2 Approach and interpretation

2.1 Informing the assessment

The Terms of Reference identified seven broad areas of activities that the panel would undertake in carrying out its assessment. A summary of the range of activities undertaken by the panel against each of these requirements is provided in Table 2.1.

Table 2.1 Approach and activities

REQUIREMENT	ACTIONS
1. Examine existing scientific literature, other relevant information and any ongoing research and monitoring projects relevant to the impacts of the Declared Commercial Fishing Activity (DCFA)	An extensive range of relevant literature was provided to the panel by the secretariat. This was augmented substantially by literature reviews commissioned by the panel and by material identified by the panel members and by experts consulted by the panel. The Fisheries Research and Development Corporation, the Australian Fisheries Management Authority (AFMA) and the South Australian Research and Development Institute were approached to provide advice on past, current and proposed research projects in Australia. Enquiries were also made of those involved in overseas fisheries for small fish pelagic species in order to identify any relevant international research.
2. Consult with and seek submissions from experts in relevant scientific disciplines where the expert panel believes this is necessary to clarify areas of uncertainty about the environmental impacts of the DCFA	A list of people consulted by the panel, and the nature of the consultation, is provided in Appendix 2. The panel's assessment has been informed by input from experts in relevant scientific and operational disciplines and the broader community of stakeholders. The panel sourced information and advice through: • substantive submissions to the interim declaration[4] • nomination, by those who made submissions, of relevant experts with whom the panel should consult • face-to-face meetings with experts and the agreed written summaries of those meetings • invited submissions • responses to specific requests for information and assistance • literature collated and provided to the panel upon commencement of its assessment by the secretariat, identified by panel members, recommended by experts and identified by reviews commissioned by the panel • information and research arising from reviews and analyses commissioned by or undertaken on behalf of the panel • consultation meetings with stakeholders • attendance at the Technical Workshop and Stakeholder Forum on Small Pelagic Fisheries, 14–18 July 2014, Adelaide.
3. Consider the fisheries management arrangements under which the DCFA is proposed to operate and the extent to which those management arrangements address the relevant environmental impacts and uncertainties	The fisheries management arrangements for the Small Pelagic Fishery (SPF) and those that were proposed to be in place for large-scale mid-water trawl operations are summarised in Chapter 3. The extent to which these arrangements mitigate the impacts associated with the DCFA is discussed in Chapters 5 and 6.

4 The panel sought and received permission to access a selection of these submissions from those who had made them.

REQUIREMENT	ACTIONS
4. Take account of the requirements of the EPBC Act as they relate to the operation of and accreditation of Commonwealth fisheries	The tests applied by the Department of the Environment in assessing the SPF under Part 13 and Part 13A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) have been taken into account in describing the regulatory conditions under which a DCFA may operate and in assessing the actions that could be taken by the DCFA and/or the regulatory authorities to avoid, reduce and mitigate adverse environmental impacts of the activity.
5. Commission new reviews, research projects, modelling or analyses which the expert panel believes are necessary to fill critical knowledge gaps and where the results of those projects and analyses will allow the expert panel to fulfil its Terms of Reference	The panel commissioned the following research. • A literature review on the impacts on EPBC Act protected species by large mid-water trawl vessels • A literature review of impacts of localised depletion of small pelagic fishes on predators and ecosystems • A technical review of the development and application of bycatch mitigation devices for marine mammals in mid-water trawl gear • A review of genetic connectivity and recent developments in genetic techniques likely to provide further insights into stock structure in six species in the SPF • A technical assessment of the role for spatial management strategies in mitigating the potential direct and indirect impacts of fishing by large mid-water trawl vessels in the SPF on protected species • Mapping of the distribution of EPBC Act protected species and fishing activity in the SPF. The nature of the research commissioned by the panel was influenced by the timeframe and budget available to it and by the panel's assessment of the factors that it considered directly relevant to its assessment.
6. Consult with relevant experts, including in the operations of the DCFA, on the nature and effectiveness of the measures available to reduce direct interactions with EPBC Act protected species and the potential ecological effects of any localised depletion resulting from the DCFA	The panel consulted with relevant experts including the Directors of Seafish Tasmania Pty Ltd (the proponents of large-scale mid-water trawl operations in the SPF) and with operators of other mid-water trawl vessels in Australian and overseas fisheries. Insights into the operations of similar vessels and their use of measures to reduce direct interactions with protected species were also gained from research reviews commissioned by the panel, from analysis of available literature and through targeted consultations.
7. Identify further necessary and practicable monitoring or research projects that would reduce critical uncertainties for decision making relevant to any future operations of the DCFA	The need for additional research and monitoring that would reduce critical uncertainties for decision making relevant to any future operations of the DCFA is identified in Chapters 5 and 6 and summarised in Chapter 7. These needs have been informed by research projects commissioned by the panel and by the panel's assessment of critical knowledge gaps.

During the course of its assessment the panel met in person on 10 occasions on a total of 30 days and by teleconference on six occasions. All records of panel meetings, teleconferences, records of meetings with experts, invited submissions and commissioned research reports were uploaded to the secure Govdex site to facilitate record keeping and for access by panel members.

2.2 Scope of the assessment

2.2.1 Introduction

The scope of the panel's assessment was dictated by its Terms of Reference. However during the course of the panel's work and in discussions with stakeholders and other experts, it became clear that some people's expectations of the panel's report significantly exceeded the scope specified in the Terms of Reference. The panel made its best efforts to ensure that there was a common understanding of what its report does and, importantly, does not address. The panel's Terms of Reference require the panel to "assess the Declared Commercial Fishing Activity, particularly the potential for the activity to result in adverse environmental impacts". Terms of Reference one to four each relate to various aspects of adverse environmental impacts. The panel considered that its Terms of Reference did not require an assessment of the adequacy of overall management of the SPF, including the process for setting total allowable catches (TACs), the sustainability of TACs, the quality or scientific rigor of the daily egg production method that underpins many of the TACs, AFMA's consultation and advisory processes, or resource allocation issues across sectors and jurisdictions. While these issues are clearly important components of the overall management of the SPF they are not central to the assessment of the potential environmental impacts of the DCFA.

However, the fifth Term of Reference provides for the panel to assess and advise on "any other matters about the environmental impacts of the Declared Commercial Fishing Activity that the Expert Panel considered relevant to its assessment". The panel considered a range of other matters that might be relevant to its assessment, including some of those identified above. The panel's consideration of these is provided below.

Overall depletion of target species

TACs for SPF target species are set in accordance with the SPF Harvest Strategy (AFMA 2008) and consistent with the Commonwealth Harvest Strategy Policy (Department of Agriculture, Fisheries and Forestry (DAFF) 2007). The Harvest Strategy aims to maintain sustainable biomass levels which take into account the requirements of the broader ecosystem. In the panel's view there were no specific attributes of the DCFA that would differentiate its impact on overall depletion of these species from that of other fishing operations, since under any fishing scenario overall catches would be constrained by the TACs.

Sustainability of TACs

The panel considered that it was outside the scope of its Terms of Reference to examine whether the TACs for SPF target species are set at sustainable levels. The panel acknowledged that some stakeholders remain concerned about the reliability or age of the data on the basis of which TACs are set. However, the panel noted that new egg production surveys for some target SPF species have been initiated since the panel's inception and that an international workshop has recently reviewed the current daily egg production methodology. The panel concluded that these concerns would be addressed independently of the panel's assessment.

Byproduct species

Catch levels have been low in the SPF (less than 600 t per year) since 2010–11 (Section 3.1.3). The panel accepts that the low economic value of the product as currently caught, together with the wide geographical area of the SPF, means that it is unlikely that the current TACs will be taken with the existing 'wet boat' fleet. The panel assumed that catches would increase above current levels under a DCFA and that it was, therefore, reasonable to also assume that there would be a concomitant increase in the level of byproduct, that is, catch that is not targeted but that has commercial value and may be retained. The main non-target species retained in the SPF that are not subject to quota arrangements in other fisheries are barracouta *Thyrsites atun* and yellowtail scad *Trachurus novaezelandiae*. The panel examined (Section 3.1.3) the nature and extent of byproduct of these species and the potential impact of the DCFA on these species. The panel concluded that they did not warrant specific assessment.

Socio-economic impacts

In the course of its consultations it was suggested to the panel that, under the fifth Term of Reference, the assessment should include socio-economic impacts of the DCFA. The panel considered this view but concluded that matters assessed under the fifth Term of Reference should relate to 'environmental' impacts. It is the panel's view that the uncertainties identified in making the Final Declaration (see Box 1.1) relate to the ecology of the marine environment rather than to a broader interpretation of 'environmental' that includes socio-economic factors. As a result, the panel has not conducted a socio-economic assessment of the impacts of the DCFA.

In particular, it was suggested to the panel that the potential impact of the DCFA on Indigenous fishing opportunities should be assessed. The panel considered that the assessment of the potential impacts of localised depletion under the second Term of Reference would be equally applicable to all fishing sectors including other commercial fisheries, Indigenous fisheries and recreational fisheries. The panel did not consider it was within the scope of its assessment to assess the socio-economic impacts on any of these sectors specifically.

Transshipment

It was also suggested to the panel that its assessment should interpret the DCFA to include a scenario in which the 'vessel' identified in the DCFA receives fish from other catching vessels. The panel acknowledged that the description of the DCFA in the first declaration did not preclude transshipment. However, it is a matter of public record that the *Final (Small Pelagic Fishery) Declaration (No. 2) 2013* deals with the potential impact of transshipment by a fishing activity of the type that is the matter of this assessment. As a result, the fishing scenario assessed in this report does not include transshipment activities and consideration of the potential impact of transshipment will be contained in the panel's assessment under the second Final Declaration.

Climate change

It was suggested to the panel that the impact of climate change should be considered in its assessment. The panel recognises that climate change is likely to have an impact on the availability and/or behaviour of small pelagic species, on the ecology of their predators and, more broadly, on the marine ecosystems within the SPF. Climate change represents an important source of long-term uncertainty. However, the panel took the view that such impacts would relate to the stocks as a whole and be more relevant to stock assessments and TAC setting processes than to consideration of the type of fishing activities that might be conducted for the species. As a result, the panel has not considered the impact of climate change specifically in assessing the impacts of the DCFA. However, potential effects of climate change on SPF target species are discussed in Chapters 4 and 6.

2.2.2 The Declared Commercial Fishing Activity

The DCFA is defined in the Terms of Reference as a commercial fishing activity which:

1. is in the area of the SPF;
2. uses the mid-water trawl method; and
3. uses a vessel which is greater than 130 metres (m) in length, has an on-board fish processing facility and has storage capacity for fish or fish products in excess of 2000 tonnes (t).

The vessel specified in the DCFA is defined in terms of length, the presence of a processing facility and a minimum storage capacity. The panel formed the view that the length of a vessel was, in itself, less likely to be of specific relevance to the assessment, since length is essentially a function of the presence and scale of the fish processing facility and the storage and freezer capacity on the vessel.

The impacts of the DCFA on the marine environment will be influenced not only by the specifications of the vessel and gear but also by the operational and fishing strategy employed. Information available to the panel on fishing operations similar to those specified in the DCFA, indicates that operating practices vary across fleets, among skippers and according to the owner's requirements. In addition, these practices are influenced by seasons, weather and ecosystem conditions that affect the availability of target fish species. Fishing plans will also be influenced by market conditions.

The panel's assessment of the DCFA required, therefore, development of an indicative scenario of how the DCFA might operate in the SPF (see Box 2.1). The DCFA fishing scenario was informed by the proponents of the use of a large-scale mid-water trawl operation in the SPF (Mr G. Geen and Mr J. Pirello, Seafish Tasmania pers. comm. 23 April 2013), the operations of large mid-water trawl freezer vessels in other Australian and international fisheries as described to the panel by the managers of and observers on similar vessels (Mr R. Wells, ResourceWise pers. comm. 28 April 2014, Mr J. Zeeberg pers. comm. 1 May 2014) and reports of the fishing practices in fisheries for small pelagic species internationally (e.g. Couperus *et al.* 2004), including those that have been certified by the Marine Stewardship Council (MSC) (Andrews *et al.* 2009, Andrews *et al.* 2010, Andrews *et al.* 2011).

Box 2.1 The indicative DCFA fishing scenario

Fishing operations

- The operators of the DCFA hold quota for each stock of all target species[5] and can operate throughout the area of the SPF. It is their intention to catch their full quota in any fishing year and to maximise efficiency within the management constraints imposed.
- The fishing season extends year round from 1 May to 30 April.
- The species targeted at any time reflects behavioural and seasonal patterns of the species and commercial considerations.
- The length of tows is likely to be variable but may last six hours or more.
- Fishing trips are between six and eight weeks.
- The DCFA does not involve receiving catch from other vessels operating in the SPF.

Gear

- The net has a headline length of approximately 80 m with a headline height of at least 35 m. The net is up to 370 m in length.
- Mesh size is up to 20 m knot to knot at the front end of the trawl, progressively declining to the codend but not less than 30 millimetres (mm) in the codend. Catch is pumped from the codend to storage tanks on the vessel and during the pumping operation the bag and codend of the trawl net are fully submerged to a depth of around 50 m. The fish pump operates at approximately 250 t/hour.
- Net electronics: sensors at the codend to detect level of catch; headline trawl sonar to assist in positioning the net with respect to the school; drop sensors to monitor the door spread; auto trawl to ensure the net stays in an open position even when the vessel is turning.
- Sonar is used to detect schools.

Vessel

- The vessel is greater than 130 m in length.
- Trawl speed is between 3 and 5 knots.
- Frozen storage capacity is greater than 2000 t and up to 4500 t.
- There is only one fishing activity of the type specified as a DCFA operating in the SPF.

Processing/freezing

- Fish are pumped into reception tanks and chilled quickly.
- Fish are pumped to the factory deck and onto the roller grader where they are graded for size and then transported by conveyers to the freezer plant where they are sorted.
- Whole fish are contact frozen into 20 kg blocks.
- Approximately 250 t per day can be contact frozen.
- Frozen blocks are bagged, boxed, strapped and weighed and stacked in the refrigerated hold.
- Catch is frozen whole onboard and the extent of processing onboard is confined to the grading of fish and packaging of frozen whole fish.
- No discarding[6] of catch or processing waste occurs in any form (i.e. no discards of biological material).

5 The best advice available to the panel suggests that, while it may be possible to target sardines with the minimum mesh size specified for mid-water trawl gear in the SPF, it is likely to be inefficient and therefore this species may not, in practice, be a target species of the DCFA.

6 This excludes captured protected species which must be reported and returned to the sea.

2.2.3 Direct interactions with EPBC Act protected species

Direct interactions

The panel was required to assess the "likely nature and extent of direct interactions of the Declared Commercial Fishing Activity with species protected under the EPBC Act, particularly seals and dolphins".

The panel considered the definition contained in a memorandum of understanding (MoU)[7], on the reporting of interactions with protected species by fishers, between the Department of the Environment and AFMA. The MoU defines an interaction as "Any physical contact an individual has with a protected species. This includes all catching (hooked, netted, entangled) and collisions with an individual of these species". However the panel considered that this definition excluded some important types of direct interactions including feeding from nets or on discards or wastes, the habituation of some marine mammals to fishing operations (Chilvers and Corkeron 2001, Allen and Loneragan 2010, Jaiteh *et al.* 2013) and acoustic disturbance from fishing operations on marine mammals (McCauley and Cato 2003, Nowacek *et al.* 2007). As a result, the panel agreed that 'direct interactions' include:

- any interactions with fishing operations or gear (including net feeding, feeding on discards or waste)
- any physical contact (including collisions on trawl warps)
- bycatch (hooked, netted or entangled) which can result in injury or mortality
- acoustic disturbance from fishing operations
- any behavioural changes in these species brought about by habituation to fishing operations.

The fishing scenario of the DCFA (Box 2.1) precludes the discarding of catch or processing waste at sea. As a result, the panel did not consider direct interactions from feeding on discards or waste in its assessment of the DCFA. For the purposes of the assessment direct interactions included net feeding, physical contact, bycatch, acoustic disturbance and/or behavioural change.

Protected species

Species protected under the EPBC Act[8] include:

1. listed nationally threatened species identified as critically endangered, endangered, vulnerable or conservation dependent
2. cetaceans (whales, dolphins, porpoises)
3. listed migratory species, including some species of:
    i. birds[9]
    ii. cetaceans
    iii. sharks and rays
    iv. marine turtles
    v. crocodiles
    vi. dugong.

7 Available at http://www.afma.gov.au/wp-content/uploads/2010/06/mou.pdf?afba77.

8 Species listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) are not protected species for the purposes of the EPBC Act. However, some species otherwise protected under the EPBC Act are also listed in CITES.

9 For the purposes of its assessment the panel has referred to all species of relevant birds as 'seabirds'.

4. listed marine species, including some species of:
    i. seasnakes
    ii. pinnipeds (fur seals, sea lions and phocid seals)
    iii. crocodiles
    iv. dugong
    v. marine turtles
    vi. seahorses, sea-dragons and pipefish
    vii. birds.

Species in group one (listed threatened species except for conservation dependent species) and group three (listed migratory species) above are matters of 'national environmental significance' under the EPBC Act. A species may fall into more than one of these groups, for example, a species may be a listed threatened species and a listed migratory species.

A full list of the EPBC Act protected species occurring in the SPF area and therefore considered relevant to this assessment is provided in Appendix 3. The list was developed by panel members and the Environmental Resources Information Network of the Department of the Environment.

The panel noted there is often some confusion in the terminology given to seals in many government environment and fisheries management related documents. The term 'seal' is often applied to all seals (pinnipeds), or sometimes only to fur seals. In this report, in relation to the SPF, references by the panel to:

- 'seals' refer to all pinnipeds, that is otariids and phocids (noting that odobenids (walrus) are also pinnipeds but do not occur in the Southern Hemisphere)
- 'fur seals' refer to otariids in the genera *Arctocephalus* and *Callorhinus*
- 'sea lions' refer to otariids in the genera *Neophoca*, *Eumetopias*, *Zalophus*, *Otaria* and *Phocarctos* (this follows the terminology detailed in Kirkwood and Goldsworthy (2013)).

Where government or industry management plans are cited in this report, ambiguity in the terminology may still exist.

2.2.4 Localised depletion of target species

Localised depletion

The panel noted that the term 'localised depletion' is widely used in fisheries science and management literature but there is no globally accepted definition. The Food and Agriculture Organization of the United Nations maintains an extensive glossary of fisheries management and scientific terms but does not include 'localised depletion'. The panel noted that the term is used but not defined in the Commonwealth Fisheries Harvest Strategy Policy (DAFF 2007). The SPF Harvest Strategy (AFMA 2008) makes explicit reference to localised depletion but does not define it, however, the Small Pelagic Fishery Resource Assessment Group (SPFRAG) has recently developed the following draft working definition of localised depletion for the SPF:

> "For the purpose of managing the Small Pelagic Fishery, localised depletion is defined as: a persistent reduction in fish abundance in a limited area, caused by fishing activity, over spatial and temporal scales that causes a negative impact on predatory species and/or other fisheries.
>
> Explanatory notes:
>
> - The risk of localised depletion is highest for target species with low mobility (e.g. abalone) and lowest for highly mobile species (e.g. pelagic fish). Predatory species with limited foraging areas, especially central place foragers, are most likely to be impacted by localised depletion. Localised depletion is less relevant to highly migratory species or species with large foraging areas.

- Geographical barriers (headlands, straits) can increase the likelihood of localised depletion by limiting movement rates.
- Localised depletion is not a reduction in the overall range of a target species due to fishing down or over-fishing the stock. Localised depletion is not a reduction in stock abundance due to the natural movement or population size of target species.
- User conflict issues that do not arise from localised depletion should be considered and resolved separately from any user conflict issues arising as a result of the identification of localised depletion occurring.
- The definition of localised depletion has been developed in the context of the management of the Small Pelagic Fishery and the potential impacts localised depletion has on predators and catches in other fisheries (NB: Broader ecological implications of the Small Pelagic Fishery can be managed by applying low exploitation rates)." (SPFRAG 2014a)

The panel commissioned a literature review of the impacts of localised depletion of small pelagic fishes on predators and ecosystems (Rogers *et al.* unpublished). That review noted that interpretation of 'localised depletion' varies in the international literature and identified a range of interpretations of the term in relation to small pelagic fishes, including:

> "Localised depletion in the Chesapeake Bay is defined as a reduction in menhaden [*Brevoortia tyrannus*] population size or density below the level of abundance that is sufficient to maintain its basic ecological (e.g. forage base, grazer of plankton), economic and social/cultural functions. It can occur as a result of fishing pressure, environmental conditions, and predation pressures on a limited spatial and temporal scale." (Maguire 2009)

> "The idea of localised depletion is extremely difficult to demonstrate in such a mobile species [Atlantic menhaden]; if it does occur then it could only occur at a relatively small scale for a relatively short time." (Haddon 2009)

> "Forage fish are vulnerable to localized depletion, which is a reduction, through fishing, in abundance or biomass in a specific area. Localized depletion occurring in key foraging areas and at critical feeding times may have a major effect on predators that have little ability to find more distant patches of abundant prey...." (Pikitch *et al.* 2012)

The panel also explored the interpretation of localised depletion with a number of fisheries science and management experts, who put forward various definitions of the term, reinforcing the findings of the Rogers *et al.* (unpublished) review.

Noting that the panel's Terms of Reference required it to assess and advise on the potential for any localised depletion of target species (arising from the DCFA) to result in adverse impacts to the Commonwealth marine environment, and considering outcomes of research and expert advice, the panel adopted the following working definition of localised depletion:

> 'a spatial and temporal reduction in the abundance of a targeted fish species that results from fishing'.

The panel considered that localised depletion is an inevitable consequence of fishing and that the issue of relevance to this assessment was the potential for adverse environmental impacts as a result of localised depletion caused by the DCFA.

Further discussion of localised depletion, including its differentiation from overall stock depletion, is provided in Chapter 6.

Target species

The Small Pelagic Fishery Management 2009 Plan (the SPF Management Plan) identifies five quota species:

- blue mackerel Sc*omber australasicus*
- jack mackerels (jack mackerel *Trachurus declivis* and Peruvian jack mackerel *T. murphyi*)
- redbait *Emmelichthys nitidus*
- Australian sardine *Sardinops sagax*.

In carrying out its assessment, the panel interpreted references to target species in the Terms of Reference to mean references to these five species. A profile of each of these species is provided in Appendix 4.

The current management arrangements in the SPF require that mesh in the net must not be less than 30 mm at any part of the net. Taking this into account the panel considered it unlikely that the DCFA would target any other small pelagic species.

2.2.5 Small pelagic species

AFMA's use of the name 'Small Pelagic Fishery', serves to differentiate the target species from larger pelagic species such as tunas and swordfish that are managed separately by AFMA (e.g. the Eastern Tuna and Billfish Fishery and the Southern Bluefin Tuna Fishery). Internationally, references to 'small pelagic fish' have included many species, most commonly anchovy, anchovetta and sardine (pilchard) but Freon *et al.* (2005) usefully defined them as "shoaling epipelagic fish characterized by high horizontal and vertical mobility in coastal areas and which, as adults, are usually 10-30 centimetres (cm) in length". They suggest that conventional 'small pelagic fish' include typical forage species such as sardine and anchovy that prey on phytoplankton and/or micro-meso-zooplankton while 'medium-sized pelagic fish' (20 cm to 60 cm) include mostly species from intermediate trophic levels such as horse mackerel, mackerels and coastal tunas.

Forage fish or low trophic level fish

These 'small pelagic' species are also known as forage fishes or lower trophic level (LTL) species, reflecting their trophic role in the marine food web. Recent studies on forage and LTL species by Pikitch *et al.* (2012) and Smith *et al.* (2011) examined the role and the effect of fishing on these species, using a large number of ecosystem models. The Lenfest Forage Fish Task Force conducted a seminal research program to provide "practical, science-based advice for the management of forage species because of these species' crucial role in marine ecosystems and because of the need for an ecosystem-based approach to fisheries management" (Pikitch *et al.* 2012). Their definition of forage fish was in terms of their function as a vital route for energy transfer from plankton to higher trophic levels and included non-fish species such as krill. They defined forage fish as those whose characteristics include "small body size, rapid growth, schooling behavior and strong responses to environmental variability". They did not include mackerels in their study. Smith *et al.* (2011), in a study for the MSC, explored the effects of fishing LTL species in five ecosystems and defined LTLs as "...species that are generally plankton feeders for the larger part of their life cycle. They are often present in high abundance and tend to form dense schools or aggregations. They include small pelagic 'forage' fish such as anchovy, sardine, herring, mackerel and capelin, but also invertebrate species such as krill." That study involved two south-eastern Australian ecosystem models that included jack mackerel, sardine and redbait as well as krill, squid and mesopelagic fishes (Johnson *et al.* 2010, Bulman *et al.* 2011). Results of that case study are discussed in Chapter 4.

In terms of size, Australian sardine is the only SPF species that could be classed as 'small'. The mackerels and redbait are 'medium'. In Lenfest terms, only the Australian sardine would fit into the category of forage fish specifically. In the MSC study (Smith *et al.* 2011), sardines, jack mackerels and redbait were all considered LTL species.