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7 Assessment of the Declared Commercial Fishing Activity

7.1 Introduction

The panel's Terms of Reference required it to assess and advise on the Declared Commercial Fishing Activity (DCFA), particularly the potential for the activity to result in adverse environmental impacts. The assessment related to:

- the likely nature and extent of direct interactions of the DCFA with species protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), particularly seals and dolphins
- the potential for any localised depletion of Small Pelagic Fishery (SPF) target species, arising from the DCFA to result in adverse impacts to the Commonwealth marine environment, including the target species' predators protected under the EPBC Act.

Based on its assessment of those issues, and consideration of the proposed management of the DCFA, the panel has provided advice on actions that could be taken to avoid, reduce and mitigate adverse environmental impacts of the DCFA and on scientific research and monitoring that could reduce uncertainties about those impacts.

A synthesis of the panel's assessment, guidance on interpretation of the outcomes of the assessment and the panel's advice, and concluding comments are provided below.

7.2 Assessment and advice on direct interactions with protected species

The DCFA is defined in terms of the fishery in which it operates, the type of fishing gear used, the length of the vessel and its storage capacity. The fishing scenario developed by the panel assumed that the freezer capacity of the DCFA would enable it to stay at sea for longer periods (up to six to eight weeks before needing to unload product) and to fish more extensively in the SPF area than has been the case in the past.

To date, mid-water trawling in the fishery has been concentrated around Tasmania. The DCFA would most likely focus its fishing effort on the shelf and slope areas of the SPF, where the target species are predominantly distributed, but would likely fish these areas more extensively and might fish in slightly deeper water off the shelf, than previous fishing operations in the SPF. Historical fishing patterns and interaction data do not, therefore, necessarily provide a good guide to the likely fishing patterns or protected species interactions of a DCFA. Further, it is not possible to predict with certainty the species composition, the spatial/temporal pattern of fishing or the intensity of fishing by the DCFA, because the fishing plan will be dictated by the prevailing environmental and economic conditions.

The panel concluded that if the DCFA operated in areas or at times of the year that have not been fished previously by mid-water trawl vessels, it is reasonable to expect that rates of interaction, the species involved and the risk profile of those species may differ from those of the past; this results in considerable uncertainty about the likely extent of direct interactions by the DCFA with protected species.

Nevertheless, the panel concluded that it is inevitable that the DCFA will interact with species protected under the EPBC Act. These species potentially include pinnipeds (referred to here as seals), cetaceans, dugong (possible but unlikely), seabirds, turtles, seasnakes, sharks and rays, syngnathids and other teleost fishes. The panel assessed each of these groups and focussed its assessment on pinnipeds, cetaceans and seabirds. The rationale for this decision is provided in Chapter 5 and Appendix 3.

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that could occur without causing an adverse environmental impact. This level would vary within and among the pinniped, cetacean and seabird groups assessed in accordance with their abundance, population trend and the resilience of the species. Some of the protected species at risk of interacting with the DCFA are listed as threatened and/or migratory species under the EPBC Act and are therefore matters of national environmental significance that are afforded a higher level of protection and require assessment of significant impacts against criteria. For example, of the pinniped species assessed, the threatened Australian sea lion, currently listed as Vulnerable under the EPBC Act, can sustain less mortality without risk of adverse environmental impacts than the more plentiful Australian and New Zealand fur seals where populations have undergone recent recovery. Similarly, while many protected seabird species occur within the area of the SPF, some of these are known to have depleted populations and are listed as threatened and/or migratory species.

For many protected species, such as most cetaceans in the SPF area, there is a lack of information about population size and trends, location of important habitats and other biological and ecological characteristics. In the absence of such information it is not possible to establish evidence-based benchmarks for direct interactions by the DCFA with protected species that would avoid adverse environmental impacts.

The panel noted the SPF and generally all fisheries are managed in similarly uncertain environments. In relation to the DCFA, the panel considered that there are actions that could be taken to avoid, reduce and mitigate the risks of adverse environmental impacts occurring and that research and monitoring could be undertaken to reduce the uncertainties.

The panel assessed the likely nature and extent of direct interactions of the DCFA with three species of pinnipeds and 21 species of cetaceans. A broader assessment of interactions with seabirds was conducted. A summary of the panel's assessment and advice on these three taxa is provided below.

7.2.1 Pinnipeds

Nature and extent of interactions

Australian fur seals Arctocephalus pusillus doriferus, New Zealand fur seals A. forsteri and Australian sea lions Neophoca cinerea are highly susceptible to interactions with trawl fisheries and occur throughout the entire area of the SPF. In southern Australia, pinniped interactions with fishing operations have occurred predominantly with demersal trawl wet boats' and freezer trawlers using mid-water trawl gear in the Southern and Eastern Scalefish and Shark Fishery (SESSF), and with mid-water trawlers in the SPF. Most mid-water and demersal trawl operations that have occurred in the SPF area have been in the south-east of Australia and most interactions in that area have been with Australian fur seals.

Seals will be attracted to any fishing activity that occurs within their foraging range and the nature of interactions with these activities are likely to include net feeding, entering the trawl net (during shooting/fishing/hauling), habituation to fishing activities and bycatch. The greater the level and frequency of fishing activity and the more predictable the presence and timing of fishing activity in areas where seals forage, the greater the number of seals likely to be attracted to, and interact with, fishing activity. If a pattern of fishing persists and provides nutritional benefits to seals, parts of the population can become habituated to fishing operations and interactions may increase over time.

While it is not possible to quantify the extent of direct interactions between seals and the DCFA, the panel considered that such interactions would occur and that some would result in mortalities. Given the broad distribution of fur seals within the SPF, the DCFA would inevitably have direct interactions with fur seals, some of which would be fatal. In areas of high fur seal abundance, interactions and mortalities are likely to be common even with current best practice mitigation devices and fishing behaviour. The Australian sea lion occurs in the area of the SPF in waters off South Australia and Western Australia. If the DCFA operated within those waters, direct interactions with and bycatch mortality of this species would be likely.

New Zealand fur seal and Australian sea lion populations off South and Western Australia have not been exposed to the same level of bycatch mortality from trawl fisheries experienced by Australian fur seals elsewhere in the SPF, so there is uncertainty about the impacts of bycatch on those populations. This is especially important for the threatened Australian sea lion.

Actions to avoid, reduce and mitigate adverse environmental impacts

The panel considered that the following actions could be used to manage the risk of adverse environmental impacts arising from direct interactions between the DCFA and pinniped species:

- use a seal excluder device (SED), only after its operation has been optimised for the vessel, fishery and bycatch species under a scientific permit, with the required level of performance of the SED developed in consultation with experts
 - for example, the panel noted that neither the soft mesh-grid, top-opening SED with hood, nor the auto trawl system proposed to be used by the *FV Abel Tasman* to mitigate pinniped bycatch has undergone trials in the SPF
- use underwater video to monitor SED efficacy and cryptic mortality
- reduce the daily and per shot trigger limits on fur seals from the proposed limit of up to 10 per day and replace the associated 50 nautical mile (nm) move-on rule with a requirement to move to an area where interactions with seals are less likely, based on available data on estimated at sea density distributions
- introduce a bycatch rate trigger limit for fur seals for the fishery or fishing areas, or a total mortality trigger for a fishing season and/or fishing areas
- ensure 100 per cent observer coverage of fishing operations and if daily or per shot trigger limits are used in conjunction with move-on rules or with a requirement to review mitigation measures, provide sufficient observer capacity to ensure that underwater video footage is monitored at the end of each shot to maximise response times to mortalities
- require 'stickers' to be removed from the net before shooting, noting that this was a requirement of the proposed seabird vessel management plan (VMP)
- prohibit the discard of any biological waste (excluding the release of any protected fauna) noting that this was a requirement of the proposed seabird VMP
- implement spatial closures that mitigate bycatch interactions with fur seals, especially in regions adjacent to breeding colonies where there is high transit and foraging activity by central-place foraging lactating adult females
- review the proposed Australian sea lion closure area off South Australia (out to 150 m depth) so as to provide consistency with management arrangements for the Gillnet Hook and Trap Fishery (out to 183 m depth)
- implement a similarly designed closure for the Australian sea lion colonies occurring within the SPF off Western Australia.

Research and monitoring to reduce uncertainties

The following research and monitoring could reduce uncertainties about the potential for adverse environmental impacts arising from direct interactions between the DCFA and protected pinniped species:

- determine the individual and cumulative fishery-related impacts on pinniped species
- establish what levels of fishery-related mortality the pinniped species can sustain
- identify regions of critical foraging habitat for the pinniped species where the management of direct interactions with the DCFA may be most needed
- investigate modifications to fishing gear and fishing behaviour that can reduce the potential for direct interactions by the DCFA with pinnipeds.

7.2.2 Cetaceans

Nature and extent of interactions

Nearly all cetaceans recorded to occur in Australian waters have ranges that overlap to some extent with the SPF area. The nature and likelihood of interactions between cetaceans and mid-water trawl fisheries varies substantially among these species. Bottlenose dolphins *Tursiops* spp. and short-beaked common dolphins *Delphinus delphis* are likely to be at higher risk of interaction based on reported interactions with trawls and bycatch mortality in Australia and internationally.

Direct interactions with fishing operations include net feeding, foraging behind trawlers, and feeding on discards and fish escaping from nets. Vessel collisions resulting in injury or death of whales and some other cetaceans are thought to be relatively common in Australian waters but are not well documented. Most severe or fatal injuries to whales from vessel strike are caused by collisions from vessels greater than 80 metres, and higher speed increases the risk of serious injury or death.

Fisheries bycatch mortality of the device is the major threat to many smaller cetacean species in Australian waters and internationally. Differences in the type of fishing operations also influence the risk of bycatch, with cetaceans more often caught in mid-water trawls than in bottom trawls, and in trawls of longer duration. The risk of bycatch increases where prey species are also targeted by fisheries and where fishing grounds overlap with important habitats used by cetaceans for aggregating, feeding, breeding and migratory routes. Acoustic disturbance can be important for cetaceans because they have a very highly developed acoustic sense and sounds are vitally important for their ecology and survival. Cetaceans that frequently interact with trawlers and other fisheries can become habituated, leading to increased risk of bycatch.

As noted above, the lack of information on the distribution and abundance, population trend, genetic structure, and location and timing of use of important habitats for most cetacean species, greatly increases the uncertainties about the likelihood of direct interactions occurring and whether such interactions would result in significant environmental impacts for these protected species.

It is highly likely that there will be some direct interactions between the DCFA and cetaceans. The DCFA would enable fishing to occur more extensively in the SPF area, which would increase the range of cetacean species likely to be encountered. The nature and extent of direct interactions by the DCFA with cetaceans is uncertain but some cetacean mortality is likely. The Panel concluded that species such as bottlenose dolphins and short-beaked common dolphins, that are known to prey on small pelagic fish, and interact extensively with trawl fisheries, are at increased risk of being taken as bycatch by the DCFA, whereas some larger whale species may be at higher risk from vessel strike or acoustic disturbance.

Actions to avoid, reduce and mitigate adverse environmental impacts

The panel considered that the following actions could be taken to manage the risk of adverse environmental impacts arising from direct interactions of the DCFA with cetaceans:

- use an excluder device only after its operation has been optimised for the vessel, fishery and for different dolphin species including both bottlenose and short-beaked common dolphins under a scientific permit with the required level of performance developed in consultation with experts, noting that excluder designs tested to date have not been consistently effective in reducing cetacean bycatch in trawls, and at present there is no solution to filter or deter cetaceans from entering the net opening
- use underwater video to monitor dolphin behaviour within the net and around the excluder device to determine the efficacy of the excluder device and levels of cryptic mortality
- introduce a bycatch rate trigger limit for dolphin species for the fishery or fishing areas, or a total mortality trigger for a fishing season and/or fishing areas on a precautionary rather than evidentiary basis
- replace the 50 nm move-on rule, in response to a single dolphin mortality, with a requirement to move to an area where interactions with cetaceans are less likely, based on available data on estimated at sea density distributions

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- assess the efficacy of acoustic deterrent pingers (with using rigorous controlled trials under a scientific permit with the required level of performance developed in consultation with experts), and temporal and spatial closures, that have been shown elsewhere to have potential to reduce the risk of interactions for some cetacean species, including some dolphins
- prohibit the discard of any biological waste (excluding the release of any protected fauna) noting that this was a requirement of the proposed seabird VMP
- ensure 100 per cent observer coverage of fishing operations and, if trigger limits are used in conjunction with moveon rules or with a requirement to review mitigation measures, provide sufficient observer capacity to ensure that underwater video footage is monitored at the end of each shot to maximise response times to mortalities
- in addition to the above actions to mitigate impacts on dolphins, ensure that monitoring and agreed management responses are in place to allow a timely management response if other cetacean species interact with the DCFA.

Research and monitoring to reduce uncertainties

The following research and monitoring could reduce uncertainties about the potential for adverse environmental impacts arising from direct interactions between the DCFA and protected cetacean species:

- identify regions in the SPF area that are important habitats for cetaceans where the management of direct interactions with the DCFA may be most needed
- determine the level of mortality arising from interactions with the DCFA that could be sustained by cetacean populations in the SPF area
- investigate modifications to the proposed fishing gear and operations of the DCFA that could reduce the potential for, or the impacts of, interactions with cetaceans
- collect, analyse and publish observer data on all cetacean interactions.

7.2.3 Seabirds

Nature and extent of interactions

The panel concluded that the past rate of interactions of SPF mid-water trawl operations with seabirds was likely to have been low and this could be at least partly explained by the low level of discharge of biological material in the fishery. Nevertheless, interactions have occurred and the SPF is an area that is known to be important to many seabird species.

Direct interactions between trawl vessels and seabirds include collisions with net-monitoring cables, warp cables and paravanes, net entanglements and habituation to fishing operations. Each of these interactions could be expected to occur with the DCFA. However, given that the DCFA fishing scenario precludes the discard of any biological material, the panel expected that the likelihood of habituation and, as a result, other forms of direct interactions was likely to be lower than in many other trawl operations.

Since it was not possible to predict with any certainty the location, timing or intensity of fishing by the DCFA the panel could not quantify the likely extent of direct interactions with seabirds.

Actions to avoid, reduce and mitigate adverse environmental impacts

The panel considered that the following actions could be taken to manage the risk of adverse environmental impacts arising from direct interactions of the DCFA with seabirds:

• the requirements in the proposed seabird VMP regarding discharge of biological material, the removal of stickers and warp maintenance be consistent with or equivalent to the advice of the Agreement on the Conservation of Albatrosses and Petrels (ACAP)

- adopt the ACAP advice regarding net binding, bird scaring lines and the use of a snatch block noting that the use of bird scaring lines and net binding are part of the seabird VMP for Australia's winter blue grenadier fishery
- if bird bafflers and warp deflectors are to be used, develop and optimise the design under scientific permit and in consultation with experts, noting that seabird captures in the SESSF have been reduced by 75 per cent using 'pinkies'
- direct deck lighting inboard and keep to the minimum level necessary for the safety of the crew
- develop advice on the correct interpretation of 'interactions' with seabirds in consultation with the Department of the Environment to ensure that it is consistent with the intent of the memorandum of understanding between the Department and AFMA and ensure that DCFA operators and crew are familiar with this advice
- ensure that the seabird VMP for the DCFA meets the requirements of the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016
- if unacceptable levels of interactions with protected seabird species occur, suspend fishing immediately and adopt one of the following options:
 - time and area closures, noting that these will rely on knowledge of spatial and temporal uses of bird habitats that overlap with the fishery
 - trigger limits and move-on rules
- consistent with the measures suggested above for pinnipeds and cetaceans, ensure 100 per cent observer coverage of all fishing activity.

Research and monitoring to reduce uncertainties

The following research and monitoring could reduce uncertainties about the potential for adverse environmental impacts arising from direct interactions between the DCFA and protected seabird species:

- identify ecologically sensitive seabird species, areas and times where spatial management strategies may be appropriate to mitigate direct interactions if required
- collect, analyse and publish observer data on all seabird interactions, including on the levels and causes of seabird bycatch, focusing especially on recording of warp interactions and trawl entanglements
- use electronic monitoring via video camera/s to assist in quantifying warp strikes
- ensure crews are properly trained in the use of the required seabird mitigation and on reporting requirements.

7.3 Assessment and advice on localised depletion

The panel interpreted localised depletion as a spatial and temporal reduction in the abundance of a targeted fish species that results from fishing. As a result, localised depletion is an inevitable consequence of fishing by the DCFA and of any fishing activity. The central issue for the panel's assessment was, therefore, whether the fishing activity of the DCFA could be concentrated enough, both spatially and temporally, to cause a localised depletion of target species sufficient to cause adverse environmental impacts to the Commonwealth marine environment.

The panel found no conclusive evidence of historical localised depletion that caused adverse environmental impacts in the SPF. However, the high level of dependence by some predators, particularly central place foragers (CPFs), highlights the need to manage for the risk of such impacts.

The panel assessed the potential impact of localised depletion on the target species and on protected CPFs. A summary of those assessments is presented below.

7.3.1 SPF target species

The panel found that SPF target species have some inherent characteristics that make them potentially susceptible to localised depletion; they are susceptible to capture as a result of their aggregating or schooling behaviour and associations with oceanographic features such as eddies and temperature and chlorophyll fronts. However, the panel also noted that other characteristics, such as being proficient swimmers, having a schooling behaviour that is dynamic and difficult to predict, and being productive and fecund, are likely to reduce the temporal and spatial extent of any such depletion.

Impacts of localised depletion on target species could result in changes in reproductive capacity and genetic diversity. However the available genetic evidence for jack mackerel *Trachurus declivis* did not suggest that past apparently high levels of fishing had significantly affected their reproductive capacity. Similarly, there have been no significant changes in age or size composition of redbait *Emmelichthys nitidus* in recent years that might indicate a potential impact on reproductive capacity. There are too few data available for the Australian sardine *Sardinops sagax* in the Eastern Zone or blue mackerel *Scomber australasicus* to determine if there have been significant changes to age or size structure or reproductive capacity but the low levels of effort and catch suggest little likelihoodthat changes have occurred. Further, there is no evidence to suggest that localised depletion has caused any impacts on genetic diversity in the SPF stocks. Additional research into stock structure would be required in order to inform management of the potential risks of localised depletion at the subpopulation level and the appropriate spatial scale at which to manage effort and catch.

Given that the exploitation rates in the SPF are considered to be conservative against international benchmarks for small pelagic fisheries and that concerns about the basis for spawning stock biomass estimates and the SPF Harvest Strategy Policy are being addressed, the panel considered that any localised depletion of SPF target species that might arise from the DCFA was unlikely to affect the overall status of stocks of those species in the SPF.

Panel advice: research and monitoring

Research and monitoring in the following areas could reduce uncertainties associated with stock structure and hence with the adverse impacts of localised depletion arising from the DCFA on target species:

- well-designed and targeted research to clarify the extent of sub-structuring of SPF target species within the East and West Zones specifically, and the SPF more broadly
- ongoing monitoring of the length frequency of catch taken by the DCFA at a statistically appropriate sampling intensity

7.3.2 Central place foragers

The dependency on near-colony prey resources at certain locations and times increases the vulnerability of CPFs to localised depletion of prey. Although CPF species have been shown to be highly responsive to changes in prey availability within their key foraging areas, very few studies have linked reduced foraging and reproductive performance to the impacts of fishing, and even fewer to localised depletion.

The nature and extent of impact of localised depletion will depend on the spatial and temporal scale of the depletion. Short-term impacts may reduce foraging efficiency resulting in longer foraging trips and/or reduced rates of provisioning to offspring (chicks/pups). If these persist they can result in reduced offspring growth rates and fledging/weaning mass and reduced offspring survival and adult breeding success. Longer-term impacts, over years and decades, can affect major demographic factors such as survival, recruitment and reproductive rates that drive population age structure, growth rates and ultimately population size.

There are few examples where the potential impacts on CPF species of localised depletion caused by fishing are actively managed. Only the case study on Peruvian boobies found compelling evidence for localised depletion. In three other case studies in the North Sea, Benguela and Alaska where declines in population size and reproductive success in CPF predators have been identified, spatial closures have been introduced as a precautionary measure to mitigate potential adverse impacts of localised depletion even though the causes of the declines are uncertain.

CPF predators that forage in the SPF, and for which SPF target species comprise or have made a significant (greater than 10 per cent) contribution to the diet, are Australian fur seal, New Zealand fur seal, Australasian gannet *Morus serrator*, short-tailed shearwater *Ardenna tenuirostris*, little penguin *Eudyptula minor*, crested tern *Thalasseus bergii* and shy albatross *Thalassarche cauta*. Key foraging areas for these species within the SPF are Bass Strait, Tasmania and South Australia. However, there remains some uncertainty about the importance of SPF species to other CPF predators, because diet information is poor or unavailable.

Since the overall catch of the DCFA is likely to be higher than that of the current SPF fleet, it is possible that the extent of localised depletion might be greater than for a single wet boat but not necessarily greater than for a fleet of wet boats. The key distinguishing feature between the DCFA and current and historical fishing operations in the SPF is that it can stay at sea longer and so fish more broadly in the area of the SPF. While this may mean that the DCFA could stay in an area for a protracted time, the need to maintain an economically viable catch rate suggests that it is more likely to move on thereby reducing the potential for localised depletion arising from its operations to have adverse impacts on CPF species.

The panel concluded that the DCFA has the potential to have adverse impacts on CPF species through localised depletion. Whether that potential is realised depends on where, when and how intensively the DCFA fishes. In addition, the panel noted that there is very limited monitoring of CPF predator populations and the chance of detecting any indirect fishery-related impact on CPFs within the SPF area is extremely low.

Actions to avoid, reduce and mitigate adverse environmental impacts

Spatial closures are the most common form of precautionary management used to mitigate the potential adverse impacts of localised depletion on CPF predators; however, the effectiveness of spatial closures for this purpose has not been clearly demonstrated. Their value depends heavily on the ability to determine the scale of spatial closures that would be appropriate for particular species at particular locations and at particular times.

The panel concluded that the risks to the key CPF species identified above from localised depletion caused by the DCFA could be addressed proactively by separating the fishing activity from their critical foraging areas. Determining the appropriate temporal or spatial scale of the closures will be challenging but reasonable datasets exist for at least some CPF species in some areas of the SPF. It may be necessary to extrapolate from this information in order to define appropriate spatial closures elsewhere in the SPF. Closures would need to be modified adaptively to reflect new information from fishing or targeted research.

Panel advice: research and monitoring

Many of the uncertainties that were identified in relation to the panel's ability to assess the extent of localised depletion likely under a DCFA reflect the dynamics of fishing operations and the economics of fishing. These types of uncertainties cannot be reduced through monitoring and research. However, research and monitoring in the following areas could reduce the uncertainties associated with the adverse impacts of localised depletion arising from the DCFA on CPF species:

- dietary studies to determine which key CPF predators or other commercially or ecologically important predators are most reliant on SPF species
- studies to better understand the critical foraging areas, habitats and times for key CPF species
- examination of the biological response of CPF predators to changes in prey availability
- investigation of potential ecological performance indicators.

7.4 Interpretation and context

7.4.1 The ecosystem

The panel noted that the ecosystem modelling studies available indicate that the SPF target species are not as influential in the southern Australian ecosystem compared to small pelagic species in other more productive global upwelling systems that support much larger biomasses of similar species. In the panel's view it is important that its assessment of the DCFA is considered in this context.

The predator-prey interactions are generally well-known for many of the commercial or 'ecologically important' species in the SPF. The panel's assessment relied on the available information but it noted that some information is now quite dated.

7.4.2 Catch levels

The panel noted that exploitation levels in the SPF are determined under the SPF Harvest Strategy in accordance with the Commonwealth Harvest Strategy Policy and Guidelines. The Department of the Environment has assessed the SPF against the Guidelines for the Ecologically Sustainable Management of Fisheries and has not imposed any conditions relating to the total allowable catches (TACs). The Panel was aware, however, that some stakeholders have concerns about the application of the Harvest Strategy by AFMA, the accuracy and age of biomass assessments and consequently, the sustainability of the TACs for SPF target species. The panel considered that these concerns are being addressed through new daily egg production surveys for the target species that will provide new data on which to assess the status of the stocks, and through a review of the SPF Harvest Strategy.

The panel noted that the preliminary findings of the recent review of the SPF Harvest Strategy suggested that current exploitation rates in the SPF are unlikely to cause adverse environmental impacts to the broader ecosystem and that the 'ecological allocation' to predators and the broader ecosystem is adequate. The panel's assessment took this finding into account while acknowledging that this does not preclude the possibility of localised adverse environmental impacts on some protected species, particularly CPFs.

The panel assumed that, under the DCFA, total catch in the SPF would be higher than over the last decade, but noted that catches would be capped by the TAC for each species and the quota holding of the DCFA operator. After consideration of all the available information and with regard to international advice on appropriate management settings for small pelagic species, the Panel assumed, for the purposes of its assessment, that the TACs for SPF target species are sustainable and enforceable. In that context the panel considered that the impact on the status of target stocks by the DCFA would be no greater than if the same quantity of catch were taken by any other fishing operation. In the Panel's view the only source of uncertainty in regard to the impact of total catches by the DCFA, related to the potential for sub-structuring of target species within the Eastern and Western Zones of the fishery. If subpopulations of the target stocks exist, and catches from these subpopulations increased as a result of the DCFA, there remains the possibility that the TAC for a Zone could be taken from one of these subpopulations; this would potentially increase the risk of overfishing of that subpopulation.

7.4.3 The DCFA fishing scenario

The panel's assessment is based on a specific DCFA fishing scenario and some associated assumptions. Some of these had a significant bearing on the outcome of its assessment and any changes to the following would necessarily affect the validity of the panel's assessment and advice:

- the DCFA does not discard any biological material
- the activity does not receive product from other fishing vessels (i.e. there is no transshipment)
- catch is pumped from the codend to the vessel rather than the net being hauled onboard

- TACs for target species are set according to the requirements of the Commonwealth Harvest Strategy Policy, the SPF Harvest Strategy and the latest available information
- there is 100 per cent independent observer coverage of all shots and pumping operations
- there is only one DCFA active in the SPF.

7.4.4 Advice on operational and regulatory actions

The panel has provided advice on actions that could be taken by the operators of the DCFA or by regulatory authorities to avoid, reduce and mitigate adverse environmental impacts of the DCFA. In the panel's view the individual actions identified have the potential to contribute to management of the risks of adverse environmental impacts arising from the DCFA. The optimal combination of these actions would, in practice, need to be determined in relation to the specific characteristics of the proposed vessel, gear and fishing plan.

7.4.5 Research and monitoring

The panel identified research and monitoring that could be undertaken to reduce uncertainties about the impact of the DCFA. Some of the identified uncertainties relate equally to previous operations in the SPF and indeed to other fisheries. It is not the panel's intention to suggest that all the research and monitoring identified in this report is a pre-requisite to the operation of the DCFA. Fisheries management in Australia and globally is conducted in the context of uncertainty and it is how this uncertainty is managed that will determine whether unacceptable levels of adverse impacts arise from fishing. The level of precaution adopted should be positively correlated to the level of uncertainty. That precaution can be reduced as new information from research, monitoring and/or fishing operations becomes available and uncertainty is reduced. Fisheries management involves trade-offs between precaution and the time and cost involved in acquiring new information to reduce uncertainty. Consideration of research and monitoring associated with the DCFA is no different in this respect.

7.4.6 Cumulative impacts

In the panel's view it is important that its assessment of the DCFA be considered in relation to other fishing activity in the SPF area. Many of the potential impacts assessed in relation to the DCFA in this report might equally result from an expansion of fishing effort by any fishing method and in any fishery that operates in the same area as the SPF. For example, while the DCFA has the potential to have direct impacts on protected species, the risks of adverse environmental impacts arising from the DCFA need to be considered in the context of the cumulative effect on these species by all fisheries in the SPF area. Such consideration is not possible until information across the relevant fisheries is collated and a holistic estimate is made of the level of interactions with protected species in the area of the SPF.

7.5 Concluding comments

The panel has identified the likely nature of the interactions of the DCFA with protected species in the SPF. The form of direct interactions, and the species most likely to be affected by both direct interactions and localised depletion, have been identified and the panel has provided specific advice on measures that could be taken to avoid, reduce and mitigate these impacts. However, even if these measures were adopted the panel considers that direct interactions with protected species and localised depletion, as defined by the panel, will occur under the DCFA. The panel's assessment has confirmed that there are considerable uncertainties relating to the extent of the impacts that would arise from the DCFA and the level of impact that would cause adverse environmental outcomes.

The panel noted that similar uncertainties are confronted in many other fisheries in Australia and elsewhere. As is the case in those fisheries, a precautionary and adaptive, risk-based approach to management of the potential impacts of the DCFA would be required. Further, as noted above, it is important that the panel's assessment of the DCFA be considered in the context of the role that SPF target species play in the southern Australian ecosystem, the fisheries management regime for those species, and of the cumulative impacts of fishing in the area of the SPF on protected species.