Evaluation of prospective assessment, consultation and management actions that should be applied to the Grey mackerel (*Scomberomorus semifasciatus*) fishery in the waters off the former Douglas Shire (Far North Queensland).

Richard Banks, Poseidon ARM (Pty) Ltd.; 15 October, 2008

Introduction

The Network for Sustainable Fishing in Douglas Shire (NSF) and Mossman Boat & Fishing Club (MBFC) have sought to bring the decline of the local grey mackerel (*Scomberomorus - semifasciatus*) fishery to the attention of the Department of Primary Industry, Queensland. Various papers, presentations and public meetings have taken place in the period 2006 to 2008 to press for management control to be applied during the grey mackerel fishing season (previously from June to mid September). Specific requests for management measures to be applied have met with the following responses:

- An emergency fisheries declaration can only be made if the chief Executive is satisfied that urgent action is needed to meet a significant threat to fisheries resources or a fish habitat or another emergency;
- The Department has to consider how access to the grey mackerel fishery has to be shared between the different stakeholders, i.e. commercial and recreational fishers. One of the most difficult issues to address in any fishery is how to share access to fishery resources between fishery sectors. Throughout the East Coast stakeholders have called for exclusive access to fisheries resources (usually recreational fishers wanting commercial netting banned).
- There is no immediate threat to the sustainability of the grey mackerel fishery since the low level of catch in the region compared to the rest of the east coats suggests that it is unlikely there are small localised populations;
- Recent catch data (from best available data, i.e. extracted from commercial fishers) suggests that the risk-from recent levels of fishing activity to grey mackerel in the Port Douglas area is low.

Poseidon Aquatic Resource Management (Pty) Ltd, an International fisheries consultancy company[1] was requested to undertake a short scoping study to evaluate the processes that could lead to the establishment of management arrangements for the localised fishery, against best available evidence. In this context the Company has reviewed scientific papers, and best available data, including catch information from local fishers and anglers. Poseidon has also analysed the legislation and consultative process that can and should be applied to the fishery, whether on a local, State or Commonwealth Scale.

Poseidon has a track record in fisheries management and control, risk analysis and fishery certification and works primarily for International donors including FAO, World Bank and Asian Development Bank.

[1] www.consult-poseidon.com

Background

The fishery

Grey mackerel are endemic to the inshore waters of northern Australia and the south coast of the island of New Guinea belonging to the Scombridae family. Approximately one third of the total commercial catch (200 of 562 tons in 2005) is presently caught in the east coast. Approximately 7%[2] of the east coast catch is reported as having been caught in the Port Douglas area in 2007. The commercial east coast - inshore finfish fishery supports between 94 and 149 commercial vessels, comprising as many as 145 gill netters. These vessels are of varying sizes. A number of small inshore liners also operate along the east coast, including 1 in Port Douglas and 2 in the Daintree area. Commercial gill netting between Port Douglas to the Daintree has also occurred in the last 5 years (2003 onwards) from Cairns based vessels operating in a seasonal fishery (between July to September). Up to four larger vessels are reported to be active, along with a further 4-6 smaller stranger craft. This period of fishing is reported by locals fishers as coinciding with spawning congregations[3].

The East Coast and Gulf of Carpentaria recreational fishery is reported to catch around 18 tons (1997/1998) in total, but recent surveys may indicate significantly larger numbers of fish taken by the recreational sector within Queensland[4]). Up to 19,000 recreational vessels are reported as having caught grey mackerel[5]. However, Cameron & Begg state that the grey mackerel fishery is essentially a commercial fishery with the recreational sector harvesting less than 5% of the overall estimated harvest[6]. 1,949 recreational boats targeted "small" mackerel (incl. grey, spotted and school or 'doggies') in Far North Queensland.

The data suggests that both the commercial and recreational fisheries have seen dramatic increases in effort from 1995 to 2005[7] (Figure 1), and 12,000 fish caught by recreational fishers in 2005 as opposed to 6,000 in 1999, and 2,000 in 2002.

[2] Extracted from Egstrome N, Technical Officer, Department of Primary Industries and Fisheries, e-mal and data extract, 27 February 2008

[3] Mark Harris, pers com, September-October 2008

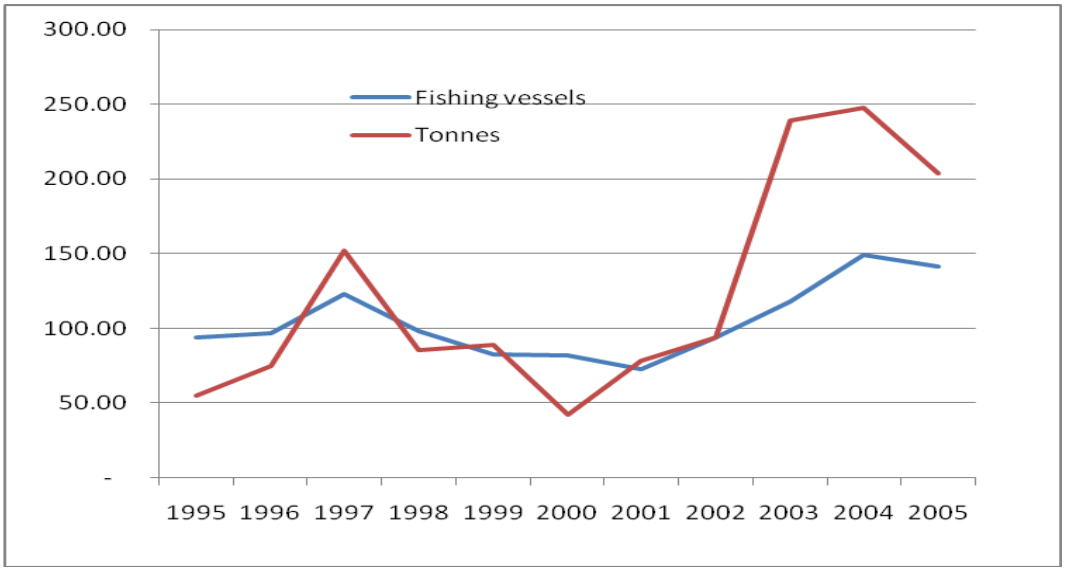
[4] DPI conducts sporadic assessments of recreational catches by species. Data was collected in the periods 1999,2002 and 2005. These indicate a six fold increase in the numbers of grey mackerel caught in the period.

[5] Williams, L.E, Queensland's fisheries resources, current conditions and recent trends, 1988-2000

[6] Cameron D and Begg G (2002), Fisheries biology and interaction in the northern Australian small mackerel fishery; pp 13

[7] Williams (*op cit*) states that pre 1995, the east coast commercial netting fishery declined significantly.

Figure 1: Changes in commercial grey mackerel fishing effort and catches, 1995-2005.



Source: DPIQ, Queensland catch statistics, http://chrisweb.dpi.qld.gov.au/CHRIS/

It is not clear what the source of growth in the number of commercial gill netters is. This may be as a result of increased targeting of grey mackerel by east coast gill netters, as opposed to the other target species (shark, barramundi, king, blue threadfins and shark[8]). It is noted however, that fishery scientists and the Inshore Finfish Management Advisory Committee) MACs have warned of increases in commercial gill net activity along the Queensland east coast.

- Cameron & Begg[9] cite that there is enormous potential (particularly in east coast waters) for additional licensed commercial fishers who have not previously harvested small mackerel (spotted and grey mackerel) to target small mackerel species in the future.

- Stakeholders[10] have recently expressed concern about the potential for effort to expand in the commercial net fishery. The recreational sector was concerned that this may potentially result in a reallocation of resources towards the net fishery. Commercial fishes were also concerned as this may affect the viability of current operators in the fishery (Finfish MAC).

Cameron & Begg cite the increase in international market demand as a significant factor leading to the increase in the targeting of grey mackerel.

The commercial value of the fishery is estimated at $ 3.3million (2005)[11]. The most profitable markets are reported as being for whole, line caught fish exported to Japan and Taiwan[12].

[8] Source: DPI (http://www2.dpi.qld.gov.au/fishweb/12542.html#3)

[9] Cameron & Begg (*op cit)*

[10] Management Advisory Committee Meeting 3/08 held 28-29 May 2008 (http://www.dpi.qld.gov.au/documents/Fisheries_PolicyAndLegislation/Inshore-MAC-meeting-3-2008.pdf)

[11] http://chrisweb.dpi.qld.gov.au/CHRIS/

Biological and ecological background

Grey mackerel are distributed in the waters of Northern Australia from Shark Bay in Western Australia to Northern New South Wales and Southern Papua New Guinea. They are pelagic species that are generally captured in inshore waters of higher turbidity. There are at least five genetically distinct stocks in Northern Australia, at least two on the east coast, the Gulf of Carpentaria, Northern Australia and Western Australia[13]. There is some evidence that larvae and juveniles are dependent on estuarine and coastal habitats and freshwater flows. Most fish are often found in large bays and off coastal headlands.

The literature indicates that Grey mackerel appear to spawn across their entire Queensland distribution between October to January but this is disputed by local fishers[14]. Recent work by David Welch *et al* however found that gonad indices were highest in September and most fish had spawned by December.

The fish may be restricted to smaller local areas, as referred to in the James Cook University research surveys but the evidence is unclear[15]. Tagging of Queensland school mackerel (doggies) (*S. queenslandicus*) support the concept of a number of (different) local stocks [16].

The Cameron & Begg management related recommendations were as follows:

- Small mackerel species (grey, Queensland school and spotted mackerel, *S. munroi*) should be managed with utmost caution until detailed stock assessments are undertaken
- School, spotted and grey mackerel are considered as separate species for management purposes
- Implement improvements to the Queensland Commercial Logbook (QFISH)[17] Program as data is inadequate to monitor the status of mackerel stocks and dependent fisheries.
- Access point and on-site surveys investigating recreational harvest and effort for small scale mackerel species should be designed and undertaken to validate and compare recreational harvest estimates

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[12] Stephen Grainger, formerly Port Douglas Seafoods, exported whole brain spiked, chilled fish direct to Japanese market in between 2003-2007 (Steve Grainger pers com, September 2008)

[13] David Welch, Presentation of survey results of a multi technique analysis of the grey mackerel stocks (genetics, parasites, otolith and growth characteristics) in Northern Australia, Biologist, James Cook University, presentation to LMAC 14 October

[14] Information from local Daintree fishers indicate spawning aggregations as early as mid June.

[15] David Welch s

[16] Cameron and Begg, 2002

[17] At the time of writing, the author was unclear as to what specific changes were made to data recording from QFISH to the current CFISH log book system and whether this has made any changes to the recording system.

Management responsibility

The fishery is classified as a component of the inshore fin fish fishery regulated under Queensland's Fisheries Regulations 1995. Commercial and recreational vessels are required to have a licence. The commercial boat licence must be officially "endorsed" for the particular fishery (that is, marked with the symbol that stands for that fishery). Each symbol denotes a certain geographical area (usually the entire east coast), target species and type of gear. As from 1984, no new primary commercial fishing boat licences are being issued.

The regulations include:

- area closures (certain areas are *closed* to netting under the *Fisheries Act 1994* and Marine Parks legislation - closure information can also be found in the *Fisheries Regulation 2008* and the *Fisheries (Gulf of Carpentaria Inshore Fin Fish) Management Plan 1999*)
- closures during spawning season
- restrictions on the number, length, drop and mesh size of nets
- restrictions on the minimum legal size of fish and in some cases Total Allowable Catches (TACs)
- net attendance requirements

Licences are transferable between vessels, irrespective of the size of that vessel.

The details of the regulations are different for the different species and fisheries:

- Harvest of barramundi is not permitted
    - in the Gulf of Carpentaria typically between October and January. The closing and opening dates are variable in this fishery, as they depend on the timing of the full moon in the calendar year.
    - on the east coast between 1 November and 1 January, effectively closing the fishery to all netting activity.
- A number of species, including Spanish and spotted mackerel, must not be targeted by commercial net fishers.
- A Size limit (recreational and commercial): A minimum size of 50cm applies to grey mackerel on the East Coast of Queensland however the size of females at first maturity is reported as 75 cm total length (Cameron & Begg, *loc.cit.*)
- Take and possession limit: Recreational fishers are limited to 10 grey mackerel.

Some specific local access prohibitions also exist including ones set by either DPI, in response to preventing an expansion in effort (Trinity Inlet); or by GBRMPA, in response to a pressure on local stocks (Trawl closure, Prince Charlotte Bay[18]) and by closures covered by the GBRMPA Representative Areas Program (RAP)

By-catch issues

Non target species

In waters between Port Douglas and Cape Tribulation other three mackerel species, namely Spanish mackerel (*Scomberomorus commerson*) spotted mackerel and Queensland school mackerel

[18] Queensland Fisheries Regulation 2008

are often caught during line fishing trips targeting grey mackerel in the same location and over the same period as the grey mackerel aggregate[19]. Fishers report that they sometimes contain near ripe roe or milt. It is possible that the offshore gill net boats when fishing in these waters also take numbers of Spanish mackerel, spotted mackerel and Queensland school mackerel all of which reach a maximum size of 100 cm or more. There is no analytical evidence to suggest that these species may or may not be caught in the net sizes 150 to 215 mm in diameter. However, there is video evidence of at least one large Spanish mackerel being landed by an offshore net boat[20]. One significant problem is that without a one gear rule, fishers could claim that mackerels, other than grey mackerel are caught in lines, as opposed to gill netting during the same trip.

Other pelagic species in the local area, including on the grey mackerel fishing grounds during the grey mackerel fishing season include the northern bluefin or longtail tuna (*Thunnus tonggol*) and bigeye tuna (*T. obesus*). Even if concerted effort is maintained by the netters to avoid the capture of tuna it is also possible that quantities of tuna would be caught in the nets from time to time.

A number of shark species including hammer heads have been observed being captured in nets set for grey mackerel in local waters[21]. The same gear is used by the offshore net boats for targeting shark outside of the grey mackerel season.

Other vertebrates

Environmental Protection Agency collects data on marine strandings in Queensland. It cites the following

- Over the last 40 years, numbers of nesting loggerhead turtles have declined (at various nesting beaches) by between 50% and 80%[i]. Incidences of 12-15 individual strandings are reported in the Daintree[22] area. 58%occurring in the period of peak netting activity;
- Estimates of dugong populations indicate that they are currently only about 3 percent of population levels in the early 1960s[ii]. Incidental catches in mesh netting is cited as a key area of concern[23];
- Whales are reported as the most likely cetacean species to be caught in commercial netting[24] within the region (latitude 16).

[19] Mark Harris, pers. com.

[20] David Cook, video record (pers.com.)

[21] David Cook, video record (pers. com.)

[22] Environmental Protection Agency, Marine strandings, Queensland marine wildlife stranding and mortality database annual report 2001-2002: III. Marine turtles (http://www.epa.qld.gov.au/publications/p01293aa.pdf/Queensland_marine_wildlife_stranding_and_mortality_database_annual_report_20012002_III_Marine_turtles.pdf)

[23] Great Barrier Reef Marine Park Authority, Environmental Status, Marine mammals, http://www.gbrmpa.gov.au/corp_site/info_services/publications/sotr/latest_updates/marine_mammals

[24] Environmental Protection Agency, Marine strandings, Marine wildlife stranding and mortality database annual report 2006: II. Cetacean and pinnipeds

Stakeholders

Stakeholders comprise:

1. Commercial and recreational fishers

- 19,000 recreational fishers and charterers,
- 149 commercial vessels, crew (1 to 4 fishers per vessel) and their owners.

2. Downstream and upstream dependents

- Commercial and recreational gear suppliers
- Processors and fish trades
- Up stream hoteliers, restaurateurs and grocery supply shops

3. The Management and control authorities

- The Department of Primary Industry, Queensland
- The Great Barrier Reef Marine Parks Authority
- The Department of Environment and Water Resources
- The Commonwealth Government

Some of these groups sit on the Fin Fish Management Advisory Committee which advises the State Minister and the Department of Primary Industry.

Relevant Management Measures and control systems

The relevant management and control legislation that should be considered when formulating changes should be as follows:

- The Fisheries Management Act (Commonwealth) 1991
- The Environment, Protection and Bio Diversity Act (Commonwealth), 1991
- The Environmental Protection and Biodiversity Conservation Act (Commonwealth), 1999
- The Environmental Protection and Biodiversity Conservation Regulation (Commonwealth), 2000
- The Fisheries Administration Act (Commonwealth), 1991
- The Great Barrier Reef Marine Park Act (Commonwealth), 1975
- The Gene Technology Act (Commonwealth), 2000
- The Fisheries Act (Queensland), 1994
- The Fisheries Amendment Regulation (Queensland) 2008.

The following key issues are relevant to the above acts:

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http://www.epa.qld.gov.au/publications/p02292aa.pdf/Marine_wildlife_stranding_and_mortality_database_annual_report_2006_II_Cetacean_and_pinnipeds.pdf

The Fisheries Act 1994 (Queensland) and Fisheries Amendment Regulation (Queensland) 1995 provides the background for Queensland's management controls and jurisdictional responsibility. It applies management measures to the fin fish gill net fishery amongst others. It is noted that some species, such as barramundi, are protected by regulated periods when they are spawning and more vulnerable to fishing pressure. For example, on Queensland's east coast the barramundi regulated period is at the time of year when spawning takes place (midday 1 November to mid day 1 February).

Some waters are closed to fishing to protect fish in these areas[25]. Regulated waters are of various kinds:

- where a population of endangered or threatened species lives;
- where fish congregate before spawning;
- where fish contribute to adjacent areas that are fished; and
- where fish may mass or be stranded at or near artificial barriers.

The Environmental Protection and Biodiversity Conservation Regulation (Commonwealth), 2000, requires that for all fisheries, from which product is exported, must undergo assessment to determine the extent to which management arrangements will ensure that the fishery is managed in an ecologically sustainable way. These 'Wildlife Trade Operations' Accreditation (WTOs) are set for three years, and 58 fisheries are listed[26]. The summary guidelines for ecologically sustainable management of fisheries are cited below:

Table 1: Guidelines for ecologically sustainable management of fisheries

Fishery	Area of interest	Yes	No
Fishery			
External influences			
Interaction with protected species			
Ecosystem impact (eg habitat, food chains etc)			
Target stock status			
By product and by-catch stock status			

[25] Laws relating to Queensland's Net Fisheries

[26] Department of the Environment, Water, Heritage and the Arts (http://www.environment.gov.au/biodiversity/trade-use/sources/operations/index.html#commercial)

The Fisheries Management Act (Commonwealth) 1991, The Environment, Protection and Bio Diversity Act (Commonwealth), 1991, The Environmental Protection and Biodiversity Conservation Act (Commonwealth), 1999, The Fisheries Administration Act (Commonwealth), 1991, The Great Barrier Reef Marine Park Act (Commonwealth), 1975, The Gene Technology Act (Commonwealth), 2000 all cite reference to the precautionary principle. A summary of the relevant references is shown in Table 2.

Table 2: References to the Precautionary principle in National Acts

Jurisdiction	Legislation	Section	Formulation
FED	The Environmental Protection and Biodiversity Conservation Act1999	391(2)Minister must consider the precautionary principle in making decisions	The precautionary principle is that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage
FED	The Environmental Protection and Biodiversity Conservation Act, 1999	Schedule 7Australian Biosphere Reserve Management Principles, Schedule 8: Australian IUCN Reserve Management Principles	Decision making must be consistent with the precautionary principle
FED	The Fisheries Administration Act, 1991	3 – objectives of the Act	Same as 351 IGAE
FED	The Fisheries Administration Act (Commonwealth), 1991	6 – objectives	Same as 351 IGAE
FED	The Great Barrier Reef Marine Park Act, 1975	39Z – must have regard to the precautionary principles when preparing management plans	Same as 351 IGAE
FED	The Gene Technology Act, 2000	4 (ea) Objects	Where there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing cost effective measures to prevent environmental degradation

Source: Weire A and Lok P

The precautionary principle is required by Law to be applied at Commonwealth Level by the Australian Fishery management Authority and at States' level by the Department of Primary Industry (and other cooperative bodies,, including the Great Barrier Reef marine parks Authority). The process is defined by law requiring participatory risk assessment to be undertaken prior to the adoption of management measures.

The precautionary approach adopted recognizes that:

- all fishing activities have significant impacts;
- fisheries impacts are not negligible unless proved otherwise;
- the complex and changing fishery system will never be perfectly understood;
- scientific advice for management is therefore always affected by uncertainty;
- management decision processes and sector's compliance add their own uncertainties;
- impacts of fisheries on the system are therefore difficult to predict accurately; and,
- consequences of management errors may be only slowly reversible.

As a consequence, and recognising that the conduct of fisheries requires that decisions are still made with incomplete knowledge, the approach requires *inter alia* that:

- a level of precaution commensurate to risk be applied at all times to all fisheries;
- it be applied systematically, i.e. in research, management and fishing operations;
- potentially irreversible changes be avoided (to maintain options for future generations);
- undesirable outcomes be anticipated and measures be taken to reduce their likelihood;
- corrective measures be applied immediately and be effective within an acceptable time;
- priority be given to conserving the productive capacity of the resource;
- precautionary limits be put on fishing capacity on highly uncertain resources;
- all fishing activities be subjected to prior authorisation and periodic review;
- the burden of proof be appropriately (realistically) placed;
- standards of proof commensurate with the potential risk to the resource be established;
- the approach is formalized in a comprehensive legal and institutional framework.

It is noteworthy that Australian Fisheries Management Authority decisions to apply the Precautionary Principle have been upheld in a number of cases, following referral to the Administrative Appeals Tribunal (AATA)[27].

The participatory risk assessment process takes the form of the following:

- Determination of the principal hazards from fishing activity;
- Determining the consequences of hazards
- Determine Likelihood of Consequence Realization
- Determine the options;
- Estimate the risks under each option; and
- Evaluate other synergistic and interacting information. This typically involves, cost-benefit, risk-risk, and risk-benefit analyses; assessing technical feasibility; determining social acceptability, legal conformance and regulatory objectives, and political perceptions and; assessing enforceability.

[27] *Weire A and Paul Loke'* Precaution and the Precautionary Principle: two Australian case studies

The case for controls to be applied in the Daintree fishery

The following observations have been sourced from discussions between the author and local stakeholders. These comments are consistent with those recorded and reported by the David Cook in various papers and letter to the Department of Primary Industry.

Douglas Shire commercial line fishers, charter fishers, recreational fishers, including annual visiting fishers, have up to 40 years fishing experience of the annual three to four month grey mackerel fishery in local waters.

The seasonal fishery in Douglas Shire used to last from late May/early June to mid September and is reportedly based on pre-spawning aggregations at well known localised fishing grounds. Catches reveal that roe are ripening throughout this period whilst the species feeds voraciously on bait fish.

Over the last few years, especially from 2004 onwards, Douglas Shire fishers have reported the numbers, size and frequency of grey mackerel schools to have dropped sharply and the arrival or formation of schools has become progressively later until the current year when no schools of any significant size were located by local commercial line fishers[28]. In addition stocks of other large inshore fish have also fallen markedly whilst stocks of baitfish have not been assessed although there is some anecdotal information that schools of baitfish may not be as large as they were previously. The locals state that '*schools of greys the size football fields have been reduced to those the size table tennis tables*'. One commercial line fisher who used to catch between 500 and 800 fish per season caught less than 100 in 2007 and 55 by the close of the current season.

The local fishers cite the decline as coinciding with the appearance of commercial netting in the area. The number of anglers and charterers has reportedly remained fairly constant although many recreational fishers report having given up trying to catch grey mackerel over the last three years as their efforts have proven fruitless.

The two remaining local grey mackerel line fishers have reported hardly covering the cost of their fuel whilst fishing grey mackerel in 2007 and 2008 and certainly not making a liveable wage. The species had previously been one on which they made significant earnings.

Local businesses in Douglas Shire, particularly caravan park owners have started to report loss of patrons as a result of poor catches from inshore fin fish catches in comparison to previous years whilst local fishers are reporting a loss of recreational opportunity and reward for effort and expenditure. Holiday makers with tinnies in tow or on the roof rack are beginning to seek alternative areas looking for better inshore fishing, especially during the winter months, as a result of poor catches of inshore and estuary fish over the past few years.

Locals, long accustomed to making significant catches of grey mackerel during the season are now unable to do so.

The locals and visiting recreational fishers, until recently, kept a healthy support industry of bait and tackle shops and outboard motor agents in business. Whilst the outer reef fishery is

[28] Mark Harris, Col Patterson pers. com. October 2008

apparently fairly healthy, the boat, tackle and tourism sectors are now loosing potential revenue from inshore fishers. Retirees, holiday makers and local owners of smaller tinnies (small aluminium dinghies) who do not normally fish the outer reef because of the distances involved, including the risk in small craft and fuel expenses are giving up fishing in the shire as word spreads of a shortage of fish of catchable size in FNQ inshore waters

Analysis

The analysis below summarises the application of two of the analytical processes that should already have been applied by the regulators. The first being the participatory approach that could have led to the introduction of management measures (Tables 3-5); and second, accreditation, required in order to meet with WTO (Table 6). The author has not consulted the commercial netting sector, but drawn from reported conclusions contained within this report. Such a consultation should have been forthcoming from the Management authorities.

Specific conclusions are as:

The main exploitation hazards (Table 3) are the grey mackerel fishery, its legal and illegal by-catches (Spotted and Spanish mackerel, as well as shark, and the entrapment of cetaceans, sea turtle and dugongs;

The environmental consequences (Table 4) of commercial fishing activity are seen as 'Significant' (target species) to 'Moderate' (by-catches). The environmental consequences of other fisheries (lining and recreational angling) are seen as 'Catastrophic' to the local line fishers' to 'Major' to recreational fishers.

The economic consequences (Table 5) suggest 'Catastrophic' impacts to the local economy linked to a loss of revenue from recreational fishing and to local lining, and a 'Moderate' impact to commercial netting, as a result of its ability to mitigate losses by transferring to other areas. A transfer of effort may of course have an impact on other areas.

The socio political consequences (Table 5) are seen as 'Significant' for the recreational and lining sector, but 'Moderate' for the commercial sector. However, non compliance issues and incidental by-catches will have significant consequences for the commercial sector.

The consequences of inaction (Table 5) for the fishery are perceived to be 'High', the consequences for other by-catch hazards as 'Moderate', but these could prove to be 'Significant' if it was found that by-catches of non target species were prevalent - Spotted mackerel, Spanish mackerel, shark and others, as well as sea turtles, whales and dugongs.

Based on the evidence (Table 6), Grey mackerel is unlikely to be accredited WTO status until appropriate and specific management measures are applied, and incidental by-catch recording takes place. This may require the introduction of an observer programme.

This report does not take the risk analysis any further, as it recognises the need for appropriate consultation processes. These processes should formulate management measures which can be agreed, through appropriate participatory analysis, by all the relevant stakeholders.

Table 3: Defining principal hazards

Hazard / Fishing method	Grey mackerel stocks	Targeted by-catch: threadfin, barramundi (if holding N2 licence), spawning aggregations of fingermark, sharks,	Non targeted by-catch: Queenfish, Spanish, spotted and school mackerel, barramundi (if not holding an N2 licence)	Other vertebrates
Commercial gill netting	Fishing effort highly significant to the localised area. 2% of the predominantly active fleet (2-4 vessels), participating occasionally, but landing up to7% of the total east coast catch from the local area in 2007.	Concerns about barramundi in their spawning season Concerns that spawning aggregations of fingermark have been repeatedly targeted by one offshore netter on their needing ground off the Daintree; local stocks of this species at an all time low.[29]	High propensity to catch spotted, school and Spanish mackerel and queenfish in nets used by commercial gill netters. Numbers of queenfish, a large inshore coastal fish popular with anglers for its fighting ability are much reduced in the Daintree area[30]	The likelihood of Gill nets being responsible for strandings of turtles and whales is high (EPA). Higher recordings in data during commercial fishing season –July to September inclusive. Dugongs also likely to be entangled but now very rare locally, some localised evidence of strandings
Local Lining	Highly selective fishing method	Low	Low	Nil

[29] Jamie Beitzel, charter fisher, pers. com.

[30] Jamie Beitzel, charter fisher, pers. comm..

Recreational angling	Only accounts for 5% of catch (Cameron & Begg), though may be higher in FNQ.	Low: proportional to numbers of recreational fishers in given areas, but managed by species specific size and bag limits	Low: proportional to numbers of recreational fishers in given areas, but managed by species specific size and bag limits	Nil to very low

Table 4: The consequences of hazards. Each response has to have the following pre-fix: Catastrophic, Major, Moderate, Minor

	Environmental impacts	Economic impacts	Social and political impacts	Cultural impacts
Fish stocks (including commercial by-catches)				
Commercial offshore gill netting	**Major** - Inability of the stock to recover if localised, resulting in a transfer to other areas, with increased conflict in these zones with other fisher groups	**Moderate** - Low impact relative to above. Only around 2-4 offshore commercial net fishers affected, as well as ability of offshore gill netters to mitigate loss by transferring effort elsewhere(perhaps to other localised fisheries eventually leading to possibility of new cases of localised overfishing)	**Moderate** - Small number of fishers with propensity to generate local political interest. Minimal social impact	**Minor** - No impact on indigenous population but resulting in loss of a local population's 40 yr old 'tradition' of making good recreational catches of grey mackerel and other large inshore species
Local Commercial Lining	**Catastrophic –** No or limited recruitment and Local fishery destroyed	**Catastrophic** - Small number of local liners and charter fishers loosing livelihoods, with need to transfer to other economic activities (most probably tourism).	**Major** - Local commercial liners are well integrated with the local community. They serve as indicators to local recreational fishers when greys are on the	**Minor** - No impact on indigenous population

		Some concern about the ability of local economy to absorb local commercial fishers. The local commercial line fishery provides a small amount of employment but a significant source of top quality fish to the local restaurants, shops and through direct sales while purchasing fuel and gear locally	fishing grounds, word travels fast and the recreational fishers make a point of going out when the commercial line fishers are catching	
Recreational angling	**Major** - No or limited recruitment and Local fishery destroyed	**Catastrophic** - Large numbers affected in the local economy. Long term Impact on local charterers, line, fishers, holiday makers, hoteliers, suppliers et	**Significant** - Unrest from local and visiting anglers, with the propensity for political concern with a loss of tourist revenues to the economy	**Minor** - No impact on indigenous population
Non targeted by-catch				
Commercial gill netting	**Moderate** - Threat to some fish stocks. By-catch levels probably not too significant but representing non compliance. No observer data to verify species by-catch	**Moderate –** presuming that targeted stocks represent the majority of the income, especially as Grey mackerel commands a premium price against other target fisheries	**Moderate** - Small number of fishers with propensity to generate local political interest. Minimal social impact	**Minor** - No impact on indigenous population
Local Lining	**Minor –** Not deemed to be significant	**Minor –** Not deemed to be significant	**Minor –** Not deemed to be significant	**Minor** - No impact on indigenous population
Recreational angling	**Minor –** Not deemed to be significant	**Minor –** Not deemed to be significant	**Minor –** Not deemed to be significant	**Minor** - No impact on indigenous population

Other vertebrates				
Commercial gill netting	**Moderate** – EPA findings suggest strandings linked to gill netting. No observer data to suggest anything to the contrary.	**Moderate** – If by-catches are small, fairly insignificant economic implications, but if not, then highly Significant.	**Significant** – Small numbers still draw considerable adverse publicity	**Minor** - No impact on indigenous population
Local Lining	**Minor** – Not deemed to be significant	**Minor** – Not deemed to be significant	**Minor** – Not deemed to be significant	**Minor** - No impact on indigenous population
Recreational angling	**Minor** – Not deemed to be significant	**Minor** – Not deemed to be significant	**Minor** – Not deemed to be significant	**Minor** - No impact on indigenous population

Note: The process is required to be participatory. The table represents the author's interpretation of findings, which would be altered in the appropriate consultation environment.

Table 5. Determine Likelihood of Consequence Realization (Risk Matrix, where risk is denoted by: N = negligible; L = low, M = moderate; H = high; E = extreme)

Fish stocks					
Consequence / Likelihood	**Insignificant**	**Minor**	**Moderate**	**Major**	**Catastrophic**
Rare					

Unlikely					
Possible					
Occasional					
Likely				H	E
Non targeted by-catch					
Consequence / Likelihood	**Insignificant**	**Minor**	**Moderate**	**Major**	**Catastrophic**
Rare			H		
Unlikely			H		
Possible			M		
Occasional			M		
Likely			M		

Other vertebrates					
	Consequence				
Consequence / **Likelihood**	**Insignificant**	**Minor**	**Moderate**	**Major**	**Catastrophic**
Rare					
Unlikely					
Possible					
Occasional					
Likely			M	H	

Table 5: Guidelines for ecologically sustainable management of fisheries

Fishery	Area of interest	Yes	No
Fishery	Grey mackerel	√	
External influences	Unknown		
Interaction with protected species	Some interactions with shark and Spanish mackerel. No observer verification available.	√	
Ecosystem impact (eg habitat, food chains etc)	Unknown		
Target stock status	Uncertain. Requires specific management measures to be applied, as opposed to measures relating to global finfish gill netting	√	
By product and by-catch stock status	Potential interactions and by catches of cetaceans, sea turtles and whales. No observer verification available	√	

Conclusions

The following relevant observations may be made:

1. Management precedents have been set in other netting fisheries (Queensland East Coast barramundi and Trinity Inlet) and trawl fisheries (Princess Charlotte Bay), but not in the case of the small mackerel fisheries, including grey mackerel.

2. Throughout east coast of Queensland, it could be argued that there is a need to manage all mackerel fisheries with utmost caution and that each stock should be managed separately (Cameron & Begg, 2002). It is also evident that there are at least two distinct stocks on the east coast of Queensland (Welch, 2008)

3. The MAC calls for caution as a result of an expansion in fishing effort by the commercial and recreational fishery sector. No caution has taken place and it would appear that latent effort has been allowed to expand to active effort in the fishery with a significant increase in the commercial catch between the periods 2000 to 2005. The MAC points to the problem of effort expansion increasing in both the commercial and recreational fisheries.

4. The management authorities, including the Department of Primary Industry, Queensland, and the Great Barrier Reef Marine Parks Authority are required by Law to apply the Precautionary Principle, or at the very least undertake a participatory risk analysis evaluation in the event of any doubt as to the state of the stocks. Were the principle to be subjected to the appropriate participatory process it would point to Significant concerns in respect to commercial gill netting in the Douglas shire area, and a damage to economic well being of the local economy if left unchecked;

5. The catches of the commercial gill netters in 2006 and 2007 would suggest that the fishery was extremely significant in terms of catch and cpue, when compared to other East Coast Queensland fisheries.

6. Precautionary principle management decisions are upheld when applied, providing that the appropriate risk assessment mechanisms is used. There is therefore no reason to wait for scientific evidence to demonstrate that a management problem exists. The prescribed analytical process will already show that there is cause for concern.

7. The Management and control authorities (The Department of Environment and Water Resources, The Department of Primary Industry and the Great Barrier Marine Parks Authority) require WTO/fishery accreditation for all fisheries from which product is exported. No WTO exists for grey mackerel or the east coast Finfish gill net fishery, with grey mackerel exported whole to Japan. If applied, the grey mackerel fishery under its current management regime is unlikely to secure a WTO.

8. Prior to 2004, the catch records of commercial fishers operating in the Douglas shire area were not significant. The growth in activity and effort is recent, with corresponding local

evidence of dramatic reductions in catch by local fishers. Commercial gill netters, as opposed to local liners and recreational fishers are not be able to demonstrate a significant historic track record in the fishery prior to 2006.

Acronyms

AATA	Administrative Appeals Tribunal
AFMA	Australian Fisheries Management Authority
DPIQ	Department of Primary Industry Queensland
EPA	Environment Protection Agency
FNQ	Far North Queensland
GBRMPA	Great Barrier Reef Marine Parks Authority
MAC	Management Advisory Committee
QFISH	Queensland Commercial Logbook
WTO	Wildlife Trade Operations
MBFC	Mossman Boat & Fishing Club
NSF	Network for Sustainable Fishing in Douglas Shire

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