Government of South Australia
Primary Industries and Regions SA

Draft REPORT
SUPPORTING THE
AQUACULTURE (ZONES – CEDUNA)
POLICY 2015

Endorsed For Release for Public Consultation

…. Day of …. 2015

Table of Contents Page

Table of Figures Page

1 INTRODUCTION

In 2012/13, South Australia's total seafood value of production was $441 million. Of this approximately 55% originates from aquaculture product (EconSearch, 2014). South Australia now accounts for 41% of the aquaculture product produced in Australia (South Australian Seafood Market Summary 2012).This share is likely to increase into the future as South Australia is the only state in Australia that has an act dedicated to aquaculture development. The main objects of the *Aquaculture Act 2001* are to:

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.

The Minister for Agriculture, Food and Fisheries (the Minister) may develop aquaculture policies for any purpose directed towards furthering the following objects of the *Aquaculture Act 2001.* Aquaculture zone policies provide guidance and clarity regarding the aquaculture industry's access to these resources. They 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 *Aquaculture Act 2001*, 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. The objectives of these Acts and policies and how aquaculture policies are consistent with, and reflective of them, are described at Appendix D1.

Aquaculture zone policies are developed to ensure that they are relevant to both community and industry needs. Where possible, it is expected that 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 is 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 will be made available to the general public for a period of two months for comment.

The Minister will then consult with, and consider the advice of, the Aquaculture Advisory Committee on all matters raised during the consultation period. As prescribed by the *Aquaculture Act 2001*, 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 Ceduna Policy Report (the Report) supports the *Aquaculture (Zones – Ceduna) Policy 2015* (Policy). Table 1 summarises the zoning framework to be established under the Policy, including classes of permitted aquaculture, total and leased area (in hectares - ha) and biomass for the Ceduna aquaculture zones and aquaculture exclusion zones (see Appendix D2). The additional species that are proposed to be farmed are molluscs and algae native to southern Australian waters and naturally distributed along the South Australian coast (Edgar 2008).

2 CURRENT AQUACULTURE

There are currently 26 active aquaculture leases in the Ceduna Policy 2015 that cover 158.7884 hectares within the four aquaculture zones within (Figures 1 & 2; Table 1).

Current aquaculture activity includes the farming of Pacific Oyster (*Crassostrea gigas*) and Native Oyster (*Ostrea angassi*) on leases that vary between 0 and 2 metres in depth.

Trials to farm Razorfish (*Pinna bicolor*) have also recently been undertaken in sites ranging between 5 and 7 metres in depth.

3 CURRENT AQUACULTURE ZONING

Prior to the introduction of the *Aquaculture Act 2001*, aquaculture in waters surrounding Ceduna was managed by the Ceduna Council Development Plan (Ceduna Council 2012), Far West Aquaculture Management Plan (Ashman 1996) and Primary Industries and Regions South Australia, Aquaculture (through assessment of applications for individual site).

The aquaculture zones in the Ceduna Policy overlays the Ced/7, Ced/8, Ced/9 and Ced/10 zones described in the Ceduna Council Development Plan 2012 (Figure 3).

The Far West Aquaculture Management Plan relates specifically to the St Peter Island, Denial Bay and Decres Bay zones and there are areas of overlap with the Ceduna aquaculture zone (Figure 4).

The Ceduna Council Development and Far West Aquaculture Management Plans were used as guiding documents with the commencement of the *Aquaculture Act 2001*, but did not carry the statutory status of aquaculture zone policies under the *Aquaculture Act 2001*.

There are important differences 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 regulations (for more information see http://www.pir.sa.gov.au/aquaculture/public_register and http://www.pir.sa.gov.au/aquaculture/legislation).

Table 1 – Summary of the proposed zoning framework under the draft *Aquaculture (Zones – Ceduna) Policy 2015*

Zone	Total area of zone (ha)	Maximum lease area (ha)*	Lease area already allocated (ha) (as of 2 December 2014)	Farming of aquatic animals that are not supplementary fed (excludes mussels)	Farming of algae
Aquaculture zone					
Denial Bay	1236	169	98.9684	Determined by licence condition	
Decres Bay	153.5	40	0		
St Peter Island North	113.5	20	20		
St Peter Island South	704	110	39.82		
Aquaculture exclusion zone					
Horseshoe	799	Nil	Nil		
Bosanquet	176	Nil	Nil		
Wittlebee	488	Nil	Nil		
St Peter Island	6346	Nil	Nil		
TOTAL	10,016	339	158.7884		

*includes 5 ha for research/educational purposes across all zones

4 CEDUNA AQUACULTURE ZONE

The scope of the draft Policy covers the Ceduna area of the Far West Coast as depicted in Figure 1. The Policy establishes a total of eight zones; four aquaculture exclusion zones and four aquaculture zones. These eight zones are described below.

4.1 Aquaculture exclusion zones

There are four aquaculture exclusion zones described in the Ceduna aquaculture zone. These are the Bosanquet, Horseshoe, Wittlebee and St Peter Island aquaculture exclusion zones. Aquaculture is prohibited in these aquaculture exclusion zones, which encompass a total area of 7,809 ha (Figure 1; Table 1).

<u>Bosanquet</u>

The Bosanquet aquaculture exclusion zone incorporates an area of 176 ha, extending 1.7 km north along the coastline from Cape Vivonne and 1.3 km west (at its greatest distance from shore) (Figure 1; Table 1). The waters of Bosanquet Bay are an important fishing ground for blue crab (*Portunus armatus*), King George Whiting and Southern Calamary This waters of this aquaculture exclusion zone range between 2.3 and 3.2 m in depth and consist of reef and dense seagrass.

<u>Horseshoe</u>

The Horseshoe aquaculture exclusion zone incorporates an area of 799 ha. It is located 1.2 km south-west of Cape Thevenard, extending a further 5.5 km seawards (Figure 1; Table 1). Although this area represents a suitable location for intertidal and subtidal aquaculture opportunities (due to it being in sheltered location) it has been designated an aquaculture exclusion zone because it is an important fishing ground for both the recreational and commercial fishing sector.

<u>Wittlebee</u>

The Wittlebee aquaculture exclusion zone incorporates an area of 488 ha. It is located seaward of Wittlebee Conservation Park (further described in Section 5.6), and mirrors the existing conservation park buffer established under the *Development Regulations 1993* (Figure 1 Table 1;).

<u>St Peter Island</u>

The St Peter Island aquaculture exclusion zone incorporates an area of 6,346 ha (Table 1). It is located around St Peter Island, and mirrors the existing conservation park buffer established under the *Development Regulations 1993,* with the exception of areas that are currently leased for aquaculture (Figure 1). These leased areas will remain available for aquaculture.

4.2 Aquaculture zones

There are four aquaculture zone described in the Ceduna Policy, which encompass an area of approximately 2,207 ha. These four aquaculture zones are:

- Denial Bay (1,236 ha);
- Decres Bay (154 ha);
- St Peter Island North (113 ha); and
- St Peter Island South (704 ha).

All four of these aquaculture zones are located within an established South Australian Shellfish Quality Assurance Program (SASQAP) growing and harvest area (Figure 5).

Aquaculture is currently being undertaken in most of these zones, with limited opportunities for future expansion. In total, a maximum of 339 hectares of lease area will be made available for the expansion of aquaculture in the Ceduna aquaculture zone (Table 1). This is approximately 15% of the total area available for aquaculture in the Ceduna aquaculture zone. Five of the 339 hectares available for expansion will be made available for use for the purposes of research or education. As of 2 December 2014, a total of 158.79 hectares is already allocated in the Ceduna aquaculture zone (Table 1).

The prescribed classes of aquaculture (Appendix D2) for the Ceduna aquaculture zones are:

a) the farming of aquatic animals (other than mussels) in a manner that does not involve regular feeding. Note: this classification takes into consideration the farming of filter feeding bivalves such as oysters, razorfish and cockles while providing the opportunity for new species such as sea cucumbers.

b) the farming of algae.

The maximum aggregate biomass (Appendix D2) of farmed species will be determined by licence conditions. Site-specific biomass limits will be informed by historical production capacity, current and future research and environmental monitoring results.

<u>Denial Bay aquaculture zone</u>

The Denial Bay aquaculture zone incorporates an area of approximately 1,236 ha. Its southernmost point is located 500 m north of Cape Beaufort extending north along the coast for approximately 11 km to 2.2 km west of Low Point (Figure 2). At its farthest point, the zone is approximately 1.5 km from shore. At its nearest point to the shore, this zone is 7.3 km west of Ceduna and 5 km west of Thevenard Jetty.

The Denial Bay aquaculture zone falls within a General Managed Use Zone of the Nuyts Archipelago Marine Park (Figure 5). The nearest conservation park to the zone is the Nuyts Archipelago Conservation Park which surrounds St Peter Island and is located 9 km to the south-east of the Denial Bay aquaculture zone (Figure 5).

The majority of the Denial Bay aquaculture zone is shallow with water depths of less than 2 m with a maximum water depth of 4 m (Figure 2). The benthic habitat of this area includes tidal flats, seagrass, salt marsh and mangroves.

The Denial Bay aquaculture zone will provide a maximum of 169 hectares of lease area for aquaculture. This zone has a current allocation of 98.97 ha of Pacific Oyster and Native Flat Oyster farming. The remaining 70.03 hectares would need to be granted through an allocation process. The allocation process is approved by the Aquaculture Tenure Allocation Board (ATAB) and involved tendering or a similar competitive process (refer to section 33 of the *Aquaculture Act 2001*).

While the predominate species being farmed in this area is the Pacific Oyster, historical data shows that Denial Bay was an important fishing ground for Native Flat Oysters during the 19th century. This suggests that this zone might be suitable for the commercial farming of Native Flat Oysters, as well as other native species such as Razorfish.

The release of an additional allocation of tenure for aquaculture will provide the opportunity to trial native species. The area of the zone encompasses current and previously assessed lapsed aquaculture leases. The maximum biomass of aquatic animals (other than mussels) in a manner that does not involve regular feeding being farmed in the Denial Bay aquaculture zone will be determined by licence conditions.

Decres Bay aquaculture zone

The Decres Bay aquaculture zone incorporates an area of approximately 154 ha and is located approximately 1.8 km east of Cape Vivonne and 4.5 km northeast of St Peter Island. The Decres Bay aquaculture zone falls within a General Managed Use Zone of the Nuyts Archipelago Marine Park (Figure 6). The nearest conservation park is the Wittelbee Conservation Park, located 1 km to the east of this aquaculture zone. The Nuyts Archipelago Conservation Park which surrounds St Peter Island is located 1.1 km south of this zone (Figure 2). The Cape D'Estrees (outer) subtidal aquaculture zone is located approximately 3.5 km to the south (outside the range of the maps provided with this policy).

The water depth of this aquaculture zone ranges between 0 and 7 m with the majority of the area being subtidal. Limited data indicate that the benthic habitat consists of largely bare sand and coarse gravel, with a low coverage of seagrass (*Halophila australis and Heterozostera/ Zostera* sp.) and dense macroalgae. The area is relatively devoid of fauna, consisting mostly of ascidians (sea squirts) and fish.

The Decres Bay aquaculture zone will provide a maximum of 40 ha of lease area for aquaculture. There are currently no operational leases in this area. Tenure for the 40 ha would need to be granted through an allocation process.

The maximum biomass of aquatic animals (other than mussels) in a manner that does not involve regular feeding being farmed in the Decres Bay aquaculture zone will be determined by licence conditions.

St Peter Island North aquaculture zone

The St Peter Island North aquaculture zone incorporates an area of approximately 113 ha and is located 1.8 km north-east of the northern-most point of Mount Younghusband Peninsula on St Peter Island. This aquaculture zone falls within a General Managed Use Zone of the Nuyts Archipelago Marine Park and within the 1 km buffer associated with the Nuyts Archipelago Conservation Park, which surrounds St Peter Island (Figures 2 and 6). The existing aquaculture sites that currently lie within the buffer are the result of negotiation between DEWNR and PIRSA in the late 1990's.

The majority of the St Peter Island North aquaculture zone is shallow with water depths of less than 2 m (Figure 2). The benthic habitat of this area is predominantly sand with some patches of seagrass.

The St Peter Island North aquaculture zone will provide a maximum of 20 hectares of lease area for aquaculture. This zone has a current allocation of 20 ha of Pacific Oyster and Native Flat Oyster farming. No additional hectares will be allocated for aquaculture in the St Peter Island North aquaculture zone as it is fully allocated.

The maximum biomass of aquatic animals (other than mussels) in a manner that does not involve regular feeding being farmed in the St Peter Island North aquaculture zone is determined by existing licence conditions.

St Peter Island South aquaculture zone

The St Peter Island South aquaculture zone incorporates an area of approximately 704 ha and falls within a General Managed Use Zone of the Nuyts Archipelago Marine Park (Figure 6). The north-western boundary of the zone follows the 1 km buffer of the Nuyts Archipelago Conservation Park around St Peter Island (Figure 2). The zone boundary encloses existing aquaculture sites resulting in a portion of four sites sitting within the 1 km buffer zone. The existing aquaculture sites that currently lie within the buffer were the result of negotiation between DEWNR and PIRSA in the late 1990's.

At its nearest point, the St Peter Island South aquaculture zone is located 1.7 km away from the Mean High Water Springs of St Peter Island and 14 km south of Ceduna.

The majority of this aquaculture zone is shallow, with a water depth of less than 2 m (Figure 2). A subtidal area in the north-east section of the zone has a water depth of approximately 7 m. The benthic habitat of this area is largely sand with significant patches of seagrass.

It is proposed that this zone will provide a maximum of 110 hectares of lease area for aquaculture.

This zone has a current allocation of 39.82 ha of Pacific Oyster and Native Flat Oyster farming. The remaining 70.18 hectares would need to be granted through an allocation process.

The maximum biomass of aquatic animals (other than mussels) in a manner that does not involve regular feeding being farmed in the St Peter Island South aquaculture zone will be determined by licence conditions.

5 CONSIDERATIONS

To be consistent with the objectives of the *Aquaculture Act 2001*, PIRSA Fisheries and Aquaculture will take the following matters into account when developing the Policy and encourage comment or advice for each during the public consultation period.

5.1 Subsequent Development Plan Amendments

The waters of the Ceduna aquaculture zone are covered by the *Land Not Within A Council Area (Coastal Waters) Development Plan*, but do not include any land in the area which is covered by a council area Development Plan. The Policy is consistent with the provisions contained in the former 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.

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*.

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

5.2 Physical and Biological Characteristics

A marine bioregion is an area within the marine environment that has distinctive biodiversity and can consist of several smaller biounits. Each biounit is defined primarily on the basis of coastal physiography, topography and major marine physical habitat or seascape features of habitat distributions at a scale of 100 km^2.

The Ceduna aquaculture zone lies within the Streaky biounit of the Murat Bioregion. The Streaky biounit covers the inshore region between Point James (west of Point Peter) and Cape Bauer near Streaky Bay (Edyvane 1999) and comprises a total area of approximately 191,000 ha.

There are two main habitats within the Streaky biounit. These are mangroves on the protected north eastern side; and samphire dominated mudflats.

Water depth in the inshore areas is shallow, typically <4 m and rarely exceeding 7 m. The major intertidal habitats of the Streaky biounit include bays, estuaries, offshore islands, sandy beaches and limestone rocky shores. Habitats that have been mapped within this biounit comprise seagrass meadows (77%), sandy bottoms (20%) and limestone reefs (2%) (Edyvane1999). The substrate

consists largely of mixed sediments in the sheltered bays, and coarse sand along the more exposed sections of coastline, while the sediment of offshore islands consists of concrete and boulder (Figure 8).

Large seagrass meadows can be found in Tourville, Murat, Bosanquet, Decres, Streaky and Smoky Bays, along with areas adjacent to Eyre and St Peter Islands. Seagrass species dominating these meadows include *Posidonia australis*, *P. sinuosa* and *Heterozostera tasmanica* in shallower regions. Subdominants include *Halophila australis* and the green algae *Caulerpa cactoides*.

A technical investigation conducted in the subtidal waters (greater than 10 m depth) of Denial Bay (south of proposed Denial Bay aquaculture zone) and Waterwitch Channel (east of St Peter island South aquaculture zone) demonstrated that the benthic habitat of the subtidal Denial Bay area was dominated by reef habitat supporting colonies of macroalgae (predominantly *Ecklonia radiata* and Seirococcacae) with less than 10% sand (Wiltshire and Loo 2009). The benthic habitat of the Waterwitch Channel was highly variable with some sites demonstrating large areas of bare sand with some macroalgae (suggesting an underlying hard substrate to allow attachment of the macroalgae), while other sites were dominated by reef and high macroalgal cover. During this investigation it was noted that sediment sampling was not possible as the substrate was too hard to allow penetration of the sediment corer. In all video transects taken, faunal abundances were low, although the difficulty in observing fauna in areas of high macroalgae is noted. Low numbers of ascidians (sea squirts), sponges, Razorfish, holothurians (sea cucumbers), Spider Crabs and starfish were observed. Numerous fish species were also observed, including the protected Weedy Seadragon (*Phyllopteryx taeniolatus*).

A benthic transect undertaken in 2008 in Decres Bay demonstrated a flat sandy seafloor with a coverage of less than 20% seagrass colonies (*Halophila australis and Heterozostera/ Zostera* sp.), bare sand and some dense patches of macroalgal species covered in epiphytes, showing a nutrient rich environment. The dominant fauna present along the video transect were filter feeding organisms such as ascidians (sea squirts) and fish.

The large seagrass meadows and estuary habitats found in the Streaky biounit contribute to the regions significant productivity and biodiversity. The coastal bays, containing substantial areas of wetlands, are important nursery areas for a number of species. Denial and Smoky Bays are important nursery grounds for several commercially important species, including King George Whiting, Blue Swimmer Crabs, Razorfish and Western King Prawns (Bryars 2003, Anthony Fowler, SARDI, pers. comm. 2009). The offshore islands are known as important breeding and roosting sites for a large variety of land and water birds.

Inshore areas (e.g. Tourville, Murat and Bosanquet Bays) are exposed to low wave energies (Edyvane 1999). Typically, wave height and wave period are approximately 1.0–1.5 m and 3.0–3.5 seconds respectively, but they can reach up to 2.5–3.0 m and 6.5–7.0 seconds in offshore areas (Petrusevics *et al.* 1998). Air temperatures at Ceduna can fall to -4.7ºC in winter and reach as high as 47.9ºC in summer. Mean annual rainfall is 250.3 mm (mean maximum of 33.4 mm in July and mean minimum of 9.3 mm in February), while the maximum mean surface water temperatures during winter are 14.4 °C and 23.0 °C during summer. Salinity ranges from 35.6 practical salinity units (psu) in autumn to 39.3 psu in spring (Rodda et al. 2009).

Water circulation in the bays and inshore areas is predominately influenced by the tide. The tidal range is less than 3 m, with the highest tides recorded during winter and the lowest tides during summer. Oceanic characteristics of this region are poorly understood, but some level of understanding can be derived from the physical characteristics of the region and comparison to other similar areas where data are available (John Middleton, SARDI, pers. comm. October 2013). Based on this, water currents are most likely wind driven and exhibit speeds of 20 to 60 cm/s with reversals every 5–10 days. The flow is most likely to interact with the headlands and islands of the Ceduna region to produce local eddies which act to mix the water horizontally, particularly during the flow reversals and lead to large horizontal

diffusion and flushing of the area. The mean alongshore flows for 'winter' and 'summer' are typically 10 to 14 cm/s to the south-east. The mean currents will also act to enhance flushing in the area.

The physical characteristics of the Ceduna aquaculture zone are likely to be favourable for the farming of intertidal and subtidal bivalve molluscs, sea cucumbers and algae species. The area has a history of successful intertidal oyster farming and provides the opportunity for trialling the farming of other species.

5.3 Indigenous Heritage

PIRSA Fisheries and Aquaculture acknowledges and recognises the native title rights and interests of the Aboriginals. It is further recognised that it is essential to the well-being 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.

The Far West Coast native title claim (*Far West Coast Native Title Claim v State of South Australia* (No 7) [2013] FCA 1285) was determined, by consent of the parties, on 5 December 2013. This consent determination follows the amalgamation of five previous, partially overlapping claims (the Edward/Ted Roberts, the Maralinga Tjarutja, the Mirning, the Wirangu #1 and Yalata native title claims), now the Far West Coast Native Title Claim Group. The native title claim group identified primarily as Mirning, Wirangu and Kokatha, with the recognition that many members were affiliated with more than one group. While it is necessary to refer to the determination itself, generally speaking, native title was determined to exist in adjacent land (as defined in the *Harbors and Navigation Act 1993* in the determination area (to the lowest astronomical tide), however, the 'non-extinguishment principle' applies. This will need to be taken into account in the event that any of the proposed zones overlap with the determination area. The determination area consists of approximately 75,249 km^2 in the far south-west of South Australia and includes many sites of significance in coastal country, wooded coastal plain and dry inland salt lake, soak and sandhill country. The determination area includes the towns of Ceduna/Thevenard, Denial Bay, Smoky Bay, Penong, Fowlers Bay and Coorabie.

A 'Claim Settlement Indigenous Land Use Agreements (ILUA)' was negotiated, and would need to be complied with; noting that any ruling extends to the low tide mark only and not into the leaseable area.

A search of Central Archive, which includes the Register of Aboriginal Sites and Objects, administered by the Department of State Development, Aboriginal Affairs and Reconciliation (DSD-AAR), has identified at least two burial (reference #'s 5633-3972 and 5633-3971) and ten archaeological sites (reference #'s 5633 - 3483, 3482, 3484, 3474, 3473, 3472, 3470, 3469, 3468 and 3210) in the Ceduna area (Figure 9).The sites are located on land but 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.

The Register is not a comprehensive record of all Aboriginal sites and objects in South Australia. Sites or objects may exist in the proposed development area, even though the Register does not identify them. All Aboriginal sites and objects are protected under the *Aboriginal Heritage Act 1988*, whether they are listed in the Register or not. Land within 200 metres of a watercourse (particularly the River Murray and its overflow areas) in particular, may contain Aboriginal sites and objects.

It is an offence to damage, disturb or interfere with any Aboriginal site or damage any Aboriginal object (registered or not) without the authority of the Minister for Aboriginal Affairs and Reconciliation. If the planned activity is likely to damage, disturb or interfere with a site or object, authorisation of the activity must be first obtained from the Minister for Aboriginal Affairs and Reconciliation under section 23 of the *Aboriginal Heritage Act 1988*. Section 20 of the *Aboriginal Heritage Act 1988* requires that any Aboriginal sites, objects or remains, discovered on the land, need to be reported to the Minister for

Aboriginal Affairs and Reconciliation. Penalties apply for failure to comply with these sections of the *Aboriginal Heritage Act 1988*.

If any Aboriginal significant areas are discovered during community engagement, PIRSA Fisheries and Aquaculture will advise the State Aboriginal Heritage Branch accordingly. The DSD-AAR 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 *Heritage Places Act 1993* and may include dwellings, industrial works, jetties, wharves, lighthouse and places designated as archaeologically significant such as whaling and sealing sites. A search of the State Heritage Register identified two European terrestrial heritage sites within the Ceduna area. These are Register Number 14424 – St Peter Island, whaling sites; and Register Number 14209 – former McKenzie's Landing, Denial Bay.

5.5 Marine Parks

The Ceduna aquaculture zone lies within the boundaries of the Nuyts Archipelago Marine Park. This marine park covers an area of 3,998 km^2 and is the largest one in South Australia, representing 15% of the South Australia's marine parks network. The eastern-most point of the marine park is located at Point Dillon, Eyre Peninsula and extends westwards along the coast for distance of approximately 280 km to 8 km west of Cape Adieu. The park extends seawards to cover the islands of the Nuyts Archipelago.

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 *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 four 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. Aquaculture farming activities are not deemed a compatible activity is this type of zone.

(d) **a restricted access zone** – is a zone primarily established so that an area may be managed by limiting access to the area. Aquaculture farming activities are not deemed a compatible activity is this type of zone.

The Ceduna zone policy and aquaculture activities in the Nuyts Archipelago 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 Nuyts Archipelago Marine Park contains a number of sanctuary zones but none are located within the Ceduna aquaculture zone. The Ceduna aquaculture zone is located within a General Managed Use Zone, where aquaculture farming activities are deemed a compatible activity. A portion of the Horseshoe aquaculture exclusion zone is located within a restricted access zone. No aquaculture activities are permitted in the aquaculture exclusion zone.

5.6 Reserves and Conservation Areas

There are no aquatic reserves established under the *Fisheries Management Act 2007* within the Ceduna aquaculture zone. There are a number of conservation parks and areas that are considered to be of high conservation value in the area.

Nuyts Archipelago Conservation Park

Nuyts Archipelago Conservation Park comprises seven islands (including St Peter Island) and covers an area of approximately 1,238 ha. The islands feature granite boulders with limestone domes and large sand dunes. The park provides haven for a number of bird, reptilian and mammalian species which utilise the area for roosting, haul-out and breeding (see section 5.7). St Peter Island was purchased by National Parks and Wildlife of South Australia in 1988 and proclaimed a Conservation Park within the Nuyts Archipelago Conservation Park.

The St Peter Island North aquaculture zone and a portion of the St Peter Island South aquaculture zone are located within the 1 km buffer zone associated with the Nuyts Archipelago Conservation Park (Figure 2). This park is on the Register of the National Estate and was proclaimed as a Wilderness Protection Area by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now known as the Department of the Environment) in 2011.

The intent of an aquaculture exclusion zone abutting reserves (1 km buffer) 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". An agreement to allow the St Peter Island North aquaculture zone and a portion of the St Peter Island South aquaculture zone to be within 1000 m of the Nuyts Archipelago Conservation Park was reached in the late 1990s.

Wittlebee Conservation Park, Decres Bay

The Wittlebee Conservation Park covers an area of 153 ha and is situated 10 km south-east of Ceduna. The park contains an area of samphire swamp, a type of swamp not generally well represented within the conservation park system. The area also includes fine sandy beaches and a low rocky headland which overlooks Decres Bay. It has social importance as a popular destination for both locals and tourists. The park is listed on the Register of the National Estate. The Wittlebee Conservation Park was proclaimed to conserve a sheltered coastal environment including mallee scrub and dune associations. The boundary of the park extends to the mean low water mark.

Laura Bay Conservation Park

Laura Bay Conservation Park covers an area of 267 ha. Laura Bay is a sheltered bay with a large sand dune system. Several different coastal environments, ranging from mallee scrub through to mangrove flats, have been conserved within the park. The sandflats in this park are an important feeding area for waders, and the island located off Dog Fence Point is an important roosting area for cormorants and gulls. The park has a high aesthetic value and is listed on the Register of the National Estate. It was proclaimed to conserve remnant mallee vegetation and coastal associations.

Tourville Bay

Tourville Bay lies 20 km west of Ceduna and contains the Davenport Creek wetland and significant mangrove habitats. The Davenport Creek wetland has national significance and has been rated as one of only three estuarine areas in South Australia to be rated as near pristine.

The mangrove area associated with Tourville Bay is the largest on the west coast of South Australia and supports a number of birds, including the threatened hooded plover and eastern curlew. It also provides breeding sites for Pied Cormorants, Grey Cormorants and White-Faced Herons, and a valuable nursery habitats for Western King Prawns, Blue Swimmer Crabs and various scalefish.This bay is listed on the Register of the National Estate.

5.7 Matters of National Environmental Significance

A search of the Protected Matters Database was conducted on 14 December 2014 using the Protected Matters Search Tool (PMST) to obtain a list of threatened and migratory species that are considered to occur in the region within a 20 km radius (Australian Government, Department of the Environment and Water Resources 2011). These data are derived primarily from general distribution maps, and it is likely that at least some of the species listed will not occur. The list represents species listed at the national level.

A total of 26 threatened species (of which 9 are listed as endangered and 17 as vulnerable) and 46 migratory species (11 endangered, 7 vulnerable) were identified. Some of the nationally listed species identified included the Australian Sea Lions, which have been known to haul-out on St Peter Island (Goldsworthy *et. al*., 2009) and both the Woylie (Brush-Tailed Bettongs) and the Wopilkara (Greater Stick-Nest Rat). The latter two have been reintroduced to this island. The legislative framework dealing with these species is described in Appendix D3. Most of the birds listed in Table 2 are highly migratory and unlikely to be significantly impacted by aquaculture in this region.

There is a number of bird species of state conservation status located in the region (Dutson et al. 2009). The Fairy Tern is listed as endangered under the *National Parks and Wildlife* Act *1972*. This species breeds along the West Coast of the Eyre Peninsula and breeding sites can be found in the northern portion of St Peter Island. The Fairy Tern will generally forage in shallow water within 2 km of the nest site, which is usually located in sheltered sandy beaches, spits and banks above the high tide line and below vegetation. Preliminary referrals with DEWNR have identified concerns if aquaculture activity is located too closely to the roosting sites of Fairy Terns. Consequently, the area identified for zoning remained close to the existing sites and did not seek to further encroach on known roosting sites.

Eastern Ospreys and White-Breasted Sea-Eagles are also listed as an endangered species in South Australia under the *National Parks and Wildlife* Act *1972.* They can be found on the island and are highly susceptible to human activity with demonstrated significant negative effects on breeding success. Dennis (2008) and Dennis et al. (2011) recommended a buffer zone of 1 km and 2 km from the nest of Eastern Ospreys and White-Breasted Sea-Eagles, respectively to minimise the effects of human activity on breeding outcomes.

St Peter Island also supports a large population of the Short-tailed Shearwater and the sandbank along the shoreline of the Southern Spit represents an important foraging area for a diverse range of shorebird (or wader) species. Seabirds may be adversely affected by activity around any feeding, roosting or nesting sites in the area. To minimise adverse interactions with seabirds, regulation 19 of the *Aquaculture Regulations 2005* specifies that each licence holder must have a written strategy approved by the Minister. In addition, risks posed by the aquaculture activity are assessed at the time of individual licence application through the Ecological Sustainable Development (ESD) assessment process consistent with the National ESD Framework (Fletcher *et. al.*, 2004).

Syngnathid fishes (e.g. seahorses, sea-dragons and pipefish) are also likely to be present in the region, especially in the seagrass, algal and reef assemblages. Syngnathid fishes are protected under the provisions of section 71 of the *Fisheries Management Act 2007*. The risk of adverse impacts to these species is low as aquaculture will not be placed over dense seagrass beds, reef or algal assemblages.

5.8 Commercial and Recreational Fishing

A large number of commercially and recreationally important species are known to occur within the Ceduna area, including King George Whiting, Sand Flathead, Snapper, Garfish, Snook, Wrasse, Yelloweye Mullet, Mulloway, Western Blue Groper, Trevally, Australian Herring, Leatherjackets, Southern Calamary, Sand and Blue Crabs, Razorfish, Western King Prawn, Abalone and Southern Rock Lobster (Edyvane 1999, Bryars 2003). Tourville Bay and Denial Bay provide valuable nursery habitats for Western King Prawns, Blue Swimmer Crabs and marine scalefish species such as King George Whiting. Aquaculture exclusion zones have been proposed around areas of high importance to commercial marine scalefish and recreational fishers to minimize unnecessary impacts on fishing activities.

5.9 Historic Shipwrecks

There are three shipwrecks proclaimed under the *Historic Shipwrecks Act 1981* or the Commonwealth *Historic Shipwrecks Act 1976* within the Ceduna aquaculture zone. Two are located in the Denial Bay aquaculture zone and one is located in the Bosanquet aquaculture exclusion zone (Figure 10).

One of the Principles of Development Control in the *Land Not Within a Council Area (Coastal Waters) 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 this Development Plan is excluded from the definition of development in the *Development Regulations, 2008* (Schedule 3, clause 16), it is a policy of PIRSA Fisheries and Aquaculture that this minimum distance is 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*, which covers South Australian coastal waters from the low water mark (or agreed baselines), but does not include State internal waters – i.e. the River Murray, Gulf St. Vincent, Spencer Gulf, Encounter Bay, Lacepede Bay, Rivoli Bay and Anxious Bay – which are covered under the *Historic Shipwrecks Act 1981*.

5.10 Shipping and Navigation

Thevenard is the only major port or harbour located in the region of Ceduna (Figure 10). The boundary of this port is described in schedule 3 of the *Harbors and Navigation Regulations 2009.* The Thevenard port is managed by the Flinders Port in accordance with the *Harbors and Navigation Act 1993*.

Access to the waters off Ceduna is provided by boat ramps located at Ceduna, Thevenard and Smoky Bay. The public and the aquaculture sector also launch boats from the beach at Denial Bay.

The Ceduna 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 in the area (Figure 1).

Infrastructure within an aquaculture zone should not pose a navigational hazard as it is a condition of aquaculture leases and licenses under regulation 16 of the *Aquaculture Regulations* that navigation marks be installed whenever structures are located in the leased area.

5.11 Tourism

Ceduna is a popular holiday destination with excellent tourist facilities that include five caravan parks and four motels. Tourists enjoy activities such as diving, fishing and boating (Eyre Peninsula Visitors Guide, 2014). Ceduna boasts rich Aboriginal cultural ties and a proud history in the agricultural, seafood and mining sectors. It's the last major town on the drive west to Perth and the first after crossing the Nullarbor from Western Australia.

One of the most popular tourist attractions on the Eyre Peninsula is the Oysterfest festival. This festival is an annual two day community event held in Ceduna during the October long weekend since 1991. The festival showcases the best of Ceduna's oysters and the local aquaculture industry. The Oysterfest attracts between 6,000 - 8,000 visitors to Ceduna each year.

At its closest point, the Ceduna aquaculture zone is approximately 6.7 km from the town of Ceduna (Figure 2). Given this distance, the impact of aquaculture is likely to be low on the visual and recreational amenity of tourists.

5.12 Sites of Scientific Importance

The PIRSA Minerals and Energy Division identify two geological monuments within the Streaky biounit. These are Eyre Island within Smoky Bay and Point Brown between Smoky and Streaky Bays (Geological survey of South Australia, 2014). Neither of these geological monuments are located within the boundaries of the Ceduna aquaculture zone.

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 throughout the farming cycle, from the introduction of spat to harvest. In addition Regulation 11 of the *Aquaculture Regulations 2005* requires licensees to report unusually high mortality rates.

Disease reporting requirements as stipulated in the *Aquaculture Regulations 2005* and *Livestock Act 1997* are considered adequate to monitor and adaptively manage any emerging production disease risks.

Table 2. The 26 vulnerable or endangered species listed by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities for the Ceduna region (as at 17 December 2014). Note the list describes species listed at the national level.

Common Name(s)	Species	Status	Type of Presence
Birds			
Antipodean Albatross	Diomedea exulans antipodensis	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Black-browed Albatross	*Thalassarche melanophris*	Vulnerable	Species or species habitat may occur within area
Campbell Albatross	*Thalassarche melanophris impavida*	Vulnerable	Species or species habitat may occur within area
Northern Royal Albatross	Diomedea epomophora sanfordi	Endangered	Foraging, feeding or related behaviour likely to occur within area
Shy Albatross, Tasmanian Shy Albatross	*Thalassarche cauta cauta*	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Southern Royal Albatross	Diomedea epomophora epomophora	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Tristan Albatross	*Diomedea exulans exulans*	Endangered	Species or species habitat may occur within area
Wandering Albatross	*Diomedea exulans (sensu lato)*	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
White-capped Albatross	Thalassarche cauta steadi	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Blue Petrel	*Halobaena caerulea*	Vulnerable	Species or species habitat may occur within area
Northern Giant-Petrel	*Macronectes halli*	Vulnerable	Species or species habitat may occur within area
Soft-plumaged Petrel	*Pterodroma mollis*	Vulnerable	Species or species habitat may occur within area
Southern Giant-Petrel	*Macronectes giganteus*	Endangered	Species or species habitat may occur within area
Hooded Plover (eastern)	Thinornis rubricollis rubricollis	Vulnerable	Species or species habitat known to occur within area
Mallee fowl	*Leipoa ocellata*	Vulnerable	Species or species habitat likely to occur within area
Mammals			
Australian Sea-lion	*Neophoca cinerea*	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Blue Whale	*Balaenoptera musculus*	Endangered	Species or species habitat may occur within area
Humpback Whale	*Megaptera novaeangliae*	Vulnerable	Species or species habitat likely to occur within area
Southern Right Whale	*Eubalaena australis*	Endangered	Breeding known to occur within area
Sandhill Dunnart	Sminthopsis psammophila	Endangered	Species or species habitat may occur within area
Wopilkara (Greater Stick-Nest Rat)	*Leporillus conditor*	Vulnerable	Species or species habitat likely to occur within area
Woylie (Brush-Tailed Bettong)	Bettongia penicillata ogilbyi	Endangered	Species or species habitat known to occur within area
Reptiles			
Green Turtle	*Chelonia mydas*	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Leatherback Turtle, LeatheryTurtle	*Dermochelys coriacea*	Endangered	Foraging, feeding or related behaviour known to occur within area
Loggerhead Turtle	*Caretta caretta*	Endangered	Breeding likely to occur within area
Fish			
Great White Shark	*Carcharodon carcharias*	Vulnerable	Foraging, feeding or related behaviour known to occur within area

6 REGIONAL IMPACT ASSESSMENT

This section contains an assessment of the expected effects of the aquaculture zone policy on the Far West Coast Region. 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.

6.1 Stakeholders

During consultation on the development of aquaculture zones, the main issues that are usually raised by stakeholders are access to the area and the aesthetics of having aquaculture farms in the region.

The following groups may be affected by the 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 Fisheries and Aquaculture 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 these 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 *Aquaculture Act 2001)*.

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 will consult with the following parties:

- Industry leaders, Department for Transport, Energy and Infrastructure (DTEI), SA Tourism Commission (SATC), South Australian Research and Development Institute, DEWNR, Department for Water, Coast Protection Board, 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 Ceduna, Eyre Regional Development Board and relevant Ceduna Community groups.

The Policy and Report describing the zoning proposal will be distributed to key stakeholders as the basis for consultation. These documents are available on the PIRSA Fisheries and Aquaculture website for 2 months. During the 2 month consultation period public briefings are conducted in the affected region to provide stakeholders with the opportunity to speak directly with PIRSA Fisheries and Aquaculture Officers.

Public notices will be placed in The Advertiser and the West Coast Sentinel seeking comment from members of the public. 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.

6.3 Potential Effects

Ceduna has a number of advantages over potential alternative locations where developers might seek to expand or initiate operations. The potential economic, social and environmental impacts of aquaculture are discussed below.

Specific favourable attributes of the Ceduna aquaculture zone include:

- Suitable physical characteristics; the Ceduna aquaculture zone is located in waters where the benthic fauna and flora are categorized as low to sparse. Also, the relatively shallow water in this area makes it suitable for intertidal and subtidal shellfish and algae aquaculture.
- Local industry support services such as boat ramps.
- Basic infrastructure including roads, electricity, telecommunications and fish processing facilities.

For existing aquaculture farmers in the Ceduna 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. water depth, wave height, currents).
- Acceptance by the local community.

Without zoning, aquaculture development is likely to occur in an *ad-hoc* manner (albeit subject to the Development Plan policy) and the full economic potential of the industry is unlikely to be achieved.

Future aquaculture development would rely on the pilot lease application process and this is not a strategic planning process. The *ad-hoc* and unplanned nature of the pilot lease application process is likely to result in a less efficient use of the area and possible costly planning disputes. It is also less streamlined for industry participants.

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 $335 million ($243 million on-farm and $92 million in downstream activities). Direct employment was estimated at 1,233 full time equivalent positions (FTE) in 2012/13 with 1,391 flow-on jobs, giving total employment of 2,625 FTE. 57% of these jobs were generated in regional South Australia. The oyster sector accounted for the majority of employment in the West Coast region (90%) with 90 FTE positions engaged in direct activities related to oyster farming.

Aquaculture zoning has a range of potential economic benefits to the state, 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 Ceduna aquaculture zone sets a limit of 339 ha that can be farmed. Although the benefits that an industry of the size allowed under this policy could have has not been modelled, the economic and social benefits for the region and South Australia derived from direct (on-farm and downstream processing) and flow-on (e.g. property and business services, retail, trade, manufacturing and transport) aquaculture activities are estimated to be high (EconSearch 2014).

Direct output (business turnover) generated by South Australian aquaculture was estimated to be $10.2 million in 2012/13 of which $4.6 million was attributed to the West Coast region. Flow-on output in other sectors of the regional economy was estimated to be $9.8 million in 2012/13 (EconSearch 2014). Total aquaculture-related contribution to gross regional product in the West Coast region was approximately $13.0 million in 2012/13, $5.8 million generated by aquaculture directly, $2.0 million generated in associated downstream activities and $5.3 million generated in other sectors of the regional economy (EconSearch 2014).

6.3.2 Social Effects

The majority of the small communities on the Far West Coast, including Ceduna, service the agricultural fishing and aquaculture industries. The impact of the rural downturn and employment opportunities provided by mining 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 Ceduna in 2004 by the low 15 to 34 year old percentile 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 aquaculture zone to minimise noise and visual impacts.

In addition, four aquaculture exclusion zones allow for commercial and recreational fishing vessels to navigate and access Murat and Bosanquet Bays.

On balance, it is also expected that:

- Additional business and capital may be attracted to the region.
- The population size/demographics of Ceduna may be affected.
- Investment may be required to improve infrastructure such as 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

The Policy does not itself address regional environmental impacts. These are addressed at the licence assessment stage. Where no or limited data are available to assess the risks posed by the aquaculture activity, such as in Decres Bay, additional video footage of the benthic habitat will need to be provided by the applicant when applying for a new site. The analysis of this footage during the application process will ensure that licensed sites will not be located over sensitive benthic habitat, thereby minimising any environmental impacts.

Risks posed by the aquaculture activity will be 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 for Agriculture and Fisheries 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.

Comments are invited that could improve the information provided above.

7 REFERENCES

Ashman, G. (1996). Far West Aquaculture Management Plan. Primary Industries South Australia. 55 pp.

Australian Bureau of Statistics (2011). National Regional Profile: Ceduna (DC) (Local Government Area) [online]. [Accessed 18 March 2011]. Available from World Wide Web:<http://www.abs.gov.au/ausstats/abs@nrp.nsf/Latestproducts/LGA47910Population/People12005-2009?opendocument&tabname=Summary&prodno=LGA47910&issue=2005-2009&num=&view=>

Australian Government, Department of the Environment and Water Resources (2011). Interactive Map for Environmental Report Tool [online]. [Accessed 2 March 2011]. Available from World Wide Web: <http://www.environment.gov.au/erin/ert/epbc/imap/map.html>

Buschmann AH, Herna´ndez-Gonza´ lez MC, Varela DA. (2008) Seaweed future cultivation in Chile: perspectives and challenges. International Journal of Environment and Pollution 33:432–56.

Bryars, S. (2003). An Inventory of Important Coastal Fisheries Habitats in South Australia. Fish Habitat Program, Primary Industries and Resources South Australia.

Ceduna Council Development Plan (2012). http://www.ceduna.sa.gov.au/page.aspx?u=811 347pp.

Chopin, T., Buschmann, A. H., Halling, C., Troell, M., Kautsky, N., Neori, A., Kraemer, G. P., Zertuche-Gonzalez, J. A., Yarish, C. and Neefus, C. (2001). Integrating seaweeds into marine aquaculture systems: a key toward sustainability. Journal of Phycology 37: 975-986.

Dennis, T. (2008). Significant coastal raptor refuge habitat locations on western Eyre Peninsula; and recommended spatial refuge parameters required to avoid nest site desertion and territory abandonment at sites likely to be threatened by increased human disturbance throughout South Australia. Report to: Coastal Management Branch Dept. for Environment and Heritage. 8pp.

Dennis, T., McIntosh, R. and Shaughnessy, P. (2011). Effects of human disturbance on productivity of White-bellied Sea-Eagles (*Haliaeetus leucogaster*). Emu 111: 179-185.

DEWNR (in draft). Appendix 1: Preliminary assessment of potential shorebird and waterbird impact: Australian Razorfish Pty Ltd Application to move lease within St Peter Island one kilometre aquaculture exclusion. 12 pp.

Dore J., Keating K., Woodhill J. and Ellis K. (2000). Sustainable Regional Development, SDR Kit. A resource for improving the community, economy and environment of your region. Greening Australia. 82 p.Dutson, G. et al. (2009). Australia's Important Bird Areas: Key sites for bird conservation. Birds Australia (RAOU) Conservation Statement No. 15, October 2009. Melbourne, Birds Australia.

EconSearch (2014). The Economic Impact of Aquaculture on the South Australian State and Regional Economies, 2012/13. A report prepared for PIRSA Fisheries and Aquaculture. 91 pp.

Edgar, G. (2008) Australian marine life: the plant and animals of temperate waters. Reed New Holland, Australia.

Edyvane, K. (1999). Conserving marine biodiversity in South Australia – Part 2 – Identification of areas of high conservation value in South Australia. Primary Industries and Resources South Australia.

Eyre Peninsula Visitors Guide (2014). South Australian Tourism Commission 2014. Accessed on 18 December 2014 URL: http://www.southaustralia.com/regionalguides/EyrePeninsula/index.html

FAO (2009). State of World Fisheries and Aquaculture 2008, FAO Fisheries Department, Rome.

Fletcher, W. J. Chesson, J., Fisher M., Sainsbury, K. J., and Hundloe, T. (2004). National ESD Reporting Framework: The 'How To' Guide for Aquaculture. FRDC Project 2000/145.1, Canberra, Australia 75 pp

Geological survey of South Australia (2014). PIRSA Minerals and Energy Resources SA_Geodata database. Accessed December 2014.

Goldsworthy, S. D., Page, B., Shaughnessy, P. D., Hamer, D., Peters, K. D., McIntosh, R. R., Baylis, A. M. M. and McKenzie, J. (2009). Innovative solutions for aquaculture planning and management: addressing seal interactions in the finfish aquaculture industry. FRDC Project number: 2004/201. SARDI Aquatic Sciences Publication Number F2008/000222-1. SARDI Research Report Series No. 288. 291 pp.

Mount, G., Fernandes, M. and Cheshire, A. (2007). Evaluation of waste management strategies for the Southern Bluefin Tuna industry. In Aquafin CRC - Southern Bluefin Tuna Aquaculture Subprogram: Tuna Environment Subproject – Evaluation of Waste Composition and Waste Mitigation. Technical report, Aquafin CRC Project 4.3.2, FRDC Project 2001/103. SARDI Publication No. RD03/0037-9. SARDI Research Report Series No. 207, Aquafin CRC, FRDC and SARDI Aquatic Sciences, Adelaide, pp. 257–280.

National Native Title Tribunal, Commonwealth of Australia (2015). Indigenous Land Use Agreements [online]. [Accessed 18th March 2015]. Available on World Wide Web: http://www.nntt.gov.au/ILUAs/Pages/default.aspxO'Bryen, P. J. and Lee, C. S. (2003). Management of aquaculture effluents workshop discussion summary. Aquaculture 226(1):227-242.

Parsons Brinkerhoff and SARDI Aquatic Sciences. (2003). Technical review for aquaculture management plans – phase 2.

Petrusevics, P., Noye, J., Harbison, P. and Petrusevics, A. (1998). Key Sites for off-shore Aquaculture development in South Australia. Prepared for PIRSA (Aquaculture Group) March 1998.

Primary Industries South Australia (1996). Spencer Gulf Aquaculture Management Plan. pp 89.

Rodda, K., Loo, M. G. K. and Doonan, A. (2009). Zone Investigations Project Phase I: Technical Review for PIRSA Aquaculture Management Plans (Volume A). South Australian Research and Development Institute. Adelaide. 112pp.SARDI Publication Number 2009/000528-1.

Standards Australia and Standards New Zealand (2009) AS/NZS ISO 31000:2009 Risk management - Principles and guidelines. Joint Australian/New Zealand Standard, Joint Technical Committee OB-007, Risk Management. Sydney, Australia and Wellington, New Zealand. 24 pp.

Wiltshire, K.H. and Loo, M.G.K. (2009). Zone investigations Project Phase II: Technical investigation of West Coast Region – Denial Bay and Waterwitch Channel Zones. South Australian Research and Development Institute (Aquatic Sciences). Adelaide. 19pp. SARDI Publication number F2009/000355-1.

8 APPENDIX A – GLOSSARY OF TERMS

Adaptive Management	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.
Assimilative capacity	The capacity of a natural body of water to receive wastewaters without deleterious effects to aquatic life.
Benthic	Of or relating to or happening on the bottom under the ocean/lake.
Biodiversity	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.
Biomass	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).
Bivalve mollusc	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.
Broodstock	Aquatic organisms from which subsequent generations are intended to be produced for the purpose of aquaculture.
Carrying capacity	The maximum population of a given organism that a particular environment can sustain.
Closures	Prohibition of fishing during particular times or seasons (temporal closures) or in particular areas (spatial closures), or a combination of both.
Depauperate	Lacking species variety.
Ecologically sustainable development (ESD)	ESD is described in the Aquaculture *Act 2001* 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'.
Ecosystem	A dynamic complex of plant, animal, fungal, and microorganism communities and the associated non-living environment interacting as an ecological unit.

Habitat	The place or type of site in which an organism naturally occurs.
Harvest	A productivity measuring technique relating to the yield of seasonal aquaculture produce.
Infauna	Aquatic organisms (animals only) that live within particulate media such as sediments or soil.
Mapcode	Fishing area defined for catch and effort statistics
Marine Park	Means an area established as a marine park under Part 3 Division 1 of the *Marine Parks Act 2007*.
Marine protected area (MPA)	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.
Mean High Water Springs	The line representing the average of all high water observations at the time of spring tide over a period of 19 years.
Organic enrichment	The supply of organic material (e.g. waste feed, faeces) to the seafloor.
Population	A group of individuals of the same species, forming a breeding unit and sharing a habitat.
Spatial	Of or relating to space.
Stakeholder	An individual or a group with an interest in the conservation, management and use of a resource.
Stock	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.
Supplementary fed	Supplementary feeding is the giving of feed to aquatic organisms to supplement any naturally available food.

APPENDIX B – LIST OF ACRONYMS

AAC	Aquaculture Advisory Council
CRC	Cooperative Research Centre
AAR	Aboriginal Affairs and Reconciliation
DAC	Development Assessment Commission
DEWNR	Department of Environment, Water and Natural Resources
DPTI	Department for Planning, Transport and Infrastructure
EMP	Environmental Monitoring Program
EPA	Environment Protection Authority
EPBC Act	The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
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	*National Parks and Wildlife Act 1972*
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 Ceduna aquaculture policy area (comprising four zones) and the Ceduna aquaculture exclusion zone is provided in the Policy.

Disclaimer: All maps presented in this report are produced by Primary Industries and Regions South Australia (PIRSA) using the best available data. However GIS data and product accuracy may vary. GIS data and products may be developed from sources of differing accuracy, accurate only at certain scales and times based on modelling or interpretation, incomplete while being created or revised etc. PIRSA reserves the right to correct, update, modify or replace GIS products without notification. PIRSA cannot assure the accuracy, completeness, reliability or suitability of this information for any particular purpose. Using GIS data for purposes other than those for which they were created may yield inaccurate or misleading results. The recipient may neither assert any proprietary rights to this information nor represent it to anyone as other than South Australian Government produced information. PIRSA shall not be liable for any activity involving this information with respect to lost profits, lost savings or any other consequential damages.

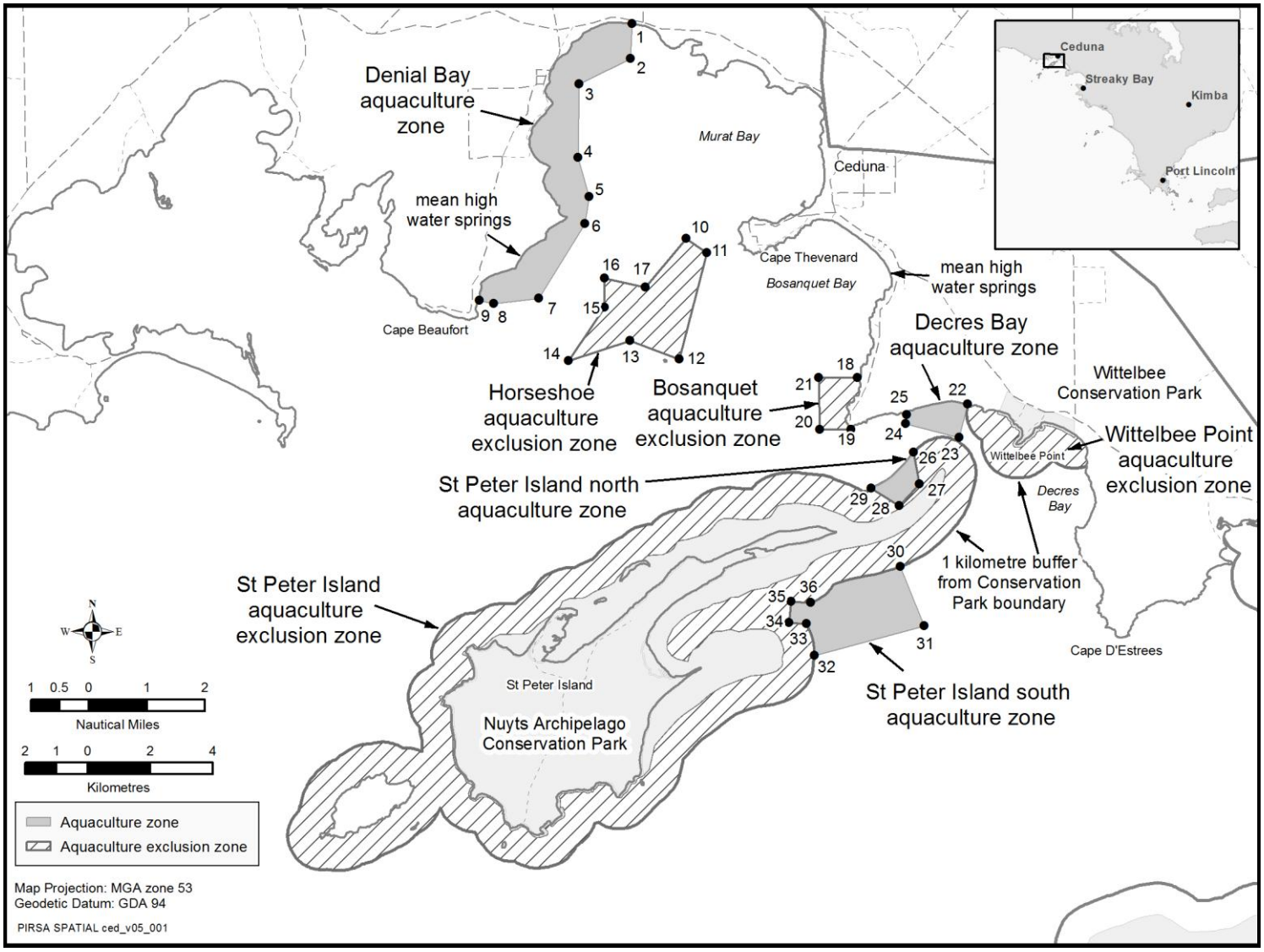

Figure 1. Overview of Ceduna aquaculture zones and the Ceduna aquaculture exclusion zones. Numbers 1-36 reflect the coordinates provided in the written description for each zone.

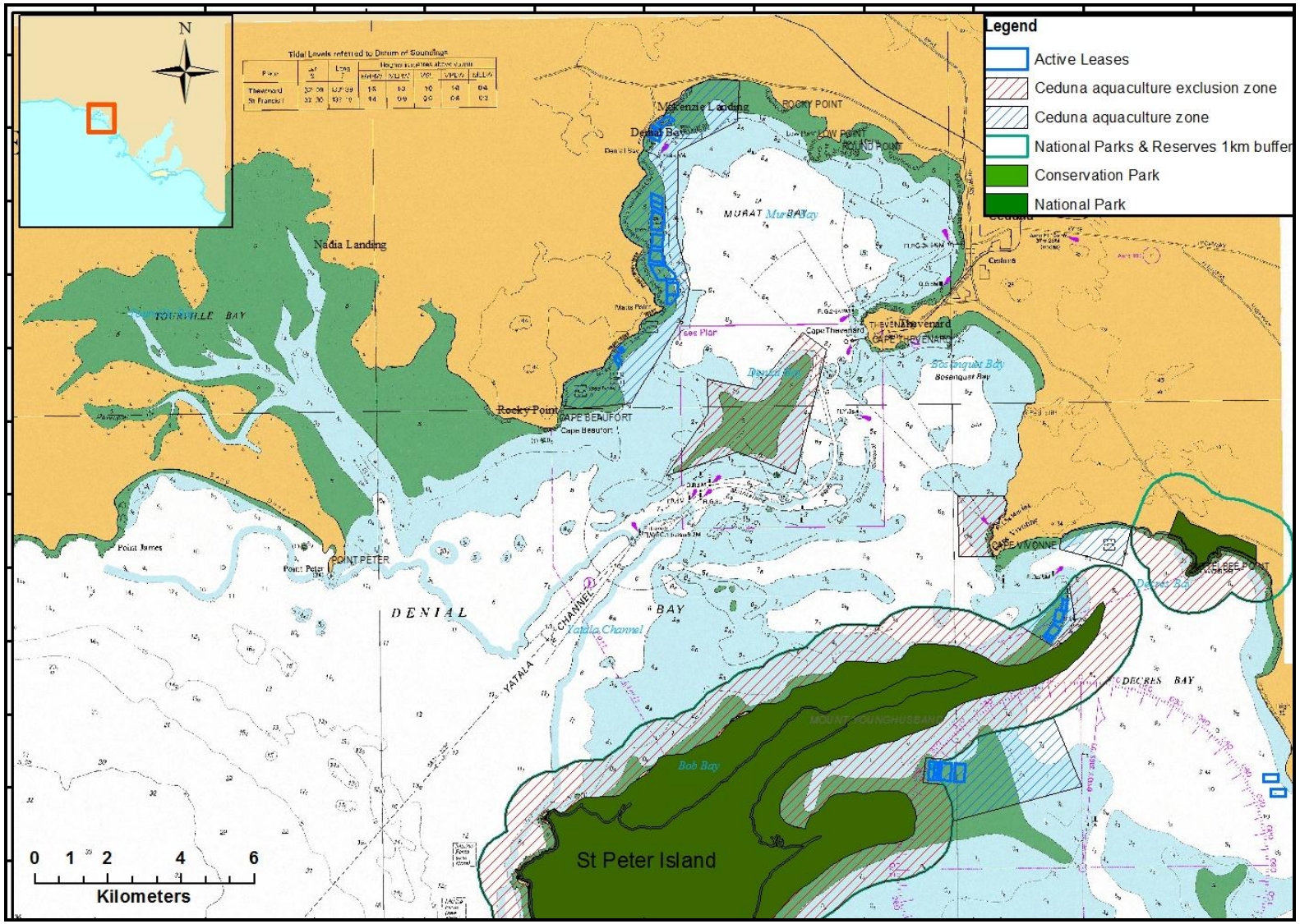

Figure 2. Overlay of the Ceduna aquaculture zones and aquaculture exclusion zones showing existing leases, depth analysis (in meters) and proximity to Conservation Park boundaries. Note: light green represents water depth = 0 (sand).

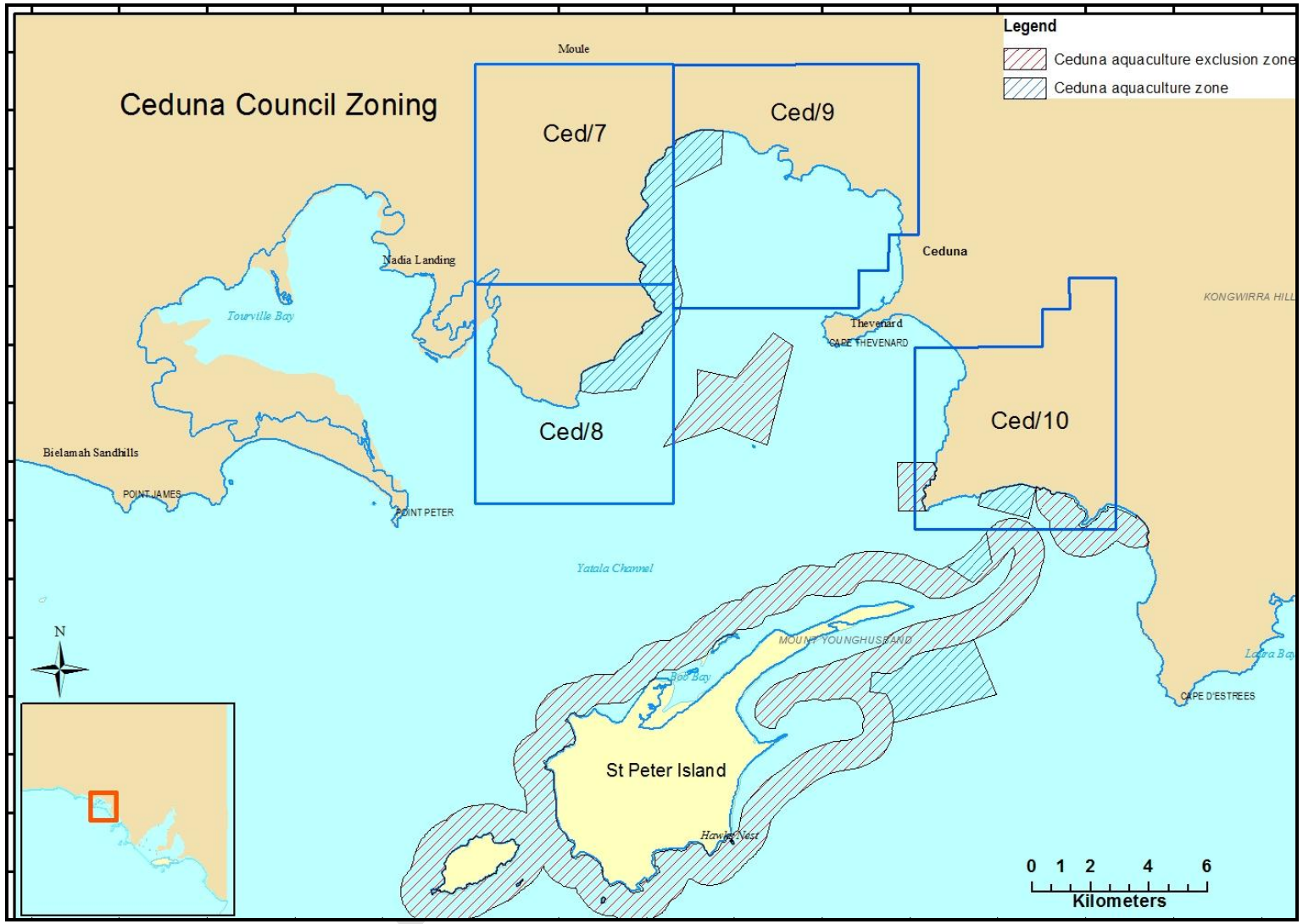

Figure 3. Overlay of the Ceduna aquaculture zones and aquaculture exclusion zones with the Ceduna Council Development Plan zones

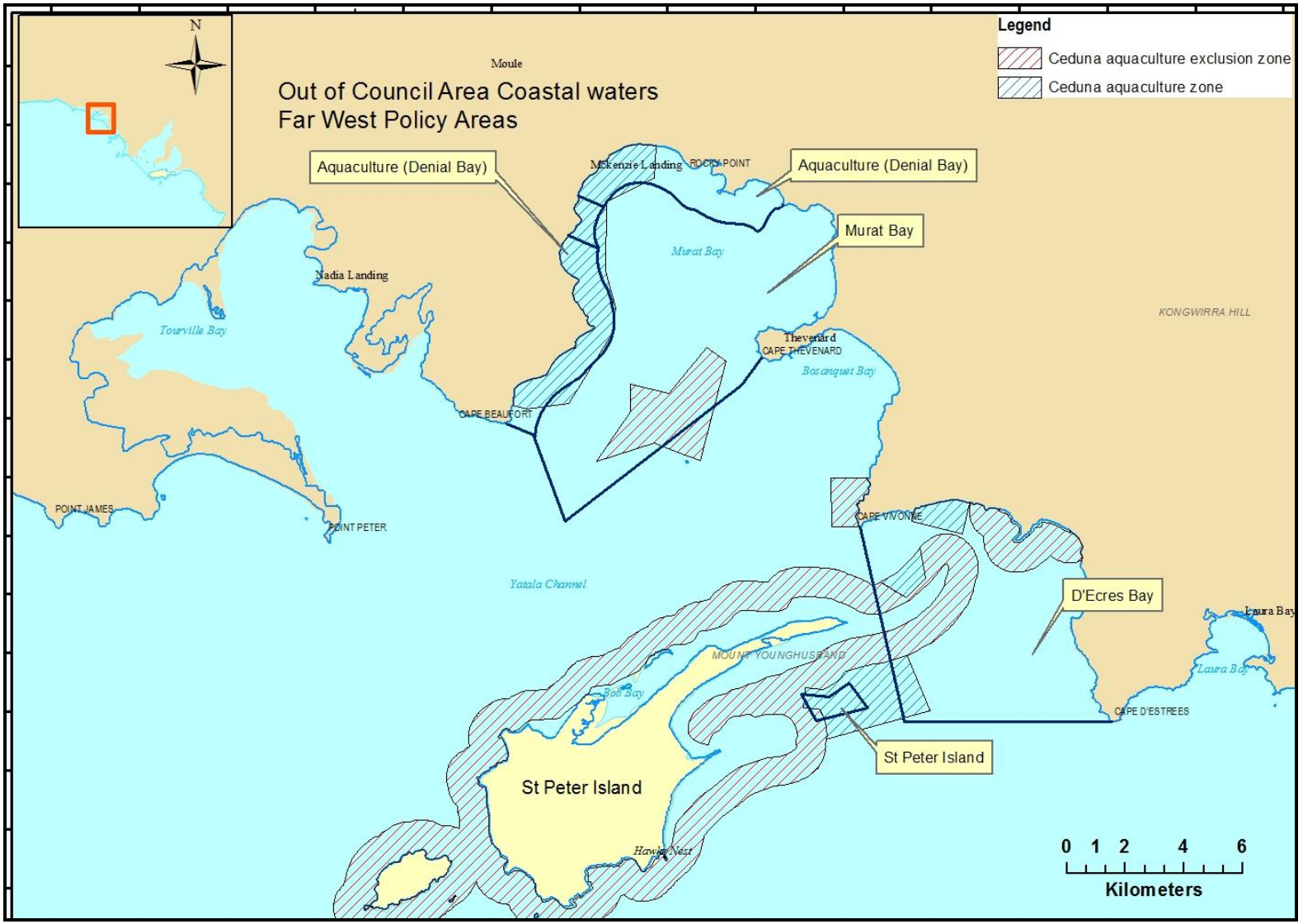

Figure 4. Overlay of the Ceduna aquaculture zones and aquaculture exclusion zones with the Far West Aquaculture Management Plan zones

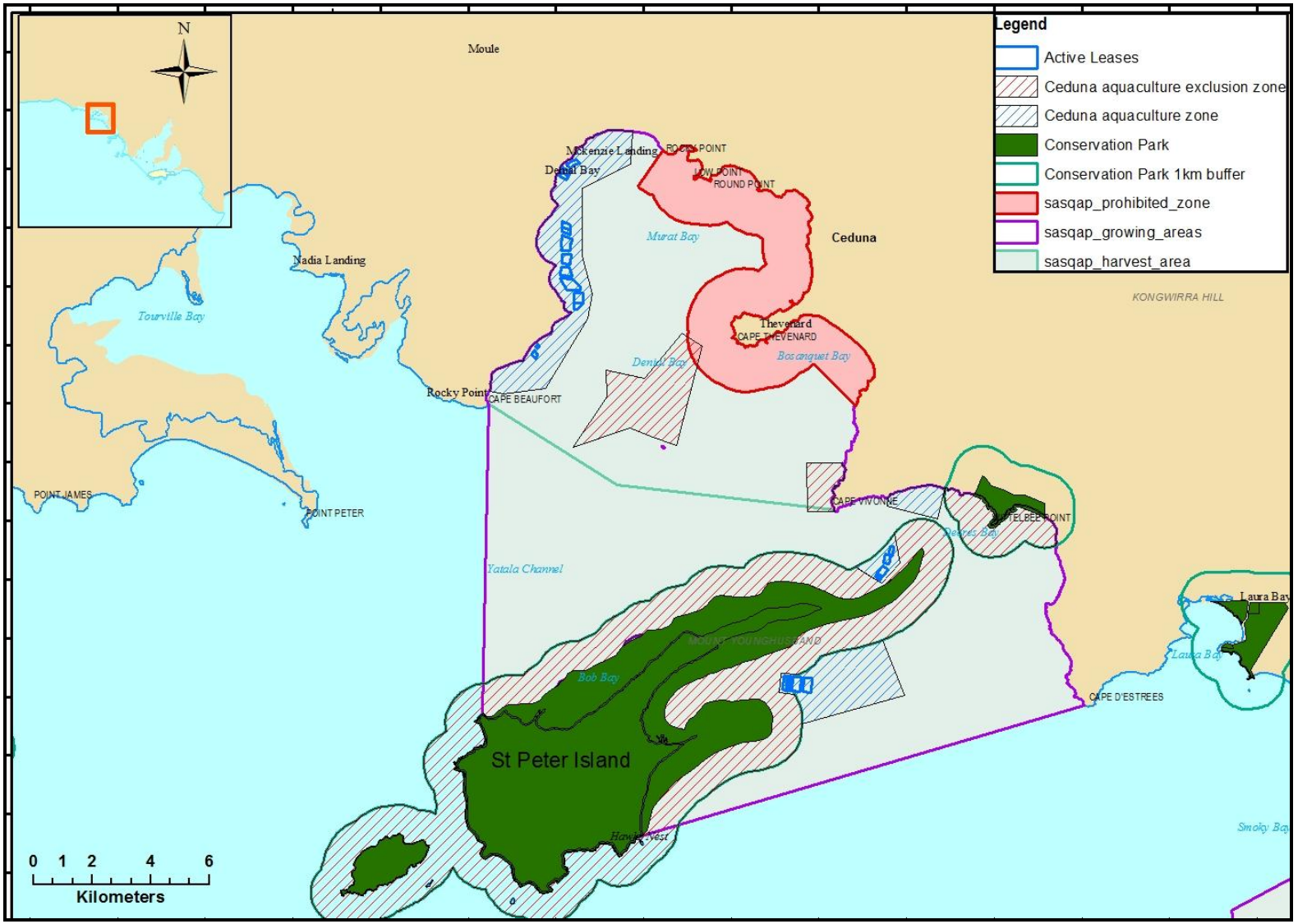

Figure 5. Overlay of the Ceduna aquaculture zones and aquaculture exclusion zones with the South Australian Shellfish Quality Assurance Program areas

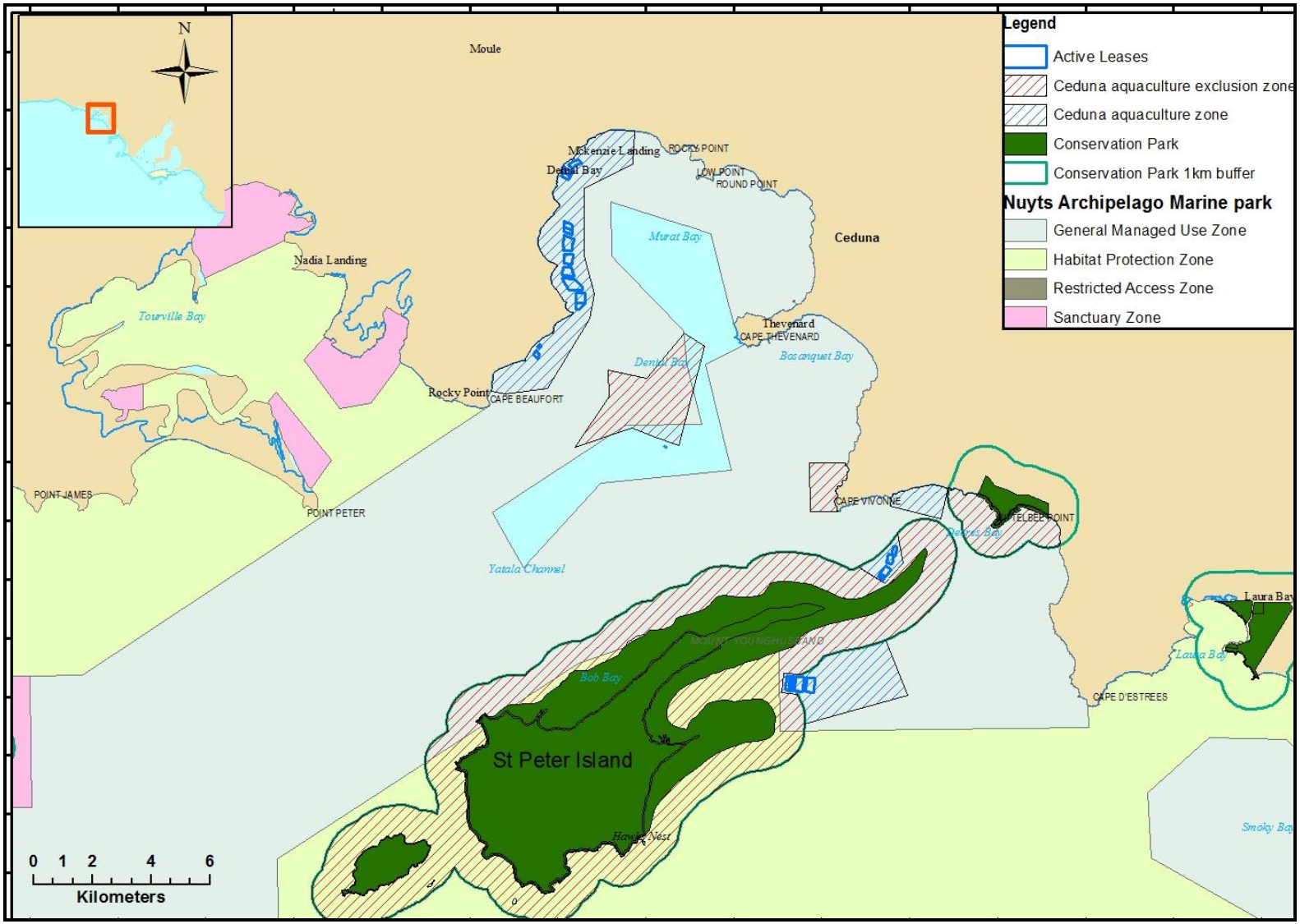

Figure 6. Overlay of the Ceduna aquaculture zones and aquaculture exclusion zones showing existing aquaculture leases and Marine Park zoning

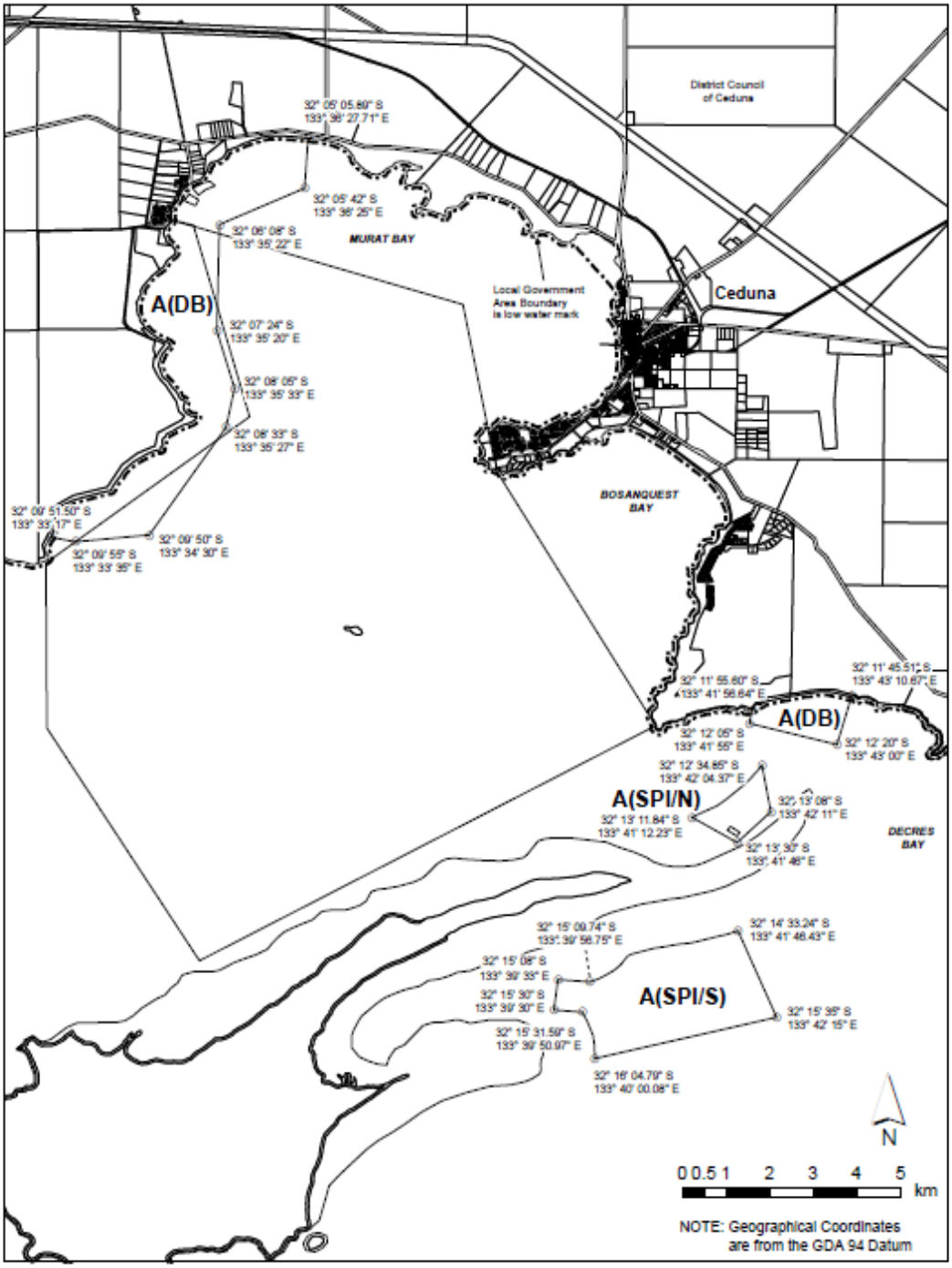

Figure 7. New zoning map to delineate the extent of the Aquaculture (Ceduna) Zone under the Land Not Within A Council Area (Coastal Waters) development plan

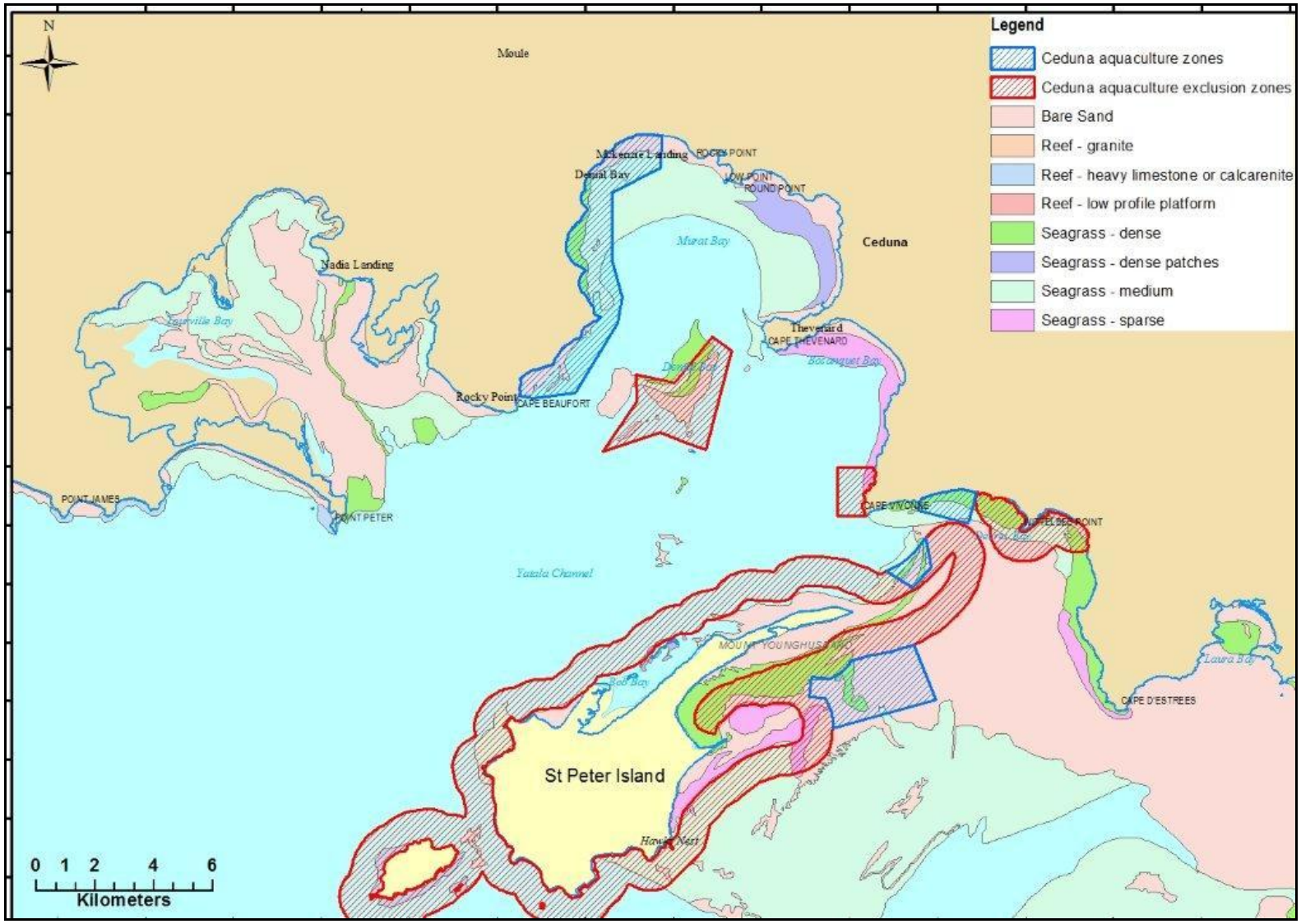

Figure 8. Overlay of the Ceduna aquaculture zones and aquaculture exclusion zones showing different categories of benthic habitat

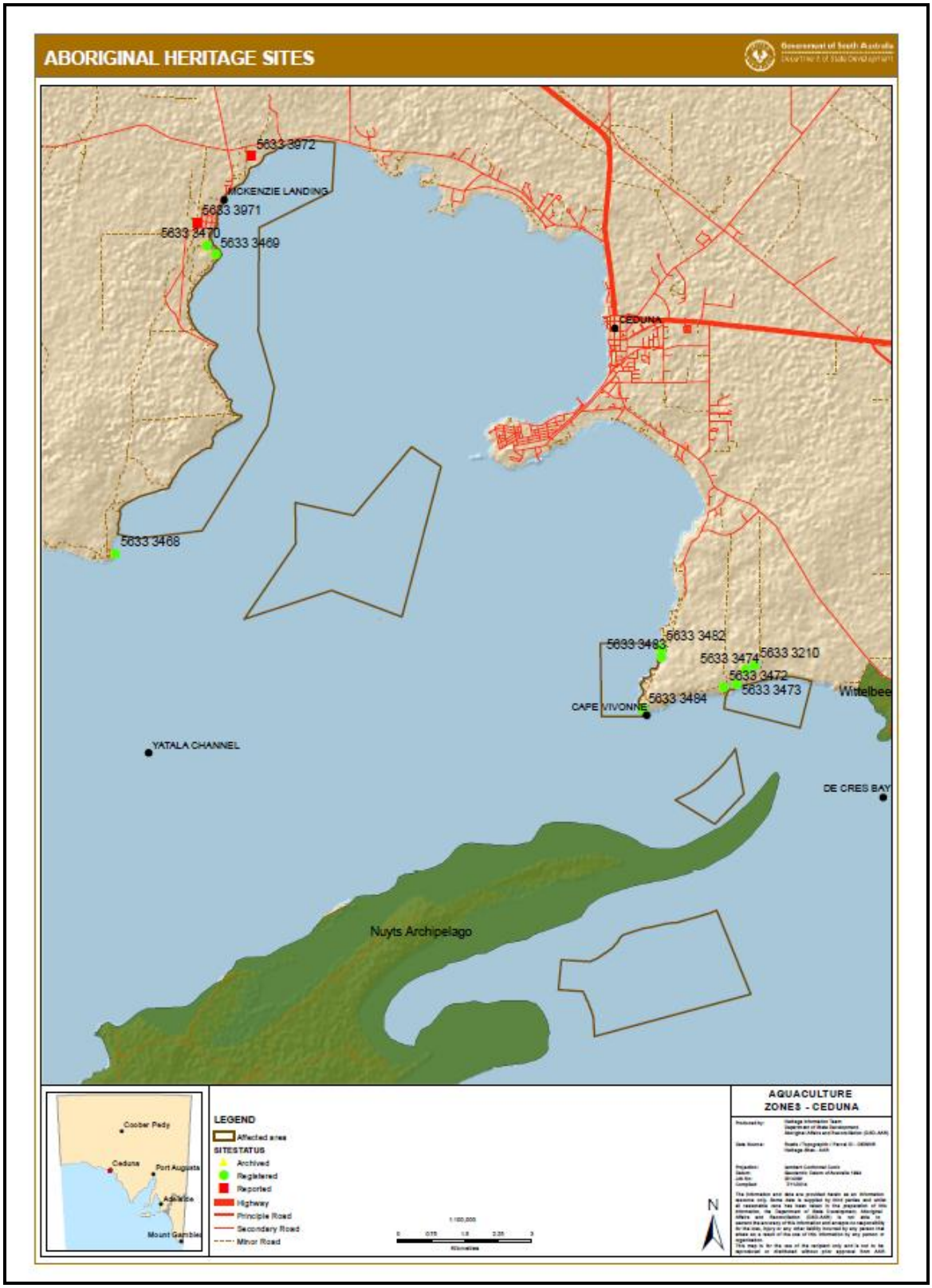

Figure 9. Approximate location of an Aboriginal archaeological site determined from the Register of Aboriginal Sites and Objects administered by the Department of State Development, Aboriginal Affairs and Reconciliation (DSD-AAR)

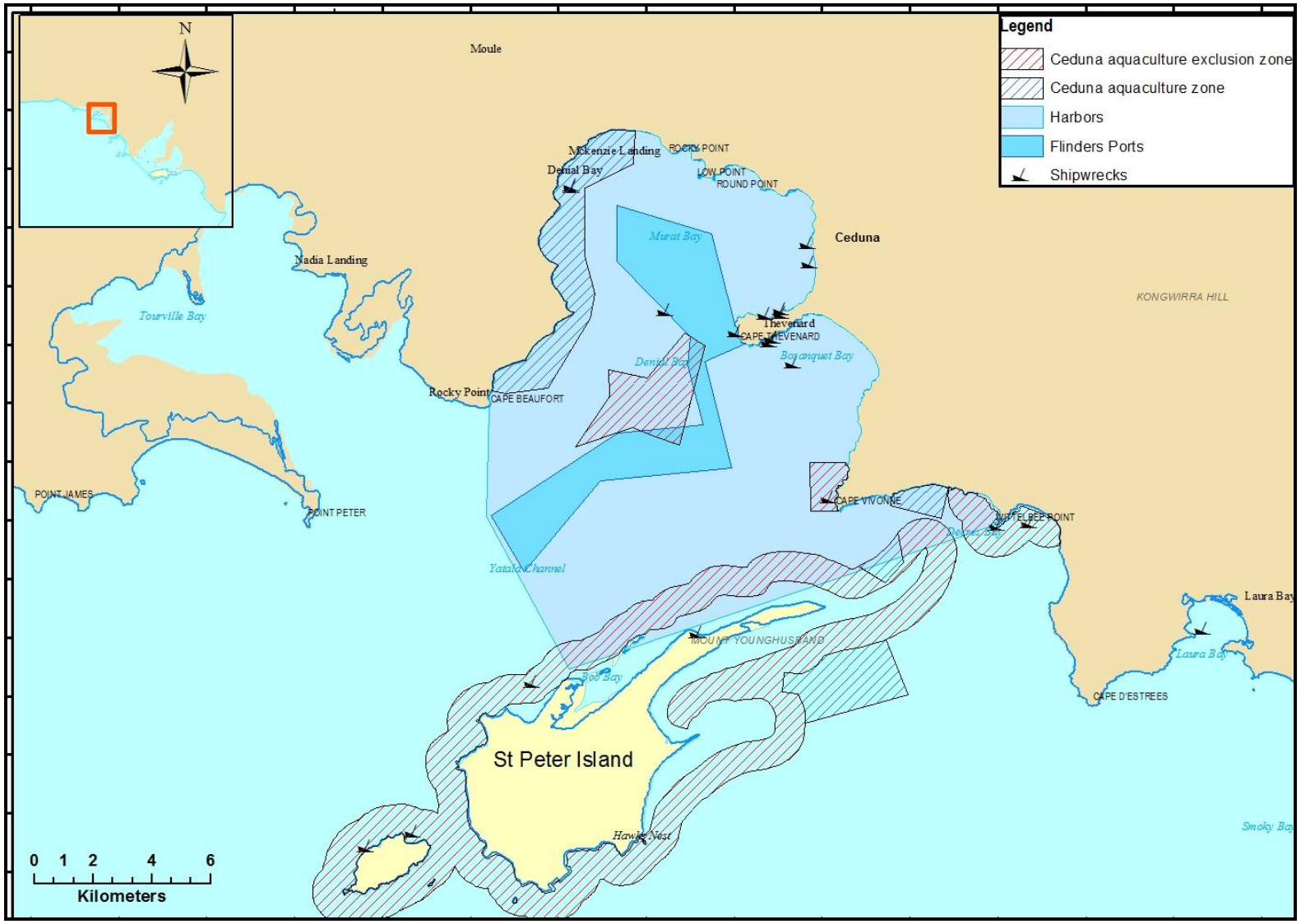

Figure 10. Location of Flinders Ports (Thevenard), Harbours and shipwrecks in the Ceduna aquaculture zone

APPENDIX D1 – BACKGROUND INFORMATION

Legislation / Policy	Objectives	Consistency
South Australia's Strategic Plan	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: Growing Prosperity Improving Wellbeing Attaining Suitability Fostering Creativity and Innovation Building Commitments Expanding Opportunities The Plan contains 98 targets across the six objectives to measure progress towards achieving these goals.	Aquaculture policies under the *Aquaculture Act2001* 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: • Target 1.1 – Economic Growth • Target 1.5 – Business Investment • Target 1.10 – Jobs • Target 1.14 – Total Exports
Planning Strategy for Regional South Australia (January 2003 – amended Dec 2007) (DPLG document)	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. • Building and/or supporting sustainable communities; • Being more efficient and sustainable; • Diversifying primary production into new areas to replace or complement existing activities; • Adding value by greater processing of produce within South Australia instead of exporting produce in its raw state; • Facilitating sustainable tourism development to achieve economic, social and environmental benefits for the state; and • Integrated and sustainable management of natural resources in a manner that maintains ecological processes.	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.
Development Act 1993 *Development*	The *Development Act 1993* and *Development Regulations 2008* detail the processes for making and assessing development applications.	This Policy is consistent with these provisions in that it seeks to ensure the ecologically sustainable development of the marine-based aquaculture industry

Legislation / Policy	Objectives	Consistency
Regulations 2008 Land Not Within A Council Area (Coastal Waters) Development Plan	'Development' is defined in the *Development Act 1993* to include: • A change in the use of land or buildings • The creation of new allotments through land division (including Strata and Community Title division) • Building work (including construction, demolition, alteration and associated excavation/fill) • Cutting, damaging or felling of significant trees • Specific work in relation to State and Local Heritage Places • Prescribed mining operations • Other acts or activities in relation to land as declared by the Development Regulations. The *Development Act 1993* requires there be a Development Plan for each part of the state. Development Plans guide development and inform assessment of development applications. 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. The policies and zoning in Development Plans need to be changed and updated over time. The *Development Act 1993* provides the legislative framework for undertaking amendments to a Development Plan. Amendments can be instigated by either the relevant Council or the Minister for Urban Development and Planning. The document used to propose changes to a Development Plan is called a Development Plan Amendment (DPA). The *Development Regulations 2008* recognise aquaculture zones identified in an aquaculture policy prepared under the *Aquaculture Act 2001*, classing them as a Category 1 development. The *Aquaculture Act 2001* and Regulations also enable the Minister for Urban Development and Planning to amend a development plan in accordance with an approved aquaculture policy under the *Aquaculture Act 2001*. Recent amendments to the *Development Act 1993* 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. 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.	and recognises and respects other users of the marine resource.

Legislation / Policy	Objectives	Consistency
Aboriginal Heritage Act 1988	The *Aboriginal Heritage Act 1988* 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. The *Native Title Act 1993* (Cth) 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). In particular, the *Native Title Act 1993* 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. 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.	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 Ceduna aquaculture zone policy it is Barngarla group (represented by Phillip Teitzel). 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 *Native Title Act 1993* (Cwth).
Australia's Ocean Policy (Cth)	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. 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.	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.
Marine Parks Act 2007	The *Marine Parks Act 2007* provides the legislative framework for the dedication, zoning and management of South Australia's marine parks. 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 designated as either Restricted Access Zones or Sanctuary Zones to provide the necessary level of	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

Legislation / Policy	Objectives	Consistency
	protection for habitats, species, ecological and geological features. Both of these zones preclude commercial fishing, recreational fishing and aquaculture operations.	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 DEWNR 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. The Policy has been prepared having regard to Marine Park objects and boundaries and in accordance with the agreement between DEWNR and PIRSA.
Natural Resources Management Act 2004 Eyre Peninsula Natural Resources Management Plan	The intent of the *Natural Resources Management Act 2004* 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.	The *Aquaculture Act 2001* and its supporting policies are also underpinned by ecologically sustainable development principles. 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.
Environment Protection Act 1993	The Objects of the *Environment Protection Act 1993* (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. The principle object of the *Environment Protection (Water Quality) Policy 2003* (Water Quality Policy)	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.

Legislation / Policy	Objectives	Consistency
Environment Protection (Water Quality) Policy 2003	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 of deposition of pollutants into any waters that results in: • Loss of sea grass or other native aquatic vegetation; or • Reduction in numbers of any native species of aquatic animal or insect; or • Increase in numbers of any non-native species of aquatic animals or insect; or • Reduction in numbers of aquatic organisms necessary to a healthy aquatic ecosystem; or • Increase in algal or aquatic plant growth; or • Water becoming toxic to vegetation on land; or • Water becoming harmful or offensive to humans, livestock or native animals; or • Increased turbidity or sediment levels.	
Harbors and Navigation Act 1993	The *Harbors and Navigation Act 1993* sets out the following objectives: • 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; • To ensure that efficient and reliable cargo transfer facilities are established and maintained; • To promote the safe, orderly and efficient movement of shipping within harbors; • To promote the economic use and the proper commercial exploitation of harbors and harbor facilities; • To provide for the safe navigation of vessels in South Australian waters; • To provide for the safe use of South Australian waters for recreational and other aquatic activities; and • Insofar as this Act applies to the Adelaide Dolphin Sanctuary, to further the objects and objectives of the *Adelaide Dolphin Sanctuary Act 2005*.	Under the *Aquaculture Act 2001*, 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. Section 20 of the *Aquaculture Act 2001* provides that the grant of aquaculture leases is subject to the concurrence of the Minister responsible for administration of the *Harbors and Navigation Act 1993*.

Legislation / Policy	Objectives	Consistency
Coast Protection Act 1972	The *Coast Protection Act 1972* establishes the Coast Protection Board. The functions of the Board are: • To protect the coast from erosion, damage, deterioration, pollution and misuse; • To restore any part of the coast that has been subjected to erosion, damage, deterioration, pollution or misuse; • 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; • 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; • To report to the Minister upon any matters that the Minister may refer to the Board for advice; • 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 • To perform such other functions assigned to the Board by or under this or any other Act.	The Policy is consistent with the provisions of the *Coast Protection Act 1972* 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.
Native Vegetation Act 1991	The objects of the *Native Vegetation Act 1991* are: • The conservation, protection and enhancement of the native vegetation of the State and, in particular, remnant native vegetation, in order to prevent further - • Reduction of biological diversity and degradation of the land and its soil; and • Loss of quantity and quality of native vegetation in the State; and • Loss of critical habitat; and • 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 • 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 • The encouragement of research into the preservation, enhancement and management of native vegetation; and	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.

Legislation / Policy	Objectives	Consistency
	• The encouragement of the re-establishment of native vegetation in those parts of the State where native vegetation has been cleared or degraded.	
Historic Shipwrecks Act 1976 (Cth) *Historic Shipwrecks Act 1981* (SA)	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 – ie the River Murray, Gulf St. Vincent, Spencer Gulf, Encounter Bay, Lacepede Bay, Rivoli Bay and Anxious Bay – which are covered under the *Historic Shipwrecks Act 1981* (SA). 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. 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.	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 *Development Act 1993*.
National Parks and Wildlife Act 1972	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.	
Fisheries Management Act 2007	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 *Fisheries Act 1982* and the *Fisheries (Gulf St. Vincent Prawn Fishery Rationalisation) Act 1987*; to make related amendments to other Acts; and for other purposes.	To minimise adverse interactions with seabirds and large marine vertebrates, regulation 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).

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. 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).

For shellfish or algae aquaculture, estimating carrying capacity is difficult 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.*, 2008).

Class of aquaculture

Classes of aquaculture under previous aquaculture zone policies referred to groups of species e.g. bivalve molluscs, finfish and tuna. 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 prescribed classes of aquaculture for the four aquaculture zones are:

- the farming of aquatic animals (other than mussels and finfish) in a manner that does not involve regular feeding;
- the farming of algae.

The Policy is primarily established for the farming of non-supplementary fed species such as oysters, cockles, razorfish, sea cucumber, scallops and algae. No finfish (including tuna) or mussel farming is permitted in the Ceduna aquaculture zone.

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 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. 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.

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 regulation 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. The risk of adverse impacts to these species is low as aquaculture will not be placed over dense seagrass beds, reef or algal assemblages.

APPENDIX D4 – LESSEE AND LICENSEE OBLIGATIONS

The *Aquaculture Act 2001* is the main piece of legislation governing the management, control and development of the aquaculture sector. The *Aquaculture Act 2001* 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 *Aquaculture Act 2001* provides for an integrated licensing and tenure system and provides a flexible approach to the granting of rights to occupy State waters. Under the *Aquaculture Act 2001*, a licence may not be granted for aquaculture in State waters unless the area is subject to a lease granted by the Minister. The *Aquaculture Act 2001* 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 *Aquaculture Act 2001* 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/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 *Aquaculture Act 2001*, 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 Environment Protection Authority 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 – if applicable);
- 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 *Aquaculture Act 2001*. 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 *Aquaculture Act 2001* 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.

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.

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 *Aquaculture Act 2001* 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.

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 (IS). 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 under the IS-1 program:

a) *Environmental audits of marine aquaculture* – The project examined the 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. 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.

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 outcomes of this work allowed PIRSA Fisheries and Aquaculture to make more informed decisions on total allowable biomass within the Fitzgerald Bay aquaculture zone and other zones that farm supplementary fed stock.

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. 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.

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 was 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.

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.