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Australian Government
Australian Fisheries Management Authority

Ecological Risk Assessment for Effects of Fishing

REPORT FOR THE OTHER LINE SUB-FISHERY OF THE CORAL SEA FISHERY

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This fishery Ecological Risk Assessment (ERA) report should be cited as:

Furlani, D., Fuller, M., Dowdney, J., Bulman, C., and Sporcic, M. (2007) Ecological Risk Assessment for the Effects of Fishing: Report for the Other Line Sub-fishery of the Coral Sea Fishery. Report for the Australian Fisheries Management Authority, Canberra.

Notes to this document:

This fishery ERA report document contains figures and tables with numbers that correspond to the full methodology document for the ERAEF method:

> (Hobday, A. J., A. Smith, H. Webb, R. Daley, S. Wayte, C. Bulman, J. Dowdney, A. Williams, M. Sporcic, J. Dambacher, M. Fuller, T. Walker. (2007) Ecological Risk Assessment for the Effects of Fishing: Methodology. Report R04/1072 for the Australian Fisheries Management Authority, Canberra)

Thus, table and figure numbers within the fishery ERA report document are not sequential as not all are relevant to the fishery ERA report results.

Additional details on the rationale and the background to the methods development are contained in the ERAEF Final Report:

Smith, A., A. Hobday, H. Webb, R. Daley, S. Wayte, C. Bulman, J. Dowdney, A. Williams, M. Sporcic, J. Dambacher, M. Fuller, D. Furlani, T. Walker. (2007) Ecological Risk Assessment for the Effects of Fishing: Final Report R04/1072 for the Australian Fisheries Management Authority, Canberra.

Executive Summary

This assessment of the ecological impacts of the Coral Sea Fishery: Other Line Sub-fishery was undertaken using the ERAEF method version 9.2. ERAEF stands for "Ecological Risk Assessment for Effect of Fishing", and was developed jointly by CSIRO Marine and Atmospheric Research, and the Australian Fisheries Management Authority. ERAEF provides a hierarchical framework for a comprehensive assessment of the ecological risks arising from fishing, with impacts assessed against five ecological components – target species; by-product and by-catch species; threatened, endangered and protected (TEP) species; habitats; and (ecological) communities.

ERAEF proceeds through four stages of analysis: scoping; an expert judgement based Level 1 analysis (SICA – Scale Intensity Consequence Analysis); an empirically based Level 2 analysis (PSA – Productivity Susceptibility Analysis); and a model based Level 3 analysis. This hierarchical approach provides a cost-efficient way of screening hazards, with increasing time and attention paid only to those hazards that are not eliminated at lower levels in the analysis. Risk management responses may be identified at any level in the analysis.

Application of the ERAEF methods to a fishery can be thought of as a set of screening or prioritization steps that work towards a full quantitative ecological risk assessment. At the start of the process, all components are assumed to be at high risk. Each step, or Level, potentially screens out issues that are of low concern. The Scoping stage screens out activities that do not occur in the fishery. Level 1 screens out activities that are judged to have low impact, and potentially screens out whole ecological components as well. Level 2 is a screening or prioritization process for individual species, habitats and communities at risk from direct impacts of fishing. The Level 2 methods do not provide absolute measures of risk. Instead they combine information on productivity and exposure to fishing to assess potential risk – the term used at Level 2 is risk. Because of the precautionary approach to uncertainty, there will be more false positives than false negatives at Level 2, and the list of high risk species or habitats should not be interpreted as all being at high risk from fishing. Level 2 is a screening process to identify species or habitats that require further investigation. Some of these may require only a little further investigation to identify them as a false positive; for some of them managers and industry may decide to implement a management response; others will require further analysis using Level 3 methods, which do assess absolute levels of risk.

For the Coral Sea Fishery, the ERAEF was limited to Level 1 analysis only.

This assessment of the Coral Sea Fishery: Other Line sub-fishery includes the following:

- Scoping
- Level 1 results for all components
- <u>No</u> Level 2 analyses have been undertaken at this stage.

Fishery Description

Gear:	Predominantly dropline, set vertically with bottom weight and top float, 10-100 snoods with hooks attached at deeper end of line, hooks baited manually; trotline (set horizontally –mainline suspended off the bottom and snoods weighted to hang vertically), and handline also used.
Area:	Sandy Cape, Fraser Island to Cape York, east of Great Barrier Reef Marine park outer boundary through to the edge of the Australian Fishing Zone (AFZ); on seamounts and plateaus.
Depth range:	generally 50-800m, may fish both shallower and deeper at times.
Fleet size:	9 fishing concessions across the multigear multimethod fishery – permits are not gear-specific within the line sector. In total, eighteen (18) boats have contributed to the effort over the 4 calendar years considered in this report (2001 to 2004), with the number of boats involved annually ranging from 6-10 boats, i.e. few boats have continued involvement between years.
Effort:	Confidentiality agreements prohibit disclosure of detailed effort data; over a 4 year period effort has steadily increased from ~150,000 to ~1,500,000 hooks/year.
Landings:	Confidentiality agreements prohibit disclosure of detailed landing weights; over a 4 year period catches have increased 4-fold.
Discard rate:	No discarding rate has been reported; discarding includes graded byproduct -sharks, redbass, snapper and leatherjackets
Main target species:	Rosy jobfish, Flame snapper, Rubyfish, Goldband snapper, Jobfish and Bar rockcod
Management:	No Management Plan, MAC or RAG; but a Statement of Management Arrangements 2004/05 is in place. No TACs or quotas exist within the CSF Line sector.
Observer program:	No observer coverage

Ecological Units Assessed

Target species:	22
By-product species:	47
Discard Species:	25
TEP species:	109
Habitats:	268 (264 benthic, 4 overlying pelagic)
Communities:	13 (9 demersal, 4 overlying pelagic)

Level 1 Results

No ecological components were eliminated at Scoping or Level 1. (There was at least one risk score of 3 – moderate – or above for each of the components).

Most hazards (fishing activities) were eliminated at Level 1 (risk scores 1 or 2). The four remaining hazards are:

- Fishing capture (impact on all 5 components);
- Fishing without capture (impact on Habitat component);
- Translocation of species (impact on all 5 components);
- Discarding catch (impact on Byproduct and TEP component); and

One internal hazard - Translocation of species - was rated as major within the Habitat component (risk score 4).

Translocation of species hazard is scored as very uncertain. It is a low probability but potentially high consequence hazard.

Significant external hazards include

- other fisheries in the region (impact on Target, Byproduct, Habitat and Communities components); and
- other anthropogenic activities (impact on Habitat).

For the Coral Sea Fishery, impacts from fishing were <u>NOT</u> assessed in more detail at Level 2.

Level 2 Results

<u>Species</u>
No Coral Sea Fishery Other Line species were assessed at Level 2 using the PSA analysis.

<u>Habitats</u>
No Coral Sea Fishery Other Line habitats were assessed at Level 2 using the habitat PSA analysis.

<u>Communities</u>
The community component was not assessed at Level 2, but should be considered in future assessments when the methods to do this are fully developed.

Summary

Four key issues emerged from the ERAEF Level 1 analysis of the Coral Sea Fishery: Other Line sub-fishery:

- Fishing capture was identified as a hazard to all components. This is particularly important given the recent rapid increase in effort in this sector, and the concentration of effort in a limited set of fishing grounds. Coupled with the significant increase in effort for the Other Line sector in recent years, is a marked decline in CPUE, and an apparent shift in the species composition of the catch. These are strong indications that current effort levels may not be sustainable.

- Fishing activity without capture was identified as a habitat hazard, due to the nature of the gear set and the lack of regeneration information for tropical-waters habitats.
- Translocation of species was identified as a moderate hazard to Target, Byproduct, TEP and Communities components, and a major risk hazard to the Habitat component; and
- Discarding was identified as a hazard to the Byproduct and TEP components.

The need for species validation has also been highlighted as a future recommendation to ensure accuracy and value to logbook data, with the issues surrounding *Lutjanus malabaracus* of particular note to the Other line sub-fishery.

Managing identified risks

Using the results of the ecological risk assessment, the next steps for each fishery will be to consider and implement appropriate management responses to address these risks. To ensure a consistent process for responding to the ERA outcomes, AFMA has developed an Ecological Risk Management (ERM) framework.

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1. Overview

Ecological Risk Assessment for the Effects of Fishing (ERAEF) Framework

The Hierarchical Approach

The Ecological Risk Assessment for the Effects of Fishing (ERAEF) framework involves a hierarchical approach that moves from a comprehensive but largely qualitative analysis of risk at Level 1, through a more focused and semi-quantitative approach at Level 2, to a highly focused and fully quantitative "model-based" approach at Level 3 (**Figure 1**). This approach is efficient because many potential risks are screened out at Level 1, so that the more intensive and quantitative analyses at Level 2 (and ultimately at Level 3) are limited to a subset of the higher risk activities associated with fishing. It also leads to rapid identification of high-risk activities, which in turn can lead to immediate remedial action (risk management response). The ERAEF approach is also precautionary, in the sense that risks will be scored high in the absence of information, evidence or logical argument to the contrary.

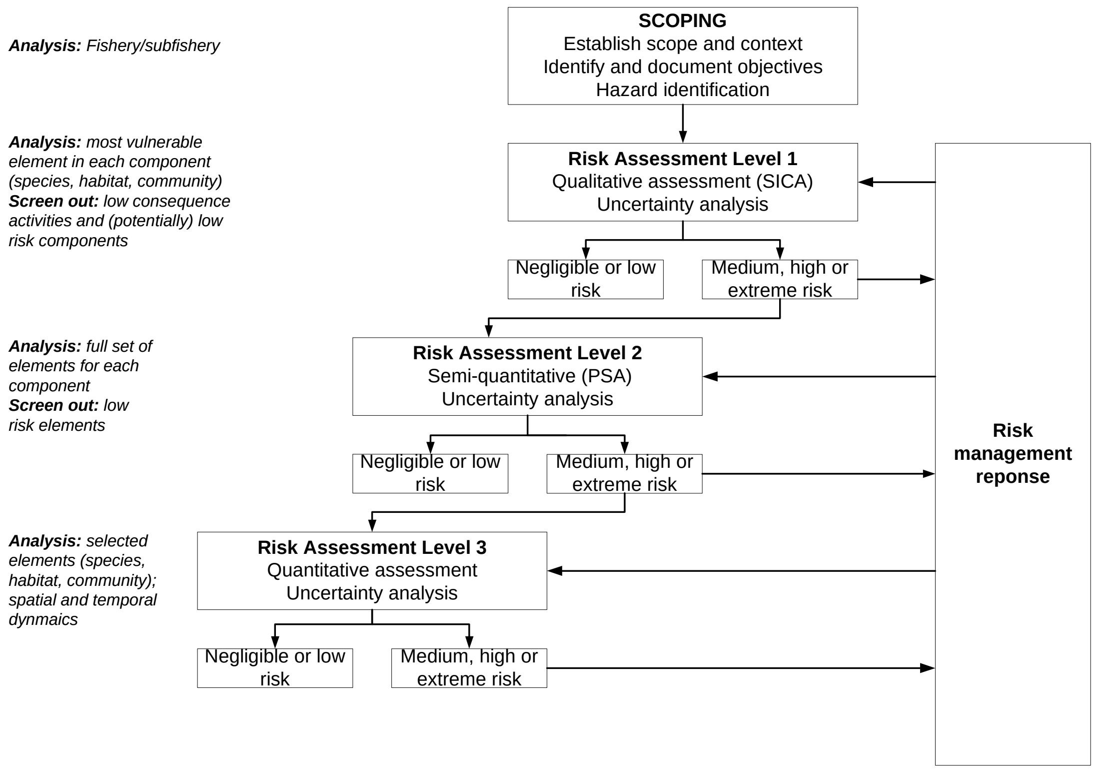


Figure 1. Overview of ERAEF showing focus of analysis for each level at the left in italics.

Conceptual Model

The approach makes use of a general conceptual model of how fishing impacts on ecological systems, which is used as the basis for the risk assessment evaluations at each level of analysis (Levels 1-3). For the ERAEF approach, five general ecological components are evaluated, corresponding to five areas of focus in evaluating impacts of fishing for strategic assessment under Environment Protection and Biodiversity Conservation (EPBC) legislation. The five *components* are:

- Target species
- By-product and by-catch species
- Threatened, endangered and protected species (TEP species)
- Habitats
- Ecological communities

This conceptual model (**Figure 2**) progresses from *fishery characteristics* of the fishery or sub-fishery, → *fishing activities* associated with fishing and *external activities*, which may impact the five ecological components (target, byproduct and bycatch species, TEP species, habitats, and communities); → *effects of fishing and external activities* which are the direct impacts of fishing and external activities; → *natural processes and resources* that are affected by the impacts of fishing and external activities; → *sub-components* which are affected by impacts to natural processes and resources; → *components*, which are affected by impacts to the sub-components. Impacts to the sub-components and components in turn affect achievement of management objectives.

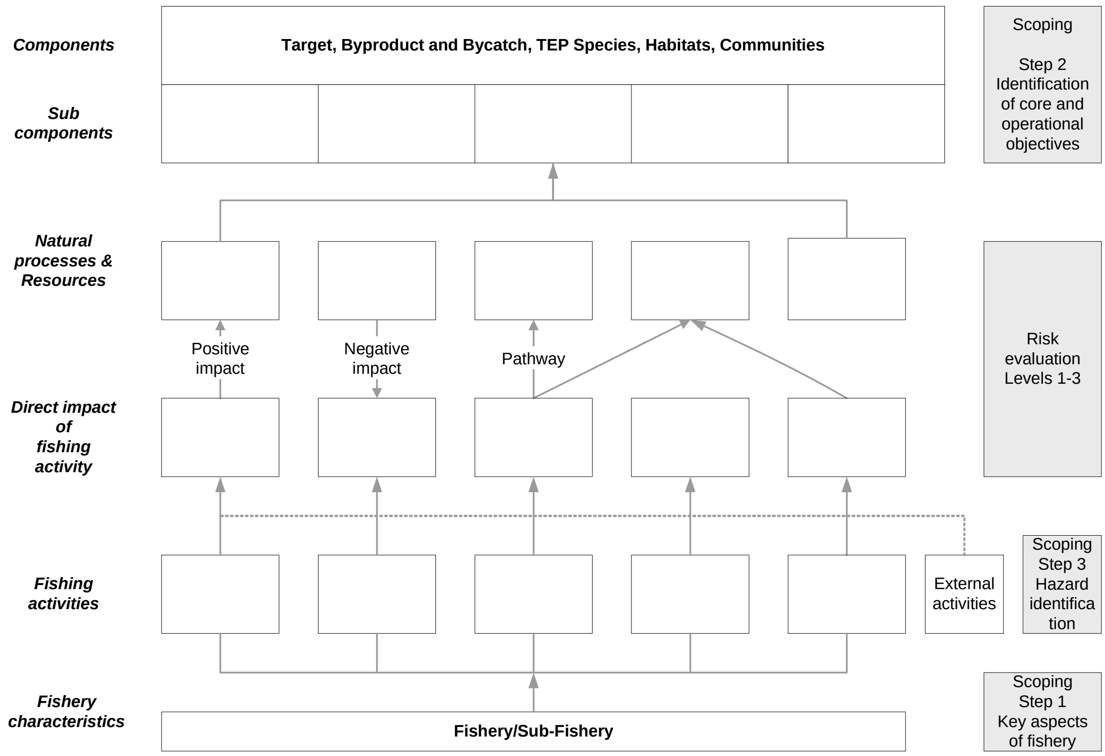


Figure 2. Generic conceptual model used in ERAEF.

The external activities that may impact the fishery objectives are also identified at the Scoping stage and evaluated at Level 1. This provides information on the additional impacts on the ecological components being evaluated, even though management of the external activities is outside the scope of management for that fishery.

The assessment of risk at each level takes into account current management strategies and arrangements. A crucial process in the risk assessment framework is to document the rationale behind assessments and decisions at each step in the analysis. The decision to proceed to subsequent levels depends on

- Estimated risk at the previous level
- Availability of data to proceed to the next level
- Management response (e.g. if the risk is high but immediate changes to management regulations or fishing practices will reduce the risk, then analysis at the next level may be unnecessary).

A full description of the ERAEF method is provided in the methodology document (Hobday *et al* 2007). This fishery report contains figures and tables with numbers that correspond to this methodology document. Thus, table and figure numbers within this fishery ERAEF report are not sequential, as not all figures and tables are relevant to the fishery risk assessment results.

ERAEF stakeholder engagement process

A recognised part of conventional risk assessment is the involvement of stakeholders involved in the activities being assessed. Stakeholders can make an important contribution by providing expert judgment, fishery-specific and ecological knowledge, and process and outcome ownership. The ERAEF method also relies on stakeholder involvement at each stage in the process, as outlined below. Stakeholder interactions are recorded.

Scoping

In the first instance, scoping is based on review of existing documents and information, with much of it collected and completed to a draft stage prior to full stakeholder involvement. This provides all the stakeholders with information on the relevant background issues. Three key outputs are required from the scoping, each requiring stakeholder input.

1. <u>Identification of units of analysis</u> (species, habitats and communities) potentially impacted by fishery activities (section 2.2.2; Scoping Documents S2A, S2B and S2C).
2. <u>Selection of objectives</u> (section 2.2.3; Scoping Document S3) is a challenging part of the assessment, because these are often poorly defined, particularly with regard to the habitat and communities components. Stakeholder involvement is necessary to agree on the set of objectives that the risks will be evaluated against. A set of preliminary objectives relevant to the sub-components is selected by the drafting authors, and then presented to the stakeholders for modification. An agreed set of objectives is then used in the Level 1 SICA analysis. The agreement of the fishery management advisory body (e.g. the MAC, which contains representatives from industry, management, science, policy and conservation) is considered to represent agreement by the stakeholders at large.
3. <u>Selection of activities</u> (hazards) (section 2.2.4; Scoping Document S4) that occur in the sub-fishery is made using a checklist of potential activities provided. The checklist was developed following extensive review, and allows repeatability between fisheries. Additional activities raised by the stakeholders can be

included in this checklist (and would feed back into the original checklist). The background information and consultation with the stakeholders is used to finalise the set of activities. Many activities will be self-evident (e.g. fishing, which obviously occurs), but for others, expert or anecdotal evidence may be required.

Level 1. SICA (Scale, Intensity, Consequence Analysis)

The SICA analysis evaluates the risk to ecological components resulting from the stakeholder-agreed set of activities. Evaluation of the temporal and spatial scale, intensity, sub-component, unit of analysis, and credible scenario (consequence for a sub-component) can be undertaken in a workshop situation, or prepared ahead by the draft fishery ERA report author and debated at the stakeholder meeting. Because of the number of activities (up to 24) in each of five components (resulting in up to 120 SICA elements), preparation before involving the full set of stakeholders may allow time and attention to be focused on the uncertain or controversial or high risk elements. The rationale for each SICA element must be documented and this may represent a challenge in the workshop situation. Documenting the rationale ahead of time for the straw-man scenarios is crucial to allow the workshop debate to focus on the right portions of the logical progression that resulted in the consequence score.

SICA elements are scored on a scale of 1 to 6 (negligible to extreme) using a “plausible worst case” approach (see ERAEF Methods Document for details). Level 1 analysis potentially result in the elimination of activities (hazards) and in some cases whole components. Any SICA element that scores 2 or less is documented, but not considered further for analysis or management response.

Level 2. PSA (Productivity Susceptibility Analysis)

No Level 2 analysis has been conducted for the Coral Sea Other Line Sub-fishery. Level 1 assessment for the sub-fishery has been completed as required for the ERAEF Stage 2 process. As such, further documentation in this report is included only as a means of understanding the ERAEF process in full.

The semi-quantitative nature of this analysis tier should reduce but not eliminate the need for stakeholder involvement. In particular, transparency about the assessment will lead to greater confidence in the results. The components that were identified to be at moderate or greater risk (SICA score > 2) at Level 1 are examined at Level 2. The units of analysis at Level 2 are the agreed set of species, habitat types or communities in each component identified during the scoping stage. A comprehensive set of attributes that are proxies for productivity and susceptibility have been identified during the ERAEF project. Where information is missing, the default assumption is that risk will be set high. Details of the PSA method are described in the accompanying ERAEF Methods Document. Stakeholders can provide input and suggestions on appropriate attributes, including novel ones, for evaluating risk in the specific fishery. The attribute values for many of the units (e.g. age at maturity, depth range, mean trophic level) can be obtained from published literature and other resources (e.g. scientific experts) without full stakeholder involvement. This is a consultation of the published scientific literature. Further stakeholder input is required when the preliminary gathering of attribute values is completed. In particular, where information is missing, expert opinion can be used to derive the most reasonable conservative estimate. For example, if the species attribute values for annual fecundity have been categorised as low, medium and high on the set [<5, 5-500, >500], estimates for species with no data can still be made. Estimated fecundity of a species such as a broadcast-spawning fish with unknown fecundity, is still likely greater than the cutoff for the high fecundity categorisation (>500). Susceptibility attribute estimates, such as "fraction alive when landed", can also be made based on input from experts such as scientific observers. The final PSA is completed by scientists because access to computing resources, databases, and programming skills is required. Feedback to stakeholders regarding comments received during the preliminary PSA consultations is considered crucial. The final results are then presented to the stakeholder group before decisions regarding Level 3 are made. The stakeholder group may also decide on priorities for analysis at Level 3.

Level 3

This stage of the risk assessment is fully-quantitative and relies on in-depth scientific studies on the units identified as at moderate or greater risk in the Level 2 PSA. It will be both time and data-intensive. Individual stakeholders are engaged as required in a more intensive and directed fashion. Results are presented to the stakeholder group and feedback incorporated, but live modification is not considered likely.

Conclusion and final risk assessment report

The conclusion of the stakeholder consultation process will result in a final risk assessment report for the individual fishery according to the ERAEF methods. It is envisaged that the completed assessment will be adopted by the fishery management group and used by the Australian Fisheries Management Authority (AFMA) for a range of management purposes, including addressing the requirements of the Environment Protection and Biodiversity Conservation Act (EPBC Act) as evaluated by Department of the Environment and Heritage.

Subsequent risk assessment iterations for a fishery

The frequency at which each fishery must revise and update the risk assessment is not fully prescribed. As new information arises or management changes occur, the risks can be reevaluated, and documented as before. The fishery management group or AFMA may take ownership of this process, or scientific consultants may be engaged. In any case the ERAEF should again be based on the input of the full set of stakeholders and reviewed by independent experts familiar with the process.

Each fishery ERA report will be revised at least every four years or as required by Strategic Assessment. However, to ensure that actions in the intervening period do not unduly increase ecological risk, each year certain criteria will be considered. At the end of each year, the following trigger questions should be considered by the MAC for each sub-fishery.

- Has there been a change in the spatial distribution of effort of more than 50% compared to the average distribution over the previous four years?
- Has there been a change in effort in the fishery of more than 50% compared to the four year average (e.g. number of boats in the fishery)?

- Has there been an expansion of a new gear type or configuration such that a new sub-fishery might be defined?

Responses to these questions should be tabled at the relevant fishery MAC each year and appear on the MAC calendar and work program. If the answer to any of these trigger questions is yes, then the sub-fishery should be reevaluated.

2. Results

The focus of analysis is the fishery as identified by the responsible management authority. The assessment area is defined by the fishery management jurisdiction within the AFZ. The fishery may also be divided into sub-fisheries on the basis of fishing method and/or spatial coverage. These sub-fisheries should be clearly identified and described during the scoping stage. Portions of the scoping and analysis at Level 1 and beyond, is specific to a particular sub-fishery. The fishery is a group of people carrying out certain activities as defined under a management plan. Depending on the jurisdiction, the fishery/sub-fishery may include any combination of commercial, recreational, and/or indigenous fishers.

The results presented below are for the Other Line sub-fishery of the Coral Sea Fishery.

2.1 Stakeholder engagement

2.1 Summary Document SD1. Summary of stakeholder involvement for fishery

CSF Other Line sub-fishery

Fishery ERA report stage	Type of stakeholder interaction	Date of stakeholder interaction	Composition of stakeholder group (names or roles)	Summary of outcome
Scoping	Phone calls & emails; requests for data. Requests for fishers contact details	18/10-18/11/2005	Justine Johnston- AFMA Philip Domaschenz- AFMA. AFMA data section-Fisher contact details provided following Level 1 (SICA) stakeholder meeting 2/12/2005.	Data often uncertain or lacking.
	Preliminary scoping and SICA documents sent to AFMA for distribution to fishers	18/11/2005		Instructed by AFMA to move to Level 1
Scoping	Information meeting with stakeholders and initial review by fisher representatives	30/11/2005	Documents distributed to fishers. Tim Smith- AFMA Justine Johnston- AFMA Philip Domaschenz- AFMA CSF stakeholder representatives Andy Dustan- Tourism Ross Daley- CSIRO Dianne Furlani- CSIRO	Limitations of CSF logbook data discussed; Feedback on species lists and hazards provided; Identified data which had not yet been provided.
Scoping	Data requests for corrected catch data, observer reports and catch disposal records Phone calls/emails for information	1/12/2005	AFMA data manager CSIRO data manager Line operators	Feedback returned and incorporated into species documents and SICAs Information incorporated into scoping documents and hazard ID's
Level 1 (SICA)	Information meeting with stakeholders and initial review by fisher representatives	30/11/2005	Documents distributed to fishers. Tim Smith- AFMA Justine Johnston- AFMA Philip Domaschenz- AFMA CSF stakeholder representatives Andy Dustan- Tourism Ross Daley- CSIRO Dianne Furlani- CSIRO	Limitations of CSF logbook data discussed; Feedback on species lists and hazards provided; Identified data which had not yet been provided. Debated the scenarios, and explanation of the consequence scoring. Identified areas for further investigation.
Level 1 (SICA)	Follow-up Workshop	6/4/2006	Postponed by AFMA	
Level 1	Attend Stakeholder	27/4/2006	AFMA,	Discussion of CSF future research

Fishery ERA report stage	Type of stakeholder interaction	Date of stakeholder interaction	Composition of stakeholder group (names or roles)	Summary of outcome
(SICA)	meeting 2006		DEH, QDPIF, DAFF, CSIRO, and CSF operators	intentions, Ministerial Directives to be met, trap trial outcomes and future trial, issues of discarding, mitigating measures already in place and those being considered.
Level 1 (SICA)	Workshop Rescheduled	28/4/2006	Documents distributed to fishers. Dave Johnson- AFMA Justine Johnston- AFMA Philip Domaschenz- AFMA Tim Smith- AFMA CSF stakeholder representatives DEH representative Tony Smith- CSIRO Dianne Furlani- CSIRO	Feedback on species lists and hazards provided. Debated the scenarios, and explanation of consequence scoring. Considered mitigating measures. Incorporate stakeholder/ AFMA changes as required to reach agreed point where Level 1 is acceptable
Level 2 (PSA)	Not conducted for the CSF in stage 2 of the ERA process.			
ERAEF reporting	AFMA comments received	6/06/2006 21/06/2006 14/07/2006		Comments addressed. Final draft submitted
	Stakeholder and AFMA comments received	28/09/2006		Comments addressed and detailed in Appendix A. Final report submitted.

2.2 Scoping

The aim in the Scoping stage is to develop a profile of the fishery being assessed. This provides information needed to complete Levels 1 and 2 and at stakeholder meetings. The focus of analysis is the fishery, which may be divided into sub-fisheries on the basis of fishing method and/or spatial coverage. Scoping involves six steps:

Step 1 Documenting the general fishery characteristics
Step 2 Generating "unit of analysis" lists (species, habitat types, communities)
Step 3 Selection of objectives
Step 4 Hazard identification
Step 5 Bibliography
Step 6 Decision rules to move to Level 1

2.2.1 General Fishery Characteristics (Step 1).

The information used to complete this step may come from a range of documents such as the Fishery's Management Plan, Assessment Reports, Bycatch Action Plans, and any other relevant background documents. The level and range of information available will vary. Some fisheries/sub-fisheries will have a range of reliable information, whereas others may have limited information.

Scoping Document S1 General Fishery Characteristics

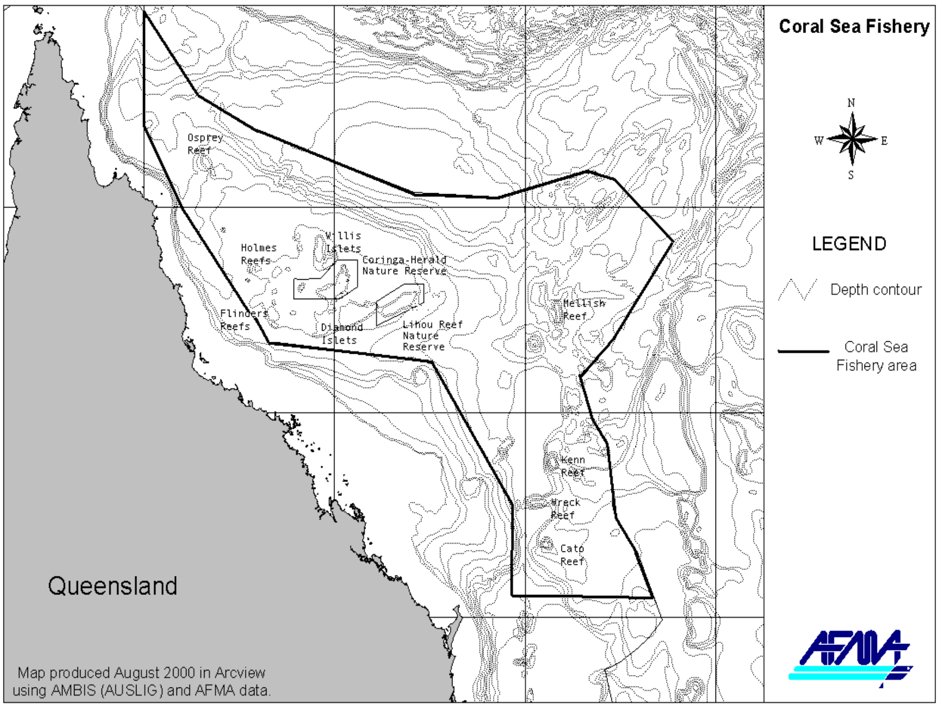
Fishery Name: Coral Sea Fishery (CSF)– Other Line sub-fishery
Date of assessment: May 2006
Assessor: Dianne Furlani

NB. All 3 CSF Line Sector sub-fisheries (Auto longline, Demersal longline and Other line) are included in the following *General Fishery Characteristics* table.

General Fishery Characteristics	
Fishery Name	Coral Sea Fishery- Line sector
Sub-fisheries	*Identify sub-fisheries on the basis of fishing method/area.* 9 fishing concessions exist across the multigear multimethod fishery – all three gear types (considered in the ERA reports as 'sub-fisheries') are eligible to operate from each permit within the Line sector (ie line sector permits are not gear specific): **Auto-longline** -(BL, identified in logbook records by boat name, fishery ID and gear; fishing in >200m depth prior to July '04, but can now be shallower with observer on board) **Demersal longline** -(BL generally with <3,000 hooks, identified in logbook records by boat name, fishery ID and gear) **Other line** -setline (DL), manual dropline (DLM), hydraulic dropline (DLH), handline (HL) and trotline (TL) methods (*AFMA "Environmental Assessment*

	Report, CSF", July 2003), identified in logbook records by boat name, fishery ID and gear.
Sub-fisheries assessed	*The sub-fisheries to be assessed on the basis of fishing method/area in this report.* Information relevant to all 3 sub-fisheries within the CSF line sector is given in this table. All 3 sub-fisheries will be individually assessed during the ERA process. Data assessed for this report covers the complete 2001 to 2004 calendar years.
Start date/history	*Provide an indication of the length of time the fishery has been operating.* Prior to the creation of the CSF, fisheries activity occurred within the East Coast Deepwater Crustacean Trawl Fishery (ECDTF) and North East Demersal Line Fishery (NEDLF). The ECDTF Development Plan was established in 1988, and conditions were rolled over annually till 1993. The NEDLF Development plan came into effect in 1991, and continued annually till 1997. Under the NEDLF, access to the fishery was restricted to those operating within the arrangements, prior to 1990. In 1991, a discussion paper, Draft management Arrangements for the East Coast Offshore Line Fishery, was issued. A series of management changes followed which saw the division of the ECDTF into several jurisdictions during 1994. Operators failed to meet performance criteria and no permits were regranted. In 1995, under Offshore Constitutional Settlement (OCS) arrangements, management was rationalized and the CSF was established. 1997 saw the implementation of the AFMA Interim Management Policy, which limited operator numbers to 13, enforced annual criteria, and established non-transferable permits. No additional access has been granted since 1997. In 2000, amendments to the policy allowed for permits to be transferable. To pave the way for a review process, changes were implemented in 2002 which split access to the sectors (line, trawl and 3 hand collection sectors).With performance criteria now required for each sector, enough data for management could be collected. Increased value and effort has resulted from the transferable permits with Gross value of production (GVP) for the CSF, all sectors combined, risen from $626,700 in 2001/02, to $1,201,200 in 2002/03 *(Caton and McLoughlin 2004)*.
Geographic extent of fishery	*The geographic extent of the managed area of the fishery. Maps of the managed area and distribution of fishing effort should be included in the detailed description below, or appended to the end of this table.* Waters from Sandy Cape, Fraser Island to Cape York, generally east of the Great Barrier Reef Marine Park outer boundary through to the edge of the Australian Fishing Zone (10 to 100 nautical miles seaward of the Great Barrier Reef). This fishery excludes the areas of the Coringa-Herald and Lihou Reef National nature Reserves. Sub-continental shelf and abyssal plains with scattered reef systems dominate the CSF. The Coral Sea Reef system comprises 6 main habitats: outer reef slope, reef crest, back reef, leeward slope or lagoon, pinnacle, and inter-reef channels.

<table>
<tr><td></td><td>The richest areas for fish diversity are the exposed outer slopes of 5-20 m depth and large bomboras and pinnacle reefs (Allen 1988).



From AFMA “Environmental Assessment Report- Coral Sea Fishery” (July 2003) Pg 15.</td></tr>
<tr><td>Regions or Zones within the fishery</td><td>Any regions or zones used within the fishery for management purposes and the reason for these zones if known

Considered as one zone.</td></tr>
<tr><td>Fishing season</td><td>What time of year does fishing in each sub-fishery occur?

May fish all year.</td></tr>
<tr><td>Target species and stock status</td><td>Species targeted and where known stock status.

Overall, the status of the CSF is uncertain (Caton and McLoughlin 2004). The line sector is considered underdeveloped although most stocks within the CSF have not been assessed (DEH Assessment of the Coral Sea Fishery 2004).

Reef and seamount species are targeted: a broad range of finfish including tropical snappers and emperors (Lethrinidae, Pristipomoides or Lutjanidae), eteline snapper (nemypterids), coral cod (Epinephelus spp, Serranidae), jobfish (Lutjanidae), and coral trout (Plectropomus leopardus). Other species may also be targeted, depending on area being fished, such as trevalla and shark.

Auto-longline Logbook, CDR and Observer Reports combined:
<table>
<tr><th>Species name</th><th>Common name</th></tr>
<tr><td>Priacanthus spp</td><td>Red bullseye</td></tr>
<tr><td>Epinephelus morrhua</td><td>Comet Grouper</td></tr>
<tr><td>Aethaloperca, Anyperodon, Epinephelus spp.</td><td>Rock cods</td></tr>
<tr><td>Plectropomus & Variola spp.</td><td>Coral trout</td></tr>
</table></td></tr>
</table>

Hyperoglyphe antarctica	Blue Eye Trevalla
Pristipomoides filamentosus	Rosy Jobfish / King Snapper
Gymnocranius spp	Sea Bream Snapper
Etelis carbunculus	Northwest Ruby Fish
Etelis coruscans	Flame Snapper

Demersal longline (BL <3,000 hooks); No observer reports are available for the Demersal longline sub-fishery. CDR data is not distinguishable for this sub-fishery as most boats are multi-gear users and CDR data is not delineated by gear. Species list has been compiled using CS01 logbook records only.

Species name	Common name
Galeocerdo cuvier	Tiger Shark
Carcharhinus sp	Blacktip sharks
Triaenodon obesus	White tip reef shark
Carcharhinus amblyrhynchos	Grey reef shark
Plectropomus & Variola spp.	Coral trout
Sphyrna lewini	Scalloped Hammerhead
Etelis coruscans	Flame Snapper
Epinephelus ergastularius & E. septemfasciatus	Bar Rockcod

Other line ((DL) (DLM) (DLH) (HL) (TL) (TR)); No observer reports are available for the Other Line sub-fishery. CDR data is not distinguishable for this sub-fishery as most boats are multi-gear users and CDR do not delineated by gear. A species list has been compiled using CS01 logbook records only:

Species name	Common name
Pristipomoides filamentosus	Rosy Jobfish / King Snapper
Etelis carbunculus	Northwest Ruby Fish
Epinephelus ergastularius E. septemfasciatus	Bar Rockcod
Wattsia mossambica	Mozambique bream
Pristipomoides multidens & P. typus	Tropical snapper
Epinephelus morrhua	Comet Grouper
Carcharhinus spp	Whaler sharks
Lutjanus sebae	Red Emperor
Lethrinus miniatus	Redthroat emperor
Acanthocybium solandri	Wahoo
Scomberomorus commerson	Spanish mackerel
Squalus mitsukurii	Greeneye dogfish
Carcharhinus brachyurus	Bronze Whaler
Aprion virescens	Green Jobfish
Plectropomus & Variola spp.	Coral trout
Variola louti	Coronation Grouper
Glaucosoma spp	Pearl perch
Gempylidae – species ID undetermined	Gemfish
Aphareus rutilans	Jobfish
Etelis coruscans	Flame Snapper
Aethaloperca, Anyperodon & Epinephelus spp.	Rock cods
Galeocerdo cuvier	Tiger Shark

Bait Collection and usage	*Identify bait species and source of bait used in the sub-fishery. Describe methods of setting bait and trends in bait usage.*

	No bait collection occurs. Bait (predominantly pilchards or mackerel) must be purchased.
Current entitlements	*The number of current entitlements in the fishery. Note latent entitlements. Licences/permits/boats and number active.* **9** fishing concessions were regranted in 2004, across the multi-gear multi-method Line sector. All line sub-fisheries are eligible to operate from each permit (i.e. permits are not gear specific within the line sector).
Current and recent TACs, quota trends by method	*The most recent catch quota levels in the fishery by fishing method (sub-fishery). Summary of the recent quota levels in the fishery by fishing method (sub-fishery).In table form* As limited species data is available from which to set catch limits, no TAC's or quotas exist within the Line sub-fisheries.
Current and recent fishery effort trends by method	*The most recent estimate of effort levels in the fishery by fishing method (sub-fishery). Summary of the recent effort trends in the fishery by fishing method (sub-fishery). In table form* Data assessed for this report covers the complete 2001 to 2004 calendar years. CS01 logbook effort data for the following 3 sub-fisheries indicates: **Auto-longline –** On average, effort (total hooks/yr) was low for the 2001 calendar year, more than doubled for 2002, and increased a further 60% for 2003 before falling again to 2002 levels. The number of hooks used for autolongline has increased from approximately 85 thousand hooks in 2001 to 201 thousand hooks in 2004. Two boats operated with autolongline gear over each of the 4 calendar years considered in the autolongline sub-fishery report. **Demersal longline –** Effort has been noted for the calendar years 2001 (2 boats) and 2004 (3 boats) only (ie there is no catch or effort reported in CS01 logbook records for 2002 and 2003 calendar years). The number of total shots has increased by ~50% although the number of hours fished is relatively constant and the number of lines set has fallen (~25%). Despite this, the total number of hooks used for demersal longline between the two years has increased dramatically, from <2 thousand hooks in 2001 to >25 thousand hooks in 2004. **Other line –** Effort for 2001 and 2002 calendar years was relatively constant with the principal increase a doubling of hours fished, but the 2003 data records a 2-3 fold increase in the number of line lifts, another doubling of hours fished, and a 75% increase in the number of shots. The 2004 data records another doubling in line lifts and a 25% increase in the number of shots. 2004 data also records a doubling in the number of hooks/line used. In summary, the 2004 effort in terms of line lifts/year and hooks used per line is up to 8 times greater than 2001. The number of hooks used for the other line sub-fishery has increased from approximately 150 thousand hooks in 2001 to 1,450 thousand hooks in 2004. In total, eighteen (18) boats have contributed to this effort, with the number of boats involved annually ranging from 6-10 boats over the 4 calendar years considered in the Other line sub-fishery report.
Current and recent fishery catch trends by method	*The most recent estimate of catch levels in the fishery by fishing method (sub-fishery) (total and/or by target species). Summary of the recent catch trends in the fishery by fishing method (sub-fishery). In table form*

	For the combined CSF, catches have steadily increased from a 40 tonne catch in 1998/99 to 150 tonnes catch in 2001/02 (*AFMA Environmental Assessment Report, CSF, July 2003*). No data summaries exist for the CSF sectors itself. Where less than 5 boats are involved, confidentiality agreements prohibit presentation of detailed data for the sub-fisheries. CS01 logbook catch data for the following sub-fisheries indicates: **Auto-longline –** Total catches for 2002 and 2003 calendar years were >30 tonnes, falling by >50% for 2004. (Catch Disposal Records indicate a combined catch weight decrease of 30% from 2002 to 2003, and a further 30% decline to 2004. Catches of all target species decreased, often considerably, and in 2003 and 2004 many new species appeared on the catch lists.) **Demersal longline –** No fishing catch was recorded for 2002 and 2003 calendar years. Catches for 2004 are more than a 5 fold increase over the 2001 catches, reflecting the increase in total hook effort, but not the magnitude. Catches for 2001 year were less than half the autolongline catch for the same period, but were greater than the autolongline catches for the 2004 year. **Other line –** Catches for the 2001 and 2002 calendar years remained stable. The 2003 catches increased more than 4-fold, and although effort increased in the 2004 calendar years, catches were 10% less than the 2003 levels. In comparison, otherline catches for the 2003 and 2004 years were 3 and 6 times greater respectively that autolongline catches for the same period, and more than 3 times the 2004 demersal catch.
Current and recent value of fishery ($)	*Note current and recent value trends by sub-fishery. In table form* Confidentiality prohibits using detailed sub-fishery data. GVP figures for the combined CSF has risen steadily from ~$150,000 in 1998/99 (*AFMA Environmental Assessment Report CSF July 2003*) to $626,700 in 2001/02, and reported as $1,201,200 in 2002/03 *(Bureau of Rural Sciences, Fishery status report 2004).* GVP for 2003/4 and 2004/5 are reported at around $850,000 and $1,100,000 respectively. (*Department of Agriculture, Fisheries and Forestry Oct. 2005*)
Relationship with other fisheries	*Commercial and recreational, state, national and international fisheries List other fisheries operating in the same region any interactions* **Auto-longline** **Demersal longline** **Other line** Species common to the CSF and other fisheries operating in the area (South East Trawl (SET) and Gillnet, Hook and Trap fisheries (GHATF)) are coral trout, snapper, emperors, and other reef fish species. It is unknown if any of these resources are shared. Limited recreational fishing may also compete for resources.
Gear	
Fishing gear and methods	*Description of the methods and gear in the fishery, average number days at sea per trip.* Lines are generally set from the stern of the boat, with hooks baited before

	deployment. Fishing trip lengths have been reported from 1-24 days, but an average of 6-10 days at sea per fishing trip appears to be the norm (*FAR 2004/05*). Further detail of method is given below in the section headed "**How gear set**". **Auto-longline** (BL) **Demersal longline** (BL) **Other line** (includes setline (DL), dropline manual hauling (DLM), dropline hydraulic hauling (DLH), handline (HL), troll (TR) and trotline (TL)).
Selectivity of gear and fishing methods	*Description of the selectivity of the sub-fishery methods* Predominantly demersal finfish and shark species, but due to its vertical set, dropline and setline methods may also be selective for pelagic species.
Spatial gear zone set	*Description where gear set i.e. continental shelf, shelf break, continental slope (range nautical miles from shore)* **Auto-longline** and **Demersal longline** deep waters on the continental slope; usually steep rocky slopes, not reefs but banks; avoid seamount areas as these have proved not profitable (Operator comment, *CSF Workshop, Nov 2005*) but logbook records show effort to have a very small focus on Northern Plateau edges, but mostly on Southern Seamounts. **Other line**
Depth range gear set	*Depth range gear set at in metres* **Auto-longline –** waters deeper than 200 m; with observer coverage, 50% of lines can be set shallower than 200 m depth. Depth range noted in autolongline Observer Reports is 18—900 m depth. The depth limits are to be reviewed in light of the observer information, and reported back to industry (*CSF Stakeholder Meeting April 2005)* **Demersal longline** (BL) – logbook records indicate the range of depths fished is from 12-500 m. **Other line** ((DL) (DLM) (DLH) (HL) (TR) (TL)) – logbook records indicate depths of between 12 and 500m are fished, with the predominant depths being 40-450 m depth.
How gear set	*Description how set, pelagic in water column, benthic set (weighted) on seabed* **Auto-longline –** sinking mainline set horizontally on the ocean floor and anchored, with baited hooks attached to the longline by short (35-60 cm) 'snood' lines hanging off at intervals of ~1m (*Observer Reports*). Each snood carries a hook at one end. Baiting of hooks occurs before deployment, as is automated. Gear is divided into a number of sets. May be many kilometers in length and typically carry 1,000 hooks per set. Can be set in deep waters on the continental slope and in areas of strong tidal currents. **Demersal longline** – (BL) gear is set as for auto-longline, but hook baiting is manual. Each set is end anchored by 25kg weights, with floats along the length of the set to maintain hooks at ~1-2m off bottom (Operator comment Stakeholder meeting 2006). Gear is set over the stern and retrieved over the side. Generally,

	200-300 hooks/line, with 1,000 hooks set each day and another 1,000 set each night, i.e. over 10 day trip, ~ 20,000 hooks set. **Other line-** - *dropline* (DLM) (DLH)- float dropline mainline set vertically with a 6kg bottom weight and a top float, between 10 and 100 snoods off the mainline and a series of hooks attached to the snoods at the deeper end of the line (hook baiting is manual). Shorter than longline gear and carrying less hooks. Set in 60-500m depth (*CSF Workshop, Nov 2005*). Reel dropline is deployed in a similar configuration, but no top float as the lines remain attached to the boat, with 4 lines set on the port side and another 4 lines set on the starboard side. - *trotline* (TL) – similar to demersal longline, but with mainline suspended off the seabed to avoid snagging and snoods weighted to hang vertically under the mainline. Snoods attached at 6-10 cm intervals; hooks baited before deployment. - *setline*- (DL) a line to which 1 or more lures or baits are attached. Set and retrieved manually, but may be employ motor to reduce labour.
Area of gear impact per set or shot	*Description of area impacted by gear per set (square metres)* **Auto-longline –** From CS01 logbooks, shot length are between 9 and 10 km with length of snoods between 35-50cm (*Observer Reports*) **Demersal longline -** From CS01 logbooks, shot length may vary from ~4 to 11 km with snoods length of 35-50cm. **Other line –** Limited area of impact on bottom as gears are predominantly set vertically in the water column.
Capacity of gear	*Description number hooks per set, net size weight per trawl shot* **Auto-longline** – generally 1,000+ hooks per set; no more than 15,000 hooks to be used, stowed or secured on the boat when fishing. **Demersal longline** – generally 60 to 200 hooks per line but may be as great as 700 hooks per line (CS01 logbook data) **Other line** – 5 linesX40 hooks (DLM), 60-70 hooks (DLH), 250 hooks/set (TL) (*CSF Stakeholder Meeting, April 2004*)
Effort per annum all boats	*Description effort per annum of all boats in fishery by shots or sets and hooks, d for all boats* See comments in "Current and recent fishery catch trends by method" section.
Lost gear and ghost fishing	*Description of how gear is lost, whether lost gear is retrieved, and what happens to gear that is not retrieve, and impacts of ghost fishing* Individual Fishing Activity Reports indicate loss of line from ~50% of trips, with loss of sinkers, and between 10-60 hooks reported generally through snagging in 200-350 m depths (*FAR Oct. 2005*) particularly for drop line method (Other line sub-fishery). FAR Reports note that broken or bitten lines are a regular occurrence, with 300-1000 hks/trip documented. Operator comments indicate, on average, 10% of hooks lost/trip (*CSF Workshop, Nov 2005*).
Issues	
Species lists by	*Species list by component (including target, by-catch/by-product and TEP), habitat and community tables*

component	See Scoping Document S1.2 Species validation issues exist for several species within the Coral Sea Fishery, as noted in specific fishery reports. In the line fishery, *Lutjanus malabaricus* has been noted in CS01 logbooks as discard from auto-longline and demersal longline, and in particularly large quantities from the Other line sub-fishery. This species has been recorded over several years from a number of boats. The species distribution does not overlap with the jurisdictional boundaries of the CSF, but as little Observer data is available to provide the correct species identification, and none from the Other line gear, it has been retained in CS01-derived species lists as "*Lutjanus malabaricus* – unvalidated". Observer data or species taxonomic validation is recommended to clarify this species issue.
Target species issues	*List any issues, including biological information such as spawning season and spawning location, major uncertainties about biology or management, interactions etc* Families targeted are highly fecund, but little specific information is available, and no information for the Coral Sea particularly. Lutjanids are estimated to live between 8-15 years, Lethrinids 15-25 years. Coral cods are known to be subject to localised depletion in the Great Barrier Reef.. Gemfish is listed as a target species for the Other Line sub-fishery, but no validated identification is available to determine the species concerned. Monitoring of all catches of target species has been recommended for this sector to allow consideration of trends, and develop management responses by the end of 2006 (*DEH 2004*). At present, no summary data is available. **Auto-longline –**

Species name	Common name
Epinephelus morrhua	Comet Grouper
Aethaloperca, Anyperodon, Epinephelus spp.	Rock cods
Plectropomus & Variola spp.	Coral trout
Priacanthus spp	Red bullseye
Etelis carbunculus	Northwest Ruby Fish
Pristipomoides filamentosus	Rosy Jobfish / King Snapper
Etelis coruscans	Flame Snapper
Gymnocranius spp	Sea Bream Snapper
Hyperoglyphe antarctica	Blue Eye Trevalla

Demersal longline –

Species name	Common name
Galeocerdo cuvier	Tiger Shark
Carcharhinus sp	Blacktip sharks
Triaenodon obesus *Carcharhinus amblyrhynchos* *Plectropomus & Variola spp.* *Sphyrna lewini* *Etelis coruscans* *Epinephelus ergastularius/ septemfasciatus*	White tip reef shark Grey reef shark Coral trout Scalloped Hammerhead Flame Snapper Bar Rockcod

Other line – This species listing has been compiled from logbook records. The

<table>
<tr><td></td><td>catch data indicates that the species composition of catches is changing, the proportion of catches of individual species is changing, and suggests that some byproduct species are approaching Target species status.
<table>
<tr><th>Species name</th><th>Common name</th></tr>
<tr><td>Pristipomoides filamentosus</td><td>Rosy Jobfish / King Snapper</td></tr>
<tr><td>Etelis carbunculus</td><td>Northwest Ruby Fish</td></tr>
<tr><td>Epinephelus ergastularius/septemfasciatus</td><td>Bar Rockcod</td></tr>
<tr><td>Wattsia mossambica</td><td>Mozambique bream</td></tr>
<tr><td>Pristipomoides multidens & P. typus</td><td>Tropical snapper</td></tr>
<tr><td>Epinephelus morrhua</td><td>Comet Grouper</td></tr>
<tr><td>Carcharhinus spp</td><td>Whaler sharks</td></tr>
<tr><td>Lutjanus sebae</td><td>Red Emperor</td></tr>
<tr><td>Lethrinus miniatus</td><td>Redthroat emperor</td></tr>
<tr><td>Acanthocybium solandri</td><td>Wahoo</td></tr>
<tr><td>Scomberomorus commerson</td><td>Spanish mackerel</td></tr>
<tr><td>Squalus mitsukurii</td><td>Greeneye dogfish</td></tr>
<tr><td>Carcharhinus brachyurus</td><td>Bronze Whaler</td></tr>
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<tr><td>Variola louti</td><td>Coronation Grouper</td></tr>
<tr><td>Glaucosoma spp</td><td>Pearl perch</td></tr>
<tr><td>Gempylidae – species ID undetermined</td><td>Gemfish</td></tr>
<tr><td>Aphareus rutilans
Etelis coruscans
Aethaloperca, Anyperodon, Epinephelus spp.</td><td>Jobfish
Flame Snapper
Rock cods</td></tr>
</table>
</td></tr>
<tr><td>Byproduct and bycatch issues and interactions</td><td>List any issues, as for the target species above

There is no by-catch action plan for the CSF. Specific by-catch mitigation measures are not in place.

Monitoring of all catches of bycatch and byproduct species has been recommended for this sector to allow consideration of trends, and develop management responses by the end of 2006 (DEH 2004). At present, no summary data is available.

Byproduct species, for each specific gear type, are listed in the relevant subfishery report under Scoping Document S2A</td></tr>
<tr><td>TEP issues and interactions</td><td>List any issues. This section should consider all TEP species groups: marine mammals, chondrichthyans (sharks, rays etc.), marine reptiles, seabirds, teleosts (bony fishes), include any key spawning/breeding/aggregation locations that might overlap with the fishery/sub-fishery.

AFMA has recently gained funding for an Ecological Based Fisheries Management (EBFM) Project aimed at enhanced data collection for the 2004/5 and 2005/6 financial years. “The final report should provide data collection, handling and associated reporting in Commonwealth fisheries in areas where adequate information does not currently exist (for example interactions with protected species and other high risk species)” (CSF Stakeholders Meeting April 2005).

At present, there are no recorded wildlife interactions (FAR Oct. 2005). Although low level interactions are expected to occur, the Statement of Management Arrangements provide measures to ensure all reasonable steps are taken to reduce</td></tr>
</table>

	impact on these species (*DEH Assessment of the Coral Sea Fishery 2004*). A list of TEP species is provided with this document. Consideration has been given to catches of turtles in particular, and operators have been instructed on how best to remove and return turtles to the water to achieve optimum survival rates (*CSF Stakeholders Meeting April 2005*). Data is being collected in logbooks and through observer coverage and further consideration of TEP species interactions is expected to occur during the ERA process, using these data. Observer Reports note sightings of shy albatross, white-crested noddy, brown booby, turtles and seal.
Habitat issues and interactions	*List any issues for any of the habitat units identified in **Scoping Document S1.2**. This should include reference to any protected, threatened or listed habitats* There is an absence of information on which to base habitat issues and interactions. The Coral Sea Reef system comprises 6 main habitats: outer reef slope, reef crest, back reef, leeward slope or lagoon, pinnacle, and inter-reef channels. Coringa-Herald and Lihou Reef National Nature Reserves are closed to fishing due to their high conservation value. Typically reefs are isolated shallow platforms dropping off steeply into deep water, with exposed outer slope and intertidal zone of consolidated limestone (Allen 1988).
Community issues and interactions	*List any issues for any of the community units identified in **Scoping Document S1.2**.* Insufficient data is available to categorically determine the impact of demersal line fishing on target species, and thus on the food chain and the larger community. There are no listed threatened ecological communities in the CSF area (*DEH Assessment of the Coral Sea Fishery 2004*).
Discarding	*Summary of discarding practices by sub-fishery, including by-catch, juveniles of target species, high-grading, processing at sea.* CS01 logbook data reports discarding for the 3 line sub-fisheries as follows: **Autolongline**: Logbook data and Observer Reports

Species name	Common name
Alopias superciliosus	Bigeye thresher
Carcharhinus altimus	Bignose shark
Congridae	Eel
“*Lutjanus malabaricus*-unvalidated”	Large Mouth Nannygai
Gymnothorax sp	moray eel
Gymnothorax sp 1	moray eel
Gymnothorax sp 2	moray eel
Paraulopus okamurai	Piedtip cucumberfish
Squalus megalops	Spurdog
Squalus mitsukurii	Greeneye dogfish
Cirrhigaleus barbifer	Mandarin shark
Squalus sp B	Dogfish
Squalus sp F	dogfish
Erthrocles schlegeli	

	Demersal longline: no observer data collected.

Species name	Common name
Squalus mitsukurii	Green-Eyed Dogfish
Squalus megalops	Spurdog
“*Lutjanus malabaricus*-unvalidated”	Large Mouth Nannygai
Nebrius ferrugineus	Tawny shark

Other line: no observer data collected.
Total discarding of…

Species name	Common name
Nebrius ferrugineus	Tawny shark
Lutjanus bohar	Red bass
“*Lutjanus malabaricus*-unvalidated”	Large Mouth Nannygai
Balistidae and Monacanthidae	Leatherjacket
Triaenodon obesus	Whitetip Reef Shark
Heniochus diphreutes	Schooling bannerfish
Triakidae	Hound sharks
Congridae	Eel
Gymnosarda unicolor	Dogtooth Tuna
Seriolella brama	Blue warehou
Rhinidae	Wedgefishes
Lutjanus erythropterus	Crimson snapper
Bodianus flavipinnis	Yellowfin pigfish
Brachaeluridae	Nurse/Zebra sharks
Siganidae	Rabbitfish
Lutjanus gibbus	Paddletail
Auxis rochei	Frigate mackerel
Ephippidae, Drepanidae	Batfish
Trachyscorpia sp	Ocean perch
Acanthuridae, Zanclidae	Moorish idol/surgeonfish
Tetraodontidae	Toadfishes
Nelusetta ayraudi	Chinaman-Leatherjacket
Lepidocybium flavobrunneum	Black Oilfish/escolar
Caranx lugubris	Black Trevally
Centrophorus moluccensis	Endeavour Dogfish

and graded discarding of…

Species name	Common name
Carcharhinus spp	Blacktip sharks
Carangidae	Trevally
Lutjanus spp.	Tropical snapper
Sharks - other	
Thyrsites atun	Barracouta
Abalistes stellaris	Starry Trigger Fish
Lethrinus laticaudis	Grass Emperor
Sphyrna lewini	Scalloped Hammerhead

Management: planned and those implemented	
Management Objectives	*The management objectives from the most recent management plan* Rather than a Management Plan, a Statement of Management Arrangements 2004/05 is in place for this fishery. In November 2004, the fishery was accredited

	as meeting the EPBC Act requirements. The CSF does not have a formal MAC or RAG process to discuss fishery-specific research priority setting or call for research proposals. Great Barrier Reef zoning changes may re-direct more attention (illegal and recreational).).
Fishery management plan	*Is there a fisheries management plan is it in the planning stage or implemented what are the key features* No Management Plan exists for any sector of the Coral Sea Fishery.
Input controls	*Summary of any input controls in the fishery, e.g. limited entry, area restrictions (zoning), vessel size restrictions and gear restrictions. Primarily focused on target species as other species are addressed below.* **Auto-longline**, **Demersal longline** and **Other line** restrictions include: limited entry provisions single jurisdiction fishing trips a specified minimum of 20 fishing days per permit per season, operational ICVMS completion of catch disposal records, “Taking or carrying tuna like species”. AFMA proforma must be submitted within 21 days of each fishing trip. Observers used on every 4th trip, with the aim to cover 25% of all shots. Lines set in less than 200m must have observer on board and coverage on 50% of deployments. **Auto longline** operators must have bird scaring tori lines installed. The 2005 stakeholders meeting agreed to look at the rational of depth limits for auto-longliners, particularly with regard to comparison of differences in target and by-catch species at different depths, between the GHATF and the CSF. To date, there has been no further communication on these depth issues.
Output controls	*Summary of any output controls in the fishery, e.g. quotas. Effort days at sea. Primarily focused on target species as other species are addressed below.* TAC’s, spatial controls
Technical measures	*Summary of any technical measures in the fishery, e.g. size limits, bans on females, closed areas or seasons. Gear mesh size, mitigation measures such as TEDs. Primarily focused on target species as other species are addressed below.* Gear restrictions, size limits,
Regulations	*Regulations regarding species (by-catch and by-product, TEP), habitat, and communities; MARPOL and pollution; rules regarding activities at sea such as discarding offal and/or processing at sea.* “Taking or carrying tuna like species” restrictions apply to all CSF sectors. Effectively this excludes the taking of billfish (Istiophoridae and Xiphiidae) and pomfrets or ray’s bream (Scombridae and Bramidae), but allows the catch of mackerels (Scomberomorus, Scomber, Acanthocybium, Grammatorcynus and Rastrelliger). All sharks taken must be landed in a prescribed manner. Shark fins not attached to their carcass are prohibited, and shark liver cannot be carried unless the carcass is

	also landed. All operators are aware of MARPOL requirements. Only 1 vessel in the CSF is not covered (by vessel size or weight) within these regulations.
Initiatives and strategies	*BAPs; TEDs; industry codes of conduct, MPAs, Reserves* CSF excludes the areas of the Coringa-Herald and Lihou Reef National nature Reserves.
Enabling processes	*Monitoring (logbooks, observer data, scientific surveys); assessment (stock assessments); performance indicators (decision rules, processes, compliance; education; consultation process* Line fishery operators are required to complete CS01 (Commonwealth Coral Sea Line, Trawl & Collection Daily Logbook), with catches verified through the SESS2 (Catch Disposal Record) Failure to meet performance criteria will result in permits not being renewed. **Autolongline** operators must employ observer data collection strategies
Other initiatives or agreements	*State, national or international conventions or agreements that impact on the management of the fishery/sub-fishery being evaluated.* By means of measures such as limited entry provisions within the CSF, catch levels have been caped at precautionary levels to ensure sustainability of commercial species. Areas or species identified through the ERA as high risk will have management measures implemented to minimize impacts. This will occur after consultation with stakeholders, and in line with AFMA legislative objectives. A proposal has recently been presented involving a voluntary exclusion of hook fishing on a number of reefs, with a Memorandum of Understanding (MoU) to accommodate tourism practices. This MoU is expected to encompass 5 reefs.
Data	
Logbook data	*Verified logbook data; data summaries describe programme* There are no data summaries available for the CSF. Raw logbook data from the CSO1 logbook has been provided but, with the 5-boat ruling and constraints of confidentiality, can only be used in general terms. Catch Disposal Records have also be accessed
Observer data	*Observer programme describe parameters as below* *Observer coverage* is not required for demersal longline or Otherline operations. As part of the autolongline permit condition, Observers must be used on autolongline vessels on every 4th trip, with the aim to cover 25% of all shots. Autolonglines set in less than 200m must have observer on board and coverage on 50% of deployments. *Purpose*: As no previous species data is available for the CSF for setting species quotas, observer coverage -together with the minimum operational commitment- has been made a permit condition to ensure adequate verified data is available for use in future species assessment and quota establishment. This data is required for

	all components of risk assessment. Data obtained by Observers is used to verify target species, catch and effort, discard and byproduct species, and TEP interactions with the fishery, as well as monitoring compliance with access conditions. *Data collection, collation and checking* do not appear to be monitored for the CSF, and *Experience, Education*, *Training* and *Resources* appears to be limited. As noted in the section **Species list by component**, there are species validation issues for the CSF that need to be addressed. A more rigorous format for Observer Reporting, with specific presence/absence reporting of issues, would be recommended to address the issues of a lack of data to refute or confirm many risk assessment issues.
Other data	*Studies, surveys* No other data is available.

2.2.2 Unit of Analysis Lists (Step 2)

The units of analysis for the sub-fishery are listed by component:

- Species Components (target, byproduct/discards and TEP components). [Scoping document S2A Species]
- Habitat Component: habitat types. [Scoping document S2B Habitats]
- Community Component: community types. [Scoping document S2C Communities]

Total Ecological Units Assessed for the Coral Sea Fishery Other Line sub-fishery

Target species:	22
By-product species:	47
Discard Species:	25
TEP species:	109
Habitats:	268 (264 benthic, 4 overlying pelagic)
Communities:	13 (9 demersal, 4 overlying pelagic)

Scoping Document S2A Species

Each species identified during the scoping is added to the ERAEF database used to run the Level 2 analyses. A CAAB code (Code for Australian Aquatic Biota) is required to input the information. The CAAB codes for each species may be found at http://www.marine.csiro.au/caab/

Target species *[CSF Other Line]*
This list was obtained by reviewing Commonwealth CSO1 Logbook data, and through discussions with stakeholders.

Sp Code	CAAB	Family	Species name	Common name	Role	Source
	37018000	Carcharhinidae	*Carcharhinus spp*	Whaler sharks	Target	CS01
	37018001	Carcharhinidae	*Carcharhinus brachyurus*	Bronze Whaler	Target	CS01
	37018022	Carcharhinidae	*Galeocerdo cuvier*	Tiger Shark	Target	CS01

DGG	37020007	Squalidae	*Squalus mitsukurii*	Greeneye dogfish	Target	CS01
GRC	37311151	Serranidae	*Epinephelus morrhua*	Comet Grouper	Target	CS01
	37311166	Serranidae	*Variola louti*	Coronation Grouper	Target	CS01
CRO	37311901	Serranidae	*Aethaloperca, Anyperodon, Epinephelus spp.*	Rock cods	Target	CS01
TCG	37311905	Serranidae	*Plectropomus* & *Variola spp.*	Coral trout	Target	CS01
BAC	37311910	Serranidae	*Epinephelus ergastularius/septemfasciatus*	Bar Rockcod	Target	CS01
	37320901	Glaucosomatidae	*Glaucosoma spp*	Pearl perch	Target	CS01
JOB	37346001	Lutjanidae	*Aphareus rutilans*	Jobfish	Target	CS01
RDE	37346004	Lutjanidae	*Lutjanus sebae*	Red Emperor	Target	CS01
SNR	37346014	Lutjanidae	*Etelis carbunculus*	Northwest Ruby Fish	Target	CS01
JOG	37346027	Lutjanidae	*Aprion virescens*	Green Jobfish	Target	CS01
JOR	37346032	Lutjanidae	*Pristipomoides filamentosus*	Rosy Jobfish / King Snapper	Target	CS01
SNF	37346038	Lutjanidae	*Etelis coruscans*	Flame Snapper	Target	CS01
SNG	37346901	Lutjanidae	*Pristipomoides multidens/ typus*	Tropical snapper	Target	CS01
RTE	37351009	Lethrinidae	*Lethrinus miniatus*	Redthroat emperor	Target	CS01
MOZ	37351027	Lethrinidae	*Wattsia mossambica*	Mozambique bream	Target	CS01
	374390??	Gempylidae	Gempylidae - species ID undetermined	Gemfish	Target	CS01
	37441007	Scombridae	*Scomberomorus commerson*	Spanish mackerel	Target	CS01
	37441024	Scombridae	*Acanthocybium solandri*	Wahoo	Target	CS01

Byproduct species *[CSF Other Line]*

Byproduct refers to any part of the catch which is kept or sold by the fisher but which is not a target species.

Sp Code	CAAB	Family	Species name	Common name	Role	Source
	37010001	Lamnidae	*Isurus oxyrinchus*	Shortfin mako	Byproduct	CS01
	37018027	Carcharhinidae	*Carcharhinus albimarginatus*	Silvertip Shark	Byproduct	CS01
	37018033	Carcharhinidae	*Carcharhinus amblyrhynchos*	Grey Reef Shark	Byproduct	CS01
	37063003	Muraenesocidae	*Muraenesox bagio*	Common pike eel	Byproduct	CS01

	37224006	Moridae	*Pseudophycis bachus*	Red cod	Byproduct	CS01
HAP	37311006	Polyprionidae	*Polyprion oxygeneios*	Hapuku	Byproduct	CS01
	37311019	Serranidae	*Epinephelus heniochus*	Bridled Grouper/ Three-lined rock cod	Byproduct	CS01
HCC	37311040	Serranidae	*Epinephelus quoyanus*	Longfin rockcod	Byproduct	CS01
	37311042	Serranidae	*Epinephelus radiatus*	Radiant rockcod	Byproduct	CS01
	37311086	Serranidae	*Epinephelus undulatostriatus*	Maori Grouper	Byproduct	CS01
	37311087	Percichthyidae	*Maccullochella macquariensis*	Trout cod	Byproduct	CS01
COT	37311136	Serranidae	*Cephalopholis cyanostigma*	Tomato Cod / Bluespotted Hind	Byproduct	CS01
BUS	37326901	Priacanthidae	*Priacanthus spp*	Bigeye	Byproduct	CS01
	37335001	Rachycentridae	*Rachycentron canadum*	Black Kingfish	Byproduct	CS01
	37337006	Carangidae	*Seriola lalandi*	Yellowtail kingfish	Byproduct	CS01
SAM	37337007	Carangidae	*Seriola hippos*	Samsonfish	Byproduct	CS01
	37337012	Carangidae	*Gnathanodon speciosus*	Golden Trevally	Byproduct	CS01
AJK	37337025	Carangidae	*Seriola dumerili*	Eye Streak Kingfish/ Amberjack	Byproduct	CS01
	37337029	Carangidae	*Elegatis bipinnulata*	Rainbow runner	Byproduct	CS01
	37337062	Carangidae	*Pseudocaranx dentex*	Silver Trevally	Byproduct	CS01
	37338001	Coryphaenidae	*Coryphaena hippurus*	Mahi Mahi	Byproduct	CS01
	37346000	Lutjanidae	Lutjanidae	Snapper	Byproduct	CS01
	37346016	Lutjanidae	*Lutjanus rivulatus*	Maori snapper	Byproduct	CS01
	37346031	Lutjanidae	*Lipocheilus carnolabrum*	Tang Snapper	Byproduct	CS01
HUS	37346033	Lutjanidae	*Lutjanus adetii*	Hussar	Byproduct	CS01
	37346055	Lutjanidae	*Pristipomoides flavipinnis*	Golden-eye Jobfish	Byproduct	CS01
SNO	37346056	Lutjanidae	*Pristipomoides zonatus*	Oblique-banded Snapper	Byproduct	CS01
SLT	37346914	Lutjanidae	*Etelis spp.*	Long Tail Rubies/Snapper	Byproduct	CS01
	37351004	Lethrinidae	*Lethrinus olivaceus*	Longnose emperor	Byproduct	CS01
	37351005	Lethrinidae	*Gymnocranius grandoculis*	Robinsons seabream	Byproduct	CS01
	37351022	Lethrinidae	*Gymnocranius euanus*	Japanese sea bream	Byproduct	CS01
SNB	37351901	Lethrinidae	*Gymnocranius spp*	Sea Bream Snapper	Byproduct	CS01
	37353000	Sparidae	Sparidae	Bream	Byproduct	CS01

	37353001	Sparidae	*Pagrus auratus*	Pink snapper	Byproduct	CS01
	37355000	Mullidae	Mullidae	Goatfishes - Barbounia	Byproduct	CS01
GBL	37384043	Labridae	*Achoerodus viridis*	Eastern Blue Groper	Byproduct	CS01
	37384104	Labridae	*Epibulus insidiator*	Sling-jaw wrasse	Byproduct	CS01
	37441010	Scombridae	*Euthynnus affinis*	Mackerel tuna	Byproduct	CS01
TBE	37445001	Centrolophidae	*Hyperoglyphe antarctica*	Blue eye trevalla	Byproduct	CS01
	37018901	Carcharhinidae	*Carcharhinus spp*	Blacktip sharks	GradedByproduct	CS01
	37019001	Sphyrnidae	*Sphyrna lewini*	Scalloped Hammerhead	GradedByproduct	CS01
	37337000	Carangidae	Carangidae	Trevally	GradedByproduct	CS01
	37346905	Lutjanidae	*Lutjanus spp.*	Tropical snapper	GradedByproduct	CS01
	37351006	Lethrinidae	*Lethrinus laticaudis*	Grass Emperor	GradedByproduct	CS01
	37439001	Gempylidae	*Thyrsites atun*	Barracouta	GradedByproduct	CS01
	37465011	Ballistidae	*Abalistes stellaris*	Starry Trigger Fish	GradedByproduct	CS01
	37990003		Sharks - other		GradedByproduct	CS01

Discard species *[CSF Other Line]*

Bycatch as defined in the Commonwealth Policy on Fisheries Bycatch 2000 refers to:

- that part of a fisher's catch which is returned to the sea either because it has no commercial value or because regulations preclude it being retained; and
- that part of the 'catch' that does not reach the deck but is affected by interaction with the fishing gear

However, in the ERAEF method, the part of the target or byproduct catch that is discarded is included in the assessment of the target or byproduct species.

Sp Code	CAAB	Family	Species name	Common name	Role	Source
	37013000	Brachaeluridae	*Brachaeluridae*	Nurse/Zebra sharks	Discard	CS01
	37013010	Ginglymostomidae	*Nebrius ferrugineus*	Tawny shark	Discard	CS01
	37017000	Triakidae	Triakidae	Hound sharks	Discard	CS01

SWT	37018038	Carcharhinidae	*Triaenodon obesus*	Whitetip Reef Shark	Discard	CS01
DGE	37020001	Squalidae	*Centrophorus moluccensis*	Endeavour Dogfish	Discard	CS01
	37026000	Rhinidae	Rhinidae	Wedgefishes	Discard	CS01
	37067000	Congridae	Congridae	Eel	Discard	CS01
	37287103	Sebastidae	*Trachyscorpia sp*	Ocean perch	Discard	CS01
	37337053	Carangidae	*Caranx lugubris*	Black Trevally	Discard	CS01
	37346005	Lutjanidae	*Lutjanus erythropterus*	Crimson snapper	Discard	CS01
RSS	37346007	Lutjanidae	*"Lutjanus malabaricus*-unvalidated*"*	Large mouth nannygai/Saddletail snapper	Discard	CS01
	37346028	Lutjanidae	*Lutjanus gibbus*	Paddletail	Discard	CS01
	37346029	Lutjanidae	*Lutjanus bohar*	Red bass	Discard	CS01
	37362000	Ephippidae, Drepanidae	Ephippidae, Drepanidae	Batfish	Discard	CS01
	37365005	Chaetodontidae	*Heniochus diphreutes*	Schooling bannerfish	Discard	CS01
	37384035	Labridae	*Bodianus flavipinnis*	Yellowfin pigfish	Discard	CS01
	37437000	Acanthuridae, Zanclidae	Acanthuridae, Zanclidae	Moorish idol/surgeonfish	Discard	CS01
	37438000	Siganidae	Siganidae	Rabbitfish	Discard	CS01
	37439008	Gempylidae	*Lepidocybium flavobrunneum*	Black Oilfish/escolar	Discard	CS01
	37441009	Scombridae	*Auxis rochei*	Frigate mackerel	Discard	CS01
	37441029	Scombridae	*Gymnosarda unicolor*	Dogtooth Tuna	Discard	CS01
	37445005	Centrolophidae	*Seriolella brama*	Blue warehou	Discard	CS01
LTH	37465000	Balistidae, Monacanthidae	*Balistidae, Monacanthidae*	Leatherjacket	Discard	CS01
	37465006	Ballistidae	*Nelusetta ayraudi*	Chinaman-Leatherjacket	Discard	CS01
	37467000	Tetraodontidae	Tetraodontidae	Toadfishes	Discard	CS01

TEP species [*CSF Other Line*]

TEP species are those species listed as Threatened, Endangered or Protected under the EPBC Act.

TEP species are often poorly listed by fisheries due to low frequency of direct interaction. Both direct (capture) and indirect (e.g. food source captured) interaction are considered in the ERAEF approach. A list of TEP species has been generated for each fishery and is included in the PSA workbook species list. This list has been generated using the DEH Search Tool from DEH home page *http://www.deh.gov.au/*

For each fishery, the list of TEP species is compiled by reviewing all available fishery literature. Species considered to have potential to interact with fishery (based on geographic range & proven/perceived susceptibility to the fishing gear/methods and examples from other similar fisheries across the globe) should also be included.

Taxa name	**Common name**	**Scientific name**	**CAAB**	**Fishery**
Chondrichthyan	Whale Shark	*Rhincodon typus*	37014001	CSF
Marine Bird	Streaked Shearwater	*Calonectris leucomelas*	40041002	CSF
Marine Bird	Lesser Frigatebird, Least Frigatebird	*Fregata ariel*	40050002	CSF
Marine Bird	Great Frigatebird, Greater Frigatebird	*Fregata minor*	40050003	CSF
Marine Bird	White-bellied Storm-Petrel (Australasian)	*Fregetta grallaria*	40042001	CSF
Marine Bird	Southern Giant-Petrel	*Macronectes giganteus*	40041007	CSF
Marine Bird	Red-tailed Tropicbird	*Phaethon rubricauda*	40045002	CSF
Marine Bird	Herald Petrel	*Pterodroma heraldica*	99999999	CSF
Marine Bird	Kermadec Petrel (western)	*Pterodroma neglecta*	40041033	CSF
Marine Bird	Wedge-tailed Shearwater	*Puffinus pacificus*	40041045	CSF
Marine Bird	Crested Tern	*Sterna bergii*	40128025	CSF
Marine Bird	Sooty Tern	*Sterna fuscata*	40128028	CSF
Marine Bird	Black-naped Tern	*Sterna sumatrana*	40128034	CSF
Marine Bird	Masked Booby	*Sula dactylatra*	40047004	CSF
Marine Bird	Brown Booby	*Sula leucogaster*	40047005	CSF
Marine Bird	Red-footed Booby	*Sula sula*	40047006	CSF
Marine Bird	Black Noddy	*Anous minutus*	40128001	CSF
Marine Bird	Common Noddy	*Anous stolidus*	40128002	CSF
Marine mammal	Common Dolphin	*Delphinus delphis*	41116001	CSF
Marine mammal	Pygmy Killer Whale	*Feresa attenuata*	41116002	CSF
Marine mammal	Short-finned Pilot Whale	*Globicephala macrorhynchus*	41116003	CSF
Marine mammal	Risso's Dolphin, Grampus	*Grampus griseus*	41116005	CSF
Marine mammal	Longman's Beaked Whale	*Indopacetus pacificus*	41120003	CSF
Marine mammal	Pygmy Sperm Whale	*Kogia breviceps*	41119001	CSF
Marine mammal	Dwarf Sperm Whale	*Kogia simus*	41119002	CSF
Marine mammal	Fraser's Dolphin, Sarawak Dolphin	*Lagenodelphis hosei*	41116006	CSF

Marine mammal	Humpback Whale	*Megaptera novaeangliae*	41112006	CSF
Marine mammal	Blainville's Beaked/Dense-beaked Whale	*Mesoplodon densirostris*	41120005	CSF
Marine mammal	Gingko-toothed/Ginko Beaked Whale	*Mesoplodon gingkodens*	41120006	CSF
Marine mammal	Strap-toothed/ Layard's Beaked Whale	*Mesoplodon layardii*	41120009	CSF
Marine mammal	Killer Whale, Orca	*Orcinus orca*	41116011	CSF
Marine mammal	Melon-headed Whale	*Peponocephala electra*	41116012	CSF
Marine mammal	Sperm Whale	*Physeter catodon*	41119003	CSF
Marine mammal	False Killer Whale	*Pseudorca crassidens*	41116013	CSF
Marine mammal	Spotted/Pantropical Spotted Dolphin	*Stenella attenuata*	41116015	CSF
Marine mammal	Striped Dolphin, Euphrosyne Dolphin	*Stenella coeruleoalba*	41116016	CSF
Marine mammal	Long-snouted Spinner Dolphin	*Stenella longirostris*	41116017	CSF
Marine mammal	Rough-toothed Dolphin	*Steno bredanensis*	41116018	CSF
Marine mammal	Bottlenose Dolphin	*Tursiops truncatus*	41116019	CSF
Marine mammal	Cuvier's Beaked/ Goose-beaked Whale	*Ziphius cavirostris*	41120012	CSF
Marine mammal	Sei Whale	*Balaenoptera borealis*	41112002	CSF
Marine mammal	Bryde's Whale	*Balaenoptera edeni*	41112003	CSF
Marine mammal	Blue Whale	*Balaenoptera musculus*	41112004	CSF
Marine reptile	Green Turtle	*Chelonia mydas*	39020002	CSF
Marine reptile	Estuarine/Salt-water Crocodile	*Crocodylus porosus*	39140002	CSF
Marine reptile	Leathery Turtle, Leatherback Turtle	*Dermochelys coriacea*	39021001	CSF
Marine reptile	Spectacled Seasnake	*Disteira kingii*	39125010	CSF
Marine reptile	Olive-headed Seasnake	*Disteira major*	39125011	CSF
Marine reptile	Turtle-headed Seasnake	*Emydocephalus annulatus*	39125012	CSF
Marine reptile	Beaked Seasnake	*Enhydrina schistosa*	39125013	CSF
Marine reptile	Elegant Seasnake	*Hydrophis elegans*	39125021	CSF
Marine reptile	Slender Seasnake	*Hydrophis gracilis*	39125023	CSF
Marine reptile	small-headed seasnake	*Hydrophis mcdowelli*	39125025	CSF
Marine reptile	Black-banded Robust Seasnake	*Hydrophis melanosoma*	39125027	CSF
Marine reptile	a seasnake	*Hydrophis ornatus*	39125028	CSF
Marine reptile	Spine-bellied Seasnake	*Lapemis hardwickii*	39125031	CSF
Marine reptile	a sea krait	*Laticauda colubrina*	39124001	CSF
Marine reptile	a sea krait	*Laticauda laticaudata*	39124002	CSF

Marine reptile	Flatback Turtle	*Natator depressus*	39020005	CSF
Marine reptile	Yellow-bellied Seasnake	*Pelamis platurus*	39125033	CSF
Marine reptile	Horned Seasnake	*Acalyptophis peronii*	39125001	CSF
Marine reptile	Dubois' Seasnake	*Aipysurus duboisii*	39125003	CSF
Marine reptile	Spine-tailed Seasnake	*Aipysurus eydouxii*	39125004	CSF
Marine reptile	Olive Seasnake	*Aipysurus laevis*	39125007	CSF
Marine reptile	Stokes' Seasnake	*Astrotia stokesii*	39125009	CSF
Teleost	Davao Pughead Pipefish	*Bulbonaricus davaoensis*	37282038	CSF
Teleost	Short-bodied Pipefish	*Choeroichthys brachysoma*	37282042	CSF
Teleost	Sculptured Pipefish	*Choeroichthys sculptus*	37282045	CSF
Teleost	Pig-snouted Pipefish	*Choeroichthys suillus*	37282046	CSF
Teleost	Fijian Banded/Brown-banded Pipefish	*Corythoichthys amplexus*	37282047	CSF
Teleost	Yellow-banded/Network Pipefish	*Corythoichthys conspicillatus*	37282032	CSF
Teleost	Australian Messmate/Banded Pipefish	*Corythoichthys intestinalis*	37282049	CSF
Teleost	Orange-spotted/Ocellated Pipefish	*Corythoichthys ocellatus*	37282050	CSF
Teleost	Schultz's Pipefish	*Corythoichthys schultzi*	37282052	CSF
Teleost	Maxweber's Pipefish	*Cosmocampus maxweberi*	37282056	CSF
Teleost	Cleaner/Janss' Pipefish	*Doryrhamphus janssi*	37282059	CSF
Teleost	Flagtail/Negros Pipefish	*Doryrhamphus malus*	37282060	CSF
Teleost	Indian/ Blue-stripe Pipefish	*Doryrhamphus melanopleura*	37282058	CSF
Teleost	Ringed Pipefish	*Dunckerocampus dactyliophorus*	37282057	CSF
Teleost	Girdled Pipefish	*Festucalex cinctus*	37282061	CSF
Teleost	Brock's Pipefish	*Halicampus brocki*	37282065	CSF
Teleost	Red-hair/Duncker's Pipefish	*Halicampus dunckeri*	37282066	CSF
Teleost	Mud/Gray's Pipefish	*Halicampus grayi*	37282030	CSF
Teleost	Whiskered/Ornate Pipefish	*Halicampus macrorhynchus*	37282067	CSF
Teleost	Spiny-snout Pipefish	*Halicampus spinirostris*	37282070	CSF
Teleost	Ribboned Seadragon/ Pipefish	*Haliichthys taeniophorus*	37282007	CSF
Teleost	Blue-speckled/Blue-spotted Pipefish	*Hippichthys cyanospilos*	37282072	CSF
Teleost	Madura/Reticulated Freshwater Pipefish	*Hippichthys heptagonus*	37282073	CSF
Teleost	Beady/Steep-nosed Pipefish	*Hippichthys penicillus*	37282075	CSF
Teleost	Spiny Seahorse	*Hippocampus jugumus*	99999999	CSF

Teleost	Flat-face Seahorse	*Hippocampus planifrons*	37282078	CSF
Teleost	Hedgehog Seahorse	*Hippocampus spinosissimus*	99999999	CSF
Teleost	Spotted/Yellow Seahorse	*Hippocampus taeniopterus*	99999999	CSF
Teleost	Zebra Seahorse	*Hippocampus zebra*	37282080	CSF
Teleost	Anderson's/Shortnose Pipefish	*Micrognathus andersonii*	37282086	CSF
Teleost	Thorn-tailed Pipefish	*Micrognathus pygmaeus*	37282087	CSF
Teleost	Short-tailed/ River Pipefish	*Microphis brachyurus*	37282090	CSF
Teleost	Pale-blotched/Spined Pipefish	*Phoxocampus diacanthus*	37282096	CSF
Teleost	Soft-coral Pipefish	*Siokunichthys breviceps*	37282097	CSF
Teleost	Duncker's Pipehorse	*Solegnathus dunckeri*	37282098	CSF
Teleost	Pipehorse	*Solegnathus sp. 1 [in Kuiter, 2000]*	37282099	CSF
Teleost	Spiny/Australian Spiny Pipehorse	*Solegnathus spinosissimus*	37282029	CSF
Teleost	Blue-finned/Robust Ghost Pipefish	*Solenostomus cyanopterus*	37281001	CSF
Teleost	Harlequin Ghost/Ornate Ghost Pipefish	*Solenostomus paradoxus*	37281002	CSF
Teleost	Double-ended/Alligator Pipefish	*Syngnathoides biaculeatus*	37282100	CSF
Teleost	Bend Stick/Short-tailed Pipefish	*Trachyrhamphus bicoarctatus*	37282006	CSF
Teleost	Long-nosed/Straight Stick Pipefish	*Trachyrhamphus longirostris*	37282101	CSF
Teleost	Hairy Pygmy Pipehorse	*Acentronura breviperula*	37282035	CSF

Scoping Document S2B1. Benthic Habitats

Risk assessment for benthic habitats considers both the seafloor structure and its attached invertebrate fauna. Because data on the types and distributions of benthic habitat in Australia's Commonwealth fisheries are generally sparse, and because there is no universally accepted benthic classification scheme, the ERAEF methodology has used the most widely available type of data – seabed imagery – classified in a similar manner to that used in bioregionalisation and deep seabed mapping in Australian Commonwealth waters. Using this imagery, benthic habitats are classified based on an SGF score, using sediment, geomorphology, and fauna. Where seabed imagery is not available, a second method (Method 2) is used to develop an inferred list of potential habitat types for the fishery. For details of both methods, see Hobday *et al* (2007).

Habitat data used for assessment of the Coral Sea sub-fisheries were largely derived from geophysical and fishery data using Scoping method 2, as few seabed image data were available. Data were available only for the NE seamount chain from a deep sea biodiversity survey undertaken in 2003 (NORFANZ: Williams *et al*., 2006).

A list of derived Benthic habitats using Scoping method 2, for the Other Line sub-fishery of the Coral Sea Fishery Line Sector. This scoping method provides an overly inclusive list as a precautionary measure in the absence of habitat image data. All habitats in this list have been identified from video, and applied to this region based on depth zone and geomorphic feature. Norfanz data considered representative of the NE seamount chain. Obvious anomaly is the inclusion of sponges as the dominant faunal taxa in tropical waters, however, this term is likely to interchangeable with 'corals' in warmer waters. Greatest effort in this sub-fishery: recorded from all depths, on Seamounts, and Northern Plateaus.

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
2732	012	inner shelf	shelf	fine sediments, unrippled, large sponges	101	25- 100	Y	SE Image Collection
2798	094	inner shelf	shelf	Fine sediments, unrippled, small sponges	102	25- 100	Y	Norfanz Image Collection
2735	016	inner shelf	shelf	fine sediments, unrippled, mixed faunal community	103	25- 100	Y	SE Image Collection
2797	093	inner shelf	shelf	fine sediments, unrippled, bioturbators	109	25- 100	N	SE Image Collection
2914	229	inner shelf	Canyon	Fine sediments, current rippled, no fauna	110	25-100	Y	WA Image Collection
2734	014	inner shelf	shelf	fine sediments, wave rippled, large sponges	111	25- 100	Y	SE Image Collection
2799	095	inner shelf	shelf	fine sediments, wave rippled, no fauna	120	25- 100	N	SE Image Collection
2800	096	inner shelf	shelf	fine sediments, wave rippled, small sponges	122	25- 100	N	SE Image Collection
2900	201	inner shelf	shelf	fine sediments, wave rippled, encrustors	126	25- 100	N	SE Image Collection

2795	091	inner shelf	shelf	fine sediments, irregular, large sponges	131	25- 100	N	SE Image Collection
2796	092	inner shelf	shelf	fine sediments, irregular, small sponges	132	25- 100	N	SE Image Collection
2733	013	inner shelf	shelf	coarse sediments, unrippled, large sponges	201	25- 100	Y	SE Image Collection
2902	205	inner shelf	Shelf	Coarse sediments, current swept, mixed low epifauna	206	25-100	Y	WA Image Collection
2919	234	inner shelf	Shelf	Coarse sediments, unrippled, solitary epifauna	207	25-100	Y	WA Image Collection
2730	010	inner shelf	shelf	coarse sediments, current rippled, no fauna	210	25- 100	Y	SE Image Collection
2794	090	inner shelf	shelf	coarse sediments, current rippled, bioturbators	219	25- 100	N	SE Image Collection
2731	011	inner shelf	shelf	coarse sediments, wave rippled, large sponges	221	25- 100	Y	SE Image Collection
2890	191	inner shelf	shelf	coarse sediments, wave rippled, small sponges	222	25- 100	N	SE Image Collection
2899	200	inner shelf	shelf	coarse sediments, wave rippled, encrustors	226	25- 100	N	SE Image Collection
2729	009	inner shelf	shelf	coarse sediments, wave rippled, sedentary	227	25- 100	Y	SE Image Collection
2793	089	inner shelf	shelf	coarse sediments, irregular, encrustors	236	25- 100	N	SE Image Collection
2727	006	inner shelf	shelf	coarse sediments, subcrop, large sponges	251	25- 100	Y	SE Image Collection
2967	282	inner shelf	shelf	Coarse sediments, subcrop, mixed faunal community	253	25- 100	Y	Norfanz Image Collection
2722	001	inner shelf	shelf	gravel, current rippled, mixed faunal community	313	25- 100	Y	SE Image Collection
2802	098	inner shelf	shelf	gravel, wave rippled, no fauna	320	25- 100	Y	SE Image Collection
2801	097	inner shelf	shelf	gravel, wave rippled, bioturbators	329	25- 100	Y	SE Image Collection
2927	242	inner shelf	Shelf	Gravel, irregular, no fauna	330	25-100	Y	WA Image Collection
2728	007	inner shelf	shelf	gravel, debris flow, mixed faunal community	343	25- 100	Y	SE Image Collection
2898	199	inner shelf	shelf	cobble, wave rippled, low/ encrusting mixed fauna	426	25- 100	N	SE Image Collection
2726	005	inner shelf	shelf	cobble, debris flow, large sponges	441	25- 100	Y	SE Image Collection
2803	099	inner shelf	shelf	Igneous rock, high outcrop, large sponges	591	25- 100	N	SE Image Collection
2725	004	inner shelf	shelf	Sedimentary rock, outcrop, large sponges	671	25- 100	Y	SE Image Collection
2723	002	inner shelf	shelf	Sedimentary rock, outcrop, large sponges	691	25- 100	Y	SE Image Collection
2724	003	inner shelf	shelf	Sedimentary rock, outcrop, mixed faunal community	693	25- 100	Y	SE Image Collection
2956	271	inner shelf	Shelf	Rock/ biogenic matrix, high outcrop, large sponges	719	25-100	Y	WA Image Collection
2957	272	inner shelf	Shelf	Rock/ biogenic matrix, Wave rippled, No fauna	720	25-100	Y	WA Image Collection
2958	273	inner shelf	Shelf	Rock/ biogenic matrix,subcrop, large sponges	751	25-100	3	WA Image Collection
2959	274	inner shelf	Shelf	Rock/ biogenic matrix, subcrop, small encrustors	756	25-100	Y	WA Image Collection
2960	275	inner shelf	Shelf	Rock/ biogenic matrix, low outcrop, mixed faunal community	763	25-100	Y	WA Image Collection
2961	276	inner shelf	Shelf	Rock/ biogenic matrix, low outcrop, octocorals	765	25-100	Y	WA Image Collection
2962	277	inner shelf	Shelf	Rock/ biogenic matrix, low outcrop (with holes/cracks), mixed faunal community	773	25-100	Y	WA Image Collection

2963	278	inner shelf	Shelf	Rock/ biogenic matrix, high outcrop, mixed faunal community	793	25-100	Y	WA Image Collection
2968	283	inner shelf	shelf	Bryozoan communities	XX6	25- 100	Y	Norfanz Image Collection
2874	173	outer shelf	shelf-break	mud, unrippled, no fauna	000	100- 200, 200- 700	N	SE Image Collection
2904	219	outer shelf	Shelf	mud, unrippled, small or large sponges	001	100- 200	Y	WA Image Collection
2878	177	outer shelf	shelf	mud, unrippled, low encrusting sponges	002	100- 200	N	SE Image Collection
2905	220	outer shelf	Shelf	Mud, flat, octocorals	005	100- 200	Y	WA Image Collection
2804	100	outer shelf	shelf	mud, unrippled, sedentary	007	100- 200	Y	SE Image Collection
2875	174	outer shelf	shelf-break	mud, unrippled, sedentary	007	100- 200, 200- 700	N	SE Image Collection
2879	178	outer shelf	shelf	mud, unrippled, bioturbators	009	100- 200	N	SE Image Collection
2964	279	outer shelf	Shelf	mud, current rippled, no fauna	010	100- 200	Y	WA Image Collection
2908	223	outer shelf	Shelf	mud, current rippled, bioturbators	019	100- 200	Y	WA Image Collection
2909	224	outer shelf	Shelf	mud, wave rippled, no fauna	020	100- 200	Y	WA Image Collection
2910	225	outer shelf	Shelf	Mud, irregular, bioturbators	039	100- 200	Y	WA Image Collection
2880	179	outer shelf	shelf	mud, subcrop, erect sponges	051	100- 200	N	SE Image Collection
2829	125	outer shelf	shelf	mud, subcrop, small sponges	052	100- 200	Y	SE Image Collection
2911	226	outer shelf	Shelf	Mud, subcrop, mixed faunal community	053	100- 200	Y	WA Image Collection
2881	180	outer shelf	shelf	mud, subcrop, low encrusting mixed fauna	056	100- 200	N	SE Image Collection
2816	112	outer shelf	shelf	fine sediments, unrippled, no fauna	100	100- 200	Y	SE Image Collection
2871	170	outer shelf	shelf-break	fine sediments, unrippled, no fauna	100	100- 200, 200- 700	N	SE Image Collection
2815	111	outer shelf	shelf	fine sediments, unrippled, large sponges	101	100- 200	Y	SE Image Collection
2817	113	outer shelf	shelf	Fine sediments, unrippled, small sponges	102	100- 200	Y	Norfanz Image Collection
2872	171	outer shelf	shelf-break	fine sediments, unrippled, octocorals	105	100- 200, 200- 700	N	SE Image Collection
2882	181	outer shelf	shelf	fine sediments, unrippled, encrustors	106	100- 200	N	SE Image Collection
2814	110	outer shelf	shelf	fine sediments, unrippled, bioturbators	109	100- 200	Y	SE Image Collection
2870	169	outer shelf	shelf-break	fine sediments, unrippled, bioturbators	109	100- 200, 200- 700	N	SE Image Collection
2883	183	outer shelf	shelf	fine sediments, current rippled, no fauna	110	100- 200	N	SE Image Collection
2884	184	outer shelf	shelf	fine sediments, current rippled, low/ encrusting sponges	112	100- 200	N	SE Image Collection
2808	104	outer shelf	shelf	fine sediments, current rippled, bioturbators	119	100- 200	Y	SE Image Collection
2821	117	outer shelf	shelf	fine sediments, wave rippled, no fauna	120	100- 200	N	SE Image Collection
2820	116	outer shelf	shelf	fine sediments, wave rippled, large sponges	121	100- 200	N	SE Image Collection

2823	119	outer shelf	shelf	fine sediments, wave rippled, small sponges	122	100- 200	N	SE Image Collection
2819	115	outer shelf	shelf	fine sediments, wave rippled, encrustors	126	100- 200	N	SE Image Collection
2822	118	outer shelf	shelf	fine sediments, wave rippled, sedentary	127	100- 200	N	SE Image Collection
2818	114	outer shelf	shelf	fine sediments, wave rippled, bioturbators	129	100- 200	Y	SE Image Collection
2810	106	outer shelf	shelf	fine sediments, irregular, no fauna	130	100- 200	N	SE Image Collection
2809	105	outer shelf	shelf	fine sediments, irregular, large sponges	131	100- 200	N	SE Image Collection
2811	107	outer shelf	shelf	fine sediments, irregular, small sponges	132	100- 200	N	SE Image Collection
2869	168	outer shelf	shelf-break	fine sediments, irregular, small sponges	132	100- 200, 200- 700	N	SE Image Collection
2885	185	outer shelf	shelf	fine sediments, irregular, low encrusting mixed fauna	136	100- 200	N	SE Image Collection
2868	167	outer shelf	shelf-break	fine sediments, irregular, bioturbators	139	100- 200, 200- 700	N	SE Image Collection
2886	187	outer shelf	shelf	fine sediments, irregular, bioturbators	139	100- 200	N	SE Image Collection
2887	188	outer shelf	shelf	fine sediments, rubble banks, low encrusting sponges	142	100- 200	N	SE Image Collection
2736	017	outer shelf	shelf	fine sediments, subcrop, large sponges	151	100- 200	Y	SE Image Collection
2813	109	outer shelf	shelf	fine sediments, subcrop, small sponges	152	100- 200	Y	SE Image Collection
2812	108	outer shelf	shelf	fine sediments, subcrop, mixed faunal community	153	100- 200	N	SE Image Collection
2888	189	outer shelf	shelf	fine sediments, subcrop, mixed low fauna	156	100- 200	N	SE Image Collection
2889	190	outer shelf	shelf	coarse sediments, unrippled, no fauna	200	100- 200	N	SE Image Collection
2748	030	outer shelf	shelf	coarse sediments, unrippled, mixed faunal community	203	100- 200	Y	SE Image Collection
2918	233	outer shelf	Shelf	Coarse sediments, unrippled, octocoral/ and bryozoans??	205	100- 200	Y	WA Image Collection
2744	026	outer shelf	shelf	coarse sediments, unrippled, encrustors	206	100- 200	Y	SE Image Collection
2745	027	outer shelf	shelf	coarse sediments, current rippled, no fauna	210	100- 200	Y	SE Image Collection
2743	025	outer shelf	shelf	coarse sediments, wave rippled, no fauna	220	100- 200	Y	SE Image Collection
2807	103	outer shelf	shelf	coarse sediments, wave rippled, small sponges	222	100- 200	N	SE Image Collection
2806	102	outer shelf	shelf	coarse sediments, wave rippled, encrustors	226	100- 200	N	SE Image Collection
2747	029	outer shelf	shelf	coarse sediments, irregular, large sponges	231	100- 200	Y	SE Image Collection
2738	019	outer shelf	shelf	coarse sediments, subcrop, large sponges	251	100- 200	Y	SE Image Collection
2805	101	outer shelf	shelf	coarse sediments, subcrop, small sponges	252	100- 200	N	SE Image Collection
2891	192	outer shelf	shelf	gravel/ pebble, current rippled, large sponges	311	100- 200	N	SE Image Collection
2892	193	outer shelf	shelf	gravel/ pebble, current rippled, mixed low fauna	316	100- 200	N	SE Image Collection
2824	120	outer shelf	shelf	gravel, current rippled, bioturbators	319	100- 200	N	SE Image Collection
2828	124	outer shelf	shelf	gravel, wave rippled, no fauna	320	100- 200	N	SE Image Collection

2827	123	outer shelf	shelf	gravel, wave rippled, large sponges	321	100- 200	N	SE Image Collection
2893	194	outer shelf	shelf	gravel/ pebble, wave rippled, low encrusting sponges	322	100- 200	N	SE Image Collection
2826	122	outer shelf	shelf	gravel, wave rippled, encrustors	326	100- 200	N	SE Image Collection
2894	195	outer shelf	shelf	gravel, wave rippled, encrustors	326	100- 200	N	SE Image Collection
2825	121	outer shelf	shelf	gravel, wave rippled, bioturbators	329	100- 200	Y	SE Image Collection
2742	024	outer shelf	shelf	gravel, irregular, encrustors	336	100- 200	Y	SE Image Collection
2895	196	outer shelf	shelf	gravel, wave rippled, encrustors	346	100- 200	N	SE Image Collection
2746	028	outer shelf	shelf	cobble, unrippled, large sponges	401	100- 200	Y	SE Image Collection
2896	197	outer shelf	shelf	cobble, unrippled, low/ encrusting mixed fauna	406	100- 200	N	SE Image Collection
2897	198	outer shelf	shelf	cobble, current rippled, low/ encrusting mixed fauna	416	100- 200	N	SE Image Collection
2749	032	outer shelf	shelf	cobble, subcrop, crinoids	454	100- 200	Y	SE Image Collection
2739	020	outer shelf	shelf	cobble, outcrop, crinoids	464	100- 200	Y	SE Image Collection
2931	246	outer shelf	Shelf	cobble/boulder (slab), outcrop, mixed low encrustors	466	100- 200	Y	WA Image Collection
2873	172	outer shelf	shelf-break	Igneous rock, high outcrop, no fauna	590	100- 200, 200- 700	N	SE Image Collection
2830	126	outer shelf	shelf	Sedimentary rock, subcrop, large sponges	651	100- 200	Y	SE Image Collection
2831	127	outer shelf	shelf	Sedimentary rock, subcrop, small sponges	652	100- 200	Y	SE Image Collection
2877	176	outer shelf	shelf-break	Sedimentary rock, subcrop, small sponges	652	100- 200, 200- 700	N	SE Image Collection
2740	022	outer shelf	shelf	Sedimentary rock, subcrop, mixed faunal community	653	100- 200	Y	SE Image Collection
2876	175	outer shelf	shelf-break	Sedimentary rock, subcrop, crinoids	654	100- 200, 200- 700	N	SE Image Collection
2939	254	outer shelf	Shelf	Sedimentary rock (?), low outcrop, large erect sponges	661	100- 201	Y	WA Image Collection
2940	255	outer shelf	Shelf	Sedimentary rock (?) low outcrop, mixed faunal community	663	100- 200	Y	WA Image Collection
2741	023	outer shelf	shelf	Sedimentary rock, outcrop, large sponges	671	100- 200	Y	SE Image Collection
2777	065	outer shelf	canyon	Sedimentary rock, outcrop, small sponges	672	100- 200	Y	SE Image Collection
2943	258	outer shelf	Shelf	Sedimentary rock (?), low outcrop, mixed faunal community	673	100- 200	Y	WA Image Collection
2944	259	outer shelf	Shelf	Rock (sedimentary?), outcrop (low, holes and cracks etc), encrustors	676	100- 200	Y	WA Image Collection
2945	260	outer shelf	Shelf	Rock (sedimentary?), outcrop, solitary	677	100- 200	Y	WA Image Collection
2965	280	outer shelf	Shelf	Rock (sedimentary?), high outcrop, solitary	681	100- 201	Y	WA Image Collection
2948	263	outer shelf	Shelf	Rock (sedimentary?), high outcrop, ?small sponges	682	100- 200	Y	WA Image Collection
2951	266	outer shelf	Shelf	Rock (sedimentary?),, high outcrop, large sponges	691	100- 200	Y	WA Image Collection
2953	268	outer shelf	Shelf	Sedimentary rock (?), high outcrop, mixed faunal community	693	100- 200	Y	WA Image Collection

2737	018	outer shelf	shelf	Sedimentary rock, outcrop, encrustors	696	100- 200	Y	SE Image Collection
2966	281	outer shelf	Shelf	Rock/ biogenic matrix, low outcrop, mixed faunal community	763	100-200	Y	WA Image Collection
2867	166	outer shelf	shelf-break	Bryozoan based communities	XX6	100- 200	Y	Norfanz Image Collection
2901	202	upper slope	Slope	mud, unrippled, no fauna	000	200- 700	Y	WA Image Collection
2846	143	upper slope	slope	mud, unrippled, large sponges	001	200- 700	N	SE Image Collection
2845	142	upper slope	slope	mud, unrippled, encrustors	006	200- 700	Y	SE Image Collection
2847	144	upper slope	slope	mud, unrippled, sedentary	007	200- 700	Y	SE Image Collection
2844	141	upper slope	slope	mud, unrippled, bioturbators	009	200- 700	Y	SE Image Collection
2843	140	upper slope	slope	mud, irregular, bioturbators	039	200- 700	Y	SE Image Collection
2760	046	upper slope	slope	fine sediments, unrippled, no fauna	100	200- 700	Y	SE Image Collection
2912	227	upper slope	Slope	Fine sediments, unrippled, sponges	101	200- 700	Y	WA Image Collection
2840	137	upper slope	slope	Fine sediments, unrippled, small sponges	102	200- 700	Y	Norfanz Image Collection
2839	136	upper slope	slope	fine sediments, unrippled, encrustors	106	200- 700	Y	SE Image Collection
2788	078	upper slope	slope, canyon	fine sediments, unrippled, sedentary	107	200- 700	Y	SE Image Collection
2758	044	upper slope	slope, canyon	fine sediments, unrippled, bioturbators	109	200- 700	Y	SE Image Collection
2837	133	upper slope	slope	fine sediments, current rippled, no fauna	110	200- 700	N	SE Image Collection
2785	073	upper slope	canyon	fine sediments, irregular, encrustors	136	200- 700	Y	SE Image Collection
2916	231	upper slope	Slope	Fine sediments, irregular, glass sponge (stalked)	137	200- 700	Y	WA Image Collection
2756	041	upper slope	slope	fine sediments, irregular, bioturbators	139	200- 700	Y	SE Image Collection
2838	134	upper slope	slope	fine sediments, subcrop, large sponges	151	200- 700	N	SE Image Collection
2787	077	upper slope	canyon, slope	fine sediments, subcrop, small sponges	152	200- 700	Y	SE Image Collection
2755	040	upper slope	slope	fine sediments, subcrop, sedentary	157	200- 700	Y	SE Image Collection
2974	284	upper slope	slope	Coarse sediments, unrippled, large sponges	201	200- 700	Y	Norfanz Image Collection
2975	285	upper slope	slope	Coarse sediments, unrippled, octocorals	205	200- 700	Y	Norfanz Image Collection
2757	043	upper slope	slope	coarse sediments, unrippled, low mixed encrustors	206	200- 700	Y	SE Image Collection
2759	045	upper slope	slope	coarse sediments, unrippled, sedentary	207	200- 700	Y	SE Image Collection
2920	235	upper slope	Slope	Coarse sediments, rippled, no fauna	210	200- 700	Y	WA Image Collection
2921	236	upper slope	Slope	Coarse sand, rippled, solitary epifauna	217	200- 700	Y	WA Image Collection
2922	237	upper slope	Slope	Coarse sand, wave rippled, bryozoan turf	226	200- 700	Y	WA Image Collection
2923	238	upper slope	Slope	Coarse sediments, irregular, octocorals (matrix of solsomalia – dead corals)	235	200- 700	Y	WA Image Collection
2786	076	upper slope	canyon, slope	coarse sediments, irregular, low mixed encrustors	236	200- 700	Y	SE Image Collection
2784	072	upper slope	canyon, slope	coarse sediments, irregular, bioturbators	239	200- 700	Y	SE Image Collection

2924	239	upper slope	Slope	Coarse sediments, subcrop, large (?) sponges	251	200- 700	Y	WA Image Collection
2925	240	upper slope	Slope	Sedimentary, subcrop, octocorals	255	200- 700	Y	WA Image Collection
2926	241	upper slope	Slope	Coarse sediments, subcrop, low encrusting community (ascidians)	256	200- 700	Y	WA Image Collection
2842	139	upper slope	slope	gravel, debris flow, no fauna	340	200- 700	N	SE Image Collection
2841	138	upper slope	slope	gravel, debris flow, encrustors	346	200- 700	Y	SE Image Collection
2834	130	upper slope	slope	cobble, debris flow, no fauna	440	200- 700	Y	SE Image Collection
2836	132	upper slope	slope	cobble, debris flow, small sponges	442	200- 700	Y	SE Image Collection
2835	131	upper slope	slope	cobble, debris flow, octocorals	445	200- 700	N	SE Image Collection
2833	129	upper slope	slope	cobble, debris flow, encrustors	446	200- 700	Y	SE Image Collection
2976	286	upper slope	slope	Cobble/ boulder, debris, sedentary	447	200- 700	Y	Norfanz Image Collection
2780	069	upper slope	canyon	cobble, outcrop, crinoids	464	200- 700	Y	SE Image Collection
2932	247	upper slope	slope	Boulders, low outcrop, no fauna	470	200- 700	Y	Norfanz Image Collection
2977	287	upper slope	slope	slabs and boulders, low outcrop, octocorals	475	200- 700	Y	Norfanz Image Collection
2978	288	upper slope	slope	Igneous Rock (?), low outcrop, octocorals	565	200- 700	Y	Norfanz Image Collection
2979	289	upper slope	slope	Igneous Rock (?), low outcrop, mixed faunal community	573	200- 700	Y	Norfanz Image Collection
2980	290	upper slope	slope	Igneous Rock (?), high outcrop, no fauna	590	200- 700	Y	Norfanz Image Collection
2981	291	upper slope	slope	Igneous Rock (?), high outcrop, mixed faunal community	593	200- 700	Y	Norfanz Image Collection
2936	251	upper slope	Slope	Sedimentary rock, subcrop, no fauna	650	200- 700	Y	WA Image Collection
2779	067	upper slope	canyon, slope	Sedimentary rock, subcrop, large sponges	651	200- 700	Y	SE Image Collection
2781	070	upper slope	canyon	Sedimentary rock, subcrop, small sponges	652	200- 700	Y	SE Image Collection
2750	033	upper slope	slope	Sedimentary rock, subcrop, mixed faunal community	653	200- 700	Y	SE Image Collection
2850	148	upper slope	slope	Sedimentary rock, subcrop, octocorals	655	200- 700	N	SE Image Collection
2753	036	upper slope	slope	Sedimentary rock, subcrop, encrustors	656	200- 700	Y	SE Image Collection
2982	292	upper slope	slope	Sedimentary Rock (?), subcrop, sedentary (with trawl marks)	657	200- 700	Y	Norfanz Image Collection
2941	256	upper slope	Slope	Sedimentary rock, outcrop, octocorals	665	200- 700	Y	WA Image Collection
2752	035	upper slope	slope	Sedimentary rock, outcrop, encrustors	666	200- 700	Y	SE Image Collection
2942	257	upper slope	Shelf break	Sedimentary rock, low outcrop, no fauna	670	200- 700	3	WA Image Collection
2848	145	upper slope	canyon, slope	Sedimentary rock, low outcrop, large sponges	671	200- 700	N	SE Image Collection
2849	146	upper slope	slope	Sedimentary rock, low outcrop, small sponges	672	200- 700	Y	SE Image Collection
2783	071	upper slope	Shelf break	Sedimentary, low outcrop, small encrustors	676	200- 700	3	WA Image Collection
2946	261	upper slope	Slope	Sedimentary, outcrop, sedentary (anemones)	677	200- 700	Y	WA Image Collection
2949	264	upper slope	Slope	Sedimentary, high outcrop, octocoral	683	200- 700	Y	WA Image Collection

2754	039	upper slope	slope	Sedimentary rock, outcrop, crinoids	684	200- 700	Y	SE Image Collection
2950	265	upper slope	Slope	Sedimentary rock (mudstone?), high outcrop, no fauna	690	200- 700	3	WA Image Collection
2952	267	upper slope	Slope	Sedimentary rock (mudstone?), high outcrop, small sponges	692	200- 700	Y	WA Image Collection
2778	066	upper slope	canyon	Sedimentary rock, outcrop, crinoids	694	200- 700	Y	SE Image Collection
2954	269	upper slope	Slope	Sedimentary, outcrop, octocorals	695	200- 700	Y	WA Image Collection
2751	034	upper slope	slope	Sedimentary rock, outcrop, encrustors	696	200- 700	Y	SE Image Collection
2955	270	upper slope	Slope	Sedimentary, high outcrop, solitary epifauna	697	200- 700	Y	WA Image Collection
2983	293	upper slope	slope	Rock/ biogenic matrix, low outcrop, mixed faunal community	763	200- 700	Y	Norfanz Image Collection
2832	128	upper slope	slope	Bryozoan based communities	XX6	200- 700	Y	Norfanz Image Collection
2862	161	mid-slope	slope	mud, unrippled, small sponges	002	700- 1500	N	SE Image Collection
2906	221	mid-slope	Slope	Mud, irregular (bioturbators), crinoids/ featherstars on whip	005	700-1500	Y	WA Image Collection
2907	222	mid-slope	Slope	Mud, flat, solitary	007	700-1500	Y	WA Image Collection
2859	158	mid-slope	slope	mud, current rippled, bioturbators	019	700- 1500	N	SE Image Collection
2861	160	mid-slope	slope	mud, irregular, sedentary	037	700- 1500	N	SE Image Collection
2860	159	mid-slope	slope	mud, irregular, bioturbators	039	700- 1500	N	SE Image Collection
2857	156	mid-slope	slope	Fine sediments, unrippled, no fauna	100	700- 1500	Y	Norfanz Image Collection
2984	156	mid-slope	slope	fine sediments, unrippled, no fauna	100	700- 1500	N	SE Image Collection
2775	063	mid-slope	slope	fine sediments, unrippled, octocorals	105	700- 1500	Y	SE Image Collection
2913	228	mid-slope	Slope	Fine, unrippled, solitary	107	700-1500	Y	WA Image Collection
2969	294	mid-slope	slope	Fine sediments, unrippled, bioturbators	109	700- 1500	Y	Norfanz Image Collection
2915	230	mid-slope	Slope	fine sediments, irregular, no fauna	130	700-1500	Y	WA Image Collection
2773	061	mid-slope	slope	fine sediments, irregular, bioturbators	139	700- 1500	Y	SE Image Collection
2769	057	mid-slope	slope	fine sediments, subcrop, bioturbators	150	700- 1500	Y	SE Image Collection
2917	232	mid-slope	Slope	Fine sediments, subcrop, octocorals	155	700-1500	Y	WA Image Collection
2970	295	mid-slope	slope	Fine sediments, subcrop, encrustors	156	700- 1500	Y	Norfanz Image Collection
2854	153	mid-slope	slope	coarse sediments, unrippled, no fauna	200	700- 1500	N	SE Image Collection
2774	062	mid-slope	slope	coarse sediments, unrippled, octocorals	205	700- 1500	Y	SE Image Collection
2851	150	mid-slope	slope	coarse sediments, current rippled, no fauna	210	700- 1500	N	SE Image Collection
2852	151	mid-slope	slope	coarse sediments, current rippled, octocorals	215	700- 1500	N	SE Image Collection
2853	152	mid-slope	slope	Coarse sediments, current rippled, sedentary	217	700- 1500	Y	Norfanz Image Collection
2971	296	mid-slope	slope	Coarse sediments, irregular, no fauna	230	700- 1500	Y	Norfanz Image Collection

2771	059	mid-slope	slope	coarse sediments, irregular,low encrusting	236	700- 1500	Y	SE Image Collection
2972	297	mid-slope	slope	Coarse sediments, subcrop, no fauna	250	700- 1500	Y	Norfanz Image Collection
2973	298	mid-slope	slope	Coarse sediments, low outcrop, no fauna	260	700- 1500	Y	Norfanz Image Collection
2928	243	mid-slope	Slope	Gravel, irregular, low encrustings	336	700-1500	2	WA Image Collection
2770	058	mid-slope	slope	cobble, unrippled, small sponges	402	700- 1500	Y	SE Image Collection
2929	244	mid-slope	Slope	Igneous rock/boulder, rubble bank, none	440	700-1500	Y	WA Image Collection
2855	154	mid-slope	slope	cobble, debris flow, crinoids	444	700- 1500	N	SE Image Collection
2856	155	mid-slope	slope	slabs/ boulders, debris flow, octocorals	445	700- 1500	Y	SE Image Collection
2762	050	mid-slope	slope	cobble, debris flow, encrustors	446	700- 1500	Y	SE Image Collection
2930	245	mid-slope	Slope	boulders and slabs, subcropping, octocorals	455	700-1500	Y	WA Image Collection
2763	051	mid-slope	slope	cobble, outcrop, no fauna	460	700- 1500	Y	SE Image Collection
2772	060	mid-slope	slope	cobble, outcrop, crinoids	464	700- 1500	Y	SE Image Collection
2776	064	mid-slope	slope	Sedimentary slab and mud boulders, outcrop, crinoids	464	700- 1500	Y	SE Image Collection
2933	248	mid-slope	Slope	Igneous rock, rubble bank, no fauna	540	700-1500	Y	WA Image Collection
2934	249	mid-slope	Seamount	Igneous rock, rubble bank, octocorals	545	700-1500	Y	WA Image Collection
2765	053	mid-slope	slope	Igneous rock, low outcrop, sedentary	567	700- 1500	Y	SE Image Collection
2935	250	mid-slope	Seamount	Igneous rock, low outcrop, no fauna	570	700-1500	Y	WA Image Collection
2903	213	mid-slope	Seamount	Igneous rock (?), outcrop, octocoral	575	700-1500	Y	WA Image Collection
2761	049	mid-slope	slope	Igneous rock, high outcrop, crinoids	594	700- 1500	Y	SE Image Collection
2858	157	mid-slope	slope	Igneous rock, high outcrop, octocorals	595	700- 1500	N	SE Image Collection
2790	081	mid-slope	seamount	Sedimentary rock, unrippled, no fauna	600	700- 1500	Y	SE Image Collection
2792	085	mid-slope	seamount	Sedimentary rock, unrippled, encrustors	606	700- 1500	Y	SE Image Collection
2767	055	mid-slope	slope	Sedimentary rock, unrippled, sedentary	607	700- 1500	Y	SE Image Collection
2863	162	mid-slope	slope	Sedimentary rock, debris flow, crinoids	644	700- 1500	N	SE Image Collection
2865	164	mid-slope	slope	Sedimentary rock, subcrop, crinoids	654	700- 1500	Y	SE Image Collection
2866	165	mid-slope	slope	Sedimentary rock, subcrop, octocorals	655	700- 1500	Y	SE Image Collection
2937	252	mid-slope	Slope	Sedimentary, subcrop, small encrustors	656	700-1500	2	WA Image Collection
2938	253	mid-slope	Slope	rock (conglomerate/sedimentary), subcrop, bioturbators	659	700-1500	Y	WA Image Collection
2768	056	mid-slope	slope, canyons, seamounts	Sedimentary rock, outcrop, mixed faunal community	673	700- 1500	Y	SE Image Collection
2764	052	mid-slope	slope	Sedimentary rock, outcrop, octocorals	675	700- 1500	Y	SE Image Collection
2782	071	mid-slope	canyon	Sedimentary rock, outcrop, encrustors	676	700- 1500	Y	SE Image Collection
2789	080	mid-slope	seamount	Sedimentary rock, outcrop, encrustors	676	700- 1500	Y	SE Image Collection

2791	084	mid-slope	seamount	Sedimentary rock, outcrop, sedentary	677	700- 1500	Y	SE Image Collection
2947	262	mid-slope	Slope	sedimentary/mudstone, high outcrop, no fauna	680	700-1500	Y	WA Image Collection
2766	054	mid-slope	slope	Sedimentary rock, outcrop, crinoids	694	700- 1500	Y	SE Image Collection
2864	163	mid-slope	slope	Sedimentary rock, high outcrop, octocorals	695	700- 1500	Y	SE Image Collection

Scoping Document S2B2. Pelagic Habitats

A list of the pelagic habitats for the Other Line sub-fishery of the Coral Sea Fishery Line Sector.

ERAEF Habitat Number	Pelagic Habitat type	Depth (m)	Comments	Reference
P4	North Eastern Pelagic Province - Oceanic	0 – > 600	this is a compilation of the range covered by Oceanic Community (1) & (2)	dow167A1, A2, A4
P5	Northern Pelagic Province - Coastal	0 – 200		dow167A1, A2, A4
P15	North Eastern Pelagic Province - Plateau	0 – > 600	this is a compilation of the range covered by the Northeastern Plateau Community (1) & (2)	dow167A1, A2, A4
P16	North Eastern Pelagic Province - Seamount Oceanic	0 – > 600	this is a compilation of the range covered by Seamount Oceanic Communities (1) & (2)	dow167A1, A2, A4

Scoping Document S2C1. Demersal Communities

In ERAEF, communities are defined as the set of species assemblages that occupy the large scale provinces and biomes identified from national bioregionalisation studies. The biota includes mobile fauna, both vertebrate and invertebrate, but excludes sessile organisms such as corals that are largely structural and are used to identify benthic habitats. The same community lists are used for all fisheries, with those selected as relevant for a particular fishery being identified on the basis of spatial overlap with effort in the fishery. The spatial boundaries for demersal communities are based on IMCRA boundaries for the shelf, and on slope bioregionalisations for the slope (IMCRA 1998; Last *et al*. 2005). The spatial boundaries for the pelagic communities are based on pelagic bioregionalisations and on oceanography (Condie *et al*. 2003; Lyne and Hayes 2004). Fishery and region specific modifications to these boundaries are described in detail in Hobday *et al*. (2007) and briefly outlined in the footnotes to the community Tables below.

Demersal communities in which fishing activity occurs in Coral Sea Other Line sub-fishery (x). Shaded cells indicate all communities within the province.

Demersal community	Cape	North Eastern Transition	North Eastern	Central Eastern	Central Eastern	South Eastern Transition	Central Bass	Tasmanian	Western Tas Transition	Southern	Western Transition	Central Western	Central Western Transition	North Western	North Western Transition	Timor	Timor Transition	Heard & McDonald Is	Macquarie Is
Inner Shelf 0 – 110m [1,2]																			
Outer Shelf 110 – 250m [1,2,]																			
Upper Slope 250 – 565m [3]																			
Mid–Upper Slope 565 – 820m[3]																			
Mid Slope 820 – 1100m[3]																			
Lower slope/ Abyssal > 1100m[6]																			
Reef 0 -110m[7, 8]																			
Reef 110-250m[8]																			
Seamount 0 – 110m																			
Seamount 110- 250m			x	x															
Seamount 250 – 565m			x	x															
Seamount 565 – 820m			x	x															
Seamount 820 – 1100m																			
Seamount 1100 – 3000m																			

Plateau 0 – 110m																			
Plateau 110- 250m[4]			x																
Plateau 250 – 565m[4]			x																
Plateau 565 – 820m[5]			x																
Plateau 820 – 1100m[5]																			

[1] Four inner shelf communities occur in the Timor Transition (Arafura, Groote, Cape York and Gulf of Carpentaria) and three inner shelf communities occur in the Southern (Eyre, Eucla and South West Coast). At Macquarie Is: [2]inner & outer shelves (0-250m), and [3]upper and midslope communities combined (250-1000m). At Heard/McDonald Is: [4]outer and upper slope plateau communities combined to form four communities: Shell Bank, inner and outer Heard Plateau (100-500m) and Western Banks (200-500m), [5]mid and upper plateau communities combined into 3 trough, southern slope and North Eastern plateau communities (500-1000m), and [6] 3 groups at Heard Is: Deep Shell Bank (>1000m), Southern and North East Lower slope/abyssal, [7]Great Barrier Reef in the North Eastern Province and Transition and [8] Rowley Shoals in North Western Transition.

Scoping Document S2C2. Pelagic Communities

Pelagic communities in which fishing activity occurs e.g. setline, dropline, trotline, handline; or that overlie the demersal communities in which fishing activity occurs in the Coral Sea Other Line sub-fishery (x). Shaded cells indicate all communities that exist in the province.

Pelagic community	North Eastern	Eastern	Southern	Western	Northern	North Western	Heard and McDonald Is[2]	Macquarie Is
Coastal pelagic 0-200m[1,2]								
Oceanic (1) 0 – 600m								
Oceanic (2) >600m								
Seamount oceanic (1) 0 – 600m	x							
Seamount oceanic (2) 600–3000m	x							
Oceanic (1) 0 – 200m								
Oceanic (2) 200-600m								
Oceanic (3) >600m								
Seamount oceanic (1) 0 – 200m								
Seamount oceanic (2) 200 – 600m								
Seamount oceanic (3) 600–3000m								
Oceanic (1) 0-400m								
Oceanic (2) >400m								
Oceanic (1) 0-800m								
Oceanic (2) >800m								
Plateau (1) 0-600m	x							
Plateau (2) >600m	x							
Heard Plateau 0-1000m[3]								
Oceanic (1) 0-1000m								
Oceanic (2) >1000m								
Oceanic (1) 0-1600m								
Oceanic (2) >1600m								

[1] Northern Province has five coastal pelagic zones (NWS, Bonaparte, Arafura, Gulf and East Cape York) and Southern Province has two zones (Tas, GAB). [2] At Macquarie Is: coastal pelagic zone to 250m. [3] At Heard and McDonald Is: coastal pelagic zone broadened to cover entire plateau to maximum of 1000m.

2.2.3 Identification of Objectives for Components and Sub-components (Step 3)

Objectives are identified for each sub-fishery for the five ecological components (target, bycatch/byproduct, TEP, habitats, and communities) and sub-components, and are clearly documented. It is important to identify objectives that managers, the fishing industry, and other stakeholders can agree on, and that scientists can quantify and assess. The criteria for selecting ecological operational objectives for risk assessment are that they:

- be biologically relevant;
- have an unambiguous operational definition;
- be accessible to prediction and measurement; and
- that the quantities they relate to be exposed to the hazards.

For fisheries that have completed ESD reports, use can be made of the operational objectives stated in those reports.

Each ‘operational objective’ is matched to example indicators. **Scoping Document S3** provides suggested examples of operational objectives and indicators. Where operational objectives are already agreed for a fishery (Existing Management Objectives), those should be used (e.g. Strategic Assessment Reports). The objectives need not be exactly specified, with regard to numbers or fractions of removal/impact, but should indicate that an impact in the sub-component is of concern/interest to the sub-fishery. The rationale for including or discarding an operational objective is a crucial part of the table and must explain why the particular objective has or has not been selected for in the (sub) fishery. Only the operational objectives selected for inclusion in the (sub)fishery are used for Level 1 analysis (**Level 1 SICA Document L1.1**).

Scoping Document S3 Components and Sub-components Identification of Objectives

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
	"What is the general goal?"	*As shown in sub-component model diagrams at the beginning of this section.*	*"What you are specifically trying to achieve"*	*"What you are going to use to measure performance"*	*Rationale flagged as 'EMO' where Existing Management Objective in place, or 'AMO' where there is an existing AFMA Management Objective in place for other Commonwealth fisheries (assumed that squid fishery will fall into line).*
Target Species	Avoid recruitment failure of the target species Avoid negative consequences for species or population sub-components	1. Population size	1.1 No trend in biomass 1.2 Maintain biomass above a specified level 1.3 Maintain catch at specified level 1.4 Species do not approach extinction or become extinct	Biomass, numbers, density, CPUE, yield	1.1 add in rationale for each objective 1.2 1.3 1.4
		2. Geographic range	2.1 Geographic range of the population, in terms of size and continuity does not change outside acceptable bounds	Presence of population across the GAB	2.1
		3. Genetic structure	3.1 Genetic diversity does not change outside acceptable bounds	Frequency of genotypes in the population, effective population size (N_e), number of spawning units	3.1

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
		4. Age/size/sex structure	4.1 Age/size/sex structure does not change outside acceptable bounds (e.g. more than X% from reference structure)	Biomass, numbers or relative proportion in age/size/sex classes Biomass of spawners Mean size, sex ratio	4.1
		5. Reproductive Capacity	5.1 Fecundity of the population does not change outside acceptable bounds (e.g. more than X% of reference population fecundity) 2 Recruitment to the population does not change outside acceptable bounds	Egg production of population Abundance of recruits	5.1 5.2
		6. Behaviour /Movement	6.1 Behaviour and movement patterns of the population do not change outside acceptable bounds	Presence of population across space, movement patterns within the population (e.g. attraction to bait, lights)	6.1
Byproduct and Bycatch	Avoid recruitment failure of the byproduct and bycatch species Avoid negative consequences for species or population sub-components	1. Population size	1.1 No trend in biomass 1.2 Species do not approach extinction or become extinct 1.3 Maintain biomass above a specified level 1.4 Maintain catch at specified level	Biomass, numbers, density, CPUE, yield	1.1 1.2 1.3 1.4
		2. Geographic range	2.1 Geographic range of the population, in terms of size and continuity does not change outside acceptable bounds	Presence of population across space	2.1

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
		3. Genetic structure	3.1 Genetic diversity does not change outside acceptable bounds	Frequency of genotypes in the population, effective population size (N_e), number of spawning units	3.1
		4. Age/size/sex structure	4.1 Age/size/sex structure does not change outside acceptable bounds (e.g. more than X% from reference structure)	Biomass, numbers or relative proportion in age/size/sex classes Biomass of spawners Mean size, sex ratio	4.1
		5 Reproductive Capacity	5.1 Fecundity of the population does not change outside acceptable bounds (e.g. more than X% of reference population fecundity) Recruitment to the population does not change outside acceptable bounds	Egg production of population Abundance of recruits	5.1
		6. Behaviour /Movement	6.1 Behaviour and movement patterns of the population do not change outside acceptable bounds	Presence of population across space, movement patterns within the population (e.g. attraction to bait, lights)	6.1
TEP species	Avoid recruitment failure of TEP species Avoid negative consequences for TEP species or population sub-components Avoid negative impacts on the population from fishing	1. Population size	1.1 Species do not further approach extinction or become extinct 1.2 No trend in biomass 1.3 Maintain biomass above a specified level 1.4 Maintain catch at specified level	Biomass, numbers, density, CPUE, yield	1.1 1.2 1.3 1.4

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
		2. Geographic range	2.1 Geographic range of the population, in terms of size and continuity does not change outside acceptable bounds	Presence of population across space, i.e. the GAB	2.1
		3. Genetic structure	3.1 Genetic diversity does not change outside acceptable bounds	Frequency of genotypes in the population, effective population size (N_e), number of spawning units	3.1
		4. Age/size/sex structure	4.1 Age/size/sex structure does not change outside acceptable bounds (e.g. more than X% from reference structure)	Biomass, numbers or relative proportion in age/size/sex classes Biomass of spawners Mean size, sex ratio	4.1
		5. Reproductive Capacity	5.1 Fecundity of the population does not change outside acceptable bounds (e.g. more than X% of reference population fecundity) Recruitment to the population does not change outside acceptable bounds	Egg production of population Abundance of recruits	5.1
		6. Behaviour /Movement	6.1 Behaviour and movement patterns of the population do not change outside acceptable bounds	Presence of population across space, movement patterns within the population (e.g. attraction to bait, lights)	6.1
		7. Interactions with fishery	7.1 Survival after interactions is maximised 7.2 Interactions do not affect the viability of the population or its ability to recover	Survival rate of species after interactions Number of interactions, biomass or numbers in population	7.1 7.2

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
Habitats	Avoid negative impacts on the quality of the environment Avoid reduction in the amount and quality of habitat	1. Water quality	1.1 Water quality does not change outside acceptable bounds	Water chemistry, noise levels, debris levels, turbidity levels, pollutant concentrations, light pollution from artificial light	1.1
		2. Air quality	2.1 Air quality does not change outside acceptable bounds	Air chemistry, noise levels, visual pollution, pollutant concentrations, light pollution from artificial light	2.1
		3. Substrate quality	3.1 Sediment quality does not change outside acceptable bounds	Sediment chemistry, stability, particle size, debris, pollutant concentrations	3.1
		4. Habitat types	4.1 Relative abundance of habitat types does not vary outside acceptable bounds	Extent and area of habitat types, % cover, spatial pattern, landscape scale	4.1
		5. Habitat structure and function	5.1 Size, shape and condition of habitat types does not vary outside acceptable bounds	Size structure, species composition and morphology of biotic habitats	5.1
Communities	Avoid negative impacts on the composition/ function/ distribution/ structure of the community	1. Species composition	1.1 Species composition of communities does not vary outside acceptable bounds	Species presence/absence, species numbers or biomass (relative or absolute) Richness Diversity indices Evenness indices	1.1
		2. Functional group composition	2.1 Functional group composition does not change outside acceptable bounds	Number of functional groups, species per functional group (e.g. autotrophs, filter feeders, herbivores, omnivores, carnivores)	2.1
		3. Distribution of the community	3.1 Community range does not vary outside acceptable bounds	Geographic range of the community, continuity of range, patchiness	3.1

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
		4. Trophic/size structure	4.1 Community size spectra/trophic structure does not vary outside acceptable bounds	Size spectra of the community Number of octaves, Biomass/number in each size class Mean trophic level Number of trophic levels	4.1
		5. Bio- and geo-chemical cycles	5.1 Cycles do not vary outside acceptable bounds	Indicators of cycles, salinity, carbon, nitrogen, phosphorus flux	5.1

2.2.4 Hazard Identification (Step 4)

Hazards are the activities undertaken in the process of fishing, and any external activities, which have the potential to lead to harm.

The effects of fishery/sub-fishery specific hazards are identified under the following categories:

- capture
- direct impact without capture
- addition/movement of biological material
- addition of non biological material
- disturbance of physical processes
- external hazards

These fishing and external activities are scored on a presence/absence basis for each fishery/sub-fishery. An activity is scored as a zero if it does not occur and as a one if it does occur. The rationale for the scoring is also documented in detail and must include if/how the activity occurs and how the hazard may impact on organisms/habitat.

Scoping Document S4. Hazard Identification Scoring Sheet

This table is completed once for each sub-fishery. **Table 4** provides a set of examples of fishing activities for the effects of fishing to be used as a guide to assist in scoring the hazards.

Fishery Name: Coral Sea Fishery (CSF) – Line Sector
Sub-fishery Name: Other Line sub-fishery (dropline, trotline, setline, handline)
Date: May 2006

Direct impact of Fishing	*Fishing Activity*	Score (0/1)	Documentation of Rationale
Capture	Bait collection	0	No bait collection occurs. All bait must be purchased.
	Fishing	1	Capture of organisms due to gear deployment, retrieval and actual fishing. Of the 3 sub-fisheries in the CSF line sector, catch (Kgs/yr) is greatest in the otherline sub-fishery.
	Incidental behaviour	1	Recreational fishing may occur occasionally when off watch. Impact is expected to be minimal.
Direct impact without capture	Bait collection	0	
	Fishing	1	There is a lack of data and information in regards to the impacts of line operations in the CSF, but the impact of line fishing is considered to be less than trawl operations (*Environmental Assessment Report July 2003*). Of the 3 line sub-fisheries, effort (Hooks/yr) is greatest in 'other line' sector.
	Incidental behaviour	1	Recreational fishing may occur occasionally when off watch. Impact is expected to be minimal.
	Gear loss	1	May occur
	Anchoring/ mooring	1	Possibly damage to animals and seafloor where anchor drops
	Navigation/steaming	1	
Addition/ movement of biological material	Translocation of species (boat launching, reballasting)	1	Could occur incidentally via boat hulls or through bilge water, involving introduction or movement of species between shallow coastal areas and similarly shallow fishing area. Use of bait may also allow introduction of pathogens (bait sourced from NSW deep-sea fisheries, squid from prawn trawlers, or GAB arrow squid). Ports predominantly used are Townsville, Cairns, Bundaberg, Mooloolaba, and Brisbane.
	On board processing	1	Some processing of shark species. One operator with historical exemption which allows shark processing – all others head and gut only. Fin fish packed whole, head on, gut in, as market demand is for unprocessed product.
	Discarding catch	1	Discarding is common. No observer coverage
	Stock enhancement	0	Does not occur.
	Provisioning	1	Baited hooks used.
	Organic waste disposal	1	Disposal of organic wastes (sewage) from the boats. MARPOL guidelines apply.
Addition of non-biological	Debris	0	Rubbish not thrown overboard. MARPOL guidelines apply.

Direct impact of Fishing	*Fishing Activity*	Score (0/1)	Documentation of Rationale
material	Chemical pollution	1	(STET) Detergent and shampoo. MARPOL guidelines apply.
	Exhaust	1	Exhaust as a result of diesel and other engines during fishing operations.
	Gear loss	1	May occur
	Navigation/ steaming	1	The navigation and steaming of vessels will introduce noise (engine noise and echo-sounders) and visual stimuli into the environment.
	Activity/ presence on water	1	The activity of vessels will introduce noise and visual stimuli into the environment
Disturb physical processes	Bait collection	0	
	Fishing	1	Impact of line fishing is considered to be less than trawl operations (*Environmental Assessment Report July 2003*). In comparison to the other two line sub-fishing methods, Other Line effort is many times greater than both autolongline and demersal longline effort. The method of fishing is also different -where longline will impact the demersal environment predominantly, 'otherline' will be more likely to impact the pelagic environment.
	Boat launching	0	No ports or harbors within the Coral Sea. Vessels in fishery come from designated ports
	Anchoring/ mooring	1	Anchoring/mooring may affect the physical processes in the area where anchors and anchor chains contact the seafloor.
	Navigation/ steaming	1	
External Hazards (specify the particular example within each activity area)	Other capture fishery methods	1	Alternate line sub-fisheries (Demersal longline, Other line), Hand collection sector, Trawl sector and Trap trials, state fisheries, international jurisdiction and recreational. Many of the same species are targeted or impacted in each of these separate fisheries.
	Aquaculture	0	offshore
	Coastal development	0	offshore
	Other extractive activities	0	At present, no current petroleum permits exist and no new releases have been granted for the CSF area (Department of Industry Tourism and Resources 2005 CD-ROM)
	Other non-extractive activities	1	Shipping lanes
	Other anthropogenic activities	1	Shipping , Recreational diving/tourism (*CSF Stakeholders Meeting 2005*)

Table 4. Examples of fishing activities.

(Modified from Fletcher *et al*. 2002)

Direct Impact of Fishing	Fishing Activity	Examples of Activities Include
Capture		Activities that result in the capture or removal of organisms. This includes cryptic mortality due to organisms being caught but dropping out prior to the gear's retrieval (i.e. They are caught but not landed)
	Bait collection	Capture of organisms due to bait gear deployment, retrieval and bait fishing. This includes organisms caught but not landed.
	Fishing	Capture of organisms due to gear deployment, retrieval and actual fishing. This includes organisms caught but not landed.
	Incidental behaviour	Capture of organisms due to crew behaviour incidental to primary fishing activities, possible in the crew's down time; e.g. crew may line or spear fish while anchored, or perform other harvesting activities, including any land-based harvesting that occurs when crew are camping in their down time.
Direct impact, without capture		This includes any activities that may result in direct impacts (damage or mortality) to organisms without actual capture.
	Bait collection	Direct impacts (damage or mortality) to organisms due to interactions (excluding capture) with bait gear during deployment, retrieval and bait fishing. This includes: damage/mortality to organisms through contact with the gear that doesn't result in capture, e.g. Damage/mortality to benthic species by gear moving over them, organisms that hit nets but aren't caught.
	Fishing	Direct impacts (damage or mortality) to organisms due to interactions (excluding capture) with fishing gear during deployment, retrieval and fishing. This includes: damage/mortality to organisms through contact with the gear that doesn't result in capture, e.g. Damage/mortality to benthic species by gear moving over them, organisms that hit nets but are not caught.
	Incidental behaviour	Direct impacts (damage or mortality) without capture, to organisms due to behaviour incidental to primary fishing activities, possibly in the crew's down time; e.g. the use of firearms on scavenging species, damage/mortality to organisms through contact with the gear that the crews use to fish during their down time. This does not include impacts on predator species of removing their prey through fishing.
	Gear loss	Direct impacts (damage or mortality), without capture on organisms due to gear that has been lost from the fishing boat. This includes damage/mortality to species when the lost gear contacts them or if species swallow the lost gear.
	Anchoring/ mooring	Direct impact (damage or mortality) that occurs and when anchoring or mooring. This includes damage/mortality due to physical contact of the anchor, chain or rope with organisms, e.g. An anchor damaging live coral.
	Navigation/ steaming	Direct impact (damage or mortality) without capture may occur while vessels are navigating or steaming. This includes collisions with marine organisms or birds.
Addition/ movement of biological material		Any activities that result in the addition or movement of biological material to the ecosystem of the fishery.
	Translocation of species (boat	The translocation and introduction of species to the area of the fishery, through transportation of any life stage. This transport can occur through movement on boat hulls or in ballast water as boats move throughout the fishery or from outside areas into

Direct Impact of Fishing	Fishing Activity	Examples of Activities Include
	movements, reballasting)	the fishery.
	On board processing	The discarding of unwanted sections of target after on board processing introduces or moves biological material, e.g. heading and gutting, retaining fins but discarding trunks.
	Discarding catch	The discarding of unwanted organisms from the catch can introduce or move biological material. This includes individuals of target and byproduct species due to damage (e.g. shark or marine mammal predation), size, high grading and catch limits. Also includes discarding of all non-retained bycatch species. This also includes discarding of catch resulting from incidental fishing by the crew. The discards could be alive or dead.
	Stock enhancement	The addition of larvae, juveniles or adults to the fishery or ecosystem to increase the stock or catches.
	Provisioning	The use of bait or berley in the fishery.
	Organic waste disposal	The disposal of organic wastes (e.g. food scraps, sewage) from the boats.
Addition of non-biological material		Any activities that result in non-biological material being added to the ecosystem of the fishery, this includes physical debris, chemicals (in the air and water), lost gear, noise and visual stimuli.
	Debris	Non-biological material may be introduced in the form of debris from fishing vessels or mother ships. This includes debris from the fishing process: e.g. cardboard thrown over from bait boxes, straps and netting bags lost. Debris from non-fishing activities can also contribute to this e.g. Crew rubbish – discarding or food scraps, plastics or other rubbish. Discarding at sea is regulated by MARPOL, which forbids the discarding of plastics.
	Chemical pollution	Chemicals can be introduced to water, sediment and atmosphere through: oil spills, detergents other cleaning agents, any chemicals used during processing or fishing activities.
	Exhaust	Exhaust can be introduced to the atmosphere and water through operation of fishing vessels
	Gear loss	The loss of gear will result in the addition of non-biological material, this includes hooks, line, sinkers, nets, otter boards, light sticks, buoys etc.
	Navigation /steaming	The navigation and steaming of vessels will introduce noise and visual stimuli into the environment. Boat collisions and/or sinking of vessels. Echo-sounding may introduce noise that may disrupt some species (e.g. whales, orange roughy)
	Activity /presence on water	The activity or presence of fishing vessels on the water will noise and visual stimuli into the environment.
Disturb physical processes		Any activities that will disturb physical processes, particularly processes related to water movement or sediment and hard substrate (e.g. boulders, rocky reef) processes.
	Bait collection	Bait collection may disturb physical processes if the gear contacts seafloor-disturbing sediment, or if the gear disrupts water

Direct Impact of Fishing	Fishing Activity	Examples of Activities Include
		flow patterns.
	Fishing	Fishing activities may disturb physical processes if the gear contacts seafloor-disturbing sediment, or if the gear disrupts water flow patterns.
	Boat launching	Boat launching may disturb physical processes, particularly in the intertidal regions, if dredging is required, or the boats are dragged across substrate. This would also include foreshore impacts where fishers drive along beaches to reach fishing locations and launch boats. Impacts of boat launching that occurs within established marinas are outside the scope of this assessment.
	Anchoring /mooring	Anchoring/mooring may affect the physical processes in the area that anchors and anchor chains contact the seafloor.
	Navigation /steaming	Navigation /steaming may affect the physical processes on the benthos and the pelagic by turbulent action of propellers or wake formation.
External hazards		Any outside activities that will result in an impact on the component in the same location and period that the fishery operates. The particular activity as well as the mechanism for external hazards should be specified.
	Other capture fishery methods	Take or habitat impact by other commercial, indigenous or recreational fisheries operating in the same region as the fishery under examination
	Aquaculture	Capture of feed species for aquaculture. Impacts of cages on the benthos in the region
	Coastal development	Sewage discharge, ocean dumping, agricultural runoff
	Other extractive activities	Oil and gas pipelines, drilling, seismic activity
	Other non-extractive activities	Defense, shipping lanes, dumping of munitions, submarine cables
	Other anthropogenic activities	Recreational activities, such as scuba diving leading to coral damage, power boats colliding with whales, dugongs, turtles. Shipping, oil spills

2.2.5 Bibliography (Step 5)

All references used in the scoping assessment are included in the References section.

Key documents can be found on the AFMA web page at www.afma.gov.au and include the following:

- Environmental Assessment Report 2003
- Statement of Management Arrangements 2004
- AFMA At a glance web page http://www.afma.gov.au/fisheries/ext_territories/coral_sea/at_a_glance.htm Last updated 14 September 2005.

Other publications that may provided information include

- Bureau of Rural Sciences (BRS) Fishery Status Reports

The detailed bibliography for the Other Line sub-fishery of the Coral Sea Fishery Line Sector is included in the reference section.

2.2.6 Decision rules to move to Level 1(Step 6)

Any hazards that are identified at Step 4 Hazard Identification as occurring in the fishery are carried forward for analysis at Level 1.

In this case, 20 out of 26 possible internal activities were identified as occurring in this fishery. Three out of 6 external activities were identified. Thus, a total of 23 activity-component scenarios will be considered at Level 1. This results in 115 total scenarios (of 160 possible) to be developed and evaluated using the unit lists (species, habitats, communities).

2.3 Level 1 Scale, Intensity and Consequence Analysis (SICA)

Level 1 aims to identify which hazards lead to a significant impact on any species, habitat or community. Analysis at Level 1 is for whole components (target; bycatch and byproduct; TEP species; habitat; and communities), not individual sub-components. Since Level 1 is used mainly as a rapid screening tool, a “worst case” approach is used to ensure that elements screened out as low risk (either activities or components) are genuinely low risk. Analysis at Level 1 for each component is accomplished by considering the most vulnerable sub-component and the most vulnerable unit of analysis (e.g. most vulnerable species, habitat type or community). This is known as credible scenario evaluation (Richard Stocklosa e-systems Pty Ltd (March 2003) Review of CSIRO Risk Assessment Methodology: ecological risk assessment for the effects of fishing) in conventional risk assessment. In addition, where judgments about risk are uncertain, the highest level of risk that is still regarded as plausible is chosen. For this reason, the measures of risk produced at Level 1 cannot be regarded as absolute.

At Level 1 each fishery/sub-fishery is assessed using a scale, intensity and consequence analysis (SICA). SICA is applied to the component as a whole by choosing the most vulnerable sub-component (linked to an operational objective) and most vulnerable unit of analysis. The rationale for these choices must be documented in detail. These steps are outlined below. Scale, intensity, and consequence analysis (SICA) consists of thirteen steps. The first ten steps are performed for each activity and component, and correspond to the columns of the SICA table. The final three steps summarise the results for each component.

- Step1: Record the hazard identification score (absence (0) presence (1) scores) identified at step 3 at the scoping level (Scoping Document S3) onto the SICA table
- Step 2: Score spatial scale of the activity
- Step 3: Score temporal scale of the activity
- Step 4: Choose the sub-component most likely to be affected by activity
- Step 5: Choose the most vulnerable unit of analysis for the component e.g. species, habitat type or community assemblage
- Step 6: Select the most appropriate operational objective
- Step 7: Score the intensity of the activity for that sub-component
- Step 8: Score the consequence resulting from the intensity for that sub-component
- Step 9: Record confidence/uncertainty for the consequence scores
- Step 10: Document rationale for each of the above steps
- Step 11: Summary of SICA results
- Step 12: Evaluation/discussion of Level 1
- Step 13: Components to be examined at Level 2

2.3.1 Record the hazard identification score (absence (0) presence (1) scores) identified at step 3 in the scoping level onto the SICA Document (Step 1)

Record the hazard identification score absence (0) presence (1) identified at Step 3 at the scoping level onto the SICA sheet. A separate sheet will be required for each component (target, bycatch and byproduct, and TEP species, habitat, and communities). Only those activities that scored a 1 (presence) will be analysed at Level 1

2.3.2 Score spatial scale of activity (Step 2)

The greatest spatial extent must be used for determining the spatial scale score for each identified hazard. For example, if fishing (e.g. capture by longline) takes place within an area of 200 nm by 300 nm, then the spatial scale is scored as 4. The score is then recorded onto the SICA Document and the rationale documented.

Spatial scale score of activity

<1 nm:	1-10 nm:	10-100 nm:	100-500 nm:	500-1000 nm:	>1000 nm:
1	2	3	4	5	6

Maps and graphs may be used to supplement the information (e.g. sketches of the distribution of the activity relative to the distribution of the component) and additional notes describing the nature of the activity should be provided. The spatial scale score at Step 2 is not used directly, but the analysis is used in making judgments about level of intensity at Step 7. Obviously, two activities can score the same with regard to spatial scale, but the intensity of each can differ vastly. The reasons for the score are recorded in the rationale column of the SICA spreadsheet.

2.3.3 Score temporal scale of activity (Step 3)

The highest frequency must be used for determining the temporal scale score for each identified hazard. If the fishing activity occurs daily, the temporal scale is scored as 6. If oil spillage occurs about once per year, then the temporal scale of that hazard scores a 3. The score is then recorded onto the SICA Document and the rationale documented.

Temporal scale score of activity

Decadal (1 day every 10 years or so)	Every several years (1 day every several years)	Annual (1-100 days per year)	Quarterly (100-200 days per year)	Weekly (200-300 days per year)	Daily (300-365 days per year)
1	2	3	4	5	6

It may be more logical for some activities to consider the aggregate number of days that an activity occurs. For example, if the activity "fishing" was undertaken by 10 boats during the same 150 days of the year, the score is 3. If the same 10 boats each spend 30 non-overlapping days fishing, the temporal scale of the activity is a sum of 300 days, indicating that a score of 6 is appropriate. In the case where the activity occurs over many days, but only every 10 years, the number of days by the number of years in the cycle is used to determine the score. For example, 100 days of an activity every 10 years averages to 10 days every year, so that a score of 3 is appropriate.

The temporal scale score at Step 3 is not used directly, but the analysis is used in making judgments about level of intensity at Step 7. Obviously, two activities can score the same with regard to temporal scale, but the intensity of each can differ vastly. The reasons for the score are recorded in the rationale column.

2.3.4 Choose the sub-component most likely to be affected by activity (Step 4)

The most vulnerable sub-component must be used for analysis of each identified hazard. This selection must be made on the basis of expected highest potential risk for each 'direct impact of fishing' and 'fishing activity' combination, and recorded in the 'sub-component' column of the SICA Document. The justification is recorded in the rationale column.

2.3.5 Choose the unit of analysis most likely to be affected by activity and to have highest consequence score (Step 5)

The most vulnerable 'unit of analysis' (i.e. most vulnerable species, habitat type or community) must be used for analysis of each identified hazard. The species, habitats, or communities (depending on which component is being analysed) are selected from **Scoping Document S2 (A – C)**. This selection must be made on the basis of expected highest potential risk for each 'direct impact of fishing' and 'fishing activity' combination, and recorded in the 'unit of analysis' column of the SICA Document. The justification is recorded in the rationale column.

2.3.6 Select the most appropriate operational objective (Step 6)

To provide linkage between the SICA consequence score and the management objectives, the most appropriate operational objective for each sub-component is chosen. The most relevant operational objective code from **Scoping Document S3** is recorded in the 'operational objective' column in the SICA document. Note that SICA can only be performed on operational objectives agreed as important for the (sub) fishery during scoping and contained in **Scoping Document S3**. If the SICA process identifies reasons to include sub-components or operational objectives that were previously not included/eliminated then these sub-components or operational objectives must be re-instated.

2.3.7 Score the intensity of the activity for the component (Step 7)

The score for intensity of an activity considers the direct impacts in line with the categories shown in the conceptual model (**Figure 2**) (capture, direct impact without capture, addition/movement of biological material, addition of non-biological material, disturbance to physical processes, external hazards). The intensity of the activity is judged based on the scale of the activity, its nature and extent. Activities are scored as per intensity scores below.

Intensity score of activity (Modified from Fletcher *et al*. 2002)

Level	Score	Description
Negligible	1	remote likelihood of detection at any spatial or temporal scale
Minor	2	occurs rarely or in few restricted locations and detectability even at these scales is rare
Moderate	3	moderate at broader spatial scale, or severe but local
Major	4	severe and occurs reasonably often at broad spatial scale
Severe	5	occasional but very severe and localised or less severe but widespread and frequent
Catastrophic	6	local to regional severity or continual and widespread

This score is then recorded on the **Level 1 (SICA) Document** and the rationale documented.

2.3.8 Score the consequence of intensity for that component (Step 8)

The consequence of the activity is a measure of the likelihood of not achieving the operational objective for the selected sub-component and unit of analysis. It considers the flow on effects of the direct impacts from Step 7 for the relevant indicator (e.g. decline in biomass below the selected threshold due to direct capture). Activities are scored as per consequence scores below. A more detailed description of the consequences at each level for each component (target, bycatch and byproduct, TEP species, habitats, and communities) is provided as a guide for scoring the consequences of the activities in the description of consequences table (see **Table 5, Appendix C**).

Consequence score for ERAEF activities (Modified from Fletcher *et al*. 2002).

Level	Score	Description
Negligible	1	Impact unlikely to be detectable at the scale of the stock/habitat/community
Minor	2	Minimal impact on stock/habitat/community structure or dynamics
Moderate	3	Maximum impact that still meets an objective (e.g. sustainable level of impact such as full exploitation rate for a target species).
Major	4	Wider and longer term impacts (e.g. long-term decline in CPUE)
Severe	5	Very serious impacts now occurring, with relatively long time period likely to be needed to restore to an acceptable level (e.g. serious decline in spawning biomass limiting population increase).
Intolerable	6	Widespread and permanent/irreversible damage or loss will occur-unlikely to ever be fixed (e.g. extinction)

The score should be based on existing information and/or the expertise of the risk assessment group. The rationale for assigning each consequence score must be documented. The conceptual model may be used to link impact to consequence by showing the pathway that was considered. In the absence of agreement or information, the highest score (worst case scenario) considered plausible is applied to the activity.

2.3.9 Record confidence/uncertainty for the consequence scores (Step 9)

The information used at this level is qualitative and each step is based on expert (fishers, managers, conservationists, scientists) judgment. The confidence rating for the consequence score is rated as 1 (low confidence) or 2 (high confidence) for the activity/component. The score is recorded on the SICA Document and the rationale documented. The confidence will reflect the levels of uncertainty for each score at steps 2, 3, 7 and 8.

Description of Confidence scores for Consequences. The confidence score appropriate to the rationale is used, and documented on the SICA Document.

Confidence	Score	Rationale for the confidence score
Low	1	Data exists, but is considered poor or conflicting
		No data exists
		Disagreement between experts
High	2	Data exists and is considered sound
		Consensus between experts
		Consequence is constrained by logical consideration

2.3.10 Document rationale for each of the above steps (Step 10)

The rationale forms a logical pathway to the consequence score. It is provided for each choice at each step of the SICA analysis.

2.3.1 Level 1 (SICA) Documents **L1.1 - Target Species Component; L1.2 - Byproduct and Bycatch Component; L1.3 - TEP Species Component; L1.4 - Habitat Component; L1.5 - Community Component**

SICA steps 1-10. Tables of descriptions of consequences for each component and each sub component provide a guide for scoring the level of consequence (see Table5, Appendix C)

L1.1 - Target Species Component

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale	Internal / External
Capture	Bait collection	0									does not occur; bait used must be purchased	I
	Fishing	1	5	3	population size	Lutjanidae: *Pristipomoides filamentosus*, rosy jobfish /*Etelis carbunculus* NW ruby fish	1.1	3	3	2	largest catches are rosy jobfish and NW ruby fish. Catches of both species increased steadily from 2001-2003 then jobfish fell by 30% in 2004 while rubyfish increased 7 fold. Combined, these two species represent 50% of the total Otherline catch for 2003 and 2004. Fishery occurs throughout year predominantly in 2 main seamount areas; =>intensity moderate - effort increasing, occurs in localised areas and could be severe; =>consequence moderate - in localised areas but need to establish this level of catch is sustainable at this scale; =>confidence high logbook data	I
	Incidental behaviour	1	4	3	population size	Serranidae:*Epinephelus ergastularius E. septemfasciatus* Bar rockcod /*Epinephalus morrhua* Groupers	1.1	1	1	1	recreational handline fishing during crew downtime when anchored. Otherline sub-fishery catches for this assemblage has tripled over the years 2003-2004 (CS01 logbook data); =>intensity negligible; =>consequence negligible; =>confidence low- no data to determine recreational catch species or amounts	I
Direct impact without capture	Bait collection	0									does not occur	I
	Fishing	1	5	3	population size	*Carcharhinus spp* whaler sharks	1.1	2	2	1	Direct impacts without capture are from cryptic fishing mortality caused by escapement of animals injured from encounters with hook and by predation from other fish after capture on hooks. This cryptic fishing mortality is difficult to measure precisely but is small compared with the fishing mortality associated with the retained catch; =>intensity minor - effort occurring in localised areas and numbers of escaping fish likely to be small; =>consequence minor - in localised areas and unable to detect	I

											changes in species composition; =>confidence low -no data to refute or confirm escapement, but also insufficient data to identify species involved	
	Incidental behaviour	1	4	3	population size	Serranidae:*Epinephelus ergastularius E. septemfasciatus* Bar rockcod /*Epinephalus morrhua* Groupers	1.1	1	1	1	handline-fishing by crew during downtime occurs infrequently, fish attracted to baits may be taken by sharks; =>intensity negligible occurs in restricted locations and infrequently; =>consequence negligible- impact of disturbance to dolphins undetectable; =>confidence low - based on assumption of interaction	I
	Gear loss	1	5	3	population size	*Carcharhinus spp* whaler sharks	1.1	3	2	2	fish may take hooks from lost gear which will interfere with future feeding, or may become tangled in lost line, insufficient data to identify species involved; =>intensity locally severe; =>consequence minor; =>confidence high- consensus, operator comments in FAR reports which note gear loss suggest shark entanglement as most likely cause	I
	Anchoring/ mooring	1	5	3	behaviour/movement	*Carcharhinus spp* whaler sharks	6.1	1	1	1	fish may be hit by anchor or anchor-chain, only locations shallow enough for anchoring, occurs rarely; =>intensity negligible anchoring uncommon; =>consequence negligible - unlikely to detect any changes; =>confidence low based on assumption but also insufficient data to identify species involved	I
	Navigation/ steaming	1	5	3	behaviour/movement	*Carcharhinus spp* whaler sharks	6.1	1	1	1	interaction with pelagic species may occur; =>intensity negligible - effort low and decreasing; =>consequence negligible unlikely to detect any changes to distribution; =>confidence low no data	I
Addition/ movement of biological material	Translocation of species	1	5	3	population size	Lutjanidae: *Pristipomoides filamentosus*, rosy jobfish /*Etelis carbunculus* NW ruby fish	1.1	3	3	1	translocation possible by hull or line fouling, or through bilge water, involving introduced species or movement of species between shallow coastal port areas and similarly shallow fishing area. Bait also used which may introduce pathogens -bait used includes fish from NSW deep-sea fisheries, squid from prawn trawlers, and GAB arrow squid; =>intensity moderate but may be locally severe- otherline sub-fishery operates in greater range of water depths than CSF DLL and ALL sub-fishery (i.e. both shallower and deeper range extended); =>consequence moderate - potential for wider long term impact (e.g. crown of thorns) effecting whole of community, which may alter prey species availability; =>confidence low; no information collected or mitigation measures communicated-no data to refute or confirm	I
	On board processing	1	5	3	population size	Lutjanidae Serranidae	1.1	2	2	2	higher predators attracted to area by waste from onboard filleting of shark species which occurs - all other fish unloaded whole (FAR report), increase in shark numbers through introduction of additional material may impact on number of fish taken by sharks; =>intensity minor; =>consequence minor;	I

											=>confidence logic backed by observer comments. Consistency of observer monitoring and noting of presence/absence of shark activity during processing would be of great value.	
	Discarding catch	1	5	3	population size	Lutjanidae Serranidae	1.1	3	2	2	Higher predators numbers increase through introduction of additional material may impact on fish numbers taken by sharks; =>intensity locally moderate; =>consequence minor; =>confidence logic. Consistency of observer monitoring and noting of presence/absence of shark activity during processing would be of great value.	I
	Stock enhancement	0									does not occur	I
	Provisioning	1	5	3	population size	Lutjanidae Serranidae	1.1	3	2	2	higher predators numbers increase through introduction of additional material may impact on fish numbers taken by sharks; =>intensity locally moderate; =>consequence minor; =>confidence logic	I
	Organic waste disposal	1	5	3	population size	Lutjanidae Serranidae	1.1	2	2	2	organic waste discarded may attract higher predators but most boats operating under MARPOL regulations and macerators now compulsory in Qld for all food scraps; =>intensity minor; =>consequence minor; =>confidence high (observer reports from other CSF line fisheries)	I
Addition of non-biological material	Debris	0										I
	Chemical pollution	1	5	3	population size	Lutjanidae Serranidae	1.1	1	1	1	chemical pollution may be detrimental to fish health, most boats operating under MARPOL regulations; =>consequence negligible - unlikely to detect any changes; =>confidence low	I
	Exhaust	1	5	3	population size	Lutjanidae Serranidae	1.1	1	1	1	exhaust may be detrimental to fish health, most boats operating under MARPOL regulations; =>consequence negligible - unlikely to detect any changes; =>confidence low	I
	Gear loss	1	5	3	population size	*Carcharhinus spp* whaler sharks	1.1	3	2	2	fish may take hooks from lost gear which will interfere with future feeding, or may become tangled in lost line; =>intensity locally severe; =>consequence minor; =>confidence high-FAR reports but also insufficient data to identify species involved	I
	Navigation/ steaming	1	5	3	behaviour/movement	*Carcharhinus spp* whaler sharks	6.1	2	1	1	interaction with pelagic species may occur; =>intensity minor; =>consequence negligible unlikely to detect any changes to distribution; =>confidence low no data to refute or confirm but also insufficient data to identify species involved	I
	Activity/ presence on water	1	5	3	behaviour/movement	*Carcharhinus spp* whaler sharks	6.1	2	2	1	activity will introduce noise (engine noise and echo-sounders); organic and visual stimuli into the environment; =>intensity minor; =>consequence: minor unlikely to detect any changes; =>confidence: low -no data to refute or confirm but also insufficient data to identify species involved	I
Disturb physical processes	Bait collection	0									does not occur	I
	Fishing	1	5	3	behaviour/movement	*Pristipomoides filamentosus*, rosy jobfish	6.1	1	1	1	Gear may disturb sediment on the seafloor and alter fish movement pattern; =>intensity negligible for vertically set gear; =>consequence minor unlikely to detect any changes; =>confidence low	I

	Boat launching	0										I
	Anchoring/ mooring	1	5	3	behaviour/movement	*Carcharhinus spp* whaler sharks	6.1	1	1	1	Anchoring/mooring may affect the physical processes in the area where anchors and anchor chains moves through the water column and contacts the seafloor, or may impact on demersal habitat for juveniles; =>Intensity negligible; =>Consequence negligible unlikely to detect any changes; =>confidence low -no data to refute or confirm but also insufficient data to identify species involved	I
	Navigation/steaming	1	5	3	behaviour/movement	*Carcharhinus spp* whaler sharks	6.1	2	2	1	navigation and steaming of vessels will introduce noise (engine noise and echo-sounders) and visual stimuli into the environment; =>intensity minor; =>consequence minor unlikely to detect any changes; =>confidence low -no data to refute or confirm but also insufficient data to identify species involved	I
External Impacts (specify the particular example within each activity area)	Other fisheries	1	5	3	population size	Lutjanidae, Serranidae	1.1	3	3	2	7 fisheries occurring over most of year. Similar species assemblages are captured within each of these fisheries; =>combined intensity localised moderate; =>consequence for seamount species may be moderate; =>confidence high logbook data. Many catch records at family level only	E
	Aquaculture	0									does not occur	E
	Coastal development	0									does not occur	E
	Other extractive activities	0										E
	Other non-extractive activities	1	5	3	behaviour/movement	Lutjanidae, Serranidae	6.1	2	2	1	Shipping probably occurs commonly across the Coral Sea but unlikely to impact on species. =>intensity minor; =>consequence minor; =>confidence low	E
	Other anthropogenic activities	1	5	3	population size	Lutjanidae, Serranidae	1.1	1	1	1	Shipping, recreational diving/tourism occurs in area presumably near/on the reef communities (CSF Stakeholders Meeting 2005). Interaction with line fishery minimal. =>Intensity negligible; =>consequence negligible; =>confidence low	E

L1.2 - Byproduct and Bycatch Component;

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale	Internal / External
Capture	Bait collection	0									does not occur	I
	Fishing	1	5	3	population size	Lutjanidae*: Lutjanus bohar* red bass; *"Lutjanus malabaricus* - unvalidated*"*	1.1	3	3	2	largest bycatches species are Lutjanidae, many bycatch species from 2001-2002 are approaching target species status for 2003-2004. Species lists are changing. Fishery occurs throughout year predominantly in 2 main seamount areas; =>intensity moderate - effort occurring in localised areas could be severe- Otherline sub-fishery effort greatest of all line sub-fisheries within the CSF; =>consequence moderate - in localised areas but need to establish this level of catch is sustainable at this scale;=>confidence high logbook data	I
	Incidental behaviour	1	4	3	population size	Lutjanidae*: Lutjanus bohar* red bass; *"Lutjanus malabaricus* - unvalidated*"*	1.1	1	1	1	Recreational handline fishing during crew downtime; =>Intensity negligible; =>consequence negligible; =>confidence low -no data to refute or confirm recreational catch species or numbers	I
Direct impact without capture	Bait collection	0									does not occur	I
	Fishing	1	5	3	population size	*Nebrius ferrugineus* Tawny shark	1.1	2	2	1	Direct impacts without capture are from cryptic fishing mortality caused by escapement of animals injured from encounters with hook and by predation from other fish or mammals after capture on hooks. This cryptic fishing mortality is difficult to measure precisely but is smaller than fishing mortality associated with the retained catch; =>intensity minor - effort occurring in localised areas but numbers of escaping fish likely to be small; =>consequence minor - in localised areas and unable to detect changes in species composition; =>confidence low -no data to refute or confirm	I
	Incidental behaviour	1	4	3	population size	Lutjanidae*: Lutjanus bohar* red bass; *"Lutjanus malabaricus* - unvalidated*"*	1.1	1	1	1	handline-fishing by crew during downtime occurs infrequently, fish attracted to baits may be taken by sharks; =>intensity negligible occurs in restricted locations and infrequently; =>consequence negligible- impact undetectable; =>confidence low - based on assumption of interaction	I
	Gear loss	1	5	3	population size	*Nebrius ferrugineus*	1.1	3	2	2	tawny shark may take hooks from lost gear which will interfere	I

						Tawny shark					with future feeding, or may become tangled in lost line; =>intensity locally severe; =>consequence minor; =>confidence high -FAR reports note boats moving on to avoid tangling and consequent breakage of lines by sharks	
	Anchoring/ mooring	1	5	3	behaviour/movement	*Nebrius ferrugineus* Tawny shark	6.1	1	1	1	fish may be hit by anchor or anchor-chain, only possible in locations shallow enough for anchoring, interaction probably doesn't occur; =>intensity negligible, anchoring uncommon; =>consequence negligible - unlikely to detect any changes; =>confidence low based on assumption	I
	Navigation/ steaming	1	5	3	behaviour/movement	*Carcharhinus* spp, *C. amblyrhynchos* Grey reef shark & *C. albimarginatus* Silvertip shark	6.1	2	1	1	interaction with pelagic species may occur. Carcharinidae species noted for their attraction to low-frequency sounds; =>intensity minor but otherline sub-fishery effort increasing greatly; =>consequence negligible unlikely to detect any changes to distribution; =>confidence low -no data to refute or confirm	I
Addition/ movement of biological material	Translocation of species	1	5	3	population size	Lutjanidae*: Lutjanus bohar* red bass; *"Lutjanus malabaricus - unvalidated"*	1.1	3	3	1	translocation possible by hull or line fouling, or through bilge water, involving introduced species or movement of species between shallow coastal port areas and similarly shallow fishing area. Bait also used which may introduce pathogens -bait used includes fish from NSW deep-sea fisheries, squid from prawn trawlers, and GAB arrow squid; =>intensity moderate but may be locally severe- otherline sub-fishery operates in greater range of water depths than CSF DLL and ALL sub-fishery (i.e. both shallower and deeper range extended); =>consequence moderate - potential for wider long term impact (e.g. crown of thorns) effecting whole of community, which may alter prey species availability; =>confidence low; no information collected or mitigation measures communicated-no data to refute or confirm	I
	On board processing	1	5	3	population size	Lutjanidae*: Lutjanus bohar* red bass; *"Lutjanus malabaricus - unvalidated"*	1.1	2	2	2	higher predators attracted to area by waste from onboard filleting of shark species which occurs - all other fish unloaded whole (FAR report), increase in shark numbers through introduction of additional material may impact on number of fish taken by sharks; =>intensity minor; =>consequence minor; =>confidence logic backed by observer comments. Consistency of observer monitoring and noting of presence/absence of shark activity during processing would be of great value.	I
	Discarding catch	1	5	3	population size	*Lutjanus bohar* red bass	1.1	3	3	2	higher predators numbers increase through introduction of additional material may impact on fish numbers taken by sharks; Red bass predominantly suffer from expanded gas bladder and remain susceptible to predation, =>intensity locally moderate; =>consequence moderate -no information available on impact or risk of life history traits; =>confidence high - observer comments. Consistency of observer monitoring and noting of presence/absence of shark activity during processing would be	I

											of great value.	
	Stock enhancement	0									does not occur	I
	Provisioning	1	5	3	population size	Lutjanidae*: Lutjanus bohar* red bass; *“Lutjanus malabaricus* - unvalidated*”*	1.1	3	2	2	higher predators numbers increase through introduction of bait may impact on fish numbers taken by sharks; =>intensity locally moderate; =>consequence minor; =>confidence logic -can be evaluated without data	I
	Organic waste disposal	1	5	3	population size	Lutjanidae*: Lutjanus bohar* red bass; *“Lutjanus malabaricus* - unvalidated*”*	1.1	2	2	2	organic waste discarded may attract higher predators but most boats operating under MARPOL regulations and macerators now compulsory in Qld for all food scraps; =>intensity minor; =>consequence minor; =>confidence high (observer reports from other CSF line fisheries)	I
Addition of non-biological material	Debris	0										I
	Chemical pollution	1	5	3	population size	Carcharhinus spp, *C. amblyrhynchos* Grey reef shark & *C. albimarginatus* Silvertip shark	1.1	1	1	1	chemical pollution may be detrimental to fish health, most boats operating under MARPOL regulations; =>consequence negligible - unlikely to detect any changes; =>confidence low - no data to refute or confirm	I
	Exhaust	1	5	3	population size	Carcharhinus spp, *C. amblyrhynchos* Grey reef shark & *C. albimarginatus* Silvertip shark	1.1	1	1	1	exhaust may be detrimental to fish health, most boats operating under MARPOL regulations; =>consequence negligible - unlikely to detect any changes; =>confidence low -no data to refute or confirm	I
	Gear loss	1	5	3	population size	*Nebrius ferrugineus* Tawny shark	1.1	3	2	2	fish may take hooks from lost gear which will interfere with future feeding, or may become tangled in lost line; =>intensity locally severe; =>consequence minor; =>confidence high-FAR reports	I
	Navigation/ steaming	1	5	3	behaviour/movement	Carcharhinus spp, *C. amblyrhynchos* Grey reef shark & *C. albimarginatus* Silvertip shark	6.1	2	1	1	interaction with pelagic species may occur. Carcharinidae species noted for their attraction to low-frequency sounds; =>intensity minor but effort increasing; =>consequence negligible unlikely to detect any changes to distribution; =>confidence low -no data to refute or confirm	I
	Activity/ presence on water	1	5	3	behaviour/movement	Carcharhinus spp, *C. amblyrhynchos* Grey reef shark & *C. albimarginatus* Silvertip shark	6.1	2	2	1	activity will introduce noise (engine noise and echo-sounders); organic and visual stimuli into the environment; =>intensity minor but effort increasing; =>consequence minor, unlikely to detect any changes; =>confidence low -no data to refute or confirm	I
Disturb physical processes	Bait collection	0									does not occur	I
	Fishing	1	5	3	behaviour/movement	Squallus spp, sharks	6.1	1	1	1	Gear may disturb sediment on the seafloor and affect species movement; =>intensity negligible for vertically set gear; =>consequence minor unlikely to detect any changes; =>confidence low -no data to refute or confirm	I
	Boat launching	0										I

	Anchoring/ mooring	1	5	3	behaviour/movement	*Nebrius ferrugineus* Tawny shark	6.1	1	1	1	Anchoring/mooring may affect the physical processes in the area where anchors and anchor chains contact the seafloor, or may impact on demersal habitat for juveniles; =>Intensity negligible; =>Consequence negligible unlikely to detect any changes; =>confidence low -no data to refute or confirm	I
	Navigation/steaming	1	5	3	behaviour/movement	Lutjanidae*: Lutjanus bohar* red bass; *"Lutjanus malabaricus* - unvalidated*"*	6.1	2	2	1	navigation and steaming of vessels will introduce noise (engine noise and echo-sounders) and visual stimuli into the environment; =>intensity minor but effort increasing; =>consequence minor unlikely to detect any changes; =>confidence low -no data to refute or confirm	I
External Impacts (specify the particular example within each activity area)	Other fisheries	1	5	3	population size	Lutjanidae*: Lutjanus bohar* red bass; *"Lutjanus malabaricus* - unvalidated*"*	1.1	3	3	2	7 fisheries occurring over most of year. Similar species assemblages are captured within each of these fisheries; =>combined intensity localised moderate; =>consequence for seamount species may be moderate; =>confidence high logbook data	E
	Aquaculture	0									does not occur	E
	Coastal development	0									does not occur	E
	Other extractive activities	0										E
	Other non-extractive activities	1	5	3	behaviour/movement	Carcharhinus spp, *C. amblyrhynchos* Grey reef shark & *C. albimarginatus* Silvertip shark	6.1	2	2	1	Shipping probably occurs commonly across the Coral Sea but unlikely to impact on species. =>Intensity minor; =>consequence minor; =>confidence low -no data to refute or confirm	E
	Other anthropogenic activities	1	5	3	population size	Carcharhinus spp, *C. amblyrhynchos* Grey reef shark & *C. albimarginatus* Silvertip shark	1.1	1	1	1	Recreational diving/tourism occurs in area presumably near/on the reef communities (CSF Stakeholders Meeting 2005). Interaction with fishery minimal. =>Intensity negligible; =>consequence negligible; =>confidence low -no data to refute or confirm	E

L1.3 - TEP Species Component;

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale	Internal / External
Capture	Bait collection	0									does not occur	I
	Fishing	1	5	3	interaction with fishery	*Sula leucogaster*, brown booby	7.1	3	3	1	brown boobys feed on bait so will be implicated in gear deployment; =>intensity localised moderate; =>consequence may be moderate as effecting localised breeding groups; =>confidence low-no bird data to refute or confirm	I
	Incidental behaviour	1	4	3	behaviour/movement	*Tursiops truncatus*, bottlenosed dolphin	6.1	2	1	1	handline-fishing by crew during downtime occurs infrequently =>intensity minor occurs in restricted locations and infrequently =>consequence negligible- impact of disturbance to dolphins undetectable =>confidence low - based on assumption, no dolphin data to refute or confirm	I
Direct impact without capture	Bait collection	0									does not occur	I
	Fishing	1	5	3	population size	*Natator depressus*, flatback turtle	1.1	3	2	2	turtles may take baited hooks but then escape with hook in tow or may become entangled in lines during deployment but pull free- this will cause damage to the turtle which may or may not become fatal; =>Intensity localised moderate; =>consequence minor; =>confidence based on logic-can be evaluated without data	I
	Incidental behaviour	1	4	3	behaviour/movement	*Tursiops truncatus*, bottlenosed dolphin	6.1	2	1	1	handline-fishing by crew during downtime occurs infrequently =>intensity minor occurs in restricted locations and infrequently =>consequence negligible- impact of disturbance to dolphins undetectable =>confidence: low - based on assumption, no dolphin data to refute or confirm	I
	Gear loss	1	5	3	population size	*Tursiops truncatus*, bottlenosed dolphin	1.1	3	2	1	dolphins may get entangled in lost gear floating midwater; =>intensity locally severe; =>consequence to population size minor; =>confidence low, no dolphin data to refute or confirm, but FAR reports do show gear lost	I
	Anchoring/ mooring	1	5	3	behaviour/movement	*Natator depressus*, flatback turtle	6.1	1	2	1	turtles may be hit by anchor or anchor-chain; =>intensity negligible; =>consequence minor; =>confidence low-no data to refute or confirm	I

	Navigation/ steaming	1	5	3	behaviour/movement	*Calonectris leucomelas*, streaked shearwater	6.1	3	2	2	streaked shearwater may be effected as it regularly sits on the surface of the water; =>Intensity localised moderate; =>consequence minor; =>confidence logic -can evaluate without data	I
Addition/ movement of biological material	Translocation of species	1	5	3	population size	*Natator depressus*, flatback turtle	1.1	3	3	1	translocation possible by hull or line fouling, or through bilge water, involving introduced species or movement of species between shallow coastal port areas and similarly shallow fishing area. Bait also used which may introduce pathogens - bait used includes fish from NSW deep-sea fisheries, squid from prawn trawlers, and GAB arrow squid; =>intensity moderate but may be locally severe; =>consequence moderate - potential for wider long term impact (e.g. crown of thorns) effecting whole of community, may alter turtle diet; =>confidence low; no information collected or mitigation measures communicated-no data to refute or confirm	I
	On board processing	1	5	3	population size	*Calonectris leucomelas*, streaked shearwater	1.1	2	2	1	increase in shark numbers through introduction of additional material may impact on number of shearwaters taken by sharks; =>intensity minor; =>consequence minor, =>Confidence low-no information is available to assess risk; high-shark presence at time of discarding noted in FAR records and situation would be expected to be the same when disposing of processed wastes. Consistency of observer monitoring and noting of presence/absence of shark activity during processing would be of great value.	I
	Discarding catch	1	5	3	population size	*Calonectris leucomelas*, streaked shearwater	1.1	2	3	1	increase in shark numbers through introduction of additional material may impact on number of shearwaters taken by sharks; =>intensity of discarding locally moderate but bird numbers low in CSF so overall intensity minor; =>consequence moderate-no information is available to assess risk; =>confidence low. Consistency of observer monitoring and noting of presence/absence of shark activity during processing would be of great value.	I
	Stock enhancement	0									does not occur	I
	Provisioning	1	5	3	population size	*Sula leucogaster*, brown booby	1.1	3	2	2	higher predators numbers increase through introduction of additional material may impact on bird numbers injured/taken by sharks; =>intensity minor; =>consequence minor; =>confidence logic-can be evaluated without data. Operator comment also that some discard is due to shark damage to fish while on hooks- may also occur in vicinity of hooks. Observer/video information in the form of presence/absence of shark activity would be valuable.	I
	Organic waste disposal	1	5	3	population size	*Calonectris leucomelas*, streaked shearwater	1.1	2	2	2	organic waste discarded may attract higher predators but most boats operating under MARPOL regulations and macerators now compulsory in Qld for all food scraps; =>intensity minor;	I

											=>consequence minor; =>confidence high (observer reports from other CSF line fisheries)	
Addition of non-biological material	Debris	0										I
	Chemical pollution	1	5	3	population size	*Calonectris leucomelas*, streaked shearwater	1.1	2	2	2	streaked shearwater may be effected as it regularly sits on the surface of the water; =>intensity minor; =>consequence minor; =>confidence logic-can be evaluated without data	I
	Exhaust	1	5	3	population size	*Calonectris leucomelas*, streaked shearwater	1.1	2	2	2	streaked shearwater may be effected as it regularly sits on the surface of the water; =>intensity minor; =>consequence minor; =>confidence logic-can be evaluated without data	I
	Gear loss	1	5	3	population size	*Tursiops truncatus*, bottlenosed dolphin	1.1	3	2	1	dolphins may get entangled in lost gear floating midwater; =>intensity locally severe; =>consequence to population size minor; =>confidence low but FAR reports do show gear lost	I
	Navigation/ steaming	1	5	3	behaviour/movement	*Calonectris leucomelas*, streaked shearwater	6.1	3	2	2	streaked shearwater may be effected as it regularly sits on the surface of the water; =>Intensity localised moderate; =>consequence minor; =>confidence logic-can be evaluated without data	I
	Activity/ presence on water	1	5	3	behaviour/movement	*Calonectris leucomelas*, streaked shearwater	6.1	3	2	2	streaked shearwater may be effected as it regularly sits on the surface of the water; =>Intensity localised moderate; =>consequence minor; =>confidence logic-can be evaluated without data	I
Disturb physical processes	Bait collection	0									does not occur	I
	Fishing	1	5	3	behaviour/movement	*Natator depressus*, flatback turtle	6.1	3	2	1	turtles may be disturbed by gear and gear deployment activity which covers several km's, with behaviour and movement effected; =>intensity over localised areas moderate; =>consequence minor; =>confidence low-no data to refute or confirm	I
	Boat launching	0									does not occur	I
	Anchoring/ mooring	1	5	3	behaviour/movement	*Natator depressus*, flatback turtle	6.1	1	2	1	turtles may be hit by anchor or anchor-chain; =>intensity negligible; =>consequence minor; =>confidence low-no data to refute or confirm	I
	Navigation/steaming	1	5	3	behaviour/movement	*Calonectris leucomelas*, streaked shearwater	6.1	3	2	2	streaked shearwater may be effected as it regularly sits on the surface of the water; =>Intensity localised moderate; =>consequence minor; =>confidence logic-can be evaluated without data	I
External Impacts (specify the particular example within each activity area)	Other fisheries	1	5	3	behaviour/movement	*Calonectris leucomelas*, streaked shearwater	6.1	3	2	1	7 fisheries occurring over most of year, streaked shearwater may have behaviour modified by boats and fishing activities as it regularly sits on the surface of the water; =>intensity moderate localised; =>consequence minor; =>confidence low-no data to refute or confirm	E
	Aquaculture	0									does not occur	E
	Coastal development	0									does not occur	E
	Other extractive activities	0										E

	Other non-extractive activities	1	5	3	behaviour/movement	*Calonectris leucomelas*, streaked shearwater	6.1	2	2	1	Shipping probably occurs commonly across the Coral Sea but unlikely to impact on species. =>Intensity minor; =>consequence minor; =>confidence low-no data to refute or confirm	E
	Other anthropogenic activities	1	5	3	behaviour/movement	*Calonectris leucomelas*, streaked shearwater	6.1	3	2	1	streaked shearwater may have behaviour modified by boats and fishing activities as it regularly sits on the surface of the water; =>intensity moderate localised; =>consequence minor; =>confidence low-no data to refute or confirm	E

L1.4 - Habitat Component;

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale	Internal / External
Capture	Bait collection	0										I
	Fishing	1	5	3	Habitat structure and Function	slabs and boulders, low outcrop, octocorals, upper slope depths	5.1	2	3	2	Drop, set, trot and hand line methods all utilised in this sub-fishery, tend to be set both deeper and shallower than Autolongline, over hard bottom features (offshore seamounts, includes plateaus) predominantly in 40- 450m depths, ~ 100 days per year max. Effects vary with gear footprint, which is a function of weight, size, impact and area gear covers. Of all line methods, droplines greatest footprint as use largest weights (~ 20 kg weights on line ends to stabilise line on benthos). Gear may remove erect forms if seafloor contact occurs during fishing. Expected to remain stationary once positioned with minimal drag during retrieval. =>Intensity of habitat capture considered minor. =>Consequence moderate, effort increasing, effects may be locally intense, and recovery of fragile complex faunal communities could be expected to take at least 1 year for complex forms. =>Confidence data on regeneration rates available	I
	Incidental behaviour	1	4	3	Habitat structure and Function	North Eastern Pelagic Province - Plateau	5.1	1	1	2	Recreational fishing when off watch, handline-fishing by crew during downtime; =>intensity negligible occurs in restricted locations and infrequently; =>consequence negligible- impact undetectable; =>confidence high-consensus	I
Direct impact without capture	Bait collection	0										I
	Fishing	1	5	3	Habitat structure and Function	slabs and boulders, low outcrop, octocorals, upper slope depths	5.1	3	3	2	Drop, set, trot and hand line methods all utilised in this sub-fishery, tend to be set over hard bottom features (offshore seamounts) predominantly in 40- 450m depths, ~ 100 days per year max. Effects vary with gear footprint, which is a function of weight, size, impact and area gear covers. Of all line methods, droplines greatest footprint as use largest weights (~	I

										20 kg weights on line ends to stabilise line on benthos).Gear may remove erect forms if seafloor contact occurs during fishing. Expected to remain stationary once positioned with minimal drag during retrieval. =>Intensity moderate, effort increasing, dropline greater footprint, and effects may be locally intense. =>Consequence moderate. If dropline, has greater consequences as weights will crush fragile complex faunal communities, and recovery could be expected to take at least 1 year for complex forms. =>Confidence high -data on regeneration rates available	
	Incidental behaviour	1	4	3	Habitat structure and Function	North Eastern Pelagic Province - Plateau	5.1	1	1	2	Recreational fishing when off watch, handline-fishing by crew during downtime; =>intensity negligible occurs in restricted locations and infrequently; =>consequence negligible- impact undetectable; =>confidence high- consensus	I
	Gear loss	1	5	3	Habitat structure and Function	Igneous Rock (?), high outcrop, mixed faunal community, upper slope	5.1	2	2	1	Lines may snag and weights lost, and are unlikely to be retrievable at depth. Lost lines tend to remain ensnared by hard rugose outcrops. Attempted retrieval may lead to breakage of coral forms as line breaking strain is high. Volume of loss difficult to measure, but is small area in total but a relatively frequent occurrence. =>Intensity minor although effort is concentrated over few areas. Gear loss occurs only in a brief period per year but effect may persist for > year depending on depth. =>Consequence minor however requires data.=> Confidence low for this fishery	I
	Anchoring/ mooring	1	5	3	Habitat structure and Function	fine sediments, unrippled, mixed faunal community, inner shelf depths	5.1	2	2	1	Trips several days and potentially use anchors to moor on shallow reef areas adjacent to fishing grounds. Anchors may damage reef structure. =>Intensity minor, likely that anchoring is random and spread out. =>Consequence interactions with benthos likely to be minor, if randomly distributed. May be greater if localised on coral structures. =>Confidence low information re anchoring required for this sub-fishery.	I
	Navigation/ steaming	1	5	3	Habitat structure and Function	North Eastern Pelagic Province - Plateau	5.1	1	1	2	Navigation/ steaming occurs daily during fishing trips, however is scored against a higher spatial scale than actual fishing activity given traveling time to offshore reefs. The pelagic water quality may change with increased turbulence and changes in water mixing that could occur from movement of vessels through water. =>Intensity and Consequence negligible due to remote likelihood of detection at any spatial or temporal scale, and interactions that may be occurring are not detectable against natural variation. =>Confidence scored high because of logical constraints.	I
Addition/	Translocation of	1	5	3	Habitat structure and	Rock/ biogenic	5.1	3	4	1	Translocation of species may occur in bilge water, vessel	I

movement of biological material	species				Function	matrix, low outcrop, mixed faunal community, inner shelf					hulls, gear or by manual removal and relocation elsewhere of species during capture and travel. =>Intensity moderate potential given area covered by operators. =>Consequence minor unless e.g. crown of thorns starfish which may then be catastrophic. Fishers could be expected to be aware of these issues and avoid areas with known outbreaks. =>Confidence low, issues need clarification for CSF.	
	On board processing	1	5	3	Water quality	North Eastern Pelagic Province - Plateau	1.1	2	2	2	Some processing of shark species, onboard filleting - all other fish unloaded whole (FAR report), head on, gut in, market demand for unprocessed product =>intensity minor; =>consequence minor; =>confidence logic backed by observer comments. Consistency of observer monitoring during processing would be of value.	I
	Discarding catch	1	5	3	Habitat structure and Function	North Eastern Pelagic Province - Plateau	5.1	2	2	1	Bycatch discarding may alter pelagic water quality for period of passage through water. Benthic habitats unlikely to be affected unless great volumes of non readily digestible discards. =>Intensity minor, other line fishery known to discard frequently. =>Consequence minor for pelagos, discards rapidly taken up by predators. =>Confidence low, need to validate volume, frequency	I
	Stock enhancement	0										I
	Provisioning	1	5	3	Water quality	North Eastern Pelagic Province - Plateau	1.1	1	1	2	Provisioning may temporarily alter water quality through the addition of nutrient rich material. =>Intensity and consequence negligible, short term increase in nutrient levels quickly taken up by scavengers. =>Confidence high logical consideration.	I
	Organic waste disposal	1	5	3	Water quality	North Eastern Pelagic Province - Plateau	1.1	1	2	2	Organic waste disposal possible on a daily basis over the entire scale of fishing effort. Water quality of pelagic habitats is considered to experience greatest impact of organic waste disposal. Overall volume of waste likely to be too small to reach benthos, or accumulate even if it does. =>Intensity negligible. =>Consequence minor, addition of high nutrient material is realistically expected to cause short term peaks in productivity or scavenging species interactions, with minimal detectibility within minutes to hours. =>Confidence high logical constraints.	I
Addition of non-biological material	Debris	0										I
	Chemical pollution	1	5	3	Water quality	North Eastern Pelagic Province - Plateau	1.1	1	2	1	Chemical losses considered to happen infrequently. Boats not likely to be scrubbed or antifouled out at sea. =>Intensity negligible, considered an uncommon event. =>Consequence minor for pelagic habitats unless major spill, small losses likely to be dispersed rapidly in winds. =>Confidence low, there is a lack of verified data on rates and types of chemical pollution.	I

	Exhaust	1	5	3	Air quality	North Eastern Pelagic Province - Plateau	2.1	1	1	1	Emissions are created during vessel operations within sub-fishery, likely to impact bird species attracted, temporarily altering air quality while they remain in contact with the exhaust. Amounts of exhaust fumes released will vary between vessels. =>Intensity and Consequence overall likely to be negligible and losses rapidly dispersed in breezes. =>Confidence low, little data.	I
	Gear loss	1	5	3	Habitat structure and Function	Igneous Rock (?), high outcrop, mixed faunal community, upper slope	5.1	2	2	1	Lines may snag and weights lost, and are unlikely to be retrievable at depth. Lost lines tend to remain ensnared by hard rugose outcrops. Volume of loss difficult to measure, but is small area in total. =>Intensity minor although effort is concentrated over few areas. Gear loss occurs only in a brief period per year but effect may persist for > year depending on depth. =>Consequence minor however requires data. =>Confidence low for this fishery	I
	Navigation/ steaming	1	5	3	Water quality	North Eastern Pelagic Province - Plateau	1.1	3	1	2	Navigation/ steaming occurs daily during fishing trips. Navigation and steaming adds non biological stimulus to the water column for as long as it takes the vessel to pass through a province. =>Intensity and Consequence negligible due to remote likelihood of detection at any spatial or temporal scale, and interactions that may be occurring are not detectable against natural variation. =>Confidence scored high because of logical constraints.	I
	Activity/ presence on water	1	5	3	Habitat structure and Function	North Eastern Pelagic Province - Plateau	5.1	3	1	2	Activity/presence on water occurs over the entire spatial scale of the fishery, daily during fishing trips, and may disrupt normal habitat function as species alter behavior accordingly. =>Intensity: moderate. Consequence negligible, remote likelihood of impact at any spatial or temporal scale. =>Confidence high, considered to occur only for length of time disturbance is present.	I
Disturb physical processes	Bait collection	0										I
	Fishing	1	5	3	Substrate quality	fine sediments, unrippled, bioturbators	3.1	2	1	1	Disturbance of sediment processes considered minimal with set, hand line methods. Some suspension of fine sediments may occur with dropline weights as settle and retrieved. Weights may drag and cause temporary resuspension which may affect species ability to avoid predation, but will not alter substrate quality in any way worth considering. =>Intensity minor. =>Consequence negligible. =>Confidence low, requires data.	I
	Boat launching	0			Substrate quality							I

	Anchoring/ mooring	1	5	3	Substrate quality	Rock/ biogenic matrix, low outcrop, mixed faunal community, inner shelf depths	3.1	2	2	1	Use of anchors may cause direct impact to coral structure altering coral function and ecological processes within reef body. In frequently used anchoring locations coral death is possible, and an observed effect of activity. =>Intensity minor, processes assumed to continue over rest of reef . =>Consequence minor if fishers spread effort, may be locally intense if same reef systems are harvested too frequently. =>Confidence low, documented effect, unknown extent in this area.	I
	Navigation/steamin g	1	5	3	Water quality	North Eastern Pelagic Province - Plateau	1.1	1	1	2	Navigation/ steaming may occur daily during fishing season. Disturbance of physical processes will occur during the normal course of steaming throughout the fishing zone. Turbulence and disturbance of pelagic water quality is unlikely to affect normal water column processes for long. Any disruption to these processes can therefore be expected to alter habitat function only briefly for macroscopic fauna. =>Intensity and Consequence negligible due to remote likelihood of detection at any spatial or temporal scale, and interactions that may be occurring are not detectable against natural variation. =>Confidence scored high because of logical constraints.	I
External Impacts (specify the particular example within each activity area)	Other fisheries	1	5	3	Habitat structure and Function	Rock/ biogenic matrix, low outcrop, mixed faunal community, upper shelf depths	5.1	3	4	1	Other fisheries and sub-fisheries occurring over most of year on the seamounts within the Northeastern pelagic province include CSF trap, trawl, demersal longline, autolongline, ETBF. Other commonwealth fisheries which also include this area within their jurisdictional boundaries include SKJ, and SBT but effort is directed elsewhere therefore is not considered to overlap. =>Intensity moderate total effort localised and targeted at demersal species which suggests potentially high cumulative impacts for the benthos in these regions. =>Consequence major on seamounts if bottom contacted and fauna removed. Regeneration of habitat in these terrains may be greater than decades to centuries. =>Confidence low, data available for temperate seamount habitats may not be applicable to tropical waters.	E
	Aquaculture	0										E
	Coastal development	0										E
	Other extractive activities	0										E
	Other non-extractive activities	1	6	3	Habitat structure and Function	North Eastern Pelagic Province - Plateau	5.1	1	2	2	Shipping occurs within the CSF, with many ~10 ports inshore of this fishery. Shipping follows specific routes around this reef system, and does not occur over it. =>Intensity negligible. =>Consequence minor if without incident.	E

											=>Confidence high due to logic. Shipping avoids reef systems	
	Other anthropogenic activities	1	6	3	Habitat structure and Function	Rock/ biogenic matrix, low outcrop, mixed faunal community, inner shelf	5.1	3	3	2	Tourism and charter activities occur in this fishery area ~ 300 days per year, therefore spatial scale increased to accommodate trips into and out of distant ports. Must include recreational dive/ research as well as fishing activity. =>Intensity moderate over the scale of the fishery. Increasing tourism activity noted in reports. =>Consequence possibly moderate given the localised intensity in the same locations used by commercial fishers. =>Data is considered sound so confidence high.	E

L1.5 - Community Component

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale	Internal / External
Capture	Bait collection	0										I
	Fishing	1	5	5	Species composition	North-Eastern Seamounts & Central Eastern Transition Seamounts 0-110m, 110-250m, 250-565m	1.1	3	3	2	Fishery occurs throughout year in 2 main areas, but most effort in seamount communities (logbook data inadequate to resolve depth strata) =>intensity moderate - effort occurring in localised areas could be severe for such relatively small community types; =>consequence moderate - in localised areas but need to establish this level of catch is ecologically sustainable so that communities are not affected over time; =>confidence high -data logbook	I
	Incidental behaviour	1	4	3	Species composition	North Eastern Plateau 0-110m	1.1	1	1	2	Handline-fishing by crew during downtime while anchored might occur; =>intensity negligible, occurs in restricted locations and infrequently; =>consequence negligible; =>confidence high - operator comments	I
Direct impact without capture	Bait collection	0										I
	Fishing	1	5	5	Species composition	North-Eastern Seamounts & Central Eastern Transition Seamounts 0-110m, 110-250m, 250-565m	1.1	2	2	1	Direct impacts without capture on these communities are from cryptic fishing mortality caused by escapement of animals injured from encounters with hook and by predation from other fish, sea lice or mammals after capture on hooks. Cryptic fishing mortality is difficult to measure precisely but is small compared with the fishing mortality of the retained catch =>intensity minor - effort occurring in localised areas but numbers of escaping fish likely to be small; =>consequence minor - in localised areas and unable to detect changes in species composition; =>confidence low -no data	I
	Incidental behaviour	1	4	3	Species composition	North Eastern Plateau 0-110m	1.1	1	1	2	Handline-fishing by crew during downtime might occur when anchored at night, fish attracted to baits may be taken by sharks; =>intensity negligible, occurs in restricted locations and infrequently; =>consequence negligible; =>confidence high -operator comments	I
	Gear loss	1	5	3	Species	North-Eastern	1.1	2	2	1	Gear loss assumed to be rare. Gear can often be retrieved if	I

					composition	Seamounts & Central Eastern Transition Seamounts 0-110m, 110-250m, 250-565m					lines break. Lost gear tends to ball up reducing likelihood of entanglement. The total area affected compared with the range of the fishery would be small (<1nm2). =>intensity minor - effort occurring in localised areas as target and non target species may be caught as gear drifts. =>consequence minor - in localised areas; =>confidence low -no data	
	Anchoring/ mooring	1	5	5	Species composition	North Eastern Plateau 0-110m	1.1	1	1	1	Shallow community chosen where anchoring may occur. Anchoring/mooring may damage or kill species in immediate vicinity of anchor =>intensity negligible =>Consequence negligible unlikely to detect any changes =>confidence low	I
	Navigation/ steaming	1	5	5	Species composition	North Eastern Seamount oceanic (1) 0-600m; North Eastern Plateau Oceanic (1) 0-600m	4.1	1	1	1	Pelagic community chosen where most effort is located. Navigation/steaming to port as well as on fishing grounds where pelagic species may encounter vessels causing mortality =>intensity negligible - effort low and decreasing. =>consequence negligible - unlikely to detect any changes =>confidence low	I
Addition/ movement of biological material	Translocation of species	1	5	5	Species composition	North-Eastern Seamounts & Central Eastern Transition Seamounts 0-110m, 110-250m, 250-565m	1.1	2	3	1	Possible translocation of pathogens could affect species composition of the reef community via hull fouling, ballast water, imported bait =>intensity minor -activity only in restricted areas =>consequence moderate effect is likely to be localised but severe and no catastrophic effects have been observed =>confidence low- there is no data	I
	On board processing	1	5	5	Distribution of the community	North Eastern Seamount oceanic (1) 0-600m	3.1	2	1	1	Discarding may attract top predators to a localised area expected. Waste expected to be taken up quickly by opportunistic scavengers or sink to benthos and scavenged by benthic species. =>intensity minor =>consequence negligible unlikely to detect persistent changes to species composition and no biological material added to community; =>confidence low no data	I
	Discarding catch	1	5	5	Distribution of the community	North Eastern Seamount oceanic (1) 0-600m	3.1	2	2	1	Discarding may attract top predators to a localised area expected. Waste expected to be taken up quickly by opportunistic scavengers or sink to benthos and scavenged by benthic species. =>intensity minor =>consequence minor unlikely to detect persistent changes to species composition and no biological material added to community; =>confidence low no data	I
	Stock enhancement	0										I
	Provisioning	1	5	4	Distribution of the community	North-Eastern Seamounts & Central Eastern Transition Seamounts 0-110m, 110-250m, 250-565m	3.1	3	1	1	Provisioning occurs through use of bait and discarding. =>Intensity moderate, occurs for every shot. =>Consequence negligible, waste expected to be taken up quickly by opportunistic scavengers or sink to benthos and scavenged by benthic species. =>Confidence low because of a lack of information.	I

	Organic waste disposal	1	5	5	Distribution of the community	North Eastern Seamount oceanic (1) 0-600m	3.1	1	1	1	Pelagic seamount community chosen where most effort is located and higher predators may be attracted to food scraps temporarily changing abundance and distribution locally. Organic waste may be discarded however vessels are subject to MARPOL regulations. =>Intensity negligible if MARPOL rules followed. =>consequence negligible - unlikely to detect any changes =>confidence low	I
Addition of non-biological material	Debris	0										I
	Chemical pollution	1	5	5	Species composition	North Eastern Seamount oceanic (1) 0-600m	1.1	1	1	1	Pelagic seamount community chosen where most effort is located. Mortality from major spills could cause species composition changes, but localised impact as boats operating under MARPOL regulations. =>intensity negligible - effort low and decreasing =>consequence negligible - unlikely to detect any changes =>confidence low	I
	Exhaust	1	5	5	Distribution of the community	North Eastern Seamount oceanic (1) 0-600m	3.1	1	1	1	Seamount pelagic community chosen where most effort is located Exhaust from running engine hazard occurs over a large range/scale could affect air quality therefore bird distribution =>intensity minor - effort low and decreasing =>consequence negligible not persistent changes, unlikely to detect any changes =>confidence low	I
	Gear loss	1	5	5	Distribution of the community	North-Eastern Seamounts & Central Eastern Transition Seamounts 0-110m, 110-250m, 250-565m	3.1	2	1	1	Gear loss assumed to be rare. Gear can often be retrieved if lines break. Lost gear tends to ball up reducing likelihood of entanglement. The total area affected compared with the range of the fishery would be small (<1nm2). =>intensity minor- gear loss uncommon but could alter physical habitat and species distribution =>consequence negligible - unlikely to detect any changes =>confidence low	I
	Navigation/ steaming	1	5	5	Distribution of the community	North Eastern Seamount oceanic (1) 0-600m	3.1	2	2	1	Pelagic seamount community chosen where most effort is located & interaction with pelagic species most likely to occur. Navigation and steaming of vessels will introduce noise (engine noise and echo-sounders) and visual stimuli into the environment thus changing distribution of community members =>intensity minor -effort low and decreasing, navigation and steaming of vessels will introduce noise (engine noise and echo-sounders) and visual stimuli into the environment. =>consequence minor unlikely to detect any changes =>confidence low	I
	Activity/ presence on water	1	5	5	Distribution of the community	North Eastern Seamount oceanic (1) 0-600m	3.1	2	2	1	Pelagic seamount community chosen where most effort is located & interaction with pelagic species most likely to occur. Activity/presence of vessels will introduce noise and visual stimuli into the environment thus changing distribution of community members =>intensity minor -effort low and decreasing. =>consequence minor unlikely to detect any changes =>confidence low	I

Disturb physical processes	Bait collection	0										I
	Fishing	1	5	5	Distribution of the community	North-Eastern Seamounts & Central Eastern Transition Seamounts 0-110m, 110-250m, 250-565m	3.1	3	1	1	Community chosen where most effort is located =>intensity moderate effort low and decreasing gear may disturb habitat supporting species in the benthic community =>consequence negligible unlikely to detect any changes but benthic species distribution may be disturbed on a very small spatial scale (m) =>confidence low	I
	Boat launching	0									No ports or harbors within the Coral Sea. Vessels in fishery come from designated ports.	I
	Anchoring/ mooring	1	5	5	Distribution of the community	North Eastern Plateau 0-110m	3.1	1	1	1	Shallow community chosen where anchoring may occur =>intensity negligible effort low and decreasing. Anchoring/mooring may affect the physical processes in the area where anchors and anchor chains contact the seafloor. =>Consequence negligible -unlikely to detect any changes =>confidence low	I
	Navigation/steaming	1	5	5	Distribution of the community	North Eastern Seamount oceanic (1) 0-600m	3.1	3	1	1	Seamount pelagic community chosen where most effort is located & interaction with pelagic species most likely to occur =>Intensity moderate - effort low, navigation and steaming of vessels will change flow characteristics of water but unlikely to affect species =>Consequence negligible - unlikely to detect any changes =>confidence low	I
External Impacts (specify the particular example within each activity area)	Other fisheries	1	5	5	Species composition	North-Eastern Seamounts & Central Eastern Transition Seamounts 0-110m, 110-250m, 250-565m	1.1	3	3	2	7 other CSF sub-fisheries occur over most of year in the seamount community - the trawl, autolongline and demersal line fisheries target similar species;(the SESS trawl fishery operates adjacent and targets some similar species, Qld state fisheries adjacent to CSF areas target same species) =>intensity moderate -total effort localised and targeted at all trophic levels of the community. =>consequence moderate - possible changes in species composition <10% but need to establish that this total level of catch is ecologically sustainable so that communities are not affected over time =>confidence high backed by logbook data	E
	Aquaculture	0										E
	Coastal development	0										E
	Other extractive activities	0										E
	Other non-extractive activities	1	5	5	Distribution of the community	North Eastern Seamount oceanic (1) 0-600m; North Eastern Plateau Oceanic (1) 0-600m.	3.1	2	2	1	Shipping occurs commonly across the Coral Sea and impact on distribution of community by introducing noise, visual stimuli into the pelagic community temporarily repelling species. =>Intensity minor =>consequence minor =>confidence low no data or information	E

	Other anthropogenic activities	1	5	5	Distribution of the community	North Eastern Seamount Oceanic (1) 0-600m; North Eastern Plateau 0-110m; North Eastern Plateau Oceanic (1) 0-600m.	3.1	3	2	1	Recreational diving/tourism occurs in area presumably near/on the reef or seamount communities (CSF Stakeholders Meeting 2005). Activities may affect distribution of community unless significant take of fish by divers will impact species abundances and possibly community composition. =>Intensity moderate =>consequence minor =>confidence low	E

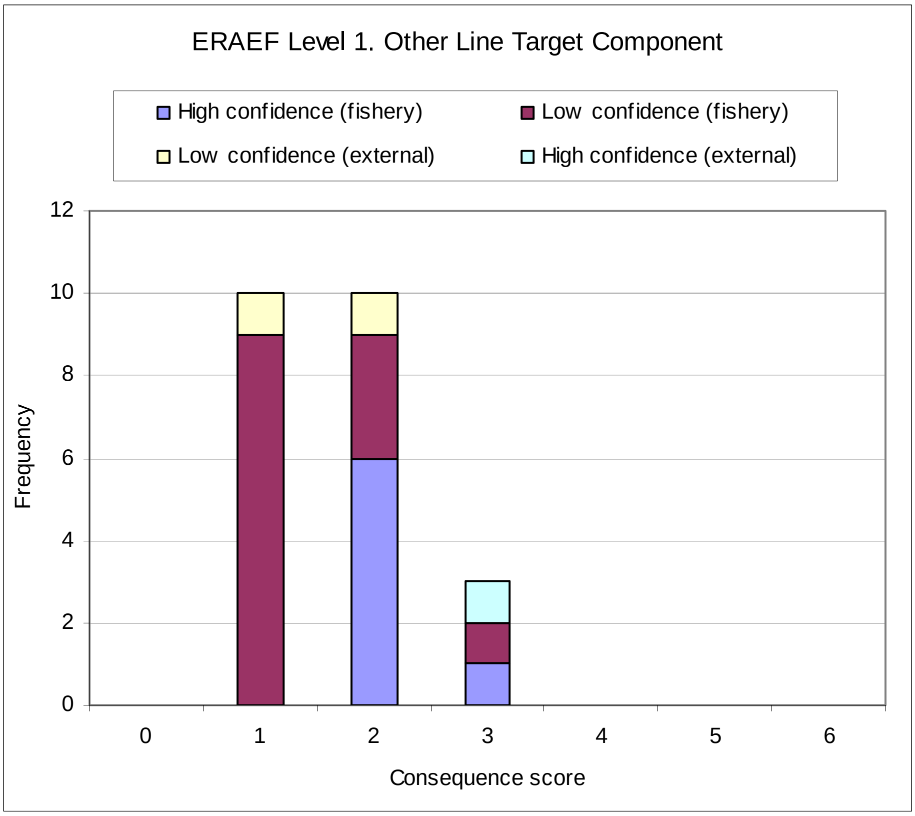
2.3.11 Summary of SICA results

The report provides a summary table (**Level 1 (SICA) Document L1.6**) of consequence scores for all activity/component combinations and a table showing those that scored 3 or above for consequence, and differentiating those that did so with high confidence (in bold).

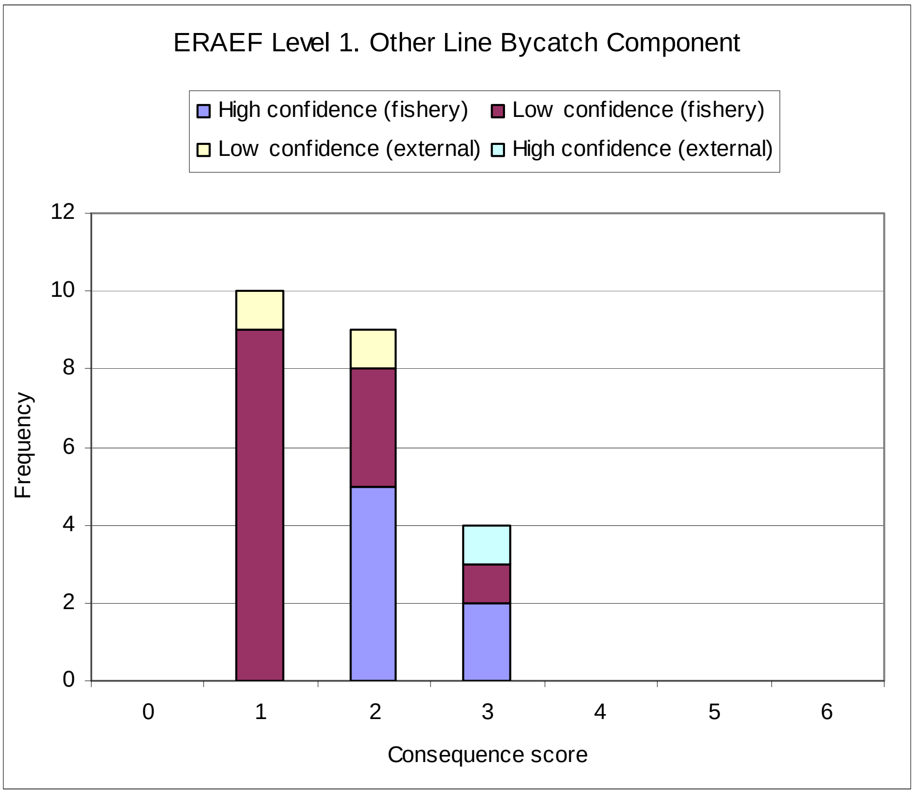
Level 1 (SICA) Document L1.6. Summary table of consequence scores for all activity/component combinations.

Direct impact	Activity	Target species	Byproduct and bycatch species	TEP species	Habitats	Communities
Capture	Bait collection					
	Fishing	**3**	**3**	3	**3**	**3**
	Incidental behaviour	1	1	1	**1**	**1**
Direct impact without capture	Bait collection					
	Fishing	2	2	**2**	**3**	2
	Incidental behaviour	1	1	1	**1**	**1**
	Gear loss	**2**	**2**	2	2	2
	Anchoring/ mooring	1	1	2	2	1
	Navigation/ steaming	1	1	**2**	**1**	1
Addition/ movement of biological material	Translocation of species	3	3	3	4	3
	On board processing	**2**	**2**	2	**2**	1
	Discarding catch	**2**	**3**	3	2	2
	Stock enhancement					
	Provisioning	**2**	**2**	**2**	**1**	1
	Organic waste disposal	**2**	**2**	**2**	**2**	1
Addition of non-biological material	Debris					
	Chemical pollution	1	1	**2**	2	1
	Exhaust	1	1	**2**	1	1
	Gear loss	**2**	**2**	2	2	1
	Navigation/ steaming	1	1	**2**	**1**	2
	Activity/ presence on water	2	2	**2**	**1**	2
Disturb physical processes	Bait collection					
	Fishing	1	1	2	1	1
	Boat launching					
	Anchoring/ mooring	1	1	2	2	1
	Navigation/steaming	2	2	**2**	**1**	1
Note: external hazards are not considered at Level 2 in the PSA analysis						
External hazards	Other fisheries	**3**	**3**	2	4	**3**
	Aquaculture					
	Coastal development					
	Other extractive activities					
	Other non extractive activities	2	2	2	**2**	2
	Other anthropogenic activities	1	1	2	**3**	2

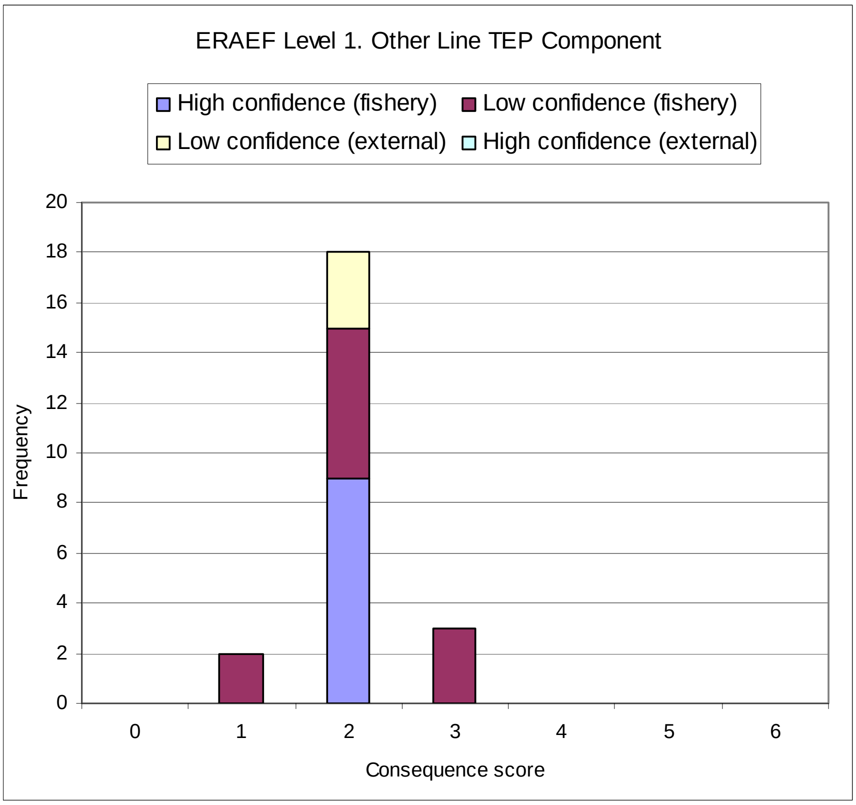
Target species: Frequency of consequence score differentiated between high and low confidence.



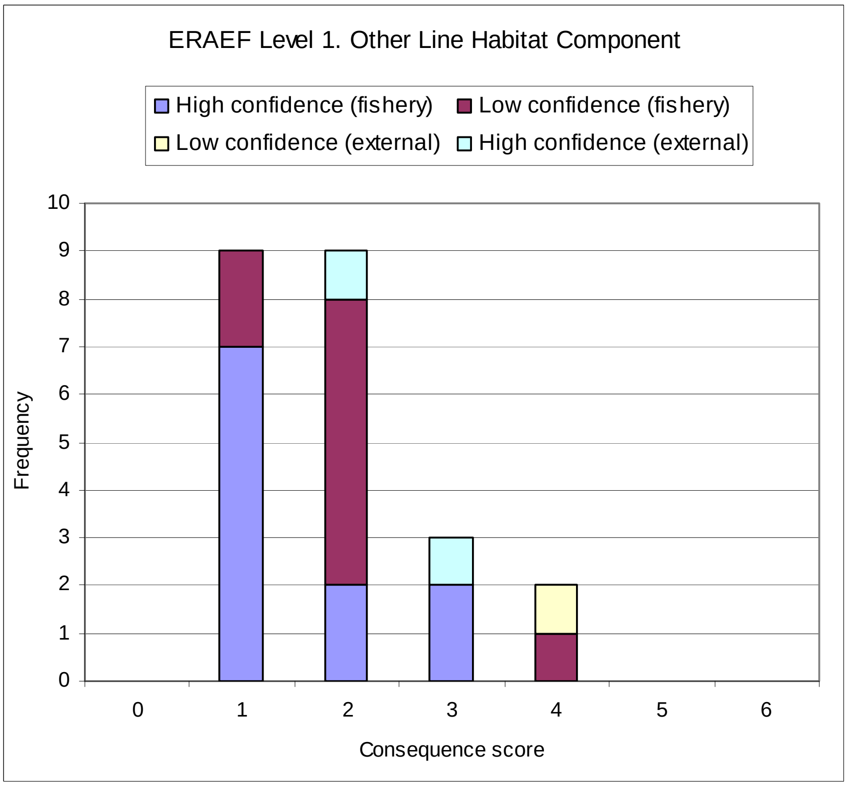
Byproduct and bycatch species:



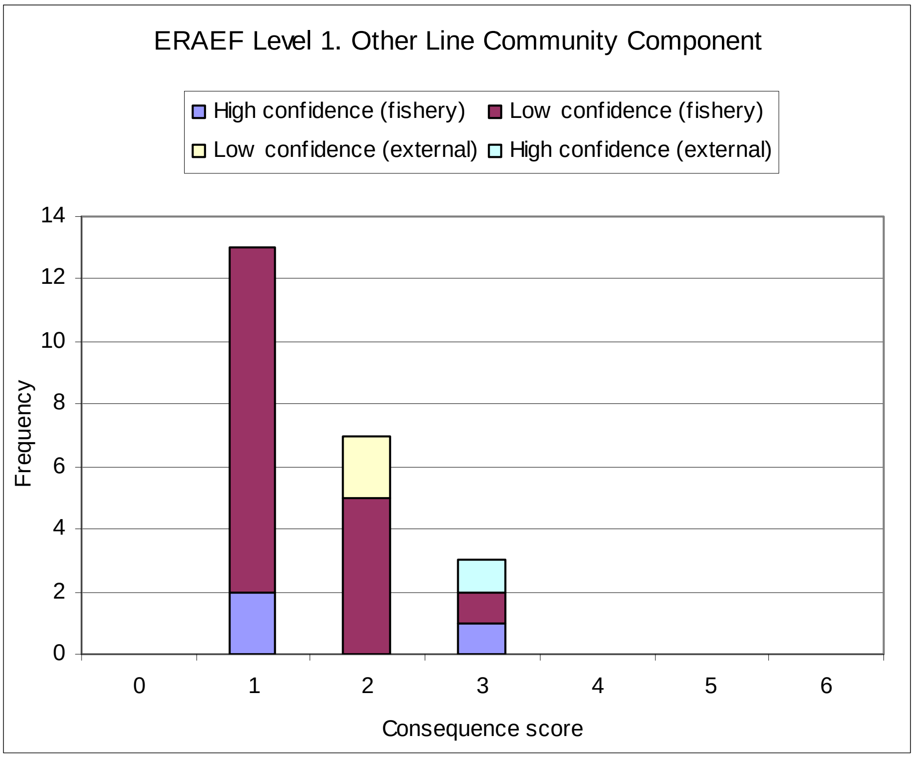
TEP species: Frequency of consequence score differentiated between high and low confidence (SICA excel workbook)



Habitats: Frequency of consequence score differentiated between high and low confidence



Communities: Frequency of consequence score differentiated between high and low confidence (SICA excel workbook)



2.3.12 Evaluation/discussion of Level 1

All five components assessed in the level 1 analysis contained consequence scores three or above. The hazards (fishing activities) involved are:

- Fishing capture (all 5 components);
- Fishing without capture (Habitat component);
- Translocation of species (all 5 components); and
- Discarding catch (Byproduct and TEP components);

and two external hazard:

- Other fisheries (Target, Byproduct, Habitat and Communities component); and
- Other anthropogenic activities (Habitat component).

All internal hazards assessed to be significant were assessed at risk score 3 (moderate), with the exception of Translocation of species for the Habitat component, which was assessed at risk score 4 (major). Confidence scores for Translocation of species are low across all components, as a result of a lack of specific data on which to assess this hazard. Confidence scores for TEP components are also low, as no specific data collection or Observer reporting occurs in the CSF Other Line sub-fishery. For all remaining hazards, the confidence score for assessment is high.

Four key fishing activity issues emerged from the ERAEF Level 1 analysis of the Coral Sea Fishery Other Line sub-fishery.

- Fishing capture was identified as a hazard to all components, largely as a result of repeated fishing effort on a small number of grounds within the CSF area, producing the potential for a more severe localised effect. Little information is available on stocks of target and byproduct species from within the CSF area. As 25% of the catch is recorded in logbook records as a genus or Family grouping only, and as no Observer data or voucher specimens have been collected, the actual species fished in this sub-fishery are often unknown. Other Line effort has increased dramatically in recent years (from 150,000 to 1,500,000 hooks per year) and although CPUE initially increased, it has now dropped markedly, and a changing array of catch species is also being recorded. The Other Line operations repeatedly fish a relatively small number of community types, and information on which to base ecological sustainability is not available.

- Fishing activity, with or without capture, was identified as a Habitat hazard. Other Line gear uses large weights to anchor gear to the seafloor and will physically impact the benthos, presenting a hazard particularly to the erect habitat forms which occur. With the increasing effort that has been noted, and the repeated fishing of localised areas, damage would be more severe. Data available for these fragile complex faunal communities suggests a prolonged regeneration time. The use of underwater video data-collection has been discussed at stakeholder meetings, and its use as a means of monitoring this risk, is strongly recommended.

- Translocation of species was identified as a moderate hazard to Target, Byproduct, TEP and Communities components, and a high risk hazard to Habitat components. For the Other Line sub-fishery, translocation hazards are presented through hull and line fouling and through bilge water. The use of imported baits in the CSF Other Line sub-fishery (including fish from NSW deep-sea fisheries, squid from prawn trawlers, and GAB arrow squid) also presents the risk of translocation of pathogens. The lack of baseline data at a species, habitat or community level, and the absence of mitigating measures within this fishery, has resulted in low confidence levels in the assessment of this risk.

  A recent Bureau of Rural Sciences (BRS) final report (Summerson and Curran 2005) also noted the high risk associated with line methods through entrainment of organisms and entanglement of vegetation, and recommends close inspection of all lines, anchor chains and anchors, to reduce translocation of motile organisms, particularly small crustacean, and plant fragments. They also strongly suggested the use of the Observer Program to provide empirical data on which to assess this risk with greater confidence.

- Discarding was identified as a hazard to the Byproduct and TEP components. Fishing Activity Reports (FAR) have noted the increase in shark numbers through the activity of gear retrieval. It is reasonable to assume that sharks would similarly investigate activities associated with discarding. One of the main discard species, red bass, is known to expand its gas bladder when brought up from depths, and will remain floundering on the surface when discarded where it will be susceptible to predation. At present no information has been collected on the survival or predation rates of discard species. Similarly, the activity associated with discarding may attract birds. Again, there is no information available to assess their risk. Observer monitoring, noting the presence/absence of shark activity and bird interactions during discarding, together with survival rates and predation of discarded fish, would be of great value and is strongly recommended.

2.3.13 Components to be examined at Level 2

No Level 2 analysis has been conducted for the Coral Sea Other Line Sub-fishery. Level 1 assessment for the sub-fishery has been completed as required for the ERAEF Stage 2 process. As such, further documentation in this report is included only as a means of understanding the ERAEF process in full.

Generally, as a result of the preliminary SICA analysis, the components to be examined at Level 2 are those with any consequence scores of 3 or above.

2.4 Level 2 Productivity and Susceptibility Analysis (PSA)

NB. No PSA has been produced for the Coral Sea Other Line Sub-fishery during the ERAEF stage 2 process.

When the risk of an activity at Level 1 (SICA) on a component is moderate or higher and no planned management interventions that would remove this risk are identified, an assessment is generally required at Level 2. The PSA approach is a method of assessment which allows all units within any of the ecological components to be effectively and comprehensively screened for risk. The units of analysis are the complete set of species habitats or communities identified at the scoping stage. The PSA results in sections 2.4.2 and 2.4.3 of this report measure risk from direct impacts of fishing only, which in all assessments to date has been the hazard with the greatest risks identified at Level 1. Future iterations of the methodology will include PSAs modified to measure the risk due to other activities, such as gear loss.

The PSA approach is based on the assumption that the risk to an ecological component will depend on two characteristics of the component units: (1) the extent of the impact due to the fishing activity, which will be determined by the susceptibility of the unit to the fishing activities (Susceptibility) and (2) the productivity of the unit (Productivity), which will determine the rate at which the unit can recover after potential depletion or damage by the fishing. It is important to note that the PSA analysis essentially measures potential for risk, hereafter noted as 'risk'. A measure of absolute risk requires some direct measure of abundance or mortality rate for the unit in question, and this information is generally lacking at Level 2.

The PSA approach examines attributes of each unit that contribute to or reflect its productivity or susceptibility to provide a relative measure of risk to the unit. The following section describes how this approach is applied to different components in the analysis. Full details of the methods are described in Hobday *et al*. (2007).

<u>Species</u>

The following Table outlines the seven attributes that are averaged to measure productivity, and the four aspects that are multiplied to measure susceptibility for all the species components.

	Attribute
Productivity	Average age at maturity
	Average size at maturity
	Average maximum age
	Average maximum size
	Fecundity
	Reproductive strategy
	Trophic level
Susceptibility	Availability considers overlap of fishing effort with a species distribution

	Encounterability considers the likelihood that a species will encounter fishing gear that is deployed within the geographic range of that species (based on two attributes: adult habitat and bathymetry)
	Selectivity considers the potential of the gear to capture or retain species
	Post capture mortality considers the condition and subsequent survival of a species that is captured and released (or discarded)

The productivity attributes for each species are based on data from the literature or from data sources such as FishBase. The four aspects of susceptibility are calculated in the following way:

Availability considers overlap of effort with species distribution. For species without distribution maps, availability is scored based on broad geographic distribution (global, southern hemisphere, Australian endemic). Where more detailed distribution maps are available (e.g. from BIOREG data or DEH protected species maps), availability is scored as the overlap between fishing effort and the portion of the species range that lies within the broader geographical spread of the fishery. Overrides can occur where direct data from independent observer programs are available.

Encounterability is the likelihood that a species will encounter fishing gear deployed within its range. Encounterability is scored using habitat information from FishBase, modified by bathymetric information. Higher risk corresponds to the gear being deployed at the core depth range of the species. Overrides are based on mitigation measures and fishery independent observer data.

For species that do encounter gear, **selectivity** is a measure of the likelihood that the species will be caught by the gear. Factors affecting selectivity will be gear and species dependent, but body size in relation to gear size is an important attribute for this aspect. Overrides can be based on body shape, swimming speed and independent observer data.

For species that are caught by the gear, **post capture mortality** measures the survival probability of the species. Obviously, for species that are retained, survival will be zero. Species that are discarded may or may not survive. This aspect is mainly scored using independent filed observations or expert knowledge.

Overall susceptibility scores for species are a product of the four aspects outlined above. This means that susceptibility scores will be substantially reduced if any one of the four aspects is considered to be low risk. However the default assumption in the absence of verifiable supporting data is that all aspects are high risk.

<u>Habitats</u>

Similar to species, PSA methods for habitats are based around a set of attributes that measure productivity and susceptibility. Productivity attributes include speed of regeneration of fauna, and likelihood of natural disturbance. The susceptibility attributes for habitats are described in the following Table.

Aspect	Attribute	Concept	Rationale
Susceptibility			
Availability	General depth range (Biome)	Spatial overlap of subfishery with habitat defined at biomic scale	Habitat occurs within the management area
Encounterability	Depth zone and feature type	Habitat encountered at the depth and location at which fishing activity occurs	Fishing takes place where habitat occurs
	Ruggedness (fractal dimension of substratum and seabed slope)	Relief, rugosity, hardness and seabed slope influence accessibility to different sub-fisheries	Rugged substratum is less accessible to mobile gears. Steeply sloping seabed is less accessible to mobile gears
	Level of disturbance	Gear footprint and intensity of encounters	Degree of impact is determined by the frequency and intensity of encounters (inc. size, weight and mobility of individual gears)
Selectivity	Removability/ mortality of fauna/ flora	Removal/ mortality of structure forming epifauna/ flora (inc. bioturbating infauna)	Erect, large, rugose, inflexible, delicate epifauna and flora, and large or delicate and shallow burrowing infauna (at depths impacted by mobile gears) are preferentially removed or damaged.
	Areal extent	How much of each habitat is present	Effective degree of impact greater in rarer habitats: rarer habitats may maintain rarer species.
	Removability of substratum	Certain size classes can be removed	Intermediate sized clasts (~6 cm to 3 m) that form attachment sites for sessile fauna can be permanently removed
	Substratum hardness	Composition of substrata	Harder substratum is intrinsically more resistant
	Seabed slope	Mobility of substrata once dislodged; generally higher levels of structural fauna	Gravity or latent energy transfer assists movement of habitat structures, eg turbidity flows, larger clasts. Greater density of filter feeding animals found where currents move up and down slopes.
Productivity			
Productivity	Regeneration of fauna	Accumulation/ recovery of fauna	Fauna have different intrinsic growth and reproductive rates which are also variable in different conditions of temperature, nutrients, productivity.
	Natural disturbance	Level of natural disturbance affects intrinsic ability to recover	Frequently disturbed communities adapted to recover from disturbance

<u>Communities</u>

PSA methods for communities are still under development. Consequently, it has not yet been possible to undertake level 2 risk analyses for communities.

During the Level 2 assessment, each unit of analysis within each ecological component (species or habitat) is scored for risk based on attributes for productivity and susceptibility, and the results are plotted as shown in Figure 13.

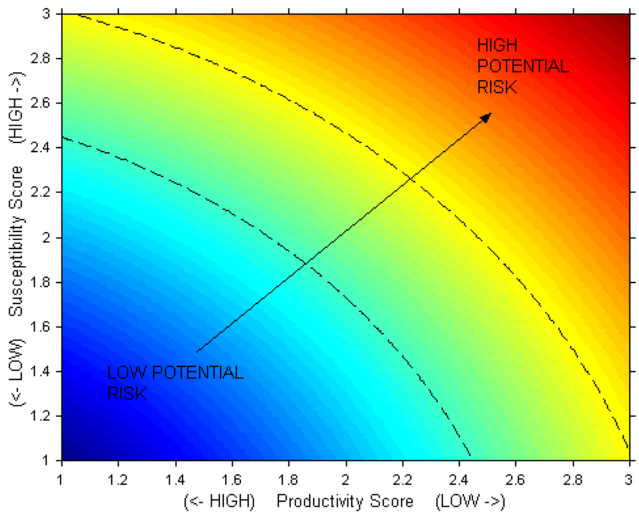


Figure 13. The axes on which risk to the ecological units is plotted. The *x*-axis includes attributes that influence the productivity of a unit, or its ability to recover after impact from fishing. The *y*-axis includes attributes that influence the susceptibility of the unit to impacts from fishing. The combination of susceptibility and productivity determines the relative risk to a unit, i.e. units with high susceptibility and low productivity are at highest risk, while units with low susceptibility and high productivity are at lowest risk. The contour lines divide regions of equal risk and group units of similar risk levels.

There are seven steps for the PSA undertaken for each component brought forward from Level 1 analysis.

Step 1 Identify the units excluded from analysis and document the reason for exclusion
Step 2 Score units for productivity
Step 3 Score units for susceptibility
Step 4 Plot individual units of analysis onto a PSA Plot
Step 5 Ranking of overall risk to each unit
Step 6 Evaluation of the PSA analysis
Step 7 Decision rules to move from Level 2 to Level 3

2.4.1 Units excluded from analysis and document reasons for exclusion (Step 1)

Species lists for PSA analysis are derived from recent observer data where possible or, for fisheries with no observer programs, from logbook and scientific data. In some logbook data, there may only be family level identifications. Where possible these are resolved to species level by cross-checking with alternative data sources and discussion with experts. In cases where this is not possible (mainly invertebrates) the analysis may be based on family average data.

ERA Species ID	Taxa Name	Scientific Name	CAAB Code	Family Name	Common Name	Role In Fishery	Source	Reason for removal

2.4.2 and 2.4.3 Level 2 PSA (Steps 2 and 3)

Summary of Species PSA results

The results in the Tables below provide details of the PSA assessments for each species, separated by role in the fishery, and by taxa where appropriate. These assessments are limited to direct impacts from fishing, and the operational objective is to avoid over-exploitation due to fishing, either as over-fishing or becoming over-fished. The risk scores and categories (high, medium or low) reflect potential rather than actual risk using the Level 2 (PSA) method. For species assessed at Level 2, no account is taken of the level of catch, the size of the population, or the likely exploitation rate. To assess actual risk for any species requires a Level 3 assessment which does account for these factors. However, recent fishing effort distributions are considered when calculating the availability attribute for the Level 2 analysis, whereas the entire jurisdictional range of the fishery is considered at Level 1.

The PSA analyses do not fully take account of management actions already in place in the fishery that may mitigate for high risk species. Some management actions or strategies, however, can be accounted for in the analysis where they exist. These include spatial management that limits the range of the fishery (affecting availability), gear limits that affect the size of animals that are captured (selectivity), and handling practices that may affect the survival of species after capture (post capture mortality). Management strategies that are not reflected in the PSA scores include limits to fishing effort, use of catch limits (such as TACs), and some other controls such as seasonal closures.

It should be noted that the PSA method is likely to generate more false positives for high risk (species assessed to be high risk when they are actually low risk) than false negatives (species assessed to be low risk when they are actually high risk). This is due to the precautionary approach to uncertainty adopted in the PSA method, whereby attributes are set at high risk levels in the absence of information. It also arises from the nature of the PSA method assessing potential rather than actual risk, as discussed above. Thus some species will be assessed at high risk because they have low productivity and are exposed to the fishery, even though they are rarely if ever caught and are relatively abundant.

In the PSA Tables below, the “Comments” column is used to provide information on one or more of the following aspects of the analysis for each species: use of overrides to alter susceptibility scores (for example based on use of observer data, or taking account of specific management measures or mitigation); data or information sources or limitations; and information that supports the overall scores. The use of over-rides is explained more fully in Hobday et al (2007).

The PSA Tables also report on “missing information” (the number of attributes with missing data that therefore score at the highest risk level by default). There are seven attributes used to score productivity and four aspects (availability, encounterability, selectivity and post capture mortality) used to score susceptibility (though encounterability is the average of two attributes). An attribute or aspect is scored as missing if there are no data available to score it, and it has defaulted to high risk for this reason. For some species, attributes may be scored on information from related species or other supplementary information, and even though this information is indirect and less reliable than if species specific information was available, this is not scored as a missing attribute.

There are differences between analyses for TEP species and the other species components. In particular, target, by-product and by-catch species are included on the basis that they are known to be caught by the fishery (in some cases only very rarely). However TEP species are included in the analysis on the basis that they occur in the area of the fishery, whether or not there has ever been an interaction with the fishery recorded. For this reason there may be a higher proportion of false positives for high vulnerability for TEP species, unless there is a robust observer program that can verify that species do not interact with the gear.

Observer data and observer expert knowledge are important sources of information in the PSA analyses, particularly for the bycatch and TEP components. There is no observer program currently in place for this sub-fishery.

A summary of the species considered at Level 2 is presented below, sorted by component, by taxa within components, and then by the overall risk score [high (>3.18), medium (2.64-3.18), low<2.64)]

ERA species ID	Scientific name	Common name	average logbook catch (kg) 2001-04	Missing > 3 attributes (Y/N)	Number of missing productivity attributes (out of 7)	Number of missing susceptibility attributes (out of 4)	Productivity (additive) 1- low , 3 - high	Susceptibility (multiplicative) 1- low , 3 - high	Overall risk score 1.41- low , 4.24 - high	Override used?	PSA risk category	Comments

Summary of Habitat PSA results

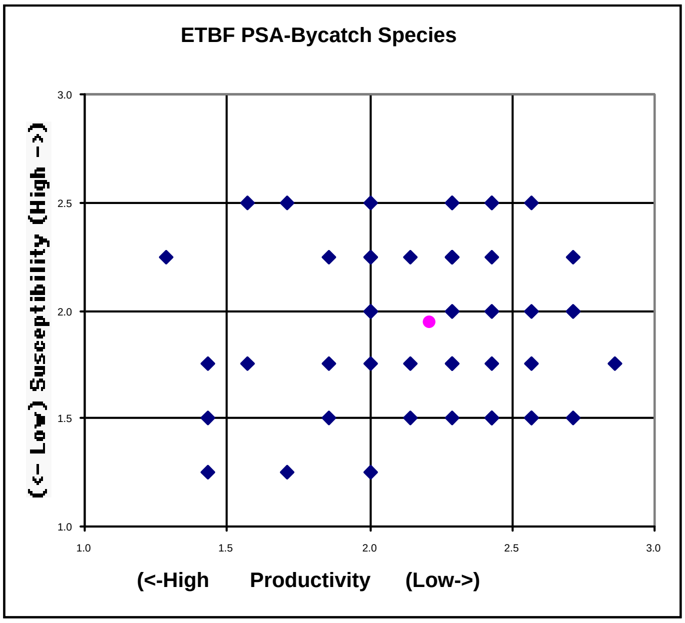
A summary of the habitats considered at Level 2 is presented below, and is sorted by the overall risk score (high, medium, low), by sub-biome, and by SGF score (Habitat type).

Record #	ERA habitat #	Sub-biome	Feature	Habitat Name	SGF Score	*n* missing attributes	Productivity score (Average)	Susceptability score (Multiplicative)	Overall Risk Score (P&Sm)	Overall Risk Ranking (2D multiplicative)	Risk ranking over-ride	Rationale

2.4.4 PSA Plot for individual units of analysis (Step 4)

The average productivity and susceptibility scores for each unit of analysis (e.g. for each species) are then used to place the individual units of analysis on 2D plots (as below). The relative position of the units on the plot will determine relative risk at the unit level as per PSA plot below. The overall risk value for a unit is the Euclidean distance from the origin of the graph. Units that fall in the upper third of the PSA plots are deemed to be at high risk. Units with a PSA score in the middle are at medium risk, while units in the lower third are at low risk with regard to the productivity and susceptibility attributes. The divisions between these risk categories are based on dividing the area of the PSA plots into equal thirds. If all productivity and susceptibility scores (scale 1-3) are assumed to be equally likely, then 1/3rd of the Euclidean overall risk values will be greater than 3.18 (high risk), 1/3rd will be between 3.18 and 2.64 (medium risk), and 1/3rd will be lower than 2.64 (low risk).

Results of the PSA plot from PSA workbook ranking worksheet would follow the format of the example below:



PSA plot for target species
PSA plot for byproduct species
PSA plot for discards/bycatch species
PSA plot for TEP species
PSA plot for habitats
PSA plot for communities

The overall risk value for each unit is the Euclidean distance from the origin to the location of the species on the PSA plot. The units are then divided into three risk categories, high, medium and low, according to the risk values (**Figure 17**). The cut-offs for each category are thirds of the total distribution of all possible risk values (**Figure 17**).

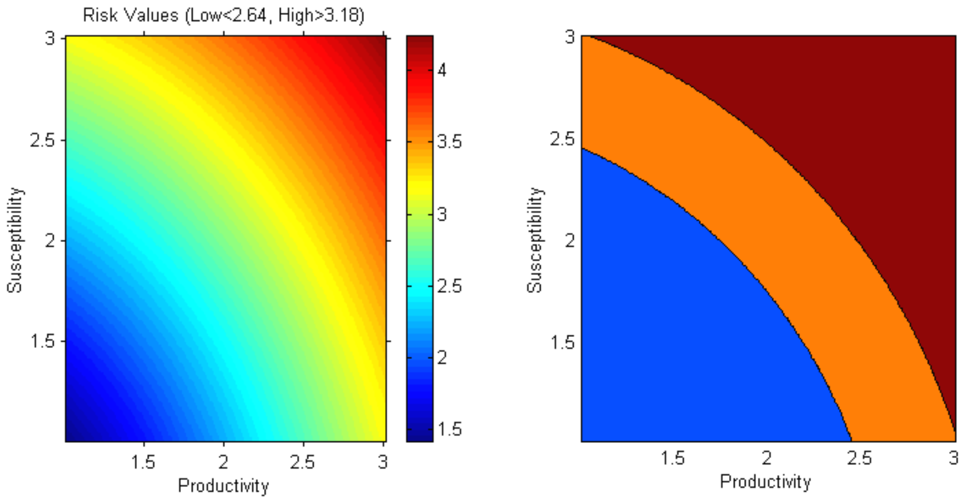


Figure 17. Overall risk values in the PSA plot. Left panel. Colour map of the distribution of the euclidean overall risk values. Right panel. The PSA plot contoured to show the low risk (blue), medium risk (orange) and high risk (red) values.

The PSA output allows identification and prioritisation (via ranking the overall risk scores) of the units (e.g. species, habitat types, communities) at greatest risk to fishing activities. This prioritisation means units with the lowest inherent productivity or highest susceptibility, which can only sustain the lowest level of impact, can be examined in detail. The overall risk to an individual unit will depend on the level of impact as well its productivity and susceptibility.

2.4.5 Uncertainty analysis ranking of overall risk (Step 5)

The final PSA result for a species is obtained by ranking overall risk value resulting from scoring the productivity and susceptibility attributes. Uncertainty in the PSA results can arise when there is imprecise, incorrect or missing data, where an average for a higher taxonomic unit was used (e.g. average genera value for species units), or because an inappropriate attribute was included. The number of missing attributes, and hence conservative scores, is tallied for each unit of analysis. Units with missing scores will have a more conservative overall risk value than those species with fewer missing attributes, as the highest score for the attribute is used in the absence of data. Gathering the information to allow the attribute to be scored may reduce the overall risk value. Identification of high-risk units with missing attribute information should translate into prioritisation of additional research (an alternative strategy).

A second measure of uncertainty is due to the selection of the attributes. The influence of particular attributes on the final result for a unit of analysis (e.g. a habitat unit) can be quantified with an uncertainty analysis, using a Monte Carlo resampling technique. A set of productivity and susceptibility scores for each unit is calculated by removing one of the productivity or susceptibility attributes at a time, until all attribute combinations have been used. The variation (standard deviation) in the productivity and susceptibility scores is a measure of the uncertainty in the overall PSA score. If the uncertainty analysis shows that the unit would be treated differently with regard to risk, it should be the subject of more study.

The validity of the ranking can also be examined by comparing the results with those from other data sources or modelling approaches that have already been undertaken in specific fisheries. For example, the PSA results of the individual species (target, byproduct and bycatch and TEP) can be compared against catch rates for any species or against completed stock assessments. These comparisons will show whether the PSA ranking agrees with these other sources of information or more rigorous approaches.

Availability of information

The ability to score each species based on information on each attribute [varied/did not vary] between the attributes (as per summary below). With regard to the productivity attributes, [least known productivity attribute] was missing in [X]% of [units], and so the most conservative score was used, while information on [best known productivity attribute] could be found or calculated for [Y% of units]. The current method of scoring the susceptibility attributes provides a value for each attribute for each species – some of these are based on good information, whereas others are merely sensible default values.

Summary of the success of obtaining information on the set of productivity and susceptibility attributes for the species. Where information on an attribute was missing the highest score was used in the PSA.

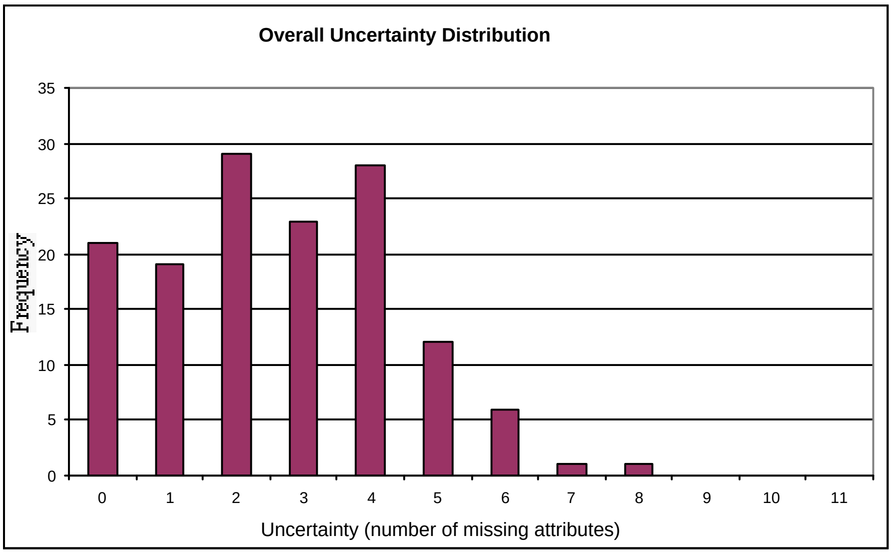
Results from PSA workbook ranking worksheet (species only).

Productivity Attributes	Average age at maturity	Average max age	Fecundity	Average max size	Average size at Maturity	Reproductive strategy	Trophic level (fishbase)
Total species scores for attribute							
n species scores with attribute unknown, (conservative score used)							
% unknown information							
Susceptibility Attributes	Availability	Encounter ability		Selectivity	PCM		
		Bathymetry overlap	Habitat				
Total species scores for attribute							
n species scores with attribute unknown, (conservative score used)							
% unknown information							

Each species considered in the analysis had information for an average of [A, (B%)] productivity attributes and [C (D%)] susceptibility attributes. This meant that, on average, conservative scores were used for less than [E%] of the attributes for a single species. [Units] had missing information for between [F and G] of the combined [H] productivity and susceptibility attributes.

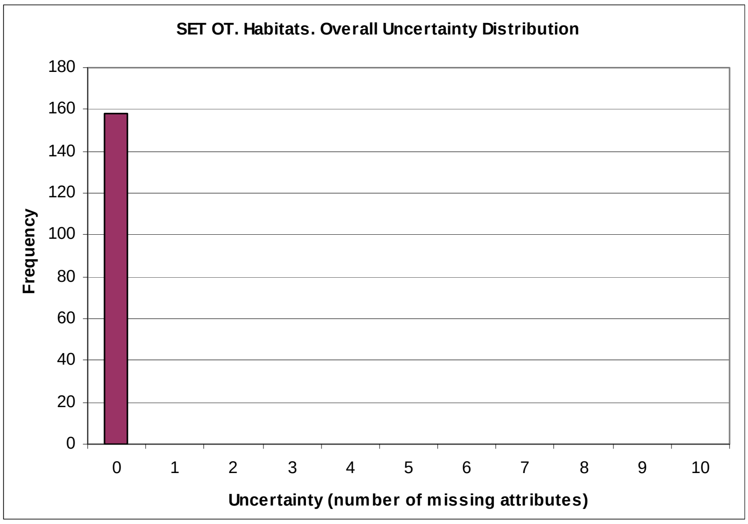
Results Overall uncertainty distribution in PSA workbook ranking graphs worksheet

Species uncertainty distribution histogram would follow the format of the example below:



Species: Overall uncertainty distribution - frequency of missing information for the combined productivity and susceptibility attributes

Habitats: Twenty-one attributes are used in the habitat PSA. All attributes are scored according to Habitat attribute tables 9-27. Only attributes that could be ranked are utilised and therefore there are no missing attributes. [example below]



Habitats: Overall uncertainty distribution- frequency of missing information for the combined productivity and susceptibility attributes

<u>Correlation between attributes</u>
In situations where attributes are strongly correlated only one of them should be included in the final PSA (Stobutzki *et al*., 2001).

Species component: The attributes selected for productivity and susceptibility [were/were not] strongly correlated (as per correlation matrix below for Productivity and susceptibility). The strongest productivity attribute correlation was between [attribute J and attribute K], while the strongest susceptibility correlation was between [attribute L and attribute M]. This correlation analysis suggests that each attribute [was/was not] "measuring" a different aspect of the [unit] characteristics and [all/not all] attributes were suitable for inclusion in the PSA.

	Age at maturity	Max age	Fecundity	Max size	Min size at maturity	Reproductive strategy	Trophic level
Age at maturity	X						
Max age		X					
Fecundity			X				
Max size				X			
Min size at maturity					X		
Reproductive strategy						X	
Trophic level							X

Correlation matrix for the species productivity attributes. The correlation (r) is based on the scores within each attribute pair. Results from PSA workbook ranking graphs worksheet.

	Availability	Encounterability	Selectivity	Post-capture mortality
Availability	X			
Encounterability		X		
Selectivity			X	
Post-capture mortality				X

Correlation matrix for the four species susceptibility attributes. The correlation (r) is based on the scores within each attribute pair. Results from PSA workbook ranking graphs worksheet.

Habitat Component: The attributes selected for productivity and susceptibility [were/not] strongly correlated (as per correlation matrix below for productivity and susceptibility). There was [X] correlation between the productivity attributes Regeneration of Fauna and Natural disturbance (r = [x]). The susceptibility correlation could not be calculated between the Availability and any other aspect, because there was no variation in the Availability score. There [was/X] correlation between the attributes used to calculate Encounterability and Selectivity. All attributes were suitable for inclusion in the PSA.

Productivity Correlation Matrix	Regeneration of fauna	Natural disturbance
Regeneration of fauna	X	
Natural disturbance	X	X

Correlation matrix for the habitat productivity attributes. The correlation (r) is based on the scores within each attribute pair. Results from PSA workbook ranking graphs worksheet.

Susceptibility Correlation Matrix	Availability score	Encounterability score (average)	Selectivity score (average)
Availability score	X		
Encounterability score (average)	X	X	
Selectivity score (average)	X	X	X

Correlation matrix for the three habitat susceptibility attributes. The correlation (r) is based on the scores within each attribute pair. Results from PSA workbook ranking graphs worksheet.

Productivity and Susceptibility Values for Species

The average productivity score for all [units] was [X ± Y] (mean ± SD of scores calculated using n-1 attributes) and the mean susceptibility score was [X ± Y] (as per summary of average productivity and susceptibility scores as below). Individual scores are shown in Appendix B: Summary of PSA results. The [small/large] variation in the average of the boot-strapped values (using n-1 attributes), indicates the productivity and susceptibility scores [are/are not] robust to elimination of a single attribute. Information for a single attribute [does not/does] have a disproportionately large effect on the productivity and susceptibility scores. Information was missing for an average of [Z] attributes out of [Y] possible for each [unit].

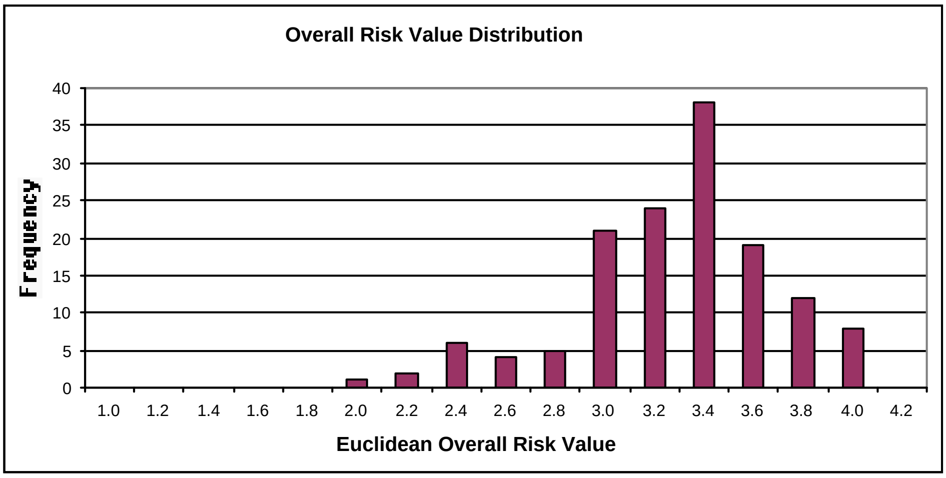
Productivity and Susceptibility Values for Habitat units.

The average productivity score for all habitats was [X ± Y] (mean ± SD of scores calculated using n-1 attributes) and the mean susceptibility score was [X ± Y] (as per summary of average productivity and susceptibility scores as below). Individual scores are shown in Appendix B: Summary of PSA results. The small/large variation in the average of the boot-strapped values (using n-1 attributes), indicates the productivity and susceptibility scores are robust to elimination of a single attribute. Information for a single attribute [does not/does] have a disproportionately large effect on the productivity and susceptibility scores. Information was missing for an average of [Z] attributes out of [Y] possible for each [unit].

Overall Risk Values for Species

The overall risk values (Euclidean distance on the PSA plot) could fall between 1 and 4.24 (scores of 1&1 and 3&3 for both productivity and susceptibility respectively). The mean observed overall risk score was [X], with a range of [Y – Z].
The actual values for each species are shown in Appendix B: Summary of PSA results. A total of [A units, (B%)] were classed as high risk, [B (C%)] were in the medium risk category, and [D (E%)] as low risk.

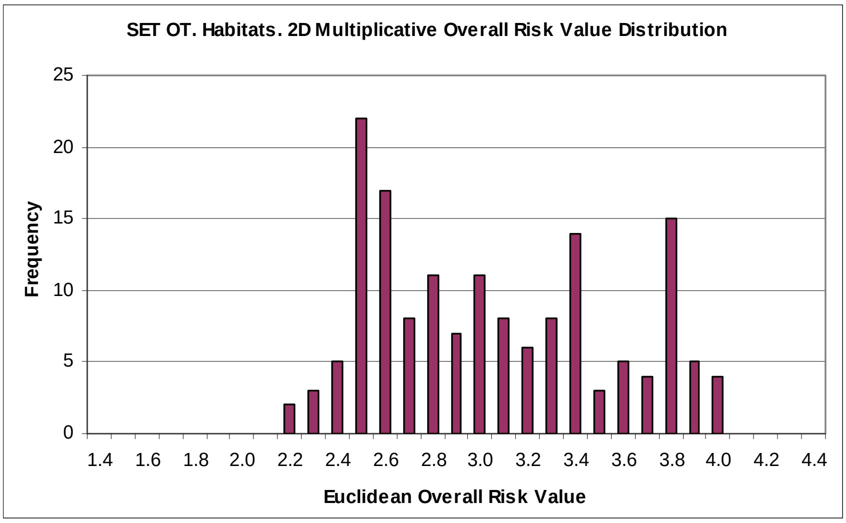
Results: Frequency distribution of the overall PSA risk values .
Evaluation example only



Frequency distribution of the overall risk values generated for the [X units] in the [fishery sub-fishery] PSA.

Overall Risk Values for Habitats

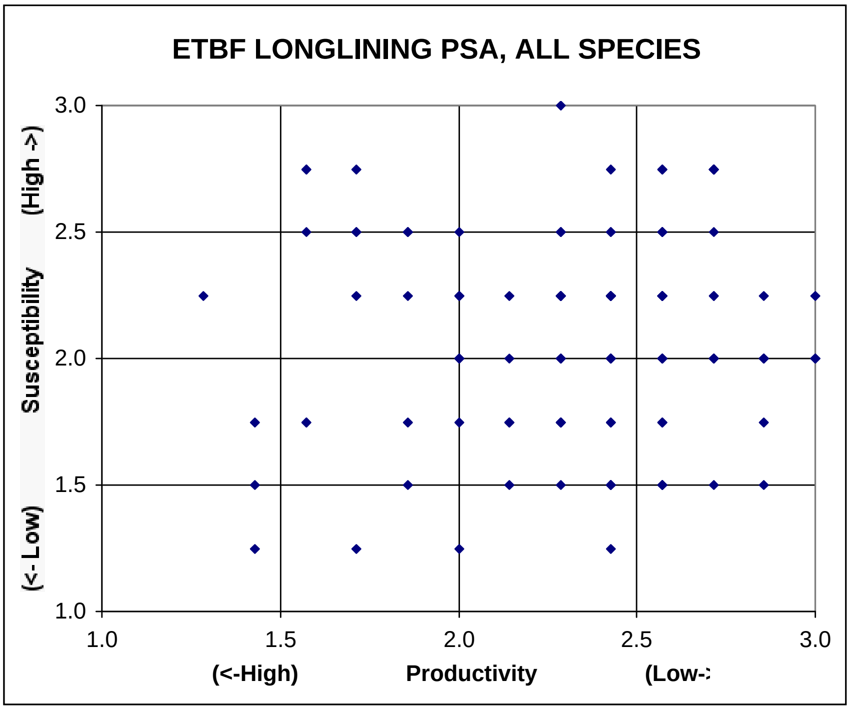
The overall risk values (Euclidean distance on the PSA plot) could fall between 1 and 4.24 (scores of 1&1 and 3&3 for both productivity and susceptibility respectively). The mean observed overall risk score was 3.01, with a range of 2.18- 3.97**.**
The actual values for each species are shown in Appendix B: Summary of PSA results. A total of 46 units, (29%) were classed as high risk, 58units, (37%) were in the medium risk category, and 54 (34%) as low risk**.**



Frequency distribution of the overall risk values generated for the [X] habitat types in the [fishery sub-fishery] PSA.

The distribution of the overall risk values of all species is shown on the PSA plot below. The species are distributed in the [all/lower left/upper right] parts of the plot, indicating that [both high and low risk units] are potentially impacted in the [fishery sub-fishery].

Results Plot for all species in the sub-fishery PSA risk values.
Evaluation example only



PSA plot for all [units] in the [fishery sub-fishery]. Species in the upper right of the plot are at highest risk.

The number of attributes with missing information is of particular interest, because the conservative scoring means these units may be scored at higher risk than if all the information was known. This relationship between the overall risk score and the number of missing attributes shows that an increase in the number of missing attributes (and hence conservative scores used) results in a skew to higher risk values. This suggests that as information becomes available on those attributes, the risk values may decline for some units.

All attributes are treated equally in the PSA, however, information on some attributes may be of low quality.

2.4.6 Evaluation of the PSA results (Step 6)

No PSA has been produced for the Coral Sea Other Line Sub-fishery. Information regarding PSA analysis is included to provide a full understanding of the ERAEF process.

Species components:
<u>Overall</u>

<u>Results</u>

<u>Discussion</u>

Habitat components:
Overall

Results:

Summary of the average productivity, susceptibility and overall risk scores.

Component	Measure	
All habitats	Number of habitats	X
	Average of productivity total	X
	Average of susceptibility total	X
	Average of overall risk value (2D)	X
	Average number of missing attributes	0

PSA (productivity and susceptibility) risk categories for the habitat component**.**

Risk category	High	Medium	Low	Total
Total Habitats	X	X	X	X

PSA (productivity and susceptibility) risk categories for sub-biome (depth zone) fished (before override adjustment).

2D Risk score	Inner-shelf	Outer-shelf	Upper-slope	Mid-slope	Total habitats
High	X	X	X	X	X
Medium	X	X	X	X	X
Low	X	X	X	X	X
Total	X	X	X	X	X

PSA (productivity and susceptibility) risk categories for sub-biome fished after Risk Ranking adjustment (stakeholder/expert override).

2D Risk score	Inner-shelf	Outer-shelf	Upper-slope	Mid-slope	Total habitats
High	X	X	X	X	X
Medium	X	X	X	X	X
Low	X	X	X	X	X
Total	X	X	X	X	X

[No] inner shelf habitats are classified as high risk, [X] as medium risk, and [X] as low risk. [X] outer shelf habitats produce high risk scores, [X] medium and [X] are at low risk. Of the upper slope [X] are classified as high risk,[X] at medium and [no] upper slope habitats appear at low risk. Habitats at mid-slope depths are either at high risk (X) or at medium risk (X), none are considered low risk.

Discussion

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2.4.7 Decision rules to move from Level 2 to Level 3 (Step 7)

For the PSA overall risk values, units that fall in the upper third (risk value > 3.18) and middle third (2.64 < risk value < 3.18) of the PSA plots are deemed to be at high and medium risk respectively. These need to be the focus of further work, either through implementing a management response to address the risk to the vulnerable species or by further examination for risk within the particular ecological component at Level 3. Units at low risk, in the lower third (risk value <2.64), will be deemed not at risk from the sub-fishery and the assessment is concluded for these units.

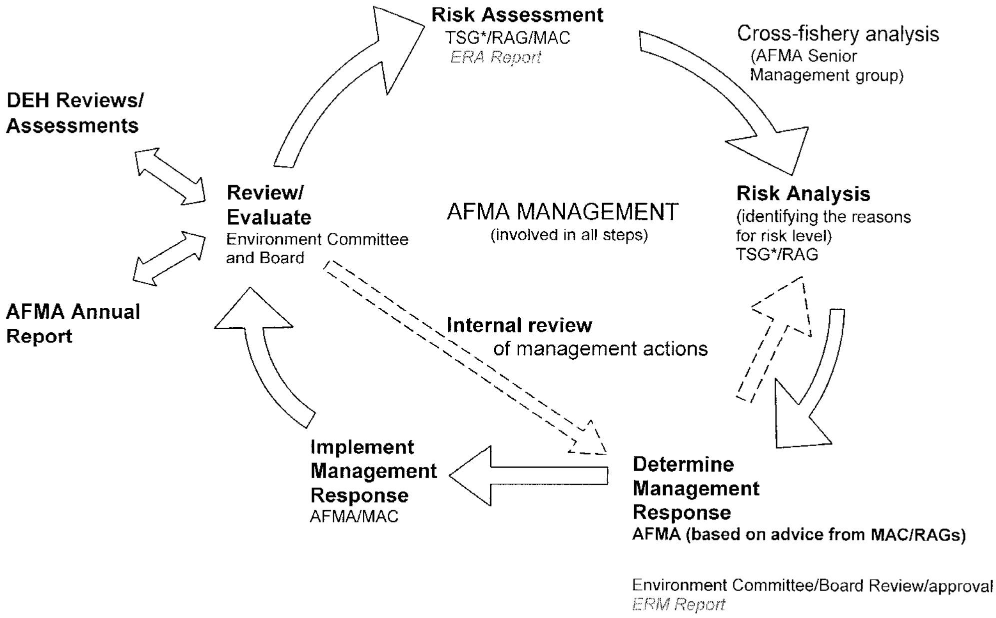
For example, if in a Level 2 analysis of habitat types, two of seven habitat types were determined to have risk from the sub-fishery, only those two habitat types would be considered at Level 3.

The output from the Level 2 analysis will result in four options:

- The risk of fishing on a unit of analysis within a component (e.g. single species or habitat type) is not high, the rationale is documented, and the impact of the fishing activity on this unit need not be assessed at a higher level unless management or the fishery changes.
- The risk of fishing on a unit is high but management strategies are introduced rapidly that will reduce this risk, this unit need not be assessed further unless the management or the fishery changes.
- The risk of fishing on a unit is high but there is additional information that can be used to determine if Level 3, or even a new management action is required. This information should be sought before action is taken
- The risk of fishing on a unit is high and there are no planned management interventions that would remove this risk, therefore the reasons are documented and the assessment moves to Level 3.

At level 2 analysis, a fishery can decide to further investigate the risk of fishing to the species via a level 3 assessment or implement a management response to mitigate the risk. To ensure all fisheries follow a consistent process in responding to the results of the risk assessment, AFMA has developed an ecological risk management framework. The framework (see Figure x below) makes use of the existing AFMA management structures to enable the ERAs to become a part of normal fisheries management, including the involvement of fisheries consultative committees. A separate document, the ERM report, will be developed that outlines the reasons why species are at high risk and what actions the fishery will implement to respond to the risks.

Figure x: Ecological Risk Management Framework



*TSG – Technical Support Group - currently provided by CSIRO.

2.5 Level 3

No Level 3 analyses have been undertaken for species, habitats or communities associated with the Other Line sub-fishery of the Coral Sea Fishery. However it is noted that effort has increased dramatically for the Other Line sector in recent years, that CPUE has declined markedly, and that there appears to have been a shift in the species composition of the catch, possibly indicative of community level effects.

3. General discussion and research implications

The Coral Sea Other Line operations are one of three Line Sector sub-fisheries in the Coral Sea Fishery zone. Other Line operates mainly on localised areas of plateaus and seamounts, in depths of 50-800m. Dropline gear is the main method used, set as a vertical mainline with a top float and bottom anchor, carrying 10-100 snoods with baited hooks attached at the deeper end of the lines. Some trotline (set horizontally – mainline suspended off the bottom and snoods weighted to hang vertically), and handline gear is also used.

Logbook data are often recorded to genus or family grouping only, for both target and byproduct-bycatch species. Where species identification is uncertain, a system of voucher-specimen collection is recommended, with specimens submitted to a biological laboratory for species validation. No Observer coverage is in place in the Other Line sub-fishery.

A lack of available data has resulted in moderate risk, low confidence assessments for some hazards in this sub-fishery. The use of underwater-video and Observer Program data-collection is recommended as a means to address this.

3.1 Level 1

One of the main issues identified through this assessment was the risks presented by Other Line fishing activities. With regard to the species and communities, effort has greatly increased in recent years and catches, which initially increased, then fell dramatically with a changing array of species also recorded. Without catch data at a validated species level, it is difficult to assess the true level of this hazard.

With regard to habitat, the methods associated with Other Line fishing activities present hazards both with and without capture. The use of underwater video as a means of collecting baseline habitat data has been discussed at stakeholder meetings, and its adoption is to be encouraged.

The hazard presented by the addition of biological material - Translocation of species - was assessed at moderate or above for all components of this Level 1 assessment. For the CSF Other Line sub-fishery, translocation risks are most likely due to hull and line fouling, bilge water and pathogens associated with imported baits. No mitigation measures are presently in place for the Other Line sub-fishery. Food and Agriculture Organisation (1995) suggests the use of a precautionary approach with corrective or mitigating procedures established before any effect occur. Similarly, Department of Agriculture, Fisheries and Forestry (DAFF) are soon to release a Code of Practice (‘*National system for prevention and management of marine pest incursions*’, due October 2006) which will also provide risk reduction measures. Consideration of these documents is recommended.

In the absence of data on translocation issues within the CSF, it is recommended that a system be established to provide baseline and continuing data on the incidence of hull and line fouling, and the use and origin of imported baits. It is important to note that the risks from translocation of species presents the classical problem for risk assessment – a low probability event combined with a potentially high impact consequence. This introduces a lot of uncertainty about risk levels associated with such hazards.

Discarding was assessed as a hazard to the Bycatch and TEP components of this sub-fishery. No Observer Program is associated with the Other Line sub-fishery, and as such no data are available to reduce the level of this risk. Similarly, no mitigating measures are in place. As effort is increasing significantly in this sub-fishery, the risk posed by this hazard will also be increasing.

External Hazards scoring three in the Habitat and Community component would both be initially addressed through the operator-initiated reef exclusion ‘Memorandum of Understanding’ being considered by stakeholders and the Tourism sector. Similarly, a suggested voluntary 3-year reef-rotational zoning system would also provide a risk reduction measure, and further development leading to its implementation should be actively encouraged.

Discussions at Stakeholder meetings have also recognised the value that could be gained by presence/absence reporting of issues as part of the Observer Programs (eg shark activities and discard survival percentages), and in obtaining underwater video footage as a means of monitoring habitat issues, community assemblages, and providing baseline data on which further risk assessment could be judged.

3.2 Level 2

Level 2 assessment was not carried out for the Coral Sea Other Line Sub-fishery as part of the ERAEF Stage 2 process.

3.3 Key Uncertainties / Recommendations for Research and Monitoring

Two important uncertainties were identified in this analysis. The first was the accuracy of the species taken by the fishery, with 25% of all catch records being identified to genus or family grouping only. The second was the possible impact of translocations, particularly through fouling (hull and line) and introduced pathogens.

In assessing risk to byproduct, bycatch and TEP species, it is not possible to assess absolute risk without knowledge of the species involved, together with supplementary information on either abundance or total mortality rates, and such data are not available for the vast majority of Other Line catch species. However it may be possible to draw inferences from information that may be available for some species, either from catch records of occurrence from other fisheries, from fishery independent survey data, or from examination of trends in CPUE from observer data. Such data should be sought and examined for the high risk species identified in this analysis.

In assessing risk to habitats, similar issues arise. In general we do not have detailed information on the amount of each habitat type present in the area of the fishery, or its spatial distribution. However some data and information do exist from which inferences can be drawn, and piecing this together in the form of maps, particularly for those habitats identified as high risk, should be a priority.

Research recommendations, arising from the Coral Sea Fishery: Other Line sub-fishery assessment, include:

- collection of voucher specimens to be submitted to a biological laboratory for species identification and validation;
- establishing observer coverage for the Other Line sub-fishery, with consistent, standardised reporting to include issues such as percentage survival of discard species, noted presence/absence of associated shark interactions, and bird activities;
- further analysis of existing logbook data to determine if current effort levels are biologically sustainable (examine CPUE trends and changes in species composition)
- the use of underwater video footage as a means of monitoring the impacts of gear on habitat structure and function (this is a general recommendation across a number of the Australian Fisheries Management Authority (AFMA) sub-fisheries)

Other recommendations include:

- adoption of mitigating measures to address translocation risks, e.g. –
    - Department of Agriculture, Fisheries and Forestry (DAFF) “National system for prevention and management of marine pest incursions” document, due for release in October 2006; or
    - Food and Agriculture Organisation (1995) precautionary approach documents; and
    - Bureau of Rural Sciences (BRS) recommendations for risk reduction with regard to introduced marine pests (Summerson and Curran 2005); and
- implementation of the CSF Stakeholders Associations’ Memorandum of Understanding (MoU) for specific reef fishing-exclusions, and the 3-year reef-rotational system.

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Glossary of Terms

Assemblage	A subset of the species in the community that can be easily recognised and studied. For example, the set of sharks and rays in a community is the Chondricythian assemblage.
Attribute	A general term for a set of properties relating to the productivity or susceptibility of a particular unit of analysis.
Bycatch species	A non-target species captured in a fishery, usually of low value and often discarded (see also Byproduct).
Byproduct species	A non-target species captured in a fishery, but it may have value to the fisher and be retained for sale.
Community	A complete set of interacting species.
Component	A major area of relevance to fisheries with regard to ecological risk assessment (e.g. target species, bycatch and byproduct species, threatened and endangered species, habitats, and communities).
Component model	A conceptual description of the impacts of fishing activities (hazards) on components and sub-components, linked through the processes and resources that determine the level of a component.
Consequence	The effect of an activity on achieving the operational objective for a sub-component.
Core objective	The overall aim of management for a component.
End point	A term used in risk assessment to denote the object of the assessment; equivalent to component or sub-component in ERAEF
Ecosystem	The spatially explicit association of abiotic and biotic elements within which there is a flow of resources, such as nutrients, biomass or energy (Crooks, 2002).
External factor	Factors other than fishing that affect achievement of operational objectives for components and sub-components.
Fishery method	A technique or set of equipment used to harvest fish in a fishery (e.g. long-lining, purse-seining, trawling).
Fishery	A related set of fish harvesting activities regulated by an authority (e.g. South-East Trawl Fishery).
Habitat	The place where fauna or flora complete all or a portion of their life cycle.
Hazard identification	The identification of activities (hazards) that may impact the components of interest.
Indicator	Used to monitor the effect of an activity on a sub-component. An indicator is something that can be measured, such as biomass or abundance.
Likelihood	The chance that a sub-component will be affected by an activity.

Operational objective	A measurable objective for a component or sub-component (typically expressed as “the level of X does not fall outside acceptable bounds”)
Precautionary approach	The approach whereby, if there is uncertainty about the outcome of an action, the benefit of the doubt should be given to the biological entity (such as species, habitat or community).
PSA	Productivity-Susceptibility Analysis. Used at Level 2 in the ERAEF methodology.
Scoping	A general step in an ERA or the first step in the ERAEF involving the identification of the fishery history, management, methods, scope and activities.
SICA	Scale, Impact, Consequence Analysis. Used at Level 1 in the ERAEF methodology.
Sub-component	A more detailed aspect of a component. For example, within the target species component, the sub-components include the population size, geographic range, and the age/size/sex structure.
Sub-fishery	A subdivision of the fishery on the basis of the gear or areal extent of the fishery. Ecological risk is assessed separately for each sub-fishery within a fishery.
Sustainability	Ability to be maintained indefinitely
Target species	A species or group of species whose capture is the goal of a fishery, sub-fishery, or fishing operation.
Trophic position	Location of an individual organism or species within a foodweb.
Unit of analysis	The entities for which attributes are scored in the Level 2 analysis. For example, the units of analysis for the Target Species component are individual “species”, while for Habitats, they are “biotypes”, and for Communities the units are “assemblages”.

Appendix A: General summary of stakeholder feedback

Date	Format received	Comment from stakeholder	Action/Explanation
Sept 28 2006	AFMA/Stakeholder provided comments	1. Target species: Level 1 - Page 11: Capture, Fishing, Population size: We do not agree that the rosy jobfish and NW ruby fish are predominantly caught in 2 main seamount areas. These fish can be caught at every reef in the Coral Sea Fishery and every bank including Flinders Reef, Willis Island, Dianne Bank, Diamond Group, Calder Rocks, Frederick Reef, Kenn Reef, Wreck Reef and Fraser Seamount. It is possible that the full potential of all these areas has not been established as yet.	**No change –** logbook records show that catches of rosy jobfish and NW ruby fish have predominantly come from 2 main seamount areas within the CSF. The actual wording in the SICA is “Fishery occurs throughout year predominantly in 2 main seamount areas”, which is accurate. The stakeholder comment is correct in saying that there is the potential to catch these species in other areas, but the ERA process is to consider data to date, not the potential of future fishing areas.
Sept 28 2006	AFMA/Stakeholder provided comments	2. Target species: Level 1 - Page 13: Addition/movement of biological material, Translocation of species, Population size: Our fishing vessels only fish in Queensland/CSF waters, so there would be no problem of species being introduced from other areas through bilges etc. My vessels and gear are well maintained and our vessels are slipped on a regular basis. All bait used is frozen.	**No change –** Species can initially be introduced by other shipping, and further translocated by any boat within Queensland, including CSF boats eg introduced mussels in Cairns port can be further translocated by any boat that uses the Cairns port. As noted in the Executive Summary, translocation is a “low probability but potentially high consequence hazard”. Further comment is also in the sections General Discussions (3.1), together with references from DAFF, FAO and DEH sources, and Recommendations (section 3.3) suggested to address this hazard. The issue was also discussed at the Stakeholder 2006 meeting, and consensus reached in producing the final consequence score.
Sept 28 2006	AFMA/Stakeholder provided comments	3. Target species: Level 1 - Page 15: External impacts; other fisheries, Population size: The CSF cannot be fished all year. The weather makes it almost impossible to fish the northern areas from January to June. Also there is only a very limited number of operators working the CSF which should make the area more sustainable.	**No change** - This section relates to external hazards, not the Other Line subfishery activities of the Coral Sea. External impacts include all other fisheries that may operate within the waters of the CSF area eg other subfisheries of the CSF itself (auto- and demersal-longline, trap, and trawl), SET and GHATF. The temporal scale applied to this hazard is ‘3’ ie 1-100 days/year, and the rationale explains that fishing occurs over most of the year, not all, which is why the temporal scale is not higher eg 4=100-200 days/yr, 5=200-300 days or 6=300-365 days/yr.
Sept 28 2006	AFMA/Stakeholder provided comments	4. Bycatch species: Level 1 - Page 16: Capture, Fishing, Population size: **A**. Saddletail snapper have not been caught	A. **Clarified** – Saddletail snapper (Lutjanus malabaricus) have been recorded in CS01 logbooks over several years by a number

		by our vessels in the Coral Sea Fishery in the past 5 years. They are prevalent in Darwin and the Northern Territory. If saddletail snapper are being logged it is most likely due to mistaken identity. **B.** The red bass are not a saleable item due to the fact that they contain ciguatera. They have a better survival rate when caught in shallower water. **C.** The fish are not restricted to 2 main seamount areas. It is possible that the full potential of the Coral Sea Fishery has not been established as yet.	of boats. As there is no Observer data or species validation available for the Other line sub-fishery, and as a result of the relatively large percentage of the discard attributed to this species, it has been retained in species lists and SICA's, but now identified as "*Lutjanus malabaricus* – unvalidated". The issues surrounding this species have also been outlined in the scoping document. B. **No change** – the comment regarding ciguatera is correct, but does not change the hazard or the SICA score. Comments regarding survival rates in shallow waters are unverified and no Observer Reporting is available in this sub-fishery. C. **No change** - see comment 1 above.
Sept 28 2006	AFMA/Stakeholder provided comments	5. Bycatch species: Level 1 - Page 17: Addition/movement of biological material, Translocation of species, Population size: **A**. Saddletail snapper are not caught in the Coral Sea Fishery. **B**. Our fishing vessels only fish in Queensland/Coral Sea Fishery waters, so there would be no problem of species being introduced from other areas through bilges etc. Our vessels and gear are well maintained and the vessels are slipped on a regular basis. All bait used is frozen.	A. **Clarified –** see comment 4A above. B. **No change** – see comment 2 above.
Sept 28 2006	AFMA/Stakeholder provided comments	6. Bycatch species: Level 1 - Page 18: Addition/movement of biological material, Discarding catch, Population size: Red Bass have a better survival rate when caught in shallower water. Red Bass contain ciguatera and as a result are discarded.	**No change –** see comment 4B above.
Sept 28 2006	AFMA/Stakeholder provided comments	7. Bycatch species: Level 1 - Page 19: External Impacts (specify the particular example with each activity), Other fisheries, Population size: **A**. Saddletail snapper are not caught in the Coral Sea Fishery. **B.** The Coral Sea cannot be fished all year. The weather makes it Almost impossible to fish the northern areas from January to June. There are only a limited number of operators working the Coral Sea Fishery also which should make the area more sustainable.	A. **No change** – see comments 4A above. B. **No change** – see comment 3 above.
Sept 28 2006	AFMA/Stakeholder provided comments	For all sub-fisheries Under "Input controls" "a specified number of fishing days per permit per season" should read "a	**Changed** - added in scoping document for each of the line subfishery reports. Now reads " a specified minimum of 20

		specified number of **minimum fishing** days per permit per season" (noted in Demersal longline comments)	fishing days per permit per season "
Sept 28 2006	AFMA/Stakeholder provided comments	What years were the logbook data taken from -this is not clear? (noted in Demersal longline comments)	**Changed** - clarified in scoping document for each of the line subfishery reports
Sept 28 2006	AFMA/Stakeholder provided comments	Under "Observer data" the purpose of observer coverage for auto longline method is to verify catch and effort and TEP species interactions. (noted in Demersal longline comments)	**Changed** - Catch and effort, and TEP interactions added to existing information in scoping document.

Appendix B: PSA results - summary of stakeholder discussions

Level 2 (PSA) Document L2.1. Summary table of stakeholder discussion regarding PSA results.

The following species were discussed at the INSERT FISHERY GROUP NAME meeting on INSERT DATE and LOCATION. ALL or SELECTED high risk species were discussed.

Taxa name	Scientific name	Common name	Role in fishery	PSA risk ranking (H/M/L)	Comments from meeting, and follow-up	Action	Outcome	Possible management response

NB. No Level 2 analysis has been conducted for Coral Sea sub-fisheries.

Appendix C: SICA consequence scores for ecological components

Table 5A. Target Species. Description of consequences for each component and each sub-component. Use table as a guide for scoring the level of consequence for target species.

(Modified from Fletcher *et al*. 2002)

Sub-component	Score/level 1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
Population size	**1. Population size** Insignificant change to population size/growth rate (r). Unlikely to be detectable against background variability for this population.	**1. Population size** Possible detectable change in size/growth rate (r) but minimal impact on population size and none on dynamics.	**1. Population size** Full exploitation rate but long-term recruitment dynamics not adversely damaged.	**1. Population size** Affecting recruitment state of stocks and/or their capacity to increase	**1. Population size** Likely to cause local extinctions if continued in longer term	**1. Population size** Local extinctions are imminent/immediate
Geographic range	**2. Geographic range** No detectable change in geographic range. Unlikely to be detectable against background variability for this population.	**2. Geographic range** Possible detectable change in geographic range but minimal impact on population range and none on dynamics, change in geographic range up to 5 % of original.	**2. Geographic range** Change in geographic range up to 10 % of original.	**2. Geographic range** Change in geographic range up to 25 % of original.	**2. Geographic range** Change in geographic range up to 50 % of original.	**2. Geographic range** Change in geographic range > 50 % of original.
Genetic structure	**3. Genetic structure** No detectable change in genetic structure. Unlikely to be detectable against background variability for this population.	**3. Genetic structure** Possible detectable change in genetic structure. Any change in frequency of genotypes, effective population size or number of spawning units up to 5%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units up to 10%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units up to 25%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units, change up to 50%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units > 50%.

Sub-component	Score/level					
	1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
Age/size/sex structure	**4. Age/size/sex structure** No detectable change in age/size/sex structure. Unlikely to be detectable against background variability for this population.	**4. Age/size/sex structure** Possible detectable change in age/size/sex structure but minimal impact on population dynamics.	**4. Age/size/sex structure** Impact on population dynamics at maximum sustainable level, long-term recruitment dynamics not adversely affected.	**4. Age/size/sex structure** Long-term recruitment dynamics adversely affected. Time to recover to original structure up to 5 generations free from impact.	**4. Age/size/sex structure** Long-term recruitment dynamics adversely affected. Time to recover to original structure up to 10 generations free from impact.	**4. Age/size/sex structure** Long-term recruitment dynamics adversely affected. Time to recover to original structure > 100 generations free from impact.
Reproductive capacity	**5. Reproductive capacity** No detectable change in reproductive capacity. Unlikely to be detectable against background variability for this population.	**5. Reproductive capacity** Possible detectable change in reproductive capacity but minimal impact on population dynamics.	**5. Reproductive capacity** Impact on population dynamics at maximum sustainable level, long-term recruitment dynamics not adversely affected.	**5. Reproductive capacity** Change in reproductive capacity adversely affecting long-term recruitment dynamics. Time to recovery up to 5 generations free from impact.	**5. Reproductive capacity** Change in reproductive capacity adversely affecting long-term recruitment dynamics. Time to recovery up to 10 generations free from impact.	**5. Reproductive capacity** Change in reproductive capacity adversely affecting long-term recruitment dynamics. Time to recovery > 100 generations free from impact.
Behaviour/movement	**6. Behaviour/ movement** No detectable change in behaviour/ movement. Unlikely to be detectable against background variability for this population. Time taken to recover to pre-disturbed state on the scale of hours.	**6. Behaviour/ movement** Possible detectable change in behaviour/ movement but minimal impact on population dynamics. Time to return to original behaviour/ movement on the scale of days to weeks.	**6. Behaviour/ movement** Detectable change in behaviour/ movement with the potential for some impact on population dynamics. Time to return to original behaviour/ movement on the scale of weeks to months.	**6. Behaviour/ movement** Change in behaviour/ movement with impacts on population dynamics. Time to return to original behaviour/ movement on the scale of months to years.	**6. Behaviour/ movement** Change in behaviour/ movement with impacts on population dynamics. Time to return to original behaviour/ movement on the scale of years to decades.	**6. Behaviour/ movement** Change to behaviour/ movement. Population does not return to original behaviour/ movement.

Table 5B. Bycatch and Byproduct species. Description of consequences for each component and each sub-component. Use table as a guide for scoring the level of consequence for bycatch/byproduct species.

(Modified from Fletcher *et al*. 2002)

Sub-component	Score/level					
	1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
Population size	**1. Population size** Insignificant change to population size/growth rate (r). Unlikely to be detectable against background variability for this population.	**1. Population size** Possible detectable change in size/growth rate (r) but minimal impact on population size and none on dynamics.	**1. Population size** No information is available on the relative area or susceptibility to capture/ impact or on the vulnerability of life history traits of this type of species Susceptibility to capture is suspected to be less than 50% and species do not have vulnerable life history traits. For species with vulnerable life history traits to stay in this category susceptibility to capture must be less than 25%.	**1. Population size** Relative state of capture/susceptibility suspected/known to be greater than 50% and species should be examined explicitly.	**1. Population size** Likely to cause local extinctions if continued in longer term	**1. Population size** Local extinctions are imminent/immediate
Geographic range	**2. Geographic range** No detectable change in geographic range. Unlikely to be detectable against background	**2. Geographic range** Possible detectable change in geographic range but minimal impact on population range and none on	**2. Geographic range** Change in geographic range up to 10 % of original.	**2. Geographic range** Change in geographic range up to 25 % of original.	**2. Geographic range** Change in geographic range up to 50 % of original.	**2. Geographic range** Change in geographic range > 50 % of original.

Sub-component	Score/level					
	1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
	variability for this population.	dynamics, change in geographic range up to 5 % of original.				
Genetic structure	**3. Genetic structure** No detectable change in genetic structure. Unlikely to be detectable against background variability for this population.	**3. Genetic structure** Possible detectable change in genetic structure. Any change in frequency of genotypes, effective population size or number of spawning units up to 5%.	**3. Genetic structure** Detectable change in genetic structure. Change in frequency of genotypes, effective population size or number of spawning units up to 10%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units up to 25%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units up to 50%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units > 50%.
Age/size/sex structure	**4. Age/size/sex structure** No detectable change in age/size/sex structure. Unlikely to be detectable against background variability for this population.	**4. Age/size/sex structure** Possible detectable change in age/size/sex structure but minimal impact on population dynamics.	**4. Age/size/sex structure** Detectable change in age/size/sex structure. Impact on population dynamics at maximum sustainable level, long-term recruitment dynamics not adversely damaged.	**4. Age/size/sex structure** Long-term recruitment dynamics adversely affected. Time to recover to original structure up to 5 generations free from impact.	**4. Age/size/sex structure** Long-term recruitment dynamics adversely affected. Time to recover to original structure up to 10 generations free from impact.	**4. Age/size/sex structure** Long-term recruitment dynamics adversely affected. Time to recover to original structure > 100 generations free from impact.
Reproductive capacity	**5. Reproductive capacity** No detectable change in reproductive capacity. Unlikely to be detectable against background variability for this	**5. Reproductive capacity** Possible detectable change in reproductive capacity but minimal impact on population dynamics.	**5. Reproductive capacity** Detectable change in reproductive capacity, impact on population dynamics at maximum sustainable level,	**5. Reproductive capacity** Change in reproductive capacity adversely affecting long-term recruitment dynamics. Time to recovery up to 5	**5. Reproductive capacity** Change in reproductive capacity adversely affecting long-term recruitment dynamics. Time to	**5. Reproductive capacity** Change in reproductive capacity adversely affecting long-term recruitment dynamics. Time to recovery > 100 generations free from

Sub-component	Score/level					
	1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
	population.		long-term recruitment dynamics not adversely damaged.	generations free from impact.	recovery up to 10 generations free from impact.	impact.
Behaviour/movement	**6. Behaviour/ movement** No detectable change in behaviour/ movement. Unlikely to be detectable against background variability for this population. Time taken to recover to pre-disturbed state on the scale of hours.	**6. Behaviour/ movement** Possible detectable change in behaviour/ movement but minimal impact on population dynamics. Time to return to original behaviour/ movement on the scale of days to weeks.	**6. Behaviour/ movement** Detectable change in behaviour/ movement with the potential for some impact on population dynamics. Time to return to original behaviour/ movement on the scale of weeks to months.	**6. Behaviour/ movement** Change in behaviour/ movement with impacts on population dynamics. Time to return to original behaviour/ movement on the scale of months to years	**6. Behaviour/ movement** Change in behaviour/ movement with impacts on population dynamics. Time to return to original behaviour/ movement on the scale of years to decades.	**6. Behaviour/ movement** Change to behaviour/ movement. Population does not return to original behaviour/ movement.

Table 5C. TEP species. Description of consequences for each component and each sub-component. Use table as a guide for scoring the level of consequence for TEP species.

(Modified from Fletcher *et al.* 2002)

Sub-component	Score/level					
	1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
Population size	**1. Population size** Almost none are killed.	**1. Population size** Insignificant change to population size/growth rate (r). Unlikely to be detectable against background variability for this population.	**1. Population size**. State of reduction on the rate of increase are at the maximum acceptable level. Possible detectable change in size/ growth rate (r) but minimal impact on population size and none on dynamics of TEP species.	**1. Population size** Affecting recruitment state of stocks or their capacity to increase.	**1. Population size** Local extinctions are imminent/immediate	**1. Population size** Global extinctions are imminent/immediate
Geographic range	**2. Geographic range** No interactions leading to impact on geographic range.	**2. Geographic range** No detectable change in geographic range. Unlikely to be detectable against background variability for this population.	**2. Geographic range** Possible detectable change in geographic range but minimal impact on population range and none on dynamics. Change in geographic range up to 5 % of original.	**2. Geographic range** Change in geographic range up to 10% of original.	**2. Geographic range** Change in geographic range up to 25% of original.	**2. Geographic range** Change in geographic range up to 25% of original.
Genetic structure	**3. Genetic structure** No interactions leading to impact on genetic structure.	**3. Genetic structure** No detectable change in genetic structure. Unlikely to be detectable against background variability for this population.	**3. Genetic structure** Possible detectable change in genetic structure but minimal impact at population level. Any change in frequency of genotypes, effective	**3. Genetic structure** Moderate change in genetic structure. Change in frequency of genotypes, effective population size or number of spawning units up to	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units up to 25%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units up to 25%.

Sub-component	Score/level					
	1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
			population size or number of spawning units up to 5%.	10%.		
Age/size/sex structure	**4. Age/size/sex structure** No interactions leading to change in age/size/sex structure.	**4. Age/size/sex structure** No detectable change in age/size/sex structure. Unlikely to be detectable against background variability for this population.	**4. Age/size/sex structure** Possible detectable change in age/size/sex structure but minimal impact on population dynamics.	**4. Age/size/sex structure** Detectable change in age/size/sex structure. Impact on population dynamics at maximum sustainable level, long-term recruitment dynamics not adversely damaged.	**4. Age/size/sex structure** Severe change in age/size/sex structure. Impact adversely affecting population dynamics. Time to recover to original structure up to 5 generations free from impact	**4. Age/size/sex structure** Impact adversely affecting population dynamics. Time to recover to original structure > 10 generations free from impact
Reproductive capacity	**5. Reproductive capacity** No interactions resulting in change to reproductive capacity.	**5. Reproductive capacity** No detectable change in reproductive capacity. Unlikely to be detectable against background variability for this population.	**5. Reproductive capacity** Possible detectable change in reproductive capacity but minimal impact on population dynamics.	**5. Reproductive capacity** Detectable change in reproductive capacity, impact on population dynamics at maximum sustainable level, long-term recruitment dynamics not adversely damaged.	**5. Reproductive capacity** Change in reproductive capacity, impact adversely affecting recruitment dynamics. Time to recover to original structure up to 5 generations free from impact	**5. Reproductive capacity** Change in reproductive capacity, impact adversely affecting recruitment dynamics. Time to recover to original structure > 10 generations free from impact
Behaviour/movement	**6. Behaviour/ movement** No interactions resulting in change to behaviour/ movement.	**6. Behaviour/ movement** No detectable change in behaviour/ movement. Time to return to original	**6. Behaviour/ movement** Possible detectable change in behaviour/ movement but minimal impact on	**6. Behaviour/ movement** Detectable change in behaviour/ movement with the potential for some impact on	**6. Behaviour/ movement** Change in behaviour/ movement, impact adversely affecting population dynamics.	**6. Behaviour/ movement** Change in behaviour/ movement. Impact adversely affecting population dynamics.

Sub-component	Score/level					
	1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
		behaviour/ movement on the scale of hours.	population dynamics. Time to return to original behaviour/ movement on the scale of days to weeks	population dynamics. Time to return to original behaviour/ movement on the scale of weeks to months	Time to return to original behaviour/ movement on the scale of months to years.	Time to return to original behaviour/ movement on the scale of years to decades.
Interaction with fishery	**7. Interactions with fishery** No interactions with fishery.	**7. Interactions with fishery** Few interactions and involving up to 5% of population.	**7. Interactions with fishery** Moderate level of interactions with fishery involving up to10 % of population.	**7. Interactions with fishery** Major interactions with fishery, interactions and involving up to 25% of population.	**7. Interactions with fishery** Frequent interactions involving ~ 50% of population.	**7. Interactions with fishery** Frequent interactions involving the entire known population negatively affecting the viability of the population.

Table 5D. Habitats. Description of consequences for each component and each sub-component. Use table as a guide for scoring the level of consequence for habitats. Note that for sub-components Habitat types and Habitat structure and function, time to recover from impact scales differ from substrate, water and air. Rationale: structural elements operate on greater timeframes to return to pre-disturbance states.

(Modified from Fletcher *et al.* 2002)

Sub-component	Score/level					
	1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
Substrate quality	**1. Substrate quality** Reduction in the productivity (similar to the intrinsic rate of increase for species) on the substrate from the activity is unlikely to be detectable. Time taken to recover to pre-disturbed state on the scale of hours.	**1. Substrate quality** Detectable impact on substrate quality. At small spatial scale time taken to recover to pre-disturbed state on the scale of days to weeks, at larger spatial scales recovery time of hours to days.	**1. Substrate quality** More widespread effects on the dynamics of substrate quality but the state are still considered acceptable given the percent area affected, the types of impact occurring and the recovery capacity of the substrate. For impacts on non-fragile substrates this may be for up to 50% of habitat affected, but for more fragile habitats, e.g. reef substrate, to stay in this category the % area affected needs to be smaller up to 25%.	**1. Substrate quality** The level of reduction of internal dynamics of habitats may be larger than is sensible to ensure that the habitat will not be able to recover adequately, or it will cause strong downstream effects from loss of function. Time to recover from local impact on the scale of months to years, at larger spatial scales recovery time of weeks to months.	**1. Substrate quality** Severe impact on substrate quality with 50 - 90% of the habitat affected or removed by the activity which may seriously endanger its long-term survival and result in changes to ecosystem function. Recovery period measured in years to decades.	**1. Substrate quality** The dynamics of the entire habitat is in danger of being changed in a major way, or > 90% of habitat destroyed.
Water quality	**2. Water quality** No direct impact on water quality. Impact unlikely to be detectable. Time taken to recover to	**2. Water quality** Detectable impact on water quality. Time to recover from local impact on the scale of days to weeks, at	**2. Water quality** Moderate impact on water quality. Time to recover from local impact on the scale of weeks to months, at	**2. Water quality** Time to recover from local impact on the scale of months to years, at larger spatial scales recovery time	**2. Water quality** Impact on water quality with 50 - 90% of the habitat affected or removed by the activity which may	**2. Water quality** The dynamics of the entire habitat is in danger of being changed in a major way, or > 90% of

Sub-component	Score/level					
	1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
	pre-disturbed state on the scale of hours.	larger spatial scales recovery time of hours to days.	larger spatial scales recovery time of days to weeks.	of weeks to months.	seriously endanger its long-term survival and result in changes to ecosystem function. Recovery period measured in years to decades.	habitat destroyed.
Air quality	**3. Air quality** No direct impact on air quality. Impact unlikely to be detectable. Time taken to recover to pre-disturbed state on the scale of hours.	**3. Air quality** Detectable impact on air quality. Time to recover from local impact on the scale of days to weeks, at larger spatial scales recovery time of hours to days.	**3. Air quality** Detectable impact on air quality. Time to recover from local impact on the scale of weeks to months, at larger spatial scales recovery time of days to weeks.	**3. Air quality** Time to recover from local impact on the scale of months to years, at larger spatial scales recovery time of weeks to months.	**3. Air quality** Impact on air quality with 50 - 90% of the habitat affected or removed by the activity .which may seriously endanger its long-term survival and result in changes to ecosystem function. Recovery period measured in years to decades.	**3. Air quality** The dynamics of the entire habitat is in danger of being changed in a major way, or > 90% of habitat destroyed.
Habitat types	**4. Habitat types** No direct impact on habitat types. Impact unlikely to be detectable. Time taken to recover to pre-disturbed state on the scale of hours to days.	**4. Habitat types** Detectable impact on distribution of habitat types. Time to recover from local impact on the scale of days to weeks, at larger spatial scales recovery time of days to months.	**4. Habitat types** Impact reduces distribution of habitat types. Time to recover from local impact on the scale of weeks to months, at larger spatial scales recovery time of months to < one year.	**4. Habitat types** The reduction of habitat type areal extent may threaten ability to recover adequately, or cause strong downstream effects in habitat distribution and extent. Time to recover from impact on the scale of > one year to < decadal	**4. Habitat types** Impact on relative abundance of habitat types resulting in severe changes to ecosystem function. Recovery period likely to be > decadal	**4. Habitat types** The dynamics of the entire habitat is in danger of being changed in a catastrophic way. The distribution of habitat types has been shifted away from original spatial pattern. If reversible, will require a long-term recovery period, on

Sub-component	Score/level					
	1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
				timeframes.		the scale of decades to centuries.
Habitat structure and function	**5. Habitat structure and function** No detectable change to the internal dynamics of habitat or populations of species making up the habitat. Time taken to recover to pre-disturbed state on the scale of hours to days.	**5. Habitat structure and function** Detectable impact on habitat structure and function. Time to recover from impact on the scale of days to months, regardless of spatial scale	**5. Habitat structure and function** Impact reduces habitat structure and function. For impacts on non-fragile habitat structure this may be for up to 50% of habitat affected, but for more fragile habitats, to stay in this category the % area affected needs to be smaller up to 20%. Time to recover from local impact on the scale of months to < one year, at larger spatial scales recovery time of months to < one year.	**5. Habitat structure and function** The level of reduction of internal dynamics of habitat may threaten ability to recover adequately, or it will cause strong downstream effects from loss of function. For impacts on non-fragile habitats this may be for up to 50% of habitat affected, but for more fragile habitats, to stay in this category the % area affected up to 25%. Time to recover from impact on the scale of > one year to < decadal timeframes.	**5. Habitat structure and function** Impact on habitat function resulting from severe changes to internal dynamics of habitats. Time to recover from impact likely to be > decadal.	**5. Habitat structure and function** The dynamics of the entire habitat is in danger of being changed in a catastrophic way which may not be reversible. Habitat losses occur. Some elements may remain but will require a long-term recovery period, on the scale of decades to centuries.

Table 5E. Communities. Description of consequences for each component and each sub-component. Use table as a guide for scoring the level of consequence for communities.

(Modified from Fletcher *et al*. 2002)

Sub-component	Score/level					
	1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
Species composition	**1. Species composition** Interactions may be occurring which affect the internal dynamics of communities leading to change in species composition not detectable against natural variation.	**1. Species composition** Impacted species do not play a keystone role – only minor changes in relative abundance of other constituents. Changes of species composition up to 5%.	**1. Species composition** Detectable changes to the community species composition without a major change in function (no loss of function). Changes to species composition up to 10%.	**1. Species composition** Major changes to the community species composition (~25%) (involving keystone species) with major change in function. Ecosystem function altered measurably and some function or components are locally missing/declining/increasing outside of historical range and/or allowed/facilitated new species to appear. Recovery period measured in years.	**1. Species composition** Change to ecosystem structure and function. Ecosystem dynamics currently shifting as different species appear in fishery. Recovery period measured in years to decades.	**1. Species composition** Total collapse of ecosystem processes. Long-term recovery period required, on the scale of decades to centuries
Functional group composition	**2. Functional group composition** Interactions which affect the internal dynamics of communities leading to change in functional group composition not detectable against natural variation.	**2. Functional group composition** Minor changes in relative abundance of community constituents up to 5%.	**2. Functional group composition** Changes in relative abundance of community constituents, up to 10% chance of flipping to an alternate state/ trophic cascade.	**2. Functional group composition** Ecosystem function altered measurably and some functional groups are locally missing/declining/increasing outside of historical range and/or allowed/facilitated new species to appear. Recovery period measured in months to years.	**2. Functional group composition** Ecosystem dynamics currently shifting, some functional groups are missing and new species/groups are now appearing in the fishery. Recovery period measured in years to decades.	**2. Functional group composition** Ecosystem function catastrophically altered with total collapse of ecosystem processes. Recovery period measured in decades to centuries.

Sub-component	Score/level					
	1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
Distribution of the community	**3. Distribution of the community** Interactions which affect the distribution of communities unlikely to be detectable against natural variation.	**3. Distribution of the community** Possible detectable change in geographic range of communities but minimal impact on community dynamics change in geographic range up to 5 % of original.	**3. Distribution of the community** Detectable change in geographic range of communities with some impact on community dynamics Change in geographic range up to 10 % of original.	**3. Distribution of the community** Geographic range of communities, ecosystem function altered measurably and some functional groups are locally missing/declining/increasing outside of historical range. Change in geographic range for up to 25 % of the species. Recovery period measured in months to years.	**3. Distribution of the community** Change in geographic range of communities, ecosystem function altered and some functional groups are currently missing and new groups are present. Change in geographic range for up to 50 % of species including keystone species. Recovery period measured in years to decades.	**3. Distribution of the community** Change in geographic range of communities, ecosystem function collapsed. Change in geographic range for >90% of species including keystone species. Recovery period measured in decades to centuries.
Trophic/size structure	**4. Trophic/size structure** Interactions which affect the internal dynamics unlikely to be detectable against natural variation.	**4. Trophic/size structure** Change in mean trophic level, biomass/ number in each size class up to 5%.	**4. Trophic/size structure** Changes in mean trophic level, biomass/ number in each size class up to 10%.	**4. Trophic/size structure** Changes in mean trophic level. Ecosystem function altered measurably and some function or components are locally missing/declining/increasing outside of historical range and/or allowed/facilitated new species to appear. Recovery period measured in years to decades.	**4. Trophic/size structure** Changes in mean trophic level. Ecosystem function severely altered and some function or components are missing and new groups present. Recovery period measured in years to decades.	**4. Trophic/size structure** Ecosystem function catastrophically altered as a result of changes in mean trophic level, total collapse of ecosystem processes. Recovery period measured in decades to centuries.

Sub-component	Score/level					
	1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
Bio-geochemical cycles	**5. Bio- and geochemical cycles** Interactions which affect bio- & geochemical cycling unlikely to be detectable against natural variation.	**5. Bio- and geochemical cycles** Only minor changes in relative abundance of other constituents leading to minimal changes to bio- & geochemical cycling up to 5%.	**5. Bio- and geochemical cycles** Changes in relative abundance of other constituents leading to minimal changes to bio- & geochemical cycling, up to 10%.	**5. Bio- and geochemical cycles** Changes in relative abundance of constituents leading to major changes to bio- & geochemical cycling, up to 25%.	**5. Bio- and geochemical cycles** Changes in relative abundance of constituents leading to Severe changes to bio- & geochemical cycling. Recovery period measured in years to decades.	**5. Bio- and geochemical cycles** Ecosystem function catastrophically altered as a result of community changes affecting bio- and geo- chemical cycles, total collapse of ecosystem processes. Recovery period measured in decades to centuries.