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NSW Marine Waters Sustainable Aquaculture Strategy

A NSW Government Initiative
2018

The NSW Marine Waters Sustainable Aquaculture Strategy is a NSW Government initiative developed by the State Aquaculture Steering Committee, comprising the Department of Premier and Cabinet, NSW Department of Planning and Environment, NSW Department of Primary Industries (Fisheries), NSW Environment Protection Authority, NSW Food Authority, Department of Industry - Lands and Water, NSW National Parks and Wildlife Service, NSW Office of Environment and Heritage, NSW Department of Planning and Environment (Resources and Geoscience), Office of Local Government, Transport for NSW (NSW Roads and Maritime Services) to encourage sustainable marine waters based aquaculture.

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Executive Summary

Overview

Sustainable seafood production that supports future demands of food security for the state is a key focus of the New South Wales (NSW) Government.

Aquaculture is a growing industry. Latest figures indicate NSW oyster and land based aquaculture is developing steadily, with the industry increasing by 8% in annual value in 2016/17, equating to \$70 million (NSW DPI, 2018). Aquaculture has also contributed benefits to the state economy, with a flow-on effect to seafood processing and retail businesses, providing a likely output of \$226 million, as well as 1,758 fulltime jobs to NSW in 2013/2014 (Barclay *et al.*, 2016).

There are a number of new investment opportunities being sought in NSW marine waters for the production of finfish, shellfish and algae.

There is a national and international trend to locate marine aquaculture further offshore away from the coast. For example, the NSW Department of Primary Industries (NSW DPI) Marine Aquaculture Research Lease (MARL) for Yellowtail Kingfish farming in sea pens, is 6 kilometres (km) from the coast off Hawks Nest, on the 40 metre (m) depth contour line. Aquaculture infrastructure, such as longlines and artificial reefs, may be submerged below the water surface.

Unlike other states and territories, the area available for marine aquaculture in NSW is currently limited, given the state's exposed coastline and limited availability of all-weather ports.

The aquaculture industry and the NSW Government are both conscious of ensuring the development of the industry proceeds in a manner which does not jeopardise its ecological sustainability and social licence.

The NSW Marine Waters Sustainable Aquaculture Strategy (MWSAS) draws on recent NSW and Australian experiences to address the risks of site selection, design, operation and both environmental and community impacts.

Independent environmental management reporting for NSW fish farms using sea pens (1999-2009 and 2016-2017) and shellfish farms using longlines (1996-2017) has shown no significant environmental impact from operations (see Section 3.2.2).

The MWSAS was developed under the auspices of the State Aquaculture Steering Committee, a high level state government multiagency group tasked with promoting sustainable industry development.

Purpose and Structure

The MWSAS promotes best practice for marine aquaculture, defining an approvals process for this type of aquaculture in NSW. It also provides the framework for the NSW Government to identify marine aquaculture investigation areas for future seafood production and will inform and guide the private sector seeking to establish marine aquaculture farms.

In summary, the MWSAS:

- provides a regulatory and industry best practice framework for the expansion of the NSW marine waters aquaculture industry in an ecologically sustainable and socially responsible manner

- provides a platform for the NSW Government to:
 - identify suitable marine aquaculture investigation areas
 - undertake appropriate environmental impact assessment and obtain relevant approvals for marine aquaculture
 - invite commercial interest by tender, to investigate and make application for leases within the investigation area
- defines the development approval and assessment processes
- provides guidance to industry and consent authorities to prepare and assess applications for aquaculture development
- provides the community and stakeholders with relevant advice to inform them about sustainable marine waters aquaculture
- avoid ad hoc aquaculture industry development in NSW waters which may be at unsuitable locations or using technologies and approaches that are not optimal for a specific location.

Scope

The MWSAS covers two types of aquaculture (see Section 1.3.2 for examples):

- Intensive aquaculture, which involves providing farmed species with specifically prepared feeds, for example finfish in sea pens
- Extensive aquaculture, which involves farming species that feed on naturally occurring matter in the water column. Examples include shellfish longlines (Blue Mussels, oysters or algae), artificial reefs (abalone culture) and ranching (placing juvenile shellfish on the sea floor).

The strategy applies to the three nautical mile jurisdictional limit of NSW marine waters where it meets Commonwealth waters, including Jervis and Twofold Bays. It does not apply to the cultivation of edible oysters in estuaries, which is governed by provisions of the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS).

Legislative Context

The MWSAS has been adopted as an Aquaculture Industry Development Plan under the *Fisheries Management Act 1994*.

Implementation of the MWSAS will be supported by provisions in relevant State Environmental Planning Policies.

Currently (as of November 2018), *State Environmental Planning Policy 62 – Sustainable Aquaculture* (SEPP 62) provides the planning framework for aquaculture. The NSW Government is consulting on proposals to include provisions for marine waters aquaculture in a new SEPP that will address a range of primary production matters and incorporate SEPP 62.

Proposed New SEPP

At the time of writing, a new *Primary Production and Rural Development SEPP* is proposed (www.planning.nsw.gov.au/primaryproductionsepp).

The proposal includes a new SEPP to replace five existing SEPPs (including SEPP 62) which will:

- clarify that natural water-based aquaculture includes ‘marine waters aquaculture’
- identify where marine waters aquaculture may be permitted
- state that marine waters aquaculture may be undertaken with development consent by a private individual or organisation, or without development consent by a public authority.

If these provisions are included in the new SEPP:

- marine aquaculture projects requiring development consent will be assessed as State Significant Development within existing requirements of the *State and Regional Development SEPP 2011*
- projects by a public authority will be assessed under the *Environmental Planning and Assessment Act 1979* as State Significant Infrastructure (SSI)
- the MWSAS will be considered by a planning authority to decide whether to grant consent to a development application, or determining to proceed to undertake or authorise an activity.

Any land or port based assessment requirements will need to be confirmed up-front by discussing the project with NSW DPI and the relevant planning authority.

Implementation

The MWSAS will support investment in sustainable marine waters aquaculture projects in two key ways:

1. NSW Government – will use the framework in the MWSAS to identify marine aquaculture investigation areas. In these areas, the NSW Government will consider opportunities to undertake up-front risk and environmental assessments.
2. Industry – will be able to work with the NSW Government to deliver projects within marine aquaculture investigation areas, or investigate and submit proposals for other locations in NSW marine waters. In the latter case, the MWSAS sets out permissible locations for marine aquaculture, and the assessment and approval requirements.

Related Strategies

The [NSW Oyster Industry Sustainable Aquaculture Strategy \(2016 – 3rd edition\)](#) (NSW DPI, 2016) and the [NSW Land Based Sustainable Aquaculture Strategy \(2009\)](#) (NSW DPI, 2009) have proved to be successful platforms for sustainable oyster and land based aquaculture industry development respectively. The strategies have helped ensure a sustainable approach to the development of the industry, increasing confidence for the aquaculture industry, investors and the community.

The MWSAS is intended to deliver similar outcomes in support of sustainable aquaculture development in NSW marine waters. The MWSAS has an increased focus on environmental monitoring programs, emergency response plans and comprehensive compliance and reporting requirements, including independent annual environmental management reporting and community engagement.

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List of Abbreviations

AAF	Australian Aquaculture Forum
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
AIDP	Aquaculture Industry Development Plan
AHIP	Aboriginal Heritage Impact Permit
ALR Act	<i>Aboriginal Land Rights Act 1983</i>
ANZECC	Australian and New Zealand Environment Conservation Council
APVMA	Australian Pesticides and Veterinary Medicines Authority
AR Act	<i>Animal Research Act 1985</i>
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
BC Act	<i>Biodiversity Conservation Act 2016</i>
CM Act	<i>Coastal Management Act 2016</i>
DECC	Department of Environment, Climate Change
DEE	Department of Environment and Energy (Commonwealth)
DoA	Department of Agriculture
DoF	Department of Fisheries
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
EHC Act	<i>Environmentally Hazardous Chemicals Act 1985</i>
EIS	Environmental Impact Statement
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
ESD	Ecologically Sustainable Development
FAO	Food and Agriculture Organization of the United Nations
FCR	Food Conversion Ratio
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
FRDC	Fisheries Research and Development Corporation
GPS	Global Positioning System
GSM	Global System for Mobile Communications
GVP	Gross Value Product
HS Act	<i>Historic Shipwrecks Act 1976</i>
IALA	International Association of Lighthouse Authorities
IMOS	Integrated Marine Observing Stations
MARL	Marine Aquaculture Research Lease

MEM Act	<i>Marine Estate Management Act 2014 (NSW)</i>
MEMA	Marine Estate Management Authority
MNES	Matters of National Environmental Significance
MS Act	<i>Marine Safety Act 1998</i>
MWSAS	New South Wales Marine Waters Sustainable Aquaculture Strategy
NATA	National Association of Testing Authorities
NOAA	National Oceanic and Atmospheric Administration
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NPWS	National Parks and Wildlife Service
NSW DoI	Department of Industry
NSW DPE	New South Wales Department of Planning and Environment
NSW DPI	New South Wales Department of Primary Industries
NSW EPA	New South Wales Environment Protection Authority
NSW OEH	New South Wales Office of Environment and Heritage
NSW RMS	New South Wales Roads and Maritime Services
NWQMS	National Water Quality Management Strategy
PIRSA	Primary Industries and Regions South Australia
POEO Act	<i>Protection of the Environment Operations Act 1997 (NSW)</i>
REDOX	Reduction-oxidation Reaction
ROV	Remotely operated vehicle
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
SSD	State Significant Development
SSI	State Significant Infrastructure
TARA	Threat and Risk Assessment
TOC	Total Organic Carbon

Glossary of Terms

Added value	An amount added to the value of a product or service, equal to the difference between its cost and the amount received when it is sold.
Ambient	Of/or relating to the immediate surroundings.
Anti-predator net	A net designed to prevent predators from interacting with cultured stock.
Aquaculture	Cultivating fish or marine vegetation for the purposes of harvesting the organisms or their progeny with a view to sell or keep the organisms in a confined area for commercial purposes as defined in the <i>Fisheries Management Act 1994</i> .
Artificial reef	Built structures placed into the environment to create fish habitat.
Attenuate	To reduce in force, value, amount or degree.
Benthic	Living in, or on the seabed.
Benthic macroinvertebrate	Animals (typically polychaete worms, crustaceans and molluscs) that live in and on the seabed and are retained on a 1 mm mesh sieve.
Biofouling	The settlement, attachment and growth of organisms, such as microorganisms, plants, algae and animals on submerged surfaces in aquatic environments.
Biosecurity matter	a) any living thing, other than a human, or b) any part of an animal, plant or living thing, other than a human, or c) a product of a living thing, other than a human, or d) a disease, or e) a prion, or f) a contaminant, or g) a disease agent that can cause disease in a living thing (other than a human) or that can cause disease in a human via transmission from a non-human host to a human, or h) anything declared by the [biosecurity] regulations to be biosecurity matter.
Broodstock	Mature or parent fish used for breeding purposes in order to produce spat, fry and fingerlings.
Carrier	Anything (whether alive, dead or inanimate, and including a human) that has, or is capable of having any biosecurity matter on it, attached to it or contained in it.
Decommissioning	A general term for a formal process to dismantle or remove something from service, for example removal of sea pen infrastructure.
Deepwater	Water that is sufficiently deep to avoid or minimise the effect of the ocean bottom on surface waves. Water deeper than one-half the surface wave length is generally considered deepwater.

Diffraction	A deviation in the direction of a wave at the edge of an obstacle in its path.
Ecologically Sustainable Development	The principles outlined in Section 6(2) of the <i>Protection of the Environment Administration Act 1991</i> .
Endemic	The restriction of an organism to a particular geographical region.
Environmental Impact Statement	A document prepared to determine the type and level of effects that a proposed project may have on the natural, social and economic environments. Its objectives are to assess if the potential impacts are acceptable; to design appropriate monitoring, mitigation, and management measures; and investigate acceptable alternatives.
Epifauna	Aquatic animals living on the surface of the seabed (sediments and rocks), aquatic plants and built structures.
Eutrophication	Enrichment of a water body with nutrients, resulting in depletion of oxygen concentration and excessive growth of aquatic plants (in particular algae).
Extensive aquaculture	Aquaculture undertaken without providing supplementary food or nutrients for the fish or marine vegetation being cultivated.
Fallowing	A husbandry practice in the marine environment that involves moving aquaculture infrastructure over different seabed areas, in order to allow these areas enough time for natural marine process remediation.
Fingerlings	A small or young fish.
Fish	As defined in the <i>Fisheries Management Act 1994</i> .
Feed Conversion Ratio	The ratio of food to weight gain of the fish. For example, a ratio of 1.1:1 means that for every 1.1 kg of food fed to fish, 1 kg of fish growth results.
Habitat Protection Zone	A NSW marine park zone which aims to conserve marine biodiversity by protecting habitats and reducing high impact activities. Recreational fishing, some forms of commercial fishing, aquaculture, fishing competitions and tourist activities are permitted in Habitat Protection Zones.
Hauling out	The behaviour associated with true seals, sea lions, fur seals and walruses temporarily leaving the water and occupying land based sites. This occurs between periods of foraging activity.
Infauna	Aquatic animals living in the sediment.
In situ	Situated in the original, natural or existing place or position.
Intensive aquaculture	Aquaculture undertaken by providing supplementary food or nutrients for the fish or marine vegetation being cultivated.

Longline	A length of rope anchored to the seabed which is supported on or near the water surface by buoys. The rope may be surface or subsurface and supports apparatus (mussel ropes, shellfish containers) to culture shellfish or algae.
Macrofauna	Benthic organisms retained in a sieve of 1.0 mm and associated with sedimentary environments.
Marine Protected Area	An area of sea dedicated to the maintenance of biological diversity and associated natural and cultural resources that allows for multiple-use and is protected through legal means.
NSW Marine Waters	NSW Marine Waters is a belt of water between the jurisdictional limits of the NSW coastline and a line three nautical miles seaward. The area includes Jervis Bay and Twofold Bay.
Matters of National Environmental Significance	Matters of national environmental significance are protected under national environment law - the <i>Environment Protection and Biodiversity Conservation Act 1999</i> . These include listed threatened species and communities, listed migratory species, Ramsar wetlands of international importance, Commonwealth marine areas, world heritage properties, national heritage places, a water resource in relation to coal seam gas development and large coal mining development, the Great Barrier Reef Marine Park and nuclear actions.
Offshore zone	Coastal waters to the seaward of the near-shore zone. In the offshore zone, swell waves are unbroken and their behaviour is not influenced by the presence of the seabed.
Pelagic	Organisms that inhabit open water.
Plankton	In the marine environment, organisms that drift or float with the ocean currents. Most planktonic organisms are very small, although larger ones do occur - for example, jellyfish.
Pseudofaeces	A specialised method of expulsion that filter-feeding molluscs use to get rid of suspended particles, such as particles of grit, which cannot be used as food. The rejected particles are wrapped in mucus and expelled without having passed through the digestive tract.
Ramsar wetlands	Refers to wetlands listed under the Ramsar Convention, which is an international treaty that embodies the commitments of its member countries to maintain the ecological character of their Wetlands of International Importance and to plan for the sustainable use of all of the wetlands in their territories. Australia is a signatory to the Ramsar Convention.
Ranching	The release of cultured juveniles into unenclosed environments for harvest at a larger size in “put, grow and take” operations.
Regular monitoring	Periodic recording of data to assess progress of a project, and/or impact of an activity on a predefined set of parameters.

Risk	A probability or threat of damage, injury, liability, loss, or any other occurrence that is caused by external or internal vulnerabilities, and that may be avoided through pre-emptive action. It is generally conceptualised in terms of the likelihood and consequence of an event (or impact) occurring as a result of some behaviour or action.
Rocky reef	Rocky reef is an area of bedrock that protrudes from the sea floor and is surrounded by unconsolidated habitats that can be dominated by mud, sand, shell, gravel, pebbles, cobbles or boulders.
Sanctuary Zone	A NSW marine park zone which provides the highest level of protection to habitat, animals, plants and areas of cultural significance by prohibiting all forms of fishing and collecting activities, and anchoring on reefs. Only activities that do not harm plants, animals and habitats are permitted.
Sea pen	A netting enclosure anchored to the seabed or to buoys in which cultivated fish for human consumption are kept captive.
Sedimentation	The settling of particles (for example, uneaten food and faeces) out of the water column in which they were initially suspended or introduced into and onto the seabed).
Shallow water	The depth in which surface waves are noticeably affected by bottom topography. Generally, water depth less than one-half the surface wave length is considered shallow water.
Shellfish	A common reference to the group of marine animals including mussels, oysters, abalone, scallops and pipis.
Shoaling	The influence of the seabed on wave behaviour. Shoaling only becomes significant in water depths of 60 m or less which is manifested as a reduction in wave speed, a shortening in wave length and an increase in wave height.
Significant Impact	A significant impact is an impact which is important, notable, or of consequence, having regard to its context, intensity or reversibility. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted and upon the intensity, duration, magnitude and geographic extent of the impacts.
Stanchions	An upright bar, frame or post forming a support or barrier.
Subsurface	Below the water's surface.
Total farm gate value	The net value of the product when it leaves the farm, after marketing costs have been subtracted.
Total Organic Carbon	The amount of carbon bound in an organic compound which is often used as a non-specific indicator of water quality.

How to use this document

The MWSAS will assist in analysing proposed aquaculture projects in the NSW marine environment. The MWSAS covers information which will ensure that aquaculture developments meet sustainability outcomes. On top of its importance for proponents and assessment authorities, it is also a key reference for the community.

The MWSAS is divided into five key areas:

1. Introduction:

Purpose, objectives and scope of the MWSAS, the alignment of the strategy with other programs, as well as implementation, legislation, compliance and consultation associated with its development.

2. Industry Overview:

Background to aquaculture in NSW, the need for sustainable seafood production and the government's commitment to developing a policy platform for viable and sustainable seafood production in NSW marine waters.

3. Constraints and Requirements:

Used to assess a proposed aquaculture development (proponent and determining authority). Details constraints where NSW marine waters aquaculture is not permissible. It also outlines approval requirements for site selection, design and operation of aquaculture in NSW marine waters that must be addressed in the environmental impact assessment to mitigate impacts on the community, other stakeholders and the environment.

The list of criteria is not considered to be exhaustive, as other specific site criteria may be identified during planning focus meetings and community consultation.

4. GIS Constraint Mapping and Site Identification:

Provides an overview of the three-stage process used to identify potential marine aquaculture investigation areas. This process consists of the use of (1) locational constraints, (2) suitability factors that contribute to optimal areas for an aquaculture enterprise, and (3) refining high suitability areas with clarification of constraints and suitability factors, on-ground assessments (substrate mapping) and identifying local attributes of an area. This doesn't exclude the requirement to undertake site specific analysis by a proponent.

5. Assessments and Approvals:

Used to address the details required in the approvals pathway.

Explanatory note

Proposals to include marine aquaculture provisions in a new SEPP were being progressed at the time of writing (see Proposed new SEPP p. ii). If these proceed, the new SEPP will use the constraints in the MWSAS to identify areas where marine waters aquaculture is not permissible.

In areas where it is permissible, the proposed SEPP would also require that a planning authority must take into consideration the assessment requirements set out in the MWSAS in deciding whether the project should proceed.

1. Introduction

1.1 Vision Statement

The vision for the marine aquaculture industry in NSW is for a thriving, economically and environmentally sustainable industry that meets future demands for high quality seafood supply for the state and creates economic opportunities in regional NSW. This is in line with a measurement in the NSW Department of Primary Industries (NSW DPI) Strategic Plan 2015-2019 to increase the value of NSW primary industries by 30% by 2020.

1.2 Purpose and Objectives

The purpose of the MWSAS is to set the over-arching strategy for the NSW Government to co-ordinate development of the marine aquaculture industry, which includes best practice guidelines, ensuring an ecologically sustainable development (ESD).

Through the MWSAS, NSW Government will promote the development of marine aquaculture, and will have the tools to assist and guide potential investors through the assessment and approvals process.

The MWSAS will:

- provide a regulatory and industry best practice framework to drive the expansion of the NSW marine waters aquaculture industry in an ecologically sustainable and socially responsible manner
- provide a platform for the NSW Government to identify suitable marine aquaculture investigation areas and invite tenders for leases within these areas
- define the development approval and assessment processes for the private sector and NSW Government-led projects
- provide guidance to industry and consent authorities to prepare and assess applications for aquaculture development
- provide the community and stakeholders with relevant information about sustainable marine waters aquaculture
- avoid ad hoc aquaculture industry development in NSW waters which may be at unsuitable locations or using technologies and approaches that are not optimal for a specific location.

1.3 Scope of the Strategy

1.3.1 NSW Marine Waters

The MWSAS covers coastal waters to the jurisdictional limit of three nautical miles offshore (state waters), but does not include estuarine environments (see Figure 1). Estuaries have been delineated by straight lines drawn between the respective low-water marks of the natural entrance points of estuaries, rivers or creeks.

The MWSAS includes Jervis and Twofold Bay. Jervis Bay however, has previously been assessed for aquaculture and therefore it is unlikely that there is potential for expansion beyond the approved 50 ha of shellfish leases. Twofold Bay on the other hand, with an existing mussel culture industry, may support additional lease areas.

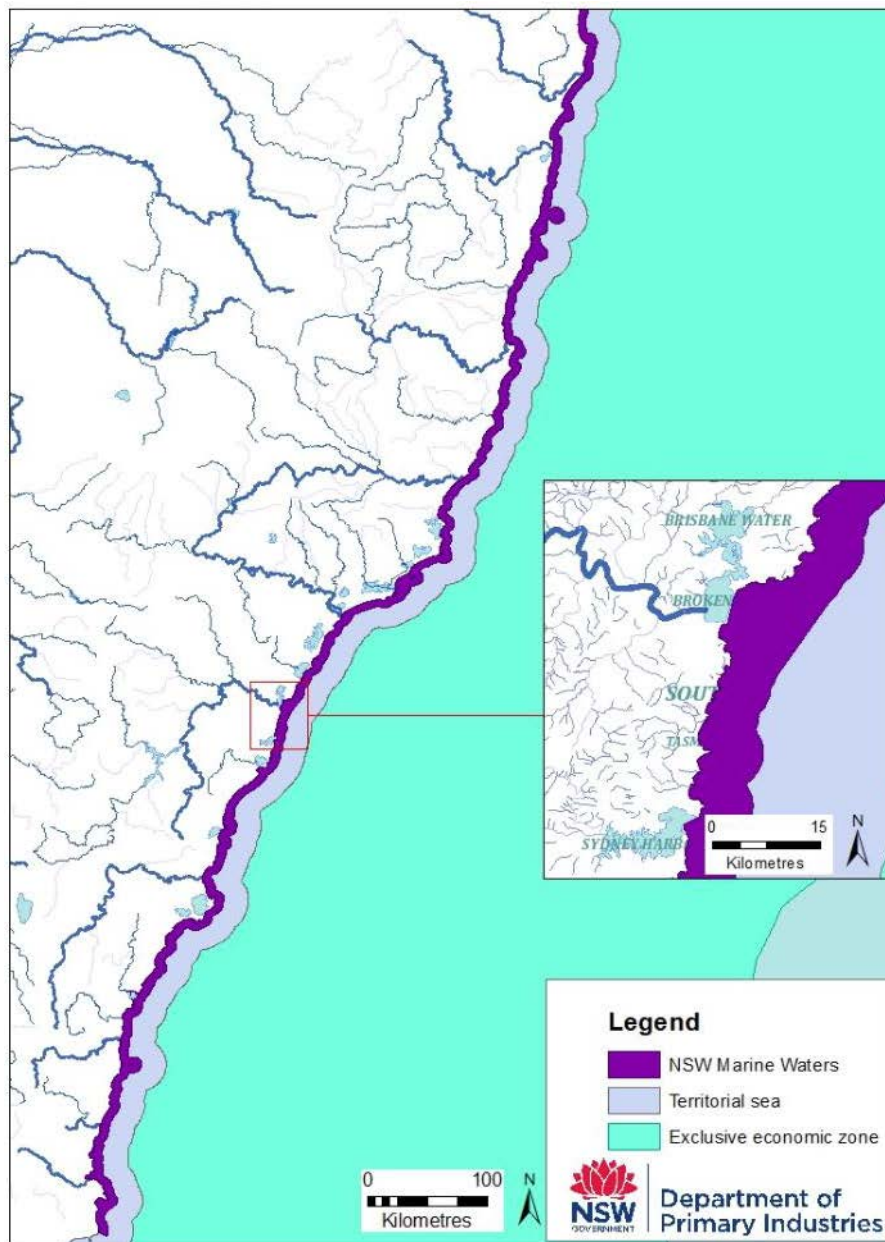


Figure 1: Defined area of NSW marine coastal waters with a detailed insert (Source: NSW DPI, 2017).

1.3.2 Types of Aquaculture

The MWSAS covers the following types of marine aquaculture used to produce seafood such as finfish, shellfish and algae:

Floating Infrastructure

Intensive aquaculture - requires nutrient input in the form of a formulated feed:

- Sea pen aquaculture approximately on the 20-50 m depth contour, floating or partly submerged (for example, finfish) (Figure 2).

View towards Cabbage Tree Island (Approx 6.5 Kms) to the left of the sea pens and Hawks Nest (Approx 8.6 Kms) to the right of the pens.



View from the sea pens towards nearest coastline (Approx 5.5 Kms)

Figure 2: Pictures of the Marine Aquaculture Research Lease located 5.5 km offshore in Providence Bay, Port Stephens (Source: NSW DPI, 2016).

Extensive aquaculture, no nutrient input; stock feed on naturally occurring matter:

- Longline aquaculture on approximately the 10 m depth or greater contour, floating infrastructure principally supported by buoys (for example, algae or shellfish such as mussels/oysters) (Figure 3).



Vessel within longline infrastructure growing mussels.



Figure 3: A longline mussel farm located 200 m from the shoreline of Twofold Bay (Source: NSW DPI, 2012).

Submerged Infrastructure

- Longline aquaculture on approximately the 20 m depth or greater contour, submerged below the surface but supported by subsurface buoys to maintain the culture infrastructure off the sea floor. Examples include algae or shellfish such as mussels/oysters
- Extensive artificial reef aquaculture on about the 15-20 m depth contour, submerged infrastructure on the sea floor (for example, abalone) (Figure 4)
- Extensive ranching at varying depths – no infrastructure (for example, shellfish seeded on ocean floor) (Figure 5).



Figure 4: Abalone growing on open ocean artificial reefs (Source: Ocean Grown, 2016).

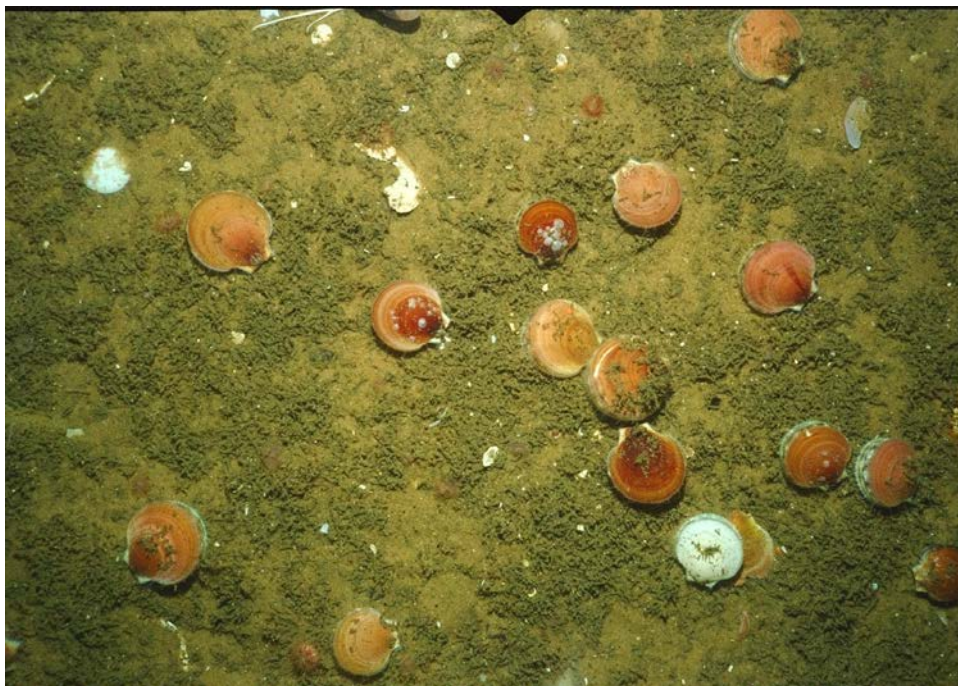


Figure 5: Ranching of scallops on the seabed (Source: NOAA, 2016).

Appendix 1 provides additional diagrams and/or photos of these four types of marine aquaculture and a map of where some marine species may be cultured.

Opportunities also exist for the development of integrated multi-trophic aquaculture that integrate different forms of aquaculture within one site. For example, algal farming near finfish pens.

1.3.3 Major Stakeholders and the Partnership Approach

The major stakeholders in the MWSAS are:

- The private sector – aquaculture businesses and other business people investing in aquaculture
- State Government – NSW DPI is the major State Government participant, delivering on the ground outcomes in four action areas (See Figure 6)
- State Aquaculture Steering Committee – providing technical assistance regarding legislative requirements, performance standards and monitoring protocols
- Aboriginal peoples
- Research organisations and non-government environment groups
- Individuals, communities and marine water users.

The partnerships between government, industry and the community are essential to:

- Maximise efficiencies and competitive advantages for new and expanding aquaculture projects
- Avoid duplication of effort by proponents and agencies
- Provide certainty in the assessment and approval processes to ensure that environmental requirements and criteria are met
- Provide direction and incentives to adopt best practice guidelines in aquaculture
- Strategically consider projects by assessing the environmental impacts both at the individual project level and cumulatively in a specific locality or a marine bioregion.

1.4 Alignment with Other Programs

The MWSAS is aligned with the Marine Estate Management Strategy, which sets the overarching strategy for the State Government to co-ordinate the management of the marine estate with a focus on achieving the objects of the *Marine Estate Management Act 2014* (MEM Act). It articulates how the Marine Estate Management Authority's (MEMA) vision and priorities for management of the marine estate will be delivered. MEMA's vision is a '*healthy coast and sea, managed for the greatest wellbeing of the community, now and into the future*'.

The Marine Estate Management Strategy is underpinned by a statewide Threat and Risk Assessment (TARA) which identified and assessed threats and risks to:

- Environmental assets - the natural attributes, components and living resources of the marine estate such as fish stocks, saltmarsh and subtidal reefs individually in 'estuaries' and 'coastal and marine' areas
- Social and economic benefits (community benefits) – how the NSW community can benefit from the NSW marine estate, such as going to the beach, running a scuba diving business or the peace of mind that we have healthy marine life. This also includes Aboriginal cultural heritage and use benefits.

Aquaculture in its various forms, were assessed as part of this process and generally deemed minimal or low risk to the assets or benefits derived from the marine estate. While estuarine

oyster aquaculture was deemed minimal to low risk to environmental assets, risk to seagrass was deemed at moderate risk from aquaculture infrastructure. Impacts on aquaculture production and business viability have been identified in the social and economic assessment, with pests and disease noted as threats to the social and economic benefits of the industry. The Marine Estate Management Strategy provides opportunity to further investigate and address identified priority threats associated with aquaculture over the next ten years.

The national Productivity Commission's (2004) report *Assessing Environmental Regulatory Arrangements for Aquaculture* recommends a tiered approach to marine aquaculture planning including:

- Clear legislative objectives to promote certainty and consistency in legislation and guide stakeholders in interpreting and applying the legislation
- The use of a spatial planning regime to designate aquaculture areas in suitable environmental locations
- The use of environmental risk assessment processes to guide decision-making based on the species, production system, site location, management practices and the condition of the local environment (such as the quality and assimilative capacity of the receiving waters)
- Allocation of marine aquaculture leases that provide long-term tenure and the right to occupy and use a specific site within an area
- Administration of various approvals (including aquaculture licenses) that set out operating conditions.

The national Productivity Commission's (2016) report on *Marine Fisheries and Aquaculture* further identifies that:

- For states with well-developed aquaculture industries, the designation of areas for potential aquaculture development provided an efficient way of identifying suitable sites, greater regulatory certainty and streamlined approval processes for investors.

Marine aquaculture planning has been used in Tasmania since 1995, Victoria (2000), South Australia (2001), Queensland (2010) and Western Australia (2015) to regulate the development of their marine aquaculture industries.

The Australian Government has also prepared a National Aquaculture Strategy (2017) with an aspirational goal of increasing the value of aquaculture from \$1 billion to \$2 billion by 2026. In relation to planning for aquaculture it identifies that:

- Individual jurisdictions, where appropriate, will investigate potential areas for prescribed areas and, as appropriate, establish streamlined approval processes for new aquaculture development in these areas
- Amend the *Commonwealth Fisheries Management Act 1991* to allow individual jurisdictions to extend their existing aquaculture regulations to cover adjoining Commonwealth waters.

The information contained in the MWSAS is derived predominantly from two successful NSW DPI SSI applications to NSW Department of Planning and Environment (NSW DPE). These applications consisted of the [Marine Aquaculture Research Lease](#) for intensive finfish aquaculture in sea pens off Port Stephens and extensive [shellfish aquaculture](#) on longlines in Jervis Bay. In these two applications NSW DPI used a risk assessment process in developing the environmental impact statements (EIS's) to determine the best siting arrangements; assess the potential impacts of the cultured species and production systems; and determine the best management practices for the benefit of the local environment and adjacent communities (see case study 1 and 2, p. 7-8). The EIS process was enhanced through the accompanying public consultation, which further refined the risk assessment process.

CASE STUDY 1: MARINE AQUACULTURE RESEARCH LEASE, PORT STEPHENS

NSW DPI and Huon Aquaculture Group Limited (Huon Aquaculture) are undertaking a five year offshore sea pen trial to: validate the commercial potential of Yellowtail Kingfish aquaculture; trial the latest sea pen technologies; and undertake environmental monitoring in the coastal waters of NSW.

Approvals Pathway

Under *State Environmental Planning Policy - State and Regional Development 2011* the proposal was classified as State Significant Infrastructure and required approval from the Minister for Planning and Environment under Section 115W of the *Environmental and Planning Assessment Act 1979* (EP&A Act).

An environmental impact statement (EIS) was prepared to accompany the application. Crown Lands provided land owner's consent, a lease was granted under Section 163 of the *Fisheries Management Act 1994* (FM Act) and a permit was obtained under the MEM Act.

Risk Assessment and Mitigation

A risk assessment process based on the *National ESD Reporting Framework: The 'How To' Guide for Aquaculture* was used to identify and mitigate potential risks associated with the proposal. This framework is based on Standards Australia and Standards New Zealand (1999; 2000) risk management methods which are used by a variety of industries to conduct risk assessments.

A total of 27 risk issues were identified and categorised that had potential to have an impact as a result of the proposal.

These risks were identified in either the construction stage or the operational stage of the MARL.

Eleven issues were identified as representing a '*negligible*' risk while 12 issues were assigned a '*low*' risk ranking. No issues were identified as representing a '*high*' or '*extreme*' risk but four were classified as '*moderate*', including (1) impacts on marine habitats - water quality, nutrient concentrations and sedimentation; (2) chemical use; (3) disease and introduced pests; and (4) impacts on migratory pathways, behavioural changes and predatory interactions.

All four '*moderate*' issues were initially classified as '*low*' after considering the proposed mitigation measures but the rankings were increased due to the lack of information on certain factors and the need to conduct further research. This ranking was thought to ensure that adequate management attention would be provided to these issues until the research activities validated these assessments.

A Modification Application was later submitted to relocate the MARL and Huon Lease further offshore. A review of the risk assessment was conducted and only two issues were re-classified. Construction noise went from '*low*' to '*negligible*' while navigation increased from '*negligible*' to '*low*'.

Environmental Management

An environmental management plan was developed to ensure that the commitments in the EIS and all approval and licence conditions are fully implemented during the five year research trial.



CASE STUDY 2: COMMERCIAL SHELLFISH AQUACULTURE

NSW DPI was granted approval for three Commercial Shellfish Aquaculture Leases within Jervis Bay consisting of two 20 hectare areas (near Callala Beach) and a 10 hectare site (near Vincentia). The three leases have been tendered to South Coast Mariculture Pty Ltd, which will initially culture mussels but also intend to trial other approved shellfish species.

Approvals Pathway

Under *State Environmental Planning Policy (State and Regional Development 2011)* the proposal was classified as SSI and required approval from the Minister for Planning and Environment under Section 115W of the EP&A Act.

An EIS was prepared to accompany the application. Crown Lands provided land owner's consent, a lease was granted under Section 163 of the FM Act and a permit was obtained under the MEM Act.

NSW DPI also sought approval under the *Control of Naval Waters Regulation 1922* and the project was deemed not to be a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) administered by the Commonwealth.

Risk Assessment and Mitigation

A risk assessment process similar to that for the MARL was undertaken to identify and mitigate potential risks associated with the proposal.



A total of 22 risk issues were identified and categorised that had potential to have an impact as a result of the proposal. These risks were identified in either the construction stage or the operational stage of the Commercial Shellfish Aquaculture Lease project.

Five issues were identified as representing a '*negligible*' risk while 14 issues were assigned a '*low*' risk ranking. No issues were identified as representing a '*high*' or '*extreme*' risk but three were classified as '*moderate*', including: (1) water quality and sedimentation; (2) genetics, disease and introduced pests; and (3) entanglement and ingestion of marine debris.

All three '*moderate*' issues were initially classified as '*low*' after considering the proposed mitigation measures but the rankings were increased due to the lack of information on certain factors and the need to conduct further research. This risk ranking was thought to ensure that adequate management attention would be provided to these issues.

Environmental Management

An environmental management plan was also developed to ensure that the commitments in the EIS and all approval and licence conditions are fully implemented by the lease holder.



These projects have been complimented by research and environmental monitoring undertaken at the NSW DPI MARL. Nine management plans were developed for this project as part of the consent process to address operational constraints. Examples of these management plans are available to NSW aquaculture lease holders and investors to assist with the assessment and approvals process (see Appendix 2).

The principles developed for the successful OISAS which covers edible oyster aquaculture in 30 estuaries and *NSW Land Based Sustainable Aquaculture Strategy* (NSW DPI, 2009) are also incorporated into this strategy.

1.5 Implementation

The MWSAS was developed as a whole-of-government project under the auspices of the State Aquaculture Steering Committee. NSW DPI is the key agency responsible for delivery of the objectives of the MWSAS. Local government and state agencies share responsibility for regulatory approval processes.

The MWSAS brings together the interests of economic development, planning and sustainable natural resource management to form a partnership that can lead to sustainable marine aquaculture and generate employment in regional NSW. Effective implementation of the MWSAS therefore requires collaboration between government, industry and the community.

Implementation of the MWSAS falls into four distinct areas as shown in Figure 6.

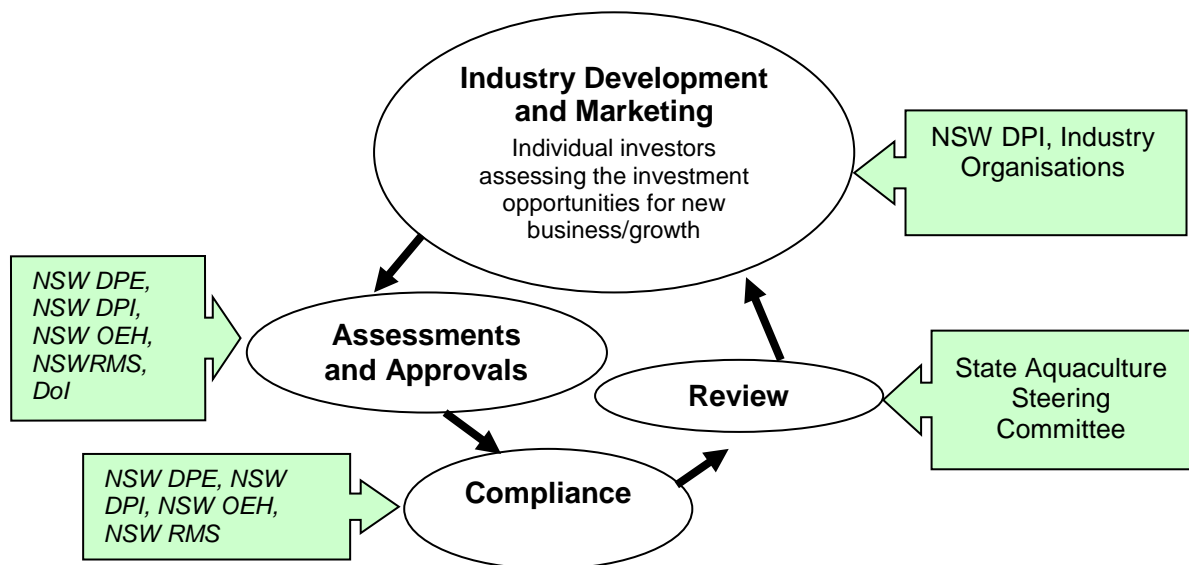


Figure 6: MWSAS implementation – the four key areas and key government agencies.

1.6 Legislation

Relevant legislation and the government agency primarily responsible for administering it in respect of aquaculture development in NSW marine waters, are detailed in Appendix 3.

1.6.1 NSW Legislation

Industry Regulation

NSW DPI manages and regulates the aquaculture industry in accordance with the provisions of the *Fisheries Management Act 1994* (FM Act).

Under the FM Act, NSW DPI issues aquaculture permits to authorise an aquaculture activity, as well as the issue of aquaculture leases over public water land on which that activity may be

undertaken. Both the aquaculture permit and lease documents contain conditions which regulate and manage the respective aquaculture activities. Lease holders are also required to enter into a lease security arrangement, which ensures the aquaculture industry shares future responsibility for potential problems arising from lease maintenance and decommissioning.

The MWSAS is given effect as an Aquaculture Industry Development Plan (AIDP) for marine aquaculture in NSW under the provisions of the FM Act. Implementation of the MWSAS is supported by planning legislation and instruments (see below).

Development Assessment and Approvals

The planning controls for marine aquaculture are set by the EP&A Act. The EP&A Act provides a framework for environmental planning in NSW and includes provisions to ensure that proposals that have potential to significantly affect the environment are subject to detailed assessment and community consultation.

State Environmental Planning Policy 62 – Sustainable Aquaculture (SEPP 62) currently provides the key regulatory framework for aquaculture.

At the time of writing, consultation was being undertaken on a proposal to update the provisions of SEPP 62 and relocate them into a new SEPP (Primary Production and Rural Development) which addresses primary production matters. It is proposed that the new SEPP will identify where marine waters aquaculture is not permissible, based on the constraint criteria set out in Table 1 of this MWSAS.

Where marine waters aquaculture is permissible, the proposal is that the new SEPP would provide that:

- Development by a private individual or organisation may be undertaken with development consent
- Activities undertaken by or on behalf of a public authority may be undertaken without development consent.

Marine waters aquaculture projects requiring development consent, would then be assessed as State Significant Development (SSD) in accordance with State and Regional Development SEPP.

Activities by, or on behalf of a public authority which may be carried out without development consent, would be considered in accordance with the environmental impact assessment requirements of the EP&A Act. If such an activity were determined as likely to significantly affect the environment, it would be assessed as SSI under the above SEPP.

Consistent with SEPP 62, there would be a requirement in the proposed new SEPP that the relevant provisions of any aquaculture industry development plan must be taken into consideration by a planning authority before a decision is made to grant development application consent, or whether to proceed to undertake or authorise an activity. The proposed new SEPP would include the assessment requirements set out in the MWSAS.

Additional constraints and requirements may be applied depending on the location and operational activities of a particular development. For example, potential impacts to Aboriginal cultural heritage or national park access issues.

Marine aquaculture development may also be subject to the provisions of *State Environmental Planning Policy (Coastal Management) 2018* (CM SEPP), particularly at locations where development controls exist in the coastal environment area and coastal vulnerability areas.

Any land or port based assessment requirements will need to be confirmed up-front by discussing the project with NSW DPI and the relevant planning authority.

Further information on the assessment and approvals process is detailed in Chapter 5.

1.6.2 Commonwealth Legislation

In addition to NSW legislation assessment processes, marine aquaculture projects may also be subject to assessment under relevant Commonwealth legislation (EPBC Act) if they potentially impact on matters of national environmental significance (MNES). Key policy statements that outline the assessment process and assessment considerations include: EPBC Act Policy Statement 1.1 (Significant Impacts Guideline 1.1) in conjunction with EPBC Act Policy Statement 2.2 (Offshore Aquaculture).

Further assessment may also be required under other Commonwealth legislation such as the *Control of Naval Waters Act 1918*, *Historic Shipwrecks Act 1976*, *Native Title Act 1993*, *Environment Protection (Sea Dumping) Act 1981* and *Submarine Cables and Pipelines Protection Act 1963*.

1.7 Compliance

The MWSAS recognises the importance of the regulatory role of NSW DPE for marine aquaculture projects that are SSD or SSI, and the role of NSW DPI in extension and compliance. In addition, NSW DPI can provide current information from research programs, and advice on best practice in aquaculture management. This will support an adaptive framework for management of activities. It is anticipated that the marine aquaculture industry will innovate and change rapidly, therefore the planning and approval regime, once established, put in place needs to be adaptive and responsive to ensure it supports innovation.

In order to ensure the industry's high standards of environmental and operational performance, planning approvals for aquaculture projects will include conditions of development consent that must be met by the proponent. The relevant planning authority (such as the NSW DPE for SSD or SSI) may undertake compliance activities to ensure the project is being undertaken in accordance with the approval.

NSW DPI undertakes actions to ensure proponents are complying with relevant aquaculture permit and lease conditions.

If a project requires Commonwealth approval, the relevant Australian Government Department may also apply conditions to any approval.

Specific compliance activities for marine aquaculture leases undertaken include:

1. Mandatory conditions of development consent issued by NSW DPE
2. Regular lease and permit condition inspections conducted by NSW DPI
3. Sanctions and actions on poor records of management are conducted by NSW DPI
4. Lease holders provide NSW DPI with an Aquaculture Lease Security Arrangement (Bond)
5. Extenuating circumstances may reduce the time period that a lessee has to comply with agreed conditions and standards of management, as well as issued compliance notices and termination of leases
6. Suspension and cancellation of permits by NSW DPI
7. Enforcement of tidy lease compliance standards by NSW DPI
8. Annual production report must be submitted to NSW DPI
9. Public liability insurance and indemnity

10. Mandatory conditions of development consent issued by NSW DPE

11. Mandatory conditions of consent issued by the DEE if the project is assessed as a 'controlled action' and requires approval under the EPBC Act.

1.8 Consultation

Key government agencies comprising the State Aquaculture Steering Committee with responsibility for environmental assessment were involved in development of the MWSAS. Stakeholder and community engagement was an essential component of development of the MWSAS. Targeted consultation was undertaken with government agencies and peak industry and stakeholder groups, including: Aboriginal groups, local government, environmental groups, community groups, local businesses, tourism providers, sailing and fishing clubs and commercial fishers. This provided an opportunity to canvass views on the value and benefits of the marine environment, perceived threats of aquaculture and ideas on how threats could be managed.

The draft MWSAS was then placed on public exhibition to invite additional stakeholder and community comment. Public consultation was undertaken through the NSW Government 'Have Your Say' website, DPI Fisheries website and Marine Estate Management Authority website. Comments received from public exhibition were reviewed by the State Aquaculture Steering Committee and are addressed in this final MWSAS.

Additional public consultation will be undertaken when the NSW Government identifies potential marine aquaculture investigation areas. This local, site specific consultation will help determine appropriate sites and address matters of concern in preparation of an application for these areas.

The MWSAS is the product of a whole-of-government review process, integrating requirements of all state government agencies and achieving a cohesive and consistent policy position for marine aquaculture development.

1.8.1 Addressing Community Concerns

Common concerns relating to marine aquaculture are raised by various stakeholder groups, including environmental, tourism, animal welfare, recreational and commercial fishing and the wider community. The primary concerns raised with NSW DPI during community consultation for the MWSAS and for the MARL and Jervis Bay projects included:

- Water quality and seafloor impacts
- Marine fauna entanglement
- Visual amenity
- Disease and pests
- Navigation.

A summary of potential site, operational and community risks identified from this consultative work is highlighted in Figure 7, with links to Section 3.2 (Assessment Requirements) in this report. The MWSAS addresses ways to mitigate these risks and other potential impacts and achieves this by appropriate site selection, design, operation, monitoring, and compliance oversight of aquaculture farms (see Section 3). The environmental management plan examples in Appendix 2 highlight operational procedures to achieve compliance in these areas.

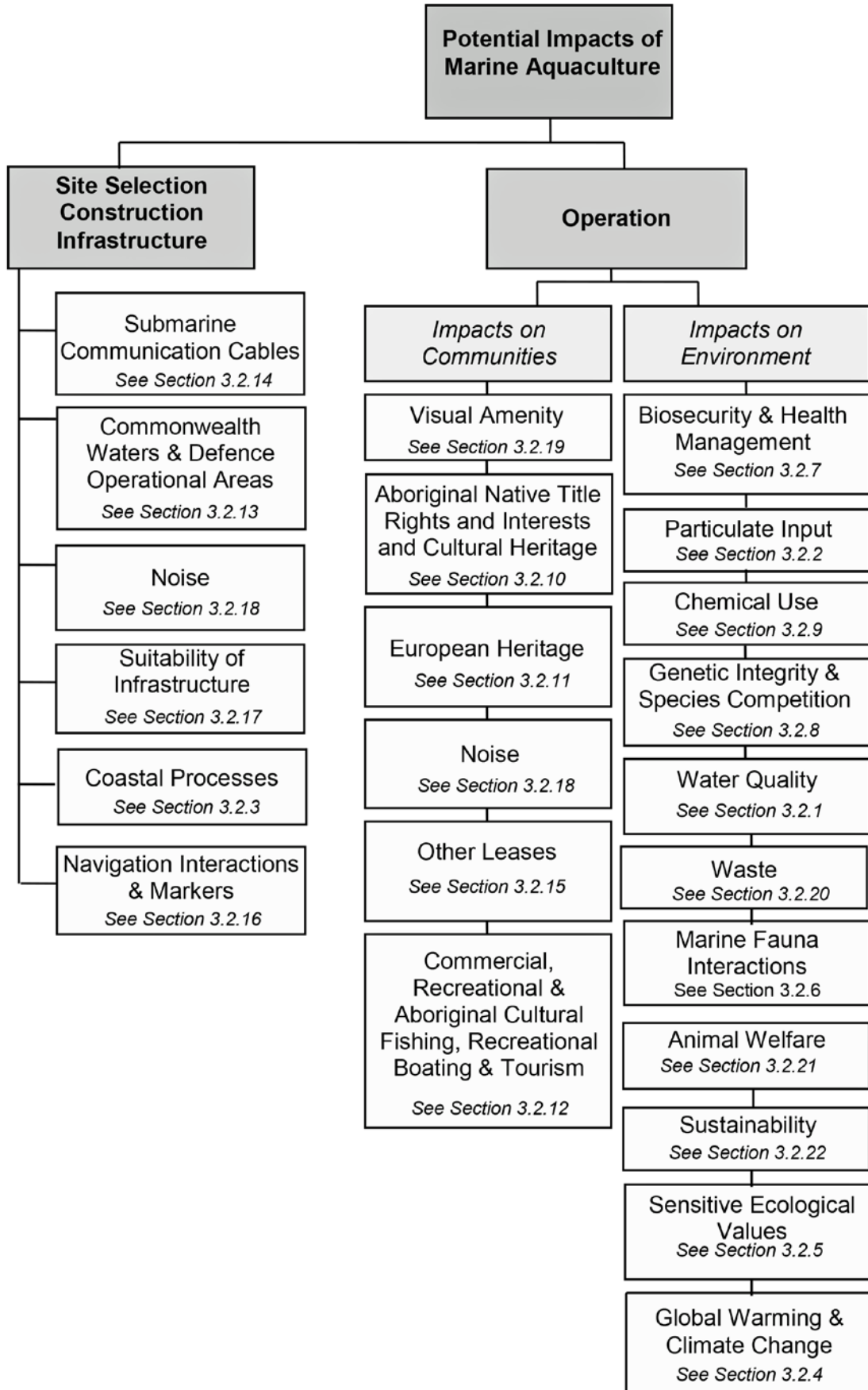


Figure 7: Potential environmental and socio-economic impacts of the proposed aquaculture operations (modified from Fletcher *et al.*, 2004).

2. Industry Overview

2.1 Aquaculture

The MWSAS uses the definition of aquaculture provided in the FM Act. In summary, aquaculture is the breeding, growing, keeping and harvesting of fish or marine vegetation, with a view to sale or commercial purpose. Fish includes not only finfish, but extends to shellfish (molluscs and crustaceans), echinoderms (sea urchins) and polychaete worms.

Aquaculture is one of the fastest-growing industries in the world (DoF, 2015). In 2012, the volume of farmed seafood overtook beef production (Web Reference 1). Global demand for seafood is rapidly expanding with world annual per capita fish consumption doubling from about 10 kg in the 1960s to 20 kg in 2016 (FAO, 2016). In 2016, 50% of the seafood consumed worldwide was produced by aquaculture (FAO, 2016).

2.2 Marine Waters Aquaculture in NSW

Up until the 1970s, coastal aquaculture in NSW was based on the intertidal cultivation of the Sydney Rock Oyster, an industry which commenced in the Georges River, Sydney, in 1872. In the 1970s the University of NSW commenced experimental cultivation of Blue Mussels using rafts in Port Stephens, Botany, Jervis and Twofold bays. During 1990s, NSW DPI undertook research into the longline production of scallops and Akoya Pearl Oysters in Jervis Bay and Port Stephens, scallops in Twofold Bay and ranching of scallops in Jervis Bay.

In the late 1980s research at Cronulla Fisheries Institute and Port Stephens Fisheries Institute expanded to include high value marine finfish species such as Snapper and Mulloway. NSW DPI began commercial scale finfish trials in sea pens in Botany Bay in 1993. The lease area was subsequently tendered to Silver Beach Aquaculture, with a lease granted in 1999. This operation ran until 2012 producing Snapper and Mulloway.

Following the approval of an EIS in 1998, 50 ha of lease area was approved for Blue Mussel culture in Twofold Bay and is currently operated by Eden Seafarms. The experimental Blue Mussel raft operation continued in Jervis Bay until 2008. In 2014, approval was granted to NSW DPI for 50 ha of shellfish leases in Jervis Bay following assessment of an EIS and Visual Amenity Report. These leases were subsequently tendered to South Coast Mariculture.

In early 1999, Pisces Marine Aquaculture began trials of Snapper in sea pens on a 30 ha lease in Providence Bay, Port Stephens. Following the submission of an EIS, the lease was approved in 2001 with a subsequent Modification Application approved in 2009 for additional pens and fish species.

In 2013, NSW DPI applied for a 20 ha MARL which was approved. NSW DPI advertised an Expression of Interest for a research partner, with Huon Aquaculture being selected. Huon Aquaculture subsequently purchased the Pisces lease.

In 2016, a Modification Application was approved to move the MARL and Huon Lease further offshore to deeper water (near the 40 m contour line) to take advantage of the latest aquaculture technology in offshore sea pens. A larger lease area was required to accommodate the mooring infrastructure.

Today in NSW, oysters are cultivated in 30 estuaries on some 2,800 ha of lease area. Approximately 1,500 ha of estuarine oyster leases in NSW are currently operating in marine parks, nature reserves, national parks and aquatic reserves. Marine parks also host a number of marine aquaculture leases.

2.3 Current Industry Profile

Current businesses operating in NSW marine waters include:

- Eden Seafarms (37.5 ha) and South Coast Mariculture (12 ha) - Twofold Bay
- South Coast Mariculture (50 ha) - Jervis Bay
- NSW DPI MARL (60 ha) - Port Stephens
- Huon Aquaculture (62 ha) - Port Stephens.

There are no artificial reefs or ranching leases in NSW at this time.

2.4 Economic, Employment and Social Values of NSW

Aquaculture accounts for 42% of total Australian fisheries gross value of product (GVP) and was worth approximately \$1.2 billion in 2014/15 (ABARES, 2016). The total local value (farm gate) of aquaculture produce in NSW in 2016/17 was \$70 million (DPI, 2018). However, the total non-market value of the aquaculture industry to the wider community of NSW is far greater than just the farm gate value (Barclay *et al.*, 2016).

An economic and social study of NSW coastal aquaculture was undertaken by Barclay *et al.* (2016), which identified the range of economic and social contributions of the NSW aquaculture industry to local communities. The study found a suite of contributions to wellbeing in rural and regional communities flowing from aquaculture operations.

The study identified that regional economies need economic diversity in order to be resilient (Barclay *et al.*, 2016). Having a range of different sectors in an economy provides mutual benefits in terms of generating connections between businesses and collectively making support industries viable. Different industries also provide different types of employment opportunities, helping ensure economic opportunities for all sectors of society.

The study identified aquaculture as a key part of economic diversity and flexibility of coastal towns in NSW. The study outlined that aquaculture had an added value and income multipliers of 2.12 and 2.17 respectively, and an employment multiplier of 1.36 for all NSW (Barclay *et al.*, 2016).

The study also identified that aquaculture and other sectors such as tourism are not an 'either/or' proposition. Each have a socially and economically important role to play in NSW communities, especially in regional areas (Barclay *et al.*, 2016). Furthermore, these sectors are interdependent. Fresh, locally produced food and environmentally protected waterways are key attractions for the tourism industry, and tourists are an important market for aquaculturists. Tourism (including recreational fishing tourism) and aquaculture are therefore not mutually exclusive. The industries support each other.

In responses to a questionnaire undertaken as part of the study, 94% of respondents agree it is important we produce our own seafood in NSW, 89% of respondents expect to eat local seafood when they visit NSW and 76% felt that eating local seafood was an important part of their coastal holiday experience. In addition, amongst the members of the general public surveyed, 63% of respondents indicated they would be interested in visiting an aquaculture operation while on holidays (Barclay *et al.*, 2016).

The different market options available, including local supply chains and links with tourism and hospitality businesses, are important links between aquaculture, hospitality and tourism (Barclay *et al.*, 2016). This enables aquaculturists to grow the industry's overall contributions to resilient local economies. The study estimated that for the year 2013–14, the state-wide estimates of both aquaculture production and the secondary sector (manufacturing industry), were an output of \$226 million, added value \$134 million, and \$69.3 million in household income with the sectors employing a total of 1,758 full time jobs across NSW.

Aquaculture is not always valued as a social or culturally important activity, but the study indicates that historically it has strongly supported cultural expression and growth, and it continues to do so in some sections of modern Australia (Barclay *et al.*, 2016). The cultural importance of fresh, local and high quality seafood to many ethnic groups within the community was also highlighted in the report for its significant potential to develop and enhance new and emerging markets, including China.

Aboriginal people maintain a keen interest in economic development opportunities in marine waters (NSW Aboriginal Land Council 2017, *pers comm.*). NSW Government established the Aboriginal Fishing Trust Fund to support fisheries related business opportunities, as well as enhance and protect Aboriginal cultural fishing.

Seafood is integral to many Australian and international visitors and how they enjoy spending time at the coast. There is scope to further enhance this, through ensuring sufficient supply of local seafood in coastal areas, and public awareness of where it can be purchased.

The supply of locally caught fish is not expected to increase from current sustainable catch levels, and approximately 85% of seafood purchased in NSW is imported (Wilkinson, 2013). In 2016-17, NSW imported \$572 million worth of seafood products for human consumption (NSW DPI, 2017). Aquaculture can contribute substantially to the increasing demand for locally sourced quality seafood, while providing employment, economic and social contributions to local communities in NSW.

2.5 Sustainable Aquaculture Growth in NSW

Sustainable seafood production is a key focus of the NSW Government's State Aquaculture Steering Committee, which is comprised of the following agencies:

- NSW Environment Protection Authority (NSW EPA)
- NSW Food Authority
- Department of Industry
- Department of Industry (Lands & Water)
- Department of Planning and Environment (Resources and Geoscience)
- Office of Local Government
- NSW Office of Environment and Heritage (NSW OEH)
- NSW Department of Planning and Environment (Planning)
- NSW Department of Primary Industries (Fisheries), (Aquatic Environment) and (Biosecurity)
- Department of Premier and Cabinet
- NSW Roads and Maritime Services (NSW RMS).

The increasing gap between capture fishery supply, along with the growing demand for seafood can only be supported by aquaculture to meet sustainable future demands of food security for the state.

NSW has areas potentially suitable for the development of marine aquaculture with access to high quality marine waters. The state's business infrastructure is well developed, with the capacity to service growth in the aquaculture sector. Aquaculture industry participants and the NSW Government's regulatory agencies are conscious of ensuring that development of the aquaculture industry in NSW proceeds in a manner that does not jeopardise its ecological sustainability. Industry and government continue to invest heavily in research, technology and management practices to ensure the sustainable growth of this industry.

3. Constraints and Assessment Requirements

The MWSAS sets out best practice for the establishment and operation of marine aquaculture projects. A risk assessment process based on the *National ESD Reporting Framework: The 'How To' Guide for Aquaculture* (Fletcher *et al.*, 2004) and the *Standards Australia and Standards New Zealand Risk Management Methods* (1999; 2000) were utilised during the development of the criteria for industry best practice management.

NSW DPI is developing suitability maps through the use of GIS constraint mapping, stakeholder interaction and on ground investigations (see Chapter 4). Investors can use this information to refine their search for a suitable aquaculture site for their proposed production methods and preferred species. The NSW Government will also use the information in this chapter to identify suitable marine aquaculture investigation areas.

This chapter lists the constraints that identify where marine waters aquaculture development will not be permissible, subject to a proposed amendment to SEPP 62 (see Section 3.1 - Table 1).

This chapter also includes the expected outcomes and the assessment requirements that must be addressed in all applications for the development of marine waters aquaculture in NSW, including proposals by private individuals, organisations or the NSW Government (see Section 3.2). The expected outcomes and assessment requirements are intended to promote industry best practice.

3.1 Constraints

Table 1 below outlines the locations in NSW marine waters where aquaculture operations will not be permissible, subject to an amendment to SEPP 62.

Table 1: Constraints for NSW marine aquaculture operations.

Criteria	Constraint
1. Conservation exclusion zones	Must <u>not</u> be within land reserved or acquired under the <i>National Parks and Wildlife Act 1974</i> , nature reserves, Aboriginal or European historic sites.
2. Marine conservation areas	Must <u>not</u> be within marine park Sanctuary Zones (or equivalent) or aquatic reserves.
3. Pipelines and cables	Must <u>not</u> be within 1 km of sewage outfall pipelines or protection zones for submarine communication cables.
4. Navigation channels and shipping port approaches	Must <u>not</u> be within 1 km of navigation channels and established shipping port approaches.
5. Department of Defence operational areas	Must <u>not</u> be within Department of Defence operational areas (for example, Naval Trace area at Jervis Bay).
6. Substrate type	Must <u>not</u> be located over rocky reefs (as

Criteria	Constraint
	defined by NSW DPI).
7. Seagrass beds	Must <u>not</u> be located over seagrass beds (as defined by NSW DPI).
8. Marine heritage items	Must <u>not</u> be within 1 km of maritime heritage items (for example, historic plane and shipwrecks).
9. Artificial reefs	Must <u>not</u> be within 1 km of purposefully constructed artificial reefs.
10. Marine infrastructure and monitoring equipment	Must <u>not</u> be within 1 km of marine infrastructure (for example, moorings, boat ramps, and marinas) and monitoring equipment (for example, Wave rider buoys). Note: <i>This distance will be regularly reviewed by NSW RMS and will require consultation prior to any site investigation.</i>
11. Species	Culture species must be spawned from the endemic population or from broodstock originating from the east coast of Australia. Culture species must <u>not</u> be genetically modified through the addition of any foreign genetic material (DNA) into an organism.
12. Distance between aquaculture leases	Must address biosecurity separation distances between farm operations.

Note: Distance must be measured from the edge of an aquaculture lease.

3.2 Assessment Requirements

The following assessment requirements must be addressed in an environmental impact assessment of a proposed marine aquaculture development, where they are relevant to the proposal. The expected outcomes can be demonstrated by meeting (or exceeding) the assessment requirement criteria.

Further information on the environmental impact assessment process is provided in Chapter 5. Environmental management plans developed by NSW DPI for the Marine Aquaculture Research Lease (Appendix 2) provide an example for proponents of how to address risks, monitor operations, respond to issues, refine operations and report on performance.

3.2.1 Water Quality Parameters

Expected Outcome
Key water quality parameters are suitable for aquaculture production and stocking biomass is set at a level to ensure no significant impacts on water quality.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 1.1. An investigation that identifies all factors that may have a potential impact on water quality in the region
- 1.2. Compliance with locational constraint criteria 3
- 1.3. Water quality sampling and analysis during the site selection process confirms that the water quality parameters are within the acceptable range for the intended use of stock (for example, human consumption) and meet the requirements of NSW Food Authority
- 1.4. An investigation on any dredging activities that occur in the region, including an assessment of potential impacts on cultured stock and food safety by considering the location of dredging activities, coastal processes characteristic of the region, physio-chemical properties of the dredge spoil material (for example, contaminants) and modelling of likely interactions with the lease
- 1.5. An investigation on the net input of nutrients into the marine environment, and evidence that NSW Department of Primary Industries has been consulted to determine if biogeochemical modelling analysis is required
- 1.6. Calculations for local trigger values for relevant water quality parameters, which meet the requirements of NSW Office of Environment and Heritage and NSW Department of Primary Industries
- 1.7. Evidence that the water quality parameters are suitable for all the physiological requirements of the cultured species (for example, water temperature, salinity, pH, dissolved oxygen, turbidity and carbon dioxide) for example, as per OISAS page 21 and Section 4.4 and Section 9 of Australian and New Zealand Environment Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ)
- 1.8. Evidence that the *National Water Quality Management Strategy* and *Marine Water Quality Objectives* water quality management recommendations have been integrated into the environmental impact assessment and environmental management plans
- 1.9. An environmental monitoring program that monitors water quality within the lease and surrounding waters prior to (that is, baseline sampling) and during the aquaculture operation.

Overview

NSW coastal marine waters range from subtropical in the north to temperate in the south of the state. The East Australian Current flows southward along the coast and ensures the coastal waters of NSW are regularly supplied with warm tropical waters from the Coral Sea. This Current also brings a broad diversity of tropical and subtropical marine species to NSW marine waters (Figure 8). Its annual variability in strength influences water temperature and the distribution and abundance of some faunal species.

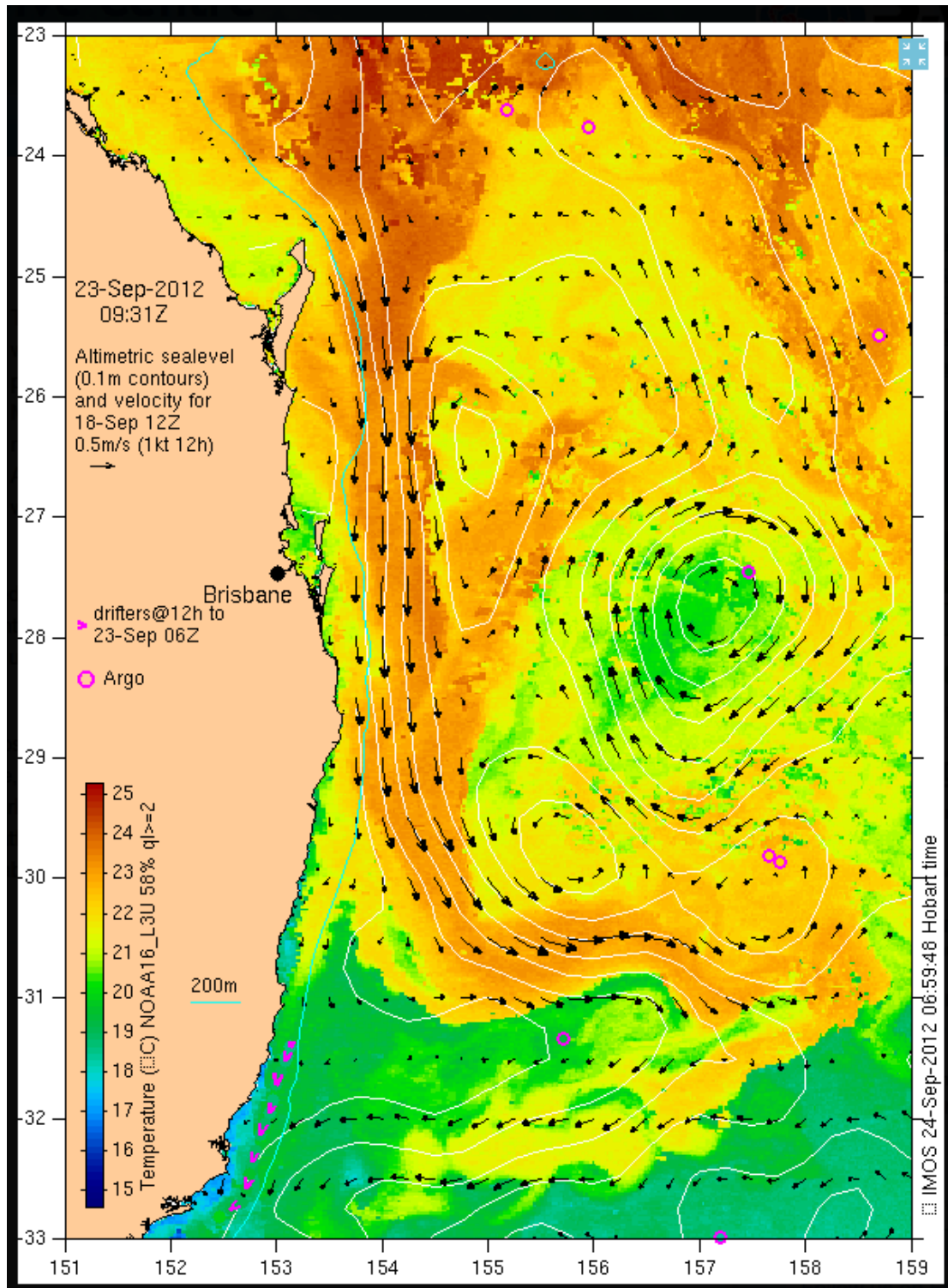


Figure 8: A depiction of the East Australian Current along the coast of NSW and southern Queensland (Source: IMOS, 2012).

A number of large rivers discharge into the marine waters of the NSW coastline (Figure 9). During high rainfall events, the discharges from these rivers may temporarily modify water quality parameters such as salinity, turbidity and temperature, near their convergence with the marine environment.

The run off from land based activities in the catchments of these rivers and creeks such as agriculture, industry and residences, are a source of potential pollutants which can temporarily affect the water quality of the marine environment. Proponents are required to

investigate all factors that may affect water quality in the region surrounding the proposed aquaculture operation.



Figure 9: The main rivers discharging into NSW marine waters (Source: LPI, 2012).

Sewage Outfall Pipelines

Aquaculture requires high quality water to produce a seafood product suitable for human consumption. The NSW coastline has a number of sewage treatment plants that discharge treated effluent directly into marine waters from ocean outfall pipelines. The level of risk associated with water quality from these outfalls depends on factors such as the volume of discharge, the level of sewage treatment prior to discharge, as well as the design and location of the discharge pipeline. The proposed aquaculture lease must be at least 1 km from the discharge point of sewage outfall pipelines to mitigate potential impacts.

Proponents are also required to undertake water quality sampling and analysis during the site selection process to confirm that the parameters are within the acceptable range for the intended use of stock. The acceptable range for water quality parameters will be site dependent and determined in consultation with NSW DPI and NSW DPE. Notably, the water quality parameters must meet the requirements of NSW Food Authority if the stock is intended for human consumption.

Dredging

Dredging is generally undertaken in rivers, estuaries and coastal marine waters to aid navigation by removing built up sediment, modifying water flow (for example, increase marine flushing), obtaining supplies of gravel, sand and other material, and to lay pipelines and cables (Web Reference 2).

This activity can potentially affect water quality through releasing contaminants and increasing turbidity. Dredging also releases nutrients contained within pore water from dredged sediments. Contaminants often remain with dredge material when it settles to the seabed, with minimal mixing or dispersion in the water column (Environment Protection Authority Victoria, 2001; Western Australian Environmental Protection Authority, 2016).

The proponent is required to conduct an investigation on any dredging activities that occur in the region surrounding the proposed aquaculture lease. An assessment of potential impacts on cultured stock and food safety must be conducted by considering the following factors:

- The location of dredging activities, including dredge spoil dumping, relative to the proposed aquaculture lease
- Coastal processes characteristic of the region
- Physio-chemical properties of the dredge spoil material, including contaminants (if any)
- Modelling of likely interactions with the aquaculture lease.

National Water Quality Management Strategy

The [National Water Quality Management Strategy](#) (NWQMS) was developed by Australian and New Zealand Governments, in cooperation with state and territory governments. The NWQMS is part of the national program for ESD and aims to deliver a nationally consistent approach to water quality management. The NWQMS aims to protect water resources by improving water quality, while supporting the businesses, industry, environment and communities that depend on water for their continued development. The NWQMS consists of three major elements: (1) policy; (2) process; and (3) guidelines.

Marine Water Quality Objectives

The NSW Government has developed the [Marine Water Quality Objectives](#) (Objectives) to simplify and streamline the consideration of water quality in coastal planning and management. The Objectives are intended for communities, local councils, Local Land Services and state agencies to use in catchment management and land use planning activities, and have been produced for the following regions: Sydney Metropolitan and Hawkesbury–Nepean; Hunter and Central Coast; South Coast; and North Coast. The Objectives are also a useful tool for strategic planning as well as development assessment of marine aquaculture in NSW.

The Objectives provide example guideline levels and/or reference levels to guide planning and management decisions affecting marine water quality, consisting of three parts including:

- **Environmental values** – the values or uses we wish to protect
- Their **indicators** – a parameter used to provide a measure of the quality of the water or condition of an ecosystem
- Their **numerical criteria** – numerical criteria or descriptive statements that indicators must be met in order to protect and maintain environmental values. The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018)* should be consulted for current guideline values.

Water quality guidelines contained in the 2016 OISAS for oyster aquaculture areas closely align with the Marine Water Quality Objectives.

Proponents are required to refer to the Objectives and the NWQMS during the assessment and approvals process. They are also required to integrate the water quality management recommendations into the environmental impact assessment and environmental management plans.

Dissolved Nutrients

The use of pelletised fish feed in sea pen aquaculture, as well as the natural metabolic processes of finfish and shellfish, results in the discharge of nutrients into the marine environment in both dissolved and solid particulate forms. The dissolved metabolic products

originating from cultured stock predominantly consist of nitrogen and phosphorus (D'orbcastel & Blancheton, 2006; Arvanitoyannis & Kassaveti, 2008; Conroy & Couturier, 2010), which are often limiting nutrients for primary production in marine environments (de Jong & Tanner, 2004).

The net input of nutrients into the marine environment from intensive finfish aquaculture depends on fish species, the nutrient content of the diet, bio-availability of nutrients in the diet, feed intake, stocking rates and operational practices (Hixson, 2014). These factors ultimately manifest in what is commonly known as the feed conversion ratio (FCR) – the amount of food required to produce one unit of growth (for example, kilogram) in a fish. Nutrients from pelletised feed that do not end up in fish tissues are ultimately released to the environment. Continuing advances in feed technology and the understanding of the dietary requirements of different species however, has resulted in decreased nutrient discharges from aquaculture facilities.

Figure 10 outlines the flow of nitrogen associated with fish feeding on sea pen farms, including the retention of nitrogen by fish, the excretion of nitrogen by fish in solid and soluble forms and metabolic by-products, as well as nitrogen inputs into the marine environment from feed wastage. The flow of nutrients associated with fish feeding is similar for phosphorus.

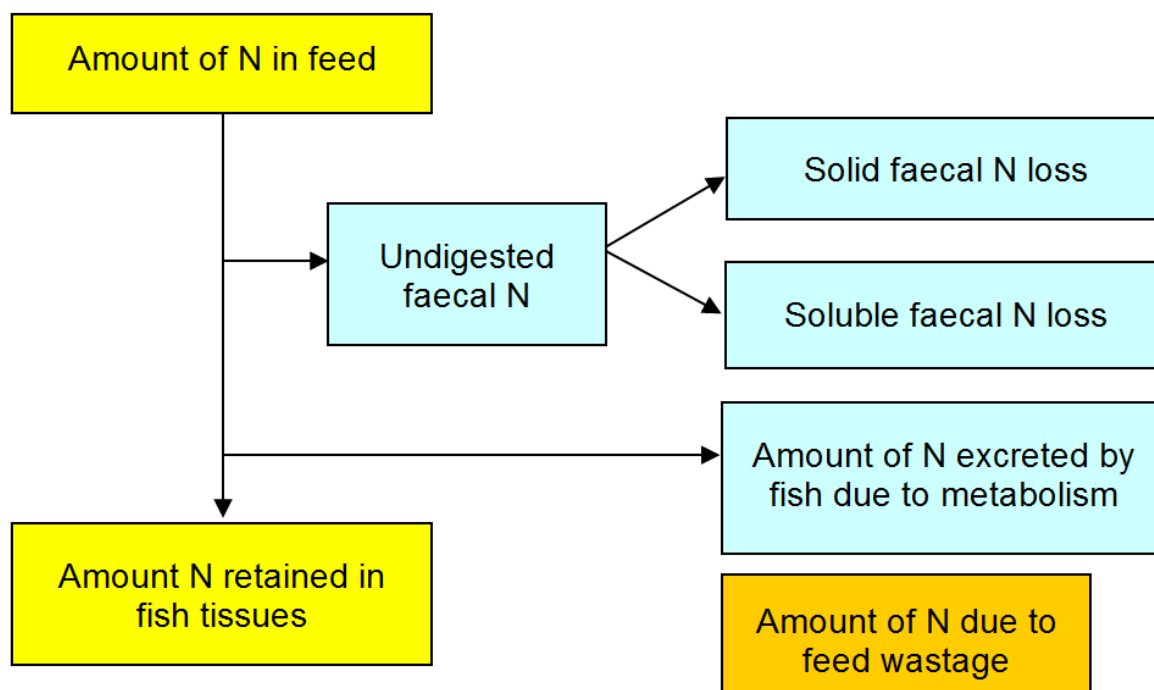


Figure 10: The flow of nitrogen (N) associated with fish feeding on sea pen farms (Source: NSW DPI, 2012).

As shellfish aquaculture is extensive (that is, no input of feed), the ecological impact is essentially a redistribution of nutrients (Joyce *et al.*, 2010). However, shellfish convert unavailable nutrient forms into bioavailable forms, and thereby represent a nutrient source. Nutrients, in the form of seston (that is, phytoplankton, zooplankton, suspended organic and inorganic matter) are filtered from the water by shellfish. Some of the seston is used by the shellfish for metabolic growth and the remainder of the organic waste is returned to the water as faeces or pseudofaeces.

The release of dissolved nutrients from shellfish directly into the water column can potentially cause localised enrichment and stimulate phytoplankton growth (Keeley *et al.*, 2009). The magnitude of the impact largely depends on the cultured species, husbandry practices,

stocking densities, dispersion of wastes by currents and the environmental carrying capacity of the region to assimilate organic inputs (Gavine & McKinnon, 2002).

Shellfish aquaculture however, usually results in a net removal of nutrients from the water column (O'Beirn *et al.*, 2013). Reduced phytoplankton concentrations, a net loss of nitrogen from the system and a decrease in suspended matter can occur in waters which have shellfish farms (Crawford, 2001). The results of a study on a pearl farm at Wanda Head, Port Stephens, indicate that for every tonne of oyster material harvested, about 7.5 kg of nitrogen, 0.5 kg of phosphorus and up to 0.7 kg of metals are removed from the environment (Gifford *et al.*, 2005).

Removing excess nutrients from the water column and reducing turbidity through removing suspended solids and phytoplankton are viewed as a potentially positive effect in degraded estuarine environments for example, however it may result in a reduction of nutrients that are essential to the functioning of the ecosystem if the area is relatively unaffected by human activities (Crawford, 2001). Seagrass beds have also been found to benefit from shellfish farms by reducing and/or controlling elevated levels of nutrients and metals (Crawford, 2001).

Nutrient Modelling

The management of sea pen and shellfish aquaculture leases must aim to ensure that dissolved nutrient inputs do not compromise the health of the marine environment. Notably, nitrogen is considered the most important parameter and regulatory tool for evaluating and managing the potential impact of Australian salmonid farming on the environment (Huon Aquaculture, 2017). Sophisticated three-dimensional biogeochemical models have proven an effective means to predict water quality behaviour under a variety of scenarios, examining the potential impacts of aquaculture operations on water quality (Huon Aquaculture, 2017).

A range of variables influence nutrient inputs from aquaculture operations including:

- Cultured species
- Stocking densities
- Operational and husbandry practices
- Dispersion of wastes by currents
- Environmental carrying capacity of the region to assimilate organic inputs
- Nutrient content and bio-availability of nutrients in the diet, as well as feed intake (intensive aquaculture only) (Hixson, 2014).

Proponents are required to examine the net input of nutrients into the marine environment from the proposed aquaculture operation, including consideration of the above variables. Proponents are also required to consult with NSW DPI to determine if biogeochemical modelling analysis of nutrient inputs is required.

Local Trigger Values

Trigger values for water quality parameters in marine ecosystems such as total nitrogen, total phosphorus, ammonia, filterable reactive phosphorus and oxides of nitrogen, are provided in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018* (Web Reference 3). However, local conditions for nutrient concentrations are found to vary considerably in NSW marine waters. Natural concentrations of nitrogen and phosphorus in seawater for example, constantly fluctuate depending on climatic conditions, ocean currents, occurrences of local upwellings and discharges from adjacent land catchments via rivers and streams. Seasonal variation of water quality parameters and vertical fluctuations throughout the water column are particularly significant. Consequently, proponents are referred to the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (2018) for

guidance on deriving site-specific guideline values for relevant water quality parameters which meet the requirements of NSW OEH, NSW EPA and NSW DPI.

The proponent must also provide evidence that the region's water quality parameters are suitable for all physiological requirements of the cultured species (for example, water temperature, salinity, pH, dissolved oxygen, turbidity, and carbon dioxide).

Environmental Management Plan

All proponents are required to prepare a water quality monitoring program for inclusion in the project's environmental management plan. An outline of the program should be included in the environmental impact assessment that supports the application. A detailed program would then be required following any approval of the proposal, which would be specified in any approval conditions.

The water quality monitoring program must monitor the water quality indicators that are relevant to the impacts that the proposal could have on all environmental values of the water (such as temperature, salinity, oxygen, pH, Chlorophyll a and concentrations of nitrogen and phosphorus) within the aquaculture lease and surrounding waters prior to and during the aquaculture operation (see Appendix 2 for an example).

3.2.2 Particulate Inputs

Expected Outcome

Potential impacts on the benthic environment are minimised and then any unavoidable impacts are adequately mitigated.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 2.1 Proposed measures that mitigate potential impacts on the benthic environment, including appropriate site selection and operational and maintenance procedures, which meet the requirements of NSW Department of Planning and Environment
- 2.2 An investigation on the nett input of particulates into the marine environment, and evidence that NSW Department of Primary Industries has been consulted to determine if deposition modelling analysis is required
- 2.3 An environmental monitoring program that monitors the benthic environment within the lease and surrounding area prior to (that is, baseline sampling) and during the aquaculture operation (at specific stocking levels).

Overview

Finfish aquaculture generally requires the use of commercially prepared pelletised feed, while cultured shellfish feed on naturally occurring plankton, drift algae and/or other nutrients in surrounding waters. Particulate inputs to the marine environment from finfish aquaculture include residual food, faecal matter, metabolic by-products and biofouling (Pillay, 2004). The main types of waste inputs from shellfish aquaculture include faeces, pseudofaeces and biofouling (Kaiser *et al.*, 1998; McKindsey *et al.*, 2011). Food waste, faeces and biofouling are predominantly composed of organic nitrogen compounds which are denser than seawater, so these particles typically settle on the seabed in the immediate vicinity of sea

pens and longlines (Islam, 2005; Holmer, 2010; Yaxley, 2012). Naturally-occurring, organic biofouling material such as seaweed and small sponges removed from infrastructure may disperse more widely with currents and swell motion than heavier organic material such as barnacles and shells. Heavier organic material is more likely to settle below, or in close proximity to farming infrastructure.

The input of organic matter can cause changes to the physical, chemical and biological characteristics of the receiving marine environment (Edgar *et al.*, 2010; Mirto *et al.*, 2011). Notably, when organic waste deposition exceeds nutrient assimilation rates, sediments become anaerobic and the composition of benthic organisms changes, particularly for infauna.

The impact from feed waste for example, is dependent on factors such as current speed, settling velocity, water temperature and pellet degradation, including feeding and ingestion rates (Stewart & Grant, 2002). Pellet size for example, influences the degree of impact on sediments where small pellets have been found to disperse over greater distances than large pellets (that is, up to three times) (Pawar *et al.*, 2002). Increasing current flows and decreasing pellet size also increase the loss of pellet mass and erosion rates (Stewart & Grant, 2002). Long-term monitoring of Tasmanian finfish leases using underwater video surveys for example, indicate that pen positioning, stocking duration and stocking intensity are the major factors that contribute to impacts on the benthos. Monitoring data reveals that visible benthic impacts are localised, and that solid particulate waste settles in distinct footprint zones directly under fish pens (Macleod *et al.*, 2002; McKinnon *et al.*, 2008).

Similarly, the impact of biofouling on the benthic environment is dependent on factors such as the quantity of fouling organisms, the removal method, assimilation capacity of the environment, the benthic fauna that are present beneath the lease (for example, scavengers) and the season. Peak fouling periods coincide with the warmer months for example, reflecting increases in larval supply and subsequent colonisation and growth, so biofouling removal occurs more frequently during summer and spring (Floerl *et al.*, 2016).

Potential impacts of aquaculture operations on the benthic environment can be mitigated by appropriate site selection and through implementing a range of operational and maintenance procedures. Regular monitoring to detect signs of significant impact and checks to ensure aquaculture lease holders comply with the mandatory mitigation measures, are also key factors. More specifically, potential impacts can be mitigated by employing the following measures:

- Appropriate stocking densities
- Ensuring the site has the carrying capacity to assimilate the predicted particulate load
- Regular removal of biofouling as well as injured and deceased stock
- Sustainable feed management (intensive aquaculture), including use of pelletised feed, optimising feed conversion ratios, using feed specific to the life cycle stage of the species being cultured and avoiding food waste
- Following of leases areas if monitoring results detect a significant impact.

It is a requirement for Water Quality and Benthic Environment Monitoring Plan to be updated at biannual reviews to reflect continual operational improvements. Proponents are required to implement measures that mitigate potential impacts of the proposed aquaculture operations on the benthic environment within and outside the lease area, including surrounding habitats. An adaptive management approach (as outlined in Section 5.9) is required and mitigation measures must meet the requirements of NSW DPE.

Particulate Input Modelling

Particulate input modelling programs can be used to provide predictions of the likely deposition of particulate matter on the seabed from aquaculture operations. Figure 11 is an example of a deposition model output, which was used to determine the likely extent and concentration of particulate matter deposition within the MARL in Port Stephens. It is evident that the greatest concentration of deposited total solids was in the immediate vicinity of the sea pens that were to be stocked with fish. It also shows concentrations decreased with increasing distance from stocked pens. The model output also illustrates that deposition of particulates is likely to be confined to the lease area.

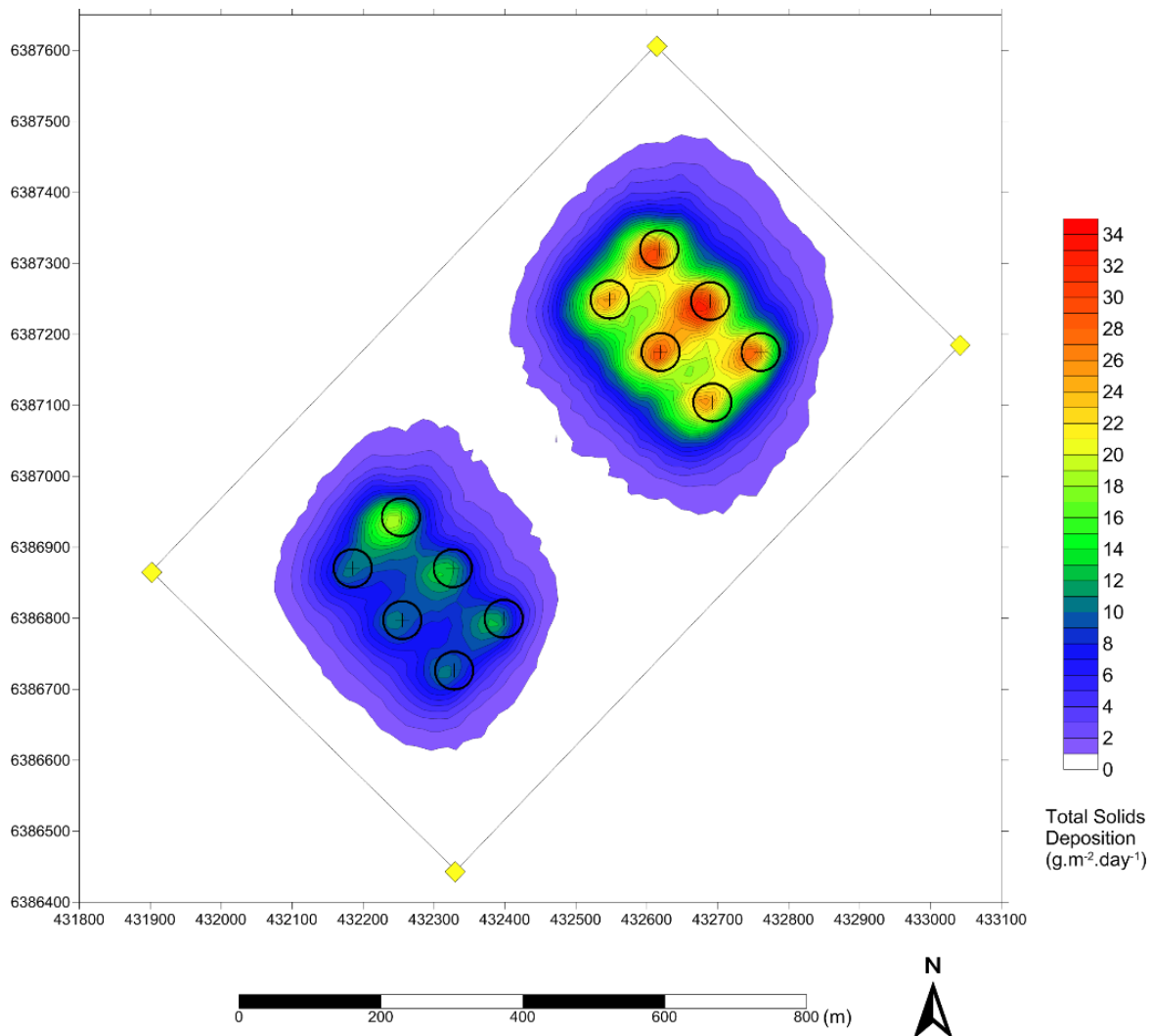


Figure 11: An example of a deposition model output – results for the MARL (Source: Huon, 2016).

Proponents are required to examine the net input of particulates into the marine environment from the proposed aquaculture operation including consideration of interacting variables. Proponents are also required to consult with NSW DPI to determine if deposition modelling analysis of particulate inputs is required.

Benthic Sampling

There are a range of factors that may affect the abundance and species diversity of macrofauna within the marine environment, such as depth, currents, sediment size, organic content of sediment, salinity, habitat type, temporal variation, temperature and nutrients. The benthic environment can be monitored biologically (for example, benthic invertebrates),

chemically (that is, the composition of elements in sediment such as total organic carbon (TOC), REDOX, sulphides and organic content) and physically (for example, the particle size of sediment and video footage/photo comparisons).

Proponents are required to monitor the benthic environment, which may include monitoring of biological, chemical and physical changes. Benthic monitoring requirements for aquaculture operations will vary depending on factors such as whether formulated feeds are used (that is, intensive vs extensive), the size of operation, site characteristics and stocking densities.

In order to assess the environmental performance of the aquaculture operation, a baseline survey must be conducted by proponents prior to the first stocking event to provide pre-farming measurements for the range of approved variables. The results from future sampling events within and around the aquaculture lease can then be referenced against both baseline data and the data collected concurrently at reference sites. Care needs to be taken to ensure that reference sites are as similar as possible to the lease site (for example, similar depths), but not impacted by the activity being monitored (marine aquaculture in this case). Generally multiple reference sites are required for scientific and statistical rigour. The data collected will be subject to seasonal differences, therefore some of the ongoing monitoring must be planned to occur at the same time of year.

Samples and video footage may be taken from under the aquaculture infrastructure, on the outside edge of the lease (compliance sites) and at locations away from the lease (control sites). This sampling regime has been employed by NSW DPI and Huon Aquaculture on the MARL to investigate the effects of the aquaculture activities on water quality and the benthic environment during the five year research trial (see case study 3, p. 30). Similarly, a 50 ha Blue Mussel farm in Twofold Bay employs a similar sampling regime, whereby total organic carbon (TOC) and benthic fauna samples are analysed (see case study 4, p. 31).

If the benthic monitoring program detects a significant impact, proponents will be required to increase monitoring effort within and external to the lease area and/or modify practices until acceptable levels are regained. Management measures to ameliorate impacts may include fallowing of lease areas and reducing stocking densities.

Environmental Management Plan

All proponents are required to prepare a benthic environment monitoring program for inclusion in the project's environmental management plan (see Appendix 2 for an example). An outline of the program should be included in the environmental impact assessment that supports the application. A detailed program would then be required following any approval of the proposal, which would be specified in any approval conditions.

CASE STUDY 3: MARINE AQUACULTURE RESEARCH LEASE ENVIRONMENTAL MONITORING PROGRAM

NSW DPI and its research partner, Huon Aquaculture, are undertaking a five year offshore sea pen trial which requires environmental monitoring to assess and mitigate potential impacts from the operation.

Monitoring Parameters

The program includes monitoring of: water quality (temperature, salinity, oxygen, pH, chlorophyll a, nitrogen, phosphorus); biological changes (benthic macro-invertebrates, that is polychaete worms and crustaceans larger than 1 mm); chemical changes (the composition of elements in the seafloor); and physical changes (sediment particle size and video footage).

Sampling Regime

Samples and video footage are taken from under sea pens, on the outside edge of the lease (compliance sites) and at three locations away from the lease in Providence Bay (control sites).

Either three (physical) or four (biological) samples are collected from pen sites, control sites and at 35 m deep compliance sites, at which remotely operated vehicle (ROV) spot dives are also undertaken.

Baseline Sampling

A baseline survey was conducted prior to stocking the sea pens with fish, which provided pre-farming measurements of the range of required variables used to assess the environmental performance of the sea pens. The results from future sampling events within and around the MARL will be referenced against both this baseline data and the data collected concurrently at the control sites.



As fish grew, additional water and benthic samples have been collected to improve baseline data, helping build a stronger picture of the effects of the operation of the MARL. The number of monitoring samples taken and analysed to date is greater than consent condition requirements.

Results

Three water quality, benthic and video monitoring studies have been conducted by an independent contractor and the University of Newcastle during the MARL's first year of operation.

Two sea pens were stocked with Yellowtail Kingfish with a standing biomass of 50 tonne when the post stocking sampling events occurred.

The environmental monitoring results (pre and post fish stocking) and video footage of these events are available on [Huon Aquaculture's website](#).

The results to date indicate no significant impact on water column chemistry or benthic invertebrate ecology.

Environmental monitoring will continue throughout the life of the MARL project to measure potential impacts on the environment as production biomass of Yellowtail Kingfish increases over time.

Review

The environmental monitoring program was reviewed six months after the MARL commenced operation. The monitoring program will continue to be reviewed by the NSW DPI/Huon Research Team every six months.



CASE STUDY 4: TWOFOLD BAY BENTHIC MONITORING

Following the approval of an EIS in 1998, 50 ha of lease area was approved for Blue Mussel culture and is currently operated by Eden Sea Farms.

The conditions of development consent require monitoring of the benthic environment to assess if the mussel farm is causing any significant changes to the marine benthic environment.

The monitoring program utilises the parameters of TOC and benthic fauna in sediments under lease areas and at control sites to monitor any changes that may occur.

Sampling Regime

Benthic sampling occurs in accordance with methods approved by NSW DPI.

Six TOC and benthic fauna samples are collected from three lease areas which have two associated control sites. Thirty six samples are collected per lease area and the associated control sites (that is, 18 TOC samples and 18 benthic samples).

Processing of Samples

The laboratory used to process samples must be approved by NSW DPI. The permit holder is required to process three of the six lease samples and three of the samples

from each of the two control sites analysed for TOC.

If a significant impact is found from the initial analysis, the remaining three samples from each site are required to be analysed for TOC.

If TOC analysis reveals that a significant impact has occurred, analysis of the benthic fauna samples is required to be analysed.

If a significant impact is detected from the benthic fauna analysis, appropriate management measures must be implemented to ameliorate these impacts.

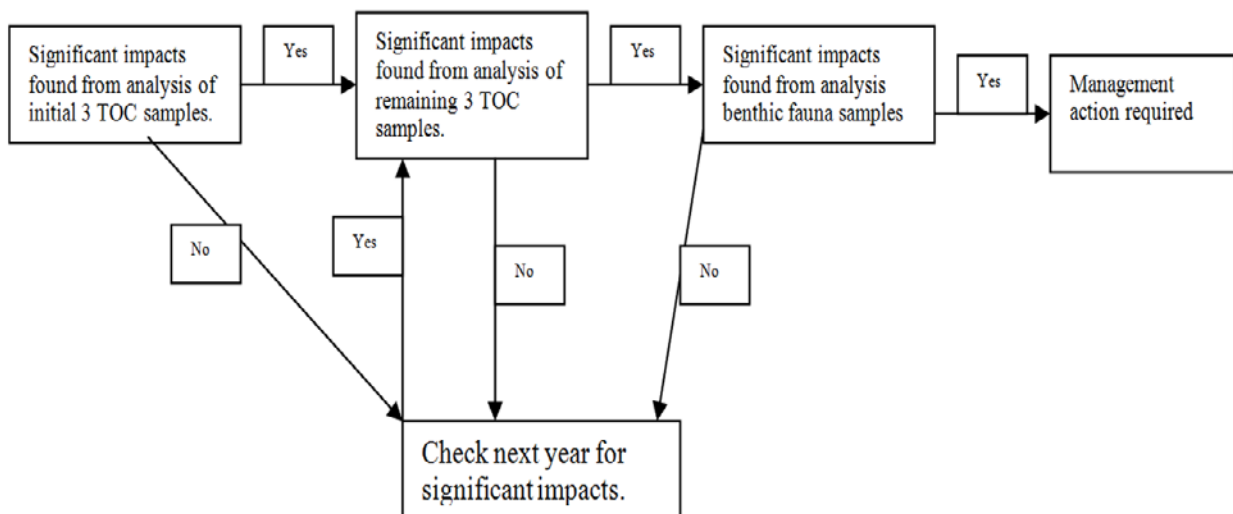
See below for a summary of the sampling assessment process.

Results

No significant impact on TOC levels has been detected in the last three surveys (that is 2007, 2009 and 2012) (Cardno Ecology Lab, 2012).

Review

The benthic monitoring program is regularly reviewed to ensure that sufficient numbers of samples are collected to provide a high degree of certainty that the mussel farm activities are not having a significant impact on the benthic environment.



3.2.3 Coastal Processes

Expected Outcome

Potential impacts on, or arising from coastal processes are first avoided, then minimised and then any unavoidable impacts are adequately mitigated.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 3.1 Evidence that the proposed site has adequate water depth to accommodate suspended aquaculture infrastructure such that it will not make physical contact with the seabed when stocked at maximum standing biomass or during the recorded sea state maximums
- 3.2 Evidence that the proposed site and infrastructure layout is aligned with the predominant local wave and swell direction
- 3.3 A minimum distance of 500 m for infrastructure between the proposed site and the mean low water mark, offshore islands, rocky reefs and bomboras (sea pen aquaculture only)
- 3.4 Evidence that the proposed infrastructure has been adequately designed to withstand prevailing coastal processes and extreme events
- 3.5 Operational and maintenance procedures, as well as infrastructure design features that minimise obstructions to water flow including appropriate mesh size on nets (sea pen aquaculture only), regular removal of biofouling and appropriate spacing of infrastructure
- 3.6 Evidence that NSW Office of Environment Heritage have been consulted and agree that the proposed lease will not have a significant impact on marine sand bodies that have been identified for future beach nourishment programs
- 3.7 Evidence that the proposed infrastructure will not interrupt sediment transport.

Overview

Coastal processes such as waves and ocean currents, are affected by the bathymetry of the seabed, the topography of the coast and offshore islands, as well as by wind and tides (Demirbilek, 2002; Buttolph *et al.*, 2006). The impact of marine aquaculture infrastructure on coastal processes can largely be minimised by adopting appropriate site selection, design features and operational procedures.

Proposed aquaculture leases must have adequate water depth to accommodate suspended aquaculture infrastructure to ensure it will not make physical contact with the seabed when stocked at maximum standing biomass or during recorded sea state maximums. The water depth required will vary depending on site characteristics, the type of aquaculture and infrastructure design (for example, predator exclusion nets). The culture of abalone on artificial reefs for example, usually require relatively shallow water depths (approximately 15-20 m) to provide divers with easy access and to take advantage of drift seaweed. The culture of finfish in sea pens, however, requires deeper waters to accommodate the infrastructure (that is, over 40 m).

The proposed site and the layout of infrastructure should consider the alignment with the predominant local wave and swell direction to further mitigate the risk of aquaculture infrastructure impeding coastal processes in the surrounding region. In addition, sea pen leases are required to be at least 500 m for infrastructure from the mean low water mark, offshore islands, rocky reefs and bomboras.

Marine aquaculture infrastructure and culture methods are rapidly evolving, meaning designs are constantly changing. Proponents are expected to consider current best practice and focus on designs that withstand the high energy offshore marine environment. Current sea pen and longline systems used on aquaculture leases for example consist of a streamlined, open and flexible design to minimise obstructions to water flow. The proposed design of infrastructure should be consistent with accepted best practice Australian and International Standards and Guidelines for the design of maritime structures.

Proponents are also required to undertake operational and maintenance procedures that minimise obstructions to water flow and sediment transport, including appropriate mesh size on nets (sea pen aquaculture only), appropriate spacing of infrastructure and regular removal of biofouling. Biofouling can place additional physical stresses on sea pen aquaculture, potentially leading to infrastructure failure.

Offshore marine sand bodies may provide suitable sources of sand for beach nourishment programs, designed to reduce the risk of beach erosion. Potential suitable sand sources have been identified and mapped at locations along the NSW coast. Proponents are required to consult with NSW OEH to ensure that the proposed aquaculture lease will not have a significant impact on marine sand bodies that have been identified for future beach nourishment programs.

In addition, proponents are required to map relevant sediment compartments listed in Schedule 1 of the *Coastal Management Act 2016* (CM Act) and provide evidence that the proposed infrastructure will not interrupt sediment transport.

3.2.4 Climate Change

Expected Outcome

Contribution to global warming and climate change arising from materials used in, or from the conduct of aquaculture operations, are first avoided or minimised wherever possible.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 4.1 Conscious and demonstrated choices to reduce the impact of the aquaculture operation on climate change

Overview

Human-caused, accelerated climate change is accepted by the NSW and Federal Government as a major environmental impact on our planet. Burning of carbon-based fossil fuels such as coal, oil, petroleum and natural gas for electricity, manufacturing, transport and heating, produces harmful pollution. This pollution contains 'greenhouse gases' that trap heat in our atmosphere, causing global warming. It is anticipated that additional greenhouse gas pollution will further increase heat in our atmosphere and detrimentally change our climate. Anticipated changes include an increase in storm frequency and intensity, and in wind and rainfall patterns (Web reference 4).

Mitigation Measures

Proponents are expected to consider the overall impact of their operation on climate change and make every effort to align with NSW government policy on reducing global warming. This may include the following:

- The choice of manufacturer and/or materials used in manufacturing aquaculture operation infrastructure
- Utilising fuel efficient, low emission vessels
- Utilising best practice renewable energy
- Reducing energy use
- Reduce consumption, re-use materials and recycle waste
- Minimise the number of vessel trips

3.2.5 Sensitive Ecological Values

Expected Outcome

Sensitive ecological values of the region are identified and maintained.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 5.1 An investigation on the region's sensitive ecological values by identifying the species, important habitat areas and other matters of conservation significance that are present within the proposed region, as well as the potential direct and indirect impacts of the aquaculture operation on these ecological values
- 5.2 An assessment of significance for threatened and protected species, populations and communities listed under the *Biodiversity Conservation Act 2016* and *Fisheries Management Act 1994* that are likely or predicted to occur in the region
- 5.3 An investigation on matters of national environmental significance listed under the *Environment Protection Biodiversity Conservation Act 1999*, including details on submitting a referral to the Minister for Environment and Energy
- 5.4 Substrate survey results which confirm what habitat types are present in the region surrounding the proposed aquaculture lease
- 5.5 Compliance with locational constraint criteria 1, 2, 6 and 7
- 5.6 Proposed measures that mitigate potential impacts on sensitive ecological values.

Overview

The marine waters of NSW, ranging from subtropical in the north through to temperate waters in the south, contain a diverse and unique range of ecological communities. Sensitive ecological areas include natural rocky reefs, marine fauna aggregation areas, migratory pathways, threatened and protected species, breeding habitat and foraging grounds, as well as marine protected areas, aquatic reserves, Ramsar wetlands, national parks, nature reserves, areas of

critical habitat and other ecological values declared under the *Biodiversity Conservation Act 2016* (BC Act), FM Act and EPBC Act.

In the first instance, proponents are required to consult environmental databases and with OEH to identify the species, important habitat areas and other matters of conservation significance that occur in the region of the proposed aquaculture lease, including the following:

- [NSW OEH BioNet](#)
- Elements Database
- [NSW DPI Threatened and Protected Species Listing](#)
- [NSW DPI Threatened Species Distribution in NSW](#)
- [Species Profiles and Threats Database](#)
- [EPBC Act Protected Matters Search Tool](#).

Proponents are also required to conduct an investigation on potential direct and indirect impacts of the proposed aquaculture operation, and assess the sensitivity of all species, habitats and ecosystem processes to these impacts. Potential impacts may include increased nutrient concentrations, sedimentation, reduced water quality, chemical pollution, increased quantities of marine debris and other wastes, reduced visual amenity and odour emissions. This investigation must assess all stages of an aquaculture operation, including construction, deployment, operation and decommissioning.

Threatened and Protected Species - State

Proponents must undertake a preliminary assessment of potential impacts (such as an 'Assessment of Significance' in accordance with EP&A Act) if the aquaculture operation is likely to have any impact on a threatened or protected species, population or community listed under the BC Act or the FM Act. The [Threatened Species Assessment Guidelines](#) provide information about the process and requirements for the preliminary assessment of significance.

If the impacts are likely to be significant, or if critical habitat is affected (including habitat critical to the recovery of species), a detailed species impact statement (SIS) may be required. In these cases, the Chief Executive of NSW OEH and NSW DPI must agree to development approval. The Minister for Environment and the Minister for Primary Industries may also need to be consulted. An SIS is mandatory if the aquaculture operation will take place on declared critical habitat.

Marine Parks - State

The *Marine Estate Management Act 2014* (MEMA) provides for the protection of marine biological diversity, marine habitats and ecological processes in marine parks, as well as ecologically sustainable resource use such as recreation, fishing, aquaculture and tourism. Section 55 of the MEMA outlines the matters that need to be considered regarding a development proposal in a marine park.

Proponents must undertake a preliminary assessment of potential impacts (such as an 'Assessment of Significance in accordance with EP&A Act) to ascertain if their proposed aquaculture operation is likely to have a significant impact on the marine park values. New aquaculture ventures will not be permitted within marine park Sanctuary Zones (or equivalent) but may be permitted in other zones of the respective marine park.

Matters of National Environmental Significance

Under the EPBC Act an activity requires approval from the Minister for Environment and Energy if the activity has, will have, or is likely to have, a significant impact on MNES. The [EPBC Act Policy Statement 1.1 \(Significant Impacts Guideline 1.1 – Matters of National Environmental](#)

[Significance](#)) and the [EPBC Act Policy Statement 2.2 \(Offshore Aquaculture\)](#) provide proponents with guidance when deciding whether the proposed aquaculture operation is likely to have a significant impact on MNES, and therefore whether a referral is required. See Section 5.8.6 for further details on the assessment and approval process under the EPBC Act.

Substrate Survey

The proponent is required to undertake a survey of the substrate in the area of the proposed aquaculture lease to confirm the habitat types that are present (for example, visual interpretation of acoustic backscatter and hillshaded bathymetry data of the seafloor). Notably, aquaculture leases must not be located over rocky reefs or seagrass beds.

Mitigation Measures

The proponent is also required to implement measures that mitigate potential impacts of the proposed aquaculture lease on the sensitive ecological values within the region. Mitigation measures must meet the requirements of NSW OEH, NSW DPI, NSW DPE and DEE.

3.2.6 Marine Fauna Interactions

Expected Outcome

Potential impacts on marine fauna are first avoided, then minimised and then any unavoidable impacts are adequately mitigated.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 6.1 The location and an assessment of key habitat areas for marine fauna in the surrounding region, including breeding, foraging, resting and migratory pathway habitat
- 6.2 Design features (such as rope tautness, colour of ropes) and operational and maintenance procedures that minimise entanglement hazards and a response plan for entanglement incidences
- 6.3 Deployment, operational and maintenance procedures that comply with the *Protection of the Environment Operations Act 1997* and the *Protection of the Environment Operations (Noise Control) Regulation 2017* by preventing unacceptable noise
- 6.4 A timeline for the deployment of anchors, moorings and infrastructure that is outside the whale migration season
- 6.5 A commitment to complying with the approved approach distances to marine fauna by the means of employing marine fauna observers during deployment and while travelling to and from leases to minimise potential impacts from noise pollution and vessel strikes
- 6.6 Monitoring and recording procedures for all interactions between marine fauna, lease infrastructure, vessels and humans

Assessment Requirements

- 6.7 A marine fauna interaction management plan which may include a marine fauna interaction protocol, observer protocol and a light spill management plan.

Overview

Marine fauna can potentially interact with aquaculture infrastructure. For example, sea birds may dive around and perch on the infrastructure while seals, marine reptiles, fish and some cetacean species may seek to use aquaculture infrastructure for foraging, resting or refuge.

Habitat Displacement

Aquaculture infrastructure displaces an area of benthic and/or pelagic habitat, which varies in extent, depending on factors such as the type of aquaculture, the size of the lease and infrastructure design. Proponents are required to assess and evaluate whether the installation of aquaculture infrastructure will result in a significant loss of marine habitat through modification, isolation, disturbance and/or fragmentation. Potential impacts on all habitat types must be considered, including breeding, foraging, resting and migratory pathways.

Entanglement and Ingestion of Marine Debris

Poorly designed or maintained aquaculture infrastructure can be an entanglement risk to marine fauna (McCord *et al.*, 2008; Groom & Coughran, 2012; DSEWPC, 2013). Marine fauna can also ingest debris such as plastics, packaging materials, gear (nets, ropes, line and buoys) and convenience items if measures are not undertaken to dispose of waste appropriately.

There are a number of factors proven to minimise these impacts. First, for some species (such as sea birds and seals) ensuring there is an adequate distance between lease areas and key habitat can greatly reduce interactions and subsequently, impacts on marine fauna, aquaculture infrastructure, cultured stock and staff. Second, it is possible to virtually eliminate entanglement risks for marine fauna by adopting appropriate design features, such as predator exclusion nets and taut lines, being vigilant with gear maintenance and using appropriate feeding regimes (Kemper *et al.*, 2003).

Consequently, proponents must identify the location of key habitat areas for marine fauna in the surrounding region and ensure that there is an adequate buffer distance between these areas and proposed aquaculture leases. Proponents must also conduct regular inspections and maintain infrastructure to ensure structural integrity and stability, especially after extreme weather events.

Anchors, mooring systems and aquaculture infrastructure should not be deployed during the whale migration season to ensure potential disturbances and interactions during this period are minimised while whales are abundant in NSW marine waters.

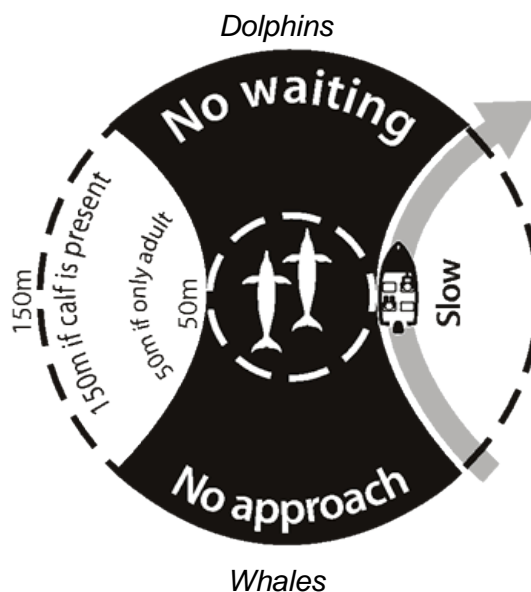
Advancements in aquaculture infrastructure designs are ongoing, and continue to reduce the risk of marine fauna interactions. For example, recent research suggests that some whale and seal species are able to see orange ropes during the day, however cannot see standard rope colours (R. Harcourt – Professor of Marine Ecology, Macquarie University 2017, *pers comm.*). Consequently, it is now an approval requirement for aquaculture developments in NSW that anchoring ropes must be orange in colour. Similarly, the latest sea pen design used on the MARL in Port Stephens, has proven very effective in preventing marine fauna interactions. Design features include nets made of a Dyneema-like material (also used in bullet proof vests), a double net system to keep predators away from workers and stock, a fully enclosed walkway to protect workers, and bird netting to prevent entry and perching. For further details on how direct interactions between sea pens and marine fauna are managed on the MARL, see Appendix 2 - Marine Fauna Interaction Management Plan.

Noise Pollution and Vessel Strikes

Human activities, such as marine vessel and machinery use, produce noises that can potentially impact the hearing of marine fauna (Hildebrand, 2009; Abrahamsen, 2012; Rolland *et al.*, 2012). As sound is the primary means for some marine fauna to communicate, detect prey and predators, navigate and obtain information about their environment (Hatch & Wright 2007; Weilgart, 2007), it is important that proven mitigation measures are implemented to minimise underwater noise.

Aquaculture introduces anthropogenic noise into the marine environment via the use of machinery during the installation of infrastructure and from marine vessel transport. The *Protection of the Environment Operations Act 1997* (POEO Act) and the *Protection of the Environment Operations (Noise Control) Regulation 2017* (POEO Noise Control Regulation) are the two key legislative measures that assist with controlling the impact of noise levels on the community. The primary purpose of these legislative measures is to provide the main legal framework for managing unacceptable noise. NSW RMS is responsible for enforcing these legislative measures associated with marine aquaculture activities. Proponents must demonstrate in the environment impact assessment that deployment, operational and maintenance procedures will not generate offensive noise. Notably, marine vessel motors must be well maintained at all times.

Proponents must also maintain the NSW OEH and DEE approved approach distances to marine fauna (see Figure 12) to minimise potential noise impacts and the risk of vessel strikes. However, these distances must be increased if there are any signs of sudden or erratic changes in behaviour (for example, quick dives, aggressive behaviour and irregular changes in swimming speed and/or direction) to avoid distress. If signs of extreme distress become apparent, operations and/or vessel movements must cease until the animals are well away from the lease and/or vessel (Web Reference 5).



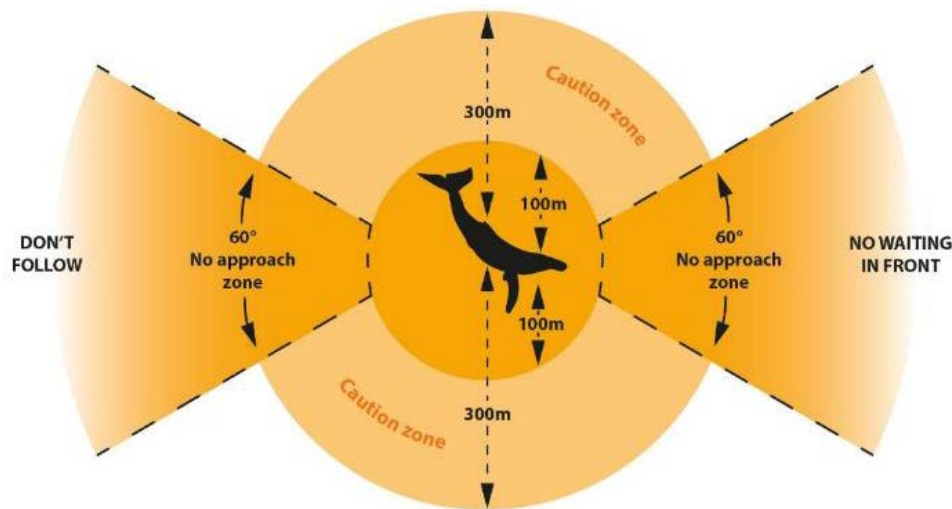


Figure 12: If approached by a marine mammal, reduce speed and maintain the recommended approach distance (Source: NSW OEH, 2014; DEE, 2017).

Marine fauna observers are required to be present on vessels during the deployment stage of aquaculture developments, including the installation of anchors, moorings and culture infrastructure, as well as during vessel movements to and from the aquaculture lease. Marine fauna observers are primarily needed to ensure the minimum approach distances are maintained. The proponent should also monitor and keep records of all interactions between marine fauna, lease infrastructure, vessels and humans. Any injuries, including vessel strikes, or serious events involving marine wildlife must be reported to the [NSW Environment Line](#) – 131 555.

Light Pollution

Artificial lights (that is, operational, navigation and vessel lights) can potentially cause disorientation and stress to some species of marine fauna and possibly impede their navigation abilities at night if appropriate mitigation measures are not implemented.

To avoid potential impacts of service vessel lights, mitigation measures include restricting operation hours to predominately daylight hours. If night operations are undertaken, lighting on service vessels must be restricted to interior and navigation lights, and external work lights are required to be shielded to concentrate light downward specifically onto work sites to help minimise the extent of artificial lights.

Environmental Management Plan

All proponents are required to prepare an approved marine fauna interaction management plan for inclusion in the project's environmental management plan (see Appendix 2 for an example which was developed by industry, government agencies and universities). An outline of the program should be included in the environmental impact assessment that supports the application. A detailed program would then be required following any approval of the proposal, which would be specified in any approval conditions.

Sea pen and longline aquaculture developments typically require the preparation of an observer protocol, which aims to minimise the potential impact of noise pollution and the risk of vessel strikes by utilising marine fauna observers to ensure that the minimum approach distances are maintained. A marine fauna interaction protocol is also likely to be required, which includes the implementation of mitigation measures to minimise the risk of entanglement and entrapment.

A response plan is also likely to be required in order to implement prompt and appropriate management responses if an entanglement or entrapment event occurs. The response plan is

required to be implemented by a marine fauna interaction committee, whose members have experience in wildlife rescue techniques.

All marine fauna interaction events must be recorded in a marine fauna interaction/observation register. In the event of an entanglement or entrapment, an incident report detailing the time, location, species and the interaction circumstances, is required to be prepared and provided to members of the marine fauna interaction committee and any other relevant authorities.

A risk assessment must be completed for all incidents which must form part of the post action report. The protocol and any incident reports are required to be reviewed annually to assess the effectiveness of the protocol and identify any issues of concern. The review ensures any necessary modifications are made (for example, infrastructure design) based on recommendations from post action reports, professional advice and field experience.

A light spill management plan may also be required if light sensitive species are present in the surrounding region.

3.2.7 Biosecurity and Health Management

Expected Outcome

Potential biosecurity impacts are first avoided, then minimised and then any unavoidable impacts are adequately mitigated.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 7.1 The location of key habitat areas for marine fauna in the surrounding region, including breeding, foraging, resting and migratory pathway habitat
- 7.2 Cultured stock must be checked and declared healthy and free of evidence of significant diseases and parasites prior to the transfer to an aquaculture lease
- 7.3 Site selection, infrastructure design features, stocking densities, and operational and maintenance procedures that minimise stress to stock
- 7.4 Systems, advice and training for lease staff, contractors, volunteers and other visitors to inform them of their biosecurity duties under the *Biosecurity Act 2015* and associated regulations
- 7.5 Biofouling management measures
- 7.6 A commitment to undertake an assessment using the National Policy for the Translocation of Live Aquatic Organisms, including corresponding mitigation measures
- 7.7 A commitment to undertake a risk based assessment prior to the interstate importation of used aquaculture equipment (if applicable)
- 7.8 Procedures for handling, treating and disposing of wastes, infrastructure and other materials that are potential carriers of disease agents or pests
- 7.9 A stock and equipment register by recording all movements and treatments

Assessment Requirements

- 7.10 A commitment to comply with the general biosecurity duty under the Biosecurity Act 2015
- 7.11 A biosecurity management plan incorporating biosecurity separation distances between farms.

Overview

Disease and Parasite Management

Disease is not just the result of the pathogen itself but a complex interaction between the pathogen, the aquatic animal and the environmental conditions (PIRSA, 2002; PIRSA, 2012). Disease is defined as any infection of an organism having the potential to result in an abnormal, pathological or unhealthy condition that is caused by a known or unknown disease agent. Disease agents or pathogen types include parasites, fungi, bacteria, prions and viruses, which may infect fish, shellfish and other marine animals, particularly when their immune system is depressed, the skin is damaged and/or there is severe stress caused by poor water quality or rough handling (Barker *et al.*, 2009; PIRSA, 2012).

Strict health monitoring programs are essential in increasing the likelihood of early identification of disease or pathogens so appropriate management can be implemented before severe impacts and infestations occur (PIRSA, 2003). Careful handling, good husbandry practices and maintenance of water quality are also critical in preventing or minimising the impact of disease and infections (PIRSA, 2003; Barker *et al.*, 2009; NSW DPI, 2015).

Hatchery stock that is disease and pathogen free is the first step in fish health management. Implementation of strict hatchery procedures ensures this is accomplished. NSW DPI has developed a NSW Hatchery Quality Assurance Scheme for finfish that addresses these issues. This scheme is longstanding. Cultured stock must be checked and declared healthy and free of evidence of significant diseases and pathogens prior to the transfer to an aquaculture lease.

Stress to stock must be minimised to reduce the risk of disease outbreaks and infections as environmental stresses lower natural resistance (Snieszko, 1974; Walker & Winton, 2010). Stock stress levels can be minimised by appropriate site selection, maintaining appropriate stocking densities (Barker *et al.*, 2009; NSW DPI, 2015) and management schedules (for example, periodic fallowing), which vary depending on the species cultured, the culture apparatus used and environmental conditions at each site. Proponents must also employ infrastructure design features (for example, predator exclusion nets) and daily operational and maintenance procedures that minimise predatory interactions (Kemper *et al.*, 2003; McCord *et al.*, 2008).

Any known or suspected case of a prohibited matter listed under Schedule 2 of the *Biosecurity Act 2015*, or a notifiable aquatic disease or pest, listed under Schedule 1, Part 2 of the *Biosecurity Regulation 2017* must be reported to an authorised officer under that Act within one working day of first being aware of, or suspecting the aquatic pest, disease or biosecurity event. Any unexplained or unusual mortalities and disease outbreaks must also be reported.

Proponents will be required to develop a biosecurity plan which clearly outlines how they will address not only the biosecurity risks of their respective operation but how they will mitigate impacts on or from other aquaculture ventures and wild fisheries stock. The federal government has developed the Aquaculture Farm Biosecurity Plan: Generic Guidelines and Template to assist in the development of a biosecurity plan. Overseas biosecurity plans such as the Faroese Veterinary Model for finfish aquaculture have greatly reduced the incidence of disease impacts on both farms and the environment. The model incorporates: fallowing periods; movement restrictions on fish and equipment; density limits; and minimum distance between hatcheries and marine water farms.

Proponents must also develop systems, advice and training for lease staff, contractors, volunteers and other visitors to inform them of their biosecurity duties under the *Biosecurity Act 2015* and associated regulations.

Biofouling must be regularly removed from aquaculture infrastructure to ensure it does not harbour pathogens, impact on water flow and quality and/or attract wild fish as a source of food and refuge (Braithwaite *et al.*, 2007; Fitridge *et al.* 2012). The potential impact of biofouling and its management must be addressed by the proponent in an environment monitoring plan (see Appendix 2 for an example).

See Section 3.2.9 Chemical Use for details on the treatment of disease, parasites and pests on aquaculture leases.

Exotic Pest Management

Marine pests can be spread by ballast water and vessel hull biofouling (Commonwealth of Australia, 2009) and can result in predation, introduction of disease or parasites, competition, habitat/native aquatic ecology degradation, as well as hybridisation with native populations that can affect genetic integrity.

The introduction of exotic species is an issue which must be dealt with on a national basis. The *National Policy for the Translocation of Live Aquatic Organisms* (Translocation Policy) (Ministerial Council on Forestry, Fisheries and Aquaculture, 1999) has been developed to meet the needs of Australia's aquaculture industry for the translocation of species within jurisdictions and across jurisdictional boundaries. These guidelines set out a risk assessment process for considering exotic pest translocation issues, which must be used by proponents to assess potential risks associated with the proposed aquaculture lease, and develop corresponding mitigation measures.

NSW DPI does not permit the importation of used aquaculture equipment from overseas. The proponent must undertake a risk based assessment prior to the interstate importation of used aquaculture equipment and must also be aware of any existing biosecurity zones in the marine environment.

Procedures must be developed for handling, treating and disposing of wastes, infrastructure and other materials that are potential carriers of disease agents or pests. The proponent is also required to maintain a stock and equipment register by recording all movements and treatments.

Emergency Biosecurity Procedures

Emergency response protocols to deal with aquatic animal disease events have been developed by NSW DPI in accordance with the provisions of [Australian Aquatic Veterinary Emergency Plan](#) (AQUAVETPLAN). The AQUAVETPLAN was developed with the aim of building and enhancing the capacity of the management of aquatic animal health in Australia.

A series of manuals detailing approaches to national disease preparedness and aquaculture animal disease events, including technical response and control strategies, as well as guidelines for dead stock disposal are provided in the AQUAVETPLAN (Web Reference 6).

General Biosecurity Duty under the *Biosecurity Act 2015*

Biosecurity is defined as 'the normal and typical health and wellbeing (security) of an animal or plant (biological). A number of provisions relating to aquatic biosecurity previously held under the FM Act were transferred to the *Biosecurity Act 2015* and associated regulations on 1 July 2017. In addition to the specific requirements, such as reporting requirements for prohibited matter and suspicion of notifiable pests and diseases, there is also a general biosecurity duty that applies to everyone. Anyone in contact with an animal or plant is required to prevent, eliminate or minimise any risks to other animals or plants.

Environmental Management Plan

All proponents are required to prepare a biosecurity management plan for inclusion in the project's environmental management plan. The plan must detail how stock health and exotic marine species will be monitored and reported on, and how potential impacts associated with disease and pests will be mitigated. An outline of the plan should be included in the environmental impact assessment that supports the application. Emergency response protocols for diseases or pests must be built into the project's environmental management plan and this must include scheduling regular simulation exercises to test response preparedness. A detailed program would then be required following any approval of the proposal, which would be specified in any approval conditions.

3.2.8 Genetic Integrity and Species Competition

Expected Outcome

Potential impacts on the local population of the cultured species are first avoided, then minimised and then any unavoidable impacts are adequately mitigated.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 8.1 Compliance with locational constraint criteria 11
- 8.2 A biosecurity management plan, including the stock breeding techniques which maintain genetic integrity
- 8.3 A structural integrity and stability monitoring program, including design features, operational procedures and maintenance schedules that mitigate the risk of escapement events (sea pen aquaculture only)
- 8.4 An escapee recapture protocol, which details the procedures for recapture attempts, recording requirements and reporting significant events to NSW Department of Primary Industries and NSW Department of Planning and Environment (sea pen aquaculture only).

Overview

A loss of genetic diversity is a potential concern if cultured stock cross breed with wild populations and originate from broodstock outside the range of the local genetic population. To mitigate the potential risks associated with the loss of genetic integrity within wild stocks, all cultured stock for marine aquaculture operations must be derived from broodstock that has been collected from the same region as the intended aquaculture operation. In addition, broodstock must be collected in sufficient numbers to ensure genetic integrity is maintained. The culturing of genetically modified organisms through the addition of any foreign genetic material (DNA) into an organism in NSW marine waters is not permitted.

Research in Australia shows that farmed fish are conditioned to feed on pellets and their foraging and survival skills may be limited, particularly if reared to adulthood.

This is supported by studies on the gut contents of escaped fish which indicate that these fish do not feed well and in turn would limit gonad development (O'Sullivan et al., 1998; PIRSA, 2003).

Escaped fish are also more likely to be predated on as they have not learnt to avoid dangerous situations, which further reduce their chance of surviving to breeding age (PIRSA, 2003).

Environmental Management Plan

All proponents are required to prepare a biosecurity management plan for inclusion in the project's environmental management plan. The plan must detail stock breeding techniques that will be used to maintain genetic integrity. An outline of the program should be included in the environmental impact assessment that supports the application. A detailed program would then be required following any approval of the proposal, which would be specified in any approval conditions.

Sea pen aquaculture operations also require a structural integrity and stability monitoring program, including design features, operational procedures and maintenance schedules that mitigate the risk of escapement events. An escapee recapture protocol is also required, which details the procedures for recapture attempts (see Appendix 2 for examples). Recaptures are possible as escapees tend to remain in close proximity to fish farms for prolonged periods. Proponents are also required to record all escapement events and report all significant events to NSW DPI and NSW DPE. A significant escapement is defined as any loss of the cultured species to the marine environment in excess of 5% of individuals at any one time. Regular simulation exercises to test recapture protocols must be scheduled to test response preparedness.

3.2.9 Chemical Use

Expected Outcome

Spills at sea are prevented and operational activities effectively mitigate potential impacts of chemicals on marine waters.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 9.1 A commitment to using chemicals to treat stock in accordance with Australian Pesticides and Veterinary Medicines Authority requirements, a veterinary prescription and legislative requirements
- 9.2 Chemical use complies with Section 120 of the *Protection of the Environment Operations Act 1997* and if any pollution event does occur, NSW Environment Protection Authority are contacted immediately
- 9.3 A commitment to ensuring that residues of chemicals are below the legal limits set in the Food Standards Code and that unregistered stock medicines will not be used
- 9.4 A commitment to determining the safest concentration and method for each chemical treatment event to prevent adverse effects such as containment infrastructure (for example, liners)
- 9.5 A commitment to securing fuel, cleaning liquids (soap), toilet products, oils and therapeutics used on-board vessels in appropriate storage containers and undertaking regular servicing of all boats and equipment; daily inspections and appropriate 'start up' and 'shut down' procedures

Assessment Requirements

- 9.6 A commitment to training staff in spill containment procedures and stocking vessels with spill kits containing adequate spill response equipment
- 9.7 A commitment to immediately notifying NSW Roads and Maritime Services of fuel/oil spill and managing large scale and severe spill incidents in accordance with NSW State Waters Marine Oil and Chemical Spill Contingency Plan
- 9.8 A biosecurity management plan, including the operational and maintenance procedures that will be undertaken to maintain the stock health.

Overview

Finfish aquaculture may require the use of some chemicals and therapeutics (that is, veterinary pharmaceuticals) to treat cultured stock for disease, to control pests and to assist with diagnostic procedures, fish handling, post-harvest transportation and euthanising fish (that is, anaesthetics) (Burrige *et al.*, 2010; NSW DPI, 2015). Clear Australian Pesticides and Veterinary Medicines Authority (APVMA) protocols are in place for the use of approved chemicals and therapeutics.

Aquaculture leases are required to keep chemical usage to a minimum by maintaining the health of the cultured stock by undertaking the following:

- Regular monitoring
- Prompt treatment of any infections
- Stocking at densities that minimises stress
- Positioning leases in areas with adequate flushing
- Implementing measures to minimise harassment from predators
- Using high quality feed
- Regularly cleaning infrastructure to avoid accumulation of biofouling organisms which may harbour diseases, parasites and/or pests.

Chemical use associated with the operation of an aquaculture lease must be in accordance with the APVMA (Web Reference 7). Alternatively, a prescription from a licensed veterinarian may be obtained prior to administering chemicals to cultured stock. The appropriate Material Safety Data Sheets are also required to be consulted when using chemicals on aquaculture leases and due care must be taken to ensure the safety of staff, stock and the environment (Barker *et al.*, 2009; NSW DPI, 2015).

Chemical use in or near waters must be managed appropriately by following the labels of registered chemical products and consulting relevant agencies on any legislative requirements. For example, the *Pesticide Act 1999* and Regulation specify requirements for pesticide use and include a requirement that, among other things, label directions are strictly followed and that pesticides are only applied in their intended situation of use. While the POEO Act does not specifically control the use of chemicals it prohibits, amongst other things, water pollution. Chemicals must be used in ways that minimise the potential for water pollution. Pollution incidents posing a material harm to the environment must be notified to each 'relevant authority' as defined under Section 148 of the *Protection of the Environment Operations Act 1997*. This includes the 'Appropriate Regulatory Authority' and the NSW EPA. Further information is provided on the NSW EPA website.

Residues of chemicals must be below the legal limits (that is, maximum residue limit) set in the Food Standards Code (as adopted into the *NSW Food Act 2003*) and no residue at any

detectable level will be permitted if there is no limit set in the Standards (Barker *et al.*, 2009; NSW DPI, 2015). Use of unregistered stock medicines or off-label products are not permitted.

A thorough assessment is required prior to the use of any therapeutics on an aquaculture lease to determine the safest treatment concentration and method to prevent any adverse effects on marine organisms, the environment and surrounding communities. Each treatment event should be assessed individually to ensure that variation in correlated factors are accounted for, such as seawater temperature, previous use and accumulation in the area, degradation rates and toxicity levels. Containment infrastructure (for example, liners) is required when therapeutics are not administered orally. Only therapeutics that pose a negligible to low risk are permitted to be used in NSW marine waters.

Fuel, cleaning liquids (soap), toilet products, oils and therapeutics used on-board vessels are required to be secured in appropriate storage containers to avoid any risks of spillages. Regular servicing of all boats and equipment; daily inspections and appropriate 'start up' and 'shut down' procedures will assist in ensuring early identification of any issues and prompt remedial action by appropriately trained staff. Any residual or out of date chemicals must be transferred to land based facilities and disposed of in an appropriate manner.

Proponents are required to train staff in spill containment procedures and have spill kits on-board vessels, which contain adequate spill response equipment such as absorbent material. NSW RMS is the responsible regulatory authority under the POEO Act for pollution from marine vessels including fuel and oil spills, and must be contacted immediately if any pollution is detected. In the very unlikely event of a large scale and/or severe pollution incident, the event must be managed in accordance with the [NSW State Waters Marine Oil and Chemical Spill Contingency Plan](#).

Resistance to Chemical Treatments

The risk of antibiotic use causing drug resistance in both target and non-target animals, as well as bacterial organisms must be minimised first by correctly diagnosing the disease, and second by appropriate use of all chemicals used in treating a disease. Third, the employment of strict operational management practices and strategies coupled with strict health management procedures will reduce the need for use of antibacterial chemicals.

Environmental Management Plan

All proponents are required to prepare a biosecurity management plan for inclusion in the project's environmental management plan. The plan must detail operational and maintenance procedures that will be undertaken to maintain stock health. An outline of the program should be included in the environmental impact assessment that supports the application. A detailed program would then be required following any approval of the proposal, which would be specified in any approval conditions.

3.2.10 Aboriginal Cultural Heritage

Expected Outcome

Potential impacts on Aboriginal cultural heritage are first avoided, then minimised and then any unavoidable impacts are effectively mitigated.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 10.1 Compliance with locational constraint criteria 1
- 10.2 Evidence that local Aboriginal communities agree that all matters relevant to Aboriginal cultural heritage have been identified, and that the marine aquaculture proposal adequately mitigates any potential impacts
- 10.3 Proposed measures that mitigate potential impacts on environmental heritage and Aboriginal objects and places, which meet statutory requirements and guidelines prepared by NSW Office of Environment and Heritage.

Overview

“The land and water within the NSW coastal landscape are central to Aboriginal spirituality and contribute to Aboriginal identity. Aboriginal communities associate natural resources with the use and enjoyment of foods and medicines, caring for the land, passing on cultural knowledge and strengthening social bonds. Aboriginal heritage and connection to nature are inseparable from each other and need to be managed in an integrated manner across the landscape” (DECC, 2009).

Aboriginal Traditional Owners are recognised as custodians of, and maintain a special connection with lands and waters occupied by their ancestors for millennia. Aboriginal Traditional Owners, as native title holders under the Commonwealth’s *Native Title Act*, may have rights over coastal waters which can include the right to protect areas of importance or significance, to access and take resources and to share or exchange those resources. As the Commonwealth’s *Native Title Act* is about the recognition and protection of existing rights, it is important to recognise that these rights may exist regardless of whether a native title claim or determination has been made.

There are Aboriginal objects and places, as well as State Heritage listed areas with Aboriginal heritage values located along the NSW coastline, which must be identified as part of the site selection process. The submerged lands along the coastline of NSW may have cultural significance to local Aboriginal communities (Schnierer & Egan, 2015). Much of the nearshore submerged coastline would have been terrestrial environments during periods of low sea level, thus utilised in a way that was different to the more contemporary historical record. Acknowledging access to the marine estate for cultural purposes has also been identified in the Marine Estate Management Strategy as a priority action. Aboriginal Traditional Owners have the right under the Commonwealth’s *Native Title Act 1993* to lodge a claim over sea country to which they have a connection.

NSW Aboriginal heritage management is guided and influenced by the following legislation:

- *National Parks and Wildlife Act 1974*
- *Environmental Planning and Assessment Act 1979*
- *Marine Estate Management Act 2014*
- *Coastal Management Act 2016*
- *Coastal Management State Environmental Planning Policy*
- *Heritage Act 1977*
- *Aboriginal Land Rights Act 1983*

- *Native Title Act 1993* (Commonwealth)
- *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
- *Native Title Act 1994* (NSW)

The presence of Aboriginal cultural heritage can be identified through literature searches such as the Comprehensive Coastal Assessment by Andrews *et al.* (2006), field investigations, database searches, such as the [Aboriginal Heritage Information Management System](#), and via consultation with local Aboriginal communities and organisations, including Local Aboriginal Land Councils. Consultation should be in line with [Aboriginal cultural heritage consultation requirements for proponents](#).

Engagement with Traditional Owners should be sought early in the planning process and not just through a statutory consultation process (refer to [Engage Early – Guidelines for proponents on best practice Indigenous engagement for environmental assessment under the Environment Protection and Biodiversity Conservation Act 1999](#)). Investigations should be in line with the [Code of practice for archaeological investigation of Aboriginal objects in NSW](#) and [Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW](#), which can also be used to support the process of investigating and assessing Aboriginal cultural heritage in the region surrounding the proposed site. It is an offence to harm Aboriginal objects and places under the NPW Act. If harm cannot be avoided, an Aboriginal Heritage Impact Permit (AHIP) can be issued by the Chief Executive of the NSW OEH under Part 6 of the NPW Act.

3.2.11 European Heritage

Expected Outcome

Potential impacts on European heritage, notably plane and shipwrecks, are first avoided, then minimised and then any unavoidable impacts are adequately mitigated.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 11.1 Compliance with locational constraint criteria 8
- 11.2 Proposed measures that mitigate potential impacts on items of European heritage which meet the statutory requirements of the *Heritage Act 1977* and guidelines prepared by NSW Office of Environment and Heritage (notably plane and shipwrecks)
- 11.3 Approval from the Heritage Council if the proposal makes changes to a heritage place listed on the State Heritage Register or covered by an interim heritage order.

Overview

NSW Heritage Act 1977 protects items of natural and cultural environmental heritage in NSW, which includes places, works, relics and buildings of cultural, scientific, historic, social, archaeological, architectural, natural or aesthetic significance (Web Reference 8). Notably, the *NSW Heritage Act 1977* protects shipwrecks, including those identified in the NSW Historic Shipwrecks Database, and some plane wrecks along the NSW coastline. The *Historic Shipwrecks Act 1976* protects historic wrecks and relics in Commonwealth waters.

The State Heritage Register lists places and objects of particular importance to the people of NSW. To be listed, an item must be significant for the whole of NSW. Associated with these Acts and the Register are searchable databases that a proponent of an aquaculture proposal should consult early in the development of the project. The information in these databases should be augmented by field investigations and any other relevant sources (for example, scuba diving websites).

Local councils also play a vital role in conserving heritage. Heritage places or objects that are important for the community in a local government area are listed on the local environmental plan (LEP) and managed by the local council.

The proponent is required to conduct a thorough investigation of items of European heritage in the region surrounding the proposed aquaculture operation. Mitigation measures which meet NSW OEH requirements, must be developed to ensure that any potential impacts are mitigated.

Heritage places, objects, plane and shipwrecks can be identified through literature searches, field investigations and database searches. Examples of databases include [State Heritage Register](#), [NSW Maritime Heritage Database](#), [NSW Wrecks](#), [Australian Hydrographic Service](#) and [Australian National Shipwreck Database](#).

Approval must be gained from the Heritage Council when making changes to a heritage place listed on the State Heritage Register, or covered by an interim heritage order. Approval is also required when excavating any land in NSW where you might disturb an archaeological relic.

3.2.12 Commercial, Recreational and Aboriginal Cultural Fishing, Recreational Boating and Tourism

Expected Outcome

The proposal is compatible with commercial, recreational and Aboriginal cultural fishing, recreational boating and tourism.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 12.1 Evidence that commercial, recreational and Aboriginal fishers, as well as recreational boaters, tour operators, relevant local associations and NSW Roads and Maritime Service have been consulted and agree that:
 - 12.1.1 The marine aquaculture operation will not unduly impact on fishing, recreational boating and tourism activities in the region surrounding the proposed site
 - 12.1.2 The marine aquaculture operation will not unduly impede navigation to and from important fishing, recreational boating and tourism sites
- 12.2 Proposed measures to mitigate potential impacts on commercial, recreational and Aboriginal cultural fishing activities, and recreational boating/tourism, which meet the requirements of the NSW Department of Primary Industries
- 12.3 Compliance with locational constraint criteria 6 and 9
- 12.4 A community stakeholder management plan.

Overview

Commercial Fishing

Commercial fishers operate throughout NSW state waters including the ocean, beaches, bays and estuaries. This industry underpins the economy of many coastal towns providing business and employment. Towns and areas such as Maclean and the Clarence River, Coffs Harbour, Port Stephens, Newcastle, the Central Coast, Wollongong, Nowra and Eden are some of the key ports for commercial fishing.

The types of commercial marine fishery activities in NSW include the following:

- Abalone Fishery - abalone are harvested from rocky reefs
- Estuary General Fishery - this fishery operates in 76 of the estuarine systems in NSW
- Estuary Prawn Trawl Fishery - the fishery mostly catches school prawns in the Clarence, Hawkesbury and Hunter rivers
- Lobster Fishery - fishers use traps to catch the lobsters from rocky reefs
- Ocean Hauling Fishery - this fishery targets 20 finfish species including sardines, Sea Mullet, Australian Salmon, Blue Mackerel, Yellowtail Scad and Yellowfin Bream
- Ocean Trawl Fishery - there are two sectors in this fishery: prawn and fish trawl where both use trawl nets in the open ocean
- Ocean Trap and Line Fishery - this fishery uses a variety of traps or lines with hooks from rocky reefs
- Sea Urchin and Turban Shell Restricted Fishery - sea urchins and turban shells are harvested from rocky reefs.

Marine aquaculture proposals are required to be assessed for compatibility with existing commercial fishing activities and if any potential impacts are identified, mitigation measures must be developed which meet NSW DPI requirements.

Recreational Fishing

Recreational fishers in NSW target various species including whiting, bream and flathead along beaches and within estuaries, while anglers largely target Snapper and Yellowtail Kingfish in coastal waters, as well as tuna and marlin further offshore. The warmer months of the year are the most popular time for recreational fishing in NSW.

Recreational fishing opportunities can be enhanced by the presence of marine aquaculture infrastructure.

Marine aquaculture proposals are required to be assessed for compatibility with existing recreational fishing activities and if any potential impacts are identified, mitigation measures must be developed which meet NSW DPI requirements.

Aboriginal Cultural Fishing

Aboriginal access to traditional aquatic biological resources is important economically, socially, culturally and spiritually. Aboriginal people still assert their right to procure a regular supply of fresh seafood for consumption, barter and trade (Schnierer, 2011).

The FM Act ensures that the fishing needs and traditions of Aboriginal people are appropriately captured in the management of fisheries resources (Schnierer, 2011). Objects of this Act include: recognising the spiritual, social and customary significance of the fisheries resource to Aboriginal people, with the aim to protect, and promote the continuation of Aboriginal cultural fishing.

Marine aquaculture proposals are required to be assessed for compatibility with Aboriginal cultural fishing activities and if any potential impacts are identified, mitigation measures must be developed which meet NSW DPI requirements.

Recreational and Commercial Boating and Tourism

In addition to individuals undertaking recreational fishing, the coastline and coastal waters of NSW offers a range of tourism and recreational boating opportunities including charter fishing, wildlife observations (for example, dolphin and whale watching, seal colony visitations and swimming with dolphins), dive charters, jet boat rides, passenger transfers, jet ski and boat hire, non-motorised water sports, yacht racing, houseboats, parasailing, swimming, snorkelling and a variety of cruises.

Aquaculture developments may provide marine tour operators, such as dolphin/whale watching, fishing, sightseeing and diving charters, with an additional attraction to visit during tours. Experience in other states has shown that aquaculture can provide a region's tourist industry with an opportunity to diversify tourists' experiences by visiting aquaculture facilities. This in turn creates greater community awareness about aquaculture and encourages an interest in tourists to source fresh local seafood.

On the Eyre Peninsula in South Australia for example, a seafood trail has been established to showcase the region's aquaculture industry, and linking the industry into mainstream tourism activities. Similarly, in Twofold Bay on the south coast of NSW, marine tour operators have been able to diversify their tourism experience by discussing mussel aquaculture in the bay during other tourist activities. This also occurs in Tasmania where eco-tourism ventures operate alongside finfish aquaculture. Huon Aquaculture for example, provides access to their pen infrastructure, with on-site experts to answer questions from tourists on locally operated tourist vessels. Such examples showcase how a resource can be shared and sustainably managed, and also illustrate how aquaculture can attract tourists, enhance their experience and contribute to the regional economy.

Marine aquaculture proposals are required to be assessed for compatibility with the commercial boating industry, recreational boat users and tourism activities. If any potential impacts are identified, consultation and negotiation with user groups must occur and mitigation measures must be developed which meet NSW RMS requirements.

Artificial Reefs

Artificial reefs have been established in a number of locations along the NSW coast, which create fish habitat and provide high quality fishing and diving opportunities. Sunken vessels and shipwrecks also function as artificial reefs and are of major interest to recreational fishers and divers.

Proposed aquaculture leases must be at least 1 km from artificial reefs to mitigate potential impacts of aquaculture operations on these structures and the associated recreational activities.

Environmental Management Plan

All proponents are required to prepare a community stakeholder management plan for inclusion in the project's environmental management plan (see Appendix 2 for an example). An outline of the program should be included in the environmental impact assessment that supports the application. A detailed program would then be required following any approval of the proposal, which would be specified in any approval conditions.

3.2.13 Commonwealth Waters and Defence Operational Areas

Expected Outcome

There are no impacts on Department of Defence operational areas.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 13.1 Compliance with locational constraint criteria 5
- 13.2 Evidence that the proponent has consulted with the Department of Defence and received confirmation that the proposed aquaculture lease does not impact on operational areas.

Overview

A number of locations along the NSW coastline are classified as either Commonwealth waters or have operational significance for the Department of Defence. Any area seaward of three nautical miles is classified as Commonwealth waters, along with a portion of the waters of Jervis Bay (see Figure 13). NSW Government is not authorised to approve or administer any aquaculture development activities in Commonwealth waters at this time. However, amendments to the Commonwealth Fisheries Management Act 1991 are proposed to allow individual jurisdictions to extend their existing aquaculture regulations to cover adjoining Commonwealth waters.

The Department of Defence has a number of operational areas along the NSW coastline which include:

- Naval live munition firing trace area of Jervis Bay (Figure 14)
- Naval explosive exclusion zone at the Multi-Purpose Wharf within Twofold Bay (Figure 15)

Public safety exclusion zones within Defence Practice Areas at Evans Head (Figure 16).

Aquaculture development is not permitted in the Department of Defence operational areas. Proponents are required to consult with the Department of Defence if the proposed aquaculture lease is within close proximity to marine and restricted land-based operational areas.

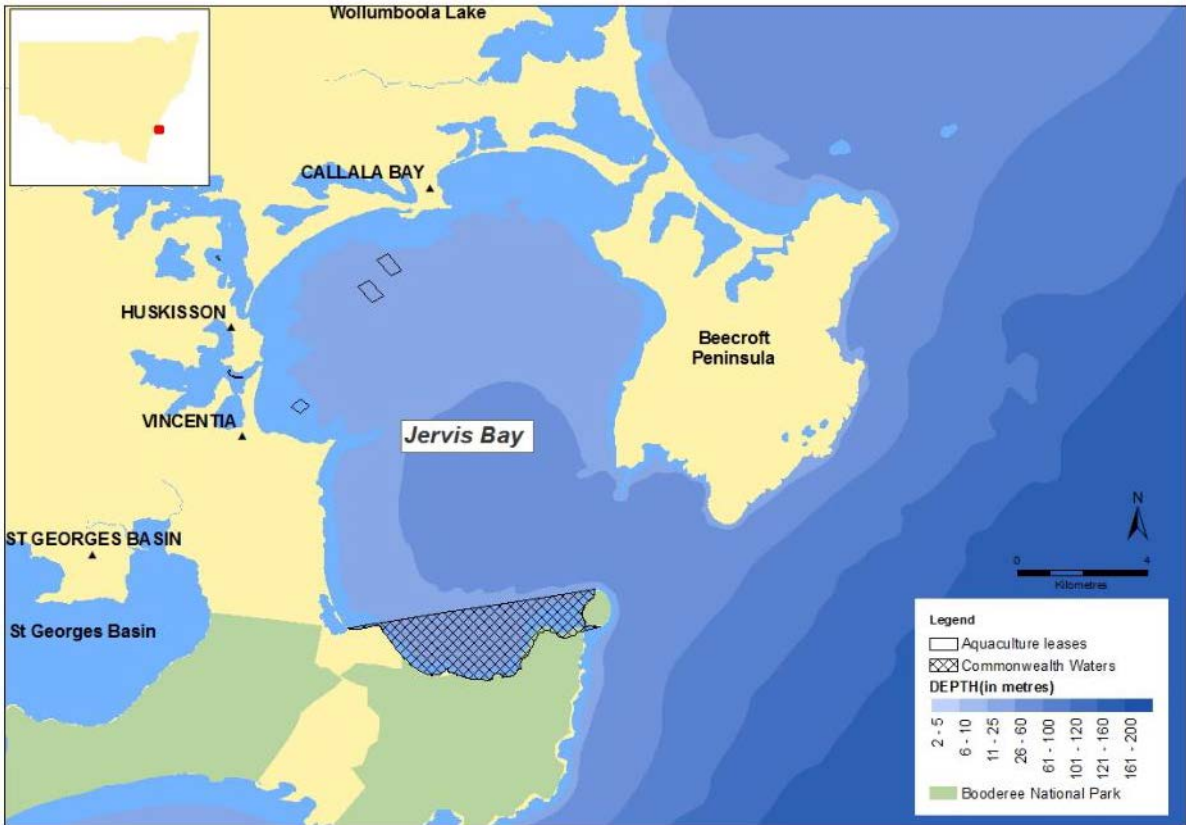


Figure 13: Commonwealth waters of Jervis Bay (Source: NSW DPI, 2017).

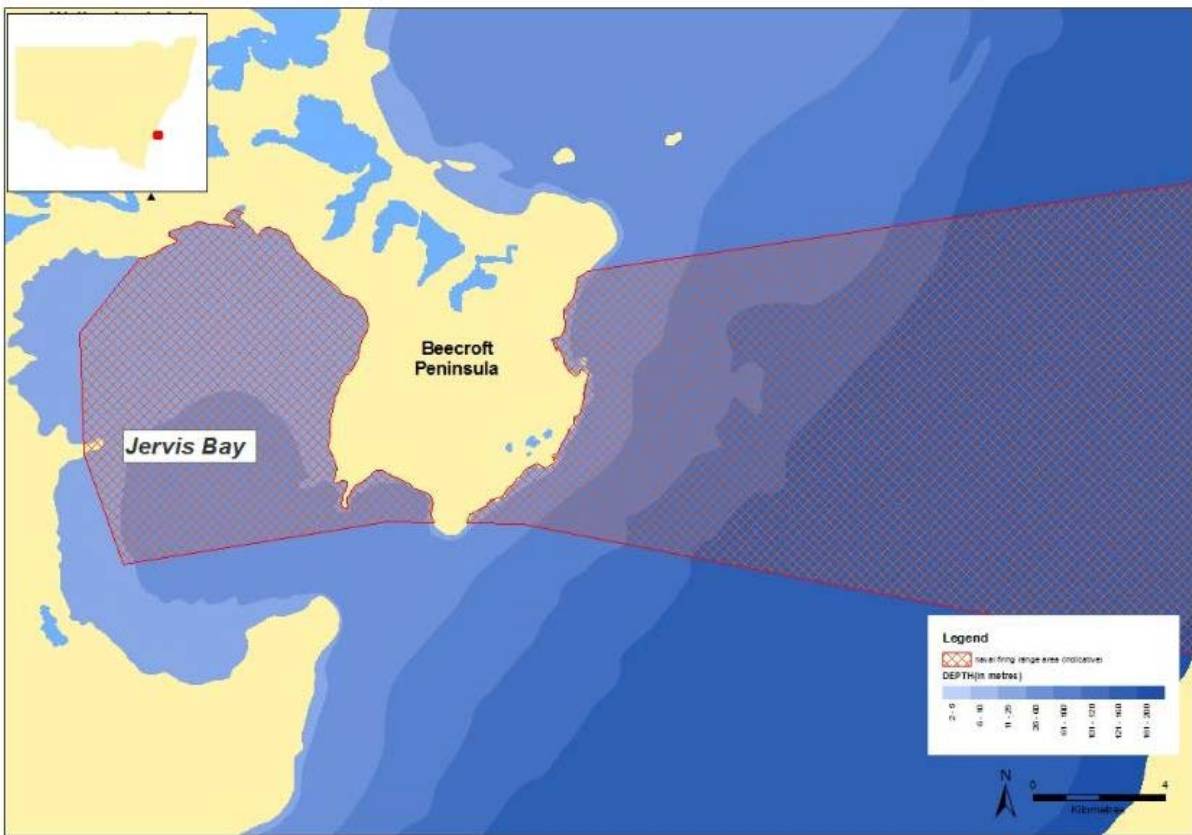


Figure 14: Naval live munition firing range trace area of Jervis Bay (Source: NSW DPI, 2017).

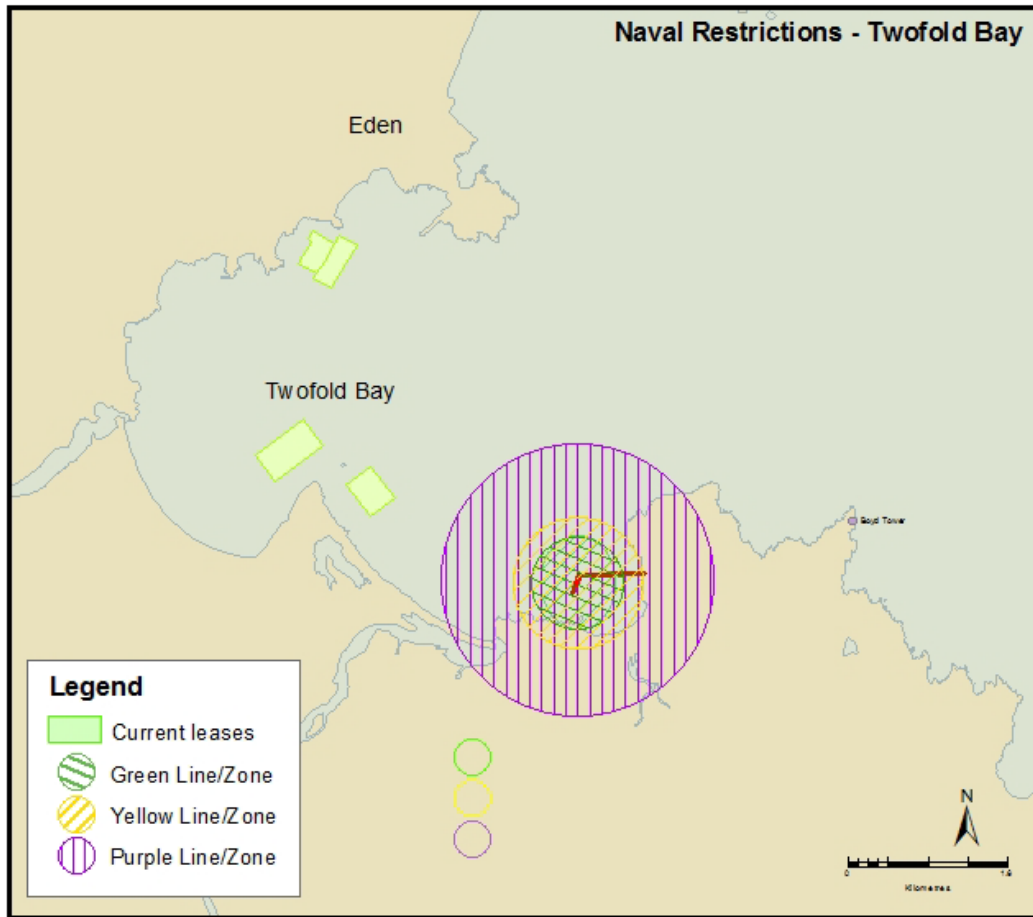


Figure 15: Naval explosive exclusion zone within Twofold Bay (Source: NSW DPI, 2017).

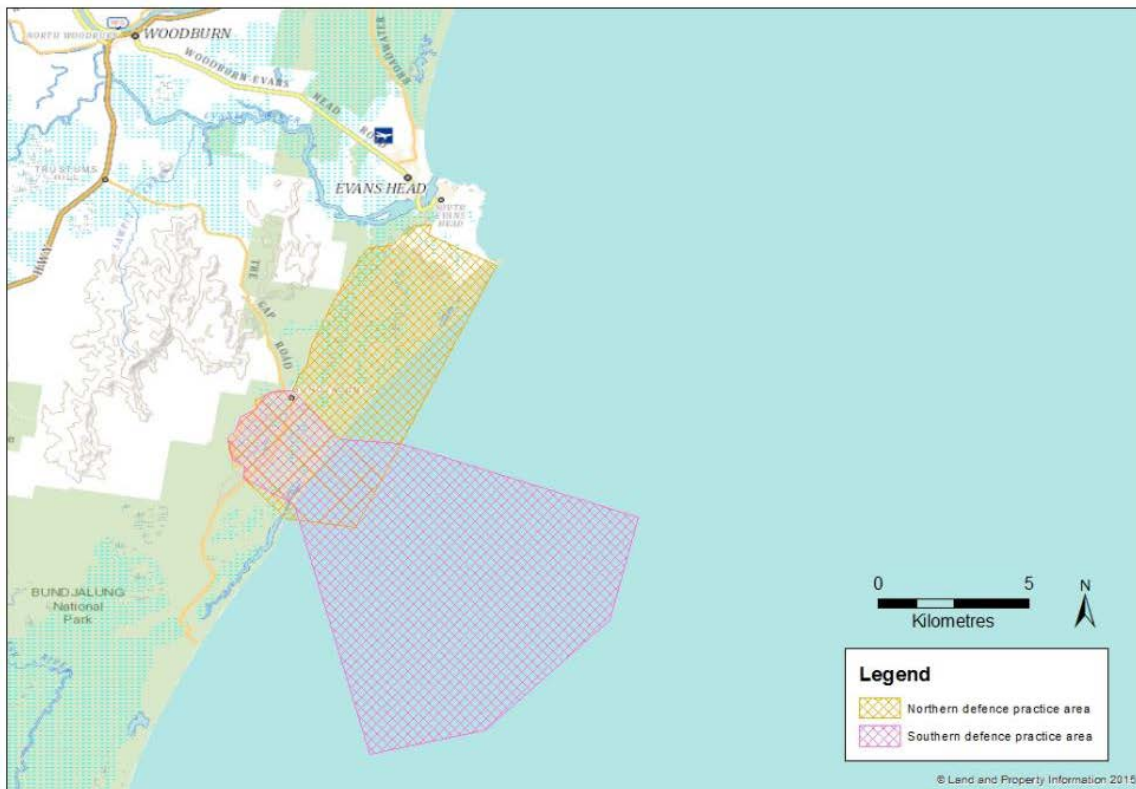


Figure 16: Public safety exclusion zones within the Defence Practice Areas at Evans Head (Source: NSW DPI, 2017).

3.2.14 Submarine Communication Cables

Expected Outcome

There are no impacts on submarine communication cables.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 14.1 Compliance with locational constraint criteria 3.

Overview

The coastal environment of NSW has a number of submerged cables of importance that need to be avoided when selecting a site for aquaculture. Submarine communication cables are laid in NSW coastal waters near Sydney (Web Reference 9) and have nominated protection zones to prevent potential damage to cable infrastructure (Figure 17 and 18).

Marine aquaculture is not permissible within submarine communication cable protection zones.

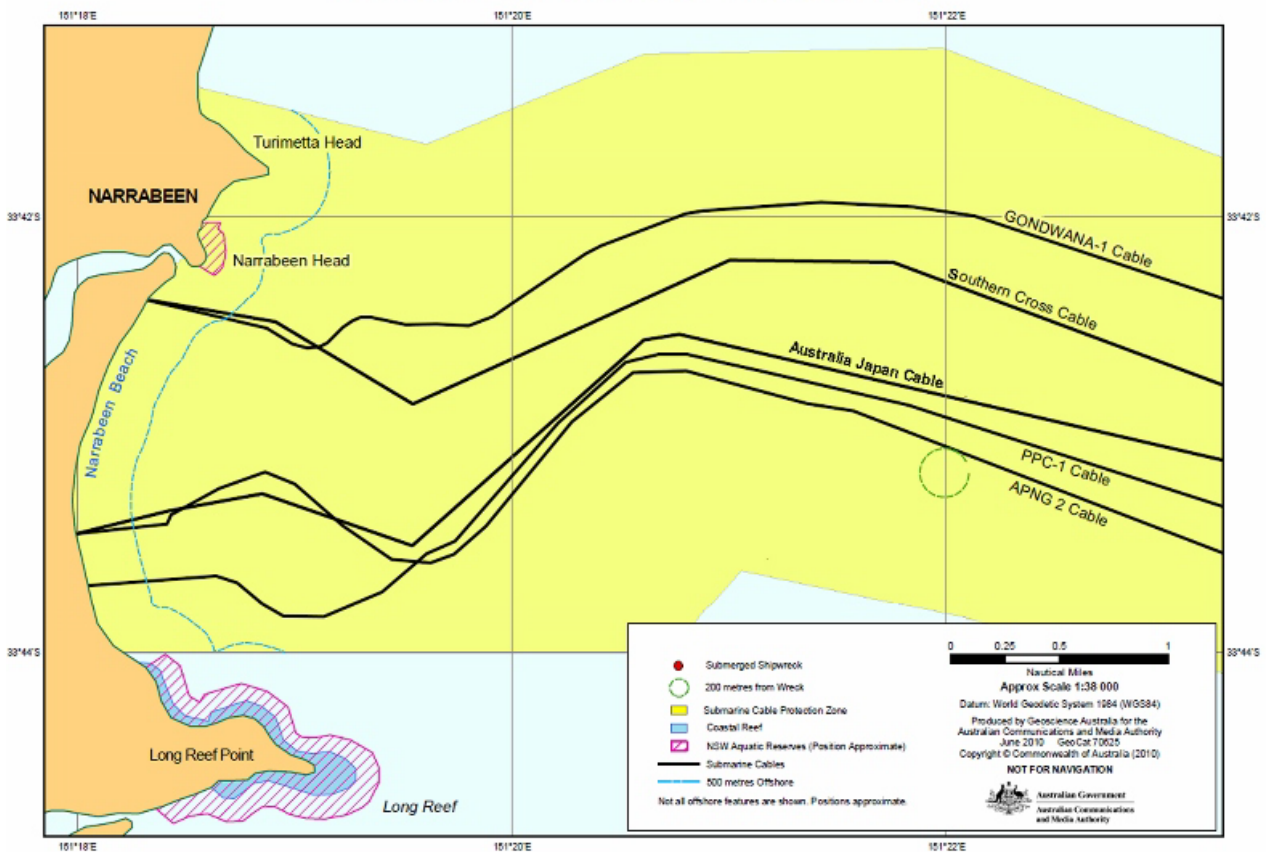


Figure 17: Submarine cables and the associated Submarine Cable Protection Zone around the Northern Protection Zone in Sydney (Source: Geoscience Australia, 2010).

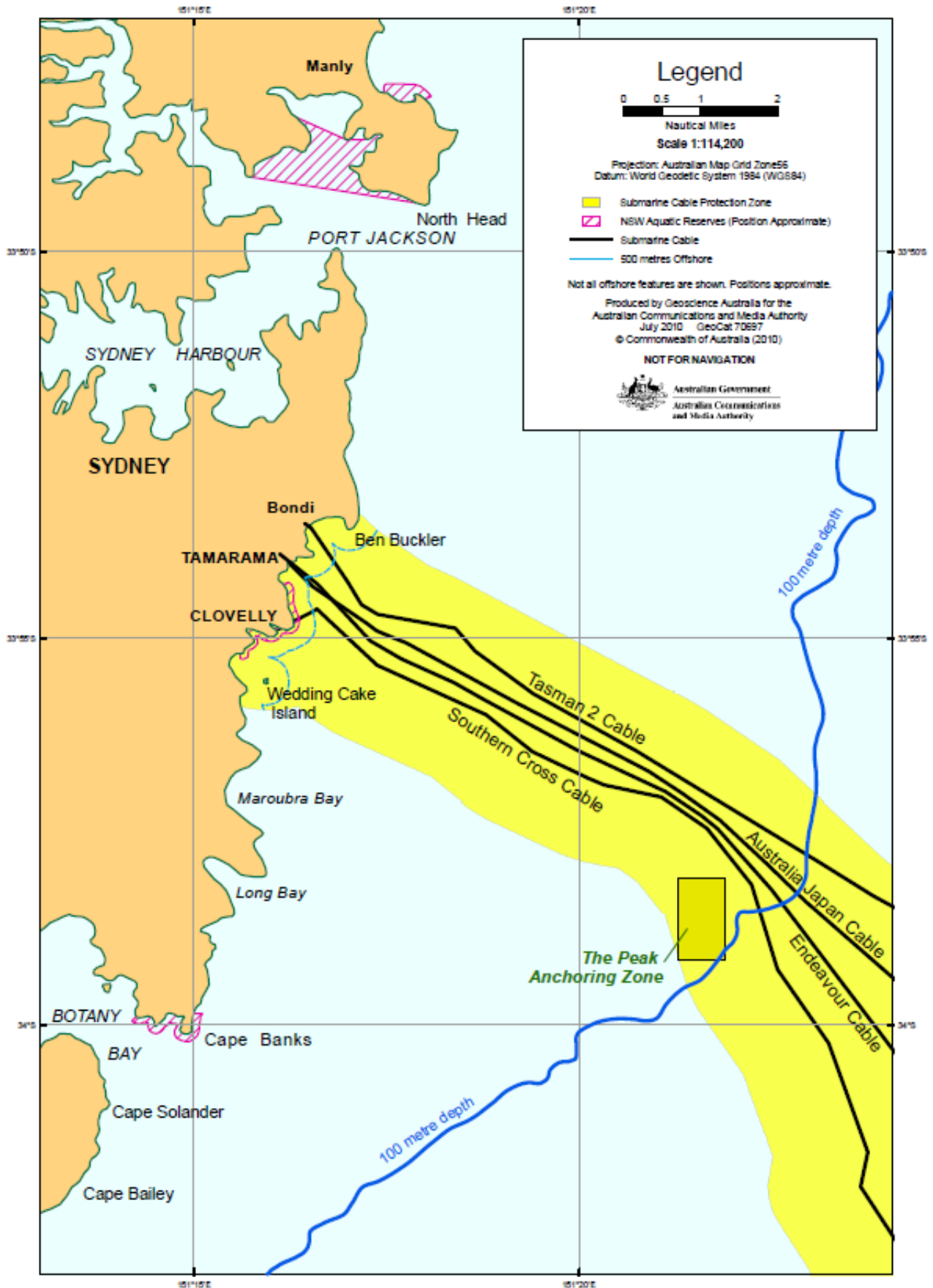


Figure 18: Submarine cables and the associated Submarine Cable Protection Zone around the Southern Protection Zone in Sydney (Source: Geoscience Australia, 2010).

3.2.15 Aquaculture and Offshore Exploration and Mining

Expected Outcome

Potential impacts on other aquaculture leases and potential impacts on current or future offshore exploration and mining are considered and mitigated.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 15.1 Compliance with locational constraint criteria 12
- 15.2 Evidence that the proponent has consulted with NSW Roads and Maritime Services and NSW Department of Primary Industries to confirm that the distance between the proposed lease and existing aquaculture leases ensures safe navigation and mitigates potential water quality, health management and benthic impacts.
- 15.3 Evidence that the proponent has consulted with Division of Resources and Geoscience to confirm any requirements regarding offshore exploration and mining.
- 15.4 Proposed measures that mitigate potential impacts to offshore exploration and mining, including appropriate site selection.

Overview

Aquaculture Leases

Adequate buffer zones between aquaculture leases are critical to mitigating biosecurity potential environmental and navigational impacts. Notably, buffer zones must aim to mitigate cumulative water quality, health management and benthic impacts. The required distance between aquaculture leases will vary, depending on factors such as the physical characteristics of the locality, type of aquaculture, ownership of the leases, whether feed and/or chemicals are used, stocking densities, existing waterway users, degree of current movement and flushing.

Biosecurity separation distances between farming operations are an integral part of industry sustainability. A detailed assessment of species, husbandry and production technology must be undertaken to reduce the biosecurity risk.

Vessels used to service marine aquaculture operations also require the ability to navigate to and from leases from different directions and in a range of sea and tidal conditions. Similarly, vessels require an adequate area to deploy and remove infrastructure, such as anchors, moorings and floating sea pens. The installation of navigational marker buoys on the corners of aquaculture leases is a NSW RMS requirement that is also critical to maintaining navigational safety in areas where aquaculture leases are in close proximity. See Section 3.2.16 for further information on navigational interactions and markers.

The proponent is required to consult with NSW RMS and NSW DPI to confirm that the distance between the proposed lease and any existing aquaculture leases ensures safe navigation and mitigates potential water quality, health management and benthic impacts.

Offshore Exploration and Mining

Marine based aquaculture can co-exist with offshore exploration and mining provided measures are undertaken to avoid or minimise any incompatibility.

The planning authority should consider whether the proposed aquaculture lease is compatible with current or future offshore exploration and mining. This should also involve a consideration of whether the proposed aquaculture lease limits access to, or assessment of, significant offshore resources.

The proponent is required to consult with Division of Resources and Geoscience on the potential impact to offshore resources, exploration and mining.

This will facilitate the mutually beneficial use of NSW coastal waters.

3.2.16 Navigation Interactions and Markers

Expected Outcome

The proposal is not a navigation hazard.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 16.1 Evidence that NSW Roads and Maritime Services have assessed the proposed aquaculture operation
- 16.2 Proposed navigational markers meet the requirements of NSW Roads and Maritime Services and the International Association of Lighthouse Authorities
- 16.3 Compliance with NSW Department of Primary Industries Aquaculture Lease Survey Specifications
- 16.4 A commitment to consult target waterway user groups about general boating rules in the vicinity of the aquaculture lease
- 16.5 A commitment that marine vessel staff will be fully qualified, undergo regular training and abide by NSW Roads and Maritime Services regulations and the *Australian Aquaculture Code of Conduct*
- 16.6 A commitment to notifying the Australian Hydrographic Office and NSW Roads and Maritime Services of the lease coordinates and ensuring that a 'Notice to Mariners' is issued and official charts and maps are amended
- 16.7 Evidence that the proponent has consulted with and complied with the requirements of the Port Authority of NSW
- 16.8 Compliance with locational constraint criteria 4
- 16.9 Compliance with locational constraint criteria 10
- 16.10 A construction, deployment and traffic management plan.

Overview

The degree of impact of aquaculture infrastructure on the safe navigation of vessels and other waterway users in an area depends on its placement in relation to features such as narrow channels, established navigation channels and shipping port approaches, identified anchorages, recreational and commercial areas, as well as how clearly marked and visible the structures are to other waterway users, particularly during severe weather.

In accordance with Section 17 of the *Marine Safety Act 1998*, proposed aquaculture leases are required to be assessed by NSW RMS to ensure they do not impede safe navigation of vessels. Navigation markers must be fitted on the corners of aquaculture leases in accordance with the requirements of NSW RMS and International Association of Lighthouse Authorities. Notably, navigational markers are required to be lit and fitted with GPS/GSM devices to alert staff if there is movement outside of the control zone within a lease. Marine aquaculture operations must also comply with NSW DPI's [Aquaculture Lease Survey Specifications](#).

The proponent is required to inform target waterway user groups about general boating rules in the vicinity of the aquaculture lease. It is strongly recommended against transiting, anchoring or diving (spearfishing) in the immediate vicinity of aquaculture infrastructure, given Work Health and Safety concerns. Notably, it is an offence to interfere with, or damage aquaculture infrastructure or stock under the FM Act. It is also an offence to transit at a speed over 6 knots within 30m of infrastructure and boaters must keep a minimum distance of 60m from diving operations notified with a blue and white 'Alpha' flag (Marine Safety Regulation 2016).

Navigation safety in the area of the aquaculture lease must also be maintained by ensuring that all staff involved in marine vessel transport are fully qualified, undergo regular training and abide by NSW RMS regulations and the *Australian Aquaculture Code of Conduct* (Appendix 5).

The proponent is required to notify the Australian Hydrographic Office and NSW RMS of the aquaculture lease coordinates and ensure that a 'Notice to Mariners' is issued and official charts and maps are amended.

Commercial Shipping

Commercial shipping occurs along the coastline of NSW which involves significant traffic in container, grain and coal ships. Shipping traffic is particularly busy around the Ports of Newcastle, Botany Bay and Port Kembla. However, most of this shipping traffic occurs in Commonwealth waters.

The Port Authority of NSW is a State Owned Corporation with responsibility for Sydney Harbour, Port Kembla and Port Botany, as well as the ports of Newcastle and Yamba in northern NSW, and Eden in the far south (Web Reference 10). Its statutory objectives and functions are derived from the provisions of the *State-Owned Corporations Act 1989*, *Ports and Maritime Administration Act 1995* and their Port Safety Operating License (Web Reference 10).

The proponent is required to consult with the Port Authority of NSW to confirm that the proposed aquaculture lease is not within a navigation channel or an established shipping port approach. The proponent must also comply with the requirements of the Port Authority of NSW to avoid impeding shipping traffic and ensure safe navigation within and around ports. This is particularly important when towing large infrastructure components such as sea pens, during the construction and deployment stages.

Contact should also be undertaken with NSW Ports that has major infrastructure in Port Botany, Port Kembla and Port of Newcastle.

Marine Infrastructure

Over 80% of the NSW population lives within 50 km of the coast. Consequently, substantial recreational and commercial activity occurs around the coastline and in adjacent marine waters. Marine infrastructure has been established to support these recreational and commercial

activities, including marinas, breakwalls, boat ramps, permanent and temporary moorings, wharfs and jetties.

Proposed aquaculture leases must be at least 1 km from marine infrastructure to ensure that access is not unduly restricted. Proponents are required to consult with NSW RMS prior to site investigations as this distance will be reviewed regularly.

Marine Monitoring Equipment

NSW marine waters contain temporary and permanent monitoring equipment that is used for a variety of data collection and satellite transmission purposes. Monitoring equipment includes buoys to monitor ocean wave heights, acoustic listening stations to record marine fauna movements and Integrated Marine Observing Stations (IMOS) to collect data on a wide range of physical, chemical and biological variables. Marine monitoring equipment is expensive to purchase, maintain and replace, and is usually logistically challenging and labour intensive to operate.

Proposed aquaculture leases must be at least 1 km from temporary and permanent monitoring equipment to mitigate potential interactions with aquaculture operations.

Environmental Management Plan

All proponents are required to prepare a construction, deployment and traffic management plan for inclusion in the project's environmental management plan (see Appendix 2 for an example). The plan must detail how potential impacts of the aquaculture operation on navigation and other waterway users will be minimised and monitored. Notably, all interactions between the aquaculture lease, service vessels and other waterway users are required to be documented and reviewed periodically. The interaction information should contain date of interaction, time, vessel registration, interaction details and photographs if possible.

An outline of the program should be included in the environmental impact assessment that supports the application. A detailed program would then be required following any approval of the proposal, which would be specified in any approval conditions.

3.2.17 Suitability of Infrastructure

Expected Outcome

The culture infrastructure is suitable for the sea state conditions at the site.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 17.1 Evidence that proven technologies, established engineering knowledge and computerised models have been used during the infrastructure design process, as well as evidence that infrastructure will be purchased from an established supplier or constructed under the guidance of a marine engineer
- 17.2 Evidence that the infrastructure design is tailored to withstand the recorded or modelled maximums for wave height, tidal range, swell and wind speed
- 17.3 A commitment that proposed structural modifications will be evaluated by the manufacturer or a marine engineer, and that a marine engineer or suitably qualified contractor will oversee the transportation and deployment of the infrastructure

Assessment Requirements

- 17.4 Operational and maintenance procedures to maintain the structural integrity of infrastructure, including inspections, maintenance and removal of biofouling
- 17.5 Compliance with the provisions of the *Fisheries Management Act 1994* and conditions stipulated in the aquaculture leases and permits
- 17.6 A structural integrity monitoring program
- 17.7 An emergency protocol (action plan) in response to incidents (escape, mortality, breakaway).

Overview

Aquaculture engineering knowledge and sea pen, longline and artificial reef technology has developed greatly over the past few decades, especially around moving aquaculture leases further offshore into high energy environments.

Ongoing research is being undertaken in relation to aquaculture developments and associated infrastructure. *Aquacultural Engineering* is the official journal of the Aquacultural Engineering Society. The journal is concerned with the design and development of effective aquacultural systems for marine and freshwater facilities. The journal aims to apply the knowledge gained from basic research which can potentially be translated into commercial operations.

Problems of scale-up and application of research data involve many parameters, both physical and biological, making it difficult to anticipate the interaction between the unit processes and the cultured animals. *Aquacultural Engineering* aims to develop this bioengineering interface for aquaculture including:

- Engineering and design of aquaculture facilities
- Engineering-based research studies
- Construction experience and techniques
- In-service experience, commissioning, operation
- Materials selection and their uses
- Quantification of biological data and constraints (Web Reference 11)

Proponents are required to use proven technologies, established engineering knowledge and computerised models during the infrastructure design process to ensure that aquaculture infrastructure remains structurally sound in all sea state conditions. More specifically, it must be tailored to withstand the recorded or modelled maximums for wave height, tidal range, swell and wind speed.

The above matters are outlined in the International Standard ISO 16488:2015. ISO 16488:2015 has built on the Norwegian Government standard NS 9415 for fish farms. This international standard presents a general method to be followed for the systematic analysis, design, and evaluation of net cage marine finfish farms. The methodology presented in this International Standard allows for determination of the adequacy of a given finfish farm's floating structure, nets, and mooring equipment for a given environment. The standard addresses specification of a design basis through evaluation of environmental conditions and acceptable risk, and specifies acceptable techniques for the design and analysis of finfish farms.

This international technical standard is intended to reduce technical and operational failures, consequently enhancing the sustainability of the industry. This International Standard offers one

tool in a link of other guidelines needed for the aquaculture industry to be environmentally sustainable (Web Reference 12).

As new standards are developed for respective aquaculture infrastructure, they should be used in the design and construction of the infrastructure. Materials must be purchased from established suppliers, or constructed under the guidance of a marine engineer who has appropriate accreditation. Any modifications made to aquaculture infrastructure must be evaluated by the manufacturer or a marine engineer. A marine engineer or suitably qualified contractor is also required to oversee the transportation and deployment of the infrastructure to ensure it remains structurally sound.

Proponents are also required to conduct operational and maintenance procedures to maintain the structural integrity of infrastructure, including routine inspections, periodic maintenance and servicing of all structural components (such as anchors, ropes, chains and connectors) and regular removal of biofouling. Immediate inspections of sea pen and longline leases are required after severe weather, and after predatory interactions and net cleaning on sea pen leases.

Aquaculture activities must be authorised under an aquaculture permit and lease in accordance with the provisions of the FM Act (see Section 5.8.2 and 5.8.3). Under these provisions, permit holders are responsible for maintaining lease infrastructure to appropriate standards, and for any incident events.

Environmental Management Plan

All proponents are required to prepare a structural integrity monitoring program for inclusion in the project's environmental management plan (see Appendix 2 for an example). The monitoring program must include regular inspection and maintenance schedules for all infrastructure components, and an emergency protocol to assist with the prevention and response to a breakaway event.

An outline of the program should be included in the environmental impact assessment that supports the application. A detailed program would then be required following any approval of the proposal, which would be specified in any approval conditions.

3.2.18 Noise

Expected Outcome

Potential noise impacts are adequately mitigated.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 18.1 An assessment of potential noise impacts, which may include the use of noise modelling programs
- 18.2 Compliance with *Protection of the Environment Operations Act 1997* and the *Protection of the Environment Operations (Noise Control) Regulation 2008*, including evidence that deployment, operational and maintenance activities will not generate unacceptable noise
- 18.3 Compliance with industry best practice for noise management.

Overview

Noise impacts need to be considered relating to underwater noise that may potentially impact marine fauna, and noise that may be audible to an adjacent community or water users. Noise from vessel movements and equipment used in aquaculture operations has the potential to impact on marine fauna (see Section 3.2.6) and people in a locality. Noise levels vary depending on weather conditions, background noise, the equipment used, the development stage (that is, installation or operation) and the season. During the warmer months of the year for example, commercial and recreational vessel traffic in NSW increases significantly, meaning noise levels are characteristically greater during this time of year (Web Reference 13).

Proponents are required to conduct an assessment of potential noise impacts from aquaculture operations, including ambient noise levels, existing land uses, noise source level, duration of operation and deployment activities, presence of noise softening measures (such as buildings or topography variations) and the sensitivity of the receiving environment (Cardno Ecology Lab, 2010). Noise modelling programs may be used to assist with evaluating potential impacts.

NSW EPA is responsible for the regulation of noise from activities scheduled under the POEO Act. The primary purpose of these legislative measures is to provide the main legal framework for managing unacceptable noise. Proponents must demonstrate compliance with these legislative measures and that offensive noise will not be generated by deployment, operational or maintenance activities.

Industry best practices for noise management must also be employed by the proponent to minimise the impacts of noise on marine fauna and surrounding communities. Some examples of industry best practices include:

- A maintenance program for marine vessel motors and other equipment to ensure they are well maintained and in good working order
- Predominantly conducting operational and maintenance procedures during daylight hours
- Fitting sound suppression devices (for example, mufflers) on equipment where possible
- Reducing boat speed near sensitive areas for marine fauna and humans
- Complying with any directions of authorised NSW RMS officers
- Acknowledging complaints and aiming to resolve them cooperatively
- Minimising noise and using courteous language in the vicinity of residential areas and other waterway users
- Maintaining good communication between aquaculture staff and the community.

3.2.19 Visual Amenity

Expected Outcome

Potential impacts on the visual amenity of the local area are adequately mitigated.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 19.1 Design features that minimise potential impacts on visual amenity
- 19.2 An investigation into the visibility of the proposed aquaculture lease from urban and residential areas, beaches and any major land based vantage points.

Overview

Visual impacts are subjective and difficult to quantify as perceptions and attitudes vary considerably and are location specific (O'Hanlon, 2004). Marine aquaculture leases are placed in open waters where there are no permanent manufactured structures, therefore it is unlikely to have a significant effect on visual amenity. Marine aquaculture leases placed in near-shore locations and embayments however, are likely to have a greater impact on visual amenity for local residents, visitors and the tourism industry. Aquaculture infrastructure can potentially alter views from passing vessels and adjacent land areas (O'Hanlon, 2004).

Proponents are required to utilise design features that minimise the visibility of aquaculture infrastructure in the marine environment. Examples of design features that reduce visibility include dark coloured materials (for example, dark coloured stanchions and buoys), minimising surface infrastructure, maximising subsurface infrastructure and a low profile design. Design features to minimise visual amenity impacts need to be balanced in instances where there are needs to ensure some infrastructure elements are visually distinct to maintain safe workplace operation and navigation.

Proponents are also required to conduct an investigation during the site selection process on potential visual amenity impacts. Factors to be considered include the distance to urban and residential areas, beaches and any major land based vantage points, as well the sea state conditions characteristic of the region.

3.2.20 Wastes

Expected Outcome

Wastes generated by the aquaculture lease are collected, stored, recycled and disposed of appropriately.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 20.1 Regularly remove biofouling from infrastructure
- 20.2 Record and manage wastes in accordance with *NSW Environment Protection Authority Waste Classification Guidelines*
- 20.3 Recycling or disposal of all general wastes, organic wastes and residual or out of date chemicals, as well as obsolete lease infrastructure at an approved land based recycling and/or landfill facility
- 20.4 Store all sewage wastes in on-board holding tanks or chemical toilets on service vessels and discharge at an approved sewage discharge point on return to port
- 20.5 Regularly service all boats and equipment, as well as conduct daily inspections and appropriate 'start up' and 'shut down' procedures to ensure early identification of any issues and prompt remedial action by appropriately trained staff
- 20.6 Comply with industry best practice for waste management
- 20.7 A waste management plan.

Overview

Marine aquaculture generates a range of wastes, including biological waste (such as biofouling and damaged stock), general waste (plastic, containers and bags) and obsolete/worn infrastructure (ropes, buoys and nets).

Biofouling

Once aquaculture infrastructure is placed in the marine environment, it quickly becomes colonised by a range of marine biofouling organisms, such as sponges, algae, ascidians, molluscs and barnacles. Sediment from the water column also settles on ropes, nets, buoys and other structural components.

Biofouling and sediment must be removed from sea pen and longline infrastructure to reduce resistance to currents and wave action. Biofouling also increases stress on moorings, deforms nets/culture apparatus and causes stock to sit too closely to the seabed (Braithwaite *et al.*, 2007).

Regular removal of biofouling assists with maintaining water quality, reduces the availability of habitat for diseases and parasites, and minimises the attraction of wild fauna (for example, herbivorous fishes) which can potentially damage infrastructure and cultured stock (Braithwaite *et al.*, 2007).

Section 120 of the POEO Act makes it an offence to cause or permit pollution of waters. Biofouling removal must be carefully monitored in accordance with the Water Quality and Benthic Environment Monitoring Plan to mitigate environmental impacts.

Biofouling removal methods vary from *in situ* cleaning using submersible net cleaning robots on sea pen nets to pressure cleaning equipment for longline systems. Chemical use is not permitted during the cleaning process. Biofouling removed *in situ* will be monitored for potential particulate impacts in accordance with Section 3.2.2 (Particulate Inputs).

Nets, culture apparatus and ropes may also be periodically removed from the lease and cleaned at appropriate land based facilities.

Biofouling wastes are predominantly organic material which can be readily used as fertiliser, mulched or incorporated into composting operations in land based facilities.

Operational Wastes

Daily operation of aquaculture leases generates general waste, such as plastics, containers and bags. Aquaculture infrastructure also requires repair or replacement, and diseased and deceased stock need to be removed from aquaculture leases.

Proponents are required to record and manage waste in accordance with the [NSW EPA Waste Classification Guidelines](#). All material that is collected must be recycled or disposed of lawfully at an approved land based recycling and/or landfill facility. Collected waste is required to be put into appropriate storage containers on service vessels to prevent spillages, attraction of pests or odour issues. Containers must be cleaned and disinfected before being returned to service vessels (Worth & Joyce, 2001). Sewage wastes from on-board holding tanks or chemical toilets on service vessels must be disposed of at an approved sewage discharge point on return to port.

Regular servicing of all boats and equipment, as well as daily inspections and appropriate 'start up' and 'shut down' procedures ensures early identification of any issues (such as potential spillages or leaks) and prompt remedial action by appropriately trained staff. Any residual or out of date products must be transferred to land based facilities and disposed of in an appropriate manner.

Marine aquaculture operations must also follow industry best practice guidelines including:

- Waste materials are reduced, reused and recycled where possible

- Aquaculture infrastructure removed from a lease is returned to shore for processing, recycling or disposal
- Collected general wastes are returned to shore for disposal
- All sewage wastes are contained on service vessels in on-board holding tanks or chemical toilets and disposed of through an approved vessel sewage discharge point on return to port
- Residual materials that cannot be reused or recycled are disposed of at an approved waste management facility.

Environmental Management Plan

All proponents are required to prepare a waste management plan for inclusion in the project's environmental management plan (see Appendix 2 for an example). The plan must detail waste handling, transport and recycling/disposal procedures, audit schedules and industry best practices.

An outline of the program should be included in the environmental impact assessment that supports the application. A detailed program would then be required following any approval of the proposal, which would be specified in any approval conditions.

3.2.21 Animal Welfare

Expected Outcome

Cultured stock is humanely treated during all stages of the operation.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 21.1 Transport and husbandry techniques and practices that comply with the *Australian Aquaculture Code of Conduct*
- 21.2 Mandatory reporting of mortality/disease events.

Overview

Marine aquaculture requires the transportation and cultivation of stock, which may consist of finfish and shellfish such as oysters, mussels, abalone and scallops. Cultured stock may initially be held in land based tanks and then transferred to the aquaculture lease for grow out.

Potential animal welfare concerns include activities associated with the transportation and culture of the stock, such as manual handling, the use of therapeutics (for example, anaesthetics), the confinement of stock to a designated area (for example, tanks, sea pens and culture apparatus), stocking densities, diseased stock disposal procedures, feed quality, harvest procedures and environmental conditions (for example, water quality and dissolved oxygen concentrations) (FRDC & DoA, 2017).

To mitigate potential animal welfare concerns, transport and husbandry techniques and practices must comply with the *Australian Aquaculture Code of Conduct* (see Appendix 5) which includes a number of guiding principles to achieve humane treatment of animals including the following:

- Seeking the development of expertise in ecological sustainability and health management
- Promoting maintenance of sustainable and efficient stocking densities
- Addressing the biological and physical requirements of the cultured species
- Encouraging the installation of anti-predator devices that exclude predators but do not cause injury
- Seeking methods that reduce stress when transferring and harvesting stock
- Endorsing humane slaughter methods
- Supporting the development of appropriate contingency plans to deal with the spread of diseases, parasites and other pathogens and unplanned releases of aquaculture stock
- Encouraging the containment of diseased or infected stock and immediate reporting of any mass mortalities of stock or other environmental problems to the relevant agencies
- Promoting the appropriate disposal of dead stock in a manner to ensure no diseases or pathogens are released into natural waterways.

Of particular importance is keeping stocking densities at a level that minimises stress to stock and regularly monitoring stock health to ensure early detection of disease, parasites or other health conditions that may arise (Web Reference 14).

3.2.22 Sustainability

Expected Outcome

The proposal complies with the principles of ecologically sustainable development.

Assessment Requirements

The expected outcome of this section will be achieved if the proposal includes:

- 22.1 A detailed description of how the proposal complies with the Australian Aquaculture Code of Conduct.

Overview

ESD is now accepted as the foundation for environmental management, including aquaculture management in NSW. As described in the *Protection of the Environment Administrations Act 1991* (POEA Act).

ESD requires the effective integration of economic and environmental considerations in decision-making processes which can be achieved through the implementation of the following principles and programs:

- (a) The precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:
 - (i) Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment
 - (ii) An assessment of the risk-weighted consequences of various options.

- (b) Inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations
- (c) Conservation of biological diversity and ecological integrity - namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration
- (d) Improved valuation, pricing and incentive mechanisms namely, that environmental factors should be included in the valuation of assets and services, such as:
 - (i) Polluter pays, that is those who generate pollution and waste should bear the cost of containment, avoidance or abatement
 - (ii) The users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste
 - (iii) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The principles of ESD are integrated into the MWSAS by:

- Identifying areas where NSW marine aquaculture is possible and ecologically sustainable if measures are implemented to protect the environment in those areas
- Describing best operational and management practices based on ESD principles, and ensure that these practices are specifically relevant to the local environment
- Implementing construction and operational management plans and recording and reporting procedures
- Considering the social, economic and cultural aspects of any proposal.

For the NSW marine aquaculture industry, adopting ESD principles will form the basis of:

- Facilitation of a systematic and recognised means of establishing the industry's resource management credentials with regulatory agencies, seafood consumers and the community
- Improved development outcomes that provide greater certainty in the assessment and decision making process
- Ensure that any significant environmental impacts, and the uncertainty associated with such impacts are understood, and if necessary effectively mitigated.

For individual marine operators the potential benefits are to:

- Reduce investor risk in identifying suitable sites and describing best practice operations
- Gain the support of the local community and reduce the risk of conflict
- Understand obligations to comply with environmental and planning legislation so that the risk of breaches can be minimised
- Have ongoing continual improvement that will help the business keep pace with developments in environmental legislation, community expectations, and relevant technological and husbandry innovations.

For the broader community the potential benefits are:

- Improved environmental outcomes that address cumulative issues and provide effective indicators of sustainability
- Ability to be heard in the assessment and approval process

- Increased certainty in the nature and operation of the industry
- Increased confidence in the environmental performance of the industry
- Improved employment outcomes with an improvement in industry viability
- Improved outcomes for regional NSW with a coordinated approach to providing sustainable marine aquaculture investment opportunities.

Key objectives of the *Coastal Management Act 2016* relevant to ESD of marine aquaculture include:

- Protecting and enhancing coastal environmental values and natural processes
- Enhancing natural character, scenic value, biological diversity and ecosystem integrity
- Removing threats to and improving the resilience of coastal waters
- Maintaining and improving water quality
- Ensuring public safety and preventing risk to life
- Encouraging development that reduces exposure to risk from coastal hazards through the siting, design, construction and operational decisions.

The Australian aquaculture industry has identified the need for ESD in the Australian aquatic environment to ensure environmental protection. Consequently, the industry developed the *Australian Aquaculture Code of Conduct* in consultation with government, non-government organisations, Aboriginal groups and other stakeholders (see Appendix 5). The Code of Conduct has 43 points to provide minimum standards for environmental performance as part of the industries commitment to ESD.

4. Constraint Mapping and Site Identification

The marine waters of NSW cover over 8,000 square kilometres. The approach used by NSW DPI to identify potential marine aquaculture areas has three stages.

First, constraints are used to reduce the areas of marine waters of NSW to areas of interest. The constraints used in this stage are identifiable exclusions and consist of a number of criteria, as shown in Table 1. The constraints apply to all aquaculture types (sea pens, longlines, artificial reef and ranching) included in this strategy (see Figure 19).

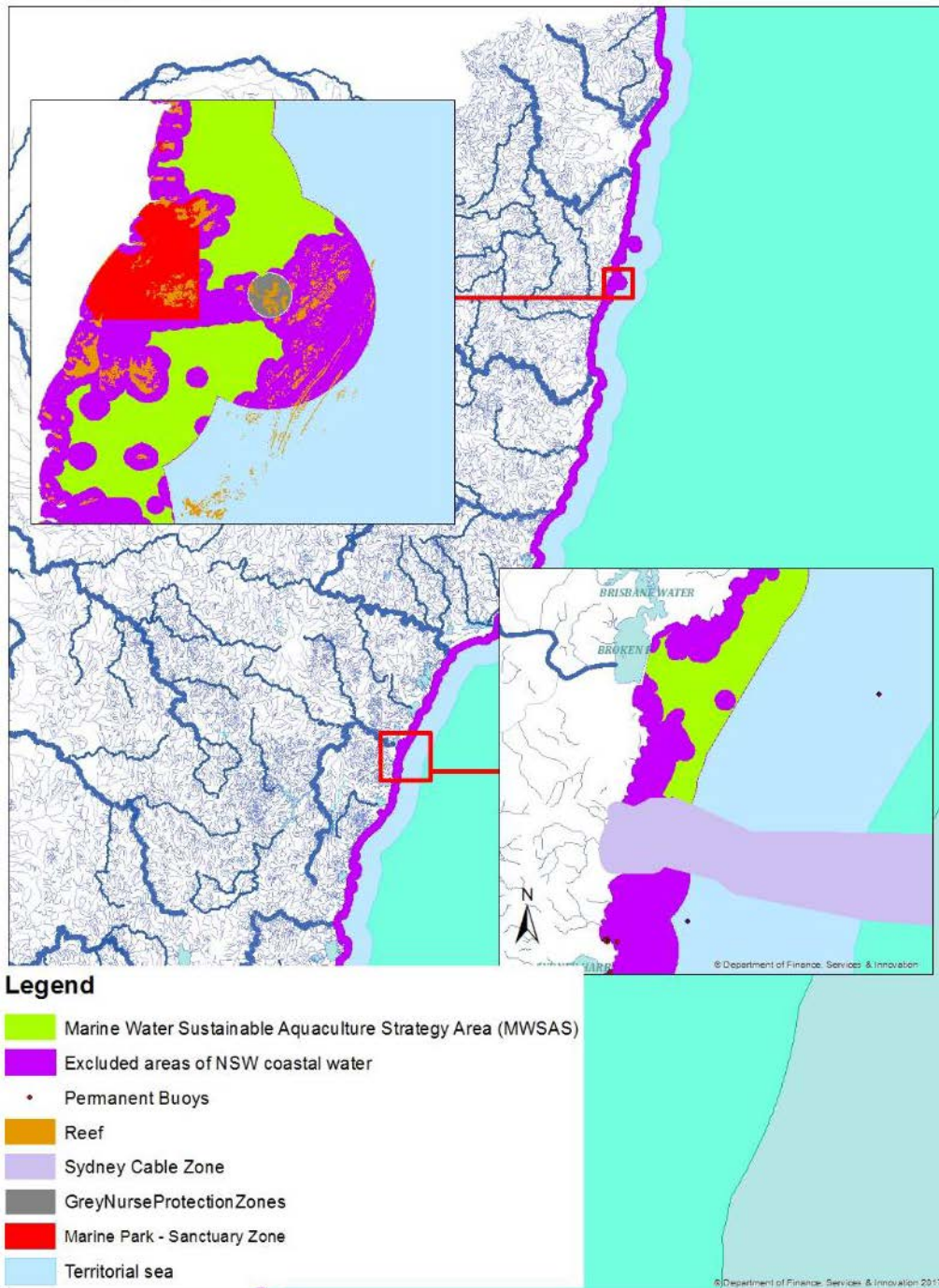


Figure 19: An example of a preliminary evaluation (constraint mapping) for two locations in NSW (Source: NSW DPI, 2017).

Spatial datasets have been sourced from authoritative public sources, or the data custodians. This stage resulted in removing approximately half of the area of state waters as potential marine aquaculture sites.

The second stage of the identification of potential marine aquaculture investigation areas by NSW DPI involves creating a grid of 1 km squares over the remaining area (see Figure 20). This grid was populated with suitability factors that contribute to optimal areas for an aquaculture enterprise. These suitability factors (Section 3.2, page 18) include attributes such as proximity to infrastructure (ports) and physical conditions, such as the water depth. Each factor is given a ranking (0 to 10) according to the benefit or otherwise it contributes to each type of aquaculture in that square kilometre. A suitability score for each type of aquaculture is calculated by weighting the different factors to the total 100% according to their importance. This also relates to the type of aquaculture and infrastructure involved. Regions of the coast with high suitability scores will be targeted for further investigation.

The third stage of this process will be refining high suitability areas with clarification of constraints and suitability factors, on-ground assessments (substrate mapping) and identifying local attributes of an area.

It is envisaged that a potential aquaculture business will use the initial assessments provided and undertake their own specific studies to ensure a site satisfies the biological requirements for the optimal culturing of a species, the operational requirements, and cost of production.

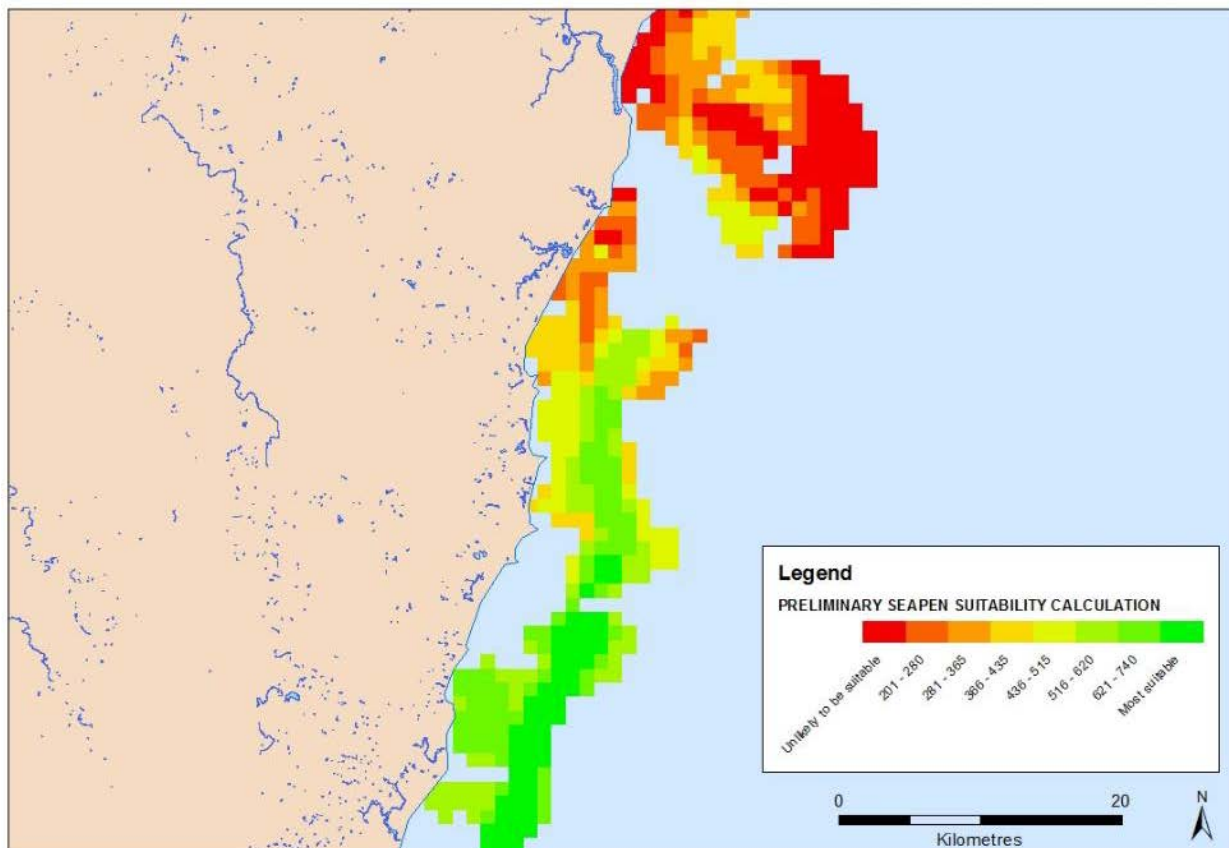


Figure 20: Example of preliminary stage two of the constraint mapping process (Source: NSW DPI, 2017).

Please note that the preliminary evaluation maps (Figure 19 and 20) have been prepared based on available information related to criteria listed in Table 1 that was readily available at the time of preparing this document. For example, not all NSW marine waters have been swath mapped to identify seabed type with certainty. Where this has not been done, proponents will need to undertake or obtain adequate swath mapping data and analysis to satisfy the requirements of these items.

Also for those areas that have been swath mapped, there is potential for the presence of very low profile reef or sand inundated reef in the survey area. Map users should be aware that interpretation of textural information may not have been verified with *in situ* observations (for example, underwater video) at an appropriate spatial scale. Ground truth video observations of seafloor points should be utilised to provide verification of seafloor characteristics present.

5. Assessments and Approvals

All marine aquaculture projects will require an environmental impact assessment in accordance with requirements of the EP&A Act. Projects may also require a range of statutory approvals prior to commencement. In addition to developing environmental management plans, proponents are required to risk assess their proposal specific to the location and identify impact mitigation measures in the EIS application. Environmental management plans and approval conditions typically specify risk mitigation, but when an unexpected impact occurs, government emergency management responses are enacted. This can result in an aquaculture operation being downsized or halted until an issue is addressed.

This section outlines the environmental impact assessment pathways that apply to different types of marine aquaculture projects as well as related approvals that may be required.

Community consultation is currently underway for proposals to update and relocate certain planning provisions for marine aquaculture from SEPP 62 into a new SEPP. These will be finalised in 2018, following the consideration of public submissions. The following sections describe the proposals outlined for marine aquaculture in the new SEPP.

5.1 Pre-lodgement

Before commencing the environmental impact assessment process, the proponent for a marine aquaculture project should:

- Make early contact with NSW DPI to identify the environmental planning and assessment requirements, and related approvals that may be required. This will specifically determine whether:
 - Any component of the project may require assessment as SSD, which would make the whole project SSD or
 - Whether the project will be assessed under the EP&A Act as an SSI.
- Obtain expert advice or consult with NSW DPE to confirm the requirements, if necessary
- Proceed to undertake the environmental assessment in accordance with relevant legislation, in consultation with the community and key stakeholders, and utilising suitably qualified and experienced technical experts where relevant.

Any land or port based assessment requirements should be confirmed up-front, by discussing the project with NSW DPE and the relevant planning authority.

5.2 Development that is not permissible

Currently, SEPP 62 regulates the permissibility of all aquaculture development. SEPP 62 does not include provisions indicating where marine aquaculture can occur.

At the time of writing, consultation was being undertaken on a proposal to update the provisions of SEPP 62 and relocate them into a new SEPP (Primary Production and Rural Development) which addresses primary production matters. It is proposed that the new SEPP will identify where marine waters aquaculture is not permissible, based on the constraint criteria set out in Table 1 of this MWSAS.

Under the proposed SEPP, a project cannot proceed if it is proposed in an area where marine waters aquaculture is not permissible.

5.3 Development that is permissible

Where marine waters aquaculture is permissible, the proposed SEPP will provide that:

- Development by a private individual or organisation may be undertaken with development consent (see Section 5.4)
- Activities undertaken by or on behalf of a public authority may be undertaken without development consent (see Section 5.5).

5.4 Private Sector Projects – State Significant Development

Under the proposed new SEPP, marine waters aquaculture projects requiring development consent would be assessed as SSD in accordance with the State and Regional Development SEPP. A proponent for SSD must request Secretary's Environmental Assessment Requirements (SEARs) from NSW DPE. The SEARs set out the matters that must be addressed by the proponent in an EIS. The completed EIS is submitted to NSW DPE and placed on public exhibition.

Further information on the SSD process is available on NSW DPE's website at: <http://www.planning.nsw.gov.au/Assess-and-Regulate/Development-Assessment/Systems>

5.5 Public Sector Projects – State Significant Infrastructure Assessment

For activities by, or on behalf of a public authority (such as research), the proposed new SEPP will provide for projects to be considered in accordance with the environmental impact assessment requirements of the EP&A Act. Public authority proponents should consult with NSW DPI to identify the relevant determining authority and the appropriate form of environmental impact assessment necessary to meet the requirements. This is usually in the form of a Review of Environmental Factors (REF).

If an activity being assessed is considered likely to significantly affect the environment, and a public authority would be both the proponent and determining authority, it will then be assessed as SSI under the State and Regional Development SEPP. In this case, the SSI project will be subject to similar requirements to obtaining SEARs, with the same public exhibition and decision-making requirements that apply to SSD. The Minister for Planning will then become responsible for determining whether the activity should proceed.

Further information on the SSI process is also available on NSW DPE's website at: <http://www.planning.nsw.gov.au/Assess-and-Regulate/Development-Assessment/Systems>.

5.6 MWSAS Assessment Requirements

The existing SEPP 62 requires that in deciding whether to grant consent to a development application or determining to proceed to undertake or authorise an activity, a planning authority must take the requirements of any AIDP into consideration.

The new SEPP proposes to retain this provision. This would mean that the assessment requirements set out in the MWSAS would be addressed for a marine waters aquaculture project as part of:

- The EIS for SSD or SSI
- The impact assessment for a public authority activity under the EP&A Act.

This is in addition to any matters set out in the SEARs.

5.7 Assessment and Approval Process

The SSI and SSD assessment and approval process required for marine aquaculture developments in NSW can be found on the DPE website at <http://www.planning.nsw.gov.au/Assess-and-Regulate/Development-Assessment/Systems>.

Assessment of SSI and SSD applications includes community engagement and input opportunities (DPE pers. comm). Applications are made publically available for a 30 day exhibition period to allow comment from the community.

5.8 Additional Assessments and Approvals

There are a number of assessments and approvals in addition to the SSI or SDD process which may be required for marine aquaculture developments in NSW (see Table 2). These are discussed below and are applicable to all marine aquaculture proposals with the exception of:

- Marine park permit, which is only required if the aquaculture lease is within a marine park
- Food Authority licence, which is only applicable if the cultured stock is intended for human consumption.

Table 2: Additional assessments and approvals for marine aquaculture developments in NSW.

Assessment or Approval	Consent Authority	Legislation
Land owner's consent (Crown land)	Department of Industry – Lands and Water	<i>Crown Lands Act 1989</i>
Aquaculture lease	NSW Department of Primary Industries	<i>Fisheries Management Act 1994 – Section 163</i>
Aquaculture permit	NSW Department of Primary Industries	<i>Fisheries Management Act 1994 – Section 144(1)</i>
Marine park permit	NSW Department of Primary Industries	<i>Marine Estate Management Regulation 2017 – Clause 12</i>
Food Authority licence	NSW Food Authority	<i>Food Regulation 2015</i>
Matters of National Environmental Significance	Commonwealth of Australia Department of Environment and Energy	<i>Environment Protection and Biodiversity Conservation Act 1999</i>

5.8.1 Land Owner's Consent

NSW marine waters aquaculture is located over submerged Crown lands. Proponents are required to apply for land owner's consent from the Department of Industry – Lands and Water. Proponents should be aware that the Crown land may be subject to a Native Title claim or determination. The recognition and protection of the special connection between Aboriginal peoples and their traditional lands and waters and their native title rights and interests, is provided for in the Commonwealth's *Native Title Act*. As such, the State Government must comply with the Commonwealth's *Native Title Act* before it issues any tenure on land where native title exists.

5.8.2 Aquaculture Lease

An aquaculture lease is required for marine waters aquaculture operations, which is issued under Section 163 of the FM Act. The lease is issued subject to conditions. An Aquaculture Lease Security Arrangement (bond) is also applied. A lease is granted on the basis of non-exclusive possession to the lease holder.

An aquaculture lease grants non-exclusive possession over the defined area for a specified period and for the purpose of aquaculture only.

5.8.3 Aquaculture Permit

Marine aquaculture operations also require authorisation under an aquaculture permit which is issued under Section 144(1) of the FM Act. The aquaculture permit specifies the aquaculture activities authorised, and is subject to conditions relevant to the specific activity.

5.8.4 Marine Park Permit

Aquaculture is a permissible use with the approval of the relevant Ministers in accordance with Clause 1.18 of the *Marine Estate Management (Management Rules) Regulation 1999*. A permit in accordance with Clause 12 of the *Marine Estate Management Regulation 2017* is required for developments in marine parks. Consultation must be undertaken with the Marine Estate Management Authority during the assessment process to ensure the proposal will not have an impact on current or future marine park objectives.

5.8.5 Food Authority Licence

The *Food Act 2003* is administered by the NSW Food Authority, with the object of ensuring food for sale is both safe and suitable for human consumption. A Food Authority Licence under the *Food Regulation 2015* must be obtained for stock destined for human consumption.

5.8.6 Matters of National Environmental Significance

Under the EPBC Act, an action requires approval from the Minister for Environment and Energy (the Minister) if the action has, will have, or is likely to have, a significant impact on a MNES.

If the proponent decides via the 'self-assessment' process that the proposed marine aquaculture operation may have a significant impact on MNES, a referral is required to be submitted to the DEE for the Minister to decide on whether assessment and approval is required under the EPBC Act. If the Minister decides that the action is likely to have a significant impact on a MNES, then it requires assessment and approval under the EPBC Act (see Figure 21).

The EPBC Act Policy Statement 1.1 (Significant Impacts Guideline 1.1) and the EPBC Act Policy Statement 2.2 (Offshore Aquaculture) provide proponents with guidance when deciding whether the proposed aquaculture operation is likely to have a significant impact on MNES, therefore, whether a referral is required.

The Minister decides whether the proposed action is (1) a 'controlled action' which requires assessment and approval under the EPBC Act; (2) 'not controlled action – particular manner' which does not require approval if the action is taken in accordance with the manner specified; or (3) 'not controlled action' which does not require approval if the action is taken in accordance with the referral.

If the Minister decides that an action requires approval, then an environmental assessment of the action must be carried out. If a bilateral agreement is in place, the action may be assessed by the state of territory in which the action is to be undertaken, using the processes accredited under the bilateral agreement. The Commonwealth accredits the NSW environment impact assessment process, so only one assessment is required for development that also requires Commonwealth approval under the EPBC Act.

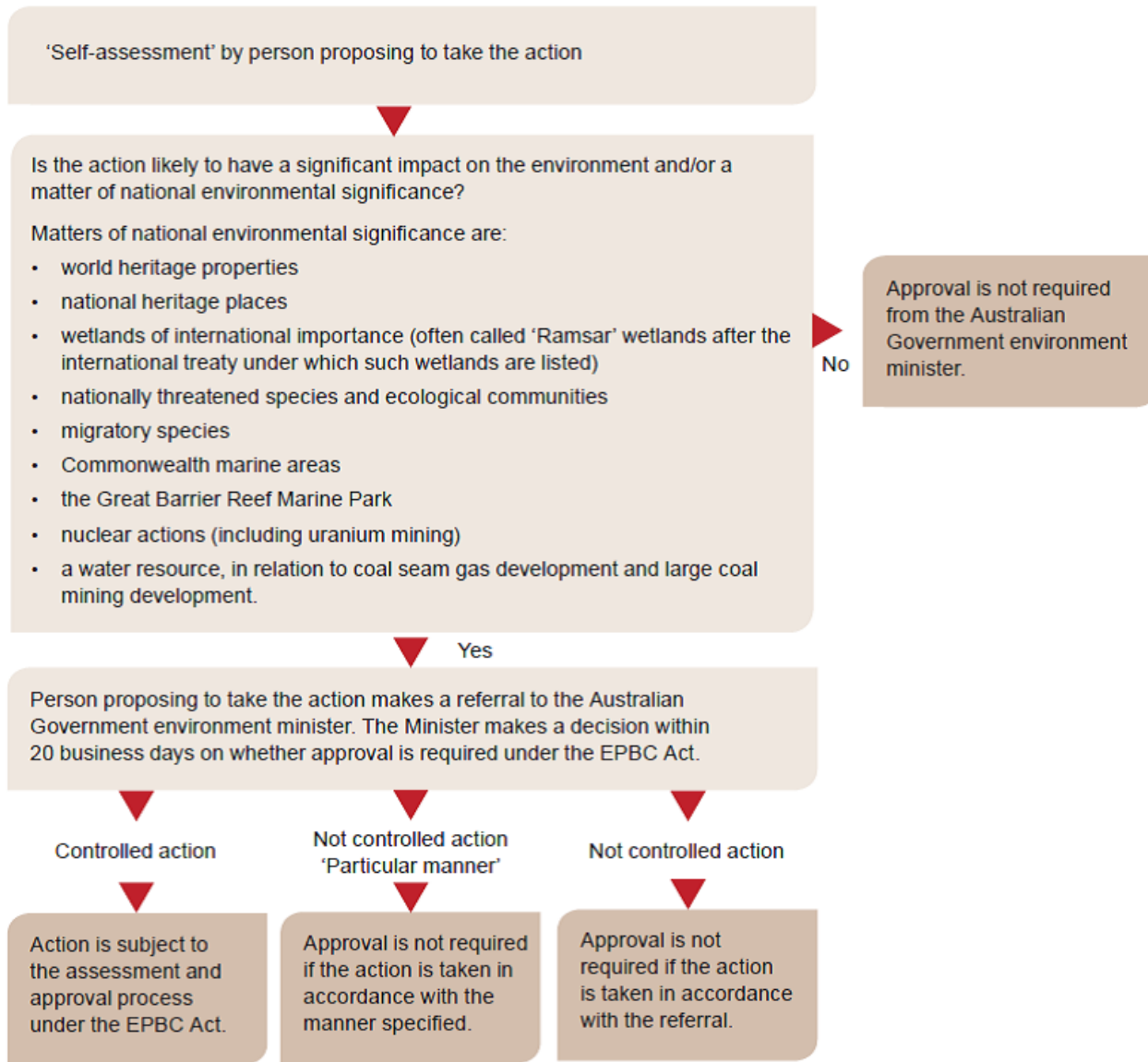


Figure 21: EPBC Act referral process (Source: Commonwealth of Australia, 2013).

After considering the environmental assessment report, the Minister decides whether to approve the action, and what conditions (if any) to impose. Assessment findings of applications are made publically available, and an appeal process exists for applications that are not approved by the Minister.

5.8.7 Land Based Approvals

Any land or port based aspect should be discussed up-front with NSW DPE and the relevant planning authority. For any part of a project that is to be carried out on the land, further assessment and approvals may be required. Generally, it would be expected that this component would form part of the overall application to carry out marine based aquaculture, and would be assessed and determined as part of that application.

5.9 Ongoing Monitoring and Review

Adaptive management is a structured, process of decision making using the best science available to improve our knowledge of the system over time, through the use of comprehensive monitoring (Figure 22). Through adaptive management, rigorous control can be applied, ensuring sustainable operation and development.

Adaptive management is a tool which should be used not only to change a system, but also to learn about the system. Because adaptive management is based on a learning process, it improves long-term management outcomes. The challenge in using the adaptive management approach is finding the correct balance between gaining knowledge to improve management in the future, and achieving the best short-term outcome based on current knowledge.

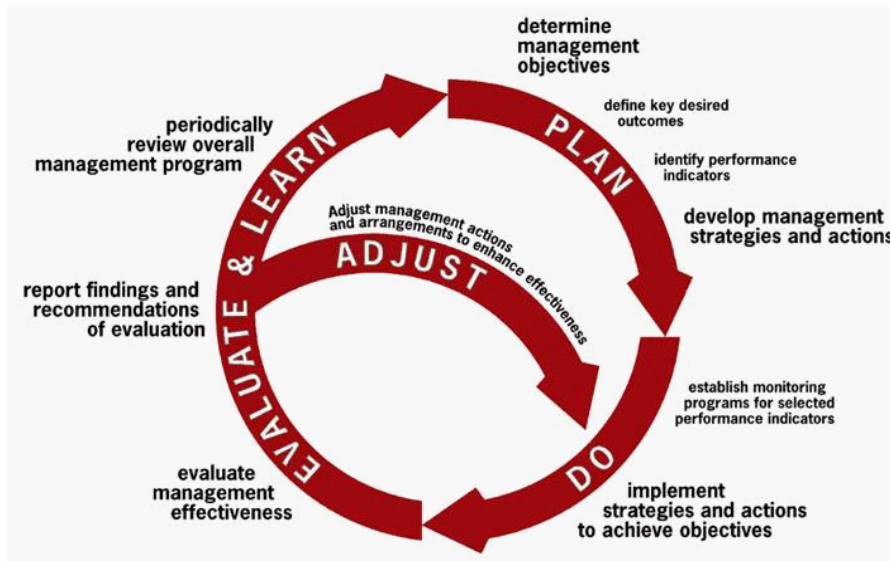


Figure 22: Example of an Adaptive Management Cycle as provided by CSIRO (Source: CSIRO, 2013).

At the core of the adaptive management process is a detailed and targeted environmental monitoring program and a whole-of-environment predictive model. An industry driven environmental monitoring strategy can be developed to optimise future production management and sustainability assessment within marine aquaculture leases.

These processes focus on addressing the main risks to the wider aquatic environment and cultured stock. The aim of the adaptive management program is to monitor production over time and ultimately increase knowledge in relation to the sustainability and feasibility of operations. Monitoring any potential adverse environmental effects will be associated with the application of relevant mitigation measures based on the severity of the observed impacts.

Adaptive management provides for flexibility, for example:

- Sampling frequency can be targeted to high risk periods
- Some parameters may be replaced by others, and/or new ones added
- Some parameters may be removed if they no longer reflect an element of risk
- The relevance of survey sites may also change with time and some may need to be created, replaced or moved.

As a general rule, monitoring is carried out not simply to accumulate a wealth of data, but rather to identify and tackle specific risks and uncertainties.

The prioritised risks are identified through consultation with the regulators, relevant experts and community stakeholders. The risks are managed by the adaptive management process with continued long-term stakeholder involvement. The following risks have been identified by NSW DPI and the aquaculture industry in general:

- Aquaculture leases have the potential to impact areas outside the lease. Examples include eutrophication and the particular requirements of areas and endangered/threatened species

- Eutrophication of the overall water body will affect water quality on the aquaculture lease
- Environmental conditions may have contributed to or have precipitated a cultured stock health event
- The right to operate is jeopardised by not maintaining the water quality and general ecology of the leased waters, and negatively impacting the local community and other industries in the region
- Neighbouring leases may affect the quality of the water flowing through adjacent lease areas.

These risks drive both the strategies (modelling/limits) and implementation plans (environmental monitoring program) of the adaptive management process.

5.10 Performance Indicators and Review

Under the FM Act, performance indicators are a requirement for an AIDP to determine if the objectives specified in the plan are being achieved. NSW DPI, other agencies, local government and the NSW marine aquaculture industry are responsible for making recommendations on the need to review and update any aspects of the strategy as a result of cumulative impacts, technological developments or other changes in the marine environment or management practices.

The strategy will be reviewed at the direction of the Deputy Director General Fisheries NSW, or if a review is triggered by the performance indicators given in Table 3.

The review should consider the need to update the strategy overall, or in relation to a particular location, aquaculture type or particular aspects of environmental performance.

Table 3: Performance indicators for MWSAS.

Indicator	Justification	Trigger for review of the strategy (Triggers calculated at June 30 every year)
Annual production	Production trends indicate industry viability and development.	Five year average production drops by 15% or more.
Harvest area classification	Classification is an indicator of longer term water quality.	The harvest classification is downgraded due to water quality deterioration since the last review.
Marine fauna interactions	To ensure best practices are being employed to mitigate marine fauna interactions.	A marine fauna interaction that results in an entanglement or death of a protected species that was not addressed in a marine fauna interaction plan or an inability to appropriately implement the plan
Benthic fauna assemblages	Benthic fauna provide an indication of the impact an aquaculture activity is having on the environment.	A significant impact is identified for which management actions (for example, fallowing) have not been successful in rectifying.
Navigation	Navigation delineation of leases is important for water user safety.	A significant navigation issue that was not considered to be vessel operator error.

Indicator	Justification	Trigger for review of the strategy (Triggers calculated at June 30 every year)
Years since review	Potential for strategy to become out of date and no longer reflect most sustainable approach.	Greater than five years since gazettal or last review.

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7. Appendices

- Appendix 1 Types of marine aquaculture
- Appendix 2 Examples of environmental management plans
- Appendix 3 State and Commonwealth legislation relevant to developing aquaculture in NSW marine waters
- Appendix 4 Consultation - Targeted Stakeholder Groups
- Appendix 5 Australian Aquaculture Code of Conduct

Appendix 1 – Types of marine aquaculture

Intensive Aquaculture

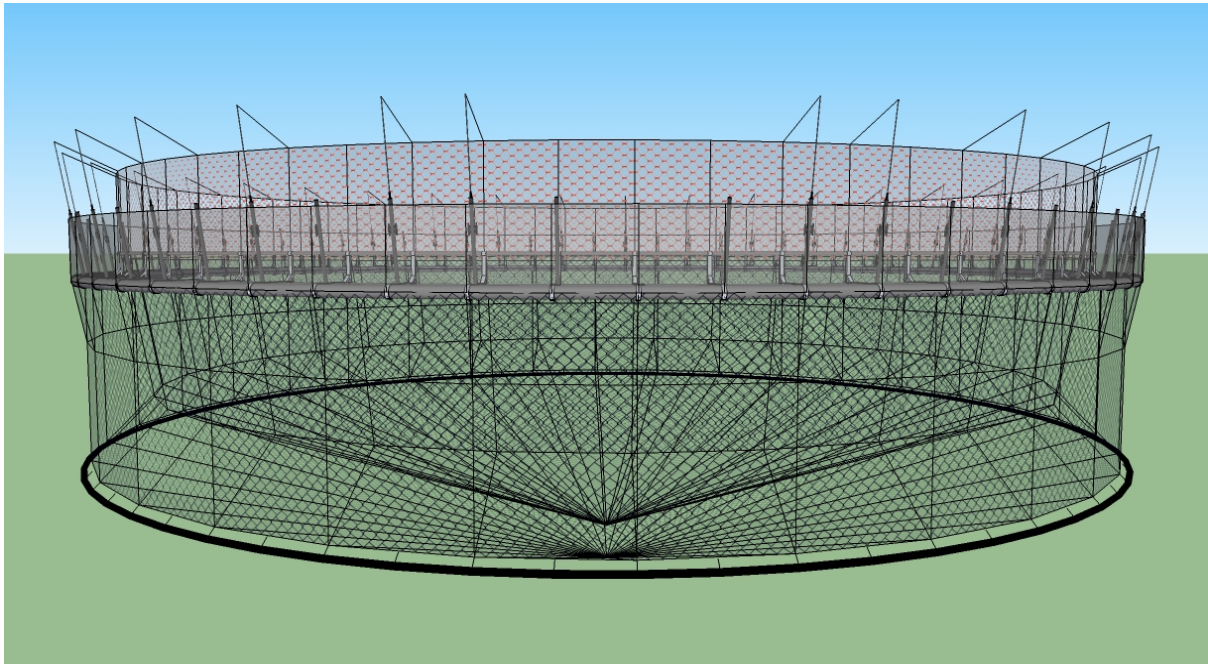


Figure 23: Sea pen for finfish aquaculture (Source: Huon, 2015).



Figure 24: Sea pen for finfish aquaculture (Source: NSW DPI, 2017).

Extensive Aquaculture

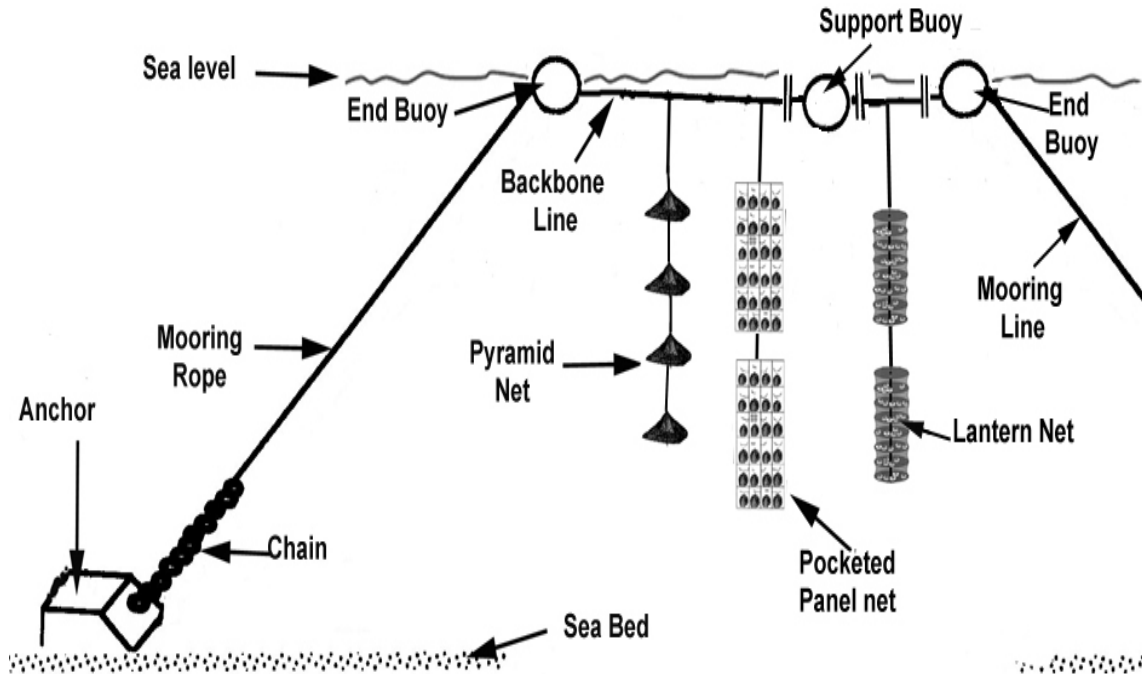


Figure 25: A schematic diagram of a longline system and cages typically used for shellfish culture (Source: NSW DPI, 2012).



Figure 26: Longline mussel infrastructure – double lines suspended below buoys (Source: NSW DPI, 2009).

Artificial Reef Aquaculture

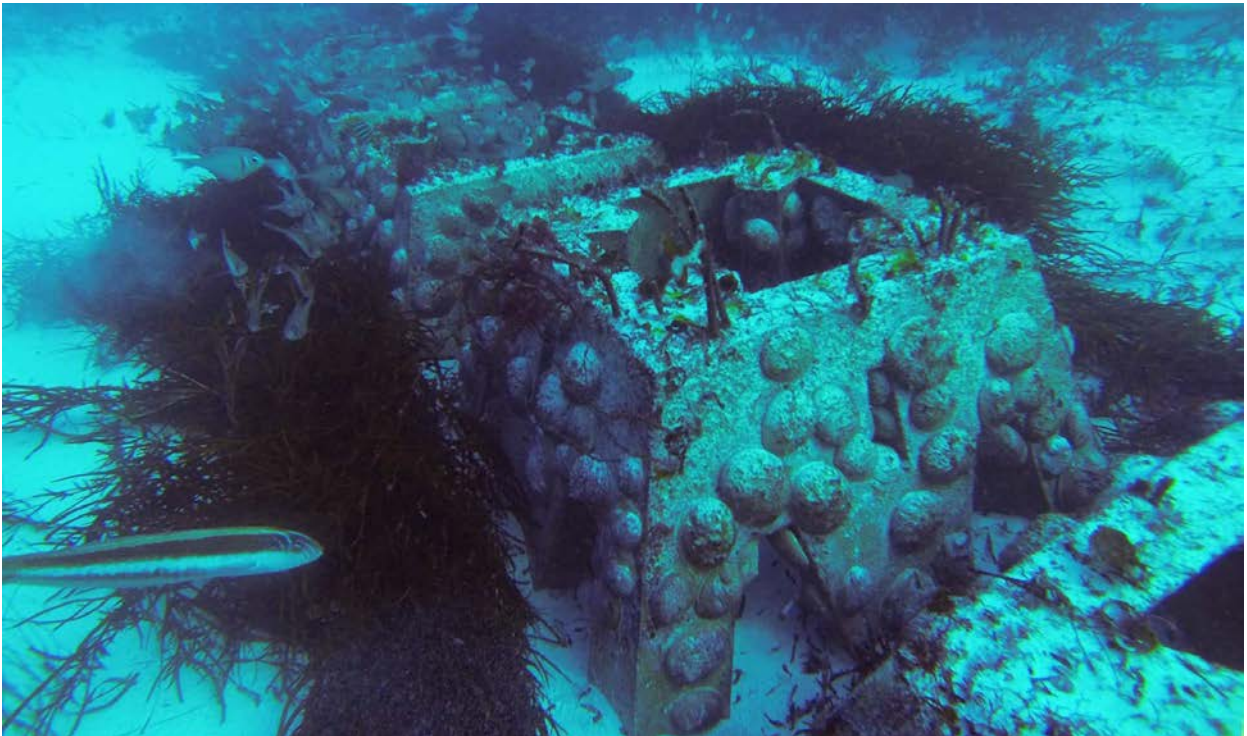


Figure 27: Abalone growing on artificial reefs (concrete blocks) in the open ocean (Source: Haejoo, 2013).

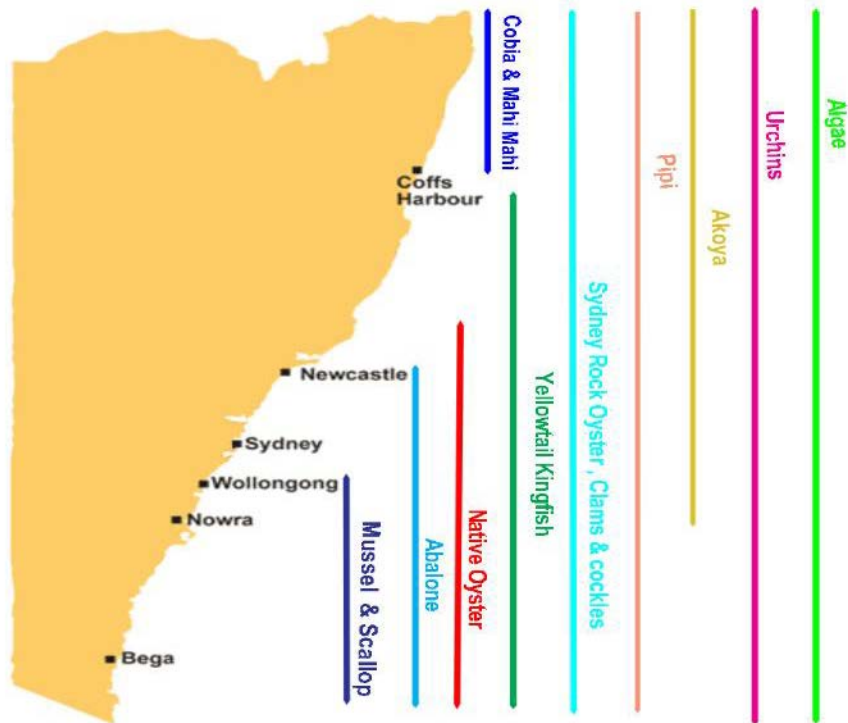


Figure 28: Broad geographical area where certain marine species can be cultured (Source: NSW DPI, 2017).

Appendix 2 – Examples of Environmental Management Plans

Environmental management plans have been developed for the MARL (sea pen aquaculture) in Port Stephens and the Commercial Aquaculture Shellfish Leases in Jervis Bay. Examples for these management plans are available to NSW aquaculture lease holders and investors to assist with the assessment and approvals process. Examples that are currently available include:

- Community stakeholder management plan
- Construction, deployment and traffic management plan
- Emergency protocol
- Biosecurity management plan
- Marine fauna interaction plan
- Waste management plan
- Water quality and benthic environment monitoring program.

Please refer to the following webpage:

<https://www.dpi.nsw.gov.au/fishing/aquaculture/publications/general>

Appendix 3 – State and Commonwealth legislation relevant to developing aquaculture in NSW marine waters

STATE LEGISLATION

Environmental Planning and Assessment Act 1979 (EP&A Act)

The EP&A Act provides a framework for environmental planning in NSW and includes provisions to ensure that proposals with the potential to significantly affect the environment are subject to detailed assessment.

The EP&A Act is administered by NSW Department of Planning and Environment (NSW DPE).

Biodiversity Conservation Act 2016 (BC Act)

Administered by NSW Office of Environment and Heritage (NSW OEH), the *Biodiversity Conservation Act 2016 (BC Act)* governs biodiversity conservation and the management of protected and threatened species. The BC Act ensures strong protection for plants and animals, supports ecologically sustainable development (including a legislated biodiversity offset scheme) and establishes the Biodiversity Conservation Trust, an organisation that supports landholders to protect and conserve biodiversity on private land. Areas of outstanding biodiversity value (AOBVs) can be declared under the Act to protect areas that contain irreplaceable biodiversity values. The BC Act also sets out processes for listing threatened species, aligning threat categories with international best practice and legislates the biodiversity conservation program for threatened species and ecological communities, *Saving our Species*.

Fisheries Management Act 1994 (FM Act)

Provisions for the protection of fish and marine vegetation are administered by NSW DPI under the FM Act. An aquaculture lease is required for marine waters aquaculture operations, which is issued under Section 163 of the FM Act. The lease is issued subject to conditions and a security bond is also applied.

Aquaculture activities are also required to be authorised under an aquaculture permit which is issued under Section 144(1) of the FM Act. The aquaculture permit specifies the aquaculture activities authorised and is subject to conditions relevant to the specific activity.

Animal Research Act 1985 (AR Act)

The AR Act, administered by NSW DPI, governs any research that involves vertebrates in NSW. It was introduced to protect the welfare of animals by ensuring that their use in research is humane, considerate, responsible and justified. All research conducted on aquaculture leases must be covered by a current Animal Research Authority and issued by an accredited Animal Care and Ethics Committee.

Marine Estate Management Act 2014 (MEM Act)

Provisions for the protection of marine biological diversity, marine habitats and ecological processes in marine parks, as well as ecologically sustainable resource use are administered by NSW DPI under the MEM Act.

Aquaculture is a permissible use with the approval of the relevant Ministers in accordance with Clause 1.18 for Habitat Protection Zones and Clause 1.24 for Special Purpose Zones of the Marine Estate Management (Management Rules) Regulation 1999. Aquaculture in accordance with Clause 1.12 is not permissible in Sanctuary Zones. A permit in accordance with Clause 12 of the Marine Estate Management Regulation 2017 is required for developments in marine parks.

National Parks and Wildlife Act 1974 (NPW Act) and the National Parks and Wildlife Regulation 2009 (NPWR)

Under the NPW Act, the Director-General of the NPWS is responsible for the care, control and management of all national parks, historic sites, nature reserves, reserves, Aboriginal areas and State game reserves. State conservation areas, reserves and regional parks are also administered under the NPW Act. The Director-General is also responsible under this legislation for the protection and care of native fauna and flora, and Aboriginal places and objects throughout NSW. The NPW Act and the NPWR are administered by NSW OEH.

Crown Lands Act 1989

Submerged land is generally classified as a type of Crown land. Submerged land includes most coastal estuaries, many large riverbeds, many wetlands and the state's territorial waters, which extend three nautical miles (5.5 km) out to sea.

If aquaculture leases are located on Crown land, the proponent is required to apply for landowner's consent through NSW Department of Industry - Lands and Water.

Heritage Act 1977

Under Section 51 of the Heritage Act 1977, a permit is required to move, damage, or destroy any historic shipwreck. The Heritage Act 1977 does not apply to state waters that are waters to which the Commonwealths Historic Shipwrecks Act 1976 applies. NSW OEH is responsible for administering this Act.

Marine Safety Act 1998 (MS Act)

The MS Act, administered by NSW RMS, sets out a range of authorisations for a variety of works in and adjacent to navigable waters.

Ports and Maritime Administration Act 1995 (PMA Act)

The MS Act, administered by NSW RMS, sets out a range of authorisations for a variety of works in and adjacent to navigable waters.

Coastal Management Act 2016 (CM Act)

The CM Act is administered by NSW OEH and replaced the Coastal Protection Act 1979. The CM Act establishes the framework and overarching objects for coastal management in NSW. The purpose of the CM Act is to manage the use and development of the coastal environment in an ecologically sustainable way.

The CM Act defines the coastal zone, comprising four coastal management areas: coastal wetlands and littoral rainforests area, coastal vulnerability area, coastal environment area and coastal use area. The CM Act establishes management objectives specific to each of these management areas, reflecting their different values to coastal communities. There are no concurrence requirements in the CM Act.

State Environmental Planning Policy (Coastal Management) 2018 (CM SEPP)

The CM SEPP establishes a strategic planning framework by mapping coastal management areas and identifying development controls to support appropriate development, help protect sensitive coastal environments and manage risks from coastal hazards. Proposed aquaculture leases may be in a coastal management area. The CM SEPP identifies development controls for consent authorities to apply to each coastal management area to achieve the objectives of the CM Act.

Aboriginal Land Rights Act 1983 (ALR Act)

The ALR Act, administered by the Office of the Registrar, provides a mechanism for compensating Aboriginal people of NSW for loss of their land.

Protection of Environment Operations Act 1997 (POEO Act)

The POEO Act is administered by NSW EPA. The aims of the POEO Act include to protect, enhance and restore the quality of the environment in NSW, reduce risks to human health and prevent environmental degradation.

It is an offence under Section 120 of the POEO Act to pollute waters. At its broadest, the POEO Act defines water pollution as introducing any matter into waters which changes the physical, chemical or biological condition of the water.

An environment protection licence is required from NSW EPA for activities listed under Schedule 1 of this Act. Sea pen, longline, artificial reef and ranching aquaculture are not considered to be scheduled activities.

Environmentally Hazardous Chemicals Act 1985 (EHC Act)

The EHC Act, administered by NSW EPA, governs the use and disposal of potentially hazardous chemicals and waste material. Any use and/or removal of hazardous chemicals and material defined under the EHC Act require licensing and must be appropriately declared.

Food Act 2003

The Food Act 2003 is administered by the NSW Food Authority with the object of ensuring food for sale is both safe and suitable for human consumption.

A Food Authority Licence under the Food Regulation 2015 must be obtained for stock destined for human consumption.

COMMONWEALTH LEGISLATION**Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)**

The EPBC Act is administered by the DEE. Proponents will need to determine if the proposed actions require assessment and approval under the EPBC Act, the EPBC Act Policy Statement 1.1 (Significant Impacts Guideline 1.1) and the EPBC Act Policy Statement 2.2 (Offshore Aquaculture).

Historic Shipwrecks Act 1976 (HS Act)

The HS Act, administered by the DEE, protects historic wrecks and relics in Commonwealth waters, extending from below the low water mark to the edge of the continental shelf.

Native Title Act 1993

The Commonwealth's Attorney-General's Department and the Department of Prime Minister and Cabinet administer this Act. The State Government must comply with the "future acts regime" in the *Native Title Act* (being Division 3 of Part 2 of that Act) when issuing tenures on land where native title exists, regardless of whether there is a claim or a determination.

It is noted that Section 211 of the *Native Title Act* preserves native title rights and interests to access, undertake or enjoy activities without a licence on land where native title exists, including: hunting, fishing, gathering, or a cultural or spiritual activity to satisfy their personal, domestic or non-commercial communal needs.

Appendix 4 – Consultation - Targeted Stakeholder Groups

Table 4: Government agencies and peak stakeholder groups consulted during drafting the MWSAS.

Stakeholders	
Aboriginal Fishing Advisory Committee	NSW Farmers Association
Australian Marine Conservation Society	NSW Food Authority
Blue Harvest	NSW Marine Estate Management Authority
Boat Owners Association	NSW National Parks and Wildlife Service
Boating Industry Association	NSW Nature Conservation Council
Bond University	NSW Office of Environment and Heritage
Department of Industry - Lands and Water	NSW Ports
Eden Seafarms	NSW Shellfish Committee
Huon Aquaculture	OceanWatch
Local Government NSW	Office of Local Government
Local Land Services	Port Authority of NSW
Marina Industry Association	Ports of Newcastle
Ministerial Fishing Advisory Committee	Professional Fishermen's Association
National Parks Association	Recreational Fishing NSW Advisory Committee
Native Title Services Corp	South Coast Mariculture
NSW Aboriginal Land Council	Sydney Fish Market
NSW Aquaculture Research Advisory Committee	Tassal
NSW COMMFISH	Transport for NSW -NSW Roads and Maritime Services
NSW Department of Planning and Environment	University of Newcastle
NSW Department of Planning and Environment (Resources and Geoscience)	University of Tasmania / Institute for Marine and Antarctic Studies
NSW Department of Premier and Cabinet	Water Police
NSW Department of Primary Industries	World Wide Fund for Nature (WWF)
NSW Environment Protection Authority	Yachting NSW

Appendix 5 – Australian Aquaculture Code of Conduct

With a clean environment and freedom from many of the major diseases experienced in the Northern Hemisphere, Australian aquaculturists have a strong competitive marketing advantage. Our 'clean and green' image has allowed many of our aquaculture products to command premium prices.

Clean water also means faster growing and healthier fish. Hence, environmental protection is a major priority for the industry, as it relies on the provision of clean waters for its livelihood. Poor site selection, insufficient capital investment, deficient farm design, inadequate public administration, or inappropriate management may mean that some aquaculture operations cause environmental change. Through the peak national body, the Australian Aquaculture Forum (AAF), the industry is committed to implementing farming practices based on ecologically sustainable development (ESD) principles. Recognition of the need for aquaculture to play a major role in protecting the marine, estuarine and freshwaters of Australia led to the development of this Code of Conduct.

The Code of Conduct evolved out of a 15 month consultation process involving more than 350 representatives from industry, government, environmental interest groups, Aboriginal groups and other stakeholders with a commitment to the sustainable management of Australia's aquatic environment.

This Code is voluntary except for the parts of the Code that are legally binding by means of associated legislation. On behalf of the wider Australian aquaculture industry, the AAF's national and state member associations have prepared and endorsed this Code's 43 points to provide minimum standards for environmental performance. AAF will encourage all aquaculturists to adopt this Code as a statement of the industry's commitment to ESD.

The preparation and distribution of this Code is one of the first steps in a strategy promoting correct environmental practices within the aquaculture industry. The guiding principles outlined in the Code of Conduct will provide specific sectors or regions of the industry with a framework in which they can develop their own Codes of Practice, with a focus on ecological and economic sustainability for their particular culture species, site or culture operation.

The Food and Agriculture Organisation of the United Nations has defined aquaculture, or fish farming, as 'the farming of the aquatic organisms, including fish, molluscs, crustaceans and plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding and protection from predators. Farming also implies individual or corporate ownership of the stock being cultivated'.

In addition to the culture of edible species (such as salmon, oysters and prawns), aquaculture in Australia includes:

- Hatchery production of juveniles for use in growout operations (farms), stocking private or public waterways for recreational fishing, and restocking natural waters for conservation purposes
- Harvesting of eels, microalgae, zooplankton or other organisms from water bodies that are under some form of lease/ or management
- Culture of aquarium and ornamental fish and aquatic plants for sale
- Culture of aquatic organisms for the extraction of pigments, fine chemicals and other products such as pearls, skins and shells
- Value-adding of traditional wild caught species such as rock lobster and Southern Bluefin Tuna.

Principles of the Aquaculture Industry

To maintain ecological and economic sustainability, the aquaculture industry has adopted a set of principles that form the basis or underlying philosophy for the Code of Conduct:

- Ecologically sustainable development
- Economic viability
- Long-term protection of the environment to ensure availability of suitable sites for aquaculture operations
- Compliance with, and auditing of adherence to, regulations and the Code of Conduct
- Resource sharing and consideration of other users of the environment
- Research and development to support the achievement of the above five priorities.

These principles provide the industry with the mechanism to implement the Code of Conduct, as well as provide specific sectors or regions of the industry with the necessary framework for developing their own Code of Practice.

The Code

Industry will work in conjunction with government and other stakeholders to ensure that aquaculture developments are managed sustainably (ecologically and economically) and that their considerable social, economic and environmental advantages are achieved. This will be accomplished through five guiding principles for environmental best practice.

For the aquaculture industry to be ecologically and economically sustainable, aquaculturists will:

- Comply with regulations
- Respect the rights and safety of others
- Protect the environment
- Treat aquatic animals humanely
- Promote the safety of seafood and other aquatic foods for human consumption.

1. To comply with the regulations aquaculturists will:

- Support practical and cost effective strategies to ensure that relevant environmental performance standards are monitored and met
- Promote appropriate incentives for responsible environmental performance and advocate sanctions for non-compliance
- Promote effective consultative mechanisms with governments, the community and other users
- Expand self management and co-regulation to include industry-based codes of practice that specifically address environmental issues.

2. To respect the rights and safety of others aquaculturists will:

- Recognise the needs of other users of the waterways and promote methods to minimise user conflicts
- Recognise that the use of public resources confers responsibility on the user
- Encourage consultation with the community and other users of the waterways to enable legitimate concerns and issues to be raised and solutions proposed
- Advocate that the farm sites and infrastructure be kept clean and tidy and noise impacts minimised

- Promote goodwill in the local community and provide for farm visits and other opportunities for education and tourism
- Recognise and promote the community benefit from monitoring and reporting on the state of the aquatic environment
- Advocate the installation of appropriate navigational markers and other measures to prevent accidents.

3. To protect the environment aquaculturists will:

- Encourage the development and operation of aquaculture in a manner and at a rate in accordance with ecologically sustainable principles
- Support a total catchment approach based on natural resources management which arrests degradation and provides improved outcomes for the sustainable resource use through effective co-operation between government agencies and the community
- Promote industry training and education opportunities in environmental awareness, clean production methods and best practice
- Recognise the importance of good site selection, system design and infrastructure to minimise ecosystem changes
- Monitor and regularly review on-farm management practices to minimise the risk of ecological damage
- Minimise and, where practicable, eliminate the use of agriculture and veterinary chemicals
- Ensure the correct use and disposal of registered chemicals
- Support the development and use of diets and feeding strategies which minimise adverse impacts
- Adopt farm design and on-farm management practices that encourage integration, recycling and reuse of effluents
- Provide for disposal or/and processing of wastes to minimise the risk of ecological damage
- Continue to work with the authorities to control the spread of exotic species
- Continue the development of protocols for dealing with genetically modified material, with particular reference to the capacity of these organisms to produce progeny or genetically modified material themselves
- Work in association with governments to develop appropriate protocols regarding the transfer and culture of exotic species and the translocation of live product within and between states
- Support the maintenance of precise records regarding the transfer or translocation of stock between areas or operations.

4. To treat aquatic animals humanely aquaculturists will:

- Seek the development of on-farm expertise in health management and ecological sustainability
- Promote the maintenance of efficient and sustainable stocking densities
- Address the physical and biological requirements of the species to be farmed
- Encourage the installation of anti-predator devices designed to exclude predators without deliberately injuring them

- Seek methods to transfer and harvest which reduce stress to stock
- Endorse the use of humane slaughter methods
- Support the development of appropriate contingency plans to deal with unplanned releases of aquaculture species/stock, or the spread of diseases, parasites and other pathogens
- Encourage the immediate reporting of any mass mortalities of stock or other environmental problems to the relevant agencies and the containment of diseased or infected stock
- Identify responsibilities for environmental monitoring proportionate to possible environmental risk and benefits
- Provide guidelines on reporting and analysis of findings, taking into account the costs and benefits of such monitoring
- Promote the correct disposal of dead stock in a manner which will not render the likelihood of any disease or pathogen being released into natural waterways
- Encourage research and development programs that are funded and supported jointly by industry and governments to expand knowledge and understanding of aquaculture operations and their environmental interactions.

5. To promote the safety of seafood and other aquatic foods for human consumption aquaculturists will:

- Support the maintenance, and expansion where necessary, of chemical residue testing as well as shellfish and other quality assurance programs
- Endorse compliance with the requirements of the National Food Hygiene Standards
- Encourage the continued adoption of internationally recognised food quality standards
- Highlight the sensitivity of the waterways to pollution and its resultant effects on the quality and safety of seafoods
- Support the maintenance of precise records regarding the transfer of products destined for human consumption between all links in the distribution and marketing chain
- Support the use of accurate product labelling.

Contacts

To find out more about the Code or learn about sustainable aquaculture practices, contact the National Aquaculture Council.

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