

Technical information supporting the 2018 coastal and marine: biosecurity (number of incursions) trend and condition report card

DEW Technical note 2018/40



Government of South Australia

Department for Environment
and Water

Technical information supporting the 2018 coastal and marine: biosecurity (number of incursions) trend and condition report card

Department for Environment and Water

May, 2018

DEWNR Technical note 2018/40



Department for Environment and Water

GPO Box 1047, Adelaide SA 5001

Telephone National (08) 8463 6946
International +61 8 8463 6946

Fax National (08) 8463 6999
International +61 8 8463 6999

Website www.environment.sa.gov.au

Disclaimer

The Department for Environment and Water and its employees do not warrant or make any representation regarding the use, or results of the use, of the information contained herein as regards to its correctness, accuracy, reliability, currency or otherwise. The Department for Environment and Water and its employees expressly disclaims all liability or responsibility to any person using the information or advice. Information contained in this document is correct at the time of writing.



This work is licensed under the Creative Commons Attribution 4.0 International License.

To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

ISBN 978-1-925668-83-4

Preferred way to cite this publication

DEW (2018). Technical information supporting the 2018 coastal and marine: biosecurity (number of incursions) trend and condition report card. DEW Technical note 2018/40, Government of South Australia, Department for Environment and Water, Adelaide.

Download this document at <https://data.environment.sa.gov.au>

Consultation and acknowledgements

Report prepared by Katelyn Ryan. Marty Deveney (SARDI), Shane Roberts (PIRSA), Alex Chalupa (Biosecurity SA), Verity Gibbs (DEWNR) provided data, expert knowledge of pests and diseases in South Australia's marine water. Simon Bryars provided oversight and technical review of this report.

Contents

Consultation and acknowledgements	ii
Contents	iii
Summary	v
1 Introduction	1
Diseases and invasive species in our coastal and marine environments	1
2 Methods	2
2.1 Data sources	2
2.2 Analysis	2
2.2.1 Trend	2
2.2.2 Condition	2
2.2.3 Limitations	3
2.2.4 Reliability	3
3 Results	5
3.1 Trend	5
3.2 Condition	8
3.3 Reliability	9
3.4 Notes on reliability	9
4 Discussion	10
4.1 Trend	10
4.2 Condition	10
4.3 Future reporting	11
5 References	12

List of figures

Figure 3.1.	Total number of notifiable diseases that were detected each year (1998–17) in the marine environment of South Australia. Trends reported are reported for 5-year periods (2013–17).....	5
Figure 4.1.	Proportion of high priority diseases that have been recorded between 1998 and 2014 in the State and in Australia.....	10

List of tables

Table 2.1.	Definition of trend classes used.....	2
Table 2.2.	Definition of trend classes used.....	3
Table 2.3.	Guides for applying information currency.....	3
Table 2.4.	Guides for applying information applicability.....	4
Table 2.5.	Guides for applying spatial representation of information (sampling design)	4
Table 3.3	Information reliability scores for numbers of incursions of diseases and invasive species	10

Summary

This document describes the indicators, data sources, analysis methods and results used to develop this report and the associated report card. The reliability of data sources for their use in this context are also described.

1 Introduction

Diseases and invasive species in our coastal and marine environments

Biosecurity risks in South Australia's coastal and marine environments include established and non-established invasive species, pathogens, microorganisms, and algae. This report summarises detections between 2013–17 of:

- notifiable diseases (endemic and exotic)
- key invasive species (established and non-established).

Some notifiable diseases occur naturally in our State and while not significant to South Australian marine ecosystems, are notifiable under international trade agreements as they may be significant to industry. Invasive species and biosecurity risks on land and inland waters are discussed in separate reports:

- Land: invasive species
- Land: biosecurity
- Inland waters: invasive species
- Inland waters: biosecurity.

Marine invasive species and diseases can be transported inadvertently by commercial and recreational vessels, attaching themselves to hulls, internal seawater systems, and damp spaces or boating gear. There are more than one million recreational vessels in Australia. These vessels are potential carriers of invasive species and diseases, which may be spread as boats move between locations. However, the largest risk of disease introductions are through livestock movements, which are regulated under the *Livestock Act 1997*.

Invasive marine species and pathogens can cause ecological and economic harm through the loss of biodiversity, reduction in productivity from aquaculture and seafood industries, damage to infrastructure and change to culturally important areas (Hayes *et al.* 2005, Molnar *et al.* 2008). The impact of invasive marine species and pathogens can be devastating to our seafood and aquaculture industries, which together contributed \$468 million (farmgate values) to the State's economy in 2014–15 (Savage 2015). For example, in both 1995 and 1998 an introduced virus killed about 70 per cent of the sardines in SA waters (Ward *et al.* 2001).

Preventing the introduction and establishment of exotic species and diseases is supported through policies, regulation and education. An example is the *International Convention for the Control and Management of Ships' Ballast Water and Sediment*, which became active in September 2017. Each year the Department of Primary Industries and Regions South Australia (PIRSA) conducts investigations into fish deaths, suspected disease reports and fish health issues. PIRSA also manages surveillance for high priority diseases, regulates livestock translocations, enforces quarantine measures and develops response plans to mitigate the impacts of disease if one is detected (e.g. eradication or containment).

2 Methods

2.1 Data sources

Records of detections were obtained directly through:

- Department of Primary Industries and Regions SA
- Wildlife Health Australia - Animals health surveillance reports
- SARDI reports
- Biological Databases of South Australia

There are many diseases and species that have the potential to enter South Australian waters. The key diseases and invasive species that are covered by this report are those that have the potential to establish populations in South Australia and to detrimentally impact industry or environment. Priority diseases included were those which are listed as notifiable in the South Australian *Livestock Act 1997* and nationally notifiable diseases, the status of which are also reported by the Commonwealth: [http://www.agriculture.gov.au/animal/aquatic/guidelines-and-resources/aquatic animal diseases significant to australia identification field guide](http://www.agriculture.gov.au/animal/aquatic/guidelines-and-resources/aquatic%20animal%20diseases%20significant%20to%20australia%20identification%20field%20guide).

2.2 Analysis

2.2.1 Trend

Trend is scored based on the change in the number of outbreaks and spread of established invasive species over time between 2013–17. Note that the number of outbreaks in a year can be influenced by short term research projects that target specific pathogens (e.g. SARDI surveillance projects for endemic diseases: *Bonamia* and *Perkinsus*) increasing the likelihood of detections.

Table 2.1. Definition of trend classes used

Trend	Description
Getting better	Over a scale relevant to tracking change in the indicator it is improving in status with good confidence
Stable	Over a scale relevant to tracking change in the indicator it is neither improving or declining in status
Getting worse	Over a scale relevant to tracking change in the indicator it is declining in status with good confidence
Unknown	Data are not available, or are not available at relevant temporal scales, to determine any trend in the status of this resource
Not applicable	This indicator of the natural resource does not lend itself to being classified into one of the above trend classes

2.2.2 Condition

Condition is scored based on a qualitative assessment of the impact of invasive species and diseases and the number of outbreaks, relative to previous years and global levels, as described in the condition statement detailed in the methods Section 2.2.2. Condition score is a single state-level statement of condition for 2017 that has been derived from the *Natural Resource Management Act 2004* and related to disease and invasive species in coast and marine environments. For this assessment, condition has been scored at state scale (and not NRM region scale) because of the scale of data.

Table 2.2. Definition of trend classes used

Condition	Description	Threshold
Very good	Natural resources and our environmental, social and economic expectations of these (eg primary productivity) are not affected by land biosecurity.	No new incursions in current year. All previous incursions are under control
Good	Natural resources and our environmental, social and economic expectations of these (eg primary productivity) are marginally affected by land biosecurity.	Incursion species are controlled and have low risk of impacting environment and industry. Stable rate of incursions.
Fair	Natural resources and our environmental, social and economic expectations of these (eg primary productivity) are moderately affected by land biosecurity.	Incursion species are controlled and have low risk of impacting environment and industry. Rate of incursion is increasing
Poor	Natural resources and our environmental, social and economic expectations of these (eg primary productivity) are significantly affected by land biosecurity.	Incursion species are not controlled and have moderate or high risk of impacting environment and industry.
Unknown	Data are not available to determine the impact of land biosecurity on our natural resources	-
Not applicable	Biosecurity impact does not lend itself to being classified into one of the above condition classes	-

2.2.3 Limitations

While there is ongoing surveillance for diseases, evidence of invasive plants, animals, algae and invertebrates in our marine environments is limited both spatially and temporally. Surveys for introduced marine species are infrequent in South Australia. Surveillance has mainly targeted the Port River-Barker Inlet, although a survey for introduced species was also conducted at Port Lincoln in 1996 (Hewitt *et al.* 1997) and in Eyre Peninsula in 2009 (Cohen *et al.* 2010). Trends have not been calculated for abundance or distribution of many invasive plants, animals, algae and invertebrates (with the exception of *Caulerpa taxifolia* in the Port River and Barker inlet).

2.2.4 Reliability

Information is scored for reliability based on the average of subjective scores (1 [worst] to 5 [best]) given for information currency, applicability, level of spatial representation and accuracy. Definitions guiding the application of these scores are provided in Table 2.3 for currency, Table 2.4 for applicability and Table 2.5 for spatial representation.

Table 2.3. Guides for applying information currency

Currency score	Criteria
1	Most recent information >10 years old
2	Most recent information up to 10 years old
3	Most recent information up to 7 years old
4	Most recent information up to 5 years old
5	Most recent information up to 3 years old

Table 2.4. Guides for applying information applicability

Applicability score	Criteria
1	Data are based on expert opinion of the measure
2	All data based on indirect indicators of the measure
3	Most data based on indirect indicators of the measure
4	Most data based on direct indicators of the measure
5	All data based on direct indicators of the measure

Table 2.5. Guides for applying spatial representation of information (sampling design)

Spatial score	Criteria
1	From an area that represents less than 5% the spatial distribution of the asset within the region/state or spatial representation unknown
2	From an area that represents less than 25% the spatial distribution of the asset within the region/state
3	From an area that represents less than half the spatial distribution of the asset within the region/state
4	From across the whole region/state (or whole distribution of asset within the region/state) using a sampling design that is not stratified
5	From across the whole region/state (or whole distribution of asset within the region/state) using a stratified sampling design

3 Results

3.1 Trend

There were two or fewer notifiable finfish and shellfish diseases detected annually between 2013–17 and two or fewer marine mammal diseases (5-year trend period) which is considered stable (see Figure 3.1, Table 3.1).

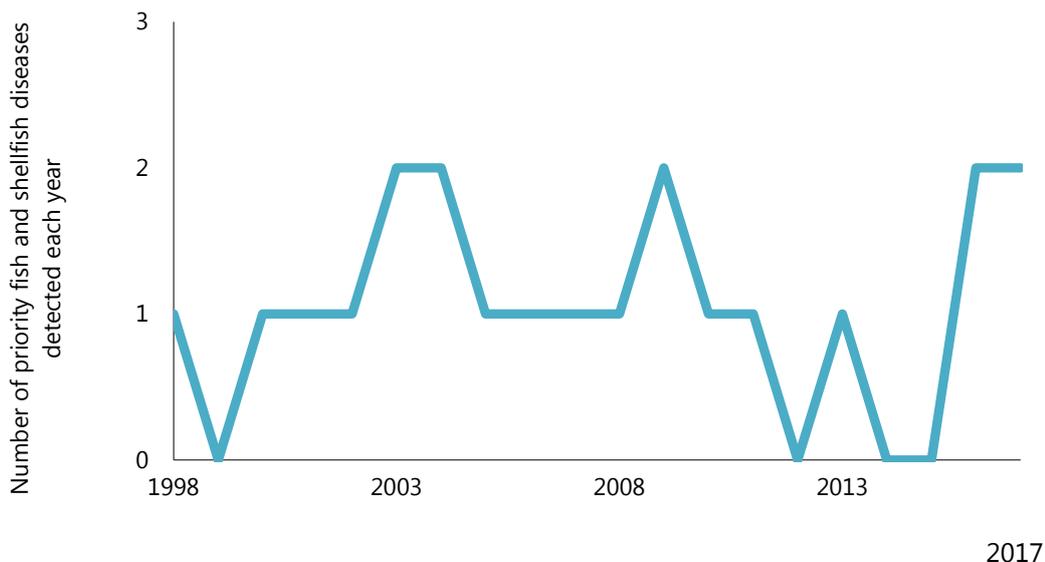


Figure 3.1. Total number of notifiable diseases that were detected each year (1998–17) in the marine environment of South Australia. Trends reported are reported for 5-year periods (2013–17)

Table 3.1. List of notifiable diseases of aquatic species (freshwater and marine) in 2017 and the occurrences of outbreaks in the past 5 years in South Australia

Finfish disease (marine and freshwater)	SA/Aus status	'13	'14	'15	'16	'17
Epizootic haematopoietic necrosis – EHN virus	Endemic to SA, NSW, Vic					
European catfish virus / European sheatfish virus	Exotic					
Infectious haematopoietic necrosis	Exotic					
Spring viraemia of carp	Exotic					
Viral haemorrhagic septicaemia	Exotic					
Channel catfish virus disease	Exotic					
Viral encephalopathy and retinopathy	Endemic to SA, QLD, NSW, Tas, WA, NT					
Infectious pancreatic necrosis	Exotic					
Infection with HPR-deleted or HPR0 infectious salmon anaemia virus	Exotic					
Infection with <i>Aphanomyces invadans</i> (epizootic ulcerative syndrome)	Endemic to SA, QLD, NSW, Vic, WA, NT					
Bacterial kidney disease (<i>Renibacterium salmoninarum</i>)	Exotic					
Enteric septicaemia of catfish (<i>Edwardsiella ictaluri</i>)	Exotic to SA, endemic to QLD, Tas, NT					
Piscirickettsiosis (<i>Piscirickettsia salmonis</i>)	Exotic					
Gyrodactylosis (<i>Gyrodactylus salaris</i>)	Exotic					
Red sea bream iridoviral disease	Exotic					
Furunculosis (<i>Aeromonas salmonicida</i> subsp. <i>salmonicida</i>)	Exotic					
<i>Aeromonas salmonicida</i> – atypical strains	Endemic to SA, QLD, NSW, Vic, Tas					
Whirling disease (<i>Myxobolus cerebralis</i>)	Exotic					
Enteric redmouth disease (<i>Yersinia ruckeri</i> – Hagerman strain)	Exotic					
Koi herpesvirus disease	Exotic					
Grouper iridoviral disease	Exotic					
Infectious spleen and kidney necrosis virus – like (ISKNV-like) viruses ¹	Exotic					
Infection with salmonid alphavirus	Exotic					

Table continues next page

Molluscs disease (marine and freshwater)	SA/Aus status	'13	'14	'15	'16	'17
Infection with <i>Bonamia ostreae</i>	Exotic					
Infection with <i>Bonamia exitiosa</i> *	Endemic to SA, NSW, Vic, Tas, WA				1	2
Infection with <i>Mikrocytos mackini</i>	Exotic					
Infection with <i>Marteilia refringens</i>	Exotic					
Infection with <i>Marteilia sydneyi</i>	Exotic to SA, endemic to QLD, NSW, WA					
Infection with <i>Marteilioides chungmuensis</i>	Exotic					
Infection with <i>Perkinsus marinus</i>	Exotic					
Infection with <i>Perkinsus olseni</i>	Endemic to SA, NSW, WA	1			1	2
Infection with <i>Xenohalotis californiensis</i>	Exotic					
Iridoviroses	Exotic					
Abalone viral ganglioneuritis						
Ostreid herpesvirus-1 μ variant (OsHV-1 μ var)	exotic to SA, endemic to NSW					
Crustaceans disease (marine and freshwater)	SA/Aus status	'13	'14	'15	'16	'17
Taura syndrome	Exotic					
White spot disease	Exotic					
Infection with yellow head virus	Exotic					
Gill-associated virus	Exotic to SA, endemic to QLD, NSW, WA, NT					
Infectious hypodermal and haematopoietic necrosis	Exotic to SA, endemic to QLD, NT					
Crayfish plague (<i>Aphanomyces astaci</i>)	Exotic					
White tail disease	Exotic to SA, endemic to QLD					
Infectious myonecrosis	Exotic					
<i>Monodon</i> slow growth syndrome	Exotic					
Infection with Candidatus <i>Hepatobacter penaei</i>	Exotic					
Acute hepatopancreatic necrosis disease (AHPND)	Exotic					
Enterocytozoon hepatopenaei	Exotic					

* "Bonamia species" has been reported previously but has recently been identified by SARDI as *Bonamia exitiosa* in South Australia and Victoria.

Monitoring of *Caulerpa taxifolia* in the Port River–Barker Inlet have found ongoing populations that are likely to be spreading. In 2016 *Caulerpa taxifolia* was detected outside of the containment zone and was treated in the Gulf Point Marina facility by SARDI Aquatic Sciences in 2017. A rigorous literature review in 2010 found there were 99 invasive species present in South Australian waters, consisting of 62 animals (59 invertebrates and 3 vertebrates) and 37 algae (Wiltshire *et al.* 2010). The review found there were 13 'trigger list' species in the South Australian records that are species on the *National System for the Prevention and Management of Marine Pest Incursion*. Trigger list species distribution are detailed in Table 3.2.

Table 3.2. Distribution and record dates for marine pests that are on the trigger list based on a review of records and distribution mapping by Wiltshire *et al* in 2010

Scientific name	Status	Dates	Distribution/ notes
Trigger species			
<i>Sabella spallanzanii</i> (European fan worm)	Established	1995 - 2010	Pt Adelaide, Adelaide coast, sporadic at other ports
<i>Gymnodinium catenatum</i>	Established	1996 - 2009	Widespread, common in Pt Lincoln
<i>Alexandrium catenella</i>	Established	1997 - 2008	Widespread, common in Pt Adelaide
<i>Alexandrium minutum</i>	Established	1986 - 2008	Widespread, common in Pt Adelaide
<i>Alexandrium tamarense</i>	Established	1988 - 2009	Widespread, common around Yorke Peninsula
<i>Caulerpa racemose</i> var. <i>cylindracea</i>	Established	2002 - 2010	Port Adelaide, O'Sullivan Beach
<i>Caulerpa taxifolia</i>	Established	2002 - 2009	Port River-Barker Inlet
<i>Codium fragile</i> ssp. <i>fragile</i>	Established	2002 - 2009	North Haven marina, West Lakes, American River
<i>Crassostrea gigas</i> (Pacific oyster)	Present	1969 - 2009	(Intentional) Aquaculture areas, some wild settlements near KI and Coffin Bay.
<i>Charybdis japonica</i>	Isolated occurrence	2000	1 adult male recorded in Outer Harbor. None found in SARDI survey in following Jan/Feb 2001.
<i>Balanus improvisus</i>	Unconfirmed		Unlikely to be present in SA
<i>Carcinus maenas</i> (European shore crab)	Previously established	1976 - 2009	Port Adelaide, Pt Vincent and the Coorong. Rarely found in recent years.
<i>Musculista senhousia</i>	Previously established	1996 - 2001	Port Adelaide but not found in recent years.

3.2 Condition

In 2017, PIRSA conducted 20 investigations; two diseases were detected - *Bonamia exitiosa* and *Perkinsus olseni*.

Subclinical detections of *Bonamia exitiosa* were recorded in several oyster farms in South Australia through a SARDI research project aimed at better understanding this pathogen.

Perkinsus olseni was detected in wild caught abalone in the western zone abalone fishery where it is historically known to occur. Clinical Perkinsosis caused a small amount of wild caught product to be rejected by a seafood processor in 2017 (**Error! Reference source not found.**).

The South Australian Museum monitors disease outbreaks in marine mammals and, where possible, collects and carries out post-mortem examinations on dolphins and whales (cetaceans) and seals and sea lions (pinnipeds) washed up on the South Australian coastline. In 2013, an outbreak of a viral disease (Morbillivirus) contributed to the deaths of over 30 dolphins. Other diseases affecting marine mammals that have been identified include tuberculosis, which was found in an Australian Sea Lion, and a naturally-occurring hookworm, which resulted in the deaths of a number of sea lion pups. There were no records of marine mammal disease outbreaks in 2017.

There were limited records of invasive species.

3.3 Reliability

The overall reliability score for this report card is 3, based on Table 3.3

Table 3.3. Information reliability scores for numbers of incursions of diseases and invasive species

Indicator	Applicability	Currency	Spatial	Accuracy	Reliability
Disease data	5	5	4	na	4
Invasive species data	4	2	1	na	2
Overall					3

3.4 Notes on reliability

The report card has been given the score of 3 out of 5 and a reliability of good. Data on marine diseases allows us to understand trends over time and condition. Invasive species information can be extensive at local scale but does not inform trends in invasive plants or animals over time at state scale.

4 Discussion

4.1 Trend

At the scale of the whole-of-state, the current trend in disease and pest outbreaks was stable for 2013–17. This trend represents disease detection. Trends in invasive species are largely unknown with the exception of *Caulerpa taxifolia*. This invasive algae has been established in the Port River–Barker Inlet system since 2002. Recent surveys in 2015–16 have demonstrated *C. taxifolia* is increasing in range and abundance. Some of this increase is expected to be a result of further contamination from marine vessels (Wiltshire & Deveney 2017).

4.2 Condition

At the whole-of-state scale, current condition of disease and pest outbreaks scored 'Good' for 2017. South Australia is largely free of marine diseases and pests and the impact of marine pests and diseases is localised.

Qualitative assessment that provided a 2017 condition score, takes into account the invasive species and diseases that occur in the coastal and marine environment and their impact. It also takes into account the success of biosecurity measures and education that prevent the entry of new invasive species.

In 2014, there were 60 priority fish and shellfish diseases that have been classified as notifiable under the *South Australian Livestock Act 1997*. Only six have been recorded in South Australia, compared to 16 for the whole-of-Australia (Figure 2).

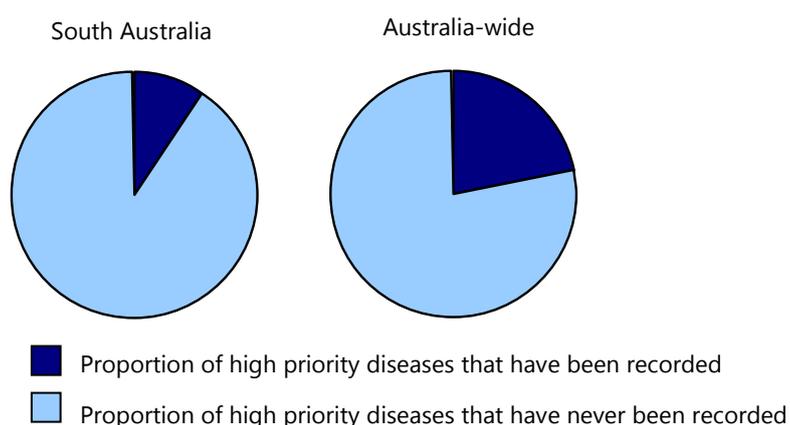


Figure 4.1. Proportion of high priority diseases that have been recorded between 1998 and 2014 in the State and in Australia

In Victoria, abalone viral ganglioneuritis (AVG) decimated both aquaculture and the fishing industry in 2005/06, with a mortality rate of up to 90% on affected reefs. The fishing was quota cut by 50% across the fishery in response to the decreased stock levels. Victorian abalone stocks are still recovering to this day. In other states of Australia, the response to exotic disease introductions have come at significant costs to the government and industry. For example, white spot disease in QLD prawn farms (\$18 million response and \$25 million loss to industry to date), and Pacific Oyster Mortality Syndrome (POMS) in Tasmania (over \$10 million in response and recovery). Industry cost of \$12 million stock loss, and more than 100 regional jobs lost to date: www.frdc.com.au/stories/Pages/26_National-impact.aspx.

During 2017, PIRSA have worked closely with the Queensland (QLD) and Australian governments to assist in the emergency response to White Spot Disease (notifiable) in QLD prawns. PIRSA implemented new import restrictions for crustaceans and polychaetes sourced from QLD, to protect South Australia's valuable crustacean fisheries and aquaculture sectors: http://pir.sa.gov.au/aquaculture/aquatic_animal_health/white_spot_disease

4.3 Future reporting

Trends may be better understood and reported in the future with the introduction of genetic testing for the maintenance of Ballast Water Management Certificates under the International Convention for the Control and Management of Ships' Ballast Water and Sediments (entered into internationally in September 2017).

5 References

Animal Health Australia (2015) Animal health in Australia 2015, Chapter 5 Canberra.

Australian Government, Department of Agriculture Fisheries and Forestry (2012) Aquatic Animal Diseases Significant to Australia: Identification Field Guide 4th Edition. DAFF, Canberra, Australia.

DEWNR (2013) Three more dolphins test positive. DEWNR Media release, Adelaide.

Government of South Australia (1997) Livestock Act (Version 1.1.2016). South Australia. Adelaide.

Hayes K, Sliwa C, Migus S, McEnnulty F & Dunstan P (2005). National priority pests: part II. Ranking of Australian marine pests. CSIRO Marine Research, Australian Government, Department of the Environment and Heritage, Canberra.

Kemper C & Tomo I (2012). Report on 'Monitoring Small cetaceans in Eastern Gulf St Vincent' (including pinnipeds). South Australian Museum, Adelaide.

Molnar JL, Gamboa RL, Revenga C & Spalding MD (2008). Assessing the global threat of invasive species to marine biodiversity. *Frontiers in Ecology and the Environment*. 6, 485-492.

National Biosecurity Committee 2016, *National framework for the management of established pests and diseases of national significance*, Department of Agriculture and Water Resources, Canberra.

Network of Aquaculture Centres in Asia-Pacific and Food and Agriculture Organization of the United Nations (1998-2013). Quarterly Aquatic Animal Disease Reports (Asia and Pacific Region). NACA: Bangkok, Thailand. Available from: Network of Aquaculture Centres in Asia Pacific.

PIRSA Fisheries and Aquaculture, prepared by EconSearch (2015) Economic Impact of Aquaculture in SA, 2014/15. Adelaide.

Savage J (2015) Australian fisheries and aquaculture statistics 2015. Fisheries Research and Development Corporation project 2016-246. ABARES, Canberra, December.

Wiltshire KH & Deveney MR (2017). The introduction of *Caulerpa taxifolia* in South Australia: infestation boundary surveys and feasibility of control for populations outside the containment area. Report for PIRSA Biosecurity SA. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2017/000204-1. SARDI Research Report Series No. 946. 16pp.

Wiltshire K, Rowling K and Deveney M (2010). Introduced marine species in South Australia: a review of records and distribution mapping. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI publication no. F2010/000305-1. SARDI Research Report Series No. 468. 232p.

Ward T, Hoedt F, McLeay L, Dimmlich W, Kinloch M, Jackson G, McGarvey R, Rogers P and Jones K (2001). Effects of the 1995 and 1998 mass mortalities on the spawning biomass of *Sardinops sagax* in South Australia, *Journal of Marine Science*, 58(4), pp. 830-841.

Ward, T. M., Hoedt, F. E., McLeay, L. J., Dimmlich, W. F., Kinloch, M. W., Jackson, G., McGarvey, R., Rogers, P. J., and Jones, K. (2001b) Effects of the 1995 and 1998 mass mortalities on the spawning biomass of *Sardinops sagax* in South Australia. *ICES. J. Mar. Sci.*, 58(4). 830–841.

