6. Environmental Impact of the East Coast Trawl Fishery

The Commonwealth "**Guidelines for the Ecologically Sustainable Management of Fisheries**" require, as overarching principles, that the fishery is conducted in a manner that:

1. *"does not threaten bycatch species"*
   [Principle2; Objective 1];

2. *"avoids mortality of, or injuries to, endangered, threatened or protected species and avoids or minimises impacts on threatened biological communities"*
   [Principle2; Objective 2]; and

3. *"minimises the impact of fishing operations on the ecosystem generally"*
   [Principle2; Objective 3].

Recapitulating on the obligations for assessing the impact of a fishery on the wider ecosystem, the guidelines require that:

- "*there is a risk analysis of the bycatch with respect to its vulnerability to fishing*" **[Guideline 2.1.2]**;
- "*there is an assessment of the impact of the fishery on endangered, threatened or protected species*" **[Guideline 2.2.2]**;
- *"there is an assessment of the impact of the fishery on threatened ecological communities"* **[Guideline 2.2.3]**; and
- *"information is collected and a risk analysis, appropriate to the scale of the fishery and its potential impacts, is conducted into the susceptibility of 1. impacts on ecological communities 2. impacts on food chains 3. impacts on the physical environment"* **[Guideline 2.3.2]**.

The guidelines also require that a number of management measures be in place to avoid:

1. *"capture and/or mortality of endangered, threatened or protected species"* **[Guideline 2.2.4]**;
2. *"impact on threatened ecological communities"* **[Guideline 2.2.5]**;
3. *"significant damage to ecosystems"* **[Guideline 2.3.3]**

This section of the Audit Report deals specifically with the impact of trawling on the environment. Specific actions in relation to environmental impact management are discussed further in Section 7. There are no listed threatened ecological communities in the ECTF and, therefore, Guideline 2.2.3 does not apply.

Benthic trawling is one of the least selective fishing methods and, as a result, the amount of discarded bycatch far outweighs the amount of retained product. The FAO has estimated that about 27 million tonnes of bycatch are discarded globally each year (Alverson *et al.*, 1994), with prawn trawling estimated to contribute more than one third of this total (Pascoe, 1997).

Australia is signatory to several international agreements, which prescribe the management of fisheries resources. Both the UNCLOS and FAO Code of Conduct for Responsible Fisheries require that fishing is conducted in a manner which does not undermine the sustainability of bycatch species. As a result of the increasing global awareness of the effects of trawling on marine ecosystems, the bycatch

and benthic impact of fishing in the ECTF is of major concern in the management of the GBR Marine Park.

The impact of fishing gear on the environment generally is the least investigated area of fisheries management. In most cases, there is little information on the biology of the bycatch (i.e. impacted non-commercial) species and on the physical and ecological impacts of fishing. Much of the available information is anecdotal, with limited quantitative research on which to base an assessment. Even in simple, single-species, spatially-limited trawl fisheries, such research can be difficult, since the impact cannot be assessed fully by studying the retained catch in a commercial trawl net. Specific research is required. As fisheries become larger in terms of species diversity and geographical spread, research costs increase accordingly.

6.1 Description of Environmental Impacts

There are no unequivocal estimates of the bycatch or the impact of trawling in the ECTF. As described in Section 5.2, there is large temporal and spatial variability in the fishery, which is reflected in a wide range of benthic habitat types and bycatch composition. Some monitoring and research work has been undertaken on environmental impacts and bycatch composition, but this has been opportunistic in terms of funding and areas studied. It is also noted that every sampling method for collecting bycatch species will have an inherent bias (due to gear selectivity) and results may differ significantly between day and night shots depending on the diurnal activity of the species (Wassenberg *et al.*, 1997).

As far as volume is concerned, estimates of bycatch range from 2 to 15 times that of the retained product. Poiner *et al.* (1999) calculated a 6 to 10 : 1 ratio for by-product versus prawn catch in the Far Northern Section of the GBR Marine Park. Preliminary data from an ECTF bycatch project in the southern part of the GBR Marine Park, currently underway, suggests that some 25,000t of bycatch is discarded for an annual production of about 10,000t of commercial product (Dr Courtney, QDPI, AFFS, *pers. comm.*). This figure is considerably lower than the figures reported by Poiner *et al.* (1999) for the northern part of the Marine Park.

As is common with all tropical penaeid fisheries, there is a large diversity of species in the bycatch. It is estimated that between 500 and 1000 species are taken as bycatch in the ECTF, of which about 30% are regarded as common. The remaining 70% are uncommon and usually taken in low numbers. This situation presents difficulties from a monitoring perspective, because "rare" organisms caught in trawls generally occur too infrequently to detect changes in abundance at a statistically significant level. Bycatch has been examined and classified for some sectors of the fishery, but there is no bycatch profile for the ECTF in its entirety.

There have been several studies on bycatch in the ECTF and in other prawn fisheries. Robins and Courtney (1999) provide a bycatch profile for each of the ECTF sectors prior to its recent restructure (Table 16). Given that the number of effort units has reduced by about 14% since 1 January 2001, it is expected that there has been a drop in the overall bycatch produced by the fleet. There has been a significant reduction in the number of turtles caught, following the requirement to use TEDs.

A three-year FRDC–funded study (No. 2000/170) entitled "*Bycatch weight, composition and preliminary estimates of the impact of bycatch reduction devices in Queensland's trawl fishery*", hereafter referred to as the "BRD Evaluation Study", is scheduled for completion by mid 2003. This study will provide updated information on bycatch composition in the various sectors of the ECTF and preliminary results have been available for the writing of the Audit Report (Dr Courtney, QDPI AFFS, *pers. comm.*). However, the primary aim of this project is the comparative evaluation of BRDs in each of the major fisheries of the ECTF. It is not designed to provide a statistically robust assessment of bycatch in the fishery as a whole.

more resistant to such disturbance. The study concluded that trawling causes changes in the composition of seabed communities.

The findings of the repeat trawl depletion experiment are very relevant in assessing the impact of trawling. As discussed in Section 5.2.4, trawling is highly aggregated and numerous vessels target some productive grounds heavily. Pitcher *et al.* (2000) concluded from logbook records that about 20% of trawl effort was concentrated in less than 5% of the trawled area. This was referred to as "intensive" fishing effort. On the other hand, some 20% of effort was spread over 60% of the trawled area. This was referred to as "extensive" fishing effort. The analysis was based on logbook data reporting catches within 30'x30' grids. Pitcher *et al.* stressed that the spatial resolution of the effort information is essential in determining the impact of trawling. The more accurately the fishing operations are reported, the greater the ability to predict trawl impact based on the biophysical characteristics of the fishing ground.

The second study, which examined the recovery of benthic communities to trawling, concluded that the amount of fauna removed each year is related to the resilience of the benthic fauna to removal, the intensity of trawl effort and the degree of aggregation of fishing. In terms of vulnerability, the study found that large sponges and flower-pot corals were particularly susceptible to trawling and that sea whips and gorgonians were the most resistant species. Also, as neither the benthic fauna nor trawl effort was distributed uniformly throughout the fishery, there were large variations in the estimated impact. Pitcher *et al.* (2000) suggest that, on average, about 4% of high–resilience fauna, 8% of medium-resilience fauna and 15% of low-resilience fauna may be removed annually in trawled areas. Extrapolating from their results, they estimated that, in heavily trawled areas, the removal of the least resilient fauna may be as high as 80%, whereas in lightly trawled areas this may be significantly lower. However, it is noted that the Far Northern Section had been fished extensively for several decades prior to the introduction of the closure. Therefore, it is likely that the habitat had been modified extensively prior to the study being undertaken.

From the work in the Far Northern Section of the GBR Marine Park it is clear that trawling has a major (and in many cases long-term) impact on the environment. Whilst acknowledging that benthic recovery rates are not well understood, the second study suggested that recovery may take up to 20 years in trawled areas (assuming trawling were to cease) for the most vulnerable species. Also, the seabed community structure may be altered permanently as less vulnerable species survive trawling better and become re-established more quickly than more vulnerable species.

The above findings relate only to the Far Northern Section of the Marine Park, which has a quite different benthic habitat structure to that of the southern fishery. The fishery also changes in terms of gear used and species targeted with increasing latitude. It is not possible, based on the northern results, to predict the impact of trawling for scallops in the southern part of the Marine Park. A three-year study entitled "*Mapping bycatch and seabed benthos assemblages in the Great Barrier Reef region for environmental risk assessment and sustainable management of the Queensland East Coast Trawl Fishery*" by a consortium of research providers is scheduled to begin in mid-2003. It will expand on the earlier "Effects of Prawn Trawling Study" and it is anticipated that this study will provide valuable information on areas not investigated so far.

6.1.4 Trophic Level Impact

Several studies (e.g. Blaber and Wassenberg, 1989, Blaber *et al*., 1999 and Hill and Wassenberg, 1992) have commented on the trophic impact of trawling. The discard of bycatch provides food for scavengers (in the case of dead discard) and predators (in the case of live or injured bycatch). In combination with the removal of the landed catch, this is likely to affect the trophic dynamics of the ecosystem and may change the community structure. There is no empirical evidence or data on this type of interaction within the ECTF.

Sharks, dolphins, fish, crabs and seabirds have been identified as the main groups of scavengers in the tropical penaeid fisheries. Dolphins and sharks tend to feed on discards at the surface, whereas portunid crabs, nemipterids, lethrinids and lutjanids predominantly scavenge on the seabed. Discards that sink are usually scavenged within hours of the discard sinking to the seabed. Some researchers (Blaber and Wassenberg, 1989; Blaber and Milton, 1994) found that increased food abundance through trawler discards has increased the populations of crested terns. Poiner *et al.* (1999) report a hundred-fold increase in this species since trawling began, possibly because the fledglings are feeding on discards. The flow-on effects to other bird populations is not yet understood. The study into the environmental effects of prawn trawling in the Far Northern Section of the GBR Marine Park concluded that it was unlikely that the amount of discards by prawn trawling in that region of the Marine Park would have serious ecological consequences.

A mass-balance, trophic–based, ecosystem model (in preparation) has been developed as part of the project entitled "*Modelling ecosystem impacts of changes in fisheries management of the commercial prawn (shrimp) trawl fishery in the far northern Great Barrier Reef*". It simulates the effects of trawling on the penaeid prawn community in the lagoonal and inter-reefal habitat and predicts trophic impacts. The data for the model were derived from the "Effects of Prawn Trawling Study". The model predicted that the trawl fleet has little impact on the target prawn species, but a greater effect on the omnivorous fish bycatch and large turtles. Simulations showed a 59% and 64% decrease in the tiger and endeavour prawn biomass respectively, with a 50% reduction in trawl effort. The model suggests that trawling removes prawn predators and other competitors and increases the food sources for prawns through discards and predicts a 15% decrease in sea bird biomass with the halving of trawl effort (Dr Gribble, QDPI, AFFS, *pers comm.*)

6.2 Mitigation Devices

Devices, which reduce bycatch in trawl nets whilst they are being towed, are known collectively as BRDs. A subset of these devices assist in the escape of turtles and other large unwanted bycatch, such as sharks, rays and sponges (referred to as "monsters" by industry). These are commonly called TEDs. Another group of devices, which are still being developed (especially for use on small vessels), are called hoppers. This work on the principle that the cod end (once hauled) is emptied into a container filled with circulating seawater, thereby keeping bycatch alive and reducing damage to the target species.

Adopting mitigation technology has obvious benefits. Firstly, it enhances the quality of the commercial product because there is less damage from cod-end crowding. Secondly, it reduces sorting and handling time for the crew and may avoid interactions with dangerous fauna (such as seasnakes and poisonous fish). By excluding "monsters", it also reduces damage to the trawl net and avoids the cod end becoming filled with large amounts of unwanted bycatch. However, these advantages are offset by potential product loss, which may occur if the devices are malfunctioning or improperly installed. Product loss has been reported to be heavy for certain species such as bugs. Also, mitigation devices can reduce the hydrodynamic performance of the gear, thereby adding to fuel costs and engine strain (Day, 2002).

Because of the high levels of bycatch in tropical penaeid fisheries and the impact of trawling on vulnerable species, a range of mitigation devices has been tested in the NPF, TSPF and ECTF over the last decade. In each of these fisheries, it is now a legislative requirement to deploy such devices during trawling. However, progress in the correct usage of BRDs has been slower on the ECTF than in the NPF and TSPF. The reasons for the delay are discussed further in Section 7.3.6. Also, it is noted that there are no monitoring and research funds provided in the current ECTF research budget to enable the scientific evaluation of new mitigation gear through scientific at-sea trials and observer surveys of fleet practices.