



**Government of South Australia**

Primary Industries and Regions SA

**REPORT  
SUPPORTING THE  
*AQUACULTURE (ZONES – TUMBY BAY)*  
*POLICY 2015***

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## 1 INTRODUCTION

Of South Australia's total seafood value of production, 55% originated from aquaculture product in 2012/13 (EconSearch, 2014). This trend is reflected worldwide with expectations that, by 2020, aquaculture will produce 60% of the global seafood demand (FAO, 2009).

South Australia produced 24% of Australia's aquaculture production in 2012/13 and 19% of the national value of seafood production (ABARE, 2014).

The Minister for Agriculture, Food and Fisheries (the Minister) may make aquaculture policies for any purpose directed towards furthering the following objects of *Act* (the Act):

- a) to promote ecologically sustainable development of marine and inland aquaculture;
- b) to maximise benefits to the community from the State's aquaculture resources; and
- c) otherwise to ensure the efficient and effective regulation of the aquaculture industry.

Aquaculture zone policies recognise the aquaculture industry as a legitimate user of the State's marine resources, providing guidance and clarity regarding the aquaculture industry's access to these resources. The policies are created to consolidate aquaculture activities in specific areas and to ensure the ecological sustainability of the existing and future industry.

In accordance with the Act, the Minister must prepare a report in relation to a policy containing:

- An explanation of the purpose and effect of the policy;
- A summary of any background and issues relevant to the policy and of the analysis and reasoning applied in formulating the policy; and
- An assessment of the consistency of the policy with the Planning Strategy and any relevant Development Plan under the *Development Act 1993*; any relevant environment protection policy under the *Environment Protection Act 1993*; and any other relevant plans or policies (Appendix D1).

Aquaculture zone policies are developed to ensure that they are relevant to both community and industry needs. Where possible and appropriate, issues raised are dealt with during the planning phase rather than during the individual aquaculture licence application process. Consequently, this Report supporting the Policy has been developed to inform and involve all stakeholders in the decision making process for the zoning of marine resources for aquaculture purposes. It will be referred to prescribed bodies and relevant public authorities as well as regional stakeholders, local indigenous communities, Native Title claimant groups, local government and industry, and made available to the general public.

The Minister will then consult with and consider the advice of the Department of Primary Industries and Regions, South Australia (PIRSA) on all matters raised during the consultation period. As prescribed by the Act following approval of the policy by the Minister, the policy will be referred to the Environment, Resources and Development Committee (ERDC) of Parliament. The ERDC may approve the policy; seek amendments to the policy or object to the policy. In the event the ERDC objects to the policy, the policy will be presented to both Houses of Parliament where either House may disallow it.

As a result of consultation and gazettal of a policy it is proposed that amendments will be made to Land Not within a Council Area (Coastal Waters) Development Plan in accordance with provisions under the *Development Regulations 2008*.

The Tumby Bay Policy Report (Report) supports the *Aquaculture (Zones – Tumby Bay) Policy 2015* (Policy).

A summary of the zoning framework to be established under the Policy is provided in Table 1 and summarises the classes of permitted aquaculture and the leased area and biomass permitted in the Tumby Bay aquaculture zones and the aquaculture exclusion zone (see Appendix D2).

Table 1 – Summary of zoning framework established under the *Aquaculture (Zones – Tumby Bay) Policy 2015*.

ZONE	LEASED AREA		CLASS	BIOMASS			
	Maximum total lease area allowed in the Policy	Lease area already allocated  (1 June 2015)		Supplementally fed		Non-supplementally fed	
				(a) Farming of prescribed wild-caught tuna	(b) Farming of aquatic animals in a manner that involves regular feeding	(c) Farming of bivalve molluscs	(d) Farming of algae
Tumby Bay aquaculture zone	1,300 ha (includes 5 ha for research/educational purposes)	20 ha	b, c and d	Nil	2,100 tonnes	16,200 tonnes	Determined by licence condition
Tumby Bay aquaculture exclusion zone	Nil	Nil	Nil	Nil	Nil	Nil	Nil

## 2 CURRENT AQUACULTURE

There is one active aquaculture lease (Figure 2) located approximately 11 km south east of Tumby Bay township and 4.5 km east of Red Cliff. This 20 hectare site is licensed to farm blacklip (*Haliotis rubra*), whirling (*H. cyclobates*) and greenlip (*H. laevigata*) abalone.

Average water depth across this lease is relatively consistent at approximately 18.6 metres. The on-site benthic environment comprises coarse, bare sand sparsely covered by red algae and sponges (total coverage of approximately 5% of the lease surface area), with occasional sea cumpers and worm midden mounds.

## 3 CURRENT AQUACULTURE ZONING

Prior to the introduction of the Act, aquaculture in waters surrounding Tumby Bay was managed by the Spencer Gulf Management Plan (Primary Industries South Australia, 1996). The Tumby Bay aquaculture zone overlays the old Port Neill, Tumby, Offshore Tumby, Offshore Gulf and Sir Joseph Banks Management Zones described by the Spencer Gulf Aquaculture Management Plan (Figure 3). With the commencement of the Act, these Management Plans were used as guiding documents, but did not carry the statutory status of aquaculture zone policies under the Act.

It is important to distinguish between aquaculture zoning and individual site allocation and management. Aquaculture zones establish areas in which aquaculture is deemed appropriate to occur, while controls relating to the performance of farm operations are applied through marine leases, licences and the *Aquaculture Regulations 2005* (see [http://www.pir.sa.gov.au/aquaculture/public\\_register](http://www.pir.sa.gov.au/aquaculture/public_register) and <http://www.pir.sa.gov.au/aquaculture/legislation>).

## 4 AQUACULTURE ZONES

The scope of the Policy covers the Tumby Bay area of the Eyre Peninsula as depicted in Figure 1 (Appendix C).

The Policy establishes two aquaculture zones as follows:

### 4.1 Tumby Bay aquaculture exclusion zone

The Tumby Bay aquaculture exclusion zone prohibits aquaculture development where important other marine resource uses and areas of high conservation significance have been identified.

The Tumby Bay aquaculture exclusion zone encompasses an area of approximately 13,765 hectares. The aquaculture zone is depicted in Figure 1 and is described in the Policy.

The aquaculture exclusion zone extends to the landward edge of the aquaculture zone and includes a 4 km buffer around the Tumby Bay township, a 1 km buffer around the Tumby Island Conservation Park as well as along the coastline south to Point Bolingbroke and a 1.5 to 3.5 km wide exclusion strip for recreational boats to travel between Tumby Bay and the Sir Joseph banks Group of islands (Figure 6).

### 4.2 Tumby Bay aquaculture zone

The Tumby Bay aquaculture zone incorporates an area of approximately 10,324 hectares and commences approximately 6.8 km from the Tumby Bay Township and approximately 2.6 km from the nearest mainland (around Red Cliff). The aquaculture zone is depicted in Figure 1 and is described in the Policy.

It is proposed that the aquaculture zone will provide a maximum of 1,300 hectares of lease area for aquaculture. This is approximately 13% of the total area of the aquaculture zone. It is proposed that at least five hectares will be used or available for use for the purposes of research or education.

Twenty hectares is already allocated in the aquaculture zone.

The prescribed classes of aquaculture (Appendix D2) for the proposed aquaculture zone are:

- b) the farming of aquatic animals (other than prescribed wild-caught tuna) of in a manner that involves regular feeding (such as kingfish, propagated tuna and abalone);
- c) the farming of bivalve molluscs (such as mussels); and
- d) the farming of algae.

The maximum aggregate biomass (Appendix D2) of aquatic animals (other than prescribed wild caught tuna) which require regular feeding proposed for the Tumby Bay aquaculture zone is 2,100 tonnes of finfish equivalent (see Appendix D2). This tonnage will be for the farming of species such as kingfish and abalone as approved by the Minister. This maximum aggregate biomass proposed to be farmed within the Tumby Bay aquaculture zone was calculated using a predictive model developed by SARDI (Tanner *et. al.*, 2007). The model indicated that the area could sustain 3,660 tonnes, however it was considered that a conservative figure of 2,100 tonnes is appropriate until the results of the Innovative Solutions Project “Carrying Capacity of Spencer Gulf – Hydrodynamic and Biogeochemical Measurement and Modelling and Performance Monitoring: FRDC Project 2009/046” are known.

To estimate the bivalve mollusc carrying capacity of the Tumby Bay aquaculture zone, a predictive model (Parsons Brinkerhoff and SARDI Aquatic Sciences, 2003) was used. Given the estimate is 52,250 tonnes, a conservative carrying capacity estimate of 16,200 tonnes is proposed. This figure is consistent with the mussel industry association’s indication that their current maximum farming production is approximately 560 m of backbones per licensed hectare with 15 m of submerged longline per metre of backbone, which equates to 12.5 tonnes per ha. Conservative allocation of tonnage across the aquaculture zone allows for ongoing monitoring and review of the productivity of the aquaculture zone, as aquaculture zone allocation approaches the modelled capacity. The Minister may increase the biomass of bivalve molluscs by notice in the Gazette if satisfied that such an increase would not compromise the overall productivity of bivalve mollusc aquaculture operations in the aquaculture zone.

A biomass limit for algae is yet to be determined. No specific limits have been applied to the biomass for algae farming, given the industry is still in its infancy. PIRSA Fisheries and Aquaculture will monitor developments and consider the need for future regulation as the industry grows.

## 5 CONSIDERATIONS

To uphold the objectives of the *Act*, PIRSA Fisheries and Aquaculture will take the following matters into account in creating the Policy and encourage comment or advice for each during the public consultation period.

### 5.1 Subsequent Development Plan Amendments

The Policy falls within the waters covered by the Coastal Waters Development Plan (Land Not within a Council Area (Coastal Waters) Development Plan). The Policy is consistent with the provisions contained in this development plan as it seeks to ensure the ecologically sustainable development of the aquaculture industry, whilst recognising and respecting other users of the marine resource.

Therefore, subject to the approval of the Minister for Planning, the new aquaculture zone as outlined in the Policy (Appendix C, Figure 7) will be incorporated into the Coastal Waters Development Plan’s maps.

Aquaculture is not considered “development” under the *Development Act 1993* if it is located within an aquaculture zone and within the Coastal Waters Development Plan. Thus, aquaculture development located within the Policy will not be subject to development approval under the *Development Act 1993*.

## 5.2 Physical Characteristics

The Tumby Bay aquaculture zone lies at the northern boundary of the Jussieu bio-unit. The northern area of the aquaculture zone lies within the southern limits of Dutton bio-unit. The Jussieu bio-unit extends from Cape Catastrophe on the south-western tip of Eyre Peninsula, north to Salt Creek (Tumby Bay). The Dutton bio-unit extends from Salt Creek (Tumby Bay) to Cape Driver (Arno Bay) on the western side of central Spencer Gulf (Edyvane, 1999). The northern region of this area (including Tumby Bay) is exposed to low wave energies with prevailing offshore winds and low exposure to swell (Petrusevics *et. al.*, 1998). The most frequent wave heights and wave periods are approximately 1 m and 3.0 s respectively with maximum wave height and wave period reaching approximately 2.5 to 3 m and 6.5 to 6 s respectively (Petrusevics *et. al.*, 1998). Water depths rarely exceed 25 m within the Jussieu bio-unit and around Tumby Bay are only 10 m up to 20 m further offshore. The islands of the Sir Joseph Banks Group provide the coastal area with some shelter from high winds and wave energy and tidal flows average less than 21 cm per sec (Parsons Brinkerhoff & SARDI, 2003). The area experiences maximum surface water temperatures of 12.4°C during winter and 22.8°C during summer (Tanner and Volkman, 2009).

The adjacent coastline is mainly sandy beaches, tidal flats and algal dominated reefs. The low energy southern section of the bay is the site of the Tumby Bay township. South of Tumby Bay are extensive supratidal and intertidal flats (the latter) covered by mangroves (Edyvane, 1999). To the northern end of Tumby Bay is a moderate wave energy coastline with intertidal areas dominated by tidal creeks, grey mangroves and seagrass including extensive seagrass meadows (*Posidonia*) in some sheltered areas (Baker, 2004).

There are extensive areas of seagrass within this region, due to the large number of sheltered sandy embayments (including Tumby Bay) (Edyvane, 1999). These bays are commonly dominated by *Posidonia australis* in shallow waters and *P. sinuosa* and *P. angustifolia* in deeper waters.

The technical investigation by SARDI (Loo *et. al.*, 2010) indicates the proposed aquaculture zone’s benthic environment consists predominantly of bare sandy substrate inhabited by ascidians (*Polycarpa* spp.), sponges and razorfish (*Pinna bicolor*) and avoids areas of seagrass (Figures 4 and 5). Only Site TB01 in the northern part of the area investigated by SARDI had high (79%) seagrass cover of *Posidonia* sp. and this area is excluded from the proposed aquaculture zone (Figure 4). Seagrass was recorded at two other sites (TB02 and TB10), with *Posidonia* sp. identified at TB02 (0.4% cover), and *Halophila* sp. (7.3% cover) at TB10 (Figures 4 and 5). It is important to note that the SARDI survey only covered a 100 m transect in a 2.5 km grid, the extent of seagrass cover may be under-estimated. It should be noted that risks posed to seagrass by an aquaculture activity are assessed at the time of individual licence application through the ESD Assessment process consistent with the National ESD Framework (Fletcher *et. al.*, 2004).

Flushing rates of 73 times per year (or every 5 days) (Luick and Middleton, 2010) are sufficiently high to allow appropriate dispersal of non-solid wastes from the site. The Tumby Bay aquaculture zone lies in water depths of less than 22 m, with approximately 90% of the aquaculture zone being in water depths of 16 to 22 m (Figure 2)<sup>1</sup>. This depth of water allows sufficient room between the bottom of commonly used farming infrastructure and the sea floor.

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<sup>1</sup> Figure 2 depths are in fathoms (1 fathom = 6 feet = 1.8 m).

The physical characteristics of the proposed aquaculture zone are favourable for the farming of finfish, subtidal mollusc and algae species.

### 5.3 Indigenous Heritage

PIRSA Fisheries and Aquaculture acknowledges and recognises the native title rights and interests of the South Australian Aboriginals. It is further recognised that it is essential to the wellbeing of Aboriginal people in the communities that their traditional values and practices are respected and their heritage and native title interests considered when aquaculture developments are planned for a particular area. PIRSA Fisheries and Aquaculture facilitates the involvement of local Aboriginal representatives in its process for developing and amending aquaculture policy and zoning.

There are no Indigenous Land Use Agreements (ILUA) or Native Title Claims in this area (National Native Title Tribunal, Commonwealth of Australia 2006a). A move to create an ILUA with Naou-Barnjarla and Barnjarla commenced in 2006. Under the ILUA model, separate agreements can be formulated with the different groups involved, such as fishers or aquaculture operators, and local, State and Federal Government (Virginia Leek, pers. comm., 14 September 2007).

The Barnjarla Native Title Claim (SC96/4) extends into coastal waters (National Native Title Tribunal, Commonwealth of Australia 2006b).

A search of Central Archive, which includes the Register of Aboriginal Sites and Objects, administered by the Department of the Premier and Cabinet-Aboriginal Affairs and Reconciliation Division (DPC-AARD), has an entry (reference # 6129 4972) for an Aboriginal site in the Tumby Bay area described as an archaeological site (Figure 8). The site is located on land approximately 2 km north of Tumby Bay. It should be noted that the site indicator does not reflect the actual area of the site; as this will vary from site to site, depending on the site information contained in the Central Archive. However, the Central Archive does not purport to be a comprehensive record of all Aboriginal sites, objects and remains in South Australia. Sites or objects may exist in the area even though they are not recorded (Justin Wearne, pers. comm., 30 March 2011).

If any Aboriginal significant areas are encountered during community engagement, PIRSA Fisheries and Aquaculture will advise the State Aboriginal Heritage Branch accordingly. The Department of Premier and Cabinet's Aboriginal Affairs and Reconciliation Division will then deal with Aboriginal Heritage clearance concerns in accordance with the *Aboriginal Heritage Act 1988*.

### 5.4 Non-indigenous and Natural Heritage Sites

Heritage sites are recorded under the register of the *Heritage Act 1993*.

### 5.5 Marine Parks

The Tumby Bay aquaculture zone lies within the boundaries of the Sir Joseph Banks Group Marine Park (Figure 6). Located in lower western Spencer Gulf and covering 2,627km<sup>2</sup>, the Sir Joseph Banks Group Marine Park includes part of the Eyre and Spencer Gulf Bioregions. The park is adjacent to Tumby Bay and includes the islands of the Sir Joseph Banks Group and Dangerous Reef. This marine park overlays two other protected areas, including the Tumby Island Conservation Park and the Sir Joseph Banks Group Conservation Park (Department of Environment and Natural Resources, 2010).

The coastal wetlands around Tumby Bay are particularly vulnerable and the seagrass meadows less resilient to physical disturbance. As such, the Tumby Bay aquaculture zone has been designed so as to minimise the risk of disturbing these sensitive and important habitats.

Marine Parks are the principal tool under the *Marine Parks Act 2007* for managing both current and future activities that take place in marine parks. The Tumby Bay zone policy and aquaculture activities

in the Sir Joseph Banks Group Marine Park are integrated to achieve multiple-use outcomes, in accordance with the objects and the four types of zones established by the *Marine Parks Act 2007*.

The *Marine Parks Act 2007* (section 13(1)) requires that management plans:

- must establish the various types of zones within the park and define their boundaries; and
- may identify and define the boundaries of special purpose areas within the park and set out the activities that will be permitted in the areas.

The *Marine Parks Act 2007* makes provision for the following types of marine park zones:

(a) a general managed use zone – is a zone established so that an area may be managed to provide protection for habitats and biodiversity within a marine park, while allowing ecologically sustainable development and use. Aquaculture activity is deemed a compliant activity within such a zone. Within this zone aquaculture farming activities are deemed a compatible activity that is permitted to be undertaken.

(b) a habitat protection zone – is a zone primarily established so that an area may be managed to provide protection for habitats and biodiversity within a marine park, while allowing activities and uses that do not harm habitats or the functioning of ecosystems. Within this zone aquaculture farming activities are deemed a compatible activity that is permitted to be undertaken.

(c) a sanctuary zone – is a zone primarily established so that an area may be managed to provide protection and conservation for habitats and biodiversity within a marine park, especially by prohibiting the removal or harm of plants, animals or marine products

(d) a restricted access zone – is a zone primarily established so that an area may be managed by limiting access to the area.

The Tumby Bay aquaculture zone lies entirely within the boundaries of a general managed use zone of the Sir Joseph Banks Group Marine Park; the exclusion zone lies predominantly within a habitat protection zone, with the remainder in a sanctuary zone.

## 5.6 Reserves and Conservation Areas

There are no aquatic reserves established under the *Fisheries Management Act 2007* within the proposed aquaculture zone.

The proposed aquaculture zone is located between the Tumby Island Conservation Park and the Sir Joseph Banks Group Conservation Park (Figure 7). The proposed aquaculture zone and aquaculture exclusion zone have been located to ensure there is a minimum 1 km buffer from these two Conservation Parks as per the following legislative requirements.

The intent of an aquaculture exclusion zone abutting reserves proclaimed under the *National Parks and Wildlife Act 1972* is consistent with *The Land Not Within A Council Area (Coastal Waters)* development plan which states “Marine aquaculture and other offshore development should be located at least: ... (b) 1000 m seaward from the boundary of any Reserve under the National Parks and Wildlife Act, unless a lesser distance is agreed with the Minister responsible for that Act”.

## 5.7 Matters of National Environmental Significance

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) addresses the protection of matters of national environmental significance.

A search of the Protected Matters Database was conducted (3 March 2011) on the Australian Government, Department of the Environment and Water Resources website (2011) using the Protected

Matters Search Tool to obtain a list of threatened and migratory species that are considered to potentially occur in the region. This data is derived primarily from general distribution maps, and accordingly, it is likely that at least some of the species listed will not occur.

The resultant report listed 31 endangered or vulnerable species (Table 2), 35 migratory species, 67 marine species, 12 whales and other cetaceans, 10 invasive species and 1 nationally important wetland.

Tumby Bay is listed as a Wetland of National Importance (Environment Australia, 2001) and is considered to be a good example of a supratidal and estuarine (particularly mangroves and samphire) coastal habitat. Many migratory species, consisting of bird, marine mammals and shark, occur within this region. The legislative framework dealing with these species is described in Appendix D3.

Tumby Island Conservation Park and Lipson Island Conservation Park are on the Register of the National Estate, due to their role in providing breeding, roosting and feeding habitats for sea birds (Department of Environment and Natural Resources, 2010). Tumby Bay and Tumby Island also provide an important breeding and/or feeding habitats for black swan (*Cygnus atratus*), Australian pelican (*Pelecanus conspicillatus*), white-faced heron (*Egretta novaehollandiae*) and other cormorant species including the little pied cormorant (*Phalacrocorax melanoleucos*) (Morelli and de Jong, 1996). Rock parrots (*Neophema petrophila*) have been recorded on Tumby Island. The Sir Joseph Banks Group of islands is also on the Register of the National Estate in recognition of the geological formation known as Spilsby Suite of the Lincoln geological complex. The importance of the island group for breeding population of Cape Barren geese (Baker, 2004) has also been noted.

There are a number of species known to occur in the region that are specifically protected by the EPBC Act including five migratory coastal bird species that are listed under international migratory bird treaties; Pacific golden plover (*Pluvialis fulva*), grey plover (*P. squatarola*), eastern curlew (*Numenius madagascariensis*), sharp-tailed sandpiper (*Calidris acuminata*) and ruddy turnstone (*Arenaria interpres*) (Baker, 2004).

Seabirds may be adversely affected by activity around any feeding, roosting or nesting sites in the area. However, section 19 of the *Aquaculture Regulations 2005* specifies that each licence holder must have a written strategy approved by the Minister to minimise adverse interactions with seabirds. In addition, risks posed by the aquaculture activity are assessed at the time of individual licence application through the ESD Assessment process consistent with the National ESD Framework (Fletcher *et. al.*, 2004).

Syngnathid fishes (e.g. seahorses, sea-dragons and pipefish) are protected under the provisions of section 71 of the *Fisheries Management Act 2007*. Syngnathid fishes are likely to be present, especially in the seagrass, algal and reef assemblages. It is known that at least some seahorses are abundant around finfish cages, using them as an alternative habitat to seagrass beds and algal assemblages. There is evidence of the presence of the leafy seadragon (*Phycodurus eques*) in the Tumby Bay area (Department of Environment and Natural Resources, 2010). The risk of adverse impacts to leafy seadragons is low as cages will not be placed over dense seagrass beds and algal assemblages.

Tumby Island has been identified as an island utilised as a haul-out site for some satellite tagged female Australian sea-lions (Table 2 and listed as vulnerable) (Goldsworthy *et. al.*, 2009). The Sir Joseph Banks Group of islands provides breeding and haul-out areas for Australian sea-lions and the long-nose fur seal (*Arctocephalus forsteri*) approximately 20 km to the south east of Tumby Bay. A major Australian sea-lion colony exists at Dangerous Reef located approximately 50 km to the south of Tumby Bay.

All marine mammals (and sharks) have the potential to become entangled in nets or mooring lines. However, section 19 of the *Aquaculture Regulations 2005* specifies that each licence holder must have a written strategy approved by the Minister to minimise adverse interactions with marine mammals (and

sharks). In addition, risks posed by the aquaculture activity are assessed at the time of application through the ESD Assessment process consistent with the National ESD Framework.

In November 2002 Cabinet approved the establishment of a Marine Mammal-Marine Protected Areas Working Group (MM-MPA AWG) to develop management arrangements to address the proximity of aquaculture developments to core areas of proposed marine protected areas and significant marine wildlife habitats such as seal colonies and whale breeding areas.

The MM-MPA AWG concluded that the only aquaculture activity to pose a risk to seal/sea lion colonies is finfish aquaculture, and the only seal/sea lion colonies at risk from finfish aquaculture are breeding colonies of Australian sea-lions. The long-nose fur seal also interacts with aquaculture operations, is not considered to be at risk from finfish aquaculture, and as such it is proposed that no restrictions will apply in relation to the long-nose fur seals.

Cabinet considered the MM-MPA AWG report and in 2005 noted the following recommendation in order to reduce the potential risk to Australian Sea-lion breeding colonies from finfish aquaculture:

Finfish aquaculture located within 5 km of any Australian sea lion breeding sites will not be approved;

Finfish aquaculture will not be approved within 15 km of the eight major Australian sea lion breeding colonies (namely The Pages, Dangerous Reef, Seal Bay, West Waldegrave Island, Olive Island, Franklin Islands, Purdie Island and Nicolas Baudin Island);

Finfish aquaculture to be located between 5-15 km of minor Australian sea lion breeding colonies will have a risk assessment applied during the licence assessment process specifically related to sea lions; and

Over 15 km, there will be no restrictions in relation to finfish aquaculture.

The proposed zone complies with the distances recommended by the MM-MPA AWG.

Table 2 – The 31 vulnerable or endangered species listed by the Department of Sustainability, Environment, Water, Population and Communities for the Tumby Bay region (as at 3 March 2011).

Common Name(s)	Species	Status	Type of Presence
Amsterdam Albatross	<i>Diomedea exulans amsterdamensis</i>	Endangered	Species or species habitat may occur within area
Australian Sea-lion	<i>Neophoca cinerea</i>	Vulnerable	Species or species habitat likely to occur within area
Bead Glasswort	<i>Tecticornia flabelliformis</i>	Vulnerable	Species or species habitat likely to occur within area
Black-browed Albatross	<i>Thalassarche melanophris</i>	Vulnerable	Species or species habitat may occur within area
Blue Petrel	<i>Halobaena caerulea</i>	Vulnerable	Species or species habitat may occur within area
Blue Whale	<i>Balaenoptera musculus</i>	Endangered	Species or species habitat may occur within area
Buller's Albatross	<i>Thalassarche bulleri</i>	Vulnerable	Species or species habitat may occur within area
Campbell Albatross	<i>Thalassarche melanophris impavida</i>	Vulnerable	Species or species habitat may occur within area
Fat-leaved Wattle	<i>Acacia pinguifolia</i>	Endangered	Species or species habitat likely to occur within area
Gibson's Albatross	<i>Diomedea exulans gibsoni</i>	Vulnerable	Species or species habitat may occur within area
Great White Shark	<i>Carcharodon carcharias</i>	Vulnerable	Species or species habitat likely to occur within area
Green Turtle	<i>Chelonia mydas</i>	Vulnerable	Species or species habitat likely to occur within area
Greencomb Spider-orchid, Rigid Spider-orchid	<i>Caladenia tensa</i>	Endangered	Species or species habitat likely to occur within area
Humpback Whale	<i>Megaptera novaeangliae</i>	Vulnerable	Species or species habitat likely to occur within area
Jumping-jack Wattle	<i>Acacia enterocarpa</i>	Endangered	Species or species habitat likely to occur within area
Leatherback Turtle, Leathery Turtle	<i>Dermochelys coriacea</i>	Endangered	Species or species habitat likely to occur within area
Loggerhead Turtle	<i>Caretta caretta</i>	Endangered	Species or species habitat likely to occur within area
Malleefowl	<i>Leipoa ocellata</i>	Vulnerable	Species or species habitat likely to occur within area
Northern Giant-Petrel	<i>Macronectes halli</i>	Vulnerable	Species or species habitat may occur within area
Shy Albatross, Tasmanian Shy Albatross	<i>Thalassarche cauta cauta</i>	Vulnerable	Species or species habitat may occur within area
Soft-plumaged Petrel	<i>Pterodroma mollis</i>	Vulnerable	Species or species habitat may occur within area
Southern Giant-Petrel	<i>Macronectes giganteus</i>	Endangered	Species or species habitat may occur within area

Common Name(s)	Species	Status	Type of Presence
Amsterdam Albatross	<i>Diomedea exulans amsterdamensis</i>	Endangered	Species or species habitat may occur within area
Southern Right Whale	<i>Eubalaena australis</i>	Endangered	Species or species habitat known to occur within area
Tristan Albatross	<i>Diomedea exulans exulans</i>	Endangered	Foraging, feeding or related behaviour may occur within area
Tufted Bush-pea	<i>Pultenaea trichophylla</i>	Endangered	Species or species habitat may occur within area
Wandering Albatross	<i>Diomedea exulans (sensu lato)</i>	Vulnerable	Species or species habitat may occur within area
West Coast Mintbush, Limestone Mintbush, Red Mintbush	<i>Prostanthera calycina</i>	Vulnerable	Species or species habitat likely to occur within area
Western Whipbird (eastern)	<i>Psophodes nigrogularis leucogaster</i>	Vulnerable	Species or species habitat likely to occur within area
Whibley Wattle	<i>Acacia whibleyana</i>	Endangered	Species or species habitat likely to occur within area
Wopilkara, Greater Stick-nest Rat	<i>Leporillus conditor</i>	Vulnerable	Species or species habitat likely to occur within area
	<i>Frankenia plicata</i>	Endangered	Species or species habitat likely to occur within area

## 5.8 Commercial and Recreational Fishing

It is intended to site the proposed aquaculture zone in a manner that minimizes unnecessary impact on commercial and recreational fishing activities.

With the close proximity of the Sir Joseph Banks Group of Islands, the sheltered bays and reefs, Tumby Bay provides recreational fishers with exceptional fishing opportunities for a number of commercially and recreationally significant species. Tumby Bay mangrove creeks provide a nursery area for King George whiting (*Sillaginodes punctata*), juvenile blue swimmer crabs (*Portunis pelagicus*), other crab species, western king prawns (*Penaeus latisulcatus*) and various other invertebrates, including bait worm species (Bryars 2003). Offshore, the reef area along the Tumby coast is reported to be a habitat for juvenile King George whiting, snapper ([http://www.pir.sa.gov.au/fisheries/recreational\\_fishing/target\\_species/snapper](http://www.pir.sa.gov.au/fisheries/recreational_fishing/target_species/snapper) - Life#Life *Pagrus auratus*), Australian salmon (*Arripis truttacea*), Australian herring (*Arripis georgianus*), trevally (*Carangoides gymnostethus*), and sea sweep (*Scorpis aequipinnis*) (Bryars, 2003).

The aquaculture zone is located within an overall area of moderate importance for the marine scalefish fishery. Snapper is the predominate catch but garfish, King George whiting, yellowfin whiting (*Sillago schomburgkii*) and southern calamary (*Sepioteuthis australis*) are also caught (Rodda *et. al.*, 2009). Blue Swimmer Crabs are also taken in the Tumby area and Black Bream in Salt Creek.

Commercial net fishing is not allowed from Tumby Bay to Dutton Bay i.e. from the intersection of latitude 34°30'S and the high water mark in Massena Bay (south of Tumby Bay) to the intersection of longitude 136°30'E and the high water mark in Dutton Bay pursuant to the *Fisheries Management Act 2007*.

## 5.9 Historic Shipwrecks

One of the Principles of Development Control in the Land Not within a Council Area (Coastal Waters) (LNWCA(CW)) Development Plan requires that "marine aquaculture development must be located at least 550 metres from a proclaimed shipwreck". Whilst aquaculture within an aquaculture zone delineated within the LNWCA(CW) Development Plan is excluded from the definition of development (Schedule 3, clause 16 *Development Regulations, 2008*), this minimum distance will be maintained in relation to any aquaculture operations in all aquaculture zone policies. Any shipwreck or relic that is older than 75 years is protected under the *Historic Shipwrecks Act 1976* (Cth), which covers water off the South Australian coast from the low water mark or the agreed baselines but does not include State internal waters – i.e. the River Murray, Gulf St. Vincent, Spencer Gulf, Encounter Bay, Lacedpede Bay, Rivoli Bay and Anxious Bay – which are covered under the *Historic Shipwrecks Act 1981* (SA).

There are no shipwrecks proclaimed under the *Historic Shipwrecks Act 1981* or the Commonwealth *Historic Shipwrecks Act 1976* within the Tumby Bay aquaculture zone. However, a video transect taken of the seafloor by SARDI during its technical investigation of the area revealed what is most probably a shipwreck. It was observed very close to the point described as 'TB13' in Figure 4. Note that this area has been excluded from the aquaculture zone. It is possible however that Tumby Bay may contain further wrecks that have not yet been located (Rodda *et. al.*, 2009).

## 5.10 Shipping and Navigation

There are no major ports within Tumby Bay. There is a Marina development and boat ramp providing an all-weather launching site within the Tumby Bay township.

A deep water loading facility and port is proposed for Sheep Hill (Lipson Cove) approximately 20 km north east of Tumby Bay (Centrex Metals Limited, 2011). The Tumby Bay aquaculture zone is located 20 km from Sheep Hill and does not interfere with any potential shipping routes going to and coming from Sheep Hill.

The proposed aquaculture zone avoids commercial shipping movement patterns or activities associated with existing jetties and wharves. An aquaculture exclusion zone will allow for navigation by commercial and recreational vessels to the popular Sir Joseph Banks Group of Islands (Figure 1) (Andrew Carr, pers. comm., 20 January 2011).

It is a condition of aquaculture leases and licenses that navigation marks be installed whenever structures are located in the leased area and section 16 of the *Aquaculture Regulations 2005* stipulate the requirement to mark-off an area and maintain those structures used to mark-off an area in a good working condition. Therefore aquaculture infrastructure within the proposed aquaculture zone should not pose a navigational hazard.

## 5.11 Tourism

Tumby Bay is a popular beachside holiday destination where visitors enjoy activities such as diving, fishing and boating (Eyre Peninsula Visitors Guide, 2010). Tumby Bay is known for its tree-lined foreshore, historic buildings and crystal blue waters. The town enjoys a 10 km white sand beach with a boat ramp and Marina development making it perfect for swimming, sailing, diving and a range of other aquatic activities.

The Tumby Bay jetty and the surrounding area are recognised as sites of interest for divers due to the presence of stingrays and less common fish species such as the sculptured sea moth (*Pegasus lancifer*) and stargazers (*Kathetostoma laeve*) as well as leafy sea dragons and short-head seahorses (*Hippocampus breviceps*) (Baker, 2004).

The Tumby Bay aquaculture zone has been situated so that visual and recreational amenity is maintained. The proposed aquaculture zone is approximately 2.6 km at its closest point to the mainland (Redcliff) and 7 km from Tumby Bay township (Figure 1).

A workshop discussing shark interactions with aquaculture was held in Adelaide in October 2004. Representatives from industry, aquaculture structure manufacturing companies, the South Australian Government and other State Governments (including environment protection, research, fisheries and aquaculture staff), met to discuss the current issues associated with shark interactions in southern Australia and what methods are in place to reduce and deal with these interactions. A discussion paper "Workshop on Shark Interactions with Aquaculture" (Murray-Jones *et. al.*, 2004) recorded the details and outcomes of the discussions held.

Some of the key points from this workshop include:

- Aquaculture cages do not appear to be attracting sharks to the region.
- The main factor triggering attacks is the presence of freshly dead fish in cages – this is a husbandry issue.
- Interactions with bronze whaler sharks are more frequent than with great white sharks. Interactions vary with site, season and operator.
- More research into shark populations and behaviour (particularly interactions with aquaculture cages) is needed."
- Since this workshop, the requirement for all marine based aquaculture licensees to submit and adhere to strategies regarding the interactions of farming operations with seabirds and large marine vertebrates have been introduced to the *Aquaculture Regulations 2005* (Regulations 19 and 20).

In addition, husbandry practices of aquaculture operators have improved as the business of aquaculture has evolved and become more commercially focussed. Some of these husbandry practices include increased frequency of diver removal of dead fish from the cages, checking for holes in nets and

introducing false bottoms to nets to increase the distance from the bottom of the cages to fish outside the cages—this decreases the opportunity for predators to get to dead fish in cages.

Marine Innovation South Australia (MISA) employs a shark and seal expert to explore South Australia's capacity to research shark and seal behaviour and population movements. This follows on from research work completed by South Australia on seal interactions with finfish farms. PIRSA Fisheries and Aquaculture considers the results of this research when zoning for aquaculture.

Scientists from SARDI have also analysed the catch and effort data from the commercial shark fishery in Spencer Gulf on both annual and monthly basis. There appears to be a seasonal (i.e. natural) trend in movement of whaler sharks into the gulf and west coast waters during the warmer months of the year. Additionally, there are some areas where sharks are already present, for example in the Spencer Gulf. Sharks are present in the area primarily because the main sea lion breeding colony is located at Dangerous Reef.

Sharks, if present naturally, may visit aquaculture facilities in that area, however fish mortalities are routinely removed and consequently no reward is presented to the sharks. As such, it is considered unlikely that aquaculture attracts additional sharks to an area.

### **5.12 Sites of Scientific Importance**

There are no recorded geological monuments located within the bio-unit (Geological survey of South Australia, 2009).

### **5.13 Biosecurity**

The health status of farmed and wild stock in the area, with particular emphasis on the occurrence of diseases listed as notifiable under the *Livestock Act 1997*, is taken into consideration. In addition Regulation 11 of the *Aquaculture Regulations 2005* requires licensees to report unusually high mortality rates. These industry specific requirements are aimed to provide an effective monitoring system that has the sensitivity and specificity to identify mortalities resulting from the introduction of an exotic or newly emerging disease pathogen, without capturing the mortalities that are ordinarily experienced annually during the 6–12 week post transfer.

Disease reporting requirements as stipulated in the *Aquaculture Regulations 2005* and *Livestock Act 1997* are considered adequate to survey and adaptively manage any emerging production disease risks. Consequently, the risk of inappropriately managed prevention of, and treatment for, disease from site operations is low.

## **6 REGIONAL IMPACT ASSESSMENT**

Matters raised in the Policy may:

- Directly affect a region or regions;
- Indirectly affect a region or regions;
- Affect or relate to regional issues; or
- Treat or affect regional and metropolitan areas differently.

Accordingly, it is considered appropriate to fully assess the effects of the Policy within the region.

This section contains an assessment of the expected effects of the aquaculture zone policy on the Eyre Peninsula Region.

## 6.1 Stakeholders

The main issues raised by stakeholders during consultation on the development of aquaculture zones are the perceived or actual encroachment of the aquaculture zone on other resource uses, for example recreational and commercial fishing (including prawn fishing and abalone fishing), and concerns around the potential for interactions with sensitive species and habitats.

The following groups may be affected by the proposed zoning and policy:-

- The Aquaculture industry, local community, native title claimants and other indigenous groups, local government, recreational and professional fishers, Government agencies, conservation groups and other NGOs, research organisations, boards and other relevant planning and natural resource management bodies, recreational users, tourists and the tourism industry, the recreational boating sector and commercial shipping.

PIRSA will seek and/or invite input and guidance from these parties throughout the consultation process.

## 6.2 Consultation Undertaken in Relation to Regional Issues

Following preparation of the Policy and Report, the Minister is required to refer both documents to prescribed bodies and to any public authority whose area of responsibility is, in the opinion of the Minister, likely to be affected by the Policy (section 12(4)(a) of the Act).

The following bodies are prescribed:

- South Australian Native Title Services Limited;
- Conservation Council of South Australia Incorporated;
- Local Government Association of South Australia;
- Seafood Council SA;
- Fisheries Council of South Australia;
- South Australian Aquaculture Council;
- South Australian Recreational Fishing Advisory Council;
- Any registered representatives of native title holders or claimants to native title in land comprising or forming part of an aquaculture zone or area to which the policy applies;
- Any person holding an aquaculture licence or aquaculture lease over an area comprising or forming part of a zone or area to which the policy applies;
- Any regional NRM Board (within the meaning of the *Natural Resources Management Act 2004*) responsible for a region comprising or forming part of an aquaculture zone or area to which the policy applies; and
- Environment Protection Authority (EPA).

In addition to prescribed bodies, PIRSA Fisheries and Aquaculture consults with the following parties:

- Industry leaders, Department for Planning Transport and Infrastructure (DPTI), SA Tourism Commission (SATC), South Australian Research and Development Institute, Department of Environment and Natural Resources (DEWNR), Department of Health, Aboriginal Affairs and Reconciliation Division, Native Title Unit, Community and Local Government Relations, Office of Regional Affairs, PIRSA Legal Unit, PIRSA Fisheries and Aquaculture, Fisheries Compliance

Services, Rural Solutions SA, District Council of Tumby Bay, Eyre Regional Development Board, and relevant Tumby Bay Community groups.

The Policy and Report describing the zoning proposal is distributed to key stakeholders as the basis for consultation. These documents are available on the PIRSA Fisheries and Aquaculture website for 2 months.

Public notices are placed in *The Advertiser* and the *Port Lincoln Times* seeking comment from members of the public.

To provide stakeholders with the opportunity to speak directly with PIRSA Fisheries and Aquaculture Officers, public briefings in the region are organised to take place during the 2 month consultation period.

Additionally, all existing lease and licence holders in the aquaculture zone area will be advised during the 2 month consultation period of the policy proposal by letter.

The following stakeholder group meetings and discussions have been held:

Date	Name of Meeting	Attendees
17 December 2010	Interagency Meeting – Proposed Tumby Bay Aquaculture Zone Policy	EPA, PIRSA Fisheries & Aquaculture, DENR, DTEI, SATC
20 January 2011	Personal Communication	Andrew Carr, PIRSA Fisheries Compliance

### 6.3 Potential Effects

The Policy defines aquaculture zones within State waters where specified classes of aquaculture will be permitted and aquaculture zones where no aquaculture will be permitted (i.e. aquaculture exclusion zones) for the waters within the Policy area. Aquaculture has a number of potential economic, social and environmental effects. These are included in the following section. All comments are invited that could improve this information.

Tumby Bay has a number of advantages over potential alternative locations where developers might seek to expand or initiate operations.

Specific favourable attributes of the Tumby Bay Aquaculture Zone include:

- Suitable physical characteristics: the waters off Tumby Bay where the proposed aquaculture zone is to be located are comprised of benthic fauna and flora categorized as sparse. It is in relatively deep water and is suitable for finfish, algae and subtidal shellfish aquaculture.
- Local industry support services including boat launching.
- Basic infrastructure including roads, electricity, telecommunications and, especially in Port Lincoln, fish processing, cold chain facilities and fish waste management facilities.

For existing farmers in the Tumby Bay and Lower Eyre Peninsula area, favourable factors include:

- Familiarity with local waters, infrastructure, institutional conditions, and commercial networks.
- Proximity to existing operations, reducing travel and communications costs.
- Established relationships with service, input providers and workforce participants.

- Optimal environmental conditions for safe operation and maximum productivity (e.g. wave height, currents).

If zoning does not occur in the Tumby Bay area, future aquaculture development would rely on the pilot lease application process (albeit subject to the Development Plan policy) and the full economic potential of the industry is unlikely to be achieved. This is not a strategic planning process and is less streamlined, less efficient, and could lead to an unplanned or ad hoc approach to resource use

### 6.3.1 Economic and Employment Factors

The aquaculture industry plays an important role in creating wealth and prosperity for South Australia, particularly in regional communities (Herreria *et. al.*, 2004; EconSearch, 2014). The aquaculture industry in South Australia has recorded strong growth in volume and product range during the past decade and this trend is set to continue. Aquaculture is evolving, with more environmentally sustainable farming systems and practices such as; inland ventures using recycled water, integrated multi-trophic aquaculture and aquaponic-type production systems.

Aquaculture can provide significant investment and employment opportunities to rural and regional economies. A report completed by EconSearch (2014) estimated the direct output of aquaculture in South Australia in 2012/13 to be \$335m (\$243m on-farm and \$92m in downstream activities). Direct employment was estimated to be in excess of 1,233 full time equivalent positions (FTE) in 2013/14 with 1,391 flow-on jobs, giving total employment of 2,625 FTE, with around 57% of these jobs generated in regional South Australia. The tuna and oyster sectors accounted for the majority of employment in the Eyre Peninsula Region (85%) while 147 FTE positions were engaged in abalone, mussel, marine finfish and other aquaculture enterprises.

Most evidence of the economic benefits of aquaculture zoning is qualitative rather than quantitative.

Aquaculture zoning has a range of potential economic benefits, including:-

- Facilitating industry growth – zoning provides a framework that facilitates the sustainable development of aquaculture activities, therefore helping to promote significant investment and to enhance employment opportunities in rural and regional economies.
- Optimizing the use of the sea – zoning helps to ensure that maximum benefits are derived from the use of the sea by encouraging activities to take place where they bring most value, and do not devalue other activities.
- Reducing costs – zoning can reduce the cost of regulation, planning and decision making, and can eliminate duplication in approval processes. For example by removing the need to obtain Department of Planning and Local Government approval where the aquaculture zone has been included in the Land Not within a Council Area (Coastal Waters) Development Plan.

The provision of tenure for aquaculture will provide the opportunity for investors and farmers to create a sustainable aquaculture industry in the region.

The Tumby Bay aquaculture zone sets a limit of 2,100 tonnes of finfish and 16,200 tonnes of shellfish that can be farmed. The benefits that an industry of the size allowed under this policy could have has not been modelled. However, the economic analysis of 2,000 tonne finfish aquaculture at Offshore Edithburgh calculated a (base case production) direct impact of \$14.1 million including fish processing and transport. An additional \$8.9 million could potentially be generated through flow-on effects, mostly in property and business services, trade, manufacturing, transport and other sectors. This would result in an annual boost to the region of \$23 million. It is also estimated that an industry of this size would directly create approximately 90 FTE in the aquaculture industry and a further 74 flow-on jobs to other occupations, resulting in a total of 164 FTE within the state (EconSearch, 2002). It is important to note,

however, that these employment figures were calculated prior to a significant finfish aquaculture industry and as such should be interpreted with caution.

Similarly, the economic impact of farming 16,200 tonnes of subtidal shellfish allocated for the Tumby Bay aquaculture zone has not been calculated. However, total subtidal shellfish production (mussels) for South Australia in 2013/14 was 1,480 tonnes (EconSearch, 2014). This generated \$6 million in direct impact plus a further \$9.8 million in flow-on impacts. It was estimated that 39 FTE were directly employed by the subtidal shellfish sector with a further 39 FTE supported as a flow-on impact. Therefore, shellfish production generated by the policy is likely to have a significant impact in terms of output and employment for the region.

The expansion of aquaculture in the Tumby Bay area arising from the aquaculture zone policy will have “downstream” implications for existing businesses in terms of maintenance and support services, including the first level of transport, processing, marketing and handling of aquaculture production.

### 6.3.2 Social Effects

The majority of the small communities on Eyre Peninsula, including Tumby Bay, were established to service the agricultural industry. The impact of the rural downturn and employment opportunities provided by the mining boom has led to a drain of its youth to the metropolitan areas and to mining centres. This is evidenced in the Australian Bureau of Statistics census of Tumby Bay in 2004 by the low proportion of 15 to 34 year old percentage of the population (Australian Bureau of Statistics, 2011).

One of the challenges for both the government and the local community is to manage the economic and social changes that will result from an expansion in aquaculture development. Social impacts resulting from zoning may include loss of resource access and amenity, noise and visual impacts, and concerns about the loss of identity, remoteness, naturalness and aesthetic values of a region. However, these have been considered in the location of the proposed aquaculture zone in that it is situated offshore to minimise noise and visual impacts and it contains a broad aquaculture exclusion zone to allow for recreational fishing vessels to navigate to the Sir Joseph Banks group of islands. There has been history of aquaculture and seafood production in the Lower Eyre Peninsula region and this has brought benefits to the local communities in the form of jobs and direct income.

On balance, it is also expected that:

- Additional business and capital may be attracted to the region.
- The population size/demographics of Tumby Bay may be affected.
- Investment may be required to improve infrastructure such as boat ramps and roads (private/public partnerships are a common practice to meet the new requirements where aquaculture is a heavy user of infrastructure).
- The scope for young people to get entry-level training and jobs may increase (Dore *et. al.*, 2000).

### 6.3.3 Environmental Effects

Technical investigations of the Tumby Bay aquaculture zone waters found that the physical characteristics were favourable for both finfish, subtidal shellfish and algae aquaculture and identified the most appropriate areas to promote sustainable development (Parsons Brinkerhoff and SARDI Aquatic Sciences, 2003; Loo *et. al.*, 2010). For example, the flushing rates of 73 times per year (or every 5 days) (Luick and Middleton, 2010) and tidal flows of 21 cm per second are considered sufficiently high to allow the appropriate dispersal of non-solid wastes from licensed sites. Because of the increased likelihood of environmentally sensitive areas, particularly seagrass, being located closer to shore, an aquaculture exclusion zone extending 1 km seaward from the mean high watermark coastline prevents leases in these areas. The technical investigation of the area by SARDI (Loo *et. al.*, 2010)

described seagrass cover as sparse to bare with seagrass recorded at only 2 of 18 sites assessed i.e. 0.4% *Posidonia* sp. and 7.3% *Halophila* sp. cover (Figures 4 and 5).

The Policy does not itself address regional environmental impacts. These are addressed at the licence assessment stage. It should be noted, however, that regional impacts to water quality that affect seagrass are difficult to measure and even more difficult to attribute to the source(s). The Policy recommends conservative biomass limits for finfish to maintain water quality within EPA requirements. These carrying capacity models are developed by SARDI so that no more than what the environment can assimilate will be farmed on the area (Fitzgibbon, 2007). Research underway in Innovative Solutions for Aquaculture Planning and Management 2 (IS-2) 'Carrying Capacity for Spencer Gulf' will provide better models for assessing carrying and assimilative capacity and in turn setting biomass limits to mitigate adverse regional impacts to water quality.

The farming of filter feeding bivalves and macro algae has the potential to offset some of the soluble nutrient waste streams from finfish farming. Currently there is no empirical data to calculate the magnitude of this offset. However, research currently underway is examining how macroalgal culture can mitigate nutrient inputs from finfish farming via the Premier's Science Research Fund project titled "Development of a Sustainable Australian Macroalgal Aquaculture Industry". The project aims to establish South Australia as a lead state in Australia in macroalgal farming and associated research and development. An objective of the research is to turn nutrient enriched waste-water streams into a resource for macroalgal production whilst also delivering environmental benefits to coastal waters.

Risks posed by the aquaculture activity are assessed at the time of licence application through the ESD Assessment process, consistent with the National ESD Framework (Fletcher *et. al.*, 2004). These assessments consider the risk of a variety of impacts to the environment at both the site and regional level. Additionally, the environmental impacts from aquaculture are monitored as part of an Environmental Monitoring Program specific to the class of aquaculture undertaken and stipulated in the *Aquaculture Regulations 2005*. The Minister can alter the maximum biomass limits of all classes of aquaculture through notice in the South Australian Government Gazette. This provides a mechanism to enable flexibility in setting biomass limits for aquaculture zones and sectors and enables future research and environmental monitoring results to be taken into consideration as they become available over time.

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## APPENDIX A – GLOSSARY OF TERMS

<i>Adaptive Management</i>	Management involving active response to new information of the deliberate manipulation of fishing intensity or other aspects in order to learn something of their effects. Within a stock, several sub-stocks can be regarded as experimental units in which alternative strategies are applied.
<i>Assimilative capacity</i>	The capacity of a natural body of water to receive wastewaters without deleterious effects to aquatic life.
<i>Benthic</i>	Of or relating to or happening on the bottom under the ocean/lake.
<i>Biodiversity</i>	The variability among living organisms from all sources (including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part) and includes: (a) diversity within species; and (b) diversity of ecosystems.
<i>Biomass</i>	The total live weight of a group (or stock) of living organisms (e.g. fish, plankton) or of some defined fraction of it (e.g. spawners), in an area, at a particular time.  Any quantitative estimate of the total mass of organisms comprising all or part of a population or any other specified unit, or within a given area at a given time; measured as volume, mass (live, dead, dry or ash-free weight) or energy (joules, calories).
<i>Bivalve mollusc</i>	Any mollusc belonging to the taxonomic class Bivalvia, being characterised by a shell consisting of two hinged sections. Includes clams, cockles, mussels, oysters, pipis and scallops.
<i>Broodstock</i>	Aquatic organisms from which subsequent generations are intended to be produced for the purpose of aquaculture.
<i>Carrying capacity</i>	The maximum population of a given organism that a particular environment can sustain.
<i>Closures</i>	Prohibition of fishing during particular times or seasons (temporal closures) or in particular areas (spatial closures), or a combination of both.
<i>Depauperate</i>	Lacking species variety.
<i>Ecologically sustainable development (ESD)</i>	ESD is described in the <i>Aquaculture Act 2001</i> as:  'Development is ecologically sustainable if it is managed to ensure that communities provide for their economic, social and physical well-being while— (a) natural and physical resources are maintained to meet the reasonably foreseeable needs of future generations; and (b) biological diversity and ecological processes and systems are protected; and (c) adverse effects on the environment are avoided, remedied or mitigated.  In making decisions as to whether development is ecologically sustainable or to ensure that development is ecologically sustainable— (a) long-term and short-term economic, environmental, social and equity considerations should be effectively integrated; and (b) if there are threats of serious or irreversible environmental harm, lack of full scientific certainty should not be taken to justify the postponement of decisions or measures to prevent the environmental harm'.
<i>Ecosystem</i>	A dynamic complex of plant, animal, fungal, and microorganism communities and the associated non-living environment interacting as an ecological unit.



<i>Habitat</i>	The place or type of site in which an organism naturally occurs.
<i>Harvest</i>	A productivity measuring technique relating to the yield of seasonal aquaculture produce.
<i>Infauna</i>	<a href="#">Aquatic</a> organisms (animals only) that live within particulate media such as sediments or soil.
<i>Mapcode</i>	Fishing area defined for catch and effort statistics
<i>Marine Park</i>	Means an area established as a marine park under Part 3 Division 1 of the <i>Marine Parks Act 2007</i> .
<i>Marine protected area (MPA)</i>	An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity and of natural resources, and managed through legal or other effective means.
<i>Mean High Water Springs</i>	The line representing the average of all high water observations at the time of spring tide over a period of 19 years.
<i>Organic enrichment</i>	The supply of organic material (eg waste feed, faeces) to the seafloor.
<i>Population</i>	A group of individuals of the same species, forming a breeding unit and sharing a habitat.
<i>Spatial</i>	Of or relating to space.
<i>Stakeholder</i>	An individual or a group with an interest in the conservation, management and use of a resource.
<i>Stock</i>	A group of individuals of a species occupying a well defined spatial range independent of other groups of the same species, which can be regarded as an entity for management or assessment purposes.
<i>Supplementary fed</i>	Supplementary feeding is the giving of feed to aquatic organisms to supplement any naturally available food.

## APPENDIX B – LIST OF ACRONYMS

CRC	Cooperative Research Centre
DAAR	Department for Aboriginal Affairs and Reconciliation
DAC	Development Assessment Commission
DENR	South Australian Department of Environment and Natural Resources
DTEI	Department for Transport, Energy and Infrastructure
DFW	Department for Water
EMP	Environmental Monitoring Program
EPA	Environment Protection Authority
EPBC Act	The Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
ERDC	Environment, Resources and Development Committee
ESD	Ecological Sustainable Development
FTE	Full Time Equivalent
ILUA	Indigenous Land Use Agreement
LGA	Local Government Association
MHWS	Mean High Water Springs
MPA	Marine Protected Area
NPW Act	<i>National Parks and Wildlife Act 1972</i>
NRM	Natural Resource Management
PIRSA	Department of Primary Industries and Regions, South Australia
SARDI	South Australian Research and Development Institute
SATC	South Australian Tourism Commission
The Minister	Minister for Agriculture, Food and Fisheries

## APPENDIX C – MAPS AND COORDINATES

A written description of the Tumby Bay aquaculture zone and the Tumby Bay aquaculture exclusion zone is provided in the Policy.

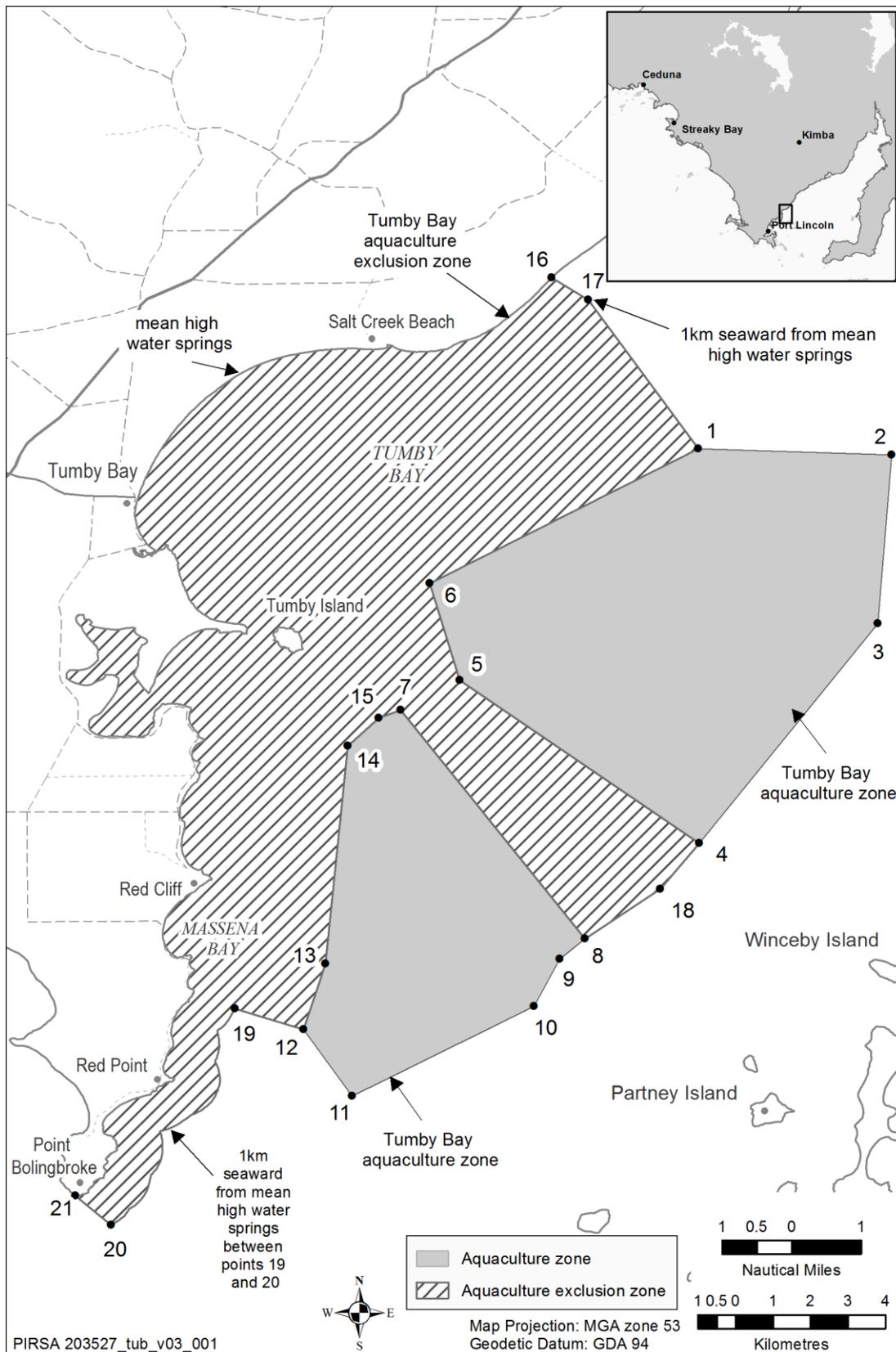


Figure 1. Overview of Tumby Bay aquaculture zone and the Tumby Bay aquaculture exclusion zone.

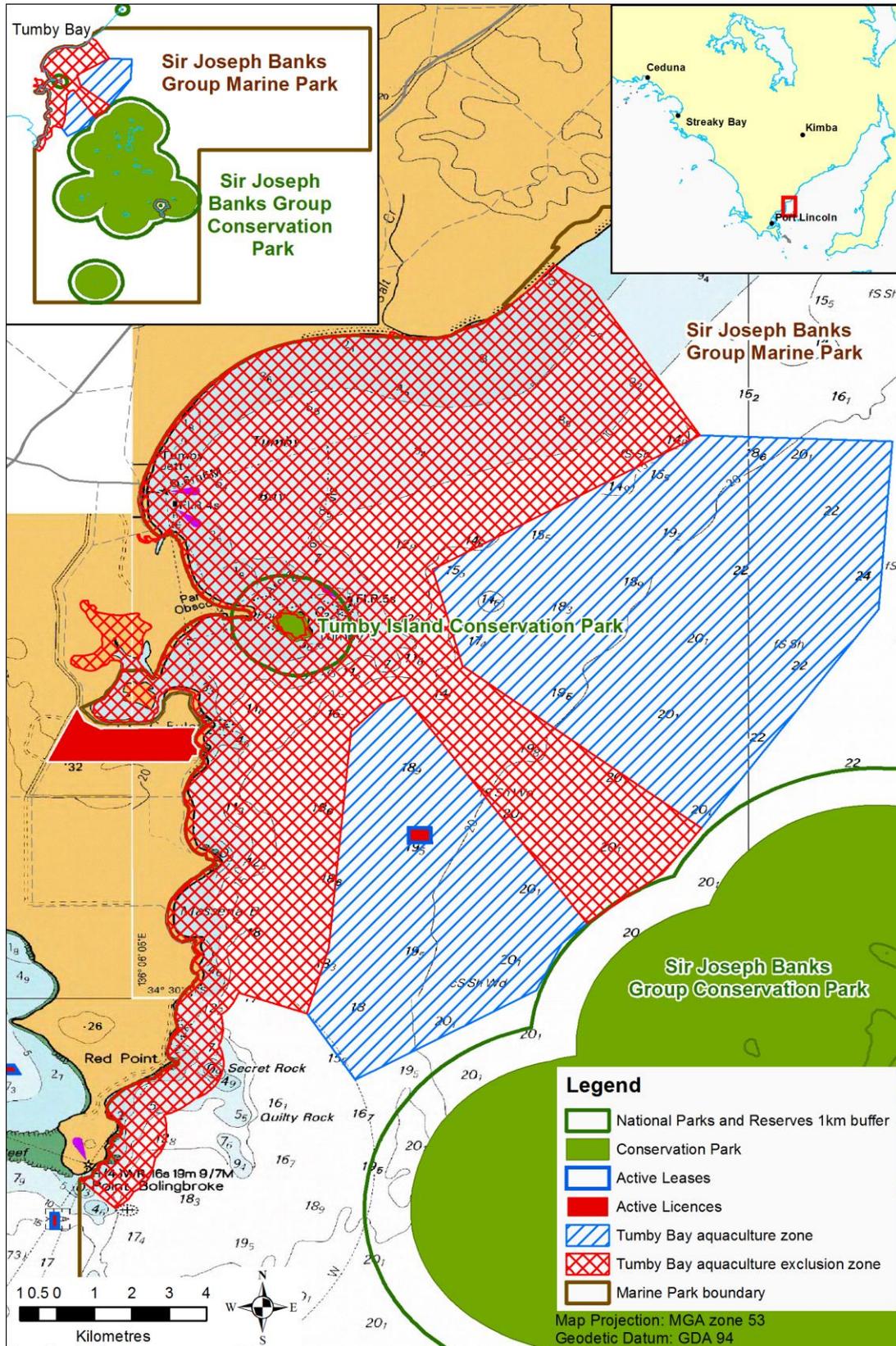


Figure 2. Overlay of the Tumby Bay aquaculture zone and exclusion zone showing existing leases, depth analysis and proximity to Marine and Conservation Park boundaries.

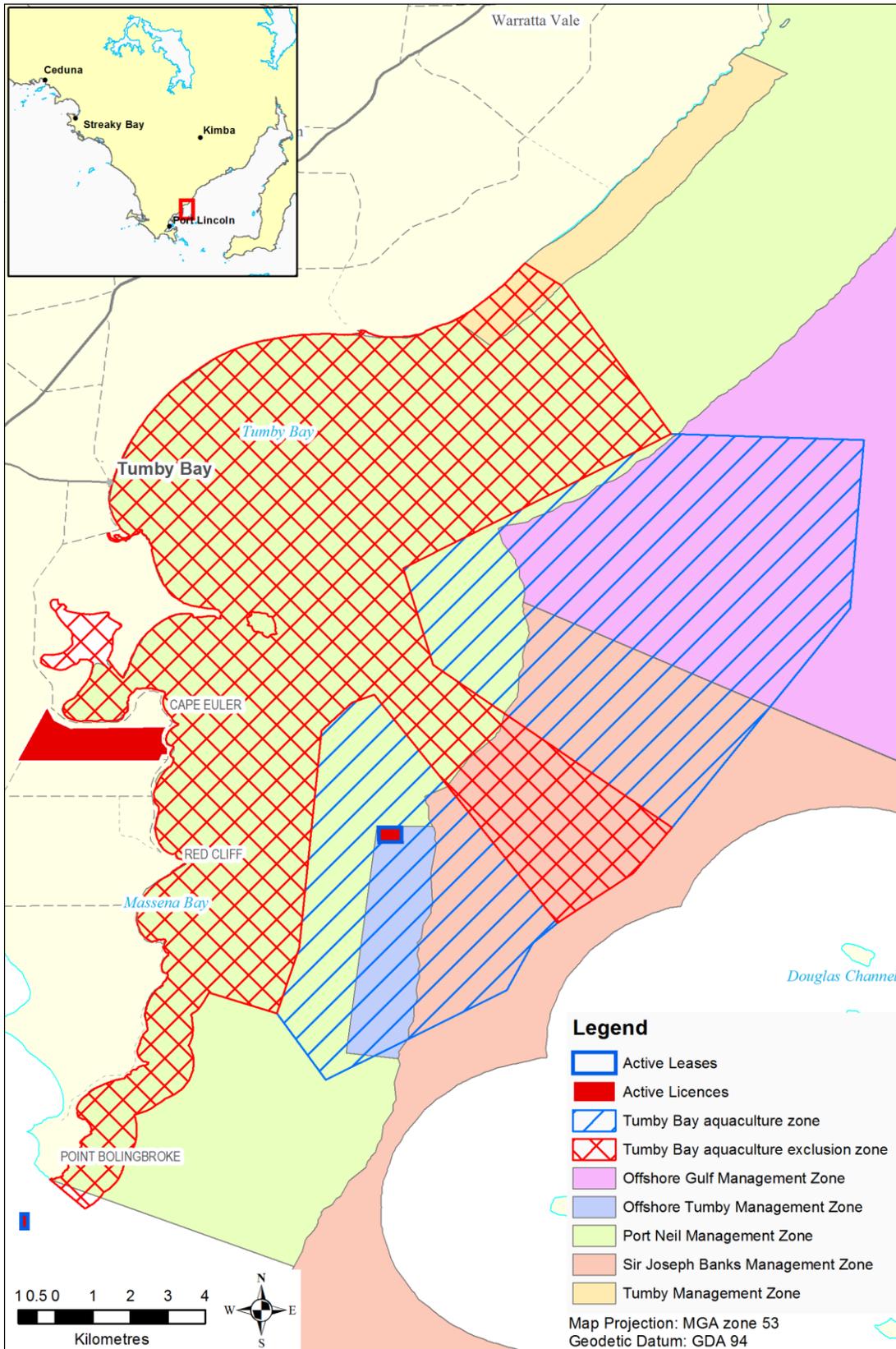


Figure 3. Overlay of the Tumby Bay aquaculture zone and aquaculture exclusion zone with previous Spencer Gulf Management Plan aquaculture zones.

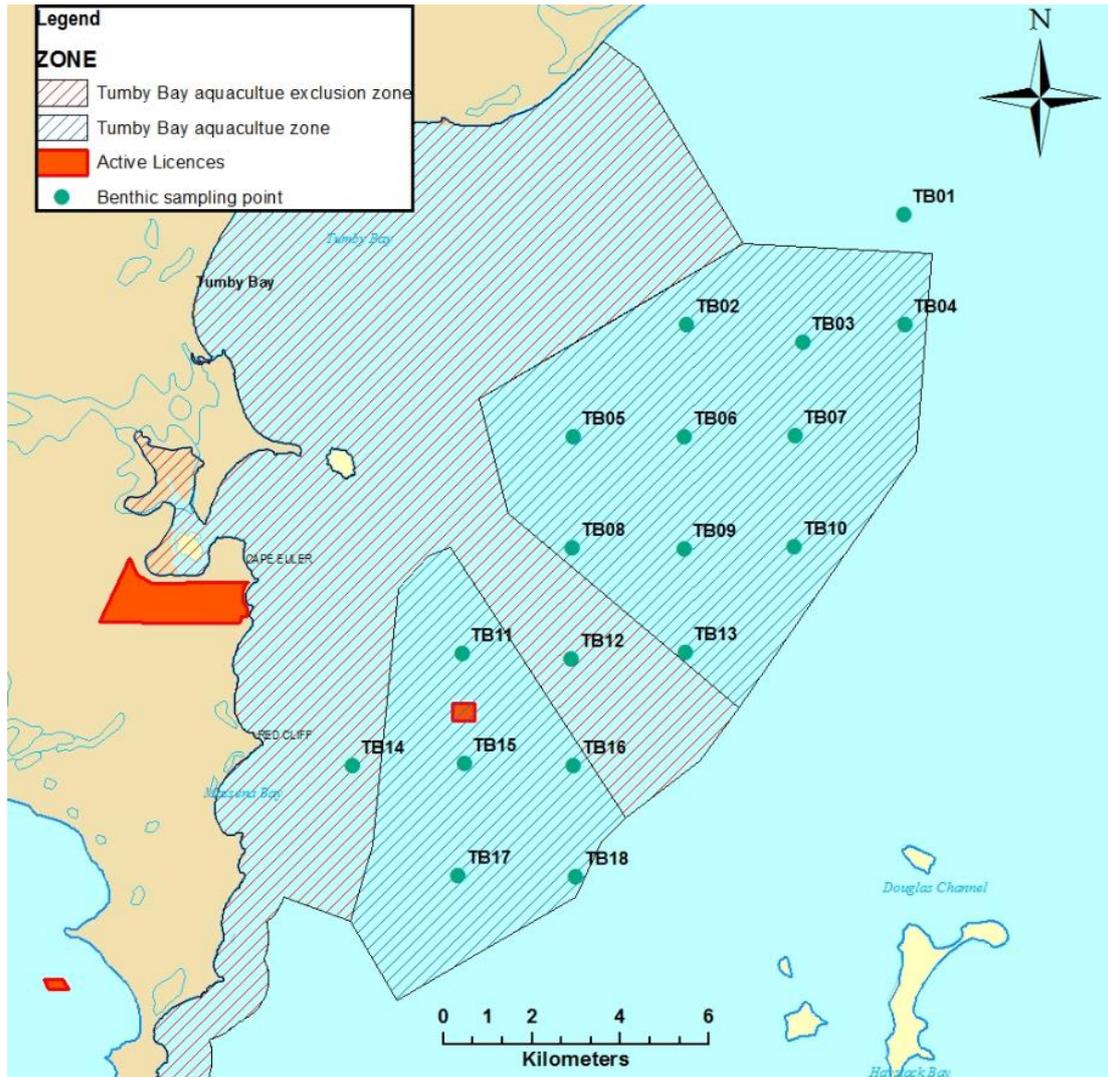


Figure 4. Overlay of the Tumbly Bay aquaculture zone and exclusion showing the spatial distribution of epibenthic sampling locations from the SARDI technical investigation

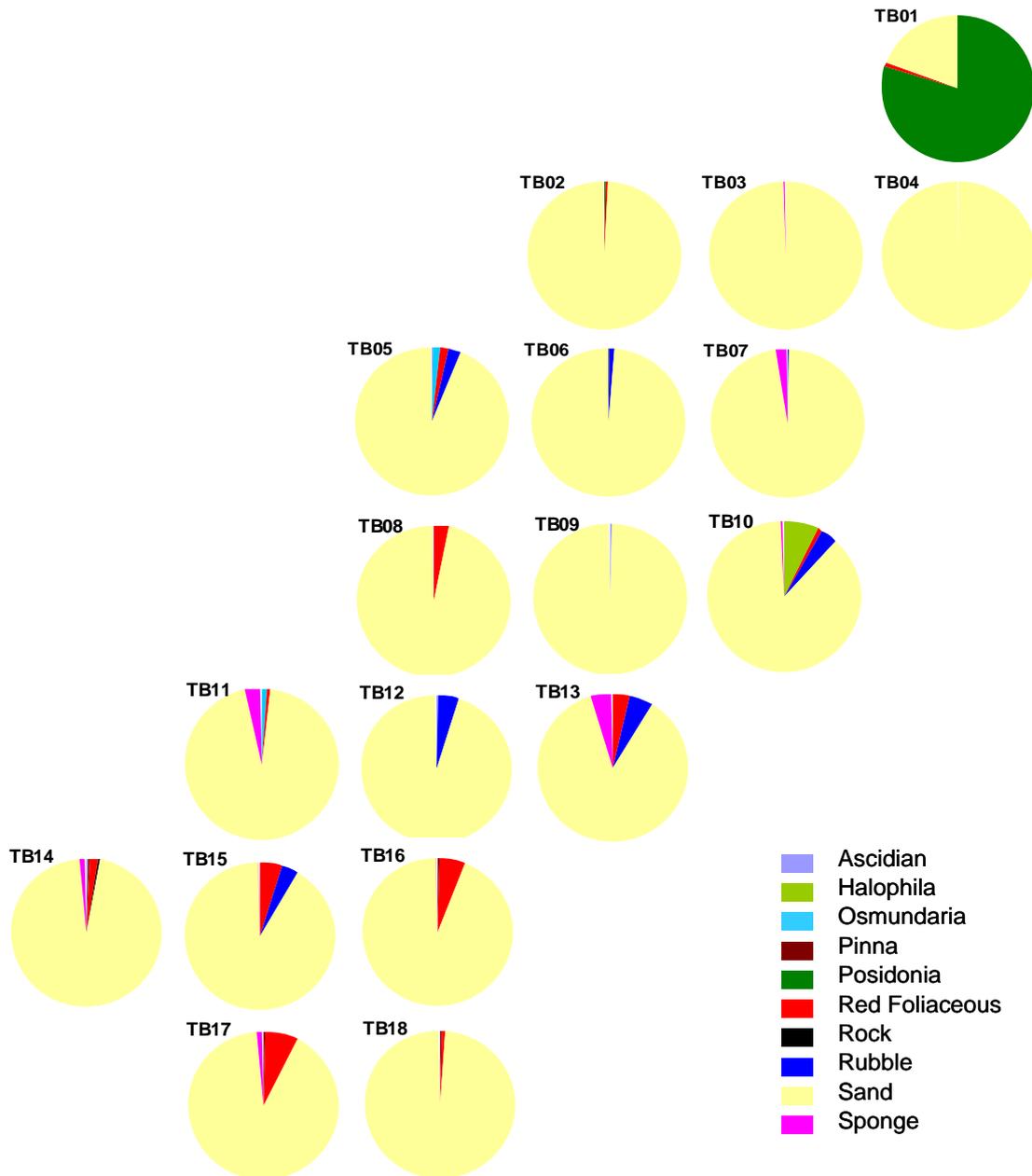


Figure 5. Percentage cover of benthos and substrate at each site in the Tumby Bay zone. Location of pies is relative to sampling location.

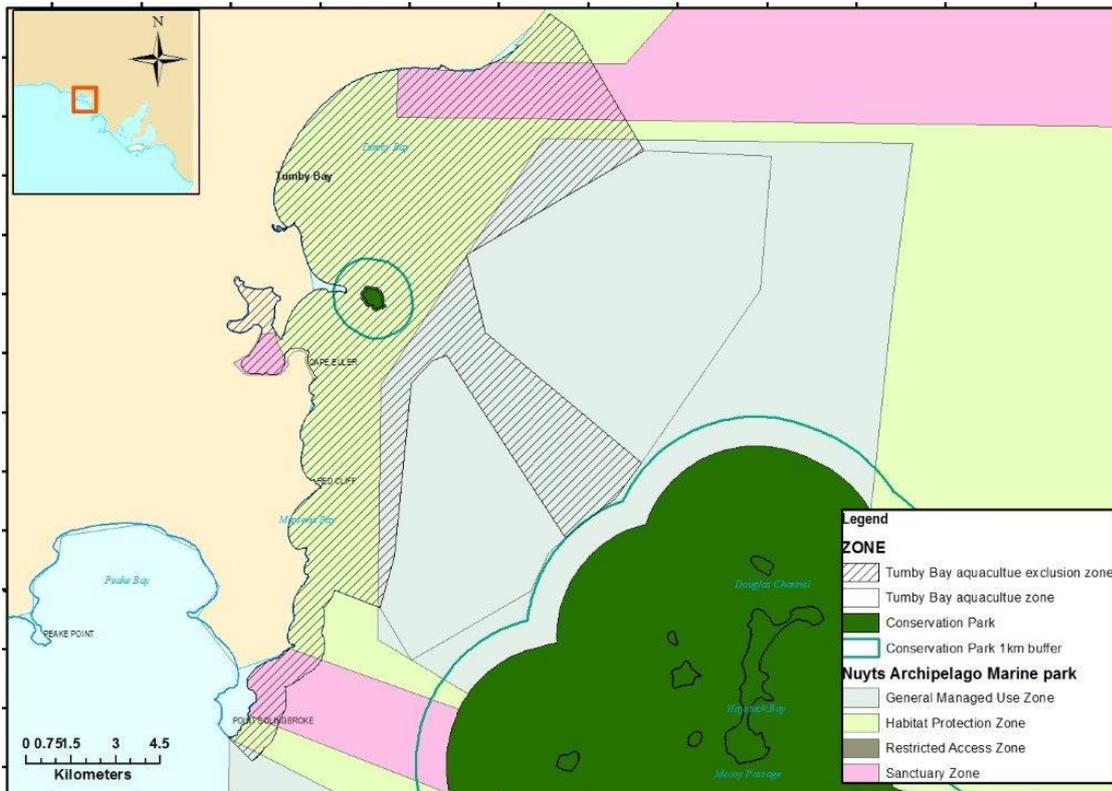


Figure 6. Overlay of the Tumby Bay aquaculture zone and exclusion zone with Marine Park boundaries.

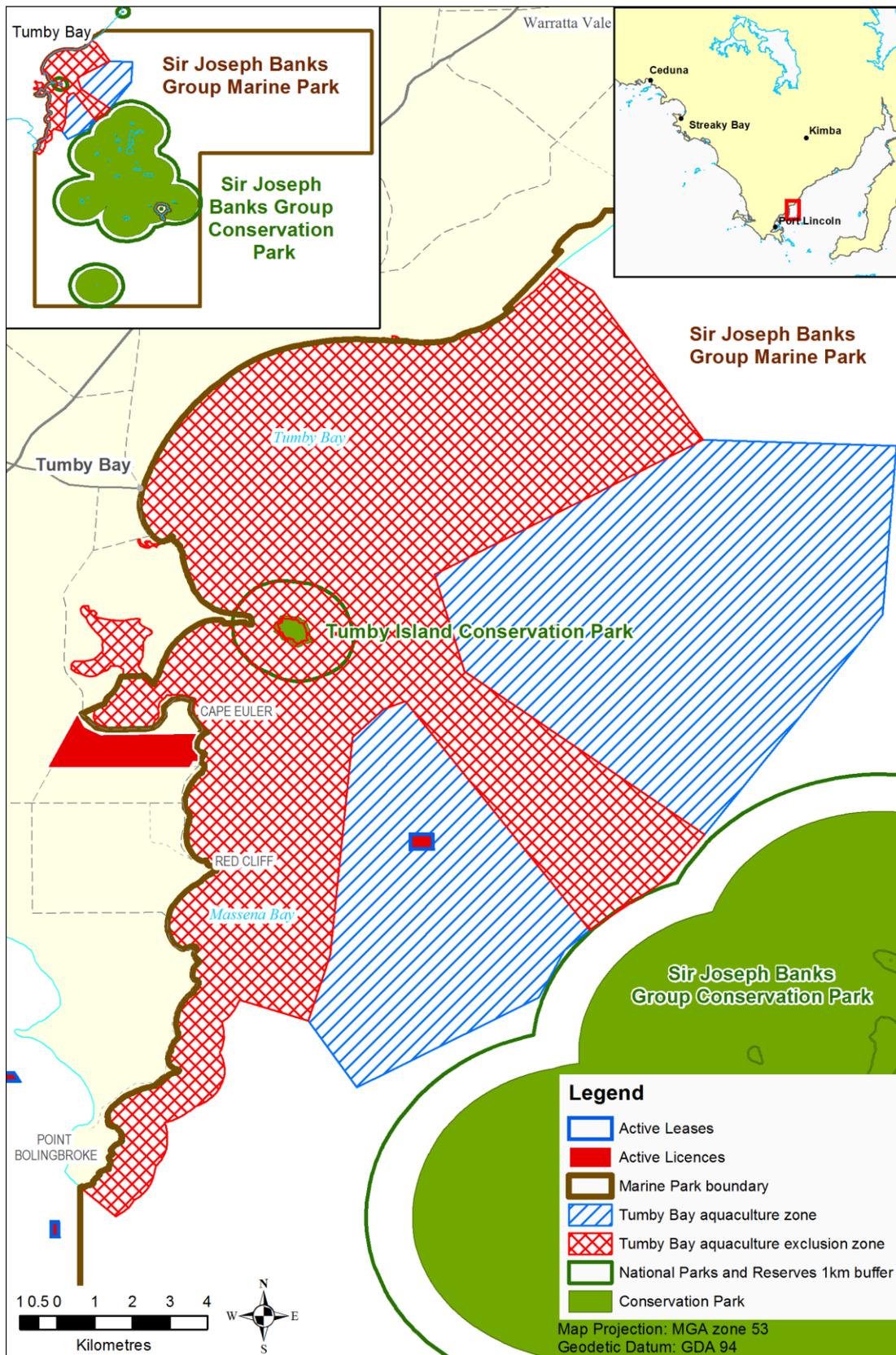
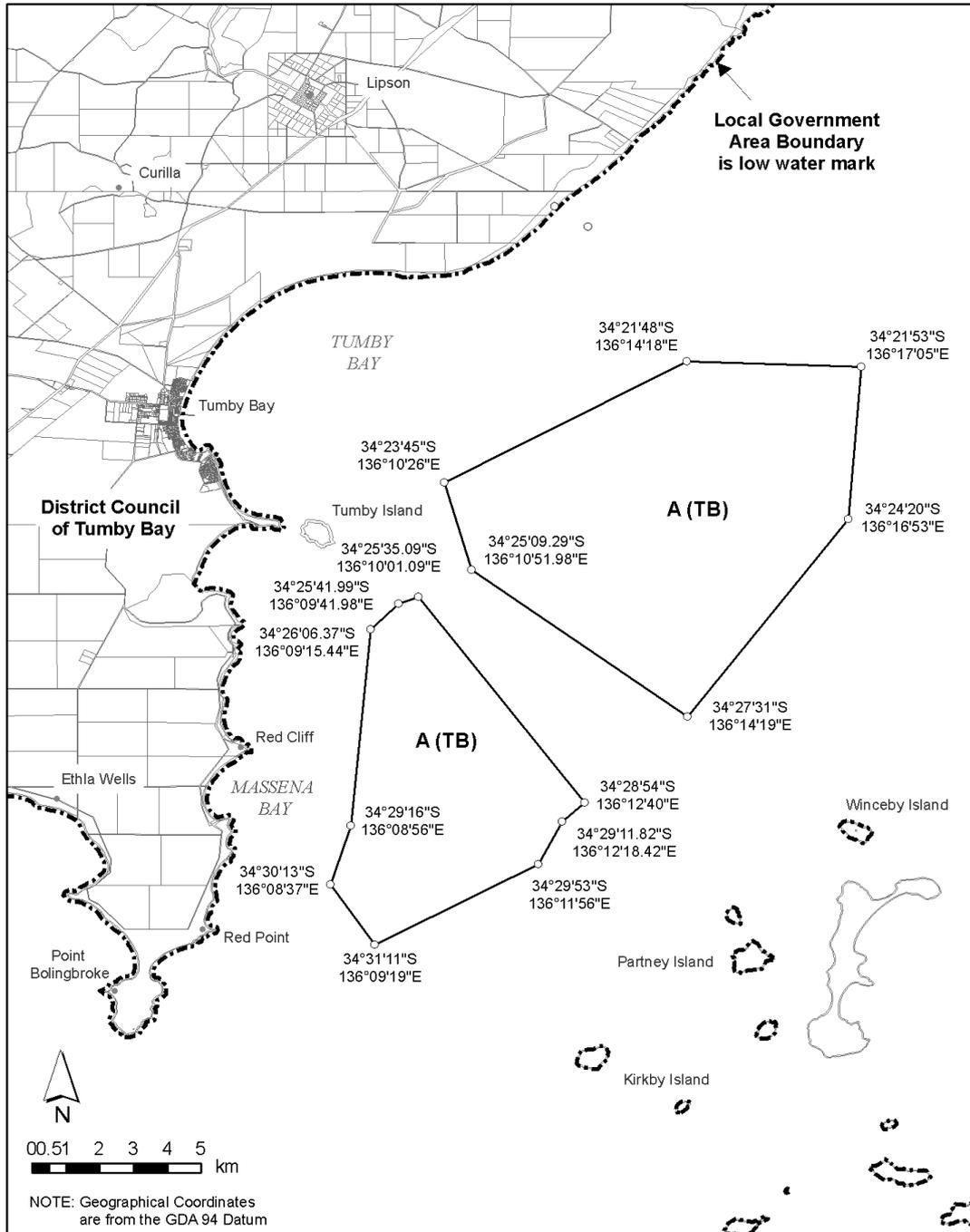


Figure 7. Overlay of the Tumby Bay aquaculture zone and exclusion zone with National Park and Reserves.



**LAND NOT WITHIN A COUNCIL AREA  
(COASTAL WATERS)  
TUMBY BAY  
MAP LNWCA(CW)/?**

- A** Aquaculture (Tumby Bay) Zone
- Zone Boundary
- - - - - Development Plan Boundary

Figure 8. New zoning map to delineate the extent of the Aquaculture (Tumby Bay) Zone under the Land Not Within A Council Area (Coastal Waters) development plan.



Figure 9. Approximate location of an Aboriginal archaeological site determined from the Register of Aboriginal Sites and Objects administered by the Department of the Premier and Cabinet-Aboriginal Affairs and Reconciliation Division.

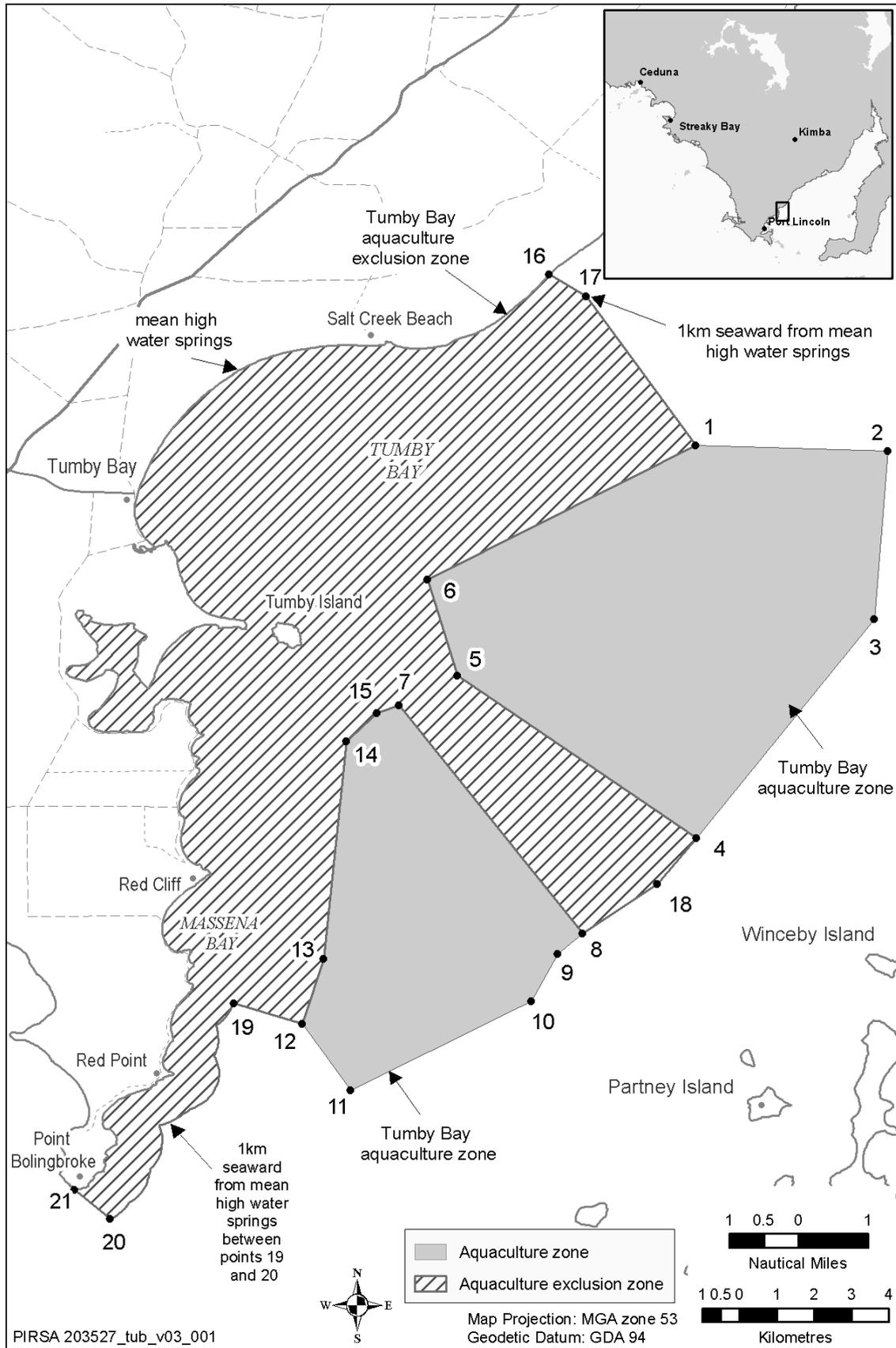


Figure 10. Schedule 2—Amendment of maps overview of Tumby Bay aquaculture zone and Tumby Bay aquaculture exclusion zone.

## APPENDIX D1 – BACKGROUND INFORMATION

Legislation / Policy	Objectives	Consistency
<p>South Australia's Strategic Plan</p>	<p>South Australia's Strategic Plan is a commitment to making the state the best it can be – prosperous, environmentally rich, culturally stimulating, offering its citizens every opportunity to live well and succeed. The Plan is built on the following objectives:</p> <ul style="list-style-type: none"> <li>Growing Prosperity</li> <li>Improving Wellbeing</li> <li>Attaining Suitability</li> <li>Fostering Creativity and Innovation</li> <li>Building Commitments</li> <li>Expanding Opportunities</li> </ul> <p>The Plan contains 98 targets across the six objectives to measure progress towards achieving these goals.</p>	<p>Aquaculture policies under the <i>Aquaculture Act 2001</i> provide the necessary policy framework to facilitate aquaculture development in South Australia. The new and developing aquaculture industry is greatly assisting economic development and will help meet these Strategic Plan targets:</p> <ul style="list-style-type: none"> <li>• Target 1.1 – Economic Growth</li> <li>• Target 1.5 – Business Investment</li> <li>• Target 1.10 – Jobs</li> <li>• Target 1.14 – Total Exports</li> </ul>
<p>Planning Strategy for Regional South Australia (January 2003 – amended Dec 2007) (DPLG document)</p>	<p>The Planning Strategy for Regional South Australia (January 2003, as amended December 2007) contains a number of strategies to support future growth in regional South Australia.</p> <ul style="list-style-type: none"> <li>• Building and/or supporting sustainable communities;</li> <li>• Being more efficient and sustainable;</li> <li>• Diversifying primary production into new areas to replace or complement existing activities;</li> <li>• Adding value by greater processing of produce within South Australia instead of exporting produce in its raw state;</li> <li>• Facilitating sustainable tourism development to achieve economic, social and environmental benefits for the state; and</li> <li>• Integrated and sustainable management of natural resources in a manner that maintains ecological processes.</li> </ul>	<p>The Policy is consistent with the strategies relating to the diversifying primary production into new areas to replace or complement existing activities and the integrated and sustainable management of natural resources in a manner that maintains ecological processes.</p>
<p><i>Development Act 1993</i></p>	<p>The <i>Development Act 1993</i> and <i>Development Regulations 2008</i> detail the processes for making and assessing development applications.</p>	<p>This Policy is consistent with these provisions in that it seeks to ensure the ecologically sustainable development of the marine-based aquaculture industry</p>

Legislation / Policy	Objectives	Consistency
<p><i>Development Regulations 2008</i></p> <p>Land Not Within A Council Area (Coastal Waters) Development Plan</p>	<p>'Development' is defined in the <i>Development Act 1993</i> to include:</p> <ul style="list-style-type: none"> <li>• A change in the use of land or buildings</li> <li>• The creation of new allotments through land division (including Strata and Community Title division)</li> <li>• Building work (including construction, demolition, alteration and associated excavation/fill)</li> <li>• Cutting, damaging or felling of <a href="#">significant trees</a></li> <li>• Specific work in relation to State and Local Heritage Places</li> <li>• Prescribed mining operations</li> <li>• Other acts or activities in relation to land as declared by the Development Regulations.</li> </ul> <p>The <i>Development Act 1993</i> requires there be a Development Plan for each part of the state. Development Plans guide development and inform assessment of development applications.</p> <p>Development Plans contain the zones, maps and written rules ('policies') which guide applicants as to what can and cannot be done in the future on any piece of land in the area covered by the Development Plan. These zones, maps and policies provide the detailed criteria against which development applications will be assessed.</p> <p>The policies and zoning in Development Plans need to be changed and updated over time. The <i>Development Act 1993</i> provides the legislative framework for undertaking amendments to a Development Plan. Amendments can be instigated by either the relevant Council or the Minister for Planning. The document used to propose changes to a Development Plan is called a Development Plan Amendment (DPA).</p> <p>The <i>Development Regulations 2008</i> recognise aquaculture zones identified in an aquaculture policy prepared under the <i>Aquaculture Act 2001</i>, classing them as a Category 1 development. The <i>Aquaculture Act 2001</i> and Regulations also enable the Minister for Planning to amend a development plan in accordance with an approved aquaculture policy under the <i>Aquaculture Act 2001</i>.</p> <p>Recent amendments to the <i>Development Act 1993</i> mean that aquaculture is not "development" under that Act if it is located within an aquaculture zone and within the LNWCA(Coastal Waters) Development Plan. Aquaculture within the designated aquaculture zone will not be subject to development assessment. However, aquaculture proposed outside of this zone will remain subject to full development assessment.</p> <p>More information on the Land Not Within a Council Area (Coastal Waters) Development Plan can be sourced by contacting the Department of Planning and Local Government on 08 8303 0600.</p>	<p>and recognises and respects other users of the marine resource.</p>

Legislation / Policy	Objectives	Consistency
<p><i>Aboriginal Heritage Act 1988</i></p>	<p>The <i>Aboriginal Heritage Act 1988</i> provides for the protection and preservation of Aboriginal sites, objects and remains, whether registered or not, without an authorisation from the Minister for Aboriginal Affairs and Reconciliation pursuant to section 23. Section 20 of this Act requires that any Aboriginal sites, objects or remains discovered on land, be reported to the Minister for Aboriginal Affairs and Reconciliation.</p> <p>The <i>Native Title Act 1993</i> (Cwth) provides for the recognition by Australian law that some Indigenous people have rights and interests that come from their traditional laws and customs (National Native Title Tribunal (NNTT) 2009).</p> <p>In particular, the <i>Native Title Act 1993</i> may validate past acts; provide for future acts; extinguish native title either in full or part; provide a process to determine native title; provides three approaches to negotiating native title, including Indigenous Land Use Agreements (ILUA); and, provides for a range of other matters including the establishment of a land trust and the National Native Title Tribunal.</p> <p>Resolution of native title claims by either consent determination or by recognition of an ILUA is a key focus in South Australia and is a key target in South Australia's Strategic Plan. Specifically, target 3.15 of the Strategic Plan aims to resolve 75% of native title claims in South Australia by 2014.</p>	<p>The Native Title Unit of the Attorney General's Department are consulted during the development of aquaculture policies to establish if there are any registered ILUA's in the area or if there are any in negotiation that need to be considered. Additionally, advice is sought from the Native Title Unit to determine who are the appropriate Native Title Groups to consult during the development of the policy. In the case of this Tumbly Bay aquaculture zone policy it is Barngarla group (represented by Phillip Teitzel).</p> <p>As part of the individual lease application process (within and outside of aquaculture zones) details of the application are referred to the Aboriginal Legal Rights Movement and the appropriate Claimant groups pursuant to section 24HA of the <i>Native Title Act 1993</i> (Cwth).</p>
<p>Australia's Ocean Policy (Cth)</p>	<p>Australia's Oceans Policy sets in place a framework for integrated and ecosystem-based planning and management for Australia's marine jurisdictions. It promotes ecologically sustainable development of the ocean resources and encourages internationally competitive marine industries, whilst ensuring the protection of marine biological diversity. The key tool is Regional Marine Planning i.e., planning based on large areas that are ecologically similar, and seeks to integrate the use, management and conservation of marine resources at the ecosystem level.</p> <p>Marine Plans establish an overarching strategic planning framework to guide State and local government planners and natural resource managers in the development and use of the marine environment. Fundamental to these Marine Plans is an ecologically based zoning model. Each of these zones is supported by goals and objectives.</p>	<p>This policy is consistent with the Australia's Ocean Policy as it seeks to avoid aquaculture development over unique and sensitive ecosystems, and provides for orderly, sustainable and internationally competitive marine industries.</p>
<p><i>Marine Parks Act 2007</i></p>	<p>The <i>Marine Parks Act 2007</i> provides the legislative framework for the dedication, zoning and management of South Australia's marine parks.</p> <p>South Australia's marine parks will be zoned for multiple-use to protect coastal, estuarine and marine ecosystems, while also providing for continued ecologically sustainable use of suitable areas. This means that most activities, including aquaculture operations, will still be allowed within a marine park. However, some activities will not be permitted in particular zones. Areas with high conservation values will be</p>	<p>It is widely recognised that Aquaculture is an important and growing industry in this State that provides significant benefits to South Australia. The needs of the industry have been considered with commitments to accommodate, as far as possible, existing aquaculture operations. This has resulted in whole-of-government policy commitments and a draft Memorandum of</p>

Legislation / Policy	Objectives	Consistency
	<p>designated as either Restricted Access Zones or Sanctuary Zones to provide the necessary level of protection for habitats, species, ecological and geological features. Both of these zones preclude commercial fishing, recreational fishing and aquaculture operations.</p>	<p>Administrative Agreement between PIRSA and the Department of Environment and Natural Resources. Together these support the relationship and likely interactions between proposed marine parks and aquaculture developments in South Australian waters and enable DENR and PIRSA to work together to address key targets from South Australia's Strategic Plan. These include increasing the value of South Australia's export income by \$25 billion by 2020 (Target 37) and maintaining the health and diversity of South Australia's unique marine environments (Target 71) and such that each is given optimal effect without detriment to the other.</p> <p>The Policy has been prepared having regard to Marine Park objects and boundaries and in accordance with the agreement between DENR and PIRSA.</p>
<p><i>Natural Resources Management Act 2004</i>  Eyre Peninsula Natural Resources Management Plan</p>	<p>The intent of the <i>Natural Resources Management Act 2004</i> is to establish an integrated system of natural resource management that will assist in achieving sustainable natural resource management in South Australia. Regional Natural Resources Management Plans are underpinned by ecologically sustainable development principles and are required to recognise best practice by an industry sector.</p>	<p>The <i>Aquaculture Act 2001</i> and its supporting policies are also underpinned by ecologically sustainable development principles.</p> <p>The Policy lies within the Eyre Peninsula Natural Resources Management Board. The Policy must take into consideration issues raised within the Eyre Peninsula Natural Resources Management Plan (NRM Plan). As the proposed aquaculture zone relates only to marine aquaculture there are no matters of water allocation, groundwater or surface water, specific to the aquaculture zone. The policy is consistent with the Eyre Peninsula NRM Plan.</p>
<p><i>Environment Protection Act 1993</i></p>	<p>The Objects of the <i>Environment Protection Act 1993</i> (EP Act) include the promotion of the principles of ecologically sustainable development, and in particular, to prevent, reduce, minimise and, where practicable, eliminate harm to the environment. The EP Act provides that communities must be able to provide for their economic, social and physical well being.</p> <p>The principle object of the <i>Environment Protection (Water Quality) Policy 2003</i> (Water Quality Policy)</p>	<p>This Policy is consistent with the provisions of the EP Act 1993 and the Water Quality Policy as it seeks to minimise or prevent harm to the environment associated with aquaculture.</p>

Legislation / Policy	Objectives	Consistency
<p><i>Environment Protection (Water Quality) Policy 2003</i></p>	<p>established under the EP Act is to achieve the sustainable management of waters by protecting or enhancing water quality while allowing economic and social development. In particular, the Policy requires all reasonable and practicable measures to be taken to avoid the discharge or deposit of waste into any waters or onto a place from which it is reasonably likely that waste will enter any waters. The Policy prescribes water quality criteria that must not be contravened and prohibits the discharge or deposition of pollutants into any waters that results in:</p> <ul style="list-style-type: none"> <li>• Loss of sea grass or other native aquatic vegetation; or</li> <li>• Reduction in numbers of any native species of aquatic animal or insect; or</li> <li>• Increase in numbers of any non-native species of aquatic animals or insect; or</li> <li>• Reduction in numbers of aquatic organisms necessary to a healthy aquatic ecosystem; or</li> <li>• Increase in algal or aquatic plant growth; or</li> <li>• Water becoming toxic to vegetation on land; or</li> <li>• Water becoming harmful or offensive to humans, livestock or native animals; or</li> <li>• Increased turbidity or sediment levels.</li> </ul>	
<p><i>Harbors and Navigation Act 1993</i></p>	<p>The <i>Harbors and Navigation Act 1993</i> sets out the following objectives:</p> <ul style="list-style-type: none"> <li>• To provide for the efficient and effective administration and management of South Australian harbors and harbor facilities for the purpose of maximising their use and promoting trade;</li> <li>• To ensure that efficient and reliable cargo transfer facilities are established and maintained;</li> <li>• To promote the safe, orderly and efficient movement of shipping within harbors;</li> <li>• To promote the economic use and the proper commercial exploitation of harbors and harbor facilities;</li> <li>• To provide for the safe navigation of vessels in South Australian waters;</li> <li>• To provide for the safe use of South Australian waters for recreational and other aquatic activities; and</li> <li>• Insofar as this Act applies to the Adelaide Dolphin Sanctuary, to further the objects and objectives of the <i>Adelaide Dolphin Sanctuary Act 2005</i>.</li> </ul>	<p>Under the <i>Aquaculture Act 2001</i>, aquaculture policies can be prescribed in State waters. These policies define areas of state waters that are considered appropriate for aquaculture, and have regard to other resource users; including operators of recreational and commercial vessels.</p> <p>Section 20 of the <i>Aquaculture Act 2001</i> provides that the grant of aquaculture leases is subject to the concurrence of the Minister responsible for administration of the <i>Harbors and Navigation Act 1993</i>.</p>

Legislation / Policy	Objectives	Consistency
<p><i>Coast Protection Act 1972</i></p>	<p>The <i>Coast Protection Act 1972</i> establishes the Coast Protection Board. The functions of the Board are:</p> <ul style="list-style-type: none"> <li>• To protect the coast from erosion, damage, deterioration, pollution and misuse;</li> <li>• To restore any part of the coast that has been subjected to erosion, damage, deterioration, pollution or misuse;</li> <li>• To develop any part of the coast for the purpose of aesthetic improvement, or for the purpose of rendering that part of the coast more appropriate for the use or enjoyment of those who may resort thereto;</li> <li>• To manage, maintain and, where appropriate, develop and improve coast facilities that are vested in, or are under the care, control and management of the Board;</li> <li>• To report to the Minister responsible for administration of the <i>Coast Protection Act 1972</i> upon any matters that the Minister may refer to the Board for advice;</li> <li>• To carry out research, to cause research to be carried out, or to contribute towards research, into matters relating to the protection, restoration or development of the coast; and</li> <li>• To perform such other functions assigned to the Board by or under this or any other Act.</li> </ul>	<p>The Policy is consistent with the provisions of the <i>Coast Protection Act 1972</i> as it seeks to protect the coast by minimising any risk of erosion, damage, deterioration, pollution and misuse of the resource, through appropriate siting of aquaculture zones and aquaculture exclusion zones, the specification of appropriate types and levels of aquaculture development.</p>
<p><i>Native Vegetation Act 1991</i></p>	<p>The objects of the <i>Native Vegetation Act 1991</i> are:</p> <ul style="list-style-type: none"> <li>• The conservation, protection and enhancement of the native vegetation of the State and, in particular, remnant native vegetation, in order to prevent further -</li> <li>• Reduction of biological diversity and degradation of the land and its soil; and</li> <li>• Loss of quantity and quality of native vegetation in the State; and</li> <li>• Loss of critical habitat; and</li> <li>• The provision of incentives and assistance to landowners to encourage the commonly held desire of landowners to preserve, enhance and properly manage the native vegetation on their land; and</li> <li>• The limitation of the clearance of native vegetation to clearance in particular circumstances including circumstances in which the clearance will facilitate the management of other native vegetation or will facilitate the sustainable use of land for primary production; and</li> <li>• The encouragement of research into the preservation, enhancement and management of native</li> </ul>	<p>The Policy is consistent with these objectives as it seeks to minimise impacts on native vegetation through appropriate siting of aquaculture zones and the establishment of aquaculture exclusion zones around sensitive habitats.</p>

Legislation / Policy	Objectives	Consistency
	vegetation; and <ul style="list-style-type: none"> <li>The encouragement of the re-establishment of native vegetation in those parts of the State where native vegetation has been cleared or degraded.</li> </ul>	
<i>Historic Shipwrecks Act 1976 (Cth)</i>  <i>Historic Shipwrecks Act 1981 (SA)</i>	<p>Any shipwreck or relic that is older than 75 years is protected under the <i>Historic Shipwrecks Act 1976 (Cth)</i>, which covers water off the South Australian coast from the low water mark or the agreed baselines but does not include State internal waters – ie the River Murray, Gulf St. Vincent, Spencer Gulf, Encounter Bay, Lacedpede Bay, Rivoli Bay and Anxious Bay – which are covered under the <i>Historic Shipwrecks Act 1981 (SA)</i>.</p> <p>If there are declared historic shipwrecks in the vicinity of aquaculture development, the developer is advised that a 550 metre radius buffer zone applies around the historic shipwreck, and that no aquaculture development should take place within this area.</p> <p>It should also be noted that while a shipwreck may not currently be protected, the 75 year rolling protections date means that it will be at some future time.</p>	<p>The Policy is consistent with these requirements and provides for a greater distance from historic shipwrecks of 550 metres which is requirement of the Land Not Within A Council Area (Coastal Waters) Development Plan under the <i>Development Act 1993</i>.</p>
<i>National Parks and Wildlife Act 1972</i>	<p>An Act to provide for the establishment and management of reserves for public benefit and enjoyment; to provide for the conservation of wildlife in a natural environment; and for other purposes.</p>	
<i>Fisheries Management Act 2007</i>	<p>An Act to provide for the conservation and management of the aquatic resources of the State, the management of fisheries and aquatic reserves, the regulation of fishing and the processing of aquatic resources, the protection of aquatic habitats, aquatic mammals and aquatic resources and the control of exotic aquatic organisms and disease in aquatic resources; to repeal the <i>Fisheries Act 1982</i> and the <i>Fisheries (Gulf St. Vincent Prawn Fishery Rationalisation) Act 1987</i>; to make related amendments to other Acts; and for other purposes.</p>	<p>To minimise adverse interactions with seabirds and large marine vertebrates, section 19 of the <i>Aquaculture Regulations 2005</i> requires a licensee to have a written interaction strategy approved by the Minister. In addition, risks posed by the aquaculture activity are assessed at the time of licence application through the ESD Assessment process, consistent with the National ESD Framework (Fletcher <i>et al.</i>, 2004).</p>

## APPENDIX D2 – AQUACULTURE ZONING FRAMEWORK

The Policy defines the broad framework for aquaculture management within the defined aquaculture zones, including the prescribed criteria that apply to each aquaculture zone/sector. More detailed considerations such as the size of each lease, the farming structures permitted on each licence and the stocking densities for different species is assessed and managed at the individual lease and licence level. Such management tools do not form part of the zoning policy.

Approval of leases and licenses in aquaculture zones will be subject to the provisions of the *Aquaculture Act 2001* and the *Aquaculture Regulations 2005*, and relevant lease and licence conditions. An assessment of individual site suitability (including an Environmental Sustainability Development Assessment) and criteria outlined in the Aquaculture Tenure Allocation Policy are considered during the assessment. Ongoing environmental monitoring provides information that is an important input to the adaptive management of aquaculture. Further information about licensing is provided in part D4 and D5 of this Appendix.

### *Carrying Capacity and Assimilative Capacity*

The concepts of 'carrying capacity' and 'assimilative capacity' are important and interrelated tools for natural resource management. Carrying capacity equates to the biomass (tonnage) of culture product that can be added to the environment at a rate that can be assimilated by the environment without significant environmental changes. Assimilative capacity refers to the extent to which the environment can cope with a particular activity without unacceptable change (O'Bryen and Lee, 2003).

Estimating carrying and assimilative capacities for finfish aquaculture is a relatively simpler task than for shellfish or algae. This is largely due to the additive versus extractive nature of finfish production compared to shellfish or algae production. For finfish aquaculture, it is possible to determine, using mass balance equations of the type described by Beveridge (1987), the changes in concentration of nitrate and ammonia in the water column. The level of confidence in these estimations reflects the empirical understanding of sources and sinks for these waste products and their interaction.

Due to physical and chemical differences in site characteristics among coastal areas where aquaculture occurs, such as water depth and ambient nutrient concentrations, it is necessary to determine carrying and assimilative capacities for each different area (Tanner *et al.*, 2007). Furthermore, it is necessary to have an understanding of the species' metabolism, used for calculations of aquaculture system oxygen requirements, fish energy requirements, environmental impact assessment, and species-specific physiological thresholds (Fitzgibbon, 2007). This data exists for Yellowtail Kingfish and mullet cultured in SA (Clark and Seymour, 2007; Fitzgibbon *et al.*, 2007), but the necessary research has not been carried out for other cultured species. Where new research is published, PIRSA Fisheries and Aquaculture will incorporate this new knowledge into their assessment and calculations.

For shellfish or algae aquaculture, estimating carrying capacity is more complicated as potential production must be estimated from available nutrient and light resources. At present there are difficulties in confidently predicting potential production. Firstly, there is limited data to ascertain the availability of nutrient and light for shellfish or algae; and, secondly, processes such as shellfish filtration, excretion and respiration rates, algae nutrient uptake and photosynthetic rates and assimilation efficiencies need to be investigated within South Australian coastal conditions and compared to seasonally varying food concentrations and temperature (Parsons Brinkerhoff and SARDI Aquatic Sciences, 2003; Mount *et al.*, 2007). Nevertheless, algae aquaculture has been recommended as a means by which the negative effects of effluent may be minimised and the environmental impact of other aquaculture activities reduced (Chopin *et al.*, 2001; Buschmann *et al.*, 2007).

### *Class of aquaculture*

Classes of aquaculture under previous aquaculture zone policies referred to groups of species e.g. bivalve molluscs; finfish; tuna etc. Under a modified format, classes of aquaculture now relate to the feeding requirements of aquatic organisms i.e. whether the organisms are supplementary fed or not supplementary fed. Grouping the classes of aquaculture around feed inputs better focuses the policy on the key determinant of environmental impact, namely, the amount of nutrient that is released into the environment. The modified format also provides greater flexibility to adaptively manage aquaculture activity through the conditions placed on individual licences.

The classes of aquaculture that may be permitted under policies are:

- the farming of prescribed wild-caught tuna;
- the farming of aquatic animals (other than prescribed wild-caught tuna) in a manner that involves regular feeding (e.g. finfish and abalone);
- the farming of bivalve molluscs (e.g. oysters, scallops, mussels, razorfish); and
- the farming of algae.

The first two of these involve the supplemental feeding of farmed animals, whereas no supplemental feeding is associated with the latter two classes. Only the suitable classes of aquaculture are incorporated into an aquaculture zone policy e.g. Aquaculture (Zones – Cape D’Estrees) Policy 2006 specifies the farming of molluscs (other than filter feeding molluscs) and algae only.

### *Biomass limits*

Control of the amount of nutrients released into or extracted from the environment is achieved at the aquaculture zone policy level by setting upper biomass limits for each aquaculture zone i.e. the maximum biomass of organisms farmed under a particular class of aquaculture at any one time. Environmental impacts are also managed by monitoring impacts on an on-going basis, through the environmental monitoring and reporting requirements stipulated in the *Aquaculture Regulations 2005*.

The Policy sets biomass limits for the farming of supplementary fed aquatic animals in terms of a tonnage of finfish biomass equivalents. The net amount of nutrient released by various types of supplementally fed organisms differs, with finfish aquaculture generating the highest amount of discharge compared, for example, with abalone. Because there is still insufficient scientific information to accurately predict the amounts of nutrients that would be released by non-fish species, this policy takes a generally cautious approach in setting biomass limits by assuming that amounts of nutrients released by all farmed organisms that are supplementally fed would be similar to that of finfish. However, in order to accommodate future use of information on nutrient release by non-fish species, the proposed policy adopts the concept of finfish biomass equivalents, where upper biomass limits are expressed and benchmarked in terms of an amount of biomass that would have an environmental impact equivalent to a stated biomass of finfish.

The impacts of overstocking systems with aquatic organisms that do not involve supplemental feeding are likely to be felt by industry (through decreased production) well before any potential environmental harm. For example, in the case of filter feeders like oysters, production is self-limiting since industry performance overall will be determined by the amount of suitable food available in the water. As a result, the focus of PIRSA Fisheries and Aquaculture’s regulatory activity for aquatic organisms (that do not involve supplemental feeding) is to meet the Government’s undertaking "to maximise benefits to the community from the State’s aquaculture resources" i.e. to ensure that an aquaculture zone is not overstocked to the ongoing detriment of licensees operating in the area.

The Policy allows for the Minister to alter the maximum biomass limits of all classes of aquaculture through notice in the South Australian Government Gazette. This provides a mechanism to enable



flexibility in setting biomass limits for aquaculture zones/sectors and enables future research and environmental monitoring results to be taken into consideration as they become available over time.

In the case of bivalve molluscs, the Minister cannot increase the maximum biomass limit unless satisfied, after consultation with relevant aquaculture industry groups, that such an increase would not compromise the overall productivity of existing bivalve mollusc farming operations in the area.

## APPENDIX D3 – PROTECTED SPECIES FRAMEWORK

The *National Parks and Wildlife Act 1972* (NPW Act) provides the legislative framework dealing with native fauna and flora in this State. Most native mammals, reptiles and birds are protected in South Australia. Under the provisions of the NPW Act, it is an offence to kill, hunt, catch, restrain, injure, molest or harass a protected animal. Rare, vulnerable and endangered species are listed in Schedules 7, 8 and 9 of the NPW Act.

The *Fisheries Management Act 2007* (FM Act) provides offence provisions for the taking, injuring or harming of an aquatic mammal or aquatic resource of a protected species. Under the provisions of section 71(1)(a) of the FM Act, a person must not kill, injure or molest, or cause or permit the killing, injuring or molestation of, a marine mammal. Furthermore, it is an offence to take protected species, which include white shark (*Carcharodon carcharias*), more commonly known as the great white shark. A statutory defence exists in cases where the defendant proves that the alleged offence was not committed intentionally and did not result from any failure on the part of the defendant to take reasonable care to avoid the commission of the offence.

All marine mammals and sharks have the potential to become entangled in nets or mooring lines and seabirds may be adversely affected by activity around any feeding, roosting or nesting sites in the area. To minimise adverse interactions with seabirds and large marine vertebrates section 19 of the *Aquaculture Regulations 2005* requires a licensee to have a written interaction strategy approved by the Minister. In addition, risks posed by the aquaculture activity are assessed at the time of licence application through the ESD Assessment process consistent with the National ESD Framework (Fletcher *et. al.*, 2004).

Syngnathid fish are protected under the provisions of section 71 of the Fisheries Management Act. Syngnathid fish are likely to be present, especially in the seagrass, algal and reef assemblages.

### **Framework specific to finfish aquaculture**

In November 2002 Cabinet approved the establishment of a Marine Mammal-Marine Protected Areas Working Group (MM-MPAWG) to develop management arrangements to address the proximity of aquaculture developments to core areas of proposed marine protected areas and significant marine wildlife habitats such as seal colonies and whale breeding areas.

The MM-MPAWG concluded that the only aquaculture activity to pose a risk to seal/sea lion colonies is finfish aquaculture, and the only seal/sea lion colonies at risk from finfish aquaculture are breeding colonies of Australian Sea-lions.

Although long-nose fur seals also interact with aquaculture operations, they were not considered to be at risk from finfish aquaculture, due to their increasing population and expansion in distribution around the coastline. As such it was proposed that no further management restrictions would apply in relation to the long-nose fur seals.

Cabinet considered the MM-MPAWG report and, in 2005, noted the following recommendations in order to reduce the potential risk to Australian Sea-lion breeding colonies from finfish aquaculture—

- Finfish aquaculture located within 5 km of any Australian sea-lion breeding sites will not be approved;
- Finfish aquaculture will not be approved within 15 km of the eight major Australian sea lions breeding colonies (namely The Pages, Dangerous Reef, Seal Bay, West Waldegrave Island, Olive Island, Franklin Islands, Purdie Island and Nicolas Baudin Island);
- Finfish aquaculture to be located between 5-15 km of minor Australian sea lion breeding colonies will have a risk assessment applied to during the licence assessment process specifically related to seals; and



- Over 15 km, there will be no restrictions in relation to finfish aquaculture.

## APPENDIX D4 – LESSEE AND LICENSEE OBLIGATIONS

The *Aquaculture Act 2001* (the Act) is the main piece of legislation governing the management, control and development of the aquaculture sector. The Act includes provisions giving the Minister for Agriculture, Food and Fisheries the powers to grant aquaculture leases (with the concurrence of the Minister for Transport) and licences and the power to make decisions on licence conditions, with the EPA's approval, as well as conditions and terms of leases.

The *Aquaculture Regulations 2005* establishes an environmental assessment, monitoring and management framework for all sectors of aquaculture.

The Act provides for an integrated licensing and tenure system and provides a flexible approach to the granting of rights to occupy State waters. Under the Act, a licence may not be granted for aquaculture in State waters unless the area is subject to a lease granted by the Minister. The Act allows for four types of lease, namely pilot, development, production and emergency leases.

Applications for leases within an aquaculture zone must be allocated through a process approved by the Aquaculture Tenure Allocation Board (ATAB). A public call is made inviting applicants to submit their proposal on the required application form. These applications are assessed by the ATAB who then make a recommendation to the Minister on which applications should proceed. Once the tenure has been provisionally granted, a licence assessment will be undertaken.

The competitive allocation process ensures a fair and efficient means of allocating the State's marine aquaculture resources.

Applications for pilot leases outside an aquaculture zone are not subject to a competitive allocation process, however the ATAB is notified of all pilot lease applications.

Management obligations are those requirements an aquaculture operator must undertake according to the Act and other relevant legislation. Penalties for a failure to comply with the requirements include expiation fines and suspension or cancellation of the lease and/or licence.

### ***Ecologically Sustainable Development***

PIRSA Fisheries and Aquaculture's Ecologically Sustainable Development (ESD) risk assessment guidelines for aquaculture licenses is based on the National ESD Framework: The 'how to' Guide for Aquaculture (Fletcher *et. al.*, 2004), underpinned by the Australian and New Zealand Standard (AS/NZ) 4360:2004 (now superseded by AS/NZS ISO 31000:2009) for risk management (Standards Australia and Standards New Zealand, 2009). The assessment process considers risks to aquatic habitats associated from individual aquaculture facilities (both marine and land-based) through to accumulative risks of the industry at the regional scale. Using these guidelines, aquaculture licence applications are assessed to determine the likely environmental, social and economic risks the proposed licence may have if approved.

The environmental risk assessment component considers the nature of the specific activity relative to the environment in which it will be undertaken at different spatial scales, namely; at the level of the individual site and at the regional level. Risks are calculated semi-quantitatively using a likelihood by consequence methodology. PIRSA Fisheries and Aquaculture's management of ESD risks can result in the amendment of site location or application of licence conditions, including (but not limited to) stocking rates, farming systems, legislative and environmental monitoring requirements. It should be noted that, in accordance with Section 52 of the Act, the Minister may vary licence conditions at any time to prevent or mitigate significant environmental harm or the risk of significant environmental harm.

This licence assessment is then formally referred to the EPA for their consideration.

## **Environmental Monitoring and Management**

Environmental risks are managed both at the licence assessment stage (as previously described above) and through PIRSA Fisheries and Aquaculture's ongoing Environmental Monitoring Program (EMP). The EMP requirements are stipulated in the *Aquaculture Regulations 2005* for each sector. Once a licence is approved, an EMP is tailored to each class of aquaculture to allow for the ongoing monitoring by licence holders of a variety of physical and biological factors considered relevant to measuring the environmental effects of the aquaculture venture.

### **Marine-based Aquaculture:**

The annual Environmental Monitoring Program includes ongoing monitoring of:

- benthic assessment (colour videotape of the sea floor and written record);
- amount and type of supplemental feed (if applicable to the species farmed);
- biomass maintained on the site;
- aquaculture waste (securing, treating, recovering);
- use of chemicals (amount, frequency and purpose);
- requirement to mark-off area and maintain structures or equipment used to mark-off area;
- farming structures (marking, mooring, maintaining, locating, and recovering);
- interaction with seabirds and large marine vertebrates.

In addition Regulations provide for:

- notification and reporting of entanglement of certain animals;
- notification and reporting of escape of stock or damage that may lead to escape of stock;
- notification and reporting of unusually high mortality rate and duty to isolate unaffected organisms.

### **Land-based Aquaculture**

The annual Environmental Monitoring Program includes (depending on the licence class of A, B or C) the ongoing monitoring of:

- water quality testing (category B and C only);
- intake water source, method of extraction, water type (i.e. fresh, brackish etc.) and volume used per month;
- where, how discharged, if treated and volume each month of water discharged;
- amount and type of supplemental feed (if applicable to the species farmed); and
- use of chemicals (amount, frequency and purpose).

Additional requirements to be monitored can be determined from the licence assessment process on a case by case basis, or based on the results of Environmental Monitoring Program reporting.

### **Marine and Other Animal Interactions**

The requirement to report interactions (such as entrapments or entanglements of seabirds and large marine vertebrates) form part of licence conditions and Regulations under the Act. If interactions occur then modifications to farming practices may be required.

A licensee must have a written strategy approved by the Minister for minimising adverse interactions with seabirds and large marine vertebrates resulting from aquaculture carried on under the licence (see

the *Aquaculture Regulations 2005*, Regulation 19). The strategy must detail operational requirements under the following categories:

- Mammal interactions
- Great white shark interaction
- Protected species interactions
- Maintenance of infrastructure
- Site surveillance

The strategy must explain what procedures the licensee will implement to minimise these risks to a level considered acceptable by the Minister. Operators may be audited against the operating practices detailed in their strategy at any time. Failure to comply with the strategy may result in an expiation fee or fine.

### ***Aquatic Animal Health Controls***

A range of controls are included in the management of licensed aquaculture activities to prevent or mitigate against diseases or parasites. All applications for new aquaculture licences are assessed for aquatic animal health risks as part of the ESD assessment (culture technique, technology and specific environment of the application). Regulations under the Act require that operators report to PIRSA any significant increases in background mortality and must not move any animals showing signs of clinical disease without Ministerial approval. Requirements designed to manage other on-farm activities are included in a variety of legislation and policy.

Diseases of particular concern and those that are regarded as posing particular threats to environmental, economic or social processes are listed as notifiable under the *Livestock Act 1997*. It is an offence under this Act to fail to report the occurrence, or suspected occurrence, of a notifiable condition.

Translocation of organisms is managed through a process of Import Risk Analysis. The outcomes of these analyses, which include factors to reduce risk of disease or pest introduction and consideration of genetic integrity, are included in Orders under the *Livestock Act*, including the *Livestock (Restrictions on Entry of Aquaculture Organisms) Notice 2008*.

Use of any therapeutants or treatments can be conducted only under a Ministerial approval (for off-label use as defined by the *Veterinary Practice Act 2003*), or under conditions specified by the Australian Pesticides and Veterinary Medicines Authority, either on the label of registered products or included in Minor Use Permits.

### ***Exotic Species***

There are potential risks associated with the introduction of organisms not from the local environment. For the protection of the aquaculture industry, and of the natural environment, controls must be maintained on the introduction and movement of aquatic organisms, bearing in mind the potential risks involved with the introduction of disease and potential for genetic manipulation.

The primary concerns associated with the introduction of non-native organisms are that they may form feral populations, which may compete for habitat and reduce the availability of nutrients to local organisms.

Potential issues associated with exotic species are addressed as part of the ESD risk assessment and licence application process.

## **Stock Escapes**

The potential for escape of aquaculture stock from a site is considered during the ESD risk assessment of the application. This assessment considers the level of risk presented by the species under consideration and the technology used. Regulations under the Act require operators to have an approved strategy to minimise and mitigate against the risk of escapes and outline the requirements that must be followed in the event of an escape.

Licensees are also required to submit a strategy relating to the escape of stock from the constraints of the licensed infrastructure and the lease area (see the *Aquaculture Regulations 2005*, Regulation 19). This strategy is required by the Minister to prevent and control the risk of escaped stock to the wild. This strategy must include methods under the following categories:

- Health monitoring
- Escape monitoring
- Dealing with escapes
- Maintenance of infrastructure
- Site surveillance
- Reporting Requirements

The strategy must explain what procedures the licensee will implement to minimise these risks to a level considered acceptable by the Minister. Operators may be audited against the operating practices detailed in their strategy at any time. Failure to comply with the strategy may result in an expiation fee or fine.

## **Site Decommissioning**

There will be times when an aquaculture site in the aquaculture zone is no longer being used. In this case the lease contract requires that the site be rehabilitated by the lessee at the expiry of the lease. The lease also requires the operator to be party to an approved indemnity scheme or bank guarantee which the Minister may draw upon if the lessee fails to clear the site.

## APPENDIX D5 – RESEARCH AND ADAPTIVE MANAGEMENT

Evidence based policies require robust research to inform the decision making process. As such PIRSA Fisheries and Aquaculture has initiated several projects with the Fisheries Research and Development Corporation (FRDC) to improve our knowledge and inform our policies, in particular, the PIRSA/FRDC Innovative Solutions for Aquaculture Planning and Management Program. This suite of projects aims to develop tools to ensure a sustainable and competitive aquaculture industry for South Australia. These tools will:

- Identify more effective ways to manage aquaculture;
- Minimise the regulatory burden on industry; and
- Ensure that environmental considerations for South Australian aquaculture remain a clear priority.

The following research projects have been completed:

a) *Environmental audits of marine aquaculture* – The project examined the impacts of Yellowtail Kingfish aquaculture in Fitzgerald Bay, and of land-based abalone aquaculture around South Australia, on a range of environmental variables. The results indicated that the environmental impacts of both sectors are minimal using current production techniques. Additionally, the project included a pilot study on light availability to seagrass beds off Cape Jaffa in the South East of the state. The results indicated that any aquaculture undertaken in this region would have to be conducted in a manner which minimises light reduction to seagrasses. Finally, research was conducted into shading effects of intertidal shellfish long-line farming infrastructure at South Spit, Stansbury. While the relative area and degree of shading effects on seagrass meadows is low, a number of recommendations were made to reduce any potential lethal and sub lethal impacts. Overall, this project provides the basis for the enhancement of current environmental monitoring programs.

b) *Addressing seal interactions* – The project has provided comprehensive appraisal of the status of the Australian sea lion population in southern Spencer Gulf and the Nuyts Archipelago, including identification of several new breeding populations. Based on satellite tracking studies of the Australian sea lion in southern Spencer Gulf, there was limited spatial overlap in the major areas used by seals and the tuna farming zone. A questionnaire survey of tuna farmers confirmed that operational interactions with seals are a continuing problem, although there were opposing views on whether they are increasing or decreasing. Australian sea lions were considered to be responsible for most attacks on tuna. long-nose fur seals were not considered a threat to farmed tuna, being too small to attack them successfully. Extensive tracking in the Nuyts Archipelago from 6 different colonies showed that there were marked inter-colony differences in foraging behaviour, and evidence of two broadly different foraging patterns - inshore (shallow) and offshore (deep) foragers. With respect to farm interactions, procedures for minimising finfish mortality attributable to seals include incorporation of seal fences on the pens, regular and frequent net maintenance and, removal of tuna carcasses. Also, efforts should be made to improve procedures for recording causes of death of farmed finfish to monitor the consequences from seal interactions.

c) *Spatial impacts and carrying capacity of aquaculture stock* – The project studied the nutrients released from Yellowtail Kingfish aquaculture in Fitzgerald Bay, and based on this data two models were produced that assist environmental management decisions. At the site scale, a seafloor deposition model was developed that predicts that areas of high sedimentation are localised around individual pens. At a more regional level, a carrying capacity model has been developed that can be used to predict the level of increased nutrient loadings in the water column associated with increases in Yellowtail Kingfish production. The physiology of Yellowtail Kingfish and mullet was studied, with the focus on determining their oxygen consumption under a variety of environmental conditions. This information is important for the modelling, as it allows for an estimate of how much of the feed is

metabolized by the fish. The outcomes of this work will allow PIRSA Fisheries and Aquaculture to make more informed decisions on total allowable biomass within the Fitzgerald Bay aquaculture zone, as well as optimal stocking densities for individual leases. These models can also be adapted to environmental conditions for other aquaculture zones. As well as PIRSA Fisheries and Aquaculture, farm managers will be able to utilize the seafloor deposition model to investigate patterns of sedimentation within a lease, allowing for decisions on how best to arrange pens so as to minimise localised seafloor sedimentation and where to place pens for fallowing.

d) *Parasite interactions between wild and farmed Yellowtail Kingfish* – The project studied the potential for parasite interactions between wild and farmed kingfish, ways of distinguishing wild from farmed kingfish and assessing migratory behaviour of wild kingfish. Wild fish migrate past kingfish sea-cages in Fitzgerald Bay in summer. This knowledge creates the potential to better manage parasite infestation during periods of increased interaction between farmed and wild kingfish. Given that parasite eggs hatch more quickly in warmer sea temperatures, surveillance and management effort for infections by monogenean parasites should be concentrated on this period. Although few reliable methods are available to distinguish natural fish from farmed fish, marking otoliths has emerged as a potential tool that could be used to discriminate any farm escapees from wild fish. The key outcomes of this project included the development of standard sampling methods for ongoing assessment of parasite prevalence and intensity in wild and farmed kingfish. These sampling techniques are expected to be incorporated into an ongoing sampling program for effective parasite management. Farm management practices to reduce the impact of parasites include regular net changes and strategically timed treatments across entire farm leases.

e) *Assessment of novel monitoring and modelling techniques to measure gill and skin fluke infestation* – A reliable and consistent means of measuring the level of gill and skin fluke infestation of farmed kingfish has been developed based on a computer driven scanning system. This novel technology is faster and more cost-effective than current methods, and will greatly enhance industry's ability to monitor and therefore control fluke infestations, through more precisely timing the application of control measures.

f) *Development of rapid environmental assessment and monitoring techniques* – The project is an extension of previous work undertaken to improve the tuna environmental monitoring program. The project aimed to determine similarities and differences in the DNA of benthic infaunal communities associated with finfish farming at Fitzgerald Bay, Arno Bay and Boston Bay. The number of individuals and the types of species of benthic infauna that live in the seafloor sediments are used to monitor the biological health of the environment around finfish farms. The outcomes of this project have decreased the time taken for an assessment of the condition of the environment and improved the accuracy of the assessment. Information from this project is used to standardise the finfish environmental monitoring program in line with the tuna environmental monitoring program.

A second suite of projects (Innovative Solutions 2 (IS-2)) is underway. The proposed projects are categorised into four areas: (1) environmental standards, (2) biosecurity, (3) new technologies and (4) climate change. The IS-2 suite of projects has been designed to provide information aimed at further supporting PIRSA's on-going efforts to improve its ecosystems-based approach to aquaculture resource management. The first project that commenced under IS-2 is entitled Carrying Capacity of Spencer Gulf: Hydrodynamic and Biogeochemical Measurement Modelling and Performance Monitoring. The ability to obtain accurate estimates of spatial and temporal variability in carbon cycling and other macro-nutrients through the ecosystems in Spencer Gulf will provide important information about potential risks and impacts of increased aquaculture activities in the Gulf. This need will be met through the development of calibrated hydrodynamic and bio-geochemical models for Spencer Gulf that will also determine more accurate carrying capacity estimates for aquaculture areas, including the concurrent use of both supplementary and non-supplementary fed organisms within each area.

Current aquaculture industry practices in South Australia were developed when the marine finfish sector was smaller and when the tuna industry was larger and had not developed technology for hatchery-rearing stock. It is now time for PIRSA's biosecurity controls to be comprehensively reviewed

This project proposes a biosecurity hazard identification, risk analysis and audit for South Australia's marine finfish and tuna aquaculture sectors, including population of generic risk trees for biosecurity from Fletcher *et. al.*, (2004), development of a generic framework including checklists for assessing biosecurity risks and evaluation of current standards and practices, identification of risks and development of risk mitigation strategies, guidelines for surveillance, industry practices and identification of critical control points for audit purposes.

In addition, PIRSA Fisheries and Aquaculture supports studies commissioned by the Australian Seafood Cooperative Research Centre (ASCRC) and its predecessor Aquafin CRC involving six research programs for the Port Lincoln-based southern Bluefin tuna (*Thunnus maccoyii*) aquaculture industry including; production, value-adding, environment, technology transfer and commercialisation, and education and training.

g) *Extension, communication and adoption of the outputs from the PIRSA and FRDC initiatives* – Through effective relationship building, communication strategies, and extension programs, outputs of the IS projects have been communicated to a range of stakeholders including government and industry groups. Effective communication and extension of Innovative Solutions research outcomes has facilitated the integration of research driven management practices with greater public and stakeholder awareness and acceptance.

A second suite of projects under Innovative Solutions (IS-2) have been completed recently or are currently underway. The IS-2 suite of projects has been designed to provide information aimed at further supporting PIRSA's on-going efforts to improve its ecosystems-based approach to aquaculture resource management.

The following IS-2 projects have been completed:

h) *Biosecurity risk assessment and development of standardised mitigation for tuna and finfish aquaculture* – This project undertook a biosecurity hazard identification, risk analysis and audit for South Australia's marine finfish and tuna aquaculture sectors, including population of generic risk trees for biosecurity from Fletcher *et. al.*, (2004), development of a generic framework including checklists for assessing biosecurity risks and evaluation of current standards and practices, identification of risks and development of risk mitigation strategies, guidelines for surveillance, industry practices and identification of critical control points for audit purposes.

i) *Carrying Capacity of Spencer Gulf: Hydrodynamic and biogeochemical measurement modelling and performance monitoring* – The ability to obtain accurate estimates of spatial and temporal variability in carbon cycling and other macro-nutrients through the ecosystems in Spencer Gulf will provide important information about potential risks and impacts of increased aquaculture activities in the Gulf. This need will be met through the development of calibrated hydrodynamic and bio-geochemical models for Spencer Gulf that will also determine more accurate carrying capacity estimates for aquaculture areas, including the concurrent use of both supplementary and non-supplementary fed organisms within each area.

j) *A review of South Australia monitoring of aquaculture* - This external review was conducted to review existing monitoring programs in South Australia. Implementation of recommendations is underway, including industry workshops with a revised environmental program for each aquaculture sector being developed.

The following IS-2 projects are currently underway:

k) *Investigations to address key policy gaps associated with the development of clam farming in South Australia: genetic and health issues aligned to translocation and stock identification* – This project aims to characterise the genetic population structure of the clam, *Katelysia rhytiphora* in South Australia in order to determine the feasibility of this species for aquaculture. The project seeks to identify and evaluate method(s) for differentiation between farmed and wild clams and to identify potential biosecurity issues relating to commercial clam aquaculture. Results from this project will inform policy development for clam aquaculture in South Australia.

l) *Application of high-resolution tracking technologies to understand movement and residency of pelagic sharks in southern Spencer Gulf: resolving spatial overlaps with marine industries, community activities and natural foraging areas* – The project will inform the development of industry best-practice guidelines and management strategies around shark interactions with aquaculture and fisheries activities. In addition, the project will assist in the identification of public awareness and perceptions around shark interactions which will also inform management decisions.

m) *Pacific oyster feeds and feeding in South Australian waters: towards ecosystem based management* – This project will (1) identify the feeding requirements of Pacific oysters, cockles and mussels (2) address the factors influencing food availability and (3) improve our understanding of the relationship between food availability, competition for resources and farm production. Outcomes from this project will inform management strategies for the relevant industries.

In addition, PIRSA Fisheries and Aquaculture supports studies commissioned by the Australian Seafood Cooperative Research Centre (ASCRC) and its predecessor Aquafin CRC involving six research programs for the Port Lincoln-based Southern Bluefin tuna (*Thunnus maccoyii*) aquaculture industry including; production, value-adding, environment, technology transfer and commercialisation, and education and training.