Marine and Tropical Sciences Research Facility (MTSRF)
December 2008 Milestone Report

Project 4.8.4 – Evaluation of the Impacts from Industry and Community uses on Inshore biodiversity

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Summary

The project continues to track smoothly with all milestones achieved in the last period. The project will ultimately produce a risk assessment for inshore ecosystems in the GBRWHA. The project continues to collect data appropriate for ecosystem risk assessment.

For reference: Milestone extracted from Project Schedule

1 December 2008

Description

- Work with QDPI&F on the observer surveys on commercial vessels (co-funding).
- Continue boat ramp surveys for recreational fishers.
- Continue sample collection from commercial fishers and seafood processors.
- Continue processing of biological samples.
- Develop Ecological Risk Assessment framework for inshore species.
- Collate data from DPI&F observer surveys.
- Briefing to DEH, DPI&F, Inshore finfish MAC, CapReef SC & GBRMPA FRAC, QSIA (including regional offices), Sunfish (including regional offices),

Project Results

Description of the results achieved for this milestone
The project is currently on track and is not experiencing any problems with achieving the set milestones.

1. ***Work with QDPI&F on the observer surveys on commercial vessels (co-funding).***
   Project staff continue to collect fisheries observer data from the commercial fishing industry, and communicate frequently with QDPI&F staff to coordinate activities. QDPI&F observers have continued to offer professional assistance and collaboration to MTSRF project staff. Core project staff will negotiate data sharing agreements in the near future.

2. ***Continue boat ramp surveys for recreational fishers.***
   Boat ramp surveys of the recreational fishery continue to be conducted by project staff throughout the greater Townsville region as well as by CapReef volunteers throughout the Yeppoon-Capricornia district. Core project staff will negotiate data sharing agreements in the near future.

3. ***Continue sample collection from commercial fishers and seafood processors.***
   The collection of biological samples from commercial fishers and seafood processors continues to be a difficult task in some areas, particularly for fish species. Gradual markets changes over the last decade encourage most product landed by the fishery be in whole on-ice form rather than the traditional form of gilled and gutted on-ice. The whole on-ice product form prevents the collection of desired biological samples including gonads for reproductive work and otoliths for ageing. We have also observed a strong regional trend in the form of landed fish. The closer a fisher is to major market opportunities, the greater the probability that the landed product will be in whole on-ice form. Despite concerted efforts to achieve a representative spread of biological sampling from throughout the GBRWHA, the collection of biological fish samples continues to be skewed to the Townsville and Rockhampton districts.

   Biological sample collection from the shark component of commercial fishers catches, presents much less of an issue. Sharks captured by the commercial fishery are either trunked or filleted allowing project observer's free access to the required biological samples.

4. ***Continue processing of biological samples.***
   Project staff and associated post-graduate students continue to efficiently process biological samples as they are sourced. Preliminary ageing of some fish and shark species has begun.

5. ***Develop Ecological Risk Assessment framework for inshore species.***
   Core project staff (Tobin and Simpfendorfer) has developed a framework for the Ecological Risk Assessment of the Queensland east coast Inshore Fin Fishery that operates within the GBRWHA. The framework can be viewed in the attached document.

6. ***Collate data from DPI&F observer surveys***
   A data request has been lodged with QDPI&F for access to their onboard observer data. As yet, this data has not been received.

7. ***Briefing to DEH, DPI&F, Inshore finfish MAC, CapReef SC & GBRMPA FRAC, QSIA*** *(including regional offices), Sunfish (including regional offices)*
   Project staff has had the opportunity to present briefings to numerous stakeholder groups since the last reporting period. Please refer to the communications section below.

Explanation of Activity changes

Project fisheries observer Olivier Bittar resigned in September 2008 to pursue other interests and was replaced in a timely manner by Jimmy White. No time was lost in this change of personnel.

Disappointing success with sourcing biological samples from commercial fish wholesalers has resulted in the project team adopting two new approaches to gathering biological samples for key fin fish species.

Problems and opportunities

In order to overcome the lack of biological samples for some fish species, the project team has adopted two additional sampling methods to complement the fisher and processor sampling. Firstly, in collaboration with boat ramp surveys, project staff are collecting biological samples from recreational fishers catches in the Hinchinbrook area through the helpful assistance from the Wanderers Caravan Park. Secondly, project staff are conducting a monthly independent net sampling trip in the greater Townsville region to maintain a consistent monthly sampling of biological samples for major target species. These two activities combined are adding significant value particularly to the monthly collection of biological samples.

Communications, major activities or events

During milestone reporting period

Project briefings have been given to:

- CapReef Steering Committee
- SUNFISH North Queensland
- Queensland Seafood Industry Association
- Balgal Beach Boating and Fishing Leisure Club
- Townsville Local Marine Advisory Committee (GBRMPA)
- Port Douglas Local Marine Advisory Committee (GBRMPA)
- Queensland Department of Primary Industries and Fisheries

Ecological Risk Assessment framework for inshore species.

Background.

Ecological risk assessments (ERAs) are useful tools for both marine park and fisheries resource managers who are increasingly pressured to consider a whole-of-system approach to fisheries and marine park management (Stobutzki *et al* 2001). The application of an ERA is particularly useful for fisheries where data limitations preclude more formal fishery status and/or stock assessments. ERAs are also usefully applied to fisheries such as the Queensland East Coast Inshore Fin Fish Fishery (ECIFFF) that targets and interact with a wide variety of shark and fin fish species. Further, all Australian fisheries with an export component (such as the ECIFFF) require assessment in accordance with the *Environment Prtection and Biodiversity Protection* (EPBC) *Act 1999* to ensure fishing activities are conducted in an ecologically sustainable manner.

The ability to demonstrate long-term ecological sustainability is at the core of many fisheries management strategies introduced in recent times (Griffiths *et al* 2006). For commercial and recreational fisheries, management strategies are increasingly required to focus on not only target species, but also by-product and bycatch species. Historically, fisheries assessments have focused on stock assessments of the main or major target species. In reality, many fisheries interact with a diverse array of fin fish and shark and ray species, and most of these species are poorly understood biologically and ecologically.

This project will employ a hierarchical approach adapted from the Ecological Risk Assessment for the Effects of Fishing (ERAEF) methodology developed by Hobday *et al* (2007). Hobday *et al* (2007) describes a hierarchical three level approach that allows many potential fishing activity risks to be screened out of the assessment process early (as low risk activities), allowing for timely recognition of high-risk species and/or activities and suitable management responses.

Framework for Project 4.8.4 ERA

In compiling this draft framework we first considered the structure of the East Coast Inshore Fin Fish Fishery as it operates within the GBRWHA. The fishery is a particularly complex multi-sector (commercial, recreational, charter), multispecies and multi-gear fishery with an extensive geographical footprint extending from Cape York in the north to Bundaberg in the south.

The fishing activity of commercial fishers is controlled mostly by input management measures implemented by the Queensland Department of Primary Industries and Fisheries (QDPI&F). Multiple shark and fin fish species are targeted with a diverse array of net fishing gears (Table 1). Marketing opportunities available to commercial fishers vary considerably along the coast with some captured species marketed in some areas and discarded as unsaleable bycatch in others.

Within the recreational and charter fishing sectors (herein grouped and referred to as the recreational fishing sector), fishing activity is controlled largely by output management measures implemented by the QDPI&F. Similar to commercial activity, a diverse array of fish and shark species are targeted to satisfy a vast variety of motivations and needs (Table 1). Some recreational fishers are driven more by the experience than actually catching a fish; some fishers fish solely for food; while others fish simply for the sport of catch and release.

In considering the diverse nature of fishery, we consider it likely that an ERA will be conducted for the commercial and recreational fisheries sectors separately. Until all available and appropriate data sets are sourced (see Data Source Section), we consider it difficult to determine an exact approach at this stage. It is clear however, that these two fishery stakeholders utilise and exploit fisheries resources through the GBRWHA in very different and divergent manners. Further division of fishery components may be required particularly within the commercial fishery sector. However, until data collection exercises are completed there remains uncertainty about what sub-components may need to be treated in isolation through the risk assessment process.

In treating at least the commercial and recreational fishery sectors separately through the ERA process, focus will remain on the primary goal: an ERA for the entirety of fisheries use in inshore areas of the GBRWHA. We perceive this can be appropriately achieved by the weighting the respective risk outcomes determined for each component species by the relative importance of that component species to the two fishing sectors. For example, if barramundi are harvested twice as frequently by the commercial than the recreational fishery, the total fishery risk outcome will be a summation of the commercial risk outcome x 0.66 and the recreational risk outcome x 0.33. In estimating separate risk outcome measures for species whose harvest is shared between the two user groups, if management response is required it may be more appropriately directed and implemented.

Fishery Components

The fishery components to be included in the ERA are –

- Target species
- Byproduct species
- Bycatch species

Target species are generally easily identifiable for the commercial net fishery, as the compulsory commercial logbook data requires fishers to record the target species for each fishing day. Conversely, clear definition of byproduct and bycatch species will present a significant challenge. For example, dependent on fishing location as well as a fishers other fishing activities, net caught catfish may be either discarded as unsaleable bycatch, retained as saleable byproduct or retained for use as bait in the crab fishery. The final scenario is common practice for many commercial net fishers within the GBRWHA as most net fishers legally participate in the mud crab fishery simultaneously to the net fishery. To overcome these potentially confounding factors, project staff will liaise with representative commercial fishers throughout the GBRWHA region in order to best understand the discard/retain practices along the entire coastline of the GBRWHA.

Similarly, the retain vs discard practices of the recreational fishing community will also vary significantly between individuals (varied motivations) as well as regionally. All available data sources will be consulted to best estimate discard rates for each fin fish and shark species.

Data Availability

In recognising the complexity of the ECIFFF, the overall success of the ERA will be inextricably linked to the quantity and quality of the inputted data. The quantity of data will be important because of the diverse nature of the fishery and of the tendency of research and monitoring programs to focus on a particular defined component of the ECIFFF. Although a comprehensive ERA could be achieved using only those data collected directly by Project 4.8.4, sourcing and utilising other data sets may fill data gaps and/or valid and complement project data.

Project staff have begun to identify databases that contain fisheries catch composition and catch rate data for either of the fishery stakeholder groups activities throughout the GBRWHA. At this time, a number of appropriate data sources have been identified (Table 1) and formal negotiations will commence in the near future to gain access to these valuable information resources. Project staff will also review the availability of representative biological information that has been summarised and reported in an earlier project milestone.

Expert Stakeholder Representatives

The final outputs and outcomes of the ERA will be more robust to scrutiny and better received by the various stakeholder interests of the ECIFFF if expert representatives of these interest groups have a degree of input and ownership over the ERA methodology and process. Further, the very nature of conducting an ERA will include many qualitative assessments of risk (see Methodology section below). To allow for this qualitative component, the project team are eager to pursue appropriate expertise representative of each stakeholder group. At this time we have identified the need for expert representation and input from the following –

- Recreational fishery
- Commercial fishery
- Fisheries management
- Marine park management
- Protected species management
- Fin fish biology
- Shark biology
- ERA implementation

Much of this expertise representation is already incorporated by the existing research team of Project 4.8.4. Further expertise will be available through the variety of post-graduate student projects being conducted within the Fishing and Fisheries Research Centre group. Voluntary participation of recreational and commercial fishery representatives is likely and desirable.

ERA Methodology - 3 Level Hierarchical Approach

An ERA for the ECIFFF will be completed using a 3 level hierarchical application adapted from Hobday *et al* (2007).

1. *Qualitative Rapid Assessment (QRA)*
2. *Susceptibility and Recovery Analysis (SRA) and Euclidean Distance Ranking (EDR)*
3. *Formal species-specific status assessments*

1. QRA - Qualitative Rapid Assessment

The initial qualitative rapid assessment will be useful as a first instance tool to quickly identify those species whose biological traits and interaction rates with the ECIFFF are such that ecological risks are low at the current levels of fisheries interaction. Given the multitude of species with which the fishery interacts, leading the ERA with the QRA is a sensible approach to quickly identifying those species whose status (risk) requires scrutiny.

The success and acceptance of the QRA relies heavily on the quality of inputted data and the appropriateness of qualifying criterion. For a species to be ranked as low risk, comprehensive catch composition data for each fishery sector must be available and demonstrate low rates of interaction (catch rate) with all components of the fishery. Further,

biological data must clearly describe growth and reproductive characteristics that can be considered sufficiently robust for population recovery should population levels be negatively impacted by some fisheries dependent or independent event.

The final outcome of the step 1 QRA will be a group of species determined low risk and requiring no further attention, and a second group of species determined to be of higher or indeterminate risk and requiring further scrutiny.

2. Susceptibility and Recovery Analysis (SRA) and Euclidean Distance Plotting and Ranking (EDPR)

SRA is considered a sufficiently robust risk analysis tool that it has been employed as a stand-alone ERA method by a variety of previous research programs (see Stobutski *et al* 2001). Each species that was not ranked as low risk through the step 1 QRA will be further scrutinised as part of the SRA.

SRA involves the calculation of a risk index for each species. The calculation of a risk index is achieved by quantifying risk against two axes – a measure of susceptibility and a measure of recovery. The susceptibility index is a measure of a species susceptibility to capture or otherwise caused mortality due to fishing activity. The recovery index is a measure of the ability a species population to recover (replenish) following depletion due to fishing activity. Five criteria will be used to calculate susceptibility and recovery indices for each species. Each species will be given a nominal ranking on a scale of 1 to 3 for each criterion. A rank of 3 for a criterion signifies a species that is either highly vulnerable to capture or has a low ability to recover following fishing related mortality. Conversely, a rank of 1 will be assigned to a criterion that would contribute to a species having a low vulnerability to capture or having a high capacity of recovery. Where no information is available to assess a criterion, a precautionary approach will assign ranks of 3. The ranks for susceptibility and recovery will then be determined by an averaging across the 5 criteria and these values graphically represented on a two-dimensional graph with recovery values on the x axis and susceptibility values on the y axis (see Figure 1).

Susceptibility indices will be calculated on the basis of 5 criteria –

1. Preferred habitat – susceptibility of a species can be measured against preferred habitat and range, and how fishing activity is distributed across these areas.
2. Marine Park Protection – susceptibility to fisheries capture will be influenced by the level of protection offered to populations due to marine park covered
3. Fishery selectivity – susceptibility of species to fishing gears varies considerably.
4. Marketability / Desirability – is a measure of how market demands and fishing motivations affect the mortality potentials of captured species
5. Fishery survival – is a measure of the post-release survival of animals the interact with fishing activity but are returned to the water.

Recovery indices will be calculated on the basis of 5 criteria –

1. Probability of Breeding – an indicator of the potential reproductive capacity of a population
2. Annual Fecundity – Annual fecundity is a measure of potential recruitment each year
3. Removal Rate – percentage of annual biomass removed by fishing activity. Species within a higher relative removal rate are amused to have a lower capacity to recover.
4. Maximum Size – larger species generally live longer and thus populations may recover more slowly after depletion (Roberts and Hawkins, 1999)

5. Mortality – potential recovery is linked to the level of fishing mortality. Where estimates of fishing mortality are unavailable, a *mortality index* will be calculated using the methods of Stobutzki *et al* (2001).

Following the calculation of susceptibility and recovery indices for each species, graphical representation will be utilised to appraise relative risk (see Figure 1). Graphing the relative risks for each species will allow for three important appraisals. Firstly, the risk level will be easily comparable between species. Secondly, the risk position of each species will be comparable to both barramundi and spotted mackerel, the only two fin fish from the ECIFFF that have received an ecologically sustainable tick through formal stock assessment procedures. Finally, for species ranked as high risk graphically appraisal will identify if that risk is driven by high susceptibility to fishery activity or low ability for population recovery following exploitation, or a combination of both.

3. Formal species-specific status assessments

The third component of the hierarchical ERA is reserved for those species within the fishery that have been ranked as high risk through steps 1 and 2. What constitutes a level of high risk will be determined during the ERA process by project staff and expert stakeholder representative discussion. Barramundi and spotted mackerel will be useful reference points for the fin fish component of the ECIFFF, against which the relative risk of other species can be measured. A similar reference point(s) is not yet available for any shark species of the ECIFFF, though may become available during the lifetime of the project as a result of current postgraduate student projects.

The timeframe of this project is likely to preclude the ability to perform formal stock assessments for those species deemed to be a high risk by the ERA process. However, as a minimum requirement, the ERA of Project 4.8.4 will –

1. Identify those species at high ecological risk
2. Identify why those species are considered at high ecological risk
    a. High risk driven by lack of information
    b. High risk because of biological inability to withstand removal
    c. High risk as a result of particularly high interaction rates with the fishery
    d. High risk as a result of a combination of the above.
3. Describe information gaps and identify and propose methods for overcoming these where they occur.
4. Suggest a tactical approach to gathering needed information

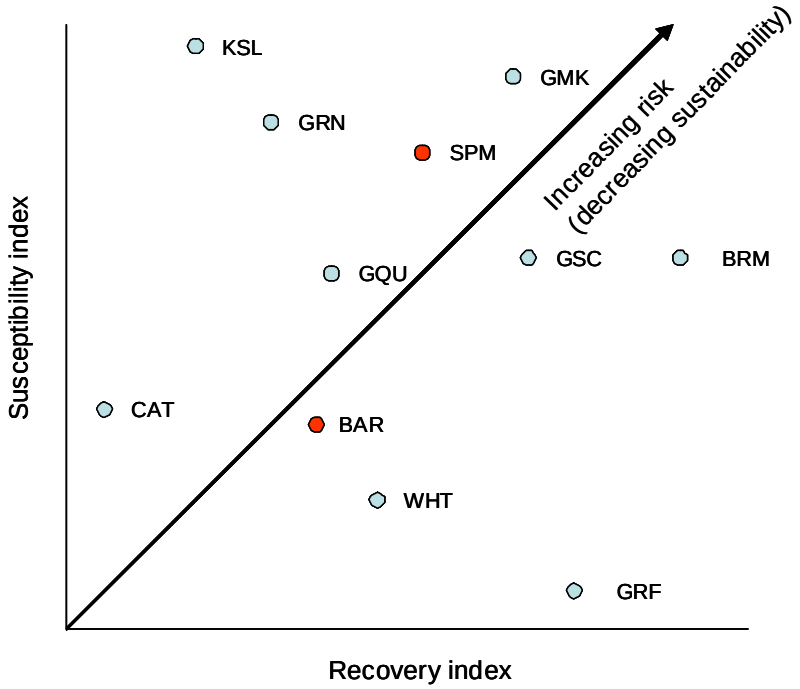
The final component of the ERA for the ECIFFF will be to ensure fisheries and marine park managers are well informed of the risk species and activities identified through this project.

Table 1. These gross fishery descriptors have been sourced from CHRIS Web for the year 2005, the most recent year for which data is available for both the recreational and commercial fisheries.

	COMMERCIAL	RECREATIONAL
Gear	Mesh and seine net	Hook and Line
Area	GBRWHA	GBRWHA
Depth Range	0 – 30m	0 – 30m
Fleet Size	239 boats	304,000 participating households within the GBRWHA*
Effort	11,030 days	unknonwn
Landings	1,813 t	6,890,719
Discard Rate	15% by number	6,995,661
Target Species	Barramundi Shark Grey mackerel Grunter Threadfins Mullet	Barramundi Grunter Cod Bream Flathead Whiting
Management	Mostly Input Management • Limited licences • Net gear limits • Size limits • Protected species • Closed seasons • Closed waters	Mostly Output Management • Limited lines and hooks • Size limits • Bag limits • Protected species • Closed seasons • Closed waters
Data Sources	MTSRF Observer CFISH Logbooks QDPI&F LTMP Observers Effects of Net Fishing Project (FRDC 98/209)	MTSRF Boat Ramps RFISH Diary Logs CapReef Boat Ramp surveys CapReef Competition surveys TOBIN, R.P. PhD Thesis JCU

* Recreational fishing participation rates estimated by Tobin & Sutton (Project 4.8.1)

Figure 1. A hypothetical representation of the risk rankings produced through the Step 2 Susceptibility and Recovery Analysis of the ERA. The graph demonstrates a group of fin fish species risk rankings relative to those determined for barramundi and spotted mackerel, the only two species of the ECIFFF for which formal stock assessments are available.



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