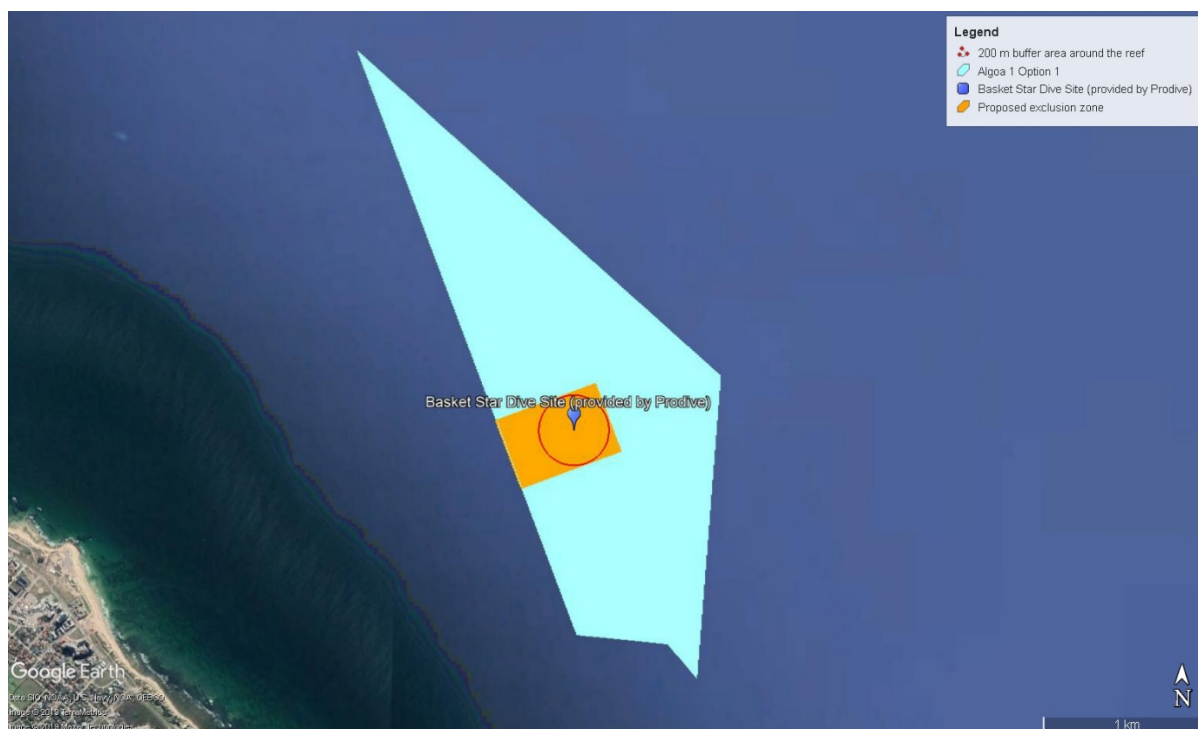


Figure 41 Basket star dive site identified by Prodiva near the centre of Algoa 1 Option 1 and recommended buffer and access zone to be excluded from the proposed Aquaculture Development Zone. The area to be excluded is 27.6 ha in size.

One diving site is situated 850 m south of Algoa 7 and the intensity of this impact is therefore considerably lower than for Algoa 1 Option 1. The probability of this impact occurring was rated as 'possible' and the impact significance rating was therefore **very low** before the implementation of mitigation measures (Table 35).

Although *bivalve* farming at Algoa 1 Option 1 has a lower ecological impact on adjacent reef systems and a much lower likelihood of attracting predators, the impact on excluding dive operators from the Basket Star diving site increases the probability of this impact occurring to 'probable'. The impact significance rating was therefore raised from 'very low' to **low** without mitigation measures. After mitigation (same as for finfish farming), the impact rating is reduced to **very low** (Table 36).

There are no dive sites in the vicinity of Algoa 6 and the impact of this site was therefore not assessed.

Table 35 CP-SE5a – Impact on SCUBA diving activities as a result of *finfish farming* at Algoa 1 Option 1 and Algoa 7 of the proposed sea-based Algoa Bay Aquaculture Development Zone.

Site	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Algoa 1 <u>Option 1</u>	Local (1)	Medium (2)	Long-term (3)	Medium (6)	Probable	MEDIUM	- ve	Medium
Algoa 7		Low (1)		Low (5)	Possible	VERY LOW		
Essential mitigation measures:								
<ul style="list-style-type: none"> Implement mitigation measures recommended in the marine specialist study for reducing organic and chemical pollution. Install predator nets to prevent sharks from obtaining a reliable food reward from the cages (marine specialist study) Algoa 1 Option 1: Maintain safe access to the Basket Star dive site. 								
Algoa 1 <u>Option 1</u>	Local (1)	Medium (2)	Long-term (3)	Medium (6)	Possible	LOW	- ve	Medium
Algoa 7		Low (1)		Low (5)	Possible	VERY LOW		

Table 36 CP-SE5b – Impact on SCUBA diving activities as a result of *bivalve farming* at Algoa 1 Option 1 and Algoa 6 of the proposed sea-based Algoa Bay Aquaculture Development Zone.

Site	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Algoa 1 <u>Option 1</u>	Local (1)	Low (1)	Long-term (3)	Low (5)	Probable	LOW	- ve	Medium
Essential mitigation measures:								
<ul style="list-style-type: none"> Implement mitigation measures recommended in the marine specialist study for reducing organic and chemical pollution. Algoa 1 Option 1: Maintain safe access to the Basket Star dive site. 								
Algoa 1 <u>Option 1</u>	Local (1)	Low (1)	Long-term (3)	Low (5)	Possible	VERY LOW	- ve	Medium

10.5.2.6 Potential impact OP-SE6: Negative economic impact on Port Elizabeth – with a focus on the existing tourism industry and businesses relying on the water sporting industry

Labelled as the "Water Sport Capital" of Africa, Port Elizabeth regularly offers a wide variety of international, national and local water sporting events. Port Elizabeth is a popular international tourism destination, in part, because of these competitive events, which include the international Ironman event (more information on the events is provided in Section 9.5.2.2).

Furthermore, terrestrial and marine eco-tourism destinations and attractions are plentiful in Algoa Bay. Island, Sea & Sundowner Cruises enable one to see Cape fur seals, numerous sea birds, surrounding shipwrecks, as well as whales and dolphins. The St Croix Island Marine Reserve is home to one of the larger breeding colonies of endangered African Penguins in South Africa, Cape fur seals and whales.

A mixed-use waterfront development has been proposed for the south side of the harbour and Kings Beach Precinct, with the proposed plan including freight handling, residential and tourist facilities, and commercial operations geared at increasing the economic development and financial sustainability capacity of Nelson Mandela Bay.

As described above and in more detail in Sections 9.5.2.1-9.5.2.3, Port Elizabeth currently offers a variety of tourism destinations and activities and the city intends to further develop the tourism sector in the area. The tourism potential of Port Elizabeth and its surrounding environment is still largely untapped and has a vast future potential that is in line with global tourism market trends (international tourism expert Prof. Ernie Heath in Tourism Tattler 2018).

The hospitality industry (accommodation, food and drink), curio shops, street vendors, as well as street artists rely on tourists and local coastal users for their income and provide many jobs to local the local community. The original socio-economic specialist study (Bloom 2013) stated that should tourism decline by 5%, there will most likely be a proportionate decrease in business. Algoa Bay's marine coastal environment supports a large proportion of the tourism and local water sport sector. The development of the marine and coastal environment must therefore take cognisance of these existing activities.

The impact on the above-mentioned activities themselves (note not the economic impact) has been assessed in Sections 10.5.2.4 and 10.5.2.510.5.2.3. It was established that competition for sea-space with water sports participants and events is limited (Section 10.5.2.5), although diving operator and yachting event routes around Algoa 1 Option 1 may have to be adjusted (Section 10.5.2.8), with potential financial implications.

The local tourism industry, recreational activities and businesses relying on tourism and general beach utilisation could be indirectly impacted by the proposed ADZ, which could cause ecosystem degradation (marine specialist study), negative visual impacts (sense of place), and a change (or even perceived change) in behaviour of ocean predators. Most of these knock-on effects are primarily applicable to finfish farming at Algoa 1 Option 1.

The various impacts that could have a knock-on effect have been assessed in the Basic Assessment Report and mitigation measures are provided (essential and recommended). These mitigation

measures are included in the Environmental Management Programme (EMPr, Appendix A of the BAR), which, should Environmental Authorisation be granted, become a legally binding document to be implemented by the Department of Agriculture, Forestry and Fisheries.

The Algoa 7 precinct is located further away from the popular Port Elizabeth beaches, although it lies adjacent to the recently promulgated Addo Elephant Park MPA. This raises concerns regarding its potential impact on conservation and ecotourism activities linked to the MPA. It can also have an impact on whale watching close to Bird Island and discourage people enjoying some of the other recreational activities, such as diving. The impact on whale and dolphin watching was also a particular concern in Mossel Bay where a mariculture project encompassing 36 finfish cages was proposed by Irvin & Johnson.

The Bloom (2013) assessment and the objections submitted by stakeholders during the previous and current application processes identified many possible external costs that should have been incorporated with the feasibility analysis conducted by Britz *et al.* 2016. However, within the timeframe and budget provided for the previous EIA (Bloom 2012, 2013), comparative feasibility study (Britz *et al.* 2016) and current BA process, such costing was not feasible, and given the speculative estimates of the revenue production costs, precision in the calculation of external costs was not warranted (Britz *et al.* 2016). The impact assessment was therefore completed based on qualitative data, i.e. the perceptions expressed during the previous EIA process and the results of the social choice modelling experiment conducted by Britz *et al.* (2016) (Table 37 and Table 38). (Although it should be noted that the output of the perception survey was in fact quantitative, which is common in socio-economic studies).

It is noteworthy that during the pre-application stakeholder consultation process, six percent of the people who provided comment felt that a study quantifying the potential economic losses should have been conducted. Peter Britz from the Rhodes University, as the lead author on the comparative studies, responded to this concern by stating that: “The socio-economic report consisted of two components which need to be read together, visibly 1) the social choice survey which modelled the perceived negative/positive environmental and recreational effects establishing an Aquaculture Development Zone and 2) a detailed economic analysis of the feasibility of aquaculture in Algoa Bay which included a realistic projection of the production potential of the sites, income, costing, and jobs. The economic feasibility analysis which was compiled by aquaculture industry experts is quantitative and considered robust based on market demand, real costs and prices. Read together, the two components of the socio-economic report substantively address the Minister’s brief and provide a basis for her making a decision.”

Britz *et al.* 2016 concluded that (page 25): “it is entirely appropriate that the social choice be partly informed by social preference, and not only with reference to expert opinion.” Furthermore, the expert opinion in the final feasibility study by Britz and Sauer (2016) concluded that “For Algoa 1, the socio-economic feasibility was ranked ‘moderately feasible’ for most indicators (Table 7). The unquantified socio-economic costs and trade-offs associated with the ‘tourism and recreation’ economy were however ranked as a ‘very low feasibility’.” The outcomes of the social preference study, the expert opinion as stated above, as well as the comments provided by the public to date (which are mostly congruent with the Britz *et al.* 2016 study) have guided the EAP in revising the economic impact rating.

Although stated in the previous EIA and the pre-application process, socio-economic monitoring is no longer recommended as a mitigation measure. The purpose of monitoring is to verify the degree of impact and to determine whether mitigation measures implemented are indeed effective and to inform future environmental management. Monitoring cannot act as a mitigation measure itself.

The degree of negative economic impact differs according to the precinct as well as the type of activity (i.e. finfish vs. bivalve) and impacts of these precincts have therefore been assessed separately in (Table 37 and Table 38). Mitigation measures for this impact include those listed in the visual impact assessment (including site reduction), marine ecological and heritage specialist studies. Negative economic impacts on Port Elizabeth are generally greater for finfish culture and at the Algoa 1 Option 1 precinct.

For finfish farming at Algoa 1 Option 1, this impact assessment shows that perceived higher risk of shark attacks alone could potentially have a profound impact on the local economy. As an example, Ironman Organisers indicated during the 2014 appeal phase and the pre-application consultation of the current BA process that the event would be moved should finfish cages be installed at Algoa 1 Option 1. This impact could potentially be irreversible and occur during the pilot phase. It has been demonstrated that there are few mitigation measures available to influence the perception of water sport participants. Furthermore, the beaches and marine environment near Algoa 1 Option 1 precinct constitute the main area where water sport events and activities take place (i.e. sensitive environment). In the absence of a detailed, quantitative socio-economic study, a precautionary approach should be applied and the intensity of the negative impact on the local economy should remain 'high' after the implementation of mitigation measures for visual, marine ecological and heritage impacts. It follows that the impact significance rating after mitigation has been raised from medium to high (Table 37).

For finfish farming at Algoa 7, this impact assessment shows that perceived higher risk of shark attacks could potentially have a low impact on the local economy. Although some stakeholders expressed concern with regards to finfish farming in the entire bay, most stakeholders were specifically concerned about Algoa 1 Option 1 (either not mentioning Algoa 7 or explicitly stating that the finfish farm would be acceptable there). Furthermore, Ironman organisers specifically stated that the event would be moved should finfish culture be implemented at Algoa 1 Option 1 (Stakeholder Consultation Report, Appendix F of the BAR). Algoa 7 could visually impact on eco-tourism cruises and diving expeditions passing the area. Finally, marine ecological impacts (including impacts on the adjacent Addo MPA) could have knock-on effects on eco-tourism activities, including the Penguin Baai dive site situated 800 m southeast of Algoa 7 (Section 9.5.2.1). The intensity of this impact remains 'low' and is likely to occur, resulting in a low impact rating before and after mitigation measures are implemented. However, the confidence in this rating is 'low' as it is unknown how event organisers and sport participants will react should this site be authorised (Table 37).

In comparison to finfish culture, the perceived increased risk of a shark attack occurring is not applicable to bivalve farming. However, Algoa 1 Option 1 will be competing for sea-space with diving operators and yachting event routes around Algoa 1 Option 1, which may have to be adjusted (Section 10.5.2.8) with potential financial implications (no mitigation available). After mitigation, visual impacts are likely to be low and some of the marine ecological impacts would still be applicable (although there are much fewer when compared to finfish farming). The impact can mostly be

mitigated by implementing specialist recommendations for visual, marine and heritage impacts. Based on the input provided by stakeholders, without mitigation measures, the impact of bivalve farming at Algoa 1 Option 1 was reassessed as **low** (Table 38). The intensity cannot be lowered further and the probability of the impact occurring is not influenced by the mitigation measures provided. The significance rating therefore remains **low** after mitigation measures are implemented (Table 38). Bivalve farming at Algoa 6 is unlikely to have a negative impact on the economy of Port Elizabeth. Bivalve farming at Algoa 6 does not contribute to the perceived increased risk of shark attacks, does not compete for sea space with recreational participants, and is not considered to have a significant negative visual impact. The probability of this impact occurring is ‘improbable’ and the impact significance before and after mitigation was found to be very low (Table 38).

The potentially high negative impact of the proposed development on Port Elizabeth’s economy and existing jobs must be carefully weighed up against the benefit of developing the mariculture sector in Algoa Bay. The perceived increased risk of shark attack and impacts on water quality as a result of finfish farming at Algoa 1 Option 1 appear to be the most important factors that could result in a negative economic impact. The economic impact can therefore be effectively reduced by excluding finfish from Algoa 1 Option 1 (Alternative Option B: No finfish at Algoa 1 Option 1 or Option C: Algoa 1 Option 1 excluded from ADZ).

Table 37 CP-SE6a – Negative economic impact on Port Elizabeth’s economy (i.e. loss of income and jobs) without and with mitigation measures for finfish culture at Algoa Bay Aquaculture Development Zone precincts 1 and 7.

Site	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Algoa 1 Option 1	Local (1)	High (3)	Long-term (3)	High (3)	Definite	HIGH	- ve	Medium
Algoa 7		Low (1)		Low (5)	Probable	LOW		Low
Essential mitigation measures:								
<ul style="list-style-type: none"> • Implement mitigation measures recommended for visual, marine-ecological, heritage impacts. • Monitor large shark movement patterns before and after ADZ development as per recommended EMPr monitoring components. • <u>Investigate the possibility of implementing a shark spotter program</u> 								
Algoa 1 Option 1	Local (1)	High (3)	Long-term (3)	High (3)	Definite	HIGH	- ve	Medium
Algoa 7		Low (1)		Low (5)	Probable	LOW		Low

Table 38 CP-SE6b – Negative economic impact on Port Elizabeth’s economy (i.e. loss of income and jobs) without and with mitigation measures for *bivalve* culture at Algoa Bay Aquaculture Development Zone precincts 1 and 6.

Site	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Algoa 1 <u>Option 1</u>	Local (1)	Low (1)	Long-term (3)	Low (5)	Definite	LOW	- ve	Medium
Algoa 6		Low (1)		Low (5)	Improbable	VERY LOW		
Essential mitigation measures:								
<ul style="list-style-type: none"> Implement mitigation measures recommended for visual, marine-ecological, heritage impacts. 								
Algoa 1 <u>Option 1</u>	Local (1)	Low (1)	Long-term (3)	Low (5)	Definite	LOW	- ve	Medium
Algoa 6		Low (1)		Low (5)	Improbable	VERY LOW		

Cumulative impacts

The local tourism industry, recreational activities and businesses relying on tourism and general beach utilisation could be directly and indirectly impacted by the proposed sea-based ADZ in Algoa Bay. The tourism potential of Port Elizabeth and its surrounding environment is still largely untapped and has a vast future potential that is in line with global tourism market trends (international tourism expert Prof. Ernie Heath in Tourism Tattler 2018). Port Elizabeth is also an industrial hub and the two very different economic goals contrast each other with every new development that constitutes a deterrent to tourism and water sport. Particularly finfish farming at Algoa 1 Option 1 is highly likely to significantly contribute toward deterring tourism and water sport in Port Elizabeth. Comparatively, bivalve farming at Algoa 1 Option 1 and 6, as well as finfish farming at Algoa 7 are likely to have a lower cumulative effect. Furthermore, South Africa is currently experiencing slow economic growth and tourism is an important sector for Port Elizabeth, providing many job opportunities to the local community.

10.5.2.7 Potential impact OP-SE7: Provision of goods and services by local businesses (leakages)

The maximum benefit to local businesses will depend on their ability to supply goods and services. Income leakage could have negative consequences for the economic development of the area. The more developed the economy, the greater the potential that the demand for goods and services can be met from internal supply, rather than depend on imports that cause an outflow of funds in the form of taxation and other transfer payments to suppliers. Regional and local multipliers tend to be lower than national multipliers due to the greater potential for leakages. Consequently, a higher propensity to import exists in smaller economies, which in turn usually have high leakage factors and lower multipliers.

The propensity to import is related to the nature and scope as well as the size of the NMB economy. The Bloom (2012, 2013) assessment of the current macro-economic status of the NMB economy

relative to the Eastern Cape Province and the national economy indicates likelihood for the importation of certain goods and services predominantly during the establishment phase. These could typically include fish processing, nets and maintenance, transportation, packaging, containers, diving services, machinery and equipment. Sea cage farmers will also need a reliable source of disease-free fry to stock sea cages. These may be supplied from established hatcheries or companies may decide to initiate their own hatcheries. Bloom (2013) estimated that import propensities could be approximately 20% during the establishment and operational phases.

Payments related to the operations of the fish farms would be disbursed to registered suppliers of goods and services in the NMB area and other locations throughout South Africa. Ownership other than ownership from individuals/consortia based in the NMB area will result in revenue transfers in the form of dividend/profit repatriation.

Sea-based bivalve culture is more established in South Africa when compared to finfish culture and is likely to experience less leakages to the local economy. The impact has therefore been assessed separately for the culture types (Table 39) (note however that the precincts themselves are not a determining factor and have therefore not been assessed separately).

The intensity of leakages from the local economy as a result of finfish farming is likely to be higher than for bivalve culture, resulting in high and medium significance of this impact before mitigation measures respectively. The procurement of a substantial portion of the goods and services from the local area will mitigate against the potential for substantial leakage. A business enhancement and capacity building initiative would contribute to the mitigation of the envisaged leakage. With mitigation measures, the impact of leakages from the local economy have been rated as **medium** and **low** for the finfish and bivalve operations respectively.

At this stage, it is not possible to quantify the size of the dividends/profits that may flow out of the NMB economy due to potential "Non-NMB ownership". Once the structures of the legal entities are established and the management contracts have been finalised, it would be possible to estimate the outflow of dividends/profits (if applicable). It follows that the confidence in the significance rating is medium.

Table 39 OP-SE7 – Negative impact on income leakage *finfish and bivalve culture* at the Algoa Bay Aquaculture Development Zone on local economic development of the area.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Finfish (Algoa 1 <u>Option 1</u> & 7)	Local (1)	High (3)	Long-term (3)	High (7)	Probable	HIGH	-ve	Medium
Bivalve (Algoa 1 <u>Option 1</u> & 6)	Local (1)	Medium (2)	Long-term (3)	Medium (6)	Probable	MEDIUM		
Mitigation measures:								
<ul style="list-style-type: none"> The procurement of a substantial portion of the goods and services from the local area Business enhancement and capacity building initiative 								
Finfish (Algoa 1 <u>Option 1</u> & 7)	Local (1)	Medium (2)	Long-term (3)	Medium (6)	Probable	MEDIUM	-ve	Medium
Bivalve (Algoa 1 <u>Option 1</u> & 6)	Local (1)	Low (1)	Long-term (3)	Low (5)	Probable	LOW		

10.5.2.8 *Potential impact OP-SE8: Collision of vessels with aquaculture farms (Vessel navigation routes, anchorage areas and general boat traffic)*

The main concern of an aquaculture site situated within navigation routes of any type of vessel is collision of the vessel with the aquaculture farm, thereby potentially damaging both the vessel and the aquaculture farm. Distance from port infrastructure to the centre of the site is a key determinant of the economic feasibility of cage aquaculture. This requirement inherently increases the risk of aquaculture precincts hindering vessel traffic.

Furthermore, collision of vessels with the aquaculture farm could occur where the aquaculture farm is situated adjacent to an anchorage area (Algoa 6 and 7). Port traffic and anchorage areas must therefore be avoided and represent a fatal flaw if the site overlaps with a shipping lane or anchorage area. For this reason, Algoa 2, 3 and 4 were excluded from the previous impact assessment process due to their position in major shipping channels. Algoa 1 Option 1 is situated 4 km from the Port Elizabeth harbour and is not within proximity of any anchorage area. However, the southern portion of Algoa 1 (Option 2) is frequently used by the chokka squid industry to take shelter from big swell and strong winds. Algoa 1 Option 1 therefore poses a risk to these vessels. DAFF engaged with the TNPA early on in the Algoa 7 site selection process and confirmed that Algoa 7 is indeed situated outside of anchorage areas and does not overlap with shipping channels leading to Ngqura harbour. Due to the fact that overlap of a site with an anchorage area or shipping lane constitutes a fatal flaw, site selection was not considered as a mitigation measure in this impact assessment. Algoa 6 is situated inshore and does not overlap with shipping lanes of either of the ports, however, this site lies adjacent to an anchorage area of the Port Elizabeth harbour.

Potential impact OP-SE8a: Risk of collision between vessels and aquaculture farms as a result of drifting ships from anchorage areas

Finfish and bivalve culture pose the same collision risks and have therefore not been assessed separately.

Algoa 1 Option 1 is situated 4 km from the Port Elizabeth harbour and does not lie within proximity of any Transnet anchorage area. However, the southern portion of Algoa 1 (Option 2) is frequently used by the chokka squid industry to take shelter from big swell and strong winds during their fishing trips. Algoa 1 Option 1 therefore poses a collision risk. The strongest winds are from the west-south-west (on average 20 knots) and weaker wind from the east (generally less than 10 knots), either resulting in wind drift of anchored ships northeast or southwest. This should generally avoid collision between the chokka squid vessels and aquaculture facilities at Algoa 1 Option 1.

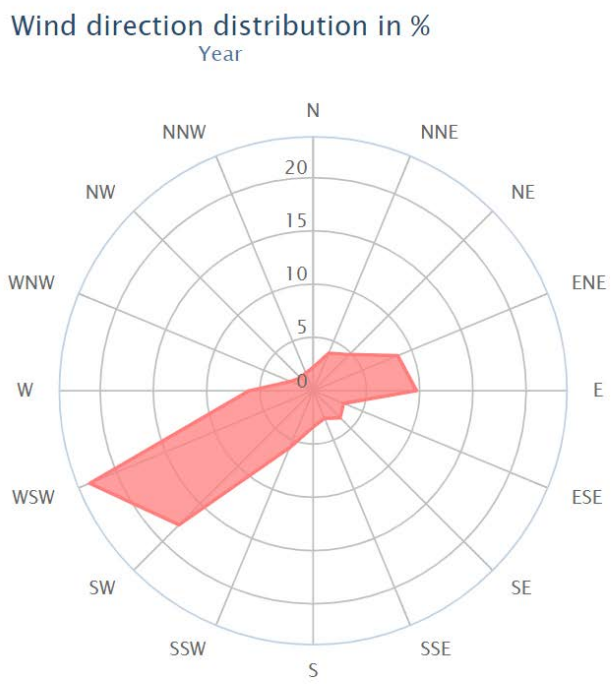
Algoa 6 is situated downwind from the existing anchorage area (to the east) and therefore constitutes a risk with regards to collision between the farms and drifting ships. A 100 m buffer zone between Algoa 6 and the anchorage area has already been considered and does not constitute a mitigation measure in this respect. Easterly winds occur strongest and most frequently during the summer months (Windfinder 2018) but on average do not exceed 10 knots (Figure 42). The risk of anchored ships drifting into Algoa 6 is therefore considered **very low**⁵ with and without mitigation measures (Table 40).

On average, Port Elizabeth experiences strongest winds from the west-south-west (20 knots) (Figure 42), which reach greatest speeds and occurrence during winter (Windfinder 2018). Furthermore, the existing buffer zone between Algoa 7 and the anchorage area to the south is only 60 m. Consequently, Algoa 7 constitutes a greater risk when compared to Algoa 6 and the risk has been rated as **low**⁶ without and as **very low** with mitigation measures (Table 40).

An additional buffer zone within the boundary of the proposed site would decrease the size of the potential aquaculture area and as such would not be ideal for the project. It would be more favourable if an appropriate buffer area could be determined by the TNPA and implemented within the boundaries of the existing anchorage areas. A buffer zone will not be available for Algoa 1 as this site is used informally.

⁵ Note that the intensity rating was amended upon review of the impact. A medium rating should be assigned if site-specific and wider natural and/or social functions and processes continue albeit in a modified way. Processes are expected to continue in the same and therefore, the intensity was changed to 'low'.

⁶ Note that the intensity rating was amended upon review of the impact. A high rating should be assigned if Site-specific and wider natural and/or social functions or processes are severely altered. Processes are expected to continue in the same way and therefore, the intensity was changed to 'low'.



© windfinder.com

Figure 42 On average, Port Elizabeth experiences strongest winds from the west-south-west (on average 20 knots) and weaker wind from the east generally less than 10 knots (Source: Windfinder.com).

Table 40 OP-SE8a – Risk of collision between vessels and aquaculture farms as a result of drifting ships from the anchorage area. Impacts were assessed without and with mitigation measures. Drifting is dependent on wind direction and strength and the risk for Algoa 1 Option 1, 6 and 7 has therefore been assessed separately.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
<u>Algoa 1 Option 1</u>	<u>Local (1)</u>	<u>Low (1)</u>	<u>Long-term (3)</u>	<u>Low (5)</u>	<u>Possible</u>	VERY LOW	- ve	Medium
Algoa 6	Local (1)	Low (1)	Long-term (3)	Low (5)	Possible	VERY LOW		
Algoa 7	Local (1)	Low (1)	Long-term (3)	Low (5)	Probable	LOW		
Mitigation measures:								
<ul style="list-style-type: none"> Consider additional buffer zone on the northern boundary of the anchorage area adjacent to the site. Clearly identified beacons and shipping channels must be identified in relation to the ADZ to assist vessels to navigate safely through the area. Install navigational markers and lights as required by SAMSA regulations. Include position of ADZ on navigational charts. Ongoing consultation with user groups to keep them informed of the ADZ developments 								
<u>Algoa 1 Option 1</u>	<u>Local (1)</u>	<u>Low (1)</u>	<u>Long-term (3)</u>	<u>Low (5)</u>	<u>Possible</u>	VERY LOW	- ve	Medium
Algoa 6	Local (1)	Low (1)	Long-term (3)	Low (5)	Improbable	VERY LOW		
Algoa 7	Local (1)	Low (1)	Long-term (3)	Low (5)	Possible	VERY LOW		

Potential impact OP-SE8b: Vessel navigation routes

Finfish and bivalve culture equally impact navigation routes and have therefore been assessed together. Yacht sailing within Algoa Bay takes place across a large area between Cape Recife and the Sundays River mouth and overlaps completely with Algoa 1 Option 1 and 7. Sea-based aquaculture could pose a navigational hazard to yachts, diving operators, cruise boats, as well as to recreational and commercial fishing vessels. Diving operator and yachting event routes around Algoa 1 Option 1 may have to be adjusted (Section 10.5.2.8), with potential financial implications. Port Elizabeth frequently hosts national and international sailing events. Spectators gather at Pollock and Hobie beaches to watch the start of the events, which is a key factor in event sponsorship. Due to the reef system inshore of Algoa 1 Option 1 the route can only be diverted offshore (approximately 6 km), thereby reducing the spectator value of this event. The ABYC anticipates that, should an aquaculture farm (finfish or bivalve) be placed at Algoa 1 Option 1, international regattas would no longer be held in Port Elizabeth due to (1) the navigational hazard in rougher sea conditions and (2) the loss of area most important for event spectators (pers. comm. 2019 Rodney Idris Hon Secretary, Algoa Bay Yacht Club).

To minimize the risk of collision, all fish cage infrastructure would have to be clearly marked on charts and by navigational markers as required by the South African Maritime Safety Authority. It is acknowledged that yachting may be affected by ADZ development within Algoa Bay, however, the relatively large area utilized by yachts within Algoa Bay and relatively small proposed ADZ areas, means that these activities should not be mutually exclusive (this is not true for yachting events as discussed in Section 10.5.2.6).

All precincts overlap to some extent with at least one type of fishing activity, while diving sites are located in proximity of Algoa 1 Option 1 and 7 and are situated within close range of marine eco-tourism boating tours (See section 9.5.2 for more information on affected user groups).

The collective risk of collision has been assessed in Table 41. The intensity of collision is considered 'medium'⁷, as navigation routes of existing vessel types may have to change, and the risk of collision remains applicable throughout the project phase (long-term). The consequence is therefore considered 'medium'. The probability of a collision occurring is relatively low without mitigation measures but is reduced to improbable when mitigation measures are implemented. The impact significance remains **low** with the implementation of mitigation measures (Table 41).

⁷ Note that the intensity rating was amended upon review of the impact. A high rating should be assigned if Site-specific and wider natural and/or social functions or processes are severely altered. Processes are expected to continue albeit in a modified way and therefore, the intensity was changed to 'medium'. The change in intensity rating reduced the overall impact significance from medium to low.

Table 41 OP-SE8b – Negative impact on vessel navigation routes with mitigation measures by Algoa Bay Aquaculture Development Zone precincts 1, 6 and 7. All precincts pose a potential hindrance to vessel traffic and collision risk is therefore considered the same for all precincts.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local (1)	Medium (2)	Long-term (3)	Medium (6)	Possible	LOW	- ve	High
Mitigation measures:								
<ul style="list-style-type: none"> Clearly identified beacons and shipping channels must be identified in relation to the ADZ to assist vessels to navigate safely through the area. Install navigational markers and lights as required by SAMSA regulations. Include position of ADZ on navigational charts. Ongoing consultation with user groups to keep them informed of the ADZ developments 								
With mitigation	Local (1)	Medium (2)	Long-term (3)	Medium (6)	Improbable	LOW	- ve	High

Cumulative impacts

There are no existing sea-based aquaculture obstructions present at this time. A number of bivalve and fish farms could have a significant impact on vessel movement within the Algoa Bay area. However, these impacts are well mitigated and cumulative impacts are unlikely to be enhanced by the proposed ADZ.

10.5.2.9 Potential impact OP-SE9: Commercial fishing industries

The proposed ADZ could contribute toward meeting the growing seafood demand and the development of new markets; however, in doing so could potentially threaten existing fishing industries if the ADZ products were to be sold on the local market. There is a concern that the supply of cheaper fish could force out competition from the traditional boat-based fishing companies. As indicated by some interviewees during the 2010-2014 EIA process, it is a concern of some stakeholders that it may be more cost-effective to produce fish in the cages than catching fish in the wild (Diederick Nel and Arno Rabe), which could leave traditional fishermen without income.

Due to security concerns mariculture operators will need to exclude other users from what was previously public sea space reducing existing fishing grounds for the chokka squid, small pelagic, shark longline and linefish commercial fisheries. Fishermen in some of the sectors operating in the Algoa Bay area are already suffering from the dwindling supply and limited resources and restricting access to important fishing grounds may exacerbate this problem.

The environmental sustainability of finfish farms forming part of the ADZ is an important consideration, as a complete disregard for the environmental impact of the finfish cage farming will have a disastrous effect on the local fishing industry. An example for this would be the transmission of disease to wild fish stock, which is especially important when farming indigenous species or when feeding fish with frozen fish (see section 9.5.2.3 for more information). Furthermore, genetic interactions with wild stocks can reduce environmental fitness of indigenous species, although with

the implementation of mitigation measures this impact is considered to be 'low'. The potential indirect impact on commercial line fisheries should finfish cage farming lead to outbreaks of diseases and parasites amongst wild stocks, is the same as the assessment for these impacts (i.e. High and Low impact significance after implementation of mitigation measures, refer to Section 10.3 and Marine Ecological Specialist Study in Appendix D of the BAR).

Stakeholders expressed concern regarding the southern part of Algoa 1 (Option 2), which overlaps with the squid breeding area frequented by current fishermen. As breeding areas provide for the best catches, the establishment of a fish farm in the same area will most likely have a significant impact on the local squid industry. The most effective mitigation measure is to reduce the size of the site and limit aquaculture to the northern section. DAFF has decided to exclude the southern portion of Algoa 1 (Option 2) from the application process (See Section 3.5.1 for more information) and the impact rating in Table 42 has been amended accordingly.

Algoa 1 Option 1 and 7 overlap with fishing grounds of all fisheries considered. Algoa 6 does not overlap with any commercial fishing sectors. Without mitigation measures, the direct impact on local fisheries as a result of competition for access to the market and for sea space was rated as **medium** for Algoa 1 Option 1 and 7 and as **low** for Algoa 6.

Although Bloom (2013) reduced the impact after mitigation for all alternative options, it is unclear what these mitigation measures are. The report mentions that stakeholders proposed that any area in which more than 5% of the annual catch or fishing effort of any documented fishery is expended, should be excluded from consideration, referencing Anchor Environmental, 2011. Except for the chokka squid fishing industry, which shows a high fishing effort at Algoa 1 Option 1 (8% of the total national effort), none of the other fishing industries contribute more than 5% of the annual catch or fishing effort. Furthermore, Section 9.5.2.4 explains that the discrepancy between effort and catch in this catch reporting block is largely due to the fact that vessels shelter from SW winds in the lee of Cape Recife, even during times when catches may be poor. The main chokka squid fishing ground at Algoa 1 has already been excluded from the ADZ by limiting the precinct to the northern portion (Algoa 1 Option 1). Consequently, no effective mitigation measure is provided by Bloom (2013) that warrants the reduction of the impact.

The 2013 Marine Specialist Study (Hutchings *et al.* 2013b) rated the impact on the local fishery exclusively based on competition for sea space, without considering competition for market space. The current BAR took cognisance of the marine specialist study as well as the socio-economic study, and the impact was reassessed as shown in Table 42.

Table 42 OP-SE9 – Negative impact of reduced fishing grounds and competition for market space for commercial fishing industries by Algoa Bay Aquaculture Development Zone precincts Algoa 1 Option 1, Algoa 6 and 7 without and with mitigation measures.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Algoa 1 <u>Option 1</u>	Local (1)	Medium (2)	Long-term (3)	Medium (6)	Probable	MEDIUM	- ve	Medium
Algoa 7	Local (1)	Medium (2)	Long-term (3)	Medium (6)	Probable	MEDIUM		
Algoa 6	Local (1)	Low (1)	Long-term (3)	Low (5)	Probable	LOW		
Optional mitigation measure:								
<ul style="list-style-type: none"> No mitigation measures are available 								

Cumulative Impact

Fishermen in the Algoa Bay area are already suffering from the dwindling supply and limited resources, as well as access restriction due to the recently proclaimed Addo MPA (although it should be noted that MPAs have a spill-over effect, which in the long-term impacts positively on surrounding fisheries). Further restricting access to important fishing grounds may contribute to cumulative impacts experienced by the local fishing industry. However, the overall contribution to reducing available fishing grounds is probably low for the following reasons:

- (5) the small size of the proposed ADZ compared to the extent of fishing grounds
- (6) DAFF has decided to exclude the southern portion of Algoa 1 (Option 2) from the application process.
- (7) Algoa 6 site does not compete in the market space (bivalve farming only); and
- (8) the exclusion of Algoa 7 from the proposed MPA specifically for aquaculture (i.e. the area would have been restricted to wild capture fisheries regardless)

10.5.2.10 Potential impact OP-SE10: Pressure on existing land-based infrastructure to support the proposed development

The establishment and operation of the proposed fish farms will require specialised land-based infrastructure, including docking, maintenance, handling, processing and cold storage facilities.

New infrastructure businesses linked to mariculture activities may include manufacturing, boat building, service equipment manufacturers, insurance companies and trade associations (Burbridge *et al.*, 2001). Interested and Affected Parties also indicated a need for better coordination of roads, harbour, fishing factories etc., as well as strategic planning between different stakeholders (Anchor Environmental 2011).

Stakeholders indicated in the previous EIA process that Port Elizabeth harbour is not currently operating at full capacity and increased usage as a result of Algoa 1 Option 1 and/or 6 could contribute to the cost-effective functioning of existing resources and the potential development of new resources.

The COEGA SEZ is currently being developed, which includes a land-based Aquaculture Development Zone, which could provide infrastructure support to Algoa 7. The negative impact on infrastructure is considered to be **medium** and **low** without and with mitigation measures respectively.

Note that the impact was found to be the same across precincts as well as for finfish and bivalve culture and has therefore not been assessed separately (Table 43).

Table 43 OP-SE10 – Negative impact on land-based infrastructure without and with mitigation measures by Algoa Bay Aquaculture Development Zone precincts 1, 6 and 7. All precincts and culture types (i.e. finfish vs bivalve) are considered to have the same effect and were assessed collectively.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local (1)	Medium (2)	Long-term (3)	Medium (6)	Definite	MEDIUM	- ve	Medium
Mitigation measures:								
<ul style="list-style-type: none"> Any additional infrastructure required for the implementation and operation of the fish farms should be provided by the developers. A partnership with Transnet could be considered to create fish production capacity that would also benefit the existing fishing industry. 								
With mitigation	Local (1)	Low (1)	Long-term (3)	Low (5)	Definite	LOW	- ve	Medium

Cumulative Impact

Multiple fish farms or farming activities could have a cumulative impact if the harbour facilities have to provide processing and storage facilities, as well as on-shore operational activities. If no additional infrastructure is provided by the fish farms, it could put a significant burden on the infrastructure that could impact other harbour-related activities. However, a number of fish farms could also create economies of scale for new infrastructure development that could also benefit the harbour's capacity and/or efficacy in future.

10.5.2.11 Potential impact OP-SE11: Impact on coastal real estate due to aesthetic nature of views and sense of place

Values of real estate are driven by various factors, among others supply and demand, interest rates, the contraction or expansion of the local economy, population growth rates and changes in disposable income to debt ratios. In addition, relative property values are based on the abundance of precincts that are either valued or avoided by consumers. As these underlying characteristics and resulting relative advantages change, so too do relative prices, as these advantages are capitalised into land values.

The proposed sea-based ADZ will have a visual impact that could negatively impact the view – and thus the sense of place - from residential properties, which in turn could impact the perceived value of seafront and sea-view properties. The Visual Impact Assessment shows that floating structures and maintenance vessels, as well as lights at night, would have a high visibility during the operational phase. Note that the coastal real estate impact assessment has been revised in line with the changes to the visual impact assessment (Section 10.4).

Algoa 1 Option 1 is located very close to Summerstrand, a popular residential and recreational area. *Finfish farming* infrastructure will be visible in the middle-ground area from the tourist receptors along the beach front of the Marine Drive area. Visibility of the infrastructure will extend several square kilometres and is defined as high (negative impact) before and after mitigation measures (Section 10.4.1.1). Note that the buffer zones suggested in the original VIA as mitigation measures are no longer applicable (see Section 10.4.1.1 for more information) and therefore the impact on coastal real estate cannot be reduced after mitigation. However, it appears that the original impact assessment by Bloom (2013) rated the consequence as 'high' and the probability of the impact occurring as 'possible' (property prices are dependent on many factors), which should have resulted in a **medium** rating prior to mitigation as per the impact assessment methodology in Section 10.2. The impact of *finfish farming* at Algoa 1 Option 1 on coastal real estate was therefore rated as **medium** before and after the implementation of mitigation measures.

Bivalve farming in contrast has a lower visual impact and can be successfully mitigated (Section 10.4.1.1). The probability of the impact occurring was rated as 'possible' as property prices are dependent on many other factors other than visual aesthetics. The impact of bivalve farming by Algoa 1 Option 1 was rated as 'low' before and **very low** after the implementation of visual mitigation measures.

Where the views of ships and other industrial and traffic activities are seen within the context of a harbour environment, the sense of place is unlikely to be impacted by the proposed aquaculture development. This is applicable to Algoa 6 and 7, which are situated within the harbour environment of the Ports of Elizabeth and Ngqura respectively. These precincts are therefore not considered to be situated in visually sensitive areas. Furthermore, Bluewater Bay constitutes the closest real estate receptor for Algoa 7, but lies outside the high exposure area (northeast) and has therefore not been considered in this impact assessment.

The impact of *bivalve farming* at Algoa 6 is considered to have a 'low' intensity and it is 'possible' for this impact to occur. The impact was therefore rated as **very low** before and after mitigation measures (Table 45).

The confidence of the ratings is low due to the lack of quantitative data on potential devaluation.

Table 44 OP-SE11a – Impact on coastal real estate due to impacts on aesthetic nature of views and sense of place as a result of *finfish farming* at Algoa 1 Option 1 of the proposed sea-based Algoa Bay Aquaculture Development Zone.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local (1)	High (3)	Long-term (3)	High (7)	Possible	MEDIUM	- ve	Low
Mitigation measures:								
<ul style="list-style-type: none"> Implement mitigation measures as detailed in the VIA. 								
With mitigation	Local (1)	High (3)	Long-term (3)	High (7)	Possible	MEDIUM	- ve	Low

Table 45 OP-SE11b – Impact on coastal real estate due to impacts on aesthetic nature of views and sense of place as a result of *bivalve farming* at Algoa 1 Option 1 and Algoa 6 of the proposed sea-based Algoa Bay Aquaculture Development Zone.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Algoa 1 <u>Option 1</u>	Local (1)	Medium (2)	Long-term (3)	Medium (6)	Possible	LOW	- ve	Low
Algoa 6	Local (1)	Low (1)	Long-term (3)	Low (5)	Possible	VERY LOW		
Mitigation measures:								
<ul style="list-style-type: none"> Implement mitigation measures as detailed in the VIA. 								
Algoa 1 <u>Option 1</u>	Local (1)	Low (1)	Long-term (3)	Low (5)	Possible	VERY LOW	- ve	Low
Algoa 6	Local (1)	Low (1)	Long-term (3)	Low (5)	Possible	VERY LOW		

Cumulative Impact

It is likely that real estate values in the area may decrease if there are multiple mariculture farms or similar developments that negatively impact on the sense of place. The contribution to cumulative impacts by Algoa 1 Option 1 is likely to be considerably higher than Algoa 6.

10.5.2.12 Potential impact OP-SE12: Increased risk of bird strikes affecting aircrafts landing at and departing from the Port Elizabeth International Airport

According to the Airports Company South Africa (ACSA) Port Elizabeth the proposed Aquaculture Development Zone overlaps with the flight path of aircrafts landing at and departing from the Port Elizabeth International Airport. ACSA is concerned that aquaculture farms may attract birds and their aggregation would increase the risk of birds colliding with aircrafts, posing a hazard to navigation.

Bird strikes can damage aircrafts, which are expensive to repair, and the damage inflicted on aircraft control surfaces or engines can lead to disaster. The likelihood of a disaster occurring is related to the density of a bird flock occurring on any given flightpath. Indeed, collision with large flocks has resulted in human casualties in the past (Scott 2009). However, these collisions are usually caused by migratory birds such as ducks, geese, starlings etc., which complete their routes at great heights posing a risk to aircrafts.

Algoa Bay and the associated protected islands provide shelter, feeding and breeding habitats for numerous sea bird species (non-migratory mainly). Piscivorous, *low-flying* sea birds could be attracted to large concentrations of fish and food in sea cages at Algoa 1 Option 1 and 7 and include sea gulls, gannets, cormorants and terns. There are two groups of three islands each, within Algoa Bay that support large colonies of birds (refer to the marine specialist study in Appendix D of this BAR for more information on birds in Algoa Bay).

Johnston *et al.* 2014 modelled flight heights of marine birds to more accurately assess collision risk with offshore wind turbines. They found that for all 25 seabird species investigated, the majority of flights were within 20 m of the sea surface. The risk of collision with seabirds is therefore improbable even without mitigation measures.

The impact of the proposed ADZ on sea birds has been assessed in the marine specialist assessment of this BAR (Appendix D). The study provides a number of mitigation measures to prevent birds from accessing the finfish cages successfully. The most effective and common mitigation measure is to install predator nets on the cages which prevents seabirds from gaining access from the air. In addition, visual deterrents (e.g. tori line type deterrents for birds) can also be installed. Feed must always be stored in closed containers on the maintenance vessels. It is in the interest of farmers to ensure that their stock or feed is not predated on by birds.

Furthermore, ACSA expressed concern regarding the processing of fish or grading and initial cleaning of bivalve on board of maintenance vessels. Discarding biological waste could potentially attract large flocks of birds. Discarding biological waste (i.e. processing waste, mortalities etc.) at sea is not permitted for biosecurity reasons and this requirement is included in the Environmental Management Programme (Appendix A of this BAR). Fish will be processed exclusively at land-based facilities.

It must be recognised that Algoa Bay has existing large sea bird colonies which perform daily migrations to and from the roosting sites and these flocks are likely currently passing Algoa 1 Option 1 and 7 sites daily. The additional risk posed by the finfish cages is relatively small as the cages are unlikely to alter flight path height of the bird flocks.

In addition, with the implementation of mitigation measures, birds will quickly learn that the cages do not constitute an easy food source, thereby reducing the duration of the impact to short-term. The probability of the finfish cages in Algoa 1 Option 1 and 7 attracting large flocks of birds will be very low, which in turn means that the collision risk is low without and insignificant with the implementation of mitigation measures. The confidence of the impact rating is, however, considered medium as no detailed information on bird flight paths (i.e. route and height) for the bird species that roost and forage in large flocks (i.e. cormorants, terns and gannets) specifically in Algoa Bay have been considered. However, given the scientific evidence regarding flight height of 25 sea bird species in the North Sea (Johnston *et al.* 2014), a detailed assessment should not be required for this Basic Assessment. Furthermore, mitigation measures are well established in the aquaculture industry and are highly effective and should minimise any risk associated with sea birds in Algoa Bay.

Table 46 OP-SE12 – Increased risk of bird strikes affecting aircrafts landing at and departing from the Port Elizabeth International Airport. All precincts and both culture methods are considered to have the same effect and were assessed collectively.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local (1)	Low (1)	Long-term (3)	Low (5)	Improbable	VERY LOW	- ve	Medium
Essential mitigation measures:								
<ul style="list-style-type: none"> • Install predator nets (top) to prevent access by seabirds from the air • Install visual deterrents (e.g. tori line type deterrents for birds) • Store feed so piscivores cannot access it • During harvesting of stock, ensure that minimal blood or offal enters the water • Develop a protocol for dealing with problem piscivores in conjunction with experts and officials (DAFF, DEA etc) • Maintain a record of all interactions with piscivores as per recommended EMPr • Fish processing is to take place at land-based facilities only • No biological waste is to be discarded at sea 								
With mitigation	Local (1)	Low (1)	Short-term (1)	Very low (3)	Improbable	INSIGNIFICANT	- ve	Medium

10.5.2.13 Potential impact OP-SE13: Impact on conservation planning in Algoa Bay

The Addo Marine Protected area was promulgated on 28 May 2019. Algoa 7 (Ngqura Harbour site) lies adjacent to the recently promulgated Addo Marine Protected Area (MPA) (Figure 24). The Marine Protected Area consists of four coastal zones comprised of three inshore controlled and one inshore restricted zone. Four offshore zones include two controlled and restricted zones. Estuaries are also included in the Addo MPA with one controlled and one restricted zone.

During the previous EIA process, SANParks, the main proponents of this MPA, indicated that they would not support the concept of commercial mariculture within MPAs and that the declaration of Algoa 5 would not align with the conservation objectives of MPAs. This lack of support was especially directed at the large size of the Algoa 5 site and its position in the centre of the proposed MPA, which would have compromised a significant proportion in the middle of the MPA.

DAFF engaged with the DEA: Branch Oceans and Coasts early on in the process when Algoa 7 was selected as a new site to be put forward during the current application process. Algoa 7 measures roughly one quarter in size when compared to Algoa 5 and is positioned on the western border of the Addo MPA just north of an anchorage site that is currently used by the TNPA for ship to ship bunkering and disposal of dredge spoil (refer to Chapter 6 of the BAR – Massie *et al.* 2019). Despite its position within the restricted zone, the proposed finfish farm would therefore be situated within an area that is likely to be disturbed even after the proclamation of the Addo MPA. The Department of Environmental Affairs Branch Oceans and Coasts excised Algoa 7 in declaring the Addo MPA on 28 May 2019.

Algoa 7 was rated to have a medium impact on the MPA (Table 47). The site potentially compromises the functioning and management of the proposed MPA and sets a negative precedent for MPAs elsewhere in South Africa. The impact is rated as irreversible due to the fact the site was excised from the MPA boundaries. There are no effective mitigation measures for this, other than the No-go option.

Table 47 OP-SE 13 - Possible impacts on the Addo Elephant MPA, Algoa 7 (irreversible).

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Algoa 7	Local (1)	Medium (2)	Long-term (3)	Medium (6)	Definite	MEDIUM	-ve	High
Optional mitigation measures:								
<ul style="list-style-type: none"> No go option DAFF is to promote and facilitate certification of finfish farms by the Aquaculture Stewardship Council, which is an independent, international non-profit organisation that manages the world's leading certification and labelling programme for responsible aquaculture. 								

10.5.3 Impact significance of alternative options

DAFF is seeking to promote farming of both bivalves and finfish in Algoa Bay and therefore three combinations of precincts have been considered as alternatives in the Basic Assessment process. These three options allow for varying degrees of farming intensities by excluding finfish farming at Algoa 1 Option 1 (Option B) or excluding Algoa 1 Option 1 as a whole (Option C).

After benefit enhancing measures Option A and B have the same number of high, medium and low positive impacts on the socio-economic environment (Table 48). Option C excludes Algoa 1 Option 1 which means that less area will be available for mariculture and therefore the benefits will be lower when compared to option A and B.

Table 48 Comparison of the sum of positive impact significance of alternative options A, B, C and D for the proposed sea-based Algoa Bay Aquaculture Development Zone on the socio-economic environment (after mitigation). In Option A, both finfish and bivalve culture are proposed for Algoa 1 Option 1, however, these impacts are not additive and therefore the impact scoring for the best-case scenario was considered.

Impact significance after mitigation	Alternative Options			
	A Algoa 1 <u>Option 1</u> : finfish and bivalves Algoa 6: bivalves Algoa 7: finfish	B Algoa 1 <u>Option 1</u> : bivalves Algoa 6: bivalves Algoa 7: finfish	C Algoa 6: bivalves Algoa 7: finfish	D No Go
High	4	4	2	0
Medium	5	5	4	0
Low	0	0	0	0
Very low	0	0	0	0
Insignificant	0	0	0	0

The negative impact on the tourism and water sport industries (i.e. negative economic impact), with potential knock-on effect on existing jobs was rated as **high** after mitigation measures are implemented. Option A has the highest number of negative impacts of medium significance when compared to the other options (Table 49). Option C excludes Algoa 1 Option 1 and consequently has the lowest negative impact on the socio-economic environment.

The Status Quo Alternative (or No-go option D) proposes that the development of fish farms in Algoa Bay do not go ahead. Given that the Eastern Cape coast is one of the few areas considered suitable for marine based aquaculture in South Africa, the 'No-go/Status Quo' option will limit the potential benefits linked to this industry. Not establishing ADZ will limit the potential to supply in the growing demand for seafood products but will also eliminate the potential socio-economic concerns associated with finfish and bivalve culture. Most importantly, this includes the **high** impact on the local economy reliant on specialised tourism and recreation (diving, swimming, and surfing).

Table 49 Comparison of the sum of negative impact significance of alternative options A, B, C and D for the proposed sea-based Algoa Bay Aquaculture Development Zone on the socio-economic environment (after mitigation). In Option A, both finfish and bivalve culture are proposed for Algoa 1 Option 1, however, these impacts are not additive and therefore the impact scoring for the worst-case scenario (i.e. finfish) was considered.

Impact significance after mitigation	A	B	C	D
	Algoa 1 <u>Option 1</u> : finfish and bivalves Algoa 6: bivalves Algoa 7: finfish	Algoa 1 <u>Option 1</u> : bivalves Algoa 6: bivalves Algoa 7: finfish	Algoa 6: bivalves Algoa 7: finfish	No Go
High	1	0	0	0
Medium	7	4	3	0
Low	11	11	8	0
Very low	7	10	6	0
Insignificant	3	3	2	0

10.6 Heritage resources

As the proposed development is undergoing an Environmental Authorisation (EA) application process in terms of NEMA, it is incumbent on the developer to establish whether a Heritage Impact Assessment (HIA) needs to be completed as per section 38(3) and 38(8) of the National Heritage Resources Act, Act 25 of 1999 (NHRA). If required such an HIA would include an underwater maritime study and any other applicable heritage components. The HIA would be conducted as part of the EA Application in terms of NEMA and the 2017 NEMA EIA Regulations.

The proposed project will affect the surface environment of the ocean more so than the sea bottom. The disturbance on the seabed will be associated with mooring/anchoring mechanism for the cages. Anchor appointed ACO Associates cc to conduct a desktop Maritime and Underwater Cultural Heritage Study as the Maritime and Underwater Cultural Heritage (MUCH) Unit at SAHRA indicated that such a study would likely to be requested. A summary of the HIA has been included in this BAR and the specialist study has been included as a standalone document in Appendix D.

South Africa has a rich and diverse underwater cultural heritage. Strategically located on the historical trade route between Europe and the East, South Africa's rugged and dangerous coastline has witnessed more than its fair share of shipwrecks and maritime dramas in the last 500 years. At least 2400 vessels are known to have sunk, grounded, or been wrecked, abandoned or scuttled in South African waters since the early 1500s. This doesn't include the as yet unproven potential for shipwrecks and other sites that relate to pre-European, Indian Ocean maritime exploration, trade and interactions along the South African east coast.

In addition to historical shipwrecks, the record of South Africa's long association with the sea is much broader and extends far back into prehistory. This element of our maritime and underwater cultural heritage is represented around the South African coast by thousands of pre-colonial shell middens and large numbers of tidal fish traps, which reflect prehistoric human exploitation of marine resources since the Middle Stone Age, more than 150,000 years ago. Another, until recently, largely unacknowledged and unexplored aspect of our maritime and underwater cultural heritage are pre-colonial terrestrial archaeological sites and palaeolandscapes which are now inundated by the sea.

This assessment considers maritime and underwater cultural heritage resources in the Algoa 1, 6 and 7, namely submerged prehistoric resources and historical shipwrecks. Note that the impact assessment was conducted for the extent of Algoa 1 as shown in the pre-application BAR (Algoa 1 Option 1 and part of Option 2). Since then, Algoa 1 has been reduced to Option 1. The impact assessment and recommendations have, however, not changed.

10.6.1 Impact Assessment for Algoa 1, 6 and 7

Aquaculture infrastructure consists of cages for finfish, long-lines for oysters and mussel rafts deployed in the water column and moored on the seafloor to prevent drifting. The only physical disturbance of the seabed related to aquaculture is the footprint mooring or anchoring points for the cages, long-lines and rafts, which can be either placed on the seabed or driven into it.

This is the only identifiable impact for maritime and underwater cultural heritage resource arising out of the development of aquaculture in Algoa Bay with heritage sites at risk as a result of the placement of anchors or from the physical penetration of the seabed to install mooring points.

On the basis of the heritage resources review in Section 9.4 (and in more detail in the study by Gribble 2019 in Appendix D of this BAR), the heritage receptors defined for this impact assessment are:

- Submerged prehistoric archaeological resources within all three proposed aquaculture areas;
- Maritime archaeological resources in Area 1;
- Maritime archaeological resources in Area 6; and
- Maritime archaeological resources in Area 7.

The assessment of impact on each of these receptors provided in the following sections is based on the methodology set out in Section 10.2.

10.6.1.1 Potential impact CP-UMH 1: Submerged prehistory – All Areas

Although no geophysical data for the Algoa Bay as a whole or for the three proposed aquaculture areas were available for this assessment, the rivers that presently debouch into the bay are likely to have done so at times of lower sea levels and will have palaeo-channels which extend offshore across the present seabed. Where archaeological material and palaeoenvironmental evidence have survived post-glacial marine transgressions, there is the potential for this material to be within or associated with now submerged palaeo-channels.

The small footprint of the seabed intervention that will result from the installation of mooring points for the aquaculture infrastructure make the potential for any interaction with or impact on submerged prehistoric archaeological material in Areas 1, 6 and 7 unlikely.

Were impacts to occur, they will be negative because the finite and non-renewable nature of heritage resources means that they cannot recover if disturbed, damaged or destroyed.

The potential impacts of the development of aquaculture in the three proposed areas on submerged prehistoric archaeological resources were found to be of local extent, low intensity but irreversible. The significance rating was **very low** and no mitigation measures are required for this impact (Table 50).

Table 50 CP-UMH1 – Negative impact on submerged prehistoric resources as a result of the Algoa Bay Aquaculture Development Zone. All precincts and both culture methods are considered to have the same effect and were assessed collectively.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local (1)	Low (1)	Long-term (3)	Low (5)	Improbable	VERY LOW	- ve	Low
Essential mitigation measures: No mitigation required.								

10.6.1.2 Potential impact CP-UMH 2: Maritime archaeology

Based on the discussion of maritime heritage resources in **Algoa 1** in Section 9.4.2 (and in more detail in the study by Gribble 2019 in Appendix D of this BAR), there is a very low possibility that shipwreck material will be present in the aquaculture area. However, two wrecks have been identified as possibly being in the area and some of those listed only as “Algoa Bay” or “Port Elizabeth” may also be present. The probability of any interaction with or impact on maritime heritage resources in Area 1 is thus possible.

Algoa 6 is the most sensitive of the three proposed aquaculture areas with respect to maritime heritage resources and it is almost certain that historical shipwreck material is present in the development area.

Although only a handful of recorded wrecks are in the vicinity of **Algoa 7**, the presence of 147 wrecks with no specific recorded locations of loss in the bay and the location of Algoa 7 on Algoa Bay’s lee shore in a south-easterly gale suggests that it is possible that shipwreck material will be present in the aquaculture area.

Geophysical data collection and/or dive surveys to inform the placement of moorings outside of an exclusionary buffer zone around any identified maritime archaeological resources is, due to the small disturbance footprint, a very effective mitigation measure. At all three sites, the impact is considered insignificant, primarily due to the fact that the impact can either be prevented or artefacts can be recovered, which reduces the duration of the impact (short-term). Algoa 6 constitutes the most sensitive site and implementation of mitigation measures are crucial to prevent impacts on the rich maritime archaeological heritage of the area.

Were impacts to occur, they will be negative because the finite and non-renewable nature of heritage resources means that they cannot recover if disturbed, damaged or destroyed.

Table 51 CP-UMH2 – Negative impact on submerged prehistoric resources as a result of the Algoa Bay Aquaculture Development Zone. All precincts and both culture methods are considered to have the same effect and were assessed collectively.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Algoa 1&7	Local (1)	Low (1)	Long-term (3)	Low (5)	Possible	VERY LOW	- ve	Low
Algoa 6	Local (1)	Low (1)	Long-term (3)	Low (5)	Probable	LOW	-ve	Low
Essential mitigation measures:								
<ul style="list-style-type: none"> Any geophysical data generated to support to development of aquaculture in this area must be archaeologically reviewed for the presence of historical shipwrecks or related material and to ground truth proposed mooring locations; If geophysical data are not collected, the proposed positions of all moorings must be ground truthed by suitably qualified divers; Should any archaeological material, be accidentally encountered during the course of developing aquaculture operations in any of the proposed areas, work must cease in that area until the project archaeologist and SAHRA have been notified, the find has been assessed by the archaeologist, and agreement has been reached on how to deal with it. 								
Algoa 1, 6&7	Local (1)	Low (1)	Short-term (1)	Very low (3)	Improbable	INSIGNIFICANT	- ve	Low

10.6.2 Impact significance of alternative options

DAFF is seeking to promote farming of both bivalves and finfish in Algoa Bay and therefore three combinations of precincts have been considered as alternatives in the Basic Assessment process (Table 52). These three options allow for varying degrees of farming intensities by excluding finfish farming at Algoa 1 (Option B) or excluding Algoa 1 as a whole (Option C). Overall, the impacts of Option C are the lowest, solely due to the exclusion of Algoa 1 as a whole. All impacts are, however, rated either very low or insignificant for all options after mitigation.

Table 52 Comparison of the sum of negative impact significance of alternative options A, B, C and D for the proposed sea-based Algoa Bay Aquaculture Development Zone on heritage resources (after mitigation). In Option A, both finfish and bivalve culture are proposed for Algoa 1, however, these impacts are not additive and therefore the impact scoring for the best-case scenario was considered.

Impact significance after mitigation	Alternative Options			
	A Algoa 1: finfish and bivalves Algoa 6: bivalves Algoa 7: finfish	B Algoa 1: bivalves Algoa 6: bivalves Algoa 7: finfish	C Algoa 6: bivalves Algoa 7: finfish	D No Go
High	0	0	0	0
Medium	0	0	0	0
Low	0	0	0	0
Very low	3	3	2	0
Insignificant	3	3	2	0

10.6.3 Recommendations

The assessment of the maritime heritage resources of Algoa Bay suggests that although there is the potential for the presence of submerged prehistoric archaeological material in the bay, the minor seabed interventions associated with the installation of aquaculture infrastructure in the three proposed areas is very unlikely to impact on this resource. No mitigation is proposed in respect of submerged prehistoric archaeological resources.

With regard to historical shipwrecks, Algoa 1 and 7 have a low potential for impacts arising out of the development of aquaculture in these areas. Algoa 6, however, is located in that area of Algoa Bay with the highest concentration of recorded historical shipwrecks. Current information from local diving charters indicates that quantities of shipwreck material are visible in and on the seabed in the area proposed for Algoa 6, and the potential for interactions between these sites and the mooring points required for aquaculture development is high if not mitigated.

The following recommendations are made in respect of mitigation measures to be applied particularly to Algoa 6, but also to Algoa 1 and 7:

- Any geophysical data generated to support to development of aquaculture in this area must be archaeologically reviewed for the presence of historical shipwrecks or related material and

to ground truth proposed mooring locations. Datasets that are particularly useful in this regard are magnetometer, side scan sonar and multibeam bathymetric data. It is recommended that the archaeologist is consulted before data are collected to ensure that the survey specifications and data outputs are suitable for archaeological review;

- Any video footage collected support to development of aquaculture in the three areas should ideally also be reviewed by the archaeologist for evidence of shipwreck material on the seabed;
- If geophysical data are not collected, the proposed positions of all moorings must be ground truthed by suitably qualified divers;
- Should the reviews and ground truthing set out above identify wreck material at or near the location of any proposed mooring, micro-siting of the mooring and the possible implementation of an exclusion zone around the archaeological feature should be sufficient to mitigate the risks to the site.
- Should any archaeological material, be accidentally encountered during the course of developing aquaculture operations in any of the proposed areas, work must cease in that area until the project archaeologist and SAHRA have been notified, the find has been assessed by the archaeologist, and agreement has been reached on how to deal with it.

Although these impacts are predominantly applicable to the construction phase of the development, mooring blocks and anchors may require maintenance, during which unexpected archaeological resources could be discovered. It is therefore important that in such an incident, work must cease in that area until the project archaeologist and SAHRA have been notified, the find has been assessed by the archaeologist, and agreement has been reached on how to deal with it (see last bullet point above). This mitigation measure is to be included in the operational phase of the EMP of this BAR (Appendix F).

ACO Associates cc concluded in their impact assessment report (Gribble 2019) that the proposed development of aquaculture in Algoa 1, 6 and 7 is unlikely to have any impact on known or unknown maritime and underwater cultural heritage resources provided that the above recommendations are implemented and that the development is considered archaeologically acceptable.

11 CONCLUSIONS AND RECOMMENDATIONS

South Africa’s coastline is very exposed and there are few suitable precincts for sea-based aquaculture and Algoa Bay was identified as a potential site in the Strategic Environmental Assessment (SEA) conducted in 2011. DAFF is mandated to enable aquaculture development in South Africa, and as such intends to declare an Aquaculture Development Zone (ADZ) comprising up to three separate precincts within Algoa Bay where bivalves and finfish can be farmed. This BAR describes and assesses potential environmental impacts associated with each of the three precincts (Algoa 1 Option 1, 6, and 7) (Figure 43) individually first, and subsequently in combination in the form of alternate options as they have been configured for this EIA process (i.e. Option A, B and C) together with the No-Go option (Alternative D) (Table 53). This Chapter should be read with the Environmental Impact Statement in Chapter 2, which provides more information on the outcomes of the marine ecological, visual, socio-economic and heritage resources impact assessments.

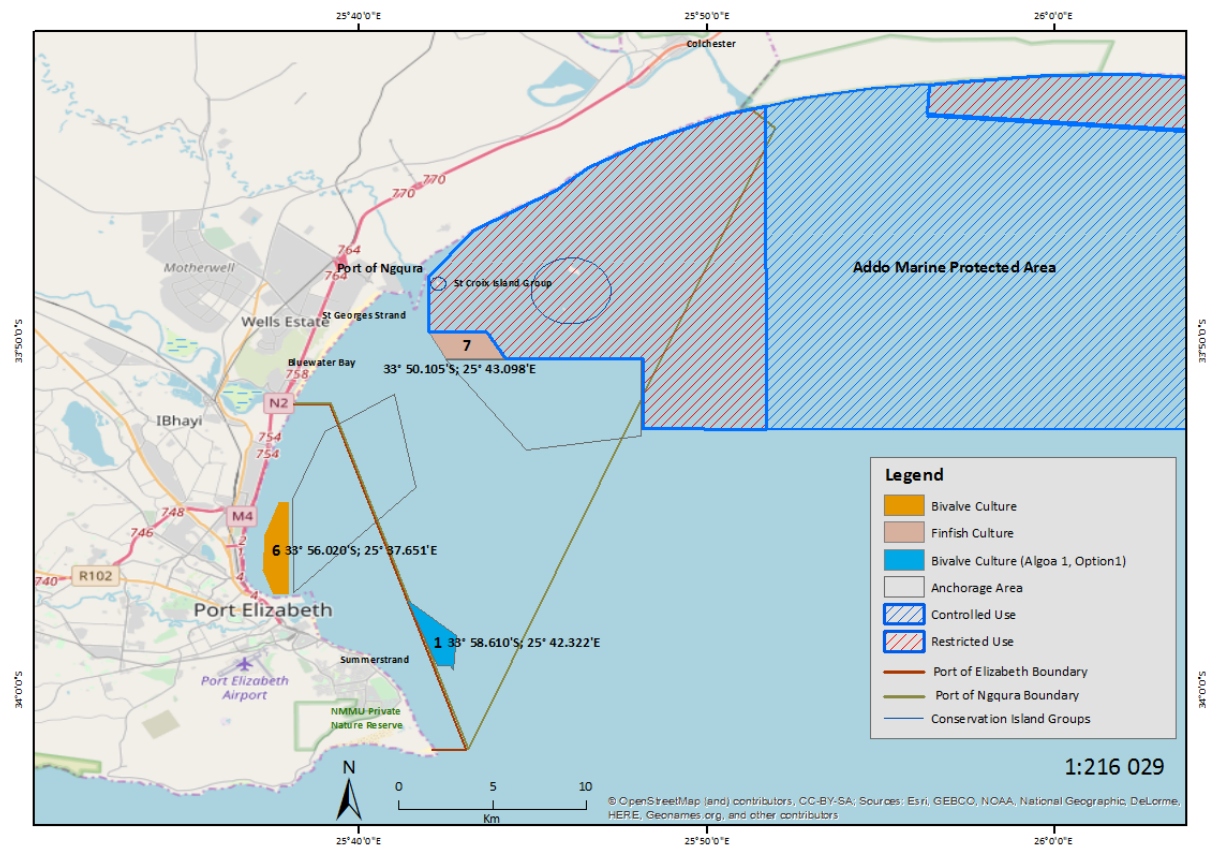


Figure 43 Precincts considered during the 2019 application for environmental authorisation for a sea-based Aquaculture Development Zone in Algoa Bay, Eastern Cape. Precincts 1 (Option 1), 6 and 7 constitute economically feasible precincts and have been considered during the present Basic Assessment process.

Table 53 Alternative options of precinct combinations involving Algoa 1 **Option 1**, 6 and 7 considered in the Basic Assessment process for the proposed sea-based Algoa Bay Aquaculture Development Zone.

Alternative options	Algoa 1 Option 1 (Summerstrand site) Size: 312 ha	Algoa 6 (Port Elizabeth Harbour site) Size: 479 ha	Algoa 7 (Ngqura Harbour site) Size: 355 ha
A	Finfish & bivalves	Bivalves	Finfish
B (DAFF preferred)	Bivalves	Bivalves	Finfish
C	X	Bivalves	Finfish
D (No-go option)	X	X	X

Based on the available information commercial *bivalve* farming at Algoa 1 Option 1 and Algoa 6 is a desirable use of the sea space within Algoa Bay provided that the mitigation measures recommended in this impact assessment are implemented. The desirability of *finfish* farming in Algoa Bay is unpacked in more detail below.

The outcomes of the social preference study, the expert opinion as stated above, as well as the comments provided by the public to date (which are mostly congruent with the Britz *et al.* 2016 study), have guided the EAP in concluding that ***finfish* culture at Algoa 1 Option 1 has the potential to cause significant economic losses in the tourism and water sports sectors of Port Elizabeth** (the impact was rated as **high** after the implementation of mitigation measures), with potentially significant knock-on effects on existing job opportunities. The city would also run the risk of losing its status as the "Water Sport Capital" of Africa as a number of sport events would likely be moved or stopped. The pre-application stakeholder consultation process demonstrated that *finfish farming* at Algoa 1 Option 1 (Summerstrand) lacks social support from the Port Elizabeth community.

The Marine Ecological Specialist Study (Appendix D of the BAR) found that *finfish* farming at Algoa 7 could have significant residual marine ecological impacts after the implementation of mitigation measures as this site is situated adjacent to the recently promulgated Addo Marine Protected Area and St Croix Island Group. A precautionary approach with diligent environmental monitoring would be required to minimise residual risks.

At the same time, additional employment opportunities in the Port Elizabeth area are desperately needed and the proposed project has the potential to create new employment opportunities and boost local economic growth.

Overall, the environmental impact assessment shows that Alternative Option B, which proposes bivalve farming at Algoa 1 Option 1 (Summerstrand site) and Algoa 6 (PE Harbour site), as well as finfish farming at Algoa 7 (Ngqura Harbour site), constitutes the best practicable environmental option for Algoa Bay. Alternative Option B has a greater potential with regards to job creation when compared to Alternative Option C (excludes Algoa 1 Option 1 from the ADZ), while also ensuring that user conflicts with the existing tourism and water sport sectors are significantly reduced when compared to Alternative Option A, which proposes finfish farming at Algoa 1 Option 1.

The proposed Alternative Option B has therefore the potential to address the socio-economic need for new employment opportunities and economic growth in the Port Elizabeth area while also minimising conflict with the local tourism industry and water sport activities

Based on the information available to date and the impact assessment conducted in the Draft BAR, the EAP supports DAFF’s application for environmental authorisation for the preferred Option B (i.e. no finfish farming at Algoa 1 Option 1), provided that rigorous environmental monitoring is conducted and the implementation of the ADZ is overseen by a well organised management structure involving key government bodies (see more information on the proposed approach below). Furthermore, the recently identified reef near the centre of Algoa 1 Option 1 must be excluded from the ADZ as recommended in the marine specialist study in Appendix D of the BAR (Hutchings *et al.* 2019) and the socio-economic impact assessment (Section 10.5.2 in this BAR).

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