Government of South Australia
Department of Primary Industries and Regions

Our ref: CORP F2021/000320
Your ref: NC-FOI/MV

CORPORATE SERVICES
Level 15
25 Grenfell Street
Adelaide SA 5000
GPO Box 1671
Adelaide SA 5001
DX 667
Tel 8429 0422
www.pir.sa.gov.au

03 August 2021

Senator Rex Patrick
Senator for South Australia
Level 2, 31 Ebenezer Place
ADELAIDE SA 5000

Dear Senator Patrick

Determination under the *Freedom of Information Act 1991*

I refer to your application made under the *Freedom of Information Act 1991* which was received by the Department of Primary Industries and Regions (PIRSA) on 9 July 2021, seeking access to the following:

> *"Copy of the environmental risk assessment associated with Kingfish aquaculture approvals for Fitzgerald Bay."*

Accordingly, the following determination has been finalised.

I have located one document that is captured within the scope of your request.

Determination

I have determined that access to the following document is **granted in full**:

Doc No.	Description of document	No. of Pages
1	Fitzgerald Bay aquaculture – Original Ecological Sustainable Development Risk Assessments dated 3/4/2019 and 27/9/2019 and updated information to supplement original Ecological Sustainable Development Risk Assessments	61

If you are dissatisfied with this determination, you are entitled to exercise your right of review and appeal as outlined in the attached documentation https://archives.sa.gov.au/finding-information/information-held-sa-government/making-freedom-information-application#Review, by completing the "FOI Application Form for Internal Review of a Determination" and returning the completed form to:

Freedom of Information Principal Officer
Department of Primary Industries and Regions
GPO Box 1671
ADELAIDE SA 5001

or via email PIRSA.FOI@sa.gov.au

In accordance with the requirements of Premier and Cabinet Circular PC045, details of your application, and the document to which you are given access, will be published in PIRSA's disclosure log. A copy of PC045 can be found at http://dpc.sa.gov.au/__data/assets/pdf_file/0019/20818/PC045-Disclosure-Log-Policy.pdf

If you disagree with publication, please advise the undersigned in writing within fourteen calendar days from the date of this determination.

Should you require further information or clarification with respect to this matter, please contact Ms Lisa Farley, Freedom of Information and Privacy Officer on 8429 0422 or email PIRSA.FOI@sa.gov.au.

Yours sincerely

Michelle Griffiths
Accredited Freedom of Information Officer
DEPARTMENT OF PRIMARY INDUSTRIES AND REGIONS

Fitzgerald Bay aquaculture

Contents

FISHERIES
& AQUACULTURE
PIRSA

PRIMARY INDUSTRIES AND REGIONS SOUTH AUSTRALIA, FISHERIES AND AQUACULTURE DIVISION MARINE LICENCE ASSESSMENT

AQ00397 (NEW)

FF00026, FF00027, FF00028, FF00029, FF00095, FF00096 (VARIATION)

SOUTH
AUSTRALIA

Government
of South Australia

Primary Industries
and Regions SA

PRIMARY INDUSTRIES AND REGIONS SOUTH AUSTRALIA, FISHERIES AND AQUACULTURE DIVISION MARINE LICENCE ASSESSMENT

Application type:	New Licence and Variation (Movement x6)
Licence numbers:	AQ00397 (new) FF00026, FF00027, FF00028, FF00029, FF00095, and FF00096 (variation)
Licence types:	Finfish
Aquaculture zone policy	*Aquaculture (Zones – Fitzgerald Bay) Policy 2008*
Aquaculture zone	Fitzgerald Bay aquaculture zone (Western Fitzgerald sector)
Production system:	Sea-cages
Species:	See Table 2
Geographical location:	Upper Spencer Gulf
From:	General Manager, Aquaculture Policy and Environment Unit
Through:	Aquaculture Policy and Environment Unit Aquatic Animal Health Unit

The following is a licence assessment by PIRSA Fisheries and Aquaculture in relation to seven aquaculture licence applications received from Clean Seas Seafood Limited. In light of the assessment's findings, I am satisfied that the ecological impacts associated with the proposed development can be appropriately managed under the conditions of the attached draft aquaculture licences to be issued pursuant to the *Aquaculture Act 2001* and associated regulations. Note however, that in accordance with Section 52 of the *Aquaculture Act 2001*, the Minister for Primary Industries and Regional Development (the Minister) may vary licence conditions at any time to prevent or mitigate significant environmental harm or the risk of significant environmental harm.

Summary of additional licence conditions:

Two additional licence conditions were identified during the assessment of the applications:

- *The Licensee must provide the Minister with a written monthly report stating biomass (tonnes), number of fish and input of feed (tonnes) and GPS coordinates per sea-cage per site.*
- *The Licensee must undertake an environmental monitoring program of the sea floor in relation to the Licensed Site when directed by the Minister in writing and in a manner and form determined by the Minister.*

The conditions of the draft aquaculture licences and requirements of the *Aquaculture Regulations* 2016 (the Regulations) are considered sufficient to manage potential environmental risks and ensure ecological sustainability.

Dr Adam Main
GENERAL MANAGER, AQUACULTURE POLICY AND ENVIRONMENT UNIT
FISHERIES AND AQUACULTURE DIVISION

3/4/19

CONTENTS

TABLES

FIGURES

BACKGROUND

PIRSA Fisheries and Aquaculture (PIRSA) have received applications from Clean Seas Seafood Limited (Clean Seas) to move six aquaculture leases and corresponding licences (see table above) [1-6] within the Western Fitzgerald sector of the Fitzgerald Bay aquaculture zone, identified in the *Aquaculture (Zones – Fitzgerald Bay) Policy 2008* [7]. Registration details of the active licences applied to be moved are outlined below:

- FF00026 (Production Lease AL00034) – 20 ha, originally approved 1 February 2002
- FF00027 (Production Lease AL00035) – 20 ha, originally approved 1 February 2002
- FF00028 (Production Lease AL00036) – 20 ha, originally approved 1 February 2002
- FF00029 (Production Lease AL00037) – 20 ha, originally approved 1 July 2002
- FF00095 (Production Lease LA00119) – 10 ha, originally approved 9 July 2009
- FF00096 (Production Lease LA00120) – 10 ha, originally approved 9 July 2009

Additionally, PIRSA has received an application [8] from Clean Seas for the following new corresponding aquaculture licence within the same sector:

- AQ00397 (Production Lease LA00428) – 50 ha

The proposal involves the consolidation of the seven sites (six movements and one new site) within the Fitzgerald Bay aquaculture zone, so that they are abutting each other. The purpose of the applications is to create a single large licensed area, comprising of seven individual sites (six movements and one new licence) to allow for the use of a submerged grid system. If approved, between them, the sites would carry a maximum biomass of 2,250 tonnes of Yellowtail Kingfish (YTK) and would result in a total leased area of 150 hectares.

It should be noted that Clean Seas are also applying for one movement and one new site in the Eastern Fitzgerald sector to create a consolidated site with a total of 133 hectares. However, this ecologically sustainable development (ESD) risk assessment is addressing only the six proposed movements and one new licence which form a consolidated area within Western Fitzgerald sector of the Fitzgerald Bay aquaculture zone.

The intent of the Fitzgerald Bay aquaculture zone is to ensure the farming of finfish is undertaken in an environmentally and socially acceptable manner [7]. The objective of the Fitzgerald Bay zone policy is to specify the class of permitted aquaculture and to prescribe criteria for the leased area size and biomass of aquatic animals to be farmed in the zone. Biomass limits for the existing six sites will not change from what was originally assessed and approved and the total allocation of biomass will remain consistent with the total allowable biomass prescribed for the Western Fitzgerald sector of the Fitzgerald Bay aquaculture zone [7]. The applicant currently operates all of the aquaculture licences within the Western Fitzgerald Bay sector of the aquaculture zone.

Between 2008 and 2012, a licence-based and standardised Finfish Environmental Monitoring Program (FEMP) was undertaken by the South Australian Research and Development Institute (SARDI) Aquatic Sciences on behalf of the finfish industry, to monitor the ongoing impacts to benthic infaunal communities adjacent to farmed licensed sites. An environmental scorecard was developed for the assessment of environmental performance and to guide decision making in relation to environmental compliance. Results were presented using a 5-tiered system where "green", the highest level, indicates an appropriate environmental outcome and "violet", the lowest level, indicates that the result is in breach of the compliance limits. As part of the program, monitoring was undertaken at sites (FF00026, FF00029, FF00030 and FF00095) in the 2009/10 and 2010/11 periods and "green" results were obtained at all sites [9].. A SARDI report, presenting temporal (2005 – 2014) infaunal DNA data from the FEMP, which demonstrated that while there was temporal variation between sites at Fitzgerald Bay there was no differences between control and compliance sites [10].

Site Location

Table 1 provides a summary of the distance and direction for the six proposed site movements. It has been proposed that the six site movements and one new site will be established so that they are adjoining, in an area with a total size of 150 hectares.

Table 1: Summary of the distance and direction of the proposed site movements within the Western Fitzgerald sector of the Fitzgerald Bay aquaculture zone.

Lease Number	AL00034	AL00035	AL00036	AL00037	LA00119	LA00120
Licence Number	FF00026	FF00027	FF00028	FF00029	FF00095	FF00096
Approximate distance from current location	200m	2,900m	3,000m	1500m	2,830m	800m
Direction from current location	E	N	NW	N	N	NE

The current and proposed location of the aquaculture sites is shown in Figure 1 (regional context) and Figure 2. All six site movements will remain in the Western Fitzgerald sector of the Fitzgerald Bay aquaculture zone. Proposed locations are approximately 17 km northeast of the nearest substantial township of Whyalla, and approximately 6 km north of Point Lowly. The total area of the sites and associated biomass will not change as a result of the six site movements. However, the proposed new site will increase the total area of all sites in the sector to 150 hectares, which is the maximum prescribed area for the Western Fitzgerald sector. A summary of the total allowable biomass and the species for farming are detailed in Table 2.

Table 2: Summary of species for the proposed new site, and current approved site movements, as prescribed by the licences, within the Western Fitzgerald sector of the Fitzgerald Bay aquaculture zone.

Lease/ Licence number	**Species**	**Biomass limits**
LA00428 / AQ00397	• Kingfish, Yellowtail *Seriola lalandi*	• 15 t/ha (finfish)
AL00034 / FF00026	• Kingfish, Yellowtail *Seriola lalandi* • Snapper *Pagrus auratus*	• 15 t/ha (finfish)
AL00035 / FF00027	• Kingfish, Yellowtail *Seriola lalandi* • Snapper *Pagrus auratus*	• 15 t/ha (finfish)
AL00036 / FF00028	• Kingfish, Yellowtail *Seriola lalandi* • Snapper *Pagrus auratus*	• 15 t/ha (finfish)
AL00037 / FF00029	• Kingfish, Yellowtail *Seriola lalandi* • Snapper *Pagrus auratus*	• 15 t/ha (finfish)
LA00119 / FF00095	• Kingfish, Yellowtail *Seriola lalandi*	• 15 t/ha (finfish)
LA00120 / FF00096	• Kingfish, Yellowtail *Seriola lalandi*	• 15 t/ha (finfish)

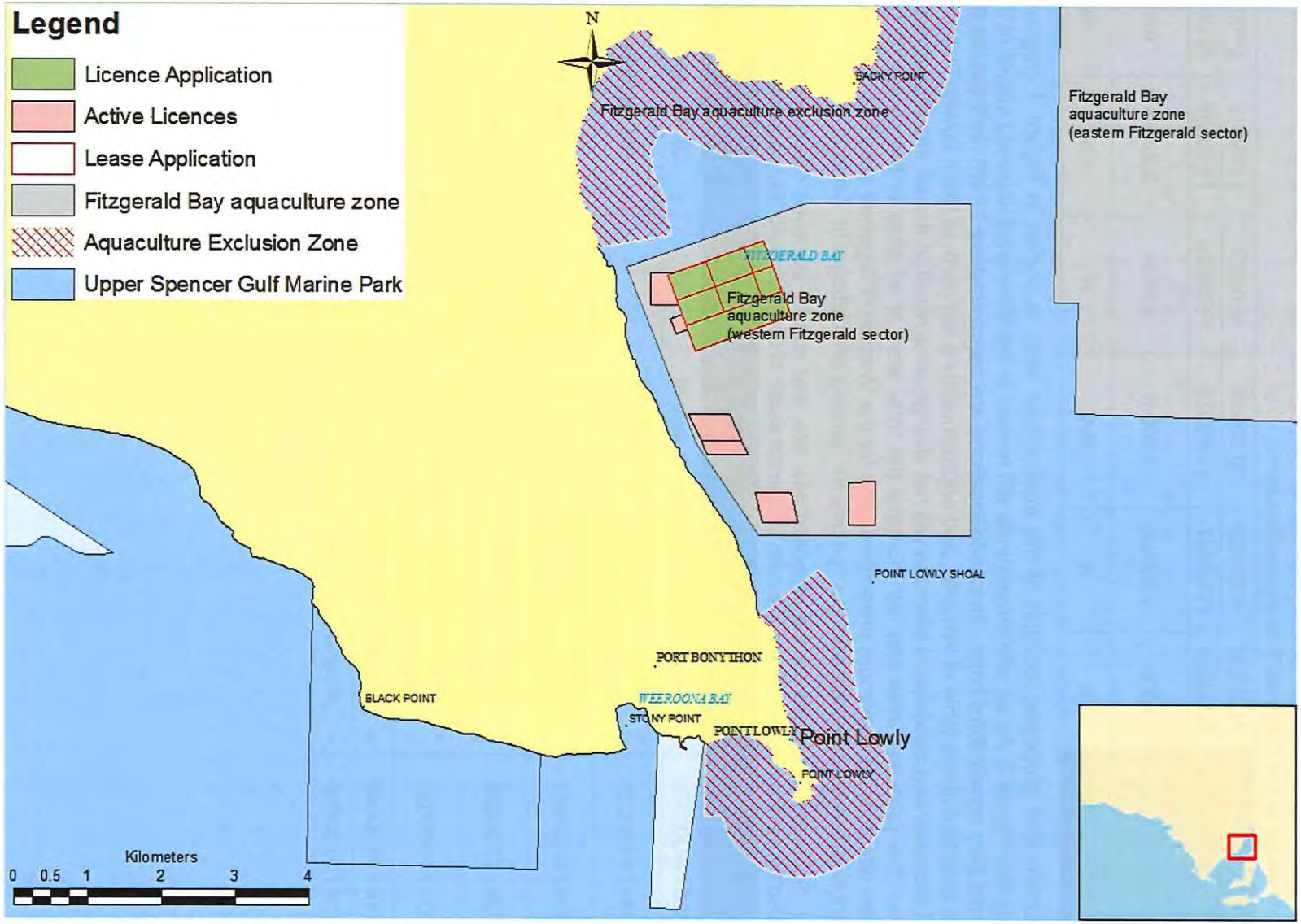


Figure 1: Current and proposed location of sites within the western Fitzgerald Bay sector of the Fitzgerald Bay aquaculture zone (regional context).

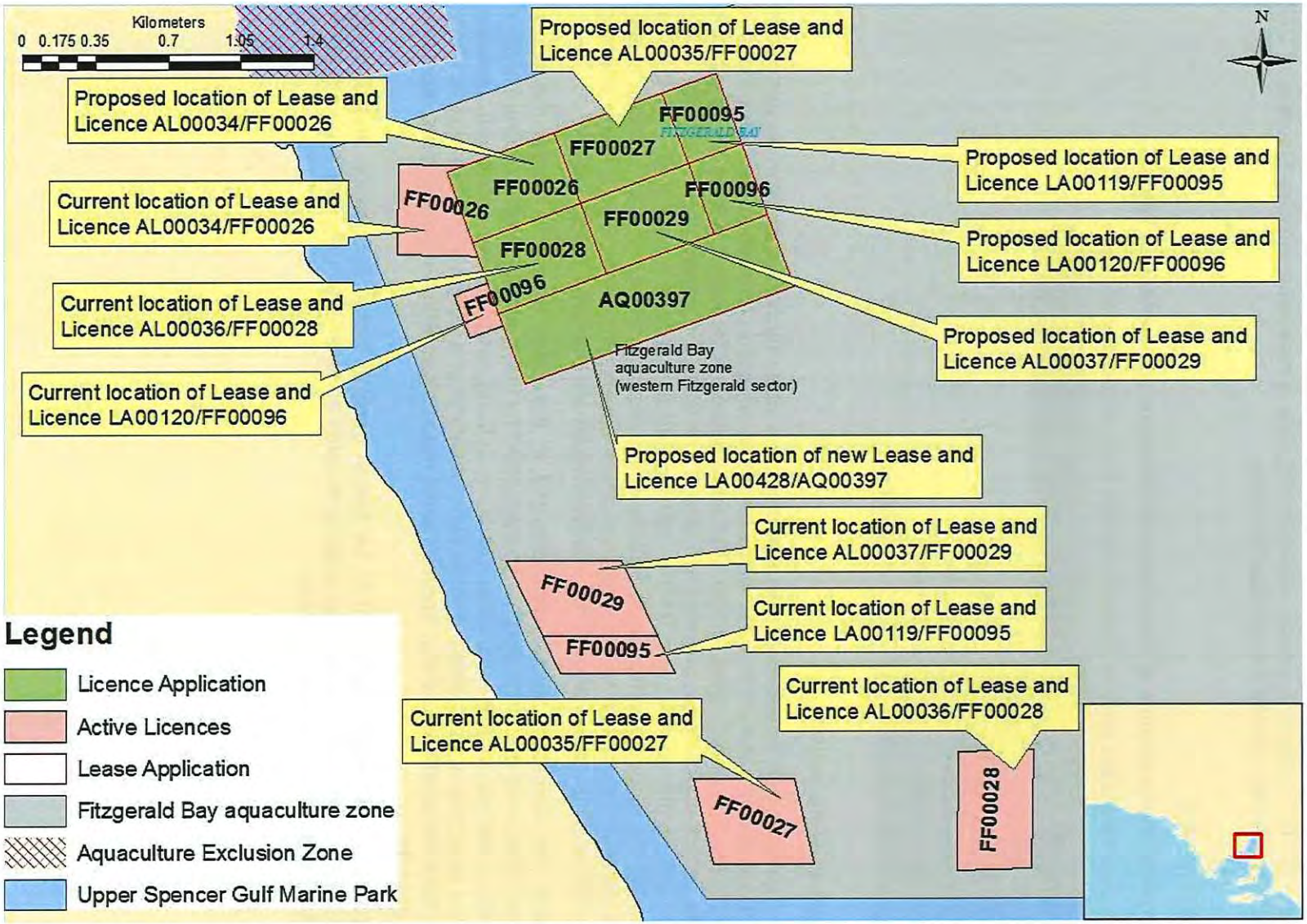


Figure 2: Current and proposed location of sites within the western Fitzgerald Bay sector of the Fitzgerald Bay aquaculture zone. Amended coordinates for each site can be found on the attached draft licences.

Environmental Monitoring Program History

A review of the Environmental Monitoring Program (EMP) history for the last three reporting periods (2014/15, 2015/16 and 2016/17) for each site of the six sites to be moved revealed that there has not been any stock on any for the sites in the Fitzgerald Bay aquaculture zone. Additionally, LA00428/AQ00397 is an application for a new site so no EMP data exists for the site. The applicant, Clean Seas, has not farmed finfish in the Fitzgerald Bay aquaculture zone since the 2010/11 reporting period, during which time a maximum monthly biomass of 242 tonnes was reported across the aquaculture zone.

Site Characteristics

The physical characteristics of the consolidated site are summarised in Table 3.

Table 3: Summary of the relevant physical characteristics of the proposed site

Development Characteristic	Description	Reference
Maximum fetch	28 km, SSE	[8]
Average annual wave height	1.2 metres	[8]
Minimum water depth	18 metres	[8]
Maximum tidal range	2.52 metres	[8]
Average water flow rate	0.3 m/s (0.58 knots)	[8]

Biogeographical observations

PIRSA Fisheries and Aquaculture has examined the video footage submitted as part of the applications and is satisfied that the video transects supplied correspond with the proposed site locations. The coordinates for the start and end-points for each transect along with the total site detection power are provided in Table 4. The detection power for all transects for the 150-hectare combined site was 93.9%, with a critical detection value of 3%. A general summary of the biogeographical observations of the seven proposed sites is provided below, while a detailed description of the biogeographical observations, including a figure showing the location of all transects and representative images are provided in Appendix 1.

Generally, the dominant habitat type depicted in the video transects across the seven proposed sites consisted of bare sand, characterised by fine grain size with a medium level of bioturbation and no notable undulation. No areas of living seagrass were observed, however detached seagrass or macroalgae fronds were observed at a low level in all transects. Other marine flora included low density, sparse brown macroalgae which also appeared detached in all transects.

The epifaunal community appeared to be low in general faunal abundance and diversity consisting of occasional filter feeding organisms such as small sponges, sea squirts (Family Ascididae) and razorfish (*Pinna bicolor*).

Table 4: Summary of video transects taken at the seven proposed sites for licences FF00026, FF00027, FF00028, FF00029, FF00095, FF00096 and AQ00397 (map datum WGS84 expressed in degrees, decimal minutes).

Transect No.	Transect start (latitude)	Transect start (longitude)	Transect end (latitude)	Transect end (longitude)	Transect length (m)
W T1	32°56.2562'S	137°45.9451'E	32°56.3043'S	137°45.9806'E	106
W T2	32°56.5573'S	137°46.0638'E	32°56.6242'S	137°46.0800'E	109
W T3	32°56.3551'S	137°46.0876'E	32°56.4107'S	137°46.0787'E	124
W T4	32°56.1517'S	137°46.1836'E	32°56.2284'S	137°46.1623'E	126
W T5	32°56.6177'S	137°46.2273'E	32°56.6854'S	137°46.2419'E	296
W T6	32°56.4133'S	137°46.2851'E	32°56.4721'S	137°46.2999'E	110
W T7	32°56.0675'S	137°46.4446'E	32°56.1114'S	137°46.4025'E	105
W T8	32°56.5145'S	137°46.4456'E	32°56.5791'S	137°46.4498'E	109
W T9	32°56.2355'S	137°46.4116'E	32°56.2873'S	137°46.3713'E	114
W T10	32°56.1741'S	137°46.5873'E	32°56.2473'S	137°46.5610'E	165
W T11	32°56.3700'S	137°46.5383'E	32°56.4560'S	137°46.5079'E	140
W T12	32°56.4062'S	137°46.7104'E	32°56.4750'S	137°46.7051'E	122

*Total site detection power the 150 hectare combined site = 93.9%, with a critical detection value of 3% (based on the Environment Protection Authority (EPA) Survey power calculator (version: 18 Feb 2016)

DEVELOPMENT/OPERATIONAL CHARACTERISTICS

Farming Structures

It is proposed that the seven sites will be developed using similar methods to that used extensively throughout the finfish sector in South Australia. The applicant has stated that a grid system, which can support up to 18 sea-cages at any one time, will be used at the proposed consolidated 150-hectare site. Figure 3 provides a representative diagram of the grid system.

Double collar sea-cages (polar circle pens) with a 44 m diameter each weighing 12.98 tonnes are proposed to be used. Cage netting will be constructed from nylon with net mesh size varying from 33 mm to 78 mm, with a maximum net depth of 10 metres (m) with each weighing approximately 2.2 tonnes. The proposed 18 sea-cages are to be secured to the grid system with 76 concrete mooring blocks, each weighing 3.0 tonnes (1.5 x 1.5 x 1.0 m) and 38 "stingray" style anchors, each weighing 250 kg (1.5 x 1.5 x 0.9 m) [8].

Each sea cage will contain bird net stands which are 4.0 m high and weigh 590 kg each. Each cage will utilise 32 net weights (weighing 140 kg each). The mooring system will incorporate six large grid floats weighing 150 kg each (2.2 x 1.6 m) and 30 small grid floats weighing 100 kg each (1.8 x 1.3 m) [8].

It has been proposed that the location of the sea cages will be placed in the deepest water available and orientated perpendicular to tidal flow to maximise water flow through the cages [8, 11]. This is expected to provide the best possible conditions to reduce the likelihood of disease (i.e. infestations of flukes and other pathogens) in an effort to minimise use of veterinary chemicals. The applicant has stated that the site has a minimum depth of 18 m; each sea cage would be fitted to ensure a minimum distance of 6 m between the bottom of the sea-cage and the seafloor is maintained [8]. Site boundaries will be marked with St Andrews Cross boundary markers.

It is proposed that the consolidated site will be serviced by a 15 tonne feed boat. Feeding rates will be similar to that currently undertaken at the operating finfish sites in Port Lincoln and Arno Bay and feed will consist of extruded dry pellets from local and international suppliers [8]. Feeding will occur from vessels using blowers initially and from a combination of blowers/centralised feeding systems (moored barge) in the future. Feeding will be monitored by video to assess for over feed.

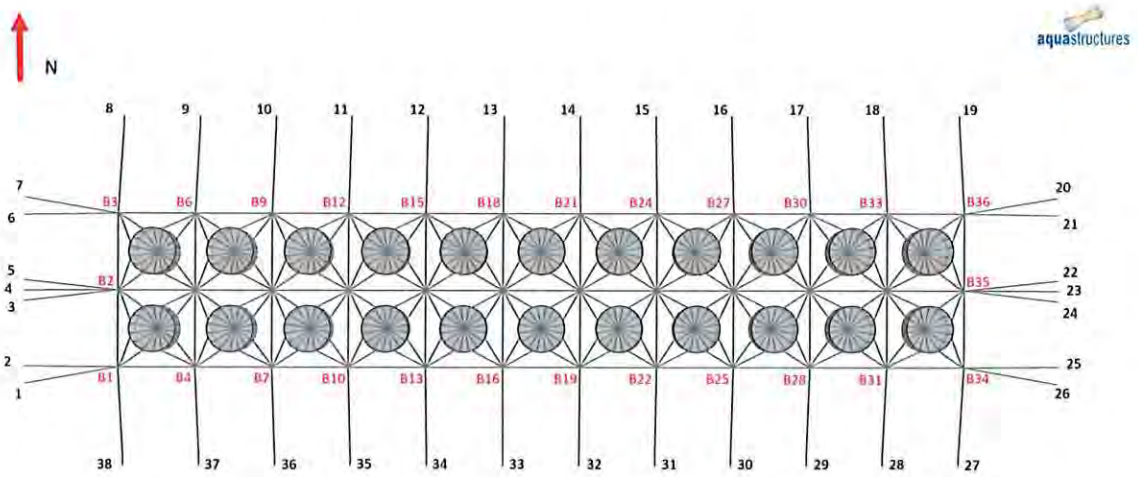


Figure 3: Mooring design for a sea-cage grid system, proposed for the western Fitzgerald Bay aquaculture sector [8]. Note that Clean Seas have confirmed that they will be using a maximum of 18 sea-cages (Jay Dent, Clean Seas, pers. comm. 20 March 2019).

The applicant has stated that nets will be cleaned in situ using commercial net washers according to standard industry practices. Cleaning of nets will be undertaken as required to prevent the establishment of macrofouling and to allow sufficient water movement. Nominally, this will occur approximately 1-2 times per week during summer and every 7-10 days during winter. The applicant has stated that general refuse, including used netting and broken infrastructure will be taken ashore and disposed at the local council landfill. Any mortalities will be removed from cages and taken to a rendering facility or fertiliser producer for disposal.

The applicant has stated that the site will be visited at least once a day (weather permitting) for above water inspections and every 1-4 days for below water inspections by dive teams. The proposed sites will be inspected for both mortality and any damaged infrastructure or debris in the vicinity of the site. Any materials considered as general refuse will be taken on shore and disposed of in council landfill. Mortalities and harvest waste are proposed to be disposed of at a rendering facility or fertiliser producer [8].

Clean Seas Farming strategy for Fitzgerald Bay

The proposed farming strategy [11] operates two sites for farming YTK in the aquaculture zone, one in the western sector (farming a maximum of 2,000 tonnes) the other in the eastern sector (farming a maximum of 2,250 tonnes).

It is anticipated that initial stocking of the western site with juveniles from the hatchery will commence in August 2019, and stock will be moved gradually to the eastern site during grading from October/November 2020 (15 months later). Stock will be held on the western site from August 2019 to July 2021 (24 months). Stock will be held on the eastern site from October 2020 to February 2022 (17 months). It is anticipated that the next year class will be introduced to the western site in October 2021 and destocked completely by August 2023.

The strategy provides for a period of four months during which fish from one year class will be held on both sites while being transferred, but for the majority of the production cycle, the strategy will lead to a separation of year classes between the two sites.

This strategy will result in the entire western site being fallowed for a period of three months every 27 months, with individual grids being fallowed for longer depending on when stock are moved to the eastern site. In addition, the strategy will result in the entire eastern site being fallowed for a period of ten months between stocking events, with individual grids being fallowed for longer depending on when stock are introduced [11].

ECOLOGICALLY SUSTAINABLE DEVELOPMENT ASSESSMENT

Method and interpretation

The ESD risk assessment for the seven applications is summarised in Table 9. Where the risk profile for individual proposed sites are considered equivalent, a combined risk has been undertaken for the seven proposed sites in each risk category. However, where the risk profile is considered different among sites (e.g. differing abundance of seagrass), separate risk assessments will been undertaken for each of the proposed sites. The ESD risk assessment should be read in conjunction with PIRSA's ESD Risk Assessment Guidelines [12], which provides explanations of each of the risks addressed. The primary aim of this assessment is to evaluate the potential ecological risks to the sustainable development of South Australia's resources from the approval of the proposed applications.

Given the number of applications within the Fitzgerald Bay aquaculture zone, consideration has been given to cumulative impacts associated with multiple applications. Therefore, the following risk assessment has been undertaken for a single 150-hectare area, farming a maximum of 2,250 tonnes of Yellowtail Kingfish (YTK).

The risk assessment method is based on the National Ecologically Sustainable Development framework, the Aquaculture 'How-To' Guide [13]. The framework was developed by the Fisheries Research and Development Corporation (FRDC) to be used consistently across fisheries and aquaculture sectors in Australia and is based on the Australia and New Zealand standard for risk management (AS/NZS 4360 1999) (now superseded by AS/NZS ISO 31000:2009 [13]). Each identified risk is assigned a risk ranking. To assign a risk ranking to an issue, two factors are determined – the likelihood that the particular event will occur and the potential consequence arising from that event. The likelihood and the consequence of a particular event are considered independently [13]. The combination of likelihood and consequence produces a risk value, which in turn is used to determine the risk ranking, associated with a particular issue [13].

The likelihood and consequence levels or categories outlined in the National ESD framework are used in this assessment (Tables 5 and 6, respectively). A risk value for each risk event is then derived by combining the likelihood of occurrence with the corresponding level of consequence using a risk matrix (Table 7). Finally, the risk value is used to determine the risk ranking (Table 8).

Table 3: Standard likelihood levels.

Level	Descriptor
Remote (1)	Never heard of, but not impossible
Rare (2)	May occur in exceptional circumstances
Unlikely (3)	Uncommon
Possible (4)	Some evidence to suggest this is possible
Occasional (5)	May occur
Likely (6)	Is likely to occur

Table 4: Standard consequence levels.

Level	Descriptor
Negligible (0)	Insignificant impacts. Impacts unlikely to be measurable at the scale of the stock, ecosystem, or community level against background variability.
Minor (1)	Possibly detectable but minimal impact on structure, function or dynamics.
Moderate (2)	Maximum appropriate/acceptable level of impact (e.g. full assimilation rate for nutrients).
Severe (3)	Wider, longer-term impacts (detectable at the stock, ecosystem, or community level).
Major (4)	Serious impacts with relatively long time frame likely to be needed to restore to an acceptable level.
Catastrophic (5)	Widespread and permanent/irreversible damage or loss will occur - possibility that problem cannot be fixed (e.g. extinction).

Table 5: Risk Matrix.

		Consequence					
Likelihood		Negligible	Minor	Moderate	Severe	Major	Catastrophic
		0	1	2	3	4	5
Remote	1	0	1	2	3	4	5
Rare	2	0	2	4	6	8	10
Unlikely	3	0	3	6	9	12	15
Possible	4	0	4	8	12	16	20
Occasional	5	0	5	10	15	20	25
Likely	6	0	6	12	18	24	30

The numbers in cells in the body of the above matrix are risk values, which are calculated by multiplying the likelihood value by the consequence value; the colours/shades correspond to risk rankings (see Table 8).

Table 6: Risk rankings and associated required levels of management.

Risk Rankings	Risk Values	Explanation & Likely Management Response
Negligible	0	Nil
Low	1 – 6	No specific additional management is needed, but low level monitoring of the issue may be required. Any current management should continue, as the risk ranking is based on the current management in place
Moderate	7 – 12	Additional information may be needed or the issue may require monitoring. Immediate management is required, but the issue should be the subject of continuous improvement with the aim of achieving a low risk ranking in the future.
High	13 – 18	Possible increases to management activities in addition to those already being applied. Needs to be monitored and any information deficiencies should be addressed.
Extreme	> 19	Increases in management activities in addition to those already being applied are strongly recommended.

Table 7: Ecologically Sustainable Development risk assessment report for FF00027, FF00027, FF00028, FF00029, FF00095, FF00096 and AQ00397.

Risk event	Likelihood x consequence	Risk ranking	Explanation and management response
Individual Facilities			
1 Construction of site and ongoing consequences of those structures			
1.1 Habitat effects (All sites)	Likely (6) x Negligible (0)	Negligible (0)	Observations from biogeographical video transects provided as part of the applications identified the benthic environment of the consolidated site consisted predominantly of a bare, flat sandy substrate with low to medium levels of bioturbation. Marine flora consisted of very low density, sparse macroalgae, predominantly as detached fronds. No areas of live seagrass were identified in any of the transects, although detached seagrass fronds were present. Overall, the epifaunal community was low in abundance and diversity, consisting primarily of the occasional filter-feeding organism. It is likely that a small area of benthic habitat will be impacted by the placement of farming infrastructure through anchoring. The grid across the consolidated site will consist of 76 concrete blocks (1.5m x 1.5m) and 38 'stingray" type anchors (1.5m x 1.5m) which would cause a direct footprint area of approximately 256.5m². However, the direct impacts are considered to be localised and therefore minimal across the 150-hectaer site. The consequence of ongoing habitat effects as a result of development at the proposed consolidated site is considered to be negligible, based on benthic habitat assessments of the sites and the results of the FEMP which demonstrated no differences between compliance and control sites [9]. The water depth where the grid and associated sea-cages are to be placed is at least 18 m, ensuring at least six metres is maintained between the bottom of sea-cages and the sea floor. This will minimise the overall effects of scouring and allow for the dispersal of nutrients. Sea-cages will be configured perpendicular to tidal movements and will not be placed down current from each other to reduce the concentration of nutrient deposition over a particular area. Overfeeding and food wastage will be eliminated by implementing strict monitoring of fish Feed Conversion Ratios (FCRs) and also the use of underwater cameras to reduce overall feed input [8, 11]. To enable PIRSA to closely monitor biomass and nutrient input on the site, an additional licence condition will require the Licensee to provide the Minister with written monthly reports stating the biomass, number of fish, input of feed and GPS coordinates per sea-cage per site. It is a requirement under regulation 22 of the Regulations for all licensees to submit an annual EMP report, including information on feed type and quantity, biomass, escape of stock, disease, chemical use and interactions with protected animals. In addition to standard licence conditions, an extra condition is proposed to be added which will require the licensee to undertake an environmental monitoring program of the sea floor in relation to the Licensed Site when directed by the Minister in writing, and in a manner and form determined by the Minister. In February 2019, a SARDI funding application developed in conjunction with PIRSA, Clean Seas and the EPA (Project no. 2018-186) was approved for endorsement by the Fisheries Research and Development Corporation (FRDC). The project, supported by the South Australian Research Advisory Committee, will assess the influence of finfish aquaculture derived nutrients on seagrasses in Fitzgerald Bay. While the

			western Fitzgerald Bay site is located over a sandy benthic habitat, there are significant seagrass meadows along the coastline to the north-west, and this project aims to assess the regional impacts of finfish farming in the Fitzgerald Bay aquaculture zone. Multiple lines of evidence will be used to assess the current condition of seagrass meadows throughout the Fitzgerald Bay region prior to the introduction of YTK. This will identify whether the system is currently impacted by existing nutrient sources. Seagrass cover and habitat condition will be assessed using remote video transects at a minimum of three sites predicted to be affected by the aquaculture nutrient plume (to be determined from SARDI hydrodynamic and biogeochemical modelling) and three control sites. Included in the assessment will be methods used by the EPA to assess broader-scale regional patterns of change in seagrass habitats around SA, and earlier SARDI assessment of seagrass condition in Gulf St Vincent. Sampling will ideally occur in June/July 2019, immediately prior to the commencement of aquaculture, and then again two years later. In the unlikely event the project is not supported by FRDC, an environmental monitoring program will be developed in conjunction with Clean Seas, SARDI and the EPA to monitor seagrass in areas predicted to be affected by the aquaculture nutrient plume. It is considered that habitat effects due to the development of the proposed consolidated site is considered likely. However, the consequence is considered negligible based on the benthic habitat type. Consequently, the overall risk of habitat effects from the development at the proposed consolidated site is considered to be negligible.
1.2 Alienation (All sites)	Likely (6) x Minor (1)	Low (6)	The granting of an aquaculture lease provides the applicant with exclusive rights to the proposed site. Consequently, it is likely that alienation will occur if the applications are approved. An early notification letter containing the details of the proposed movements and new finfish site was sent to external stakeholders on 4 July 2018. Stakeholders were provided with two weeks to submit any comments to PIRSA. In addition to early notifications and in accordance with section 50(1)(b)(i) of the *Aquaculture Act 2001*, the application for the new corresponding licence (AQ00397) was publicly advertised in *The Advertiser* and the *Whyalla News* (local paper) on 30 August 2018 for a public consultation period of two weeks. During public notice, a number of submissions were submitted to PIRSA. Any issues regarding the proposed activity raised through the notification processes were considered by PIRSA during the assessment of the application. Given the objections regarding the proposed activity, it is considered that the consequence of any alienation resulting from the approval of these applications is minor. Moreover, this risk assessment relates to an existing aquaculture zone where finfish farming has historically taken place. Clean Seas is the only licence holder in the western Fitzgerald Bay sector, which will be fully allocated (in hectares) should this application be approved. As such, the proposed movements and new site are unlikely to impact other aquaculture operators. Given this information, the overall risk of alienation resulting from the proposed consolidated site is considered to be low.
1.3 Erosion	N/A	N/A	Not applicable to marine based applications
1.4 Seepage	N/A	N/A	Not applicable to marine based applications

1.5 Water flow (All sites)	Likely (6) x Minor (1)	Low (6)	It is considered likely that the development at the proposed consolidated site will have an effect on the water flow. The applicant has stated that sea-cages will be placed in a grid arrangement, with two rows of 11 sea-cages to be placed perpendicular to tidal flow, which will limit the overall impact to natural water movement [8, 11]. The applicant proposes a maximum of 18 sea-cages which would be placed in an area of approximately 11.1% of the 150 hectare consolidated site (16.7 hectares). The applicant has stated that the sea-cages will have the dimensions of 44 m diameter by a maximum of 10 m deep (total volume of 15,205 m^3). The approximate volume of the 16.7 hectare area where the grid will be located is (167,000 m^2 x 18 m deep) or 3,006,000 m^3. Based on the total sea-cage volume (334,510 m^3), the sea-cages will occupy approximately 11.1% of the volume of the proposed grid area (16.7 hectares). In addition, sea-cages will be located on sites with a minimum of 18 m water depth, leaving a minimum of 6 m between the bottom of the cages and the sea floor. Sea-cages will be regularly cleaned (at least once per week) to allow for water movement through nets and other infrastructure. Although the impact of natural water flow due to development of infrastructure is considered likely, the consequence is considered minor, based on the relative volume of the structures compared to the site volume (11.1% of the grid area) and the distance to the seafloor. Therefore, the overall risk of impacts to the natural water flow experienced at the proposed new sites is considered to be low.
1.6 Shading (All sites)	Likely (6) x Negligible (0)	Negligible (0)	It is likely that some shading from farming structures will occur, in comparison to what would naturally be experienced over the proposed site area. The total area covered by the proposed 18 sea-cage grid system is approximately 33,451 m^2 (including interior of sea-cages occupied intermittently by stock). The proposed 18 sea-cage grid system will cover an area of 16.7 hectares. As such, the relative area of the structures compared to the overall area of the grid structure (16.7 hectares) is 20.0 %. As discussed in in risk event 1.1 – Habitat effects, the benthic habitat at the proposed sites is identified to contain predominantly bare sand with low diversity and abundance of algae and no observed live seagrass. Given both the environmental monitoring requirements (also discussed in risk event 1.1 – Habitat effects) and the relative percentage of coverage from the proposed development of the sites, the consequence of shading on the benthic environment is considered to be negligible. Accordingly, the overall risk of shading at the proposed consolidated site is considered to be negligible.

1.7 Rehabilitation (All sites)	Rare (2) x Moderate (2)	Low (4)	The primary risk in terms of rehabilitation is lease abandonment, where the lease owner does not rehabilitate a site. This may result in farming infrastructure, including sea-cages and anchors, remaining in situ where it can cause navigation hazards or habitat impacts. This is however considered to be a rare occurrence for the finfish aquaculture sector. It is a lease condition that the Lessee must rehabilitate the site, prior to the expiration of the lease. The rehabilitation, including the remove off all aquaculture structures, debris, rubbish and waste from the Leased area, must be performed by the Lessee at its cost to the reasonable satisfaction of the Minister. In addition, it is also a lease condition that the lessee must reinstate and rehabilitate the current Leased area at the Lessee's cost, prior to any variation. In addition to the above lease conditions, lessees must either provide a guarantee from its bankers in the amount of $10,000.00 or contribute to an indemnity scheme established and or nominated by the Minister for the aquaculture industry for each lease held. Clean Seas have contributed $40,000 to an indemnity scheme, which is held by PIRSA, and can be used to rehabilitate the sites to their former condition. Therefore, in the event the leases are not rehabilitated appropriately by the lessee, there are resources available to rehabilitate the sites. Given the above, the likelihood of the non-rehabilitation of the proposed sites is considered rare whilst the consequence is considered to be moderate. Accordingly, the overall risk of the sites not undergoing full rehabilitation after being vacated is considered to be low as there are management provisions in place, including PIRSA's site environmental audits and follow-up compliance inspections, to ensure site rehabilitation is undertaken if and when required.
1.8 Navigation (All sites)	Likely (6) x Negligible (0)	Negligible (0)	It is a lease requirement that the outer boundaries of each lease must be marked with navigational markers when any structures are present on each leased site. Navigation markers are expected to meet the requirements set for each individual lease type. The likelihood for the site facilities to pose a hazard to navigation is considered likely. However, the consequence of navigation issues is considered to be negligible, given the area is a Gazetted aquaculture zone and the requirement to install navigational markers. Hence, the overall risk of any navigational issues arising from the proposed sites is considered to be negligible.
1.9 Visual (All sites)	Unlikely (3) x Minor (1)	Low (3)	The proposed consolidated site is located approximately six kilometres from the nearest small settlement of Point Lowly, and within an existing aquaculture zone. Therefore, the likelihood that the proposed consolidated site would be visually unappealing from a community perspective from the town is unlikely. The proposed consolidated alignment of the sites means that aquaculture structures will not be spread over a large area which is considered to reduce any visual impact compared to infrastructure spread over a larger area. In the unlikely event of visual impacts from site infrastructure, the consequence is considered to be minor given the majority of the proposed sites are existing licences within an established aquaculture zone located six kilometres from the nearest populated coastline (Point Lowly). Accordingly, the overall risk of negative visual impacts resulting from site infrastructure being developed on site is considered to be low.

2 Operating impacts			
The use of resources by the facility			
2.1 Noise	Likely (6) x Negligible (0	Negligible (0)	It is likely that noise will be generated by daily operation of dive and feed boats and feed blowers. However, it is unlikely that the noise generated by these operations will exceed that of other commercial vessels in the area, including the deep water bulk export port of Port Bonython that is located approximately six kilometres to the south of the proposed site; capable of berthing vessels to a capacity of 100,000 tonnes. The site is also approximately six kilometres from the nearest populated coastline (Point Lowly) and is situated within an existing aquaculture zone that has previously been actively farmed. Therefore, both the consequence and overall risk of excessive noise arising from the proposed aquaculture development are considered to be negligible.
2.2 Escape	Occasional (5) x Minor (1)	Low (5)	The likelihood of escape is considered occasional, based on reports of four escape events with an estimated loss of approximately 500 fish in the last 12 months. The applicant has stated that all above-water infrastructure will be inspected above every two days by company staff, with below-water inspections every four days by dive teams (weather permitting) as part of general operations. This aims to ensure the integrity of farming infrastructure and therefore minimise the risk of escape events. The risk to the environment as a result of escape is considered to be low since YTK are native to South Australia and wild populations can be found in Spencer Gulf. A report by Fowler *et al.* (2003) concluded it was likely that the YTK which researchers caught in northern Spencer Gulf were escaped YTK, based on body shape and ear-bone structure [14]. Sampling for this study occurred within weeks of three escape events (two reported on 31 January 2003, one on 6 April 2003) and that it took 17 fishing days to capture 77 YTK in northern Spencer Gulf. Two-thirds of YTK that were caught had empty stomachs and those that had fed exhibited feeding characteristics that suggested poor survival skills, such as eating plant material (for this carnivorous species). Reported sightings by the public and catches by the researchers, throughout Spencer Gulf, decreased after late March and early April, with most catches between late February and early March, suggesting YTK either moved from Spencer Gulf or died [14]. Given this and the native status of YTK, the consequence of stock escaping from the proposed site operations is considered to be minor. To prevent and/or minimise escape events, the applicant has submitted a strategy relating to escape of stock as required by the Regulations. All strategies are assessed for the frequency of site inspections during normal operating conditions and following extreme weather events; the ability of farming structures to contain stock and withstand anticipated weather conditions; and the applicant's management plan in the event of stock escapes. Furthermore, regulation 26 of the Regulations requires licensees to take all reasonable measures to contain or prevent the escape or further escape of stock if aquaculture stock has escaped, or a farming structure or other equipment has been damaged that may lead to the escape of aquaculture stock, after becoming aware of the escape or damage (as soon as practicable). Given the above, the likelihood of escape of stock is considered occasional whilst the consequence is considered to be minor. Accordingly, the overall risk of the escape of stock at the proposed consolidated site is considered to be low.

2.3 Chemicals and therapeutants	Likely (6) x Minor (1)	Low (6)	It is likely that veterinary chemicals will be used on site since the applicant has proposed the use of hydrogen peroxide, praziquantel (PZQ) and oxytetracycline (OTC) under Ministerial approval and veterinarian supervision as potential treatments for disease [8]. The farming strategy proposed by Clean Seas to separate year classes in different sectors [11] minimises the risk from disease and parasitic infection (improved fluke control) by minimising the risk of infectivity to incoming stock from older fish already present on the site. It is anticipated by the applicant that separation of year classes removes the interaction between year classes, thereby reducing infection. Under the *South Australian Agricultural and Veterinary Products (Control of Use) Act 2002*, agricultural and veterinary chemicals defined under that Act must (unless authorised by a permit) be registered by the Australian Pesticides and Veterinary Medicines Authority (APVMA) prior to being sold, supplied and/or used in the State. Furthermore, any use of registered chemical products must be undertaken in accordance with a permit or labelled instruction to ensure that the environmental and food safety assessments accepted by the APVMA, which aim to protect environment and consumer health, are valid for that specific use. Hydrogen peroxide is currently permitted by the Australian Pesticides and Veterinary medicines Authority (APVMA) as a bathe treatment in YTK aquaculture (permit no. PER 83276 – expires 30/11/2019). However, no permit currently exists for the use of PZQ or OTC in YTK aquaculture. In the event the applicant wishes to use of the off-label (or unregistered) chemicals, a veterinarian can prescribe a product for off-label use on trade animals pursuant to the *Agricultural and Veterinary Products (Control of Use) Act 2002*, although permits or full registration of that product with the APVMA are required to be pursued. Under regulation 10 of the Regulations, the use of a treatment or disinfectant that is not a registered veterinary product under the *Agricultural and Veterinary Products (Control of Use) Act 2002* requires the approval of the Minister. Regulation 10 provides for off-label use for one-off, irregular, emergency and experimental treatment, under veterinary prescription. Within PIRSA, off-label chemical use approval processes involving discharges to the environment are supported by an internal policy including guidelines for assessment of total environmental effects (including non-target species). Off-label use of veterinary chemicals has been successful in managing disease in YTK aquaculture, to allow the collection of data to support industry in applying to the APVMA for the ongoing use of PZQ and OTC in YTK aquaculture. It is noteworthy that Clean Seas have submitted applications to the APVMA for the ongoing use of PZQ in YTK aquaculture. If the use of other chemicals and therapeutants are required on site, licensees are required to report use when completing annually submitted EMP report, and must seek Ministerial approval for off-label (or unregistered) chemicals pursuant to regulation 10 of the Regulations. Ministerial approvals for the use of veterinary chemical products may include conditions such as peak daily use limits, environmental monitoring requirements, maximum discharge limits and reporting Given the legislative requirements of licensees in respect to the use of registered and non-registered chemical substances in aquaculture, including but not limited to the Regulations, the *Environment Protection (Water Quality) Policy 2015* and the *Agricultural and Veterinary Products (Control of Use) Act 2002*, the consequence of chemical use is considered to be minor. Accordingly, while chemical use is likely to occur on site the overall risk is considered to be low.

2.4 Entanglement or confinement	Rare (2) x Severe (3)	Low (6)	Entanglement or confinement of protected animals have previously been reported for the finfish sector, albeit rarely. Wildlife interactions that might occur with sea-cage farming in Spencer Gulf include interactions with seabirds, sharks and protected marine vertebrates [15]. In the last 12 months, five interactions have been reported with fur seals from the finfish sector, none of which resulted in a fatality. However, one interaction with a common seagull was reported which resulted in a fatality. In each case involving fur seals, animals were released alive or the animal swam out on its own accord. The nearest breeding Australian sea-lion colony (at Sir Joseph Banks group of islands) is located 220 km to the south of the site proposed consolidated site. According to the outcomes of the Marine Mammal Marine Protected Areas Working Group report, there are no restrictions in relation to finfish aquaculture greater than 15 km from a breeding seal colony. According to outcomes of the 2004 Marine Mammal Marine Protected Areas Working Group report, there are no restrictions in relation to finfish aquaculture greater than 15 km from a breeding seal colony. The consequences of an adverse interaction are considered severe, particularly where it leads to the death of an animal. To mitigate interactions, the applicant proposes daily checks for, and removal of, any dead and moribund fish from sea-cages (weather permitting) as a strategy to prevent attracting predators. Further, nets are intended to be checked daily for the presence of any holes and any damage will be repaired immediately. Regular net maintenance and keeping nets and ropes taut are measures proposed by the applicant to reduce predator interaction, damage and entanglement [8]. A seal jump fence around sea-cage pontoons is incorporated into the infrastructure but the applicant has stated that it is unlikely that it will be required (Jay Dent, Clean Seas, pers. comm. 20 March 2019). The applicant must abide by all licence conditions and the requirements of the Regulations relating to interactions with protected animals (regulations 18 and 27), through submission and, adherence to, an approved strategy and reporting requirements. The proposed mitigation measures and the legislative provisions around entanglements with, or confinement of protected animals reduce the risk of adverse impacts which is considered to be low.
2.5 Habitat effects	Likely (6) x Minor (1)	Low (6)	The benthic habitat is likely to be affected by various day-to-day farming practices, there are however procedural regimes in place to reduce impacts to the seafloor. Impacts to the habitat of the site caused by boating activities will be minor as no anchoring will occur during feeding or maintenance activities. Feeding practices will be monitored with video to avoid build-up of feed below sea-cages and daily intake will be assessed against a feed model [8]. In the event of feed falling through sea-cages, it is likely that scavengers will contribute to the removal of the excess feed [16]. The risk is further reduced because of the nature of the sandy benthic environment and general lack of epibenthic fauna and flora across the site. Fish may be harvested on site; however, waste will be minimal as all processing will occur onshore. In this event, all waste will be collected and returned to shore and disposed of at a rendering facility for the production of fertiliser [8]. Nets will be cleaned in-situ at least once per week using commercial net washers according to standard industry practice to prevent the establishment of tertiary biofouling. The frequency of cleaning will ensure limited accumulation of biofouling organisms and sedimentation. Where possible wastes will be collected [8].

			In a 2017 report containing infaunal monitoring of the aquaculture zone around Fitzgerald Bay undertaken by SARDI [10], statistical analyses of data collected indicated sites sampled within the Fitzgerald aquaculture zone had infaunal assemblages that fall within the range of insignificant variability when compared to reference sites. That is, there was no evidence in the data collected that finfish aquaculture is having an effect on infauna. Therefore, the consequence of habitat effects resulting from ongoing operations of the proposed site is considered to be minor. As required by regulation 25(e) of the Regulations, stocked sea cages must not be located in the same place that stocked sea cages have been located within the preceding 12 months unless otherwise approved in writing by the Minister. Clean Seas has proposed an overall farming strategy for the Fitzgerald Bay region which includes a fallowing regime for the grid system in the western Fitzgerald Bay sector. The fallowing regime includes a complete grid fallow of three months following destocking of a year class, with individual grid bays being fallowed for longer. The applicant will be required to apply to the Minister As detailed in risk event 1.1 – Habitat effects, an additional licence condition has been added to the draft licence which will require the licensee to undertake an environmental monitoring program of the sea floor in relation to the licensed site when directed by the Minister. This environmental monitoring program has been developed as a three-year FRDC research project, or, in the event that this is not supported, or is terminated, as an individual EMP developed in conjunction relevant parties. The results of the programs, along with annual EMP requirements, will allow impacts to the benthos from farming practices to be monitored and adaptively managed. Based on the above considerations, the overall risk of habitat impacts resulting from site operations is considered to be low.
2.6 Disease Management	Rare (2) x Moderate (2)	Low (4)	There are no notifiable diseases associated with YTK in Australia; however, there are some pathogens that are known to affect YTK aquaculture in SA which identified below. Farmed YTK can be seriously affected by blood fluke (*Paradeontaxylix* spp.), skin fluke (*Benedenia seriolaei*) and gill fluke *Zeuxapta seriolae* (gill fluke) [17]. The applicant has proposed the use of hydrogen peroxide (APVMA permitted product), and praziquantel under Ministerial approval as treatment measures for such infestations [8]. The strategy proposed by Clean Seas to separate year classes on different leases further minimises the risk from disease and parasitic infection (improved fluke control) by minimising the risk of infectivity to incoming stock from older fish already present on the site. A separation of year classes removes the interaction between year classes and reduces the potential infection rates. There is also a known disease risk of infection by *Photobacterium* spp in South Australia. Clean Seas has proposed the use of oxytetracycline (having APVMA permit) to treat this infection. The use of chemicals and therapeutants follows a rigorous assessment process, which is discussed in risk event 2.3 – Chemicals and therapeutants. Regulation 14 of the Regulations stipulates that if a licensee knows, or ought reasonably to know, that an aquatic organism proposed to be introduced into the licence area is or may be affected with a disease, the licensee must ensure that the aquatic organism is not introduced into the licence area without the prior written approval of the Minister. Regulation 13 of the Regulations also requires licensees to report unusually

			high mortality rates. Given the above information, the overall risk of inappropriately managed prevention of, and treatment for, disease from the proposed consolidated site operations is considered to be low.
Wastes generated from operation of the facility			
2.7 Sedimentation	Likely (6) x Minor (1)	Low (6)	The probability of sedimentation occurring from a finfish farming operation is likely as YTK will be fed manufactured dry pellets. The maximum biomass proposed by the applicant for the consolidated 150 hectare site is 2,250 tonnes (= 15 tonnes/ha) [8]. The ability of YTK to process the nutrients in the pellets (i.e. FCRs) is dependent on the water temperature and developmental stage of fish. In a final report on refining YTK feeds and feed management produced by SARDI [18], FCRs were reported as high as 1.45 in a summer temperature trial but as low as 4.43 in a winter temperature trial. Higher FCRs (the smaller the number the greater assimilation of available nutrients in feed and less waste) are likely to result in less suspended solids produced through faeces. Sedimentation resulting from uneaten food will be monitored through the use of video of feeding practices to mitigate against the build-up of excess feed beneath sea-cages [8]. Sedimentation from other particulate matter will be controlled through regular net cleaning to prevent the build-up of biofouling material. Mean water flow in the area is predicted at 0.58 knots [8]. Depth-averaged current speeds measured to the south of Point Lowly as part of the FRDC project 2009/046 investigating the carrying capacity of Spencer Gulf using hydrodynamic and biogeochemical modelling were 1.2 knots (maximum) with an average of 0.4 knots (M. Doubell, SARDI, pers. comm.18 September 2018). Annual and ongoing EMP requirements of the licensee is considered sufficient to identify and adaptively manage any sedimentation impacts. Furthermore, regulation 25(e) of the Regulations require a 12-month fallowing period of stocked sea cages, unless otherwise approved by the Minister. Fallowing time allows any sedimentary material to be turned over by natural processes. The farming strategy submitted by Clean seas will result in the entire western site being fallowed for a period of three months every 27 months with individual grids being fallowed for longer depending on when stock are moved. Regulation 25(d) of the Regulations requires a minimum of three metres between farming structures and the seafloor which facilitates dispersal of nutrients/material, which is facilitated through the proposed site development (i.e. minimum of six metres between the bottom of sea-cages and the seafloor. Given the composition of the benthic habitat, the requirement to participate in a research program monitoring the impacts to nearby seagrass meadows (see risks 1.1 and 2.5 – Habitat effects), outcomes from previous infaunal monitoring, species biology (FCRs) and the relatively strong currents of the area, the overall risk of sedimentation at the proposed site is considered to be low.
2.8 Culture organism disposal	Rare (2) x Moderate (2)	Low (4)	In the event of termination or mortality of stock through site production, the waste created will need to be disposed of. In accordance with section 25 of the *Environment Protection Act 1993*, every fish farmer has a general environmental duty to take all reasonable and practical measures to prevent or minimise environmental harm resulting from an activity that pollutes, or might pollute, the environment on the aquaculture site. This includes the appropriate management of aquaculture mortalities.

			The applicant has stated that all waste created by cultured organisms will be stored will be returned to shore to be disposed of at a rendering facility or fertilizer producer. Therefore, the likelihood of impacts through improper disposal of mortalities of farmed organisms from site operations is considered to be rare. The consequence of improper disposal of culture organisms is considered to be moderate, as it is likely that any disposal of deceased organisms at sea would be assimilated through natural processes. Accordingly, the overall risk is considered to be low.
2.9 General refuse	Rare (2) x Moderate (2)	Low (4)	Subregulation 3(1) of the Regulations, defines aquaculture waste as 'waste generated in the course of carrying on aquaculture, but does not include waste created by living aquatic organisms'. Regulation 11 of the Regulations requires the licensee to ensure that aquaculture waste does not cause an unsightly or offensive condition at the licence area and that any such waste is secured or treated in a manner designed to prevent it being blown, washed or swept off the licence area. Furthermore, this regulation also requires a licensee to ensure that if aquaculture waste is blown, washed or swept off the licence area, it is recovered as soon as practicable. These requirements of licensees will ensure all reasonable measures are taken to prevent waste material entering the site or surrounding environment. The applicant has stated that the site will be accessed once or twice daily (weather permitting) with inspections of farming structures and stock undertaken. Any materials considered as general refuse will be taken to shore for disposal at the local council landfill, which for the City Council of Whyalla is the Mount Laura Waste and Resource Recovery Centre. Therefore, the likelihood of improper disposal of general refuse from site operations is considered to be rare. Annual EMP requirements provided by the Regulations require licensees to report the amount of general refuse produced on site, as well as provide details on the method of disposal. These requirements are designed to prevent, identify and adaptively manage any adverse environmental impacts from site operations. Given the above, the consequence of improper disposal of general refuse is considered moderate with the overall risk considered to be low.
2.10 Biofouling	Unlikely (3) x Moderate (2)	Low (6)	It is a standard licence condition, that 'The licensee shall in the event that it receives reasonable direction from the Minister to do so, cease and desist from any activity which in the reasonable opinion of the Minister may tend to cause environmental harm (as defined in the *Environment Protection Act 1993*)'. The removal of biofouling in accordance with the *Environment Protection Act 1993* is recommended to be undertaken on-shore, and all waste is to be disposed of at an EPA licensed disposal facility. However, shore-based cleaning of nets is not always practical and it likely to lead to increased stress to the stock and escape events while changing nets. While in situ cleaning of nets is not a preferred cleaning method, a high frequency of cleaning should ensure that any removed biofouling is primary in nature and minimal in volume and therefore the cleaning process is not likely to cause environmental harm (i.e. produce putrescible waste). The applicant has stated that the net will be cleaned in situ at least once per week using commercial net washers according to standard industry practice. Where possible, wastes will be collected and returned to shore, however in situ cleaning is considered to have a moderate consequence. Annual EMP reports submitted by licensees require information to be submitted regarding the amount of biofouling produced on site, as well as the methods used to dispose of biofouling. These EMPs are reviewed

			annually, allowing any impacts to the benthos from farming practices, including the incorrect disposal of biofouling to be monitored and adaptively managed before any long-term impacts occur. The frequency of cleaning and low level of accumulated biofouling in between cleaning events is expected to reduce the risk of improper disposal of biofouling on site facilities, which is considered to be an overall low risk.
2.11 Water quality	N/A	N/A	This risk event relates to land-based applications only.
2.12 Processing	Rare (2) x Moderate (2)	Low (4)	The applicant has indicated there will be some harvest activities occurring on site on harvest vessels, however, no fish processing will occur on site. The applicant has stated that harvesting waste (such as guts and gills) will be taken to shore for disposal at a rendering facility. Given these measures for containing waste, the likelihood of improper disposal from processing practices is considered to be rare. If improper processing practices were to occur, the consequence of such activity is moderate, when considering disposal of processed fish waste is likely to be assimilated through natural processes (see risk event 2.8 – Culture organism disposal). Accordingly, the overall risk is considered to be low.
REGIONAL EFFECTS			
The below risks consider potential impacts from a regional perspective, with the focus on the net effects of resulting from the addition of the consolidated site to the aquaculture zone, with consideration of the current level of aquaculture activity undertaken within the region. When an application is received for a site within an aquaculture zone of an established aquaculture zone policy area, many of the risks below (denoted as N/A) have already been considered in the development of the zone policy, and are therefore not addressed in the licence-based risk assessment. Specifically, a zone policy has prescribed limits for the maximum allocation of area and biomass, along with suitable species for aquaculture. These limits have been determined through scientific technical investigations on the benthic and pelagic environments within the zone, which determine the capacity of a zone, suitability of the area for aquaculture and the cumulative impacts of aquaculture. This risk assessment is for an area of water in the *Aquaculture (Zones – Fitzgerald Bay) Policy 2008* and is consistent with its statutory requirements. That is, it is proposed to occur within a prescribed zone (western Fitzgerald Bay aquaculture zone), and within the hectare and biomass limits prescribed for that zone.			
3 Water use quality and quantity			
3.1 Nutrients	N/A	N/A	N/A
3.2 Sedimentation	N/A	N/A	N/A
3.3 Chemicals	N/A	N/A	N/A
3.4 Flow	N/A	N/A	N/A
4 Ecological community structure and biodiversity			
4.1 Listed migratory and threatened species	N/A	N/A	N/A
4.2 Sensitive habitats	N/A	N/A	N/A

4.3 Behavioural changes	N/A	N/A	N/A
4.4 Translocations between regions	Remote (1) x Minor (1)	Low (1)	Yellowtail Kingfish fingerlings will be produced at Clean Seas land-based facility on Eyre Peninsula and transferred directly to the site. The likelihood that fish will be translocated between regions is therefore considered to be remote. Given the legislative provisions of the Regulations around moving fish that may be affected with disease, the low risk of poor disease management (discussed in risk event 2.6 – Disease management), the consequence and of this activity is considered to be minor. Accordingly, the overall risk posed by the translocation of stock is considered to be low.
4.5 Phytoplankton	N/A	N/A	N/A
4.6 Benthic communities	N/A	N/A	N/A
5 Physical structures, construction and tenure			
5.1 Loss of access	N/A	N/A	N/A
5.2 Effect on human cultural heritage areas	N/A	N/A	N/A
5.3 Navigation	N/A	N/A	N/A
6 Production			
6.1 Disease	Remote (1) x Minor (1)	Low (1)	Significant (endemic) diseases relating to YTK have been previously identified in risk event 2.6 – Disease management. The applicant has proposed the use of hydrogen peroxide, oxytetracycline and praziquantel under Ministerial approval and veterinarian supervision as treatment measures for those conditions, the use of which has been considered in risk event 2.3 – Chemicals and therapeutants. Given the considerations outlined in risk events 2.3 and 2.6, the fact that YTK are native to State waters and the requirements of regulations 13 and 14 of the Regulations (relating to notification of unusually high mortalities and containment of stock suspected to be affected without disease), the consequence of disease spread is considered to be minor. Given the strategies proposed by Clean Seas for aquatic animal health monitoring and treatment, and the legislative requirements of licensees in terms of disease occurrences, the overall risk of disease spreading from one site to another is considered to be low.
6.2 Disposal of waste	N/A	N/A	N/A

REFERENCES

[1] Clean Seas Seafood Limited, Jay Dent (2018). AL00034/FF00026 – Application of vary conditions (movement) of an aquaculture lease.

[2] Clean Seas Seafood Limited, Jay Dent (2018). AL00035/FF00027 – Application of vary conditions (movement) of an aquaculture lease.

[3] Clean Seas Seafood Limited, Jay Dent (2018). AL00036/FF00028 – Application of vary conditions (movement) of an aquaculture lease.

[4] Clean Seas Seafood Limited, Jay Dent (2018). AL00037/FF00029 – Application of vary conditions (movement) of an aquaculture lease.

[5] Clean Seas Seafood Limited, Jay Dent (2018). LA00119/FF00095– Application of vary conditions (movement) of an aquaculture lease.

[6] Clean Seas Seafood Limited Tuna, Jay Dent (2018). LA00120/FF00096 – Application of vary conditions (movement) of an aquaculture lease.

[7] PIRSA Fisheries and Aquaculture (2011). *Aquaculture (Zones – Fitzgerald Bay) Policy 2008.*

[8] Clean Seas Seafood Limited, Jay Dent (2018). Application for a new marine aquaculture lease.

[9] Preliminary Results for FEMP – SARDI to PIRSA (2013).

[10] Tanner, J.E., Giblot-Ducray, D. and Loo M.G.K. (2017). Temporal Analysis of Infaunal DNA Data from the Tuna and Finfish Environmental Monitoring programs, 2005-2014. Report prepared for PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2016/000392-1. SARDI Research Report Series No. 916. 24pp.

[11] Clean Seas Seafood Limited Farming strategy for Fitzgerald Bay dated February 2018.

[12] PIRSA Fisheries and Aquaculture (2009). PIRSA Fisheries and Aquaculture Division's Ecologically Sustainable Development (ESD) Risk Assessment Guidelines. Primary Industries and Resources South Australia, 45 pp.

[13] 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.

[14] Fowler, A.J., Ham, J.M. and P.R. Jennings (2003). Discriminating between cultured and wild kingfish (*Seriola lalandi*) in South Australia. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. RD03/0159.

[15] Harrison, S. (2003). Interactions between seabirds and tuna farms near Port Lincoln. Flinders University. Honours thesis, pp 27.

[16] Svane, I. and Barnett, J. (2007). The occurrence of benthic scavengers and their consumption at SBT farms off Boston and Rabbit Islands, Port Lincoln, South Australia: a preliminary study. P169-180 In Fernandes, M., Lauer, P., Cheshire, A., Svane, I., Putro, S., Mount, G., Angove, M., Sedawie, S., Tanner, J., Fairweather, P., Barnett, J. & A. Doonan 2007. Aquafin CRC - Southern Bluefin Tuna Aquaculture Subprogram: Tuna Environment Subproject Evaluation of Waste Composition and Waste Mitigation. Aquafin CRC Project 4.3.2 (FRDC Project No. 2001/103).

[17] Diggles, B. K. and Hutson, K. (2007). Diseases of kingfish (Seriola lalandi) in Australasia. Aquaculture Health International. 3. 12-14.

[18] Stone, D.A.J., D'Antignana, T.D. and Bansemer, M.S (2016). Final Report. Refining Yellowtail Kingfish feeds and feed management. Prepared by the South Australian Research and Development Institute (Aquatic Sciences, Adelaide. AS-CRC Project No. 2013/730. 144pp.

Appendix 1: Biogeographical description of the consolidated 150-hectare site

Twelve transects were undertaken at the proposed location for the 150-hectare consolidated site, ranging from 106 m to 296 m in length (total site transect length = 1626 m). Using the EPA survey power calculator, a detection power of 93.9% was achieved at a critical feature cover of 3%. The location of each transect are shown in Figure 4 below.

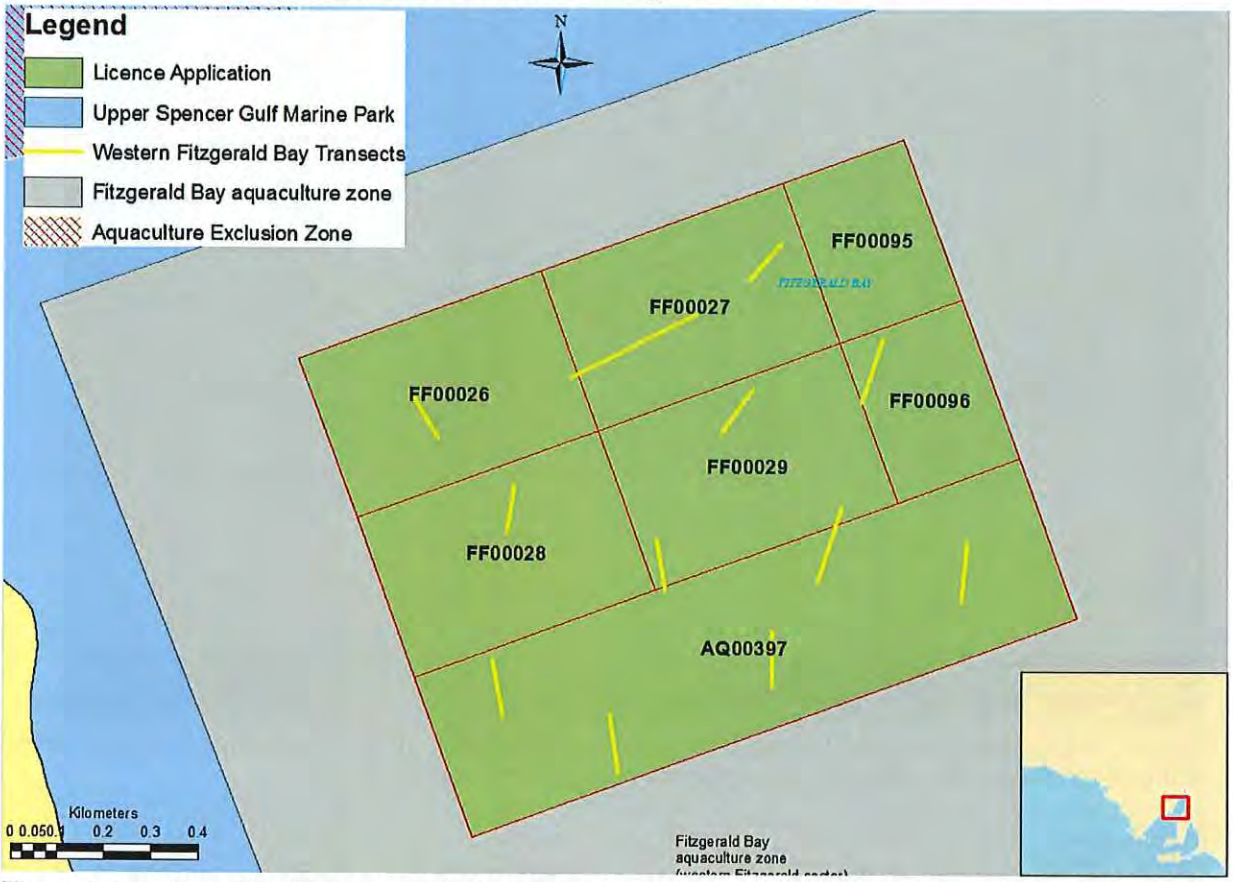


Figure 4: Location of the biogeographical transects taken for the proposed 150-hectare consolidated site.

The 12 video transects depicted a benthic environment, consisting of a fine grained sandy substrate with very slight undulation. The dominant habitat type of "bare sand" was observed in all transects. No areas of live seagrass were observed in any of the 12 video transects. Although, detached seagrass fronds (species indistinguishable) at various states of decomposition were noted at a very low level, indicating the presence of seagrass in the region (Figure 5). Other marine flora included very low density, predominantly detached, macroalgae. The epifaunal community appeared to be generally low in abundance and diversity and consisted of occasional filter feeding organisms such as sea squirts (Family Ascididae) and razorfish (*Pinna bicolor*). A medium level of bioturbation was predominant throughout the video transects (Figure 6).

Figure 5: Representative image of the benthic environment taken from transect 8 at the proposed location of the consolidated site, indicating the presence of detached seagrass fronds.

Figure 6: Representative image of the benthic environment taken from transect 5 at the proposed location of the consolidated site, indicating a medium level of bioturbation.

FISHERIES
& AQUACULTURE
PIRSA

PRIMARY INDUSTRIES AND REGIONS SOUTH AUSTRALIA, FISHERIES AND AQUACULTURE DIVISION MARINE LICENCE ASSESSMENT

AQ00396 (NEW)

AQ00140 (VARIATION)

SOUTH
AUSTRALIA

Government
of South Australia

Primary Industries
and Regions SA

PRIMARY INDUSTRIES AND REGIONS SOUTH AUSTRALIA, FISHERIES AND AQUACULTURE DIVISION MARINE LICENCE ASSESSMENT

Application type:	New Licence and Movement
Licence number and type:	AQ00396 and AQ00140, respectively (Finfish)
Lease number and type:	LA00427 and LA00130, respectively (Production Lease)
Aquaculture zone policy	*Aquaculture (Zones - Fitzgerald Bay) Policy 2008*
Aquaculture zone	Fitzgerald Bay aquaculture zone (Eastern Fitzgerald sector)
Proposed species	Yellowtail Kingfish (*Seriola lalandi*)
Proposed production system	Sea Cages
Geographical location:	Upper Spencer Gulf, South Australia
From:	General Manager, Aquaculture
Through:	Aquaculture Policy and Environment Unit Aquatic Animal Health Unit

Following is a licence assessment by PIRSA Fisheries and Aquaculture in relation to the above aquaculture licence applications. In light of the assessment's findings, I am satisfied that environmental impacts associated with the proposed development can be appropriately managed under the conditions of the attached aquaculture licences to be issued pursuant to the *Aquaculture Act 2001* and associated regulations. Note however that, in accordance with section 52 of the *Aquaculture Act 2001*, the Minister for Primary Industries and Regional Development (the Minister) may vary licence conditions at any time to prevent or mitigate significant environmental harm or the risk of significant environmental harm.

Summary of modified/additional licence conditions:

Two additional licence conditions were identified during the assessment of these applications:

- *The Licensee must provide the Minister with a written monthly report stating biomass (tonnes), number of fish and input of feed (tonnes) and GPS coordinates per sea-cage per site.*
- *The Licensee must undertake an environmental monitoring program of the sea floor in relation to the Licensed Site when directed by the Minister in writing and in a manner and form determined by the Minister.*

The conditions of the draft aquaculture licences and requirements of the *Aquaculture Regulations 2016* (the Regulations) are considered sufficient to manage potential environmental risks and ensure ecological sustainability.

Dr Adam Main
GENERAL MANAGER, AQUACULTURE
FISHERIES AND AQUACULTURE DIVISION
27/9/2019

CONTENTS

TABLES

FIGURES

BACKGROUND

The Fisheries and Aquaculture Division of Primary Industries and Regions SA (PIRSA) have received the following applications from Clean Seas Seafood Limited (Clean Seas):

- Application for a new 73-hectare (ha) production lease (LA00427) inside an aquaculture zone [1].
- Application for a new 73 ha marine aquaculture licence (AQ00396) inside an aquaculture zone [2].
- Application to vary conditions (movement) of a 60 ha aquaculture lease (LA00130) inside an aquaculture zone [3]. The purpose of the variation is to relocate the lease to adjacent the proposed new lease to create a consolidated 133 ha lease area.

Each of the sites are located within the Eastern Fitzgerald sector of the Fitzgerald Bay aquaculture zone, identified within the *Aquaculture (Zones – Fitzgerald Bay) Policy 2008.*

The intent of the Fitzgerald Bay aquaculture zone is to ensure the farming of finfish is undertaken in an environmentally and socially acceptable manner. The objective of the *Aquaculture (Zones – Fitzgerald Bay) Policy 2008* is to specify the class of permitted aquaculture and to prescribe criteria for the leased area size and biomass of aquatic animals to be farmed in the zone. Biomass limits for the existing licence area will not change from what was originally assessed and approved and the total allocation of biomass will remain consistent with the total allowable biomass prescribed for the Eastern Fitzgerald sector of the Fitzgerald Bay aquaculture zone.

Clean Seas currently operates all of the aquaculture licences within both sectors of the Fitzgerald Bay aquaculture zone. While Fitzgerald Bay was the original focus of Yellowtail Kingfish aquaculture in South Australia, it has not been utilised for around ten years [4].

Site Location

The consolidated 133 ha licence area (the site) is located within the deepest available water within the sector and is orientated perpendicular to the prevailing current direction to maximise water flow through the farm [1]. Spatial mapping using the ESRI ArcGIS spatial mapping software identified the proposed site is approximately 2.3 kilometres north-east of the Mean High Water Mark near Crag Point (Figure 1). The nearest active marine lease not operated by Clean Seas is located 2.2 kilometres west of the proposed site; Intertidal Mollusc (Oysters) licence AQ00138.

The nearest built-up area along the coastline is located just south of Douglas Point, approximately 2.4 kilometres north-west of the proposed site. Spatial mapping identified the site is located within a General Managed Use Zone (GMUZ) of the Upper Spencer Gulf Marine Park, and identified the below nearby areas of conservation significance:

- the Blanche Harbour-Douglas Bank Aquatic Reserve (7.7 km north); and
- the Winninowie Conservation Park (8.5 km north-east).

A search of the Register of Aboriginal Sites and Objects (the Register) administered by the Department of the Premier and Cabinet, Aboriginal Affairs and Reconciliation (DPC:AAR) was conducted on 17 July 2018 (Objective ID: A3683873). The search revealed that the Register had no entries for Aboriginal sites within the proposed lease areas.

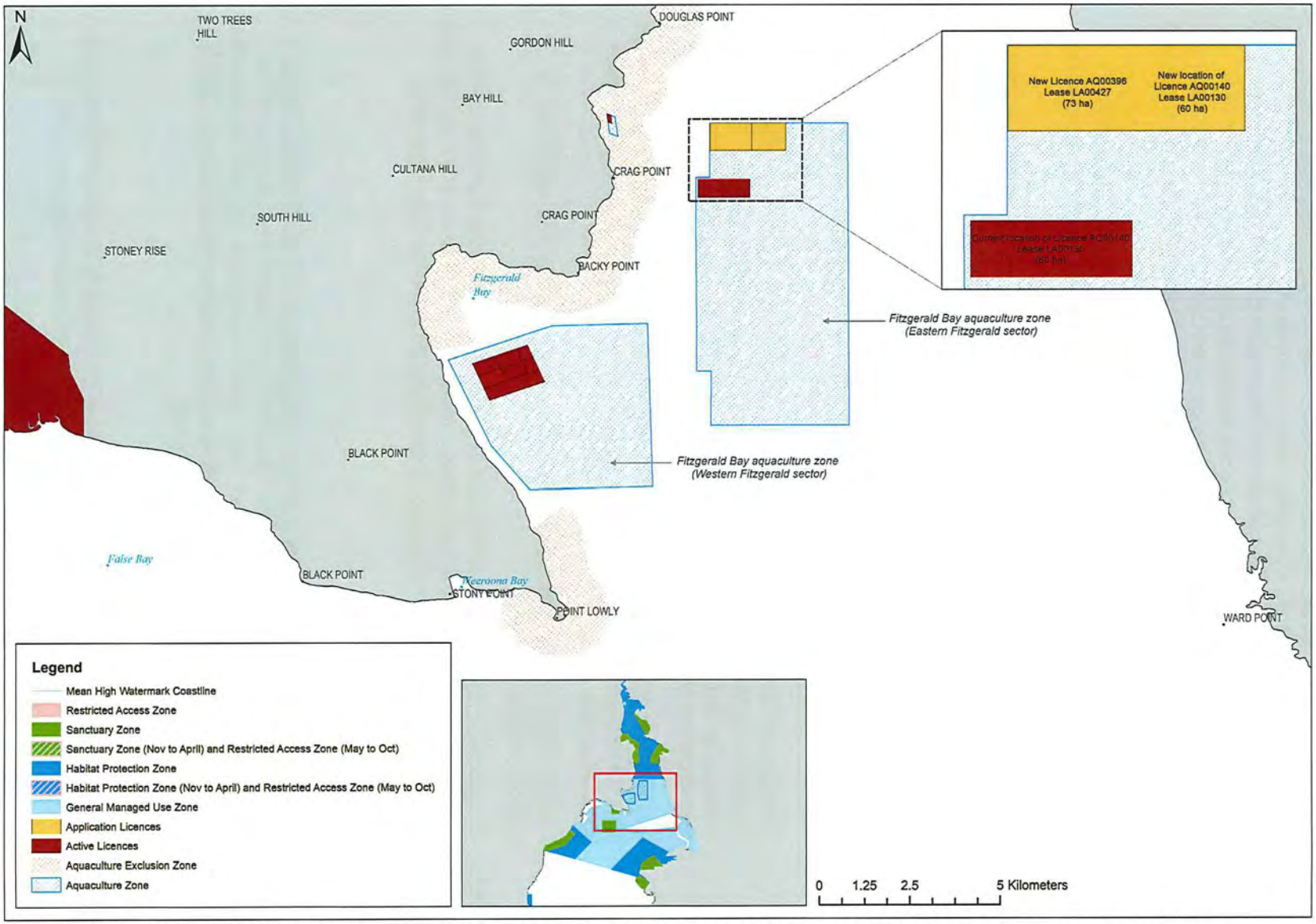


Figure 1: Proposed location of aquaculture leases LA00427 (licence AQ00396) and LA00130 (licence AQ00140) within the Eastern Fitzgerald sector.

Environmental Monitoring

Between 2008 and 2012, a licence-based and standardised Finfish Environmental Monitoring Program (FEMP) was undertaken by the South Australian Research and Development Institute (SARDI) Aquatic Sciences on behalf of the finfish industry, to monitor the ongoing impacts to benthic infaunal communities adjacent to farmed licensed sites. An environmental scorecard was developed for the assessment of environmental performance and to guide decision making in relation to environmental compliance. Results were presented using a 5-tiered system where "green", the highest level, indicates an appropriate environmental outcome and "violet", the lowest level, indicates that the result is in breach of the compliance limits.

A SARDI report, presenting temporal (2005 – 2014) infaunal DNA data from the FEMP, which demonstrated that while there was temporal variation between sites at Fitzgerald Bay, there was no differences between control and compliance sites [5].

On 30 June 2019, the Fisheries Research and Development Corporation (FRDC) executed a Project Agreement for assessing the capacity for sustainable finfish aquaculture in the vicinity of seagrasses (Project Number: 2018-186), using Fitzgerald Bay as a case study.

The objectives of the FRDC project entitled '*Assessing the capacity for sustainable finfish aquaculture in the vicinity of seagrasses*' are to:

- Determine cost-effective approaches to assessing the influence of finfish aquaculture derived nutrients on seagrasses and what that influence is.
- Develop a predictive modelling ability to estimate carrying capacity and allow scenario analysis of future aquaculture development and how it might affect seagrasses, to allow managers to make informed decisions about where to place future developments, and how much to allow existing developments to expand.
- Use Fitzgerald Bay as a case study to document seagrass condition using a range of metrics both before the commencement of finfish aquaculture, and once production has reached a substantial level.
- Develop a range of cost-effective indicators for monitoring the effects of aquaculture on adjacent seagrass beds.

SARDI will undertake modelling of the farming activity prior to stocking sea-cages to determine the fate of nutrients from the western and eastern farming blocks. This will inform the location of sampling sites for both the FRDC project and the site-specific monitoring program that Clean Seas will be required to undertake.

PROPOSED SPECIES

The existing licence (AQ00140) is currently licensed for the farming of Yellowtail Kingfish (*Seriola lalandi*) and Mulloway (*Argyrosomus japonicus*). Clean Seas have requested the latter species be removed from the licence (Dan Fisk, Clean Seas, Email dated 25 September 2019) and will therefore be excluded from the assessment. The consolidated area of both licences (AQ00396 and AQ00140) will be developed for the farming of Yellowtail Kingfish only.

Stocking

Clean Seas operate a land-based hatchery located in Arno Bay (aquaculture licence FT00560) where Yellowtail Kingfish is hatchery-reared. This is where Clean Seas will source aquaculture stock [2].

Based on the most recent information provided by the applicant to date, it is anticipated that the Eastern Fitzgerald sector will be stocked with fish from November 2019 (Jay Dent, Clean Seas, email dated 12 August 2019). It is noteworthy that while the new licence area (AQ00396) or the variation to AQ00140 may not be approved/available by this time, Clean Seas have indicated they could utilise the current location of lease (LA00130) and corresponding licence area (AQ00140) which is capable of holding up to 900 tonnes of finfish, as an interim measure.

ENVIRONMENTAL CHARACTERISTICS

Site Characteristics

The physical characteristics of the consolidated site are summarised in Table 1 below.

Table 1: Physical characteristics of the proposed licence area comprising AQ00140 and AQ00396.

Characteristic	Description	Reference
Maximum fetch	140 kilometres (SSW)	[2]
Annual wave height	2.8 metres (maximum), 1.2 metres (average)	[2]
Minimum water depth	18 metres	[2]
Maximum tidal range	2.52 metres	[2]
Average water flow rate and direction	0.3 m/s (north-south)	[2]
Average water temperature	24.1°C (summer), 13.9°C (winter)	[2]

Benthic Biogeographical Observations

Twelve transects were undertaken at the proposed location for the 133-hectare consolidated licence area, ranging from 120 metres to 155 metres in length (total site transect length = 1655 metres). Using the Environment Protection Authority (EPA) survey power calculator, a detection power of 97% was achieved at a critical feature cover of 3%. The location of each transect and a summary of the dominant habitat present are provided on pages nine to ten, and a map provided below (Figure 2).

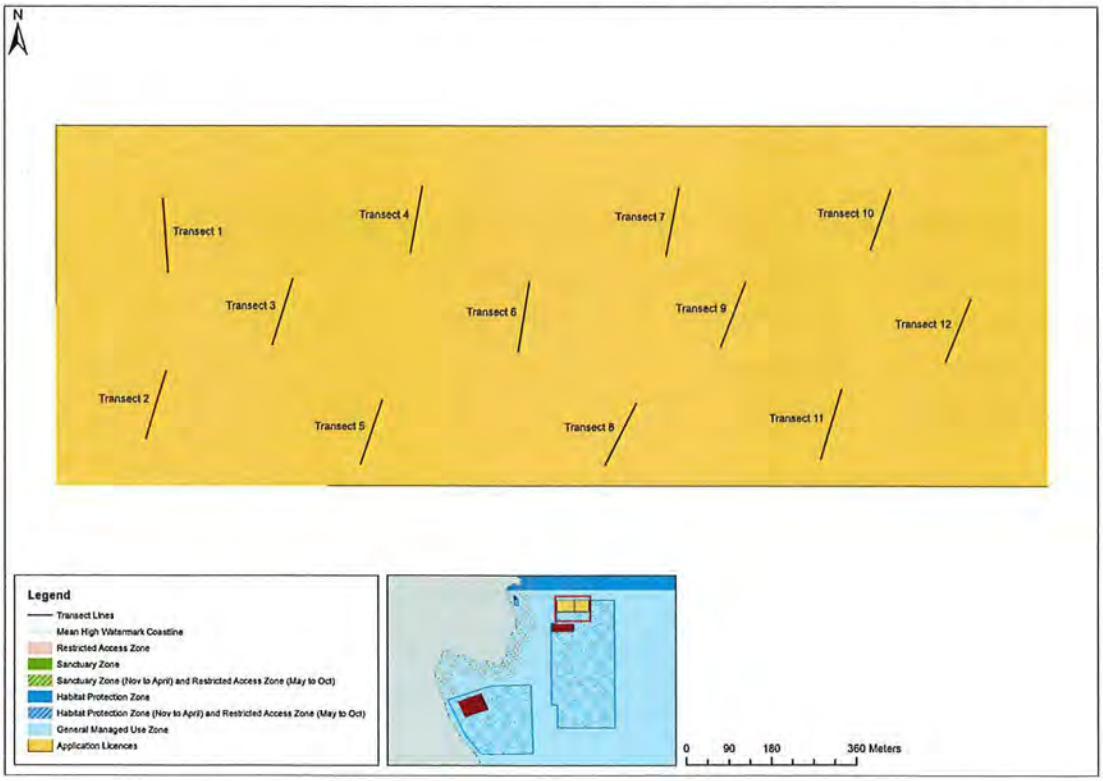


Figure 2: Location of the twelve video transects collected over the proposed location of aquaculture leases LA00427 (licence AQ00396) and lease LA00130 (licence AQ00140) within the Eastern Fitzgerald sector.

The 12 video transects depicted a benthic environment, consisting of a fine-grained sandy substrate with very slight undulation. The dominant habitat type of "bare sand" was observed in all transects, similar to that observed in the Western Fitzgerald sector. No areas of live seagrass were observed in any of the 12 video transects. However, detached seagrass blades (species indistinguishable) at various states of decomposition were noted at a very low level.

Consistent with the assessment completed for the Western Fitzgerald sector licence areas, the epifaunal community appeared to be generally low in abundance and diversity and consisted of occasional filter feeding organisms such as sea squirts (Family Ascididae) and razorfish (*Pinna bicolor*). Blue swimmer crabs (*Portunus armatus*) were also observed in two of the transects. A medium level of bioturbation was predominant throughout all video transects.

Transect 1 (coordinates GDA 94, Latitudes and Longitudes – Degrees Decimal Minutes)

Transect start point:	32° 52.7153' S	137° 49.4527' E
Transect end point:	32° 52.7990' S	137° 49.4583' E
Transect length:	155 metres	
Dominant habitat:	Bare sand	

Transect 2 (coordinates GDA 94, Latitudes and Longitudes – Degrees Decimal Minutes)

Transect start point:	32° 52.9105' S	137° 49.4562' E
Transect end point:	32° 52.9867' S	137° 49.4327' E
Transect length:	144 metres	
Dominant habitat:	Bare sand	

Transect 3 (coordinates GDA 94, Latitudes and Longitudes – Degrees Decimal Minutes)

Transect start point:	32° 52.8058' S	137° 49.6017' E
Transect end point:	32° 52.8804' S	137° 49.5781' E
Transect length:	136 metres	
Dominant habitat:	Bare sand	

Transect 4 (coordinates GDA 94, Latitudes and Longitudes – Degrees Decimal Minutes)

Transect start point:	32° 52.7011' S	137° 49.7500' E
Transect end point:	32° 52.7767' S	137° 49.7363' E
Transect length:	120 metres	
Dominant habitat:	Bare sand	

Transect 5 (coordinates GDA 94, Latitudes and Longitudes – Degrees Decimal Minutes)

Transect start point:	32° 52.9435' S	137° 49.7040' E
Transect end point:	32° 53.0158' S	137° 49.6790' E
Transect length:	140 metres	
Dominant habitat:	Bare sand	

Transect 6 (coordinates GDA 94, Latitudes and Longitudes – Degrees Decimal Minutes)

Transect start point:	32° 52.8093' S	137° 49.8717' E
Transect end point:	32° 52.8880' S	137° 49.8590' E
Transect length:	140 metres	
Dominant habitat:	Bare sand	

Transect 7 (coordinates GDA 94, Latitudes and Longitudes – Degrees Decimal Minutes)

Transect start point:	32° 52.7024' S	137° 50.0427' E
Transect end point:	32° 52.7800' S	137° 50.0279' E
Transect length:	132 metres	
Dominant habitat:	Bare sand	

Transect 8 (coordinates GDA 94, Latitudes and Longitudes – Degrees Decimal Minutes)

Transect start point:	32° 52.9466' S	137° 49.9939' E
Transect end point:	32° 53.0164' S	137° 49.9582' E
Transect length:	136 metres	
Dominant habitat:	Bare sand	

Transect 9 (coordinates GDA 94, Latitudes and Longitudes – Degrees Decimal Minutes)

Transect start point:	32° 52.8098' S	137° 50.1182' E
Transect end point:	32° 52.8826' S	137° 50.0898' E
Transect length:	140 metres	
Dominant habitat:	Bare sand	

Transect 10 (coordinates GDA 94, Latitudes and Longitudes – Degrees Decimal Minutes)

Transect start point:	32° 52.7042' S	137° 50.2842' E
Transect end point:	32° 52.7722' S	137° 50.2611' E
Transect length:	125 metres	
Dominant habitat:	Bare sand	

Transect 11 (coordinates GDA 94, Latitudes and Longitudes – Degrees Decimal Minutes)

Transect start point:	32° 52.9306' S	137° 50.2282' E
Transect end point:	32° 53.0090' S	137° 50.2045' E
Transect length:	133 metres	
Dominant habitat:	Bare sand	

Transect 12 (coordinates GDA 94, Latitudes and Longitudes – Degrees Decimal Minutes)

Transect start point:	32° 52.8285' S	137° 50.3756' E
Transect end point:	32° 52.8992' S	137° 50.3467' E
Transect length:	154 metres	
Dominant habitat:	Bare sand	

DEVELOPMENTAL/OPERATIONAL CHARACTERISTICS

The proposed development involves the consolidation of two sites (one movement and one new area) within the Eastern Fitzgerald sector of the Fitzgerald Bay aquaculture zone, so that they are abutting each other. The purpose of this is to create a consolidated licence area to allow for the use of a submerged grid mooring system, similar to that being installed on Clean Seas' licence areas located within the Western Fitzgerald sector.

If approved, the licence area(s) would hold a maximum biomass of 1,995 tonnes of Yellowtail Kingfish across 133 hectares, equivalent to 15 tonnes of finfish per licensed hectare.

Mooring System

The consolidated licence area will accommodate a submerged 16-cage grid mooring to hold sea-cages. Figure 3 provides a representative diagram of a grid system [1].

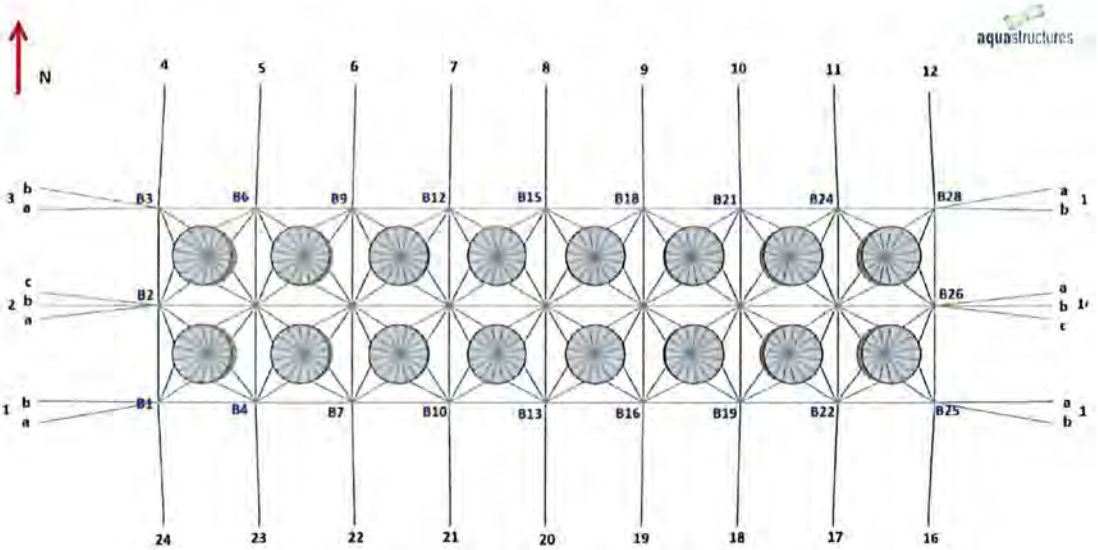


Figure 3: Representative diagram of the mooring grid proposed for development within the consolidated 133-hectare licence area.

The grid system proposed for use supports up to 16 sea-cages. Sea-cages are secured to the grid system with 60 concrete mooring blocks, each weighing three tonnes (1.5 m x 1.5 m x 1.0 m) and 30 anchors each weighing 250 kilograms (1.5 m x 1.5 m x 0.9 m). Each cage will contain a bird net stand which are four metres high and weigh 590 kilograms. Each cage will utilise 32 net weights (512 kg total per cage). The mooring system will incorporate six large grid floats weighing 150 kilograms (2.2 m x 1.6 m) and 20 smaller grid floats weighing 100 kilograms each (1.8 m x 1.3 m) [1].

Sea Cages

The applicant proposes the use of double collar sea-cages (polar circle pens). Each sea-cage has a diameter of 44 metres and weighs 12.98 tonnes. Cage netting is constructed from nylon with net mesh size varying from 33 to 78 millimetres. Each cage netting has a maximum depth of ten metres and weighs approximately 2.2 tonnes [1].

Feeding Methods

Aquaculture stock held within the Eastern Fitzgerald sector will be fed extruded dry pellets [2] delivered by an automated feed barge installed within the proposed licence area [1]. Feeding is expected to be conducted in a manner consistent with operations undertaken in Port Lincoln and Arno Bay, including daily feed intake monitoring (using video) and assessment against a feed model [2].

Site Maintenance, Cleaning and Waste Disposal

The applicant has stated that the site will be visited once or twice daily from 07:00 am to 17:00 pm seven days a week when juvenile fish are present [2]. During site visits, the proposed licence area will be inspected for both mortality and any damaged infrastructure or debris in the vicinity of the site.

The applicant has stated that nets will be cleaned in situ using commercial net washers according to standard industry practices [2]. Cleaning of nets will be undertaken as required to prevent the establishment of macrofouling and to allow sufficient water movement. Nominally, this will occur approximately one to two times per week during summer and every ten days during winter [2].

The applicant has stated that general refuse, including used netting and broken infrastructure will be taken to land and disposed at the local council landfill and any mortalities will be removed from cages and taken to a rendering facility or fertiliser producer for disposal [2].

Harvesting and Processing of Aquatic Resources

The applicant has stated that aquaculture stock may be harvested on site with stock processed onshore [2]. Harvesting waste will be taken to a rendering facility [2].

Aquatic Animal Health Management

Common diseases known to cause problems in Yellowtail Kingfish and management strategies proposed by the applicant are outlined in Table 2 below.

Table 2: Common diseases known to affect Yellowtail Kingfish and management strategies proposed by Clean Seas.

Pathogen	Disease	Proposed Management
Benedinia seriolae	Skin Fluke	Hydrogen Peroxide bathing Site fallowing and year class separation
Zeuxapta seriolae	Gill Fluke	Hydrogen Peroxide bathing Praziquantel bathing Site fallowing and year class separation
Photobacterium spp.	Photobacteriosis	Vaccine Health monitoring Monitoring of oxygen Oxytetracycline treatment Regular cleaning of nets
Cardicola sp.	Blood Fluke	In-feed Praziquantel

ECOLOGICALLY SUSTAINABLE DEVELOPMENT ASSESSMENT

Method and interpretation

The ecologically sustainable development (ESD) risk assessment for this application is summarised in Table 7. Table 7 should be read in conjunction with the PIRSA's ESD Risk Assessment Guidelines [6], which provides explanations of each of the risks addressed. The primary aim of this assessment is to evaluate the potential ecological risks to the sustainable development of South Australia's resources from the approval of the proposed application.

The risk assessment method is based on the National Ecologically Sustainable Development framework, the Aquaculture 'How-To' Guide [7]. The framework was developed by the Fisheries Research and Development Corporation (FRDC) to be used consistently across fisheries and aquaculture sectors in Australia and is based on the Australia and New Zealand standard for risk management (AS/NZS 4360 1999) (now superseded by the International Standard ISO 31000:2018 [8]). Each identified risk is assigned a risk ranking. To assign a risk ranking to an issue, two factors are determined – the likelihood that the particular event will occur and the potential consequence arising from that event. It is noteworthy that the likelihood and the consequence of a particular event are considered independently [8]. The combination of likelihood and consequence produces a risk value, which in turn is used to determine the risk ranking, associated with a particular issue [8].

The likelihood and consequence levels or categories outlined in the National ESD framework are used in this assessment (Tables 3 and 4, respectively). A risk value for each risk event is then derived by combining the likelihood of occurrence with the corresponding level of consequence using a risk matrix (Table 5). Finally, the risk value is used to determine the risk ranking (Table 6).

Table 3: Standard likelihood levels.

Level	Descriptor
Remote (1)	Never heard of, but not impossible
Rare (2)	May occur in exceptional circumstances
Unlikely (3)	Uncommon
Possible (4)	Some evidence to suggest this is possible
Occasional (5)	May occur
Likely (6)	Is likely to occur

Table 4: Standard consequence levels

Level	Descriptor
Negligible (0)	Insignificant impacts. Impacts unlikely to be measurable at the scale of the stock/ecosystem/community level against background variability.
Minor (1)	Possibly detectable but minimal impact on structure/function or dynamics.
Moderate (2)	Maximum appropriate/acceptable level of impact on (e.g. full assimilation rate for nutrients).
Severe (3)	Wider, longer-term impacts (detectable at the stock/ecosystem/community level).
Major (4)	Serious impacts with relatively long time frame likely to be needed to restore to an acceptable level.
Catastrophic (5)	Widespread and permanent/irreversible damage or loss will occur - possibility that problem cannot be fixed (e.g. extinction).

Table 5: Risk Matrix

		Consequence					
Likelihood		Negligible	Minor	Moderate	Severe	Major	Catastrophic
		0	1	2	3	4	5
Remote	1	0	1	2	3	4	5
Rare	2	0	2	4	6	8	10
Unlikely	3	0	3	6	9	12	15
Possible	4	0	4	8	12	16	20
Occasional	5	0	5	10	15	20	25
Likely	6	0	6	12	18	24	30

The numbers in cells in the body of the above matrix are risk values, which are calculated by multiplying the likelihood value by the consequence value; the colours/shades correspond to risk rankings (see Table 6 overleaf).

Table 6: Risk rankings and associated required levels of management

Risk Rankings	Risk Values	Explanation & Likely Management Response
Negligible	0	Nil
Low	1 – 6	No specific additional management is needed, but low level monitoring of the issue may be required. Any current management should continue, as the risk ranking is based on the current management in place
Moderate	7 – 12	Additional information may be needed or the issue may require monitoring. Immediate management is required, but the issue should be the subject of continuous improvement with the aim of achieving a low risk ranking in the future
High	13 – 18	Possible increases to management activities in addition to those already being applied. Needs to be monitored and any information deficiencies should be addressed
Extreme	> 19	Increases in management activities in addition to those already being applied are strongly recommended

Table 7: Ecologically sustainable development risk assessment report for the proposed consolidated licence area (AQ00140 and AQ00396).

Risk event	Likelihood x Consequence	Risk ranking	Explanation and management response
Individual Facilities			
1 Construction of site and ongoing consequences of those structures			
1.1 Habitat effects	Likely (6) x Negligible (0)	Negligible (0)	Similar to the Western Fitzgerald sector licence biogeographical observations, the video transects provided as part of the applications identified the benthic environment of the consolidated 133-hectare site within the Eastern Fitzgerald sector consisted predominantly of a bare, flat sandy substrate with medium to low levels of bioturbation. No areas of live seagrass were identified in any of the transects, although detached seagrass fronds were present. Overall, the epifaunal community was low in abundance and diversity, consisting primarily of the occasional filter-feeding organism. It is likely that a small area of benthic habitat will be impacted by the placement of farming infrastructure through anchoring. The grid across the consolidated site will consist of 60 concrete mooring blocks (1.5 metres x 1.5 metres) and 30 'stingray" type anchors (1.5 metres x 1.5 metres) which would cause a direct footprint area of approximately 202.5 m^2. These direct impacts are considered to be localised and therefore minimal across the consolidated 133-hectare licence area. The consequence of ongoing habitat effects as a result of development at the proposed consolidated site is considered to be negligible, based on benthic habitat assessments of the sites and the results of the FEMP which demonstrated no differences between compliance and control sites [5]. The water depth where the grid and associated sea-cages are to be placed is at least 18 metres, allowing six metres to be maintained between the bottom of sea-cages and the sea floor. This will minimise the overall effects of scouring and allow for the dispersal of nutrients. Sea-cages will be configured perpendicular to tidal movements and will not be placed down current from each other to reduce the concentration of nutrient deposition over a particular area. Overfeeding and food wastage and subsequent deposition on the sea floor will be eliminated by thorough monitoring of fish Feed Conversion Ratios (FCRs) and also the use of underwater cameras to control overall feed input [1, 2]. To enable the monitoring of biomass and nutrient input on the site, an additional licence condition will require the Licensee to provide the Minister with written monthly reports stating the biomass, number of fish, input of feed and GPS coordinates per sea-cage per site. It is a requirement under regulation 22 of the Regulations for all licensees to submit annual environmental monitoring, including information on feed type and quantity, biomass, escape of stock, disease, chemical use and interactions with protected animals. In addition to standard licence conditions, an additional licence condition has been added to the licence, requiring the licensee to undertake a periodic environmental monitoring program of the sea floor in relation to the Licensed Site when directed by the Minister in writing, and in a manner and form determined by the Minister (pursuant to regulation 23 of the Regulations).

1.1 Habitat effects (continued)	Likely (6) x Negligible (0)	Negligible (0)	A site-specific monitoring program was developed by PIRSA for the Western Fitzgerald Bay site, which will be updated to include the Eastern Fitzgerald Bay site. Specifically, the program will include on-site benthic video requirements for the consolidated area. Further to the environmental monitoring provisions of the Regulations, the FRDC project entitled '*Assessing the capacity for sustainable finfish aquaculture in the vicinity of seagrasses*' will assess the influence of finfish aquaculture derived nutrients on seagrasses in Fitzgerald Bay. While the proposed consolidated licence area within the Eastern Fitzgerald sector of Fitzgerald Bay is located over a sandy habitat, there are significant seagrass meadows known to occur along the coastline to the north-west, and the FRDC project aims to assess the regional impacts of finfish farming using Fitzgerald Bay as a case study. Multiple lines of evidence will be used to assess the current condition of seagrass meadows throughout Fitzgerald Bay prior to the introduction of Yellowtail Kingfish. This will identify whether the system is currently impacted by existing nutrient sources. Seagrass cover and habitat condition will be assessed using remote video transects at a minimum of three sites predicted to be affected by the aquaculture nutrient plume (to be determined from SARDI hydrodynamic and biogeochemical modelling) and three control sites. Included in the assessment will be methods used by the EPA to assess broader-scale regional patterns of change in seagrass habitats around South Australia, and earlier assessments of seagrass condition in Gulf St Vincent by the South Australian Research and Development Institute (SARDI). Sampling will ideally occur prior to the commencement of aquaculture operations within the region, and then again two years later. Given the relatively low level of direct disturbance from site infrastructure, the proposed methods of monitoring feed input along with environmental monitoring provisions; it is considered the consequence of any habitat effects will be negligible, particularly given the benthic habitat type. Accordingly, the overall risk of habitat effects from the development at the proposed consolidated site is considered to be negligible.

1.2 Alienation	Likely (6) x Minor (1)	Low (6)	Clean Seas is the only licence holder in the Eastern and Western Fitzgerald Bay sectors, which will be fully allocated (in hectares) should the new licence application be approved, so the proposed activities are unlikely to impact other aquaculture operators. The granting of an aquaculture lease provides the applicant with exclusive rights to the proposed site so it is likely that alienation will occur if the applications are approved. An early notification letter containing the details of the proposed movement and new finfish site was sent to external stakeholders on 4 July 2018. Stakeholders were provided with two weeks to submit any comments to PIRSA. In addition to the early notification process and in accordance with section 35(9)(b)(i) of the *Aquaculture Act 2001*, the application for the new corresponding licence (AQ00396) was publicly advertised in *The Advertiser* and the *Whyalla News* (local paper) on 30 August 2018 for a public consultation period of two weeks. During public notice, a number of submissions objecting to the proposed development were submitted to PIRSA. As such, it is considered that the consequence of any alienation resulting from the approval of these applications is minor – the applications relate to an existing aquaculture zone where finfish farming has historically taken place. Accordingly, the overall risk of alienation resulting from the proposed consolidated site is considered to be low.
1.3 Erosion	N/A	N/A	This risk event relates to discharge of water from land-based applications.
1.4 Seepage	N/A	N/A	This risk event relates to discharge of water from land-based applications.

1.5 Water flow	Likely (6) x Minor (1)	Low (6)	It is considered likely that the installation of sea cages at the proposed consolidated site will have an effect on natural water flow. The applicant has stated that sea-cages will be placed in a grid arrangement, with two rows of eight sea-cages to be placed perpendicular to tidal flow, which will limit the overall impact to natural water movement [1, 2]. The applicant proposes a maximum of 16 sea-cages, which would be placed in an area of approximately 12.2 hectares (9.17 %) of the consolidated 133-hectare licence area. The applicant has stated that the sea-cages will have the dimensions of 44 metres diameter by a maximum of ten metres deep (total volume of 15,205 m^3). Additionally, 60 concrete mooring blocks (1.5 m x 1.5 m x 1.0) will be installed, equating to a total volume of 135 m^3. The approximate volume of the 12.2-hectare area where the grid will be located is (122,000 m^2 x 18 metres depth) or 2,196,000 m^3. Based on the total sea-cage and mooring block volume (243,280 m^3 + 135 m^3 = 243, 415 m^3), the significant components of farming structures on the site will occupy approximately 11.1 % of the volume of the proposed grid area and 1.02 % of the total 133-hectare consolidated licence area (volume). Although the impact of natural water flow due to development of infrastructure is considered likely, the consequence is considered minor since farming structures will be located within 18 metres of water, allowing a minimum of six metres depth between the bottom of the cages and the sea floor. Sea-cages will also be regularly cleaned (at least once per week) to ensure the flow of water through netting is not impeded. Based on the relative volume of the grid area occupied by farming structures and the distance to the seafloor. Accordingly, the overall risk of impacts to the natural water flow experienced at the proposed new sites is considered to be low.
1.6 Shading	Likely (6) x Negligible (0)	Negligible (0)	It is likely that some shading from farming structures will occur, in comparison to what would naturally be experienced over the proposed licence area. The total area covered by the proposed 16 sea-cage grid system is approximately 24,328 m^2 (including interior of sea-cages occupied intermittently by stock). The proposed 16 sea-cage grid system will cover an area of 12.2 hectares, so the relative area of the site occupied by farming structures compared to proposed grid area is 19.9 % and 1.83 % of the total 133-hectare consolidated licence area. As discussed in in risk event 1.1 – Habitat effects, the benthic habitat at the proposed sites is identified to contain predominantly bare sand with low diversity and abundance of flora and epifauna. Given both the environmental monitoring requirements (also discussed in risk event 1.1 – Habitat effects) and the relative low percent of site coverage from the proposed development of the consolidated licence area, the consequence of shading on the benthic environment is considered to be negligible. Accordingly, the overall risk of shading at the proposed consolidated site is considered to be negligible.

1.7 Rehabilitation	Rare (2) x Moderate (2)	Low (4)	The primary risk in terms of rehabilitation is lease abandonment, where the lease owner does not rehabilitate a site. This may result in farming infrastructure, including sea-cages and anchors, remaining in situ where it can cause navigation hazards or habitat impacts. This is however considered to be a rare occurrence for finfish aquaculture. It is a lease condition that the Lessee must rehabilitate the site, prior to the expiration of the lease. The rehabilitation, including the removal off all aquaculture structures, debris, rubbish and waste from the Leased area, must be performed by the Lessee at their cost to the reasonable satisfaction of the Minister. It is also a lease condition that lessees must reinstate and rehabilitate a current leased area at the lessee's cost, prior to any variation to a leased area. In addition to the above lease conditions, lessees must either provide a guarantee from their bankers in the amount of $10,000.00 or contribute to an indemnity scheme established and or nominated by the Minister for the aquaculture industry for each lease held. Clean Seas have contributed $40,000 to an indemnity scheme, which is held by PIRSA, and can be used to rehabilitate the sites to their former condition. Therefore, in the event the leases are not rehabilitated appropriately by the lessee, there are monetary resources available to rehabilitate the sites. While the likelihood of the non-rehabilitation of the proposed sites is considered rare, the consequence is considered moderate, as there are management provisions in place, including PIRSA's site environmental audits and follow-up compliance inspections, to ensure site rehabilitation is undertaken if required. Accordingly, the overall risk of the sites not undergoing full rehabilitation after being vacated is considered to be low.
1.8 Navigation	Likely (6) Negligible (0)	Negligible (0)	It is likely that farming structures on the proposed consolidated licence area will present a hazard to marine navigation, particularly since there will be various floating structures present on site. It is a lease condition for the outer boundaries of a lease to be marked with navigational markers. Navigation markers must meet the requirements set for the lease type, and must be installed if any farming structures are present on the lease site. In addition to navigational marking requirements, the concurrence of the Minister responsible for the administration of the *Harbors and Navigation Act 1993* (the Minister for Transport, Infrastructure and Local Government) to grant lease LA00427 was obtained on 31 August 2018 (Objective ID: A3748399). This requirement under section 20 of the *Aquaculture Act 2001* and section 15 of the *Harbors and Navigation Act 1993* ensures the consequence of any navigational hazard remains negligible. It is noteworthy that a condition of concurrence granted requires a Notice to Mariners to be issued at least one week prior to the deployment of any infrastructure or pens within the lease. Accordingly, the overall risk to navigation posed by the proposed activity is considered negligible

1.9 Visual	Unlikely (3) x Minor (1)	Low (3)	The proposed consolidated site is located approximately 2.4 kilometres south-east from the nearest built-up area along the coastline, and is within an existing aquaculture zone. Therefore, the likelihood that the proposed consolidated site would be visually unappealing from a community perspective from the town is considered unlikely. The proposed consolidated licence area and use of a grid mooring system means that farming structures will not be spread over a large area, and is considered to reduce any visual impact compared to infrastructure spread over a larger area. In the unlikely event of visual impacts from site infrastructure, the consequence is considered to be minor given there are existing licences within an established aquaculture zone. Accordingly, the overall risk of negative visual impacts resulting from site infrastructure being developed on site is considered to be low.
2. Operating Impacts			
The use of resources by the facility			
2.1 Noise	Unlikely (3) x Negligible (0)	Negligible (0)	Noise will be generated by daily operation of dive and feed boats, as well as from feed blowers operating from the feed barge. However, it is unlikely that the noise generated by these operations will exceed that of other commercial vessels in the area, including the deep water bulk export port of Port Bonython that is located approximately 13 kilometres south-west of the proposed site; capable of berthing vessels to a capacity of 100,000 tonnes. The site is also approximately 2.4 kilometres from the nearest populated coastline (near Crag Point) and is situated within an existing aquaculture zone that has previously been actively farmed. Therefore, both the consequence and overall risk of excessive noise arising from the proposed aquaculture development are considered to be negligible.
2.2 Escape	Occasional (5) x Minor (1)	Low (5)	To prevent and/or minimise escape events, the applicant has submitted a strategy relating to escape of stock as required by the Regulations. All strategies are assessed for the frequency of site inspections during normal operating conditions and following extreme weather events; the ability of farming structures to contain stock and withstand anticipated weather conditions; and the applicant's management plan in the event of stock escapes. Regulation 26 of the Regulations also requires licensees to take all reasonable measures to contain or prevent the escape or further escape of stock if aquaculture stock has escaped, or a farming structure or other equipment has been damaged that may lead to the escape of aquaculture stock – as soon as practicable after becoming aware of the escape or damage. However, the likelihood of escape is considered occasional, based on reports of three escape events with an estimated loss of approximately 400 fish in the last 12 months. The applicant has stated that all above-water infrastructure will be inspected every two days by company staff, with below-water inspections every four days by dive teams (weather permitting) as part of general operations. This aims to ensure the integrity of farming infrastructure and therefore minimise the risk of escape events.

2.2 Escape (continued)	Occasional (5) x Minor (1)	Low (5)	A report by Fowler *et al.* (2003) concluded it was likely that Yellowtail Kingfish which researchers caught in northern Spencer Gulf were escaped stock, based on body shape and ear-bone structure [9]. Sampling for this study occurred within weeks of three escape events (two reported on 31 January 2003, one on 6 April 2003) and that it took 17 fishing days to capture 77 Yellowtail Kingfish in northern Spencer Gulf. Two-thirds of the Yellowtail Kingfish caught had empty stomachs and those that had fed exhibited feeding characteristics that suggested poor survival skills, such as eating plant material (for this carnivorous species). Reported sightings by the public and catches by the researchers, throughout Spencer Gulf, decreased after late March and early April, with most catches between late February and early March, suggesting Yellowtail Kingfish either moved from Spencer Gulf or died [9]. Given this, and since Yellowtail Kingfish are native to South Australia, the consequence of stock escaping from the proposed site operations is considered to be minor. Accordingly, the overall risk of the escape of stock at the proposed consolidated site is considered to be low.
2.3 Chemicals and therapeutants	Likely (6) x Minor (1)	Low (6)	It is likely that veterinary chemicals will be used on site since the applicant has proposed the use of hydrogen peroxide, praziquantel (PZQ) and oxytetracycline (OTC) under Ministerial approval and veterinary supervision as potential treatments for disease. It is anticipated by the applicant that separation of year classes removes the interaction between year classes, thereby reducing infection [2]. However, full year class separation may not be immediately possible because of operational limitations prior to the delivery of a new heavy vessel (Jay Dent, Clean Seas, email dated 1 August 2019). Under the South Australian *Agricultural and Veterinary Products (Control of Use) Act 2002*, agricultural and veterinary chemicals defined under that Act must (unless authorised by a permit) be registered by the Australian Pesticides and Veterinary Medicines Authority (APVMA) prior to being sold, supplied and/or used in the State. Furthermore, any use of registered chemical products must be undertaken in accordance with a permit or labelled instruction to ensure that the environmental and food safety assessments accepted by the APVMA, which aim to protect environment and consumer health, are valid for that specific use. Hydrogen peroxide is currently permitted by the APVMA as a bath treatment in Yellowtail Kingfish aquaculture (permit no. PER 83276 – expires 30/11/2019). However, no permit currently exists for the use of PZQ or OTC in Yellowtail Kingfish aquaculture. In the event the applicant wishes to use of the off-label (or unregistered) chemicals, a veterinarian can prescribe a product for off-label use on trade animals pursuant to the *Agricultural and Veterinary Products (Control of Use) Act 2002,* although permits or full registration of that product with the APVMA are required to be pursued. Under regulation 10 of the Regulations, the use of a treatment or disinfectant that is not a registered veterinary product under the *Agricultural and Veterinary Products (Control of Use) Act 2002* requires the approval of the Minister. Regulation 10 provides for off-label use for one-off, irregular, emergency and experimental treatment, under veterinary prescription. Within PIRSA, off-label chemical use approval processes involving discharges to the environment are supported by an internal policy including guidelines for assessment of total environmental effects (including non-target species).

2.3 Chemicals and therapeutants (continued)	Likely (6) x Minor (1)	Low (6)	Off-label use of veterinary chemicals has been successful in managing disease in Yellowtail Kingfish aquaculture, to allow the collection of data to support industry in applying to the APVMA for the ongoing use of PZQ and OTC in Yellowtail Kingfish aquaculture. It is noteworthy that Clean Seas have submitted applications to the APVMA for the ongoing use of PZQ in Yellowtail Kingfish aquaculture. If the use of other chemicals and therapeutants are required on site, licensees are required to report use when completing annually submitted EMP reports, and must seek Ministerial approval for off-label (or unregistered) use of chemicals pursuant to regulation 10 of the Regulations. Ministerial approvals for the use of veterinary chemical products may include conditions such as peak daily use limits, environmental monitoring requirements, maximum discharge limits and reporting. Given the legislative requirements of licensees in respect to the use of registered and non-registered chemical substances in aquaculture, including but not limited to the Regulations, the *Environment Protection (Water Quality) Policy 2015* and the *Agricultural and Veterinary Products (Control of Use) Act 2002*, the consequence of chemical use is considered to be minor. Accordingly, the overall risk is considered to be low.
2.4 Interactions and entanglements	Rare (2) x Severe (3)	Low (6)	The entanglement or confinement of protected animals have previously been reported for the finfish sector, albeit rarely. Wildlife interactions that might occur with sea-cage farming in Spencer Gulf include those involving seabirds, sharks and protected marine vertebrates [10]. In the last 12 months, eight interactions have been reported within the finfish sector, each involving fur seals. In seven of those eight events the animals were released alive. In the other one event, the animal was reported as deceased and the entanglement likely to have occurred during the tow of a stocked sea-cage. Given this information, the likelihood of adverse interactions and entanglements occurring at the proposed consolidated site is considered to be rare. The consequences of an adverse interaction are considered severe, particularly where it leads to the death of an animal. To mitigate interactions, the applicant proposes daily checks for, and removal of, any dead and moribund fish from sea-cages (weather permitting) as a strategy to prevent attracting predators. Further, nets are intended to be checked daily for the presence of any holes and any damage will be repaired immediately. Regular net maintenance and keeping nets and ropes taut are measures proposed by the applicant to reduce predator interaction, damage and entanglement [2]. A seal jump fence around sea-cage pontoons is incorporated into the infrastructure but the applicant has previously stated that it is unlikely that it will be required (Jay Dent, Clean Seas, pers. comm. 20 March 2019). Licensees must abide by all licence conditions and the requirements of the Regulations relating to interactions with protected animals (regulations 18 and 27), through submission and, adherence to, an approved strategy and reporting requirements. The proposed mitigation measures and the legislative provisions around entanglements with, or confinement of protected animals reduce the risk of adverse impacts and are considered to be low.

2.5 Habitat effects	Likely (6) x Minor (1)	Low (6)	The benthic habitat on the proposed consolidated site is likely to be affected by various day-to-day farming practices, however there are procedural regimes in place to reduce impacts to the seafloor. Impacts to the habitat of the site caused by boating activities are expected to be minor since– • The on-site habitat is comprised predominantly of bare sand; • no anchoring will occur during feeding or maintenance activities; • no processing will occur at the site, but rather onshore with waste collected and disposed of at a rendering facility for the production of fertiliser [2]; • nets will be cleaned in-situ at least once per week using commercial net washers according to standard industry practice to prevent the establishment of tertiary biofouling; • feeding practices will be monitored with video to avoid build-up of feed below sea-cages and daily intake will be assessed against a feed model [2]; and • in the event of feed falling through sea-cages, it is likely that scavengers will contribute to the removal of the excess feed [11]. Additionally, in the 2017 report containing infaunal monitoring of the aquaculture zone around Fitzgerald Bay undertaken by SARDI [5], statistical analyses of data collected indicated sites sampled within the Fitzgerald aquaculture zone had infaunal assemblages that fall within the range of insignificant variability when compared to reference sites. That is, there was no evidence in the data collected that finfish aquaculture is having an effect on infauna. To reduce ongoing impacts to the sea floor, regulation 25(e) of the Regulations provides that stocked sea cages must not be located in the same place that stocked sea cages have been located within the preceding 12 months, unless otherwise approved in writing by the Minister. Clean Seas has proposed an overall farming strategy for the Fitzgerald Bay region, which includes a fallowing regime for the grid system in the Eastern Fitzgerald sector. The fallowing regime expects a complete grid fallow of ten months following destocking of a year class, with individual grid bays being fallowed for longer [12]. As detailed in risk event 1.1 – Habitat effects, an additional licence condition has been added to the draft licence which will require the licensee to undertake an environmental monitoring program of the sea floor in relation to the licensed site when directed by the Minister. This periodic environmental monitoring program will be developed in addition to the FRDC research project, pursuant to regulation 23 of the Regulations. The results of these monitoring programs, along with annual environmental monitoring requirements, will allow impacts to the benthos from farming practices to be monitored and adaptively managed to ensure no long-term impacts occur. Based on the above considerations, the overall risk of habitat impacts resulting from site operations is considered to be low.

2.6 Disease Management	Unlikely (3) x Minor (1)	Low (3)	There are no notifiable diseases associated with Yellowtail Kingfish in Australia; however, there are some pathogens known to affect Yellowtail Kingfish aquaculture in South Australia. Farmed Yellowtail Kingfish can be seriously affected by blood fluke (*Paradeontaxylix* spp.), skin fluke (*Benedenia seriolaei*) and gill fluke (*Zeuxapta seriolae*) [13]. The applicant has proposed the use of hydrogen peroxide (APVMA permitted product), and praziquantel under Ministerial approval as treatment measures for such infestations [2]. There is also a known disease risk of infection by *Photobacterium* spp. in South Australia. Clean Seas has proposed the use of oxytetracycline to treat such infections which requires Ministerial approval. Applications for Ministerial approval pursuant to regulation 10 of the Regulations follow a rigorous assessment process, which is discussed in risk event 2.3 – Chemicals and therapeutants. The farming strategy proposed by Clean Seas to separate year classes on different leases further minimises the risk from disease and parasitic infection (improved fluke control) by minimising the risk of infection to incoming stock from older fish already present on the site. A separation of year classes removes the interaction between year classes and reduces the potential infection rates; however, as identified earlier, this may not be immediately achievable. Given the above, the likelihood of improper disease management is considered to be unlikely. In the event of disease occurring, regulation 14 of the Regulations stipulates that if a licensee knows, or ought reasonably to know, that an aquatic organism proposed to be introduced into the licence area is or may be affected with a disease, the licensee must ensure that the aquatic organism is not introduced into the licence area without the prior written approval of the Minister. Regulation 13 of the Regulations also requires licensees to report unusually high mortality rates. This aims to ensure that any disease events are appropriately managed and have a minor consequence to the surrounding environment. Accordingly, the overall risk of inappropriately managed prevention of, and treatment for, disease from aquaculture operations at the proposed consolidated site is considered to be low.
Wastes generated from operation of the facility			
2.7 Sedimentation	Likely (6) x Minor	Low (6)	The likelihood of sedimentation occurring from a finfish farming operation is likely since Yellowtail Kingfish will be fed manufactured dry pellets. The maximum biomass that would be permitted for culture on the consolidated 133-hectare site is 1,995 tonnes (= 15 tonnes/ha). The ability of Yellowtail Kingfish to process the nutrients in the pellets (i.e. FCRs) is dependent on the water temperature and developmental stage of fish. In a final report on refining YTK feeds and feed management produced by SARDI [14], FCRs were reported as high as 1.45 during a summer temperature trial but as low as 4.43 during a winter temperature trial. Higher FCRs (the smaller the number the greater assimilation of available nutrients in feed and less waste) are likely to result in less suspended solids produced through faeces. Sedimentation resulting from uneaten feed will be managed via video monitoring of feeding practices to mitigate against the build-up of excess feed beneath sea-cages [2]. Sedimentation from other particulate matter will be controlled through regular net cleaning to prevent the excess build-up of biofouling material.

2.7 Sedimentation (continued)	Likely (6) x Minor (1)	Low (6)	Mean water flow in the area is predicted at 0.3 m/s [2]. Depth-averaged current speeds measured to the south of Point Lowly as part of the FRDC project 2009/046 investigating the carrying capacity of Spencer Gulf utilising hydrodynamic and biogeochemical modelling were 1.2 knots (maximum) with an average of 0.4 knots (M. Doubell, SARDI, pers. comm.18 September 2018). Annual and ongoing EMP requirements of the licensee is considered sufficient to identify and adaptively manage any sedimentation impacts. Furthermore, regulation 25(e) of the Regulations requires a 12-month fallowing period of stocked sea cages, unless otherwise approved by the Minister. Fallowing time allows any sedimentary material to be turned over by natural processes. The farming strategy submitted by Clean seas will result in the entire Eastern site being fallowed for a period of ten months following destocking, with individual grids being fallowed for longer depending on when stock are moved. Regulation 25(d) of the Regulations requires a minimum of three metres between farming structures and the seafloor, which facilitates dispersal of nutrients/material, which is facilitated through the proposed site development (i.e. minimum of six metres between the bottom of sea-cages and the seafloor). Given the composition of the benthic habitat, the requirement to participate in a research program monitoring the impacts to nearby seagrass meadows (see risks 1.1 and 2.5 – Habitat effects), outcomes from previous infaunal monitoring, species biology (FCRs) and the relatively strong currents of the area, the overall risk of sedimentation at the proposed site is considered to be low.
2.8 Culture organism disposal	Rare (2) x Moderate (2)	Low (4)	In the event of termination or mortality of stock through site production, the waste created will need to be disposed of. In accordance with section 25 of the *Environment Protection Act 1993*, every fish farmer has a general environmental duty to take all reasonable and practical measures to prevent or minimise environmental harm resulting from an activity that pollutes, or might pollute, the environment on the aquaculture site. This includes the appropriate management of aquaculture mortalities. The applicant has stated that all waste created by cultured organisms will be collected and returned to shore to be disposed of at a rendering facility or fertiliser producer. Therefore, the likelihood of impacts through improper disposal of mortalities of farmed organisms from site operations is considered to be rare. The consequence of improper disposal of culture organisms is considered to be moderate since any disposal of deceased organisms (minimal amounts) at sea would be assimilated through natural processes. Accordingly, the overall risk is considered to be low.
2.9 General refuse	Rare (2) x Moderate (2)	Low (4)	Subregulation 3(1) of the Regulations, defines aquaculture waste as waste generated in the course of carrying on aquaculture activities, but does not include waste created by living aquatic organisms. Regulation 11 of the Regulations requires licensees to ensure that aquaculture waste does not cause unsightly or offensive conditions at the licence area and that any such waste is secured or treated in a manner designed to prevent it being blown, washed or swept off the licence area.

2.9 General refuse (continued)	Rare (2) x Minor (1)	Low (2)	Furthermore, that regulation requires a licensee to ensure that if aquaculture waste is blown, washed or swept off the licence area, it is recovered as soon as practicable. These requirements aim to ensure all reasonable measures are taken to prevent waste material entering the site or surrounding environment. Therefore, the likelihood of improper disposal of general refuse from site operations is considered to be rare. The applicant has stated that the site will be accessed once or twice daily (weather permitting) with inspections of farming structures and stock undertaken. Any materials considered as general refuse will be taken to shore for disposal at the local council landfill, which for the City Council of Whyalla is the Mount Laura Waste and Resource Recovery Centre. Given the above, the consequence of improper disposal of general refuse is considered minor. Annual environmental monitoring report requirements mandated by the Regulations require licensees to provide the amount of general refuse produced on site, as well as provide details on the method of disposal. These requirements are designed to prevent, identify and adaptively manage any adverse environmental impacts from site operations before any long term impacts occur. Accordingly, the overall risk of improper disposal of general refuse from site operations is considered to be low.
2.10 Biofouling	Unlikely (3) x Moderate (2)	Low (6)	It is a standard licence condition, that 'The licensee shall in the event that they receive reasonable directions from the Minister to do so, cease and desist from any activity which in the reasonable opinion of the Minister may tend to cause environmental harm (as defined in the *Environment Protection Act 1993*)'. The removal of biofouling in accordance with the *Environment Protection Act 1993* is recommended to be undertaken on-shore, and all waste is to be disposed of at an EPA-licensed disposal facility. However, shore-based cleaning of nets is not always practical and it is likely to lead to increased stress to the stock and potential escape events while changing nets. While in-situ cleaning of nets is not a preferred cleaning method, a high frequency of cleaning should ensure that any removed biofouling is primary in nature, minimal in volume and therefore the cleaning process is unlikely to cause environmental harm (i.e. produce putrescible waste). The applicant has stated that the nets will be cleaned in situ at least once per week using commercial net washers in accordance with standard industry practice. Where possible, wastes will be collected and returned to shore, however in-situ cleaning is considered to have a moderate consequence. Annual environmental monitoring report requirements provided by the Regulations require licensees to provide the amount of biofouling produced on site, as well as the methods used to dispose of biofouling. These reports are reviewed annually, allowing any impacts to the benthos from farming practices, including the incorrect disposal of biofouling to be monitored and adaptively managed before any long-term impacts occur. The frequency of cleaning and low level of accumulated biofouling in between cleaning events is expected to reduce the risk of improper disposal of biofouling on site facilities, which is considered to be an overall low risk.
2.11 Water quality	N/A	N/A	This risk event relates to discharge of water from land-based applications.

2.12 Processing	Remote (1) x Moderate (2)	Low (2)	The applicant has indicated there will be some harvest activities occurring on site on harvest vessels, however, no fish processing will occur on site. The applicant has stated that harvesting waste (e.g. gills and guts) will be taken to shore for disposal at a rendering facility. Given these measures for containing waste, the likelihood of improper disposal from processing practices is considered to be remote. If improper processing practices were to occur, the consequence of such activity is moderate, when considering disposal of processed fish waste is likely to be assimilated through natural processes (see risk event 2.8 – Culture organism disposal). Accordingly, the overall risk is considered to be low.
Regional Effects			
The below risks consider potential impacts from a regional perspective, with the focus on the net effects resulting from the addition of the consolidated site to the aquaculture zone, with consideration of the current level of aquaculture activity undertaken within the region. When an application is received for a site within an aquaculture zone of an established aquaculture zone policy area, many of the risks below (denoted as N/A) have already been considered in the development of the zone policy, and are therefore not addressed in the licence-based risk assessment. Specifically, a zone policy has prescribed limits for the maximum allocation of area and biomass, along with suitable species for aquaculture. These limits have been determined through scientific technical investigations on the benthic and pelagic environments within the zone, which determine the capacity of a zone, suitability of the area for aquaculture and the cumulative impacts of aquaculture. This risk assessment is for an area of water in the *Aquaculture (Zones – Fitzgerald Bay) Policy 2008* and is consistent with its statutory requirements. That is, it is proposed to occur within a prescribed zone (Fitzgerald Bay aquaculture zone – Eastern Fitzgerald sector) and its respective hectare and biomass limits prescribed.			
3 Water use, quality and quantity			
3.1 Nutrients	N/A	N/A	N/A
3.2 Sedimentation	N/A	N/A	N/A
3.3 Chemicals	N/A	N/A	N/A
3.5 Flow	N/A	N/A	N/A
4 Ecological community structure and biodiversity			
4.1 Listed threatened and migratory species	N/A	N/A	N/A
4.2 Sensitive habitats	N/A	N/A	N/A
4.3 Behavioural changes to species	N/A	N/A	N/A

4.4 Translocations between regions	Remote (1) x Minor (1)	Low (1)	Fingerlings will be produced at Clean Seas' land-based hatchery at Arno Bay (Eyre Peninsula) then transferred to licence areas within the Fitzgerald Bay aquaculture zone, therefore translocations between regions is considered remote. Given the legislative provisions of the Regulations in regards to moving fish that may be affected with disease, the low risk of poor disease management (see risk event 2.6 – Disease management), the consequence of this activity is considered to be minor. Accordingly, the overall risk posed by the translocation of stock is considered to be low.
4.5 Phytoplankton	N/A	N/A	N/A
4.6 Benthic communities	N/A	N/A	N/A
5 Physical structures, construction and tenure			
5.1 Loss of access	N/A	N/A	N/A
5.2 Effect on human cultural heritage areas	N/A	N/A	N/A
5.3 Navigation	N/A	N/A	N/A
6 Production			
6.1 Disease	Rare (2) x Minor (1)	Low (2)	Significant (endemic) diseases relating to Yellowtail Kingfish have been previously identified in risk event 2.6 – Disease management. The applicant has proposed the use of hydrogen peroxide, oxytetracycline and praziquantel under Ministerial approval and veterinary supervision as treatment measures for those conditions, the use of which has been considered in risk event 2.3 – Chemicals and therapeutants. Since the overall risk of inappropriately managed prevention of, and treatment for, disease from aquaculture operations at individual site level is low, the likelihood of disease spreading between / among sites (i.e. regionally) is considered to be rare. Given the considerations outlined in risk events 2.3 and 2.6, the fact that Yellowtail Kingfish are native to State waters, and the requirements of regulations 13 and 14 of the Regulations (relating to notification of unusually high mortalities and containment of stock suspected to be affected without disease), the consequence of disease spread is considered to be minor. Accordingly, the overall risk of disease spreading from one site to another is considered to be low.
6.2 Disposal of waste	N/A	N/A	N/A

REFERENCES

[1] Clean Seas Seafood Limited (2018). ATAB Marine Application for a production lease inside an aquaculture zone. 6 pp

[2] Clean Seas Seafood Limited (2018). Application for a new marine aquaculture licence (inside an aquaculture zone), 14 pp.

[3] Clean Seas Seafood Limited (2018). Application to vary conditions (movement) of an aquaculture lease (inside an aquaculture zone), 8 pp.

[4] Fisheries Research and Development Corporation (2019). Project Agreement for the Assessing the capacity for sustainable finfish aquaculture in the vicinity of seagrasses, Project Number: 2018-186, executed 30 June 2019, 102 pp.

[5] Tanner, J.E., Giblot-Ducray, D. and Loo M.G.K. (2017). Temporal Analysis of Infaunal DNA Data from the Tuna and Finfish Environmental Monitoring programs, 2005-2014. Report prepared for PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2016/000392-1. SARDI Research Report Series No. 916. 24 pp.

[6] PIRSA Fisheries and Aquaculture (2009). PIRSA Fisheries and Aquaculture Division's Ecologically Sustainable Development (ESD) Risk Assessment Guidelines. Primary Industries and Resources South Australia, 45 pp.

[7] Fletcher, W., Chesson, J., Fisher, M., Sainsbury, K. and Hundloe, T. (2004). National ESD Reporting Framework: The "How To" Guide for Aquaculture. Version 1.1 FRDC, Canberra, Australia. 88 pp.

[8] International Standard (2018). ISO 31000:2018 Risk management - Guidelines. 16pp.

[9] Fowler, A.J., Ham, J.M. and P.R. Jennings (2003). Discriminating between cultured and wild kingfish (*Seriola lalandi*) in South Australia. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. RD03/0159.

[10] Harrison, S. (2003). Interactions between seabirds and tuna farms near Port Lincoln. Flinders University. Honours thesis, pp 27.

[11] Svane, I. and Barnett, J. (2007). The occurrence of benthic scavengers and their consumption at SBT farms off Boston and Rabbit Islands, Port Lincoln, South Australia: a preliminary study. P169-180 In Fernandes, M., Lauer, P., Cheshire, A., Svane, I., Putro, S., Mount, G., Angove, M., Sedawie, S., Tanner, J., Fairweather, P., Barnett, J. & A. Doonan 2007. Aquafin CRC - Southern Bluefin Tuna Aquaculture Subprogram: Tuna Environment Subproject Evaluation of Waste Composition and Waste Mitigation. Aquafin CRC Project 4.3.2 (FRDC Project No. 2001/103).

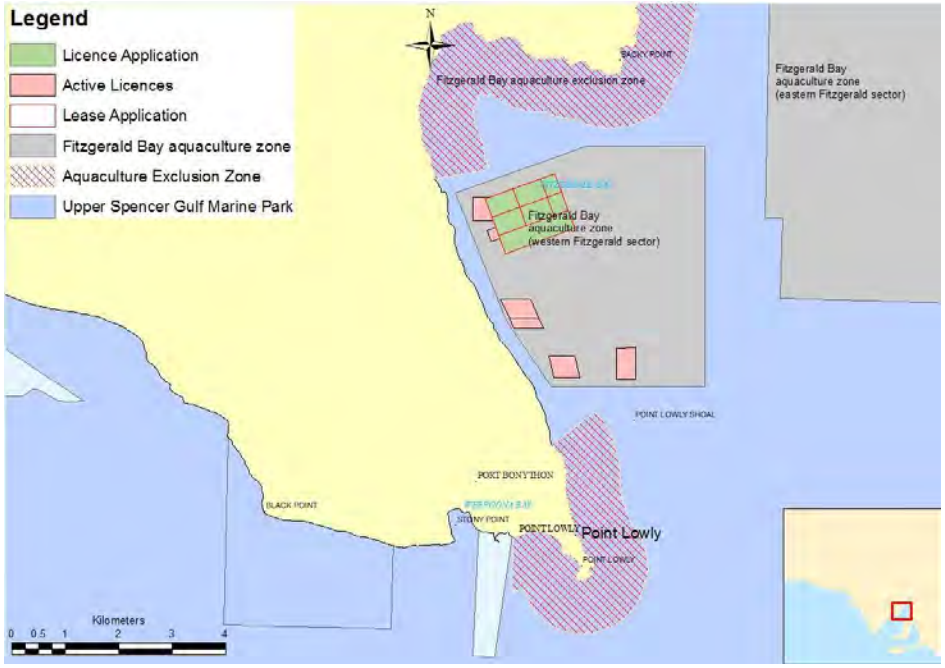
[12] Clean Seas Seafood Limited (2018). Farming strategy for Fitzgerald Bay, dated 28 February 2018.

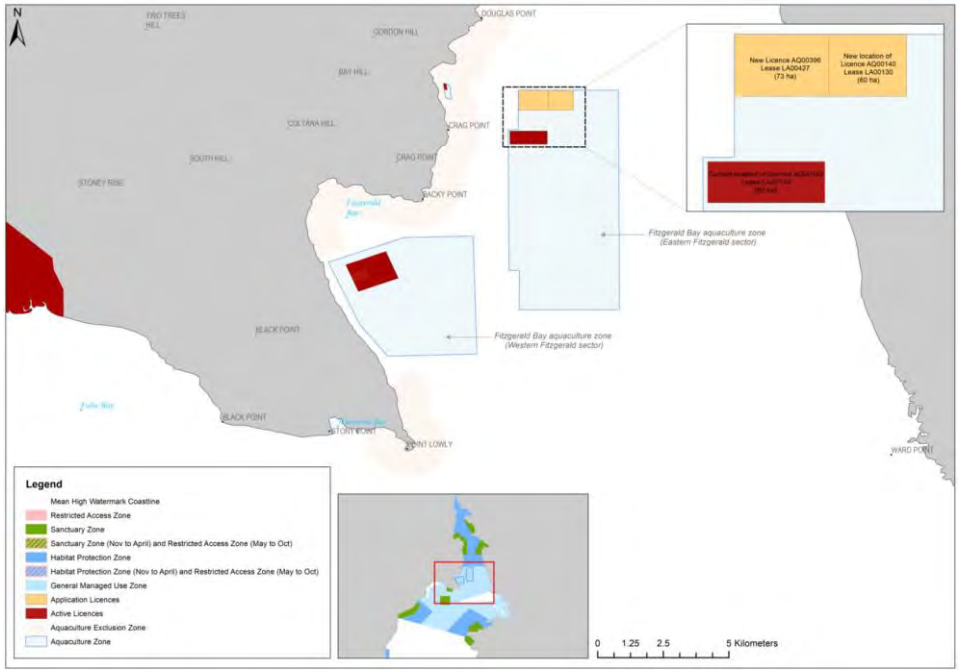
[13] Diggles, B. K. and Hutson, K. (2007). Diseases of kingfish (Seriola lalandi) in Australasia. Aquaculture Health International. 3. 12-14.

[14] Stone, D.A.J., D'Antignana, T.D. and Bansemer, M.S (2016). Final Report. Refining Yellowtail Kingfish feeds and feed management. Prepared by the South Australian Research and Development Institute (Aquatic Sciences, Adelaide. AS-CRC Project No. 2013/730. 144 pp.

Updated information to supplement original Ecological Sustainable Development (ESD) Risk Assessment for Clean Seas Fitzgerald Bay aquaculture sites:

- Western sector - AQ00397 (new) and movement of 6 sites (FF00026, FF00027, FF00028, FF00029, FF00095 and FF00096).
- Eastern sector - AQ00396 (new) movement of 1 site (AQ00140).





At the time the original ESD risk assessments were undertaken (2018 and 2019), advice from SARDI on the intensity and direction of finfish nutrient plumes and previous SARDI research on the feeding behaviour of escaped kingfish suggested there was no concern in regard to impacts to the Giant Australian Cuttlefish (GAC). Therefore, no further risk assessment was undertaken for GAC or included in the original ESD risk assessment.

However, due to the increase in concerns from the public and the Conservation Council SA related to potential impacts to GAC from finfish escapes and nutrient pollution, and the availability of new scientific information, PIRSA have reviewed and updated the risk events in the ESD relating to Escape and Listed migratory and Threatened Species with respect to GAC to include the most recent information and science available (see below). After consideration of available data, both risks were considered to be low.

2.2 Escape	Occasional (5) x Minor (1)	Low (5)	The likelihood of escape is considered occasional, based on reports of four escape events with an estimated loss of approximately 2100 fish in the last 24 months (as of May 2021). The applicant has stated that all above-water infrastructure will be inspected above every two days by company staff, with below-water inspections every four days by dive teams (weather permitting) as part of general operations. This aims to ensure the integrity of farming infrastructure and therefore minimise the risk of escape events. The risk to the environment as a result of escape is considered to be low since YTK are native to South Australia, wild populations can be found in Spencer Gulf, and Clean Seas use broodstock captured from South Australian waters. Research has shown escaped YTK are poor feeders and unlikely to survive. A report by Fowler *et al.* (2003) was initiated after a series of escape events and concluded it was likely that the YTK which researchers caught in northern Spencer Gulf were escaped YTK, based on body shape and ear-bone structure [14]. Sampling for this study occurred within weeks of three escape events (two reported on 31 January 2003, one on 6 April 2003) and that it took 17 fishing days to capture 77 YTK in northern Spencer Gulf. Two-thirds of YTK that were caught had empty stomachs and those that had fed exhibited feeding characteristics that suggested poor survival skills, such as eating plant material (for this carnivorous species). With respect to impacts of escaped YTK on cuttlefish, no cuttlefish were found in the stomachs of escaped YTK. Wild kingfish did have some cuttlefish in their stomachs, but they were not the Giant Australian Cuttlefish species and are not a major prey item. Cuttlefish are a food source for a variety of predators including dolphins, sharks, large fish (snapper), seals and seabirds. Reported sightings of escaped YTK by the public and catches by the researchers, throughout Spencer Gulf, decreased after late March and early April 2003, with most catches between late February and early March, suggesting YTK either moved from Spencer Gulf or died [14]. Thus the likelihood of escaped YTK predating on native species, including the Giant Australian Cuttlefish, is considered to be unlikely. Given this and the native status of YTK, the consequence of stock escaping from the proposed site operations is considered to be minor. To prevent and/or minimise escape events, the applicant has submitted a strategy relating to escape of stock as required by the Regulations. All strategies are assessed for the frequency of site inspections during normal operating conditions and following extreme weather events; the ability of farming structures to contain stock and withstand anticipated weather conditions; and the applicant's management plan in the event of stock escapes. Furthermore, regulation 26 of the Regulations requires licensees to take all reasonable measures to contain or prevent the escape or further escape of stock if aquaculture stock has escaped, or a farming structure or other equipment has been damaged that may lead to the escape of aquaculture stock, after becoming aware of the escape or damage (as soon as practicable). Given the above, the likelihood of escape of stock is considered occasional whilst the consequence is considered to be minor. Accordingly, the overall risk of the escape of stock at the proposed consolidated site is considered to be low.

4.1 Listed migratory and threatened species	Rare (2) x Severe (3)	Low (6)	The Giant Australian Cuttlefish (GAC) is the world's largest cuttlefish species, growing to 50 cm in mantle length and over 10 kg in weight. The conservation status of the GAC is Near Threatened (Population decreasing). The species is short lived with a life cycle of 1-2 years. Point Lowly, in South Australia's northern Spencer Gulf, is the only known site where GAC form dense spawning aggregations. The annual spawning aggregation of GAC at Point Lowly declined by 90% between 1999 and 2012. It has since recovered to relatively high levels, and over the last 10 years has demonstrated the population's capacity to fluctuate over relatively short time scales. In 2013, SARDI evaluated a range of environmental factors (including nutrients from Yellowtail Kingfish farming) to better understand the 1999-2012 decline in the Giant Australian Cuttlefish population at Point Lowly. The best scientific explanation for the decline in cuttlefish population abundance is related to variations in water temperature (in line with mounting scientific literature), but rainfall and heavy metal pollutants have also been documented to correlate. In a presentation by Dr Mike Steer (SARDI Aquatic Sciences) to the Whyalla Council on 24 June 2020, sea surface temperature since 2013 has also correlated well with cuttlefish abundance: www.pir.sa.gov.au/fishing/recreational_fishing/cuttlefish. Clean Seas ceased farming operations in Fitzgerald Bay in 2012 and cuttlefish numbers happened to increase since then. There has been concern by some members of the public and the Conservation Council SA that there is a direct link between farming and the GAC population decline. A more recent exploratory analysis (2021) by some members of the cuttlefish working group found a negative correlation between the number of cuttlefish and finfish aquaculture in Fitzgerald Bay with a 2-4 year lag. However there is no clear evidence of cause. Drawing correlations in the absence of a factor (such as farming) can be misleading. Further analysis is warranted in the future and would be a topic of discussion at the ongoing Cuttlefish Working Group. For the purpose of this science based risk assessment, reliance will be on peer reviewed published science, and advice from scientific experts. Point Lowly is approximately 6 km south of the proposed aquaculture site. To address any potential risk to the GAC aggregations from finfish farming, the South Australian Research and Development Institute (SARDI) undertook oceanographic modelling in 2020 to demonstrate the spatial footprint of aquaculture-related nutrients and other derived organic matter from the proposed farms in the Upper Spencer Gulf. The 2020 modelling was based on the estimated biomass to be held on the sites (3,000 tonnes). The modelling was rerun in June 2021 based on a biomass of 4,245 tonnes (maximum biomass for the zone). Both modelling studies demonstrated the nutrient levels are expected to remain well below the Australian and New Zealand Environment and Conservation Council (ANZECC) 2000 water quality guideline trigger values both within and outside the zone. Those trigger values are used to determine when impact may occur for the purpose of initiating environmental monitoring to detect any impact and implement appropriate management strategies. Maximum ammonium levels were estimated at less than the south-central (SA) guidelines of 50 ug N/L, or more conservative south-east guidelines of 15 ug N/L which have both been used previously. The modelling also demonstrated strong tidal flows of more than 0.6 meters per second in the vicinity of the aquaculture zone, together with other hydrodynamic variables, quickly disperse nutrients from the finfish farms. Nutrients are dispersed over distances of 5-10 km predominately to the north, after

			which they fall within background levels. Due to seasonal feeding regimes and kingfish growth, nutrient inputs are at their peak in March and at their lowest between June to October, which includes the period when the GAC are aggregating (in May to July). Based on regional circulation patterns, the SARDI modelling demonstrated a negligible to minimal impact of aquaculture to the west and south of Point Lowly (where the Giant Australian Cuttlefish largely aggregate) because of aquaculture derived nutrients. Despite nutrient plumes being under ANZECC guideline trigger values, ongoing environmental monitoring is required by the licence holder, so any potential impacts would be detected early. Furthermore, while GAC aggregations are not within nutrient plumes and are not considered to be at risk from aquaculture derived nutrients, GAC populations will be monitored independently (e.g. SARDI, Universities, community groups, GAC tourism operators) so an understanding of their population trends over time will be known. Therefore the likelihood of finfish farming nutrients impacting GAC aggregations is rare and the overall risk is considered to be low.