Researching the Environmental Impacts of the MSC certification programme 2011

A report submitted to the MSC by:

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ACRONYMS

AR	Assessment report (MSC)
B	Biomass
BPA	Benthic protection Area
BSAI	Bering Sea and Aleutian Islands
CAR	Corrective Action Request
CB	Certification Bodies
COP	Code of Practice
CoC	Chain of Custody
DoC	Department of Conservation (NZ)
DFO	Department of Fisheries and Oceans (Canada)
DWG	Deep Water Group (NZ)
EEZ	Exclusive Economic Zone
ETP (TEP)	Endangered, Threatened, Protected (Threatened, endangered & protected)
EU	European Union
FAM	Fisheries Assessment Methodology (MSC)
HFMC	Hoki Fishery Management Company
ITQ	Individual Transferable Quota
IUCN	International Union for Conservation of Nature
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yield
NEA	North east arctic
NGO	Non-government organisation
NPFMC	North Pacific Fishery Management Council (USA)
NRA	Near, Rat, and Andreanof Islands
NS	North Sea
NZ	New Zealand
OMP	Operational Management Plan
P	Principle (MSC)
PI(s)	Performance indicator(s)
RAR	Re-Assessment Report (MSC)
SA / SR	Surveillance audit/Surveillance report (MSC)
SFA	Shrimp Fishing Areas
SH(s)	Stakeholder(s)
SLED	Sea lion excluder device
SSB	Spawning Stock Biomass
SSL(CH)	Steller sea Lion (Critical Habitat)
TA(C)C	Total Allowable (Commercial) Catch (NZ)
TOR	Terms of reference
VMP(s)	Vessel Management Plan(s)

1. EXECUTIVE SUMMARY

1.1. Introduction

1. In 2010 the MSC commissioned MRAG Ltd, in collaboration with Poseidon Ltd and Meridian Ltd Prime, to examine the evidence for environmental impacts related to the MSC certification programme. The terms of reference (TOR) required the contractors to build on previous work examining the environmental benefits of certification, develop scientifically robust tools and replicable methodologies to measure environmental/ecological impacts of certification to the MSC standard, use these tools to assess current evidence about the environmental impact of the MSC programme, and investigate evidence for the wider impacts of certification on environmental sustainability.

1.2. Methodology

2. The consultants developed a **methodology based on the MSC assessment flow**, with monitoring of the pre-assessments, full assessments and surveillance/reassessments (Figure 1). The results provide information on the changes occurring within fisheries pre-certification (between pre-assessment and certification) and post-certification (between certification and the final audit report).

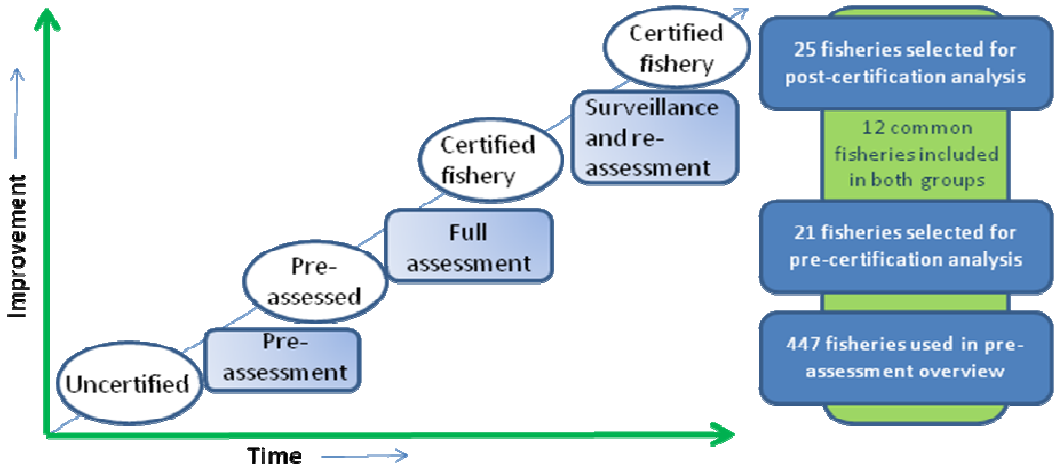


Figure 1. Summary schematic of the MSC assessment flow and study sample

3. **The population of fisheries** available for analysis differs at each of these stages. It is largest for the pre-certification analysis, and smallest for the post certification analysis. Three different samples of fisheries were therefore chosen for the study as follows:

   a) **Pre-certification overview:** Summary information on the types of pre-assessment that have been completed were supplied by certification bodies, contributing to a dataset of 447 pre-assessments;

   b) **Pre-certification sample analysis:** Pre-assessment reports from 21 fisheries were analysed from a sample of 40 that were requested from certification bodies, from fisheries that were subsequently certified and where the fisheries client had agreed

to its use in this study. The pre-certification fisheries were selected to ensure coverage of the following variables of pre-assessment: year of certification; scale of fishery; gear type; species type; geographical region and certification body. The selection overlaps with the fisheries analysed in the post-certification sample.

c) **Post-certification sample:** In the post-certification sample assessment reports, surveillance reports and re-assessment reports were examined from 25 of the 27 certified fisheries that at the time of starting the analysis had undergone 2 surveillance audits. This sample size is reflective of the "young" age of the MSC programme. The Bering Sea and Aleutian Islands Alaska (Pacific) cod freezer longline and Alaska salmon fisheries were not included because of the re-organisation of these fisheries at re-assessment. 11 fisheries were common between the pre-certification and post-certification samples.

Table 1. Fishery samples for pre-certification and post-certification analysis

Certified fisheries with ≥2 surveillance audits	*Included in pre-certification analysis*	*Included in post-certification analysis*
1. American Albacore Fishing Association Pacific (North)		✓
2. American Albacore Fishing Association Pacific (South Pacific)		✓
3. Astrid Fiske North Sea Herring Fishery (formerly the NS Herring Swedish Pelagic Fishery)	✓	✓
4. Australian Mackerel Icefish	✓	✓
5. Bering Sea and Aleutian Islands (BS/AI) Pollock Fishery		✓
6. Burry Inlet Cockles	✓	✓
7. Canadian Northern Prawn Trawl Fishery		✓
8. Gulf of Alaska Pollock		✓
9. Hastings fleet Dover sole (trammel net)	✓	✓
10. Hastings Fleet Pelagic Fishery	✓	✓
11. Lake Hjälmaren pikeperch fish-trap & gillnet		✓
12. Lakes and Coorong Fisheries Southern Australia	✓	✓
13. Loch Torridon nephrops creel fishery		✓
14. New Zealand hoki		✓
15. Norway North Sea saithe	✓	✓
16. Oregon Pink Shrimp	✓	✓
17. Patagonian scallop		✓
18. Pelagic Freezer-Trawler Association North Sea herring	✓	✓
19. Scottish Pelagic Sustainability Group Ltd (SPSG) North Sea herring		✓
20. South Africa hake trawl		✓
21. South Georgia Patagonian toothfish longline	✓	✓
22. South-west handline mackerel	✓	✓
23. US North Pacific halibut		✓
24. US North Pacific sablefish		✓
25. Western Australia rock lobster		✓
26. Aker Biomarine Antarctic krill	✓	
27. Atlantic deep sea red crab	✓	
28. Cornish sardine	✓	
29. Denmark blue shell mussel	✓	
30. Euronor North Sea saithe	✓	
31. Oregon Dungeness crab	✓	
32. Portugal sardine purse seine	✓	
33. Tosakatsuo Suisan pole and line skipjack tuna	✓	
34. Vietnam Ben Tre clam hand gathered	✓	

4. In order to explore the effect of the MSC programme on actual observed environmental change (rather than process-related changes which are expected to lead to environmental impacts), we specifically looked only at the **8 'outcome' performance indicators (PIs) or 'on the water' environmental impacts**. In Principle 1, 'Target species', these are stock status, reference points and stock recovery. In Principle 2, 'Ecosystem', these are retained species, bycatch species, endangered, threatened and protected (ETP) species, habitats and ecosystems. The third, Principle 3, 'Management system', does not have any PIs that relate

to actual environmental outcomes. However, since the current Fisheries Assessment Methodology (FAM) was only introduced in 2009, it was necessary to map earlier assessment tree PIs to the outcome PIs in the current FAM.

5. **Environmental change** was explored in three ways:
    a) Changes in the assessment or pre-assessment **scores** achieved by the fishery for each outcome PI were monitored throughout the fishery's engagement with the MSC. Where scores were not provided explicitly, they were inferred from the comments of Certification Bodies (CBs), at pre-assessment, or from the presence/absence of conditions, at certification and subsequent assessments. Three categories of score were recognised: <60; ≥60 and <80; and ≥80;
    b) Changes in the trends of **indicators**, derived from the literature such as stock status or bycatch, over the time period of engagement with the MSC; and
    c) Changes identified by **stakeholders** through interviews.

6. A key **challenge** of the analysis was mapping the PIs, the indicators and the conditions triggered in the pre-FAM assessments. All of the fisheries considered in the post-certification analysis which had very different assessment trees to that provided in the FAM required this mapping to do done, as their pre-assessment and certification assessment trees differed from the 2009 FAM assessment tree.

7. **Causality** of change was explored through interviews, supported by inferential analysis of the quantitative data. For the interviews three respondents were identified for each of the 25 post-certification analysis fisheries (one client, one NGO and one management) and two respondents for each of the non-overlapping 9 pre-certification sample fisheries. Interviews were secured with 54 organisations across 36 different fisheries. Respondents were asked to identify whether there had been any trends in the outcome indicators, and if so whether these were attributable to the MSC. The interviews contained a combination of open and closed-ended questions for both quantitative and qualitative analysis.

8. **The wider impacts of the MSC certification programme** were explored by interviewing stakeholders about changes observed in certified fisheries, and their opinions about the impact of certification on other, non-certified fisheries, from both fisheries management and ocean sustainability perspectives. Through discussion with MSC staff and stories that had emerged from previous work commissioned by the MSC (Net Benefits, 2009), four hypotheses were developed to investigate the feasibility of deeper analysis of scenarios that may lead to wider impacts from MSC certification.

1.3. Results

1.3.1. Pre-assessment overview

9. Out of the 447 fisheries that have gone through pre-assessments to date (2010), 48% were recommended by CBs to be suitable to proceed to full assessment with caution, with a suggestion that some issues need to be fixed before approaching the assessment. 35% were recommended to proceed without needing any additional work. Nevertheless, significant numbers of fisheries receiving cautionary recommendations, and some 6% of those receiving negative recommendations proceeded to full assessment. Overall, 35% of pre-assessed fisheries have moved through to full assessment.

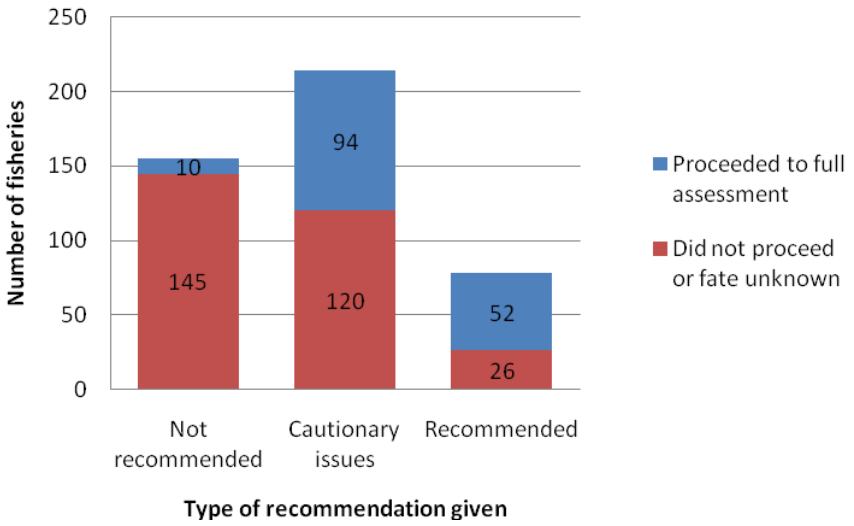


Figure 2. Numbers of fisheries that proceeded, or not, to full assessment and the recommendation that was provided in the pre-assessment (n=447)

10. A very high proportion of the fisheries being pre-assessed (55%) and moving through to full assessment (54%) derive from the North Atlantic. Shellfish fisheries are more likely to be recommended to proceed to full assessment than other types of fisheries.

11. The most significant feature of this analysis is that although roughly equal proportions of large, medium and small-scale fisheries have gone through pre-assessment, small-scale fisheries are significantly the least likely to be recommended to proceed to full assessment, and are least likely to proceed if in receipt of such a recommendation. This may reflect the difficulty of acquiring data from small-scale fisheries, and problems associated with the cost of certification and management systems.

1.3.2. Pre-certification analysis

12. The majority of outcome PIs assessed at pre-assessment remained within the same score category by the time of certification. 59% of the PIs remained ≥80, signifying that performance against the PI was already considered sustainable before entering the MSC certification process. Improvements were evident in 18% of the PIs across the 21 fisheries. Five PIs increased from a fail (<60) to an unconditional pass (≥80) and four PIs increased from a fail to conditional pass (>60 to ≤80). The remaining 22 PIs (13%) improved from a conditional to an unconditional pass.

13. Eight percent of the PIs appeared to decrease in score between pre-assessment and the final assessment (either re-assessment or a surveillance report). This was primarily due to an issue not being fully understood at time of pre-assessment which then triggered a condition for the PI at final assessment. In most cases either better understanding of the MSC methodology by assessment team members or provision of further information during the main assessment process were the cause for the decrease in score.

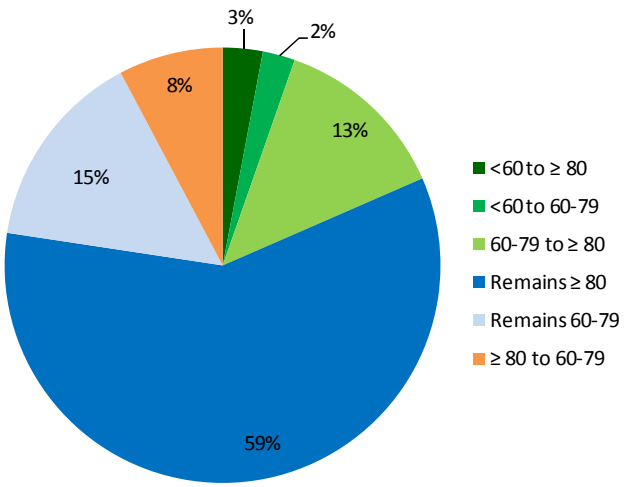


Figure 3. Change between pre-assessment and certification score, amalgamated for all outcome performance indicators across the sample of 21 fisheries

14. The majority of improvements in PI score between pre-assessment and point of certification were evident in the fisheries certified between 2006 and 2010, compared with those certified between 2001 and 2005, but this was not statistically significant (X^2= 4.89, n=168, p = 0.087). Trends were identified in the types of recommendation given at pre-assessment. For those fisheries that received a recommendation to proceed to full assessment, the proportion of outcome PIs scoring ≥80 remained constant between pre-assessment and full assessment. For the fisheries that received a cautionary recommendation to proceed to full assessment, the proportion of PIs scoring ≥80 increased from 41% at pre-assessment to 76% at full assessment. This difference was highly significant; the five fisheries that received a cautionary recommendation increased in PI score significantly more than the remainder 16 fisheries. This demonstrates that there were greater improvements between pre-assessment and full assessment for fisheries that required improvement.

1.3.3. Post-certification analysis

15. In the post-certification analysis, changes over the period from full assessment to final surveillance or re-assessment were assessed (depending on which was later). For stock status there was a significant relationship between the trends of PI scores and indicator trends. There was also significant probability that closure of an 'outcome' condition (i.e. one directly linked to an on-the-water impact) related to stock biomass would be associated with an increase in stock biomass. For the post-certification fisheries, therefore, changes in PI score can be assumed to reflect real changes in environmental performance

16. Under Principle 1, the PI score for stock status increased from <80 to ≥80 in 9% of fisheries and increased within the ≥80 score category for 12% of fisheries. 9% for fisheries experienced a decline from ≥80 to <80, with a further 9% decreasing within the ≥80 score category. Many of these declines were attributable to the fisheries that entered the MSC programme earlier which encountered significant problems on re-certification because later assessments were conducted using more up to date revisions of the assessment methodology.

17. In Principle 2, improvements were seen in 12% of PI scores. Between 75 and 92% of fisheries either improved score or remained within the ≥80 score category for each PI. More improvements were seen in bycatch, habitats and ecosystem categories than in retained and ETP categories.

18. Examination of the reasons for closure of conditions revealed that whereas most closure of stock status (Principle 1) conditions required an increase in stock status, most Principle 2 conditions were closed based on a decrease in the uncertainty over environmental performance. This was generated by improvements in knowledge or management actions.

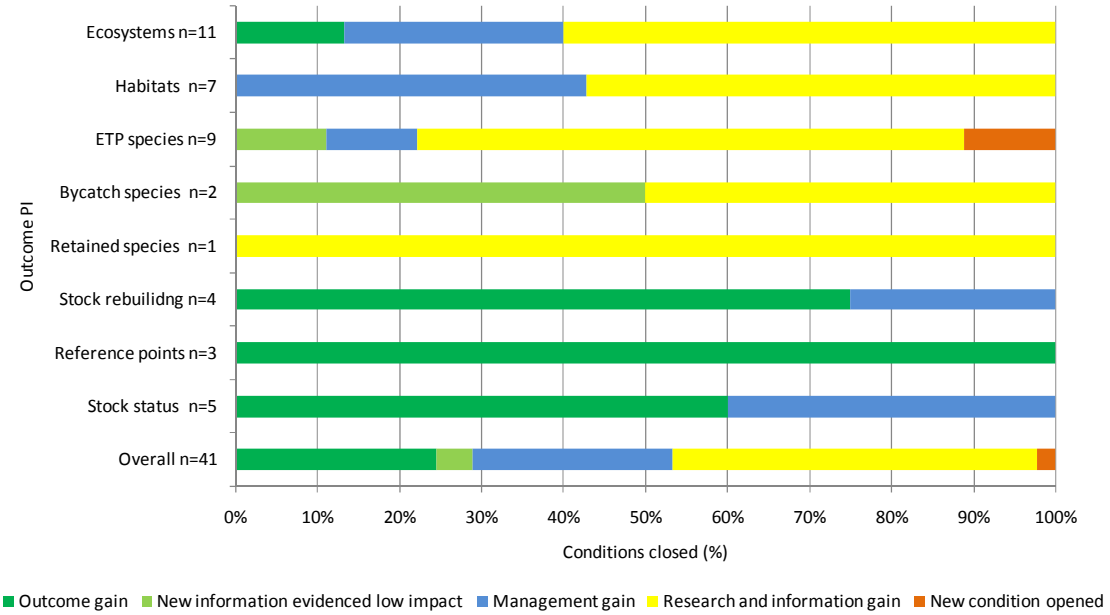


Figure 4. Reasons for closure of conditions related to outcome PIs

1.3.4. Causality: Stakeholder consultation

19. Across all outcome PIs, **35% of respondents suggested that the situation of the fishery had improved**, compared to only 7% of responses that the situation had deteriorated. The three outcomes that were identified most often as having improved were **bycatch, reference points and ETP species**.

20. In situations where stakeholders identified improvement, **49% of respondents attributed the improvement to the MSC certification**, primarily due to there being **new research or information, or changes in management, although in respect of stock status changes in fishing effort were equally important**. Where stakeholders attributed the improvement to activities not linked to the MSC certification, the most important changes identified were changes in fishing practice/effort, new management, and new research. Most improvement was attributed to the post-certification period rather than the pre-certification period. The MSC was judged to have had some influence on the fishery by 44% of respondents. Stakeholders reported that the MSC had raised awareness about Principle 2 impacts in particular

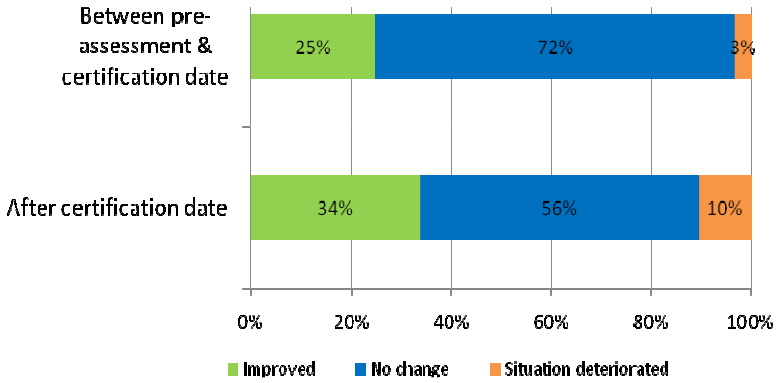


Figure 5. Consultation answers to the question "between pre-assessment, certification date and after certification, have changes taken place in the fishery (stock/environmental)?" (n=53 number of interviews)

1.3.5. Wider impacts

21. In relation to the wider impacts of the MSC programme on non-certified fisheries and on the marine environment, the majority of the stakeholders interviewed believed that the MSC programme had either directly led to, contributed to, or influenced some form of change in non-certified fisheries or the wider environment. Some respondents believed the MSC programme had led to no significant changes. Of those that did make a connection between the MSC programme and wider impacts, many expressed the view that MSC certification was not the sole reason for, or instigator of change. Indeed, for many, those changes that emerged did so in parallel with other initiatives or changes in management philosophy happening at the same time.

22. The majority of respondents did believe that the MSC process leads to actions or outcomes outside the strict boundaries of a certified fishery. Five main areas of change (in non-certified fisheries or potential wider impact upon the environment) emerged:
    a) **Research** – acceleration, focus or expansion of scope in certified and non-certified fisheries;
    b) **Fisheries management** – changes in management of non-certified fisheries;
    c) **Attitudes, mindsets, awareness** – changes leading to higher management or voluntary standards in certified and non-certified fisheries;
    d) **Holistic approaches** – management becoming or staying focused on wider environmental concerns in certified and non-certified fisheries;
    e) **Stakeholder engagement** – improved working relationships leading to positive outcomes in non-certified fisheries.

23. To explore the wider impact of certification, three hypotheses of change were identified and examined:
    a) **Bycatch or habitat impact is reduced in a certified fishery due to new management regulations which are applied equally to other fisheries**. This was investigated through the South African Hake (MSC certified) licensing regulations, which apply also to non-certified fisheries, but no direct correlation with the MSC certification were detected, and through the implementation of protected habitat areas in New Zealand;

b) **Certification of a fishery targeting a particular stock encourages certification of other fishery units for that stock, with a decreasing number of unsustainable practices being detected**. Data from the North Sea herring fishery assessments suggest that there is some evidence to support this theory of change.

c) **Economic incentives emerging from certified fisheries catalyse improvements in non-certified fisheries as they prepare for certification**. The cod fishery certifications may be candidates for this approach, which could involve deriving changing market prices, although this was not shown to be effective in the present study.

1.4. Conclusions

24. Taken as a whole, the results of the study indicate that significant numbers of fisheries are finishing the pre-assessment process with recommendation to proceed, but with caution. These fisheries are making the largest improvements prior to certification, whereas those receiving simple recommendations to proceed have not made similar improvements as they appear to have little incentive to make any changes prior to full assessment.

25. The greatest quantified outcome changes are being made in stock status, which is the PI which has been most closely monitored and for which more information is available. The most significant improvements in fisheries are being made post-certification and are linked to specific conditions. In Principle 2 outcomes, there are some examples of 'on the water' improvements, such as reduction of bird bycatch in South Africa hake, reduction of bycatch of Chinook salmon in the Gulf of Alaska pollock fishery, reduction of effort in the Bering Sea and Aleutian Islands pollock fishery, reduced bird mortality in Patagonian toothfish in addition to the elimination of the discarding of hooks and implementation of protected areas. However, the majority of low scores are associated with uncertainty about impacts, and improvements in scores are a result of increased certainty that impacts are low (through improved research as well as implementation of management measures).

26. After certification, fisheries continue to improve (Figure 6) encouraged by the use of conditions. The trend in improvement can be tracked through changes in FAM PI scores. This suggests that fisheries receiving a conditional pre-assessment recommendation will improve from 50% of their outcome PIs scoring ≥80 at pre-assessment to 70% of outcome PIs scoring ≥80 at certification, and will make further improvements over the subsequent 5-10 years until some 91% of outcome PIs score ≥80.

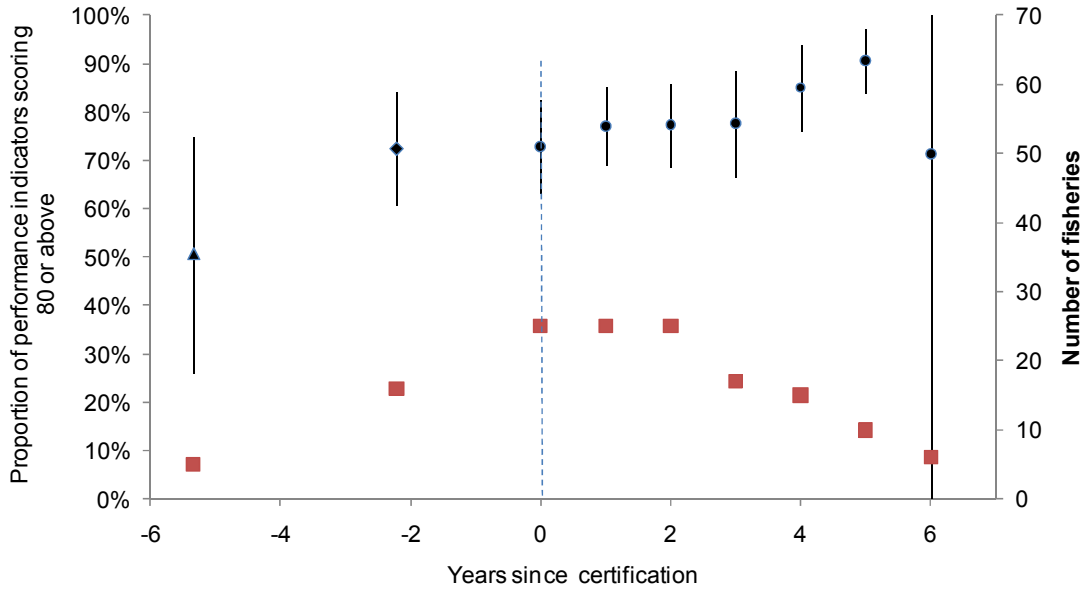


Figure 6. Percentage of total FAM PIs scoring ≥80 using full data set of fisheries
Stock rebuilding was not included to avoid duplication of stock status scores. 95% binomial CIs on proportions are shown (Zar, 1999). Red squares = number of sample fisheries at each point in time; triangle = fisheries receiving recommendations at pre-assessment; diamond = fisheries receiving no recommendations at pre-assessment; blue circles =fisheries in post-certification sample. Points before zero are from the pre-assessment sample. Note: The decline in performance in year 6 is predominantly due to the presence of the earliest certified fisheries, and although it may be expected that some fisheries will continue to attract new conditions after re-assessment, this situation may improve as these older fisheries are joined by the newer assessments.

27. There is wide acceptance that ecolabel certification schemes such as the MSC increase major buyer and consumer awareness and provide tools to turn awareness into action, improve dialogue between stakeholders, and foster significant change in attitude in the management of natural resources, particularly in raising awareness of ecosystem impacts of fisheries (Ozinga, 2004). Many stakeholders coming from different interest groups cited engagement in the MSC programme as useful for advancing their interests and in improving the management of the fishery. The fact that about half of the interventions leading to improvements in fisheries were attributed to the activity of certification suggests that stakeholders perceive the programme to generate positive benefits.

28. In summary, analysis of the evidence and stakeholder views confirms that 'on the water' environmental improvements have occurred in MSC-certified fisheries and these improvements are incremental throughout a fishery's involvement with the programme. These changes are closely linked to the closure of conditions that are raised during certification and subsequent surveillance, as well as through the requirements identified during the pre-assessment stage.

2. INTRODUCTION

2.1. Background

The overexploited state of many fisheries has been well publicized over the last decade (FAO, 2010). Although recent reviews have identified that in some areas exploitation rates have declined and some stocks are being managed sustainably (Worm et al., 2009, Wakeford et al., 2009, Beddington et al., 2007, Coll et al., 2008, Branch et al., 2011), estimates of the number of stocks that are overexploited and require rebuilding are still high (Worm et al., 2009, Parkes et al., 2010). Against this background market-based initiatives for fishery products have proliferated, seeking to educate and influence customer choice towards choosing sustainably wild caught seafood (Jacquet and Pauly, 2007). These can be roughly classified as either consumer awareness schemes which often include the publication of consumer choice guides, such as the Monterey Bay Aquarium seafood wallet card, and third party certification schemes, such as the MSC (Parkes et al., 2010). The MSC was created out of a desire to realise the dual vision of securing long term supplies of fish for global markets, and creating a viable, alternative tool to help halt or reverse the decline in global fish stocks.

Fishery certification by the MSC began in 1999 and now approximately 12% of the world's edible wild caught fish are engaged in the programme (either certified or in assessment), including ~40% of the global prime whitefish catch (cod, Alaska pollock, hake, haddock, hoki and saithe) (MSC 2010; Parkes *et al.,* 2009). The MSC uses a voluntary, market-based policy instrument to pursue its vision – an eco-labelling programme that employs an internationally recognised sustainability standard (the Principles and Criteria for Sustainable Fishing) against which fisheries are measured. The MSC is fully consistent with the FAO guidelines for ecolabels for marine capture fisheries (WWF, 2008), which specify requirements for each of three areas: (i) the management systems, (ii) the fishery and associated "stock under consideration" for which certification is being sought and (iii) consideration of serious impacts of the fishery on the ecosystem (FAO, 2008). The fundamental Principles on which the MSC certification standard of sustainability is based adhere to these requirements closely; Principle 1: maintaining healthy target fish populations; Principle 2: understanding and maintaining the integrity of marine ecosystems; and Principle 3: implementing effective fisheries management systems.

If a fishery's performance is high enough to meet the MSC standards unconditionally, it need not make any improvements to be certified by the MSC. Nevertheless, there is an expectation from many stakeholders that fisheries certified by the MSC should be showing improvements in their sustainability, particularly since a criticism of the MSC is that it allows certification of fisheries that do not meet the sustainability expectations of those stakeholders (Lankester, 2008). Furthermore, most fisheries are certified with one or more "conditions" for improvements – additional research or management action – that should lead to an improvement in sustainability. The certification and assessment methodologies do not seek to measure such improvements directly, and as yet the MSC has not developed a framework or routine procedure for doing this.

Although certification and consumer choice schemes have had some success in raising consumer awareness about environmental issues (Jacquet and Pauly, 2007), it has often been difficult to detect actual changes in environmental sustainability that can be attributed to a particular scheme (Jacquet et al., 2009). To date, only Agnew *et al.* (2006) and the MSC (2009) have attempted to document the direct impacts of an eco-label certification on fisheries. Both of these review the impacts of the MSC programme of certification. Agnew *et al.* (2006) provided a broad impartial survey with quantitative review of ten fisheries for which a total of 89 environmental gains were reported. However, they

were only able to review gains made following certification, and were unable to analyse pre-certification improvements that may have been stimulated by interest in eventual certification.

The major conclusions from the Agnew *et al.* study were:

- All certified fisheries showed some environmental gain, evidenced primarily by changes in the assessment scores. Some gains were seen in areas where there were no conditions, but most of the significant gains were associated with conditions. In general deriving direct correlations between changes in scores and actual, in the water changes to performance, proved very difficult to achieve.
- Environmental gains were classified as institutional change (that might lead to environmental gains), research (that should lead to gains if implemented by management), operational action (new activities that would be expected to lead to gains) and operational gains (actual observed changes). Examples of operational gains include a reduction in discards, demonstrated return to sustainability of bycatch species, continued absences of Illegal, Unreported and Unregulated fishing and recovering benthic diversity in protected areas.
- In the Agnew et al (2006) study, operational gains accounted for 18% of all gains, and of these gains, 65% were attributed partially/mainly to certification. Fisheries allocated a higher number of conditions resulted in greater gains and, similarly, greater gains were observed in older fisheries and in the most controversial fisheries.

The MSC's certification standard has a pass-fail threshold, in contrast to a continuous improvement scheme. As such, as long as a fishery meets the required standard for each criterion there is no requirement for improvements in fishery's performance in relation to its impact upon the environment. Thus the potential for the ecolabelling scheme to influence real and positive environmental change may depend on the interest that a certified fishery system has to improve its performance prior to assessment. Indeed, the MSC's "theory of change" suggests that the majority of environmental improvements may be made prior to formal assessment, as fisheries seek to meet the standard (MSC, 2011). This is supported by recent theoretical studies suggesting that fisheries improve up to the benchmark required by certification, providing they were initially close enough to that level (Parkes et al., 2010, Tlusty, 2011).

The extent to which certification acts to incentivise improving performance in fisheries has not been easy to test, partly because a large proportion of the improvement is in fisheries management processes (e.g. greater engagement among fishers, government and other stakeholders), partly because of the large number of changing factors that influence marine ecosystems and fishery markets, and partly because it is difficult to develop consistent indicators of change to track fishery performance prior to engagement with a certification scheme (Agnew et al., 2006). Also, the MSC has significantly revised its certification methodology since the majority of these studies were undertaken, creating more explicit performance criteria directly linked to scientifically defined environmental outcomes (MSC, 2010a). This revision has improved the robustness and consistency of application of the MSC's standard, particularly with respect to the impact of the fishery on the ecosystem (Principle 2), which has been a previous criticism of the MSC (Ward, 2008, Ward, 2008a).

The MSC (2009) published a report titled *Net Benefits: The first ten years of MSC certified sustainable fisheries*[1], which drew on a number of preceding studies undertaken by the MSC, cataloguing the qualitative benefits In this report the MSC posed the question: *"Does certification make a fishery more sustainable, or does it simply reward best practice that exists already?"* The conclusion was that, despite previous work demonstrating environmental improvements in MSC certified fisheries, questions still remain over the causal links to the MSC certification programme.

[1] http://www.msc.org/documents/fisheries-factsheets/net-benefits-report/Net-Benefits-report.pdf/view

2.1.1. Objectives

In light of the continued need to examine what improvements are being made to fisheries certified by the MSC, in 2009 the MSC commissioned MRAG, Poseidon and Meridian Prime to investigate existing assessment and pre-assessments with the following TORs.

1. Build on previous work examining the environmental benefits of certification;
2. Further develop scientifically robust tools and replicable methodologies to measure environmental/ecological impacts of certification to the MSC standard that will build a strategic framework for the future measurement and analysis of environmental impacts of the MSC programme;
3. Catalogue and assess, by fishery type or other logical groupings, current evidence about environmental impact of the MSC programme using the tools and methodologies developed under Objective 2;
4. Investigate evidence for the wider impacts of certification on environmental sustainability;
5. Further contribute to building the ecological case for certification through contributions to the peer reviewed literature.

Given the results of previous studies, this study focussed on outcome gains – that is changes in the actual status, or perceived status, of the target stock, retained species, bycatch, endangered/threatened/protected species, habitats and ecosystems. This approach followed the framework defined by the MSC's new Fisheries Assessment Methodology (2009).

The study used, as source material, assessments and pre-assessments of fisheries within the MSC programme.

Before entering assessment, most fisheries undertake a pre-assessment review. This may be undertaken by a CB, but can be undertaken by anyone. The MSC identifies, but does not completely prescribe, a methodology for pre-assessments.

Fisheries seeking certification may need to be improved to reach the full MSC acceptable standard (a score of more than 80 on each PI). Improvement may take place prior to a pre-assessment, after a pre-assessment or after certification, assuming that the fishery meets the minimum acceptable standards and passes assessment. If improvement happens after certification it will usually be expected to be linked to conditions of certification. However, a fishery may generate improvements independent of certification conditions, simply because it is being well managed. A fishery need not attract conditions – if it meets the standard of 80 or more on all PIs it will not attract conditions.

At assessment, fisheries are assessed against a number of Performance Indicators (PI), which are scored between 60 (the minimum acceptable performance[2]) and 100 (top performance, generally equivalent to world best practice). Fisheries may only be certified if they score more than an average of 80 (global best practice) on each of the three Principles, and meet the minimum acceptable standard for all individual PIs. If the fishery scores less than 80 for any PI, it is required to improve its performance on that PI to the point at which it will score 80. The method used to acknowledge and address low performance involves the raising of a 'condition'; a specified action which the fishery must complete within a recommended timeframe in order to maintain their certification. Fisheries are subject to annual surveillance audits in order to confirm that they continue to meet the sustainability standard, or are making progress to improve their performance where necessary. If a fishery fails to meet the requirements within the specified time frame the certification may be revoked.

[2] As defined in MSC's "Theory of Change", http://www.msc.org/documents/msc-brochures/msc-theory-of-change

As stated, fisheries are subject to annual surveillance at which their progress against conditions is monitored in addition to any other aspects affecting sustainability. A certificate only lasts for 5 years, at which point fisheries must be re-assessed in full.

2.1. Introduction to report

This final report concludes all elements of the research into the environmental gains of the MSC programme. Two interim reports were submitted in January and March 2011.

3. METHODOLOGY

3.1. Overall approach

The project methodology was devised using a three phase approach:

- Phase 1 examined the performances of fisheries pre-certification, using pre-assessment and assessment reports
- Phase 2 examined the performance of fisheries post-certification, using assessment reports, surveillance reports and re-assessment reports
- Phase 3 examined the wider impacts of the certification programme on associated but uncertified fisheries

The MSC programme is currently in a state of almost exponential increase, with new fisheries being certified and entering agreements with certifiers for assessment weekly. It was important, therefore, to identify firstly the population of fisheries assessments that could be analysed for the different tasks. To do this, fisheries were divided into four categories (Figure 7):

Category 1 includes all fisheries that have undergone a pre-assessment. There are more than three times the number of fisheries in Category 1 than those that are in assessment or have already been certified. As all fisheries in categories 2-4 have also had a pre-assessment, they also fall within Category 1.

Category 2 includes all fisheries that are currently undergoing assessment.

Categories 3 and 4 are similar in that they form the smallest subset of fisheries, those that have had an assessment, and in all likelihood a pre-assessment, and have been certified. For the purposes of this study, however, it was necessary to have some post-certification reports to analyse. Category 4 therefore, is the subset of fisheries which have had 2 or more surveillance audits.

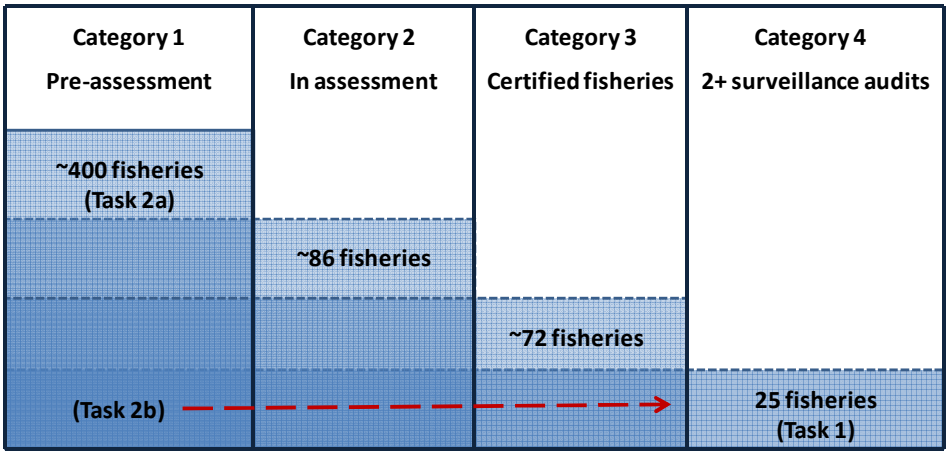


Figure 7. The four categories of fisheries involved in the MSC programme and their relation to the study methodology (2010)

Previous studies (Agnew *et al.,* 2006) have shown that in the past many conditions have been attached to changes in process, research etc, and only a few to actual outcomes. While progress against the former issues may eventually lead to better fisheries management and ecological outcomes, the present study deliberately focussed exclusively on changes regarding the outcome of

an issue. As an example, in order to identify an environmental impact involving the reduction of trawling on hard substrata, the primary interest or concern is the actual change to the damage being done (e.g. proportion of hard substratum impacted) rather than the research (identifying where the hard substrata lie) or the process (generating a review committee or introducing licence conditions), however much they may contribute to an actual change in ecological outcome.

The present study, therefore, focussed only on those performance indicators describing 'outcome results' in order to specifically explore the *environmental impacts* [3] , i.e., operational gains (or losses) which are 'real' or 'on-the-water' outcomes or results of actions (Agnew *et al.,* 2006). Other factors – research and management – were not ignored, but were considered as factors that may influence changes in outcome, rather than environmental impacts in their own right.

Although many of the assessments that were analysed used pre-FAM trees[4], for consistency this study related all its analysis to relevant PIs identified from the MSC FAM framework[5], i.e.

Principle 1:
- 1.1.1 Stock status
- 1.1.2 Reference points
- 1.1.3 Stock rebuilding

Principle 2:
- 2.1.1 Retained species
- 2.2.1 Bycatch species
- 2.3.1 ETP species
- 2.4.1 Habitats
- 2.5.1 Ecosystems

No PIs were included for analysis under Principle 3 due to the fact that this principle focuses on management results which do not fall under the definition of a quantifiable 'outcome result'.

It was sometimes necessary to breakdown the FAM PIs ETP (2.3.1) and Ecosystems (2.5.1) into sub-categories in our analysis. For ETP species, the sub-categories included: Fish; birds; and marine mammals and for ecosystems the sub-categories were biodiversity and ghost fishing. This was due to the fact that the fisheries for each of the ETP section could all be having varied levels of impact and that species assessments are undertaken separately for them, generally speaking. For ecosystems, the sub-categories were perceived to be the two occasions where a quantitative assessment was available to analysis and that it was necessary in this study to investigate both indicators (biodiversity and levels of ghost fishing).

3.2. Analysis of pre-certification changes

This analysis sought to answer the question*: "are significant outcome-related environmental improvements being implemented by fisheries prior to certification that can be attributed to their identification in pre-assessment reports?".*

Two research tracks were followed in this task:

[3] Termed "operational – result gain" in Agnew *et al.* (2006)

[4] The FAM "tree" is the name given to the illustration that outlines the assessment levels involved in the assessment process, for a detailed description of the MSC FAM tree refer to the MSC "Fisheries Assessment methodology and Guidance to certification bodies" (p. 9-11).

[5] http://www.msc.org/documents/scheme-documents/methodologies/Fisheries_Assessment_Methodology.pdf

1. a high level summary of all pre-assessments that have been completed to date. This includes fisheries that are currently in the full assessment process and those that have not entered the full assessment process.
2. an analysis of the changes that have taken place within a fishery from pre to full assessment stages. This includes only fisheries that have achieved MSC certification.

3.2.1. Overview of pre-assessments

Pre-assessments are confidential, and although the MSC has recently agreed a Technical Advisory Board Directive to require pre-assessments to be made available (still confidentially) to the MSC at the time that a fishery enters certification, for the many fisheries that do not enter certification following a pre-assessment no record exists except with the CB and the Client.

Summary information on all pre-assessments was requested from current and past CBs. A data collection format for such information was first applied by the MSC in late 2008. Minor modifications were made to the data collection format within this project's data request to bring the requested information into line with recent MSC policy development and the objects of our inquiry. Additional data requested included year of pre-assessment (MSC fiscal year), scale of fishery (according to catch volume and vessel capacity), gear type, species type, and geographical region.

Data supplied by certification bodies to the MSC in early 2009 were included in individualised data requests to each CB. Each CB was asked to provide: 1) an update; 2) additional information; or 3) if no data previously supplied to the MSC, a full set of data as set out in the standardised data collection form.

Analysis involved interrogating the data according to the variables set out in the data collection form. The focus of reporting is upon the results of evaluating the proportion of fisheries by region, gear, scale or species type that were recommended to proceed into full assessment, those that had cautionary issues to attend to before proceeding and those not recommended to proceed. Reporting also focuses upon the outcomes of these recommendations, i.e. the proportions within each category that did or did not proceed to full assessment.

3.2.2. Analysis of pre-assessment reports

40 fisheries that progressed from pre-assessment to full assessment were selected to form the basic population of fisheries for this task. The intention was to ensure a reasonable variety of fisheries within the sample. Selection was based on consideration of the 71 fisheries that had gained MSC certification at the initial data gathering stage against the criteria presented in Table 4.

The CB, which on occasion changed between pre-assessment, main assessment and surveillance, was also noted. While this variable should not impact the assessments undertaken against the MSC standard, this resulted in analysing fisheries pre-assessments and assessments from more CBs.

With a population of 40 fisheries selected, the pre-assessment reports were requested from the CBs. Assurances were given that the confidentiality of the pre-assessments would be maintained. This proved too many to analyse within the time frame of the project, so a second subset was chosen, of 21 fisheries for detailed analysis. 12 of the fisheries were also included in the analysis of post-certification actions (section 3.3).

The following tasks were undertaken:

1. **Mapping of pre-and main PIs**: outcome indicators were mapped from the existing assessment trees of the older fisheries to the newer FAM outcome PIs. In many cases there were multiple potential PIs in the old trees that were equivalent to a single FAM outcome PI. The newer pre-assessments generally used the FAM structure, so mapping was easier. A single score was assigned for each FAM PI equivalent. No scores are available for most pre-assessments, so we colour coded both pre-assessment and main assessment to reflect

whether the status failed, is a conditional pass or is an unconditional pass - see Table 2 below for a theoretical example.

2. **Determining whether changes in score reflect real changes "in the water"**. The PI score trends were objectively examined and compared to actual data on indicator trends.
3. **Pre-assessment issues raised and recommendations**. We examined the issues raised in the pre-assessment. In most pre-assessments reviewed these have been raised as weaknesses or concerns which then feed into the recommendations. These recommendations are simply a risk assessment, providing the client information on whether to proceed to full assessment or not. These recommendations cannot include advice on how to address weaknesses, only on the standards that need to be attained. They can, however, suggest timelines (e.g. to progress immediately or delay until certain information becomes available).
4. **Attribution of change**: this key part of the process was based upon direct discussions with the client fishery managers who will be contacted by telephone and email. Where necessary external bodies were also consulted e.g. fisheries managers and scientists in order to fully attribute the drivers for changes and to quantify the role of the MSC process in this.

Table 2. Example of pre-assessment / main assessment outcome status comparison (theoretical)

FAM PI	Original FCM PI	Pre-assessment March 2003	Main assessment Oct 2005
1.1.1 Stock status	1.1.6.1	Stock assessment - above B_{pa} & below F_{pa}	90
1.1.2 Reference points	1.1.3.1	Ref pts not set	80
1.1.3 Stock rebuilding	-	N/A	N/A
2.1.1 Retained species	-	Assessed as part of bycatch species	
2.2.1 Bycatch species	2.1.5.3	Not quantified but no issues raised	85
	2.1.2.2	Not quantified but no issues raised	80
2.3.1 ETP species	2.2 2.2.1.3	ETP species & risks identified	75
2.4.1 Habitats	2.1.5.4	Potential impacts highlighted	90
2.5.1 Ecosystems	2.1.3.2	Gear loss considered very rare	80
	2.1.5.2	Not quantified but no issues raised	90

Colour key:	Fail (<60)	Conditional pass (60-79)	Unconditional pass (80 - 100)

Quantification at pre-assessment level is normally undertaken based on a score boundaries i.e. <60 signifies outright fail, 60-79 a conditional pass and ≥80 an unconditional pass. Specific scores are then given at main assessment stage. Analysis of change is therefore focused on changes across these boundaries, and not changes within boundaries. For presentation purposes colour coding has been established for such changes as shown in Table 10.

The full list of candidate pre-assessments obtained from CBs is presented in Annex D. The 21 fisheries taken forward for analysis are shown in Table 3. The chosen fisheries were determined based on which pre-assessments were provided while ensuring a sample across time of pre-assessment, time of certification, scale of fishery, gear type, species type, geographical region and CB. The sample of 21 pre-assessments taken forward for analysis consists of approximately half (12) post-certification fisheries and half (9) pre-assessment only fisheries.

Table 3. Fisheries included within the pre-assessment analysis

MSC certified fisheries	Pre-Assessment Date	Certification Date	Landings(t)
Fisheries in pre-assessment and post-certification			
Astrid Fiske North Sea herring	Mar 2007	Jun 2008	5,000
Australia mackerel icefish	Oct 2003	March 2006	1,200
Burry Inlet cockles	Mar 2000	Apr 2001 (1) / Feb 2007 (2)	3,500
Hastings fleet Dover sole (trammel net)	Mar 2003	Sept 2005	72
Hastings fleet pelagic herring and mackerel	Mar 2003	Sept 2005	10
Lakes and Coorong, South Australia	Jan 2003	Jun 2008	-
Norway North Sea saithe	Mar 2004	Jun 2008	296,000
Oregon pink shrimp	Apr 2004	Dec 2007	5,700
Pelagic Freezer-Trawler Association North Sea herring	Sep 2002	May 2006	160,000
South Georgia Patagonian toothfish longline	Dec 2000	Mar 2004 (1) / Sept 2009 (2)	3,500
South-west handline mackerel	Mar 2000	Aug 2001 (1) / Feb 2007 (2)	1,750
Patagonian scallop	Jul 2004	Dec 2006	45,000
Fisheries in pre-assessment analysis only			
Aker Biomarine Antarctic krill	Aug 2008	June 2010	55,000
Atlantic deep sea red crab	Jul 2008	Sept 2009	2,688
Cornish sardine	Mar 2004	Jun 2010	1,248
Denmark blue shell mussel	Mar 2008	Jan 2010	30,000
Euronor North Sea saithe	Jan 2009	Mar 2010	16,767
Oregon Dungeness crab	Nov 2003	Nov 2010	10,500
Portugal sardine purse seine	Dec 2007	Jan 2010	78,000
Tosakatsuo Suisan pole and line skipjack tuna	Mar 2008	Nov 2009	4,000
Vietnam Ben Tre clam hand gathered	Jun 2007	Nov 2009	8,660

The sample of fisheries represents coverage across species groups, gear types, scale of landing and vessel scale (Table 4). However due to the fact that the majority of all MSC certified fisheries are located in the North Atlantic, together with the fact that Moody Marine have undertaken such a high proportion of assessments, the sample is dominated by fisheries from this geographic region and CB.

Table 4. Number of pre-assessment analysis fisheries across different attributes

Attribute	# of fisheries		Attribute	# of fisheries	
Species group	pelagic	8	Gear	trawl	8
	shellfish	8		net	4
	demersal	4		line	3
	mixed	1		pot	2
Scale of landings	large	6		other	4
	medium	8	Vessel scale	large	11
	small	7		medium	2
Geographic region	North Atlantic	12		small	8
	South Pacific	4	Certification Body	Moody Marine	12
	North Pacific	2		SCS	4
	South Atlantic	2		FCI	1
	Inland	1		MEP	1
Client	Industry	15		MRAG	1
	Management	6		OIA	1
				Tavel	1
Pre-assessment conclusion	Recommended to proceed straight into full assessment				16
	Recommended to address issues prior to entering full assessment				5

The sample of 21 fisheries includes a broad spectrum of time, both in terms of the pre-assessment and certificate dates (Figure 8) and the time period between these processes (Figure 9). The sample for pre-assessment analysis therefore includes both 'first generation' fisheries and 'next generation' fisheries; 29% of the fisheries in the sample were certified in 2010, furthermore 57% were certified between 2008 and 2010.

Within the sample of 21 fisheries, the average time period between pre-assessment and award of MSC certificate was 2 years and 9 months. This compares well with the average of 2.5 years, based on a sample of 56 fisheries for which the MSC have pre-assessments. The majority of fisheries in our sample took 1-2 years to progress from pre-assessment to certificate award. Two fisheries took six-seven years for this process. All, except one, of the fisheries entering pre-assessment in 2007 were awarded certificate within 1-2 years.

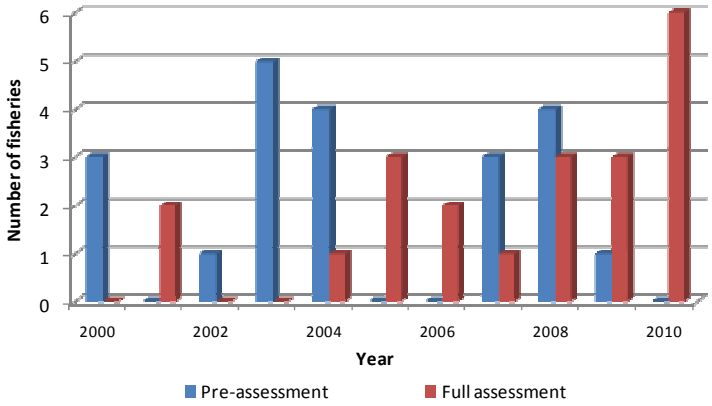


Figure 8. Year of pre-assessment and full assessment (certificate awarded) for the 21 pre-assessment fisheries in the sample

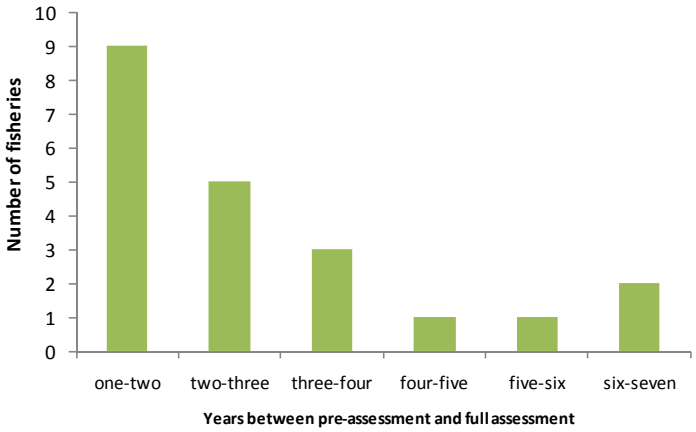


Figure 9. Number of years between pre-assessment and full assessment (certificate awarded)

3.3. Analysis of post-certification data

Fisheries were chosen based on the criteria that they had available a minimum of one assessment report in addition to two or more surveillance reports (Category 4 in Figure 7). In an attempt to increase sample size the study also considered certified fisheries with only one surveillance report provided they had a condition regarding an outcome PI raised during certification and closed out by the time the surveillance report took place (within Category 3 in Figure 7), however there were no fisheries which met this criterion.

At the commencement of the project (15th September 2010) there were 27 fisheries which met the selection criterion (Table 6). Two of these were not included: Bering Sea and Aleutian Islands Alaska (Pacific) cod freezer longline and Alaska salmon. The cod fishery was not included as it has since been recertified under a general unit of certification which includes longline, jig and pot methods, and the original certificate has been regarded as redundant for comparison with the new assessment. Alaska salmon was also discounted due to the difficulties in mapping of indicators and conditions in the original 2000 assessment. Therefore, a total of 25 fisheries were included in Task 1.

Where possible, results were analysed in terms of the fishery type, specifically within the categories in Table 5. These categories are fairly broad given the limited number of data points (fisheries) available for analysis in Tasks 1 and 2. For 'management region', in order to obtain a large enough sample; all those regions outside of the US and EU were pulled into one category of 'other'. For details of where these regions are please refer to Table 6.

Table 5. Identified 'typologies' for possible use in analysis[6]

Scale of landings	Large scale commercial, medium scale, small scale
Species group	Demersal, pelagic, and crustacean/shellfish, other
Gear type	Demersal trawl (Dt), Pelagic trawl or seine (Pt/s), longline (l), Passive (P), Benthic trawl (Bt), Mixed (M)
Management region	EU, US, other

Details of these fisheries and the categories they fall into are provided in Table 5. Although these were selected because they represented the best time series available, the sample provided a good distribution across the categories fishery scale, species group, gear type and management region (see Figure 10).

Table 6. Fishery sample for analysis of post-certification impacts

Certified Fisheries with 2+ surveillance audits	*Species group*	*Management region*	*scale of landings[7]*	*vessel scale[8]*	*gear*	*CB*
1. American Albacore Fishing Association Pacific (North)	pelagic	US	large	medium	line	Moody
2. American Albacore Fishing Association Pacific (South Pacific)	pelagic	US	large	medium	line	Moody
3. Astrid Fiske North Sea Herring Fishery (formerly the NS Herring Swedish Pelagic Fishery)	pelagic	EU	large	large	trawl	FCI

[6] Only these divisions were listed because the categories formed equally distributed groups for analysis purposes, other categories only contained approximately one or two fisheries thus were listed under 'other'.
[7] small = <2000t; medium = 2,000 to 30,000t; large = >30,000t
[8] small = no vessel or <12m; medium = 12-25m; large = >25m

4. Australian Mackerel icefish	pelagic	Australia	small	large	trawl	SCS
5. Bering Sea and Aleutian Islands (BS/AI) Pollock Fishery	demersal	US	large	large	trawl	SCS
6. Burry Inlet Cockles	shellfish	EU	small	small	other	Moody
7. Canadian Northern Prawn Trawl Fishery	shellfish	Canada	large	medium	trawl	Moody
8. Gulf of Alaska Pollock	demersal	US	large	large	trawl	Moody
9. Hastings fleet Dover sole (trammel net)	demersal	EU	small	small	net	Moody
10. Hastings Fleet Pelagic Fishery	pelagic	EU	small	small	net	Moody
11. Lake Hjälmaren pikeperch fish-trap & gillnet	freshwater/ diadramous	Sweden	small	small	pot	Moody
12. Lakes and Coorong Fisheries Southern Australia	mixed	Australia	small	small	other	SCS
13. Loch Torridon nephrops creel fishery	shellfish	EU	small	small	pot	Moody
14. New Zealand hoki	demersal	New Zealand	large	large	trawl	Moody
15. Norway North Sea saithe	demersal	Norway	large	large	trawl	Moody
16. Oregon Pink Shrimp	shellfish	US	medium	medium	trawl	Tavel
17. Patagonian scallop	shellfish	Argentina	medium	large	trawl	OIA
18. Pelagic Freezer-Trawler Association North Sea herring	pelagic	EU	large	large	trawl	Moody
19. Scottish Pelagic Sustainability Group Ltd (SPSG) North Sea herring	pelagic	EU	medium	large	trawl	FCI
20. South Africa hake trawl	demersal	South Africa	large	large	trawl	Moody
21. South Georgia Patagonian toothfish longline	demersal	EU	large	large	line	Moody
22. South-west handline mackerel	pelagic	EU	small	small	line	Moody
23. US North Pacific halibut	demersal	US	medium	large	line	SCS
24. US North Pacific sablefish	demersal	US	medium	large	line	SCS
25. Western Australia rock lobster	shellfish	Australia	medium	medium	pot	SCS

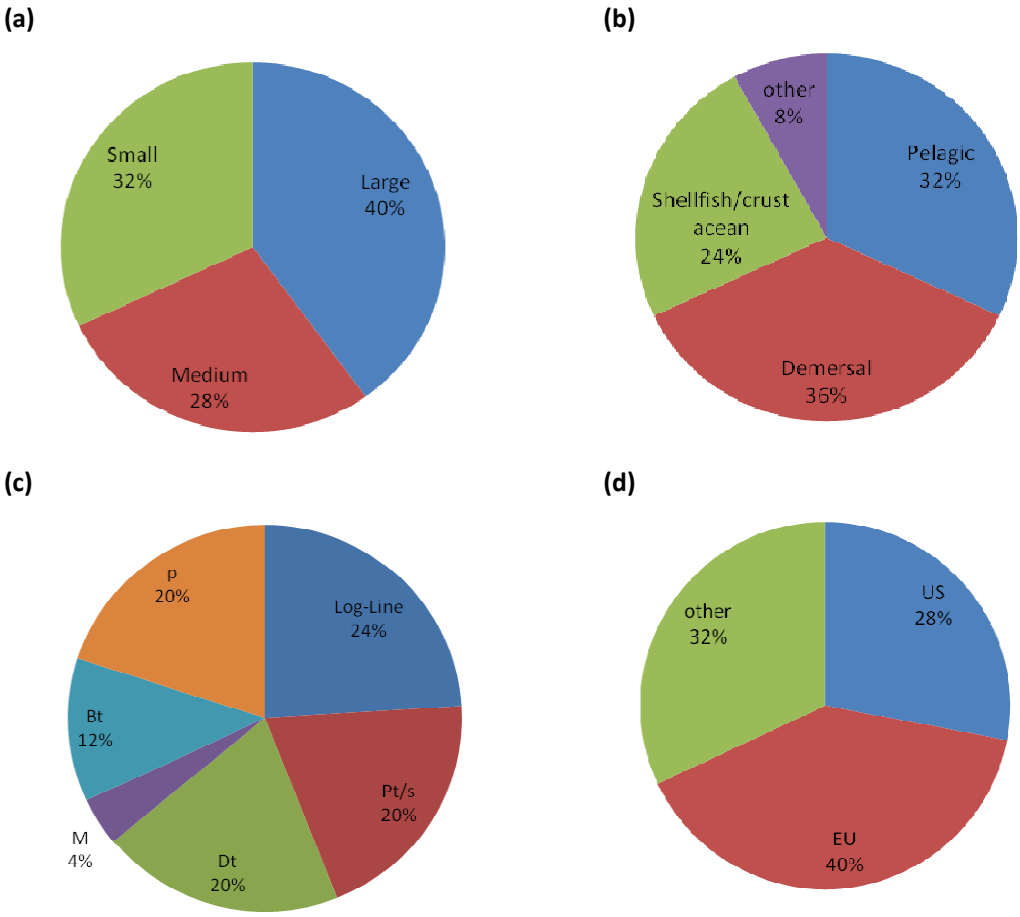


Figure 10. Overview of sample: a) scale of landings, b) species group, c) gear type and d) management region

Once the 25 fisheries had been identified, a standard analysis was carried out for each case study in order to provide comparable results for use in meta-analyses. To achieve an unbiased assessment of performance, several aspects were considered for each fishery. The process included:

1. Gathering all available documentation including assessment reports, surveillance reports and reassessment reports in addition to other data sources such as stock assessments and peer reviewed articles (other information sources were only consulted where necessary to provide additional information when evidence was not available in the MSC reports themselves or when clarifications were required);
2. In order to conduct a standardised analysis the fisheries were reviewed in relation to the FAM PIs. Many of the fisheries had used pre-FAM assessment trees, so the identification of relevant PIs and the mapping of these to the FAM PI formed an important part of the process (see below).
3. Performance of the fishery in relation to these outcome PIs was monitored in two ways:
    - Tracking the score of the related PIs through the fishery's history since MSC certification– through initial assessment, audits and – if available – reassessment and subsequent audits;
    - Tracking the raw data indicators of each of these PIs – e.g., stock size, biomass, bycatch mortality – over the same time period;

4. Conditions raised for the mapped indicators were investigated in terms of whether they had been closed out and the reason, noting in particular whether the closure had resulted in a change in the raw data of the outcome indicator;
5. Documenting potential causes of these environmental changes;
6. Stakeholder consultation.

"Mapping" of PIs through a fishery's MSC history

Mapping was conducted using a similar method to that described for the pre-assessments in the previous section. However, the problem of mapping from existing trees to a single FAM outcome PI was complicated both by the existence of non-FAM trees for all the post-certification sample of fisheries, and the fact that trees changed between assessment and re-assessment. In this study, only those PIs considered to be 'outcome-results' were attempted to be included[9]. By mapping all of these varied outcome indicators used by different certification bodies at different times to the new FAM and tracing the progress of all these outcome indicators, a history of the indicator was mapped through time. Increases or decreases in environmental performance of these indicators could then be observed, and potential drivers of the change were assessed. This involved reviewing all potential factors, including the effects of closed conditions, impacts of unexpected climatic events, changes in management etc. Likely causes of any changes occurring in the fishery that became apparent through the assessment, reassessment and surveillance reports and other literature were documented during the course of Task 1.

In many cases, it was not possible to decipher what the driver of change was from a desk study due to missing details in the area, or where a number of possibilities existed, additionally the focus of the reports were never to provide this detail. The stakeholder consultation exercise aimed to provide more information on the causes of these changes to clarify any uncertainties and fill knowledge gaps. It was assumed probable that there was a combination of reasons for change in many of the fisheries, and that the assigned causality might be subjective. To overcome this potential source of error and to reduce bias, interviews were stratified to include a stakeholder from each end of the spectrum (e.g. a client and an NGO) in addition to a third party in order to validate results through triangulation. The sourcing of differing viewpoints were analysed and compared with the available raw data to provide an unbiased review.

Separation of 'outcome indicators' from assessment report criterion/indicators

In the absence of direct criteria regarding only an environmental 'outcome' indicator, "information" or "knowledge" based criteria which included quantitative information regarding the extent of change were mapped to the FAM PI. This merging of an outcome result (e.g., the extent of discarding) with information (how much was known about discarding) was a regular occurrence in many assessments. In these situations, the 'outcome' could not be separated from the 'information' as the two were given a joint numerical score. This issue was also seen in the reverse, whereby a criterion requiring an outcome answer/evidence was closed out once information was provided and not a movement of an outcome indicator.

Where there was a change in assessment criterion between the initial assessment and the subsequent Surveillance Reports (SRs), or Reassessment reports (RARs) and the SRs for the RAR, comparisons between the two scores could not be drawn. In some instances, the extent of impact and information available were combined within a single indicator. As an example, in South African (SA) hake, the habitats outcome PI was mapped to - *Does the fishery have unacceptable impacts on habitat structure?* – which was originally scored at 60 due to lack of information not the outcome

[9] In some cases not only 'outcome' indicators were included e.g. where information indicators answered the criterion with quantitative outcome details.

situation. The score was increased to 75 in the RAR because studies demonstrated that there were no adverse affects on benthos. The score still did not reach 80, even though the condition should have been closed out, due to lack of information rather than the actual outcome results. In other cases, the outcome criteria have simply changed over time, making comparisons of scores over time impossible. For these reasons, the final analyses use both PI scores allocated to these criteria over time in addition to the raw indicator data to review the changes which have taken place and investigate why these have occurred, through the analysis of conditions raised and the effect of closure of these on outcome indicators.

Analysing changes in PI scores

To obtain summary statistics on the number of PIs with particular scores it was necessary to account for the fact that, with the exception of any fisheries using the FAM, the number of PIs related to each outcome FAM PI changed over time and with different certification bodies (see fishery mapping exercise in Annex D). Changes in PI scores could therefore be analysed either using the total number of PIs relevant to a particular outcome, or by reducing the data to a single PI score for each outcome, in which case the lowest of the scores in a group of PIs were used to approximate what would have been a single FAM score. Section 5 used the former method as here it was possible to map individual PIs defined in the assessment to corresponding PIs in the pre-assessment (as these were generated based on judgement of the comments). Sections 6 used the latter method as here multiple PIs were mapped to multiple PIs and so instead of direct linkages between individual PIs, a comparison of means was preferable.

In Section 9.3, timelines of improvements in MSC fisheries are presented throughout the entire period of involvement of the MSC, i.e. from pre-assessment to reassessment or final surveillance audit. For this analysis, rather than track exact PI scores, which may fluctuate due to slight variations in definition between years or for other reasons, only boundary changes were assessed, i.e. movement of PI scores above or below 80, the point at which a condition is raised or closed. In these timelines, the percentage of fisheries with a condition (or issue in the case of pre-assessment) raised for each FAM at each point in time was used. This approach removed any bias which may be present in comparing multiple PI scores and allowed the inclusion of pre-assessment information which did not provide scores, but only indicated whether there was an issue present or not. In addition, this method also prevented too much weight being placed on small fluctuations in PI scores which may be considered unreliable, and is instead driven by the movement of PI scores across scoring boundaries which are considered more robust.

Reference points and stock rebuilding PIs

It was necessary to consider the FAM PIs ‘reference points (1.1.2)’ and ‘stock rebuilding (1.1.3)’ in a slightly different way to the other FAM PIs. The outcome indicator for reference points was judged based on either the presence or absence of appropriate reference points and trend over time were not analysed. The FAM PI stock rebuilding was only scored when appropriate and so the sample size was often low for these analyses.

3.4. Wider impacts of the MSC programme

This area of the study was a scoping exercise into the wider impacts of the fishery certification programme on both fisheries management and the overall sustainability of ocean ecosystems. Any analysis of these topics were potentially the most difficult to undertake, and the most uncertain in their outcome. However, the aim was to produce ideas and test the feasibility of various kinds of analysis that might help to answer the questions posed about wider impact of the MSC programme beyond the boundaries of certified fisheries. One of the key lines of inquiry is whether the existence of the MSC certification programme influences the adoption of higher standards of fisheries management practice in non-certified fisheries, ultimately leading or contributing to wider positive environmental impacts in ocean ecosystems.

The scope of this research changed following the revision of the project specification to substantially increase the number of certified fisheries that would be included in the post-certification analysis. So, while the research into wider benefits of certification still focused upon identifying methodologies that might be applied to investigate the wider impacts of the MSC programme, detailed analysis of one or two options was not undertaken. Rather, two lines of inquiry were explored: 1) investigating stakeholder viewpoints about the MSC's wider impacts; and 2) exploring methods for analysing and understanding the wider impacts of the MSC's certification programme.

3.4.1. Stakeholder viewpoints about MSC's wider impacts

Several questions related to the potential wider impacts that MSC certification may have had on fisheries management and the marine environment were incorporated into the stakeholder consultation questionnaire/interview template (see section 3.5). These questions explored what role the MSC played in the process of changes in the fisheries, what influence MSC had (if any) on the adoption of better fisheries management practices in fisheries that are not engaged in the MSC programme, and any strategies or management measures that have been adopted that are expected to lead to future gains in environmental sustainability. This allowed the exploration of the perceptions of key actors about causal links between the MSC programme and the changes observed. Results were classified into five categories of outcome that emerged from stakeholder responses: research; management; attitudes, mindsets and awareness; holistic approaches; and stakeholder engagement.

3.4.2. Exploring methods to analyse and understand wider impacts

Starting from some of the issues and ideas that arose in the MSC's Net Benefits (2009) report, a number of stories emerged about the potential for wider impact of the MSC. For example, the solution of a bycatch problem in an MSC fishery that is taken up by other fisheries; the adoption of new policy by a management authority or Regional Fisheries Management Organisation arising from research conducted as part of the MSC process; or drivers for improved performance leading to MSC assessment arising from competition for market access from similar products (e.g. whitefish from SA and Europe, both accessing the same market, where a price differential has opened up). These stories were used as catalysts to develop more detailed "theories of change" where we hypothesised four separate impact pathway scenarios. We then investigated the quantitative data that might be available to test each scenario. In some scenarios, we conducted a hypothetical test with available data to demonstrate the feasibility of conducting such analysis. We focused on achieving outputs which describe the analysis that might be undertaken in the future through commissioned projects. Though we did not develop individual indicators, except in occasional circumstances to illustrate an example, we did discuss the types of indicators that are most likely to yield useful results in relation to the MSC's wider impacts on fisheries management and the sustainability of ocean ecosystems.

3.5. Stakeholder consultation

Detailed stakeholder consultation was undertaken in the form of interviews for all of the project phases simultaneously to avoid approaching the same stakeholders multiple times. The consultation was used to clarify points that arose during the desk based case studies during the post certification analysis, to produce a clearer picture of attribution of change in any terms for analysis.

The detailed consultation included the distribution of a questionnaire to a wide range of identified stakeholders, see Annex B for a copy of the questionnaire and Annex C for a list of stakeholders. This resulted in four methods of approaching stakeholders:

1) Summary of pre-assessment data phase: contacted all of the CBs and requested data on approx. 447 fisheries;
2) Sample pre-assessment analysis: interviewed all of the fisheries selected, 21 in total, and attempted to contact two persons/organisations; one for each of the independent and fishery related organisations;
3) Post certification analysis: interviewed those not in the scope of the sample pre-assessment consultation plus additional stakeholders to give a total population interviewed for each fishery of three individuals – the client; one scientific individual/body or management; and one other stakeholder e.g. NGO;
4) Wider impacts: During stakeholder interviews for Tasks 1 and 2, questions were asked (the final 5 questions) regarding their views on the wider impacts of the MSC programme in order to deepen the inquiry into the perceptions of key actors as to MSC's contribution to, or influences on, changes in attitude, perception, or ecological outcomes of fisheries management.

Annex D: stakeholder contacts provides details of the organisations that it was possible to interview and thus include their opinions in this study. For post certification analysis phase it was the intention to contact organisations spanning 3 different sectors: a) the environment e.g. NGO, client, charity/trust b) Independent e.g. CB, independent scientist and c) Fishery related e.g. management, industry, client. Of a possible 75 organisations, 43 were interviewed. Of the total of 25 fisheries in the task, at least one organisation was contacted for each of them. For pre-assessment analysis phase, it was the intention to interview two organisations for each of the 18 fisheries. Of a possible total of 36, 25 interviews took place. It was not possible to contact anyone from a total of three of the fisheries.

There were a variety of reasons for not interviewing certain persons such as there was no response or they declined to partake.

Qualitative results of the consultation are distributed throughout the results and discussion sections of this report, supporting the other findings and discussing some of the attributions of change where it arises in the results. Section 7 presents some quantitative results of the exercise.

4. PRE-CERTIFICATION OVERVIEW

This section describes the results from the analysis of the summary pre-assessment data and provides an overview of the fisheries from category 1 (Figure 7) that are involved in the MSC.

4.1. Synopsis

Out of the 447 fisheries that have received pre-assessments to date, 48% were recommended by CBs to be suitable to proceed to full assessment with caution, with a suggestion that some issues need to be fixed before approaching the assessment. 35% were recommended to proceed without needing any additional work. Nevertheless, significant numbers of fisheries receiving cautionary recommendations, and some 6% of those receiving negative recommendations proceeded to full assessment. Overall, 35% of the fisheries have so far moved through to full assessment.

A very high proportion of the fisheries being pre-assessed (55%) and moving through to full assessment (54%) derive from the North Atlantic. Shellfish fisheries are more likely to be recommended to proceed to full assessment than other types of fisheries.

The most significant feature of this analysis, however, was that although roughly equal proportions of large, medium and small scale fisheries are being pre-assessed, small scale fisheries are significantly the least likely to be recommended to proceed to full assessment, and are least likely to proceed if in receipt of such a recommendation. This may reflect the difficulty of acquiring data from small scale fisheries, on the one hand, and problems associated with the cost of certification, on the other.

4.2. Results

A total of 447 pre-assessments were analysed. The number of fisheries entering the MSC programme through pre-assessments was initially low and slow (note there are some uncertainties about the data inputs discussed below in section 4.2.1). For the last four years, however, the rate has increased dramatically (Figure 11).

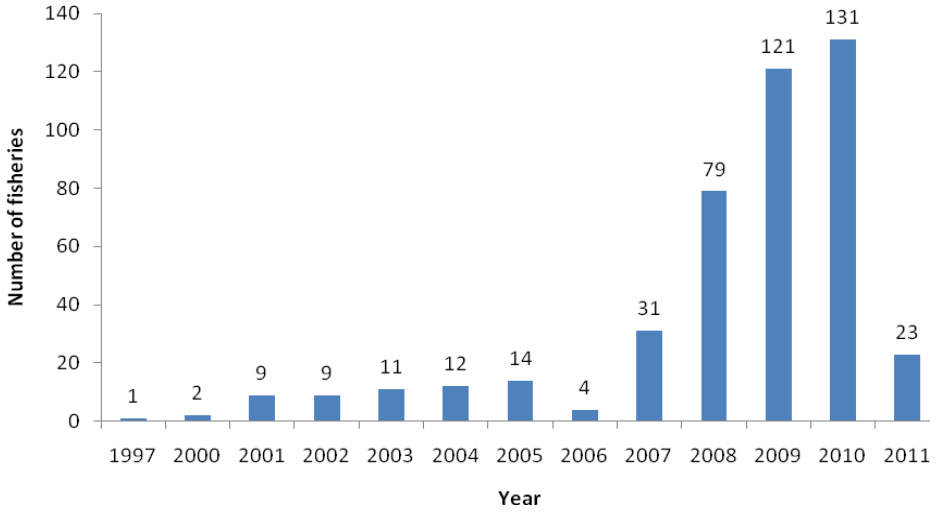


Figure 11. Pre-assessments conducted by certification bodies each year (n=447)

Pre-assessment reports generally provide three types of recommendation: 1) the fishery is not recommended to proceed into full assessment; 2) the fishery could proceed with caution, although it is advisable that some issues are fixed before proceeding; and 3) it is recommended that the fishery could proceed to full assessment with minimal additional action.

The outcomes of pre-assessments are presented in Table 7. Approximately 35% of all pre-assessments were not recommended to proceed because the issues were considered too significant to enable the fishery to pass the MSC standard. A further 48% were considered as having "cautionary issues" that may prevent a fishery from passing the standard, thus indicating which issues might need fixing before proceeding into the full assessment process. Only 17% of all pre-assessments were recommended for the full assessment process without needing to change elements of the fisheries management process or outcomes.

Table 7. Summary of pre-assessment information submitted by CBs to this study
The full data are categorised by year of pre-assessment, ocean area, scale of fishery or species grouping. Summaries are given only for the first presentation, year.

	numbers			numbers			proportions		
year, area, scale or species	not recommended	cautionary	recommended	not recommended that proceeded	cautionary that proceeded	recommended that proceeded	not recommended that proceeded	cautionary that proceeded	recommended that proceeded
1997			1			1			100%
2000	1	1			1		0%	100%	
2001	1	6	1		2	1	0%	33%	100%
2002	2	4	3		3	3	0%	75%	100%
2003	3	7	2	1	4	1	33%	57%	50%
2004	2	8	2	1	7	2	50%	88%	100%
2005	7	6	1	2	5		29%	83%	0%
2006	1	2	1		1	1	0%	50%	100%
2007	7	18	8	1	13	5	14%	72%	63%
2008	22	44	13	3	26	12	14%	59%	92%
2009	45	51	22	1	21	12	2%	41%	55%
2010	50	59	22	1	10	14	2%	17%	64%
2011	14	8	2		1		0%	13%	0%
total	**155**	**214**	**78**	**10**	**94**	**52**	**6%**	**44%**	**67%**
Arctic	3	5	10		4	10	0%	80%	100%
Arctic, Atlantic, N		1			1			100%	
Atlantic, N	98	103	46	4	49	31	4%	48%	67%
Atlantic, N & S		1	1			1		0%	100%
Atlantic, S	2	8			3		0%	38%	
Freshwater	2	1					0%	0%	
Indian	11	7	3		2	1	0%	29%	33%
Indian & Pacific, S	1	3	1				0%	0%	0%
Pacific, N	22	41	5	4	23	3	18%	56%	60%
Pacific, N & S	1	3	4	1	1	3	100%	33%	75%
Pacific, S	12	35	3	1	7	1	8%	20%	33%
Southern		6	2		4	2		67%	100%
Other	3		3				0%		0%
Large	16	81	24	3	45	18	19%	56%	75%
Medium	33	65	17	2	24	14	6%	37%	82%
Small	68	61	24	5	24	10	7%	39%	42%
Other	38	7	13		1	10	0%	14%	77%
Anadromous	4	12	1		6	1	0%	50%	100%
Demersal	32	70	24	3	38	19	9%	54%	79%
Freshwater	5	1	1		1		0%	100%	0%
Mixed	50	5	11	1	2	7	2%	40%	64%
Pelagic	35	59	21	4	22	12	11%	37%	57%
Shellfish	26	67	17	2	25	13	8%	37%	76%
Other	3		3				0%		0%

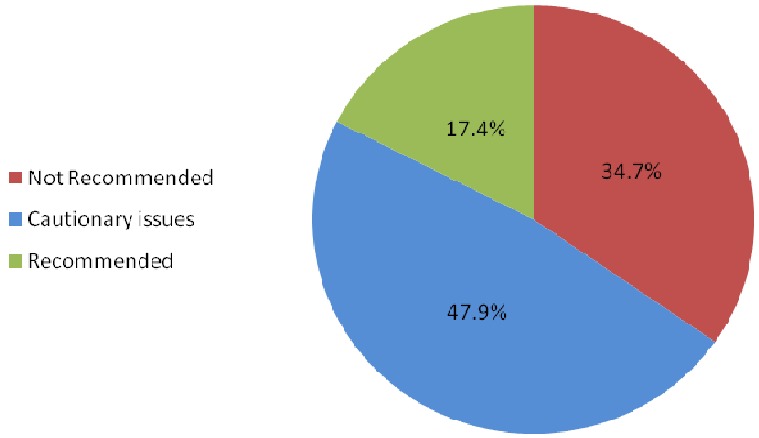


Figure 12. Outcomes of fishery evaluations at pre-assessment (n=447)

The subsequent action taken by fishery clients was also analysed. Of the 447 pre-assessments reported to the project team, only 156 of them were reported to have proceeded into full assessment. This represents almost 35% of all fisheries undergoing pre-assessment. Effectively, based on this data, this means that just over 65% of all fisheries that undergo a pre-assessment do not move forward into full assessment. The reason for such a result may be explained, in part, by the fact that over 90% of those that were not recommended to proceed did not and more than half of those classified as 'cautionary' fisheries did not proceed either.

Of those that were pre-assessed, nearly 70% of those that *were* recommended to proceed did so (52 fisheries) (Figure 13). Almost 44% (n=94) of all pre-assessed fisheries that received a 'cautionary' evaluation also went forward into full assessment for certification (noting there is no information in the summary data about the time elapsed between pre-assessment and full assessment). A potentially surprising result, although it should be treated with some caution due again to the unknown (from this summary data set) period of time elapsed between pre-assessment and full assessment, was that of those fisheries that were recommended not to proceed 6.5% (n=10) did enter into full assessment. Speculation about the reasons may incline towards the positive: time passed, issues were resolved and the fishery client decided to move towards certification (in which case, it might be reasonable to assume positive environmental outcomes); or towards the more sceptical or negative: the client may have decided to shop around, hoping for a different outcome from another CB.

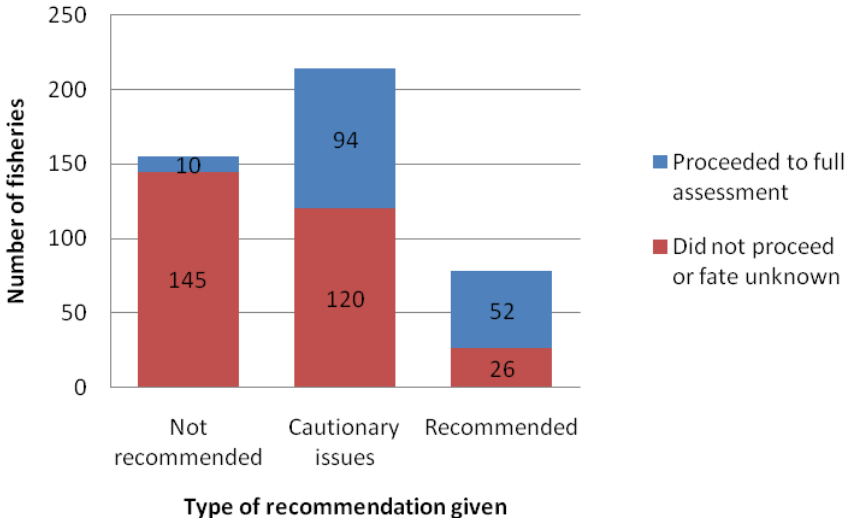


Figure 13. Numbers of fisheries that proceeded, or not, to full assessment (n=447).

These data also show that of all the fisheries proceeding to full assessment, the largest proportion (94 fisheries, 60.3%) were from the cautionary recommendations category.

We next examined the data for patterns by scale of fishery, scale of vessel, ocean area, species, and gear. There was a very similar proportion of small (30.9%), medium (31.2%) and large (31.2%) 'scale of landings' among fisheries undergoing pre-assessment (Figure 14). Analysing the data by 'scale of vessels' reveals that the majority of fisheries undergoing pre-assessment are large scale, although a significant proportion are also small and medium scale fisheries (Figure 15).

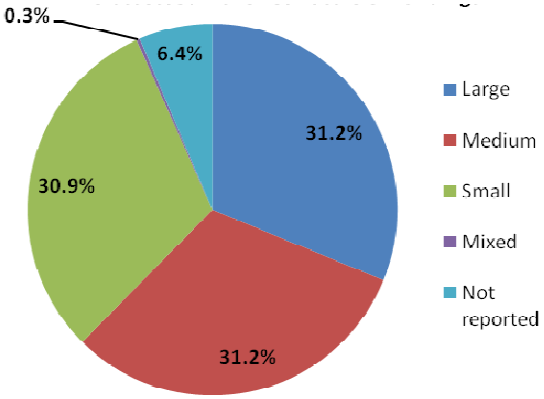


Figure 14. Scale of landings for all pre-assessed fisheries (n=447)

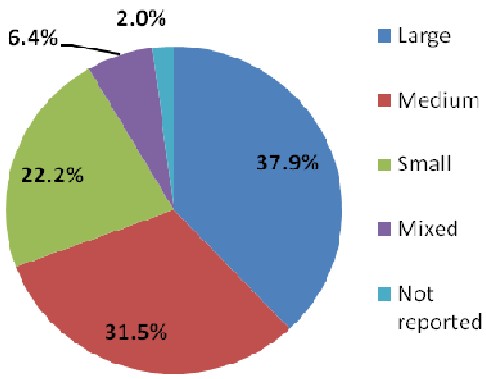


Figure 15. Scale of vessels for all pre-assessed fisheries

In geographical terms, while all the oceanic regions of the world are represented in Figure 16, over half (54.1%) of all pre-assessed fisheries are in the North Atlantic Ocean (north east and north west). The next most significant regions for pre-assessments are the north Pacific (15.1%) and south Pacific Oceans (12.4%).

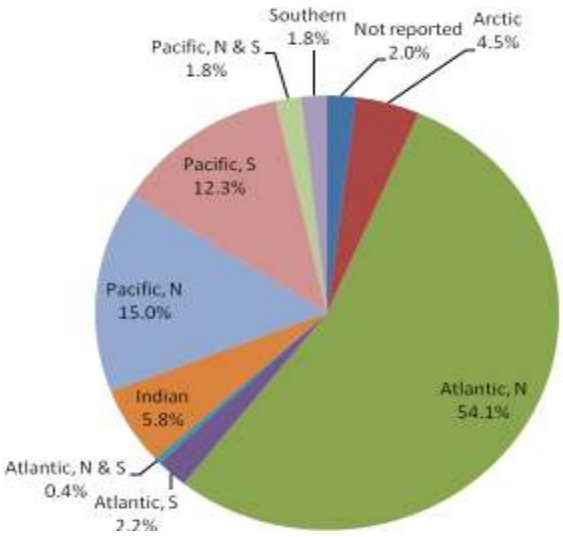


Figure 16. All fishery pre-assessments by oceanic region (n=447)

The data were further analysed to identify whether there were consistent patterns amongst categories of fisheries undertaking pre-assessment. A Generalised Linear Model[10] with binomial errors was used to test the probability that: a) a fishery of a specific type would be fully recommended or recommended with caution to proceed to full assessment; and b) a fishery with a cautionary or full recommendation would actually proceed to full assessment. The differences between these results are important. The first model tested the fisheries for suitability to be certified, i.e. to closeness to the MSC standard. The second model tested the willingness of the clients to move their fisheries further into the MSC process.

For model (a), year (modelled as a factor, not as a linear continuous variable), scale and species were significant ($p < 0.05$). The gear factor was very noisy (i.e. there is a large amount of unexplained variation) and did not contribute significantly to the model. Ocean area also did not contribute significantly to the model. Vessel size was not included in the model as it was confounded (largely correlated) with fishery scale. A plot of the trends of each of the terms in the model is shown in Figure 18.

By contrast, for model (b), ocean, year and scale were significant. Gear was very close to being significant at the 5% level ($P=0.06$). Species was not significant. A plot of the trends of each of the terms in the model is shown in Figure 19.

[10] A Generalised Linear Model fits a model consisting of several parameters (such as year, scale, etc) to minimise the variability in observed response, here the probability that a fishery will be recommended to proceed to assessment. In this model there are 4 parameters, each treated as a factor (rather than a continuous variable) with a number of levels corresponding to the levels seen in the plot (i.e. 3 levels for scale of fishery). The model predicts the probability of an outcome given a specific set of parameter values, e.g. for a large demersal fishery from the N Atlantic pre-assessed in 2009. Each level of each parameter is multiplied by a constant. The deviance of each level from the null model, and the confidence around that estimate, is shown here. The overall significance of a parameter, such as fishery scale, is determined by an analysis of variance, given in the paragraph above the figure. Trends in parameter effects can easily be seen, and the extent to which they depart from the null model (zero on the y axis), although the significance of the difference between different levels of a parameter is only roughly indicated by the overlap or non-overlap of the estimated confidence intervals. In these plots the width of the bar, and the block lying on the x axis, indicates the size of the dataset – for instance there are relatively few anadromous and freshwater species fisheries in the sample, and consequently the estimate of the effect is quite uncertain.

The majority of fisheries moving forward into full assessment are large scale fisheries (Figure 17). The number of medium and smaller scale fisheries (based on landings) proceeding into full assessment are almost even. Significantly, regardless of scale, the largest proportion of those moving into full assessment were also cautionary fisheries, and for large scale fisheries, this category of fisheries makes up the largest proportion.

These results are also seen clearly in the models (Figure 18, Figure 19), where mode (a) pointed up a very significant difference between large and small scale fisheries, the latter being generally less often recommended for full assessment. The second model showed that even within those recommended for full assessment (either full recommendation or cautionary) the take-up of full assessment was lower for small scale fisheries, presumably because of multiple operational considerations such as cost.

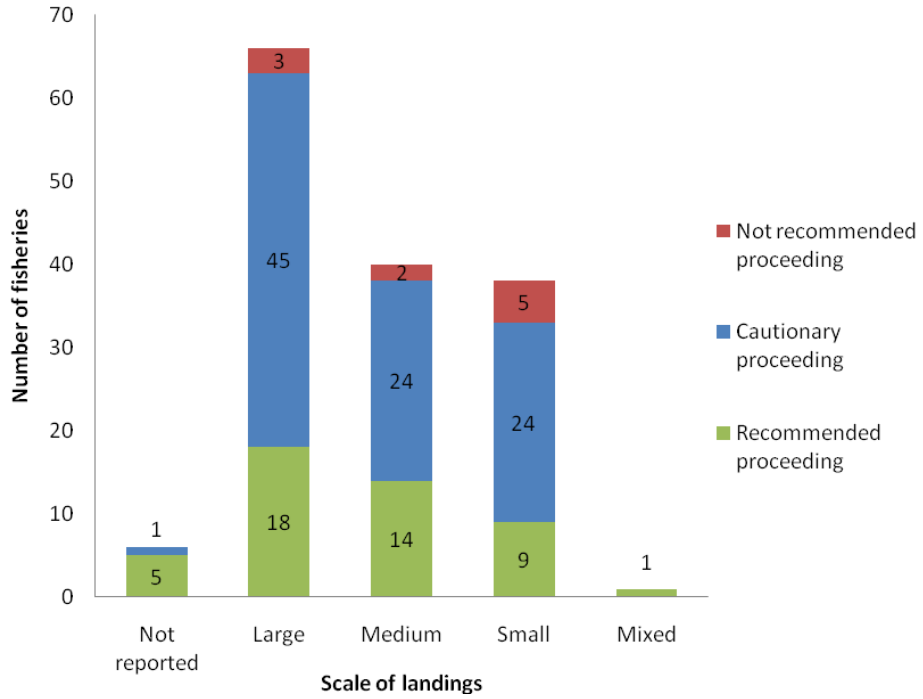


Figure 17. Fisheries entering full assessment according to scale of landings and pre-assessment outcome (n=156)

Looking at those fisheries that proceeded into full assessment, first by hemisphere (Figure 20), by a very significant majority, fisheries in the northern hemisphere undergoing full assessment outnumber those from the southern hemisphere by about 7 to 1. Looking more closely at specific oceanic regions, as has already been intimated earlier in this report, the majority of the fisheries undergoing full assessment are from the North Atlantic Ocean. However, all oceanic regions are represented by fisheries in the full assessment process for certification against MSC's environmental standard.

The trend in year with model (b) is to be expected (Figure 19); the significance of the year factor in the first model reflects quite a variable pattern between years, but no apparent trend over time. An interesting result from the ocean area factor is that fisheries from the South Pacific are more likely to be recommended for full assessment, and least likely to take up the offer. The fishery types that are most likely to be recommended for full assessment are shellfish fisheries.

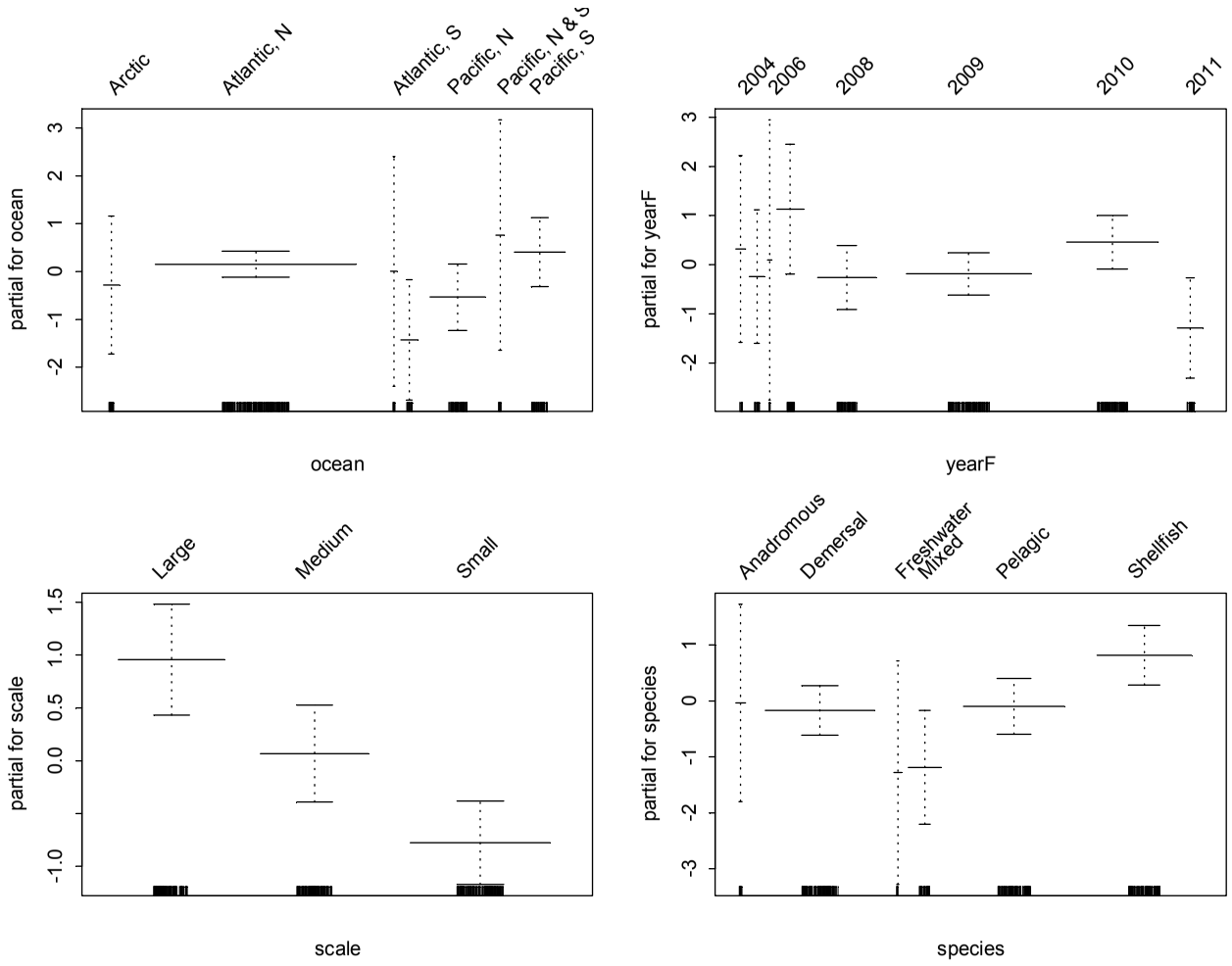


Figure 18. Trends in individual terms in the generalised linear model on the probability that a fishery will be recommended or recommended with caution to proceed to full assessment by a pre-assessment, plotted using the plot.gam function of Splus

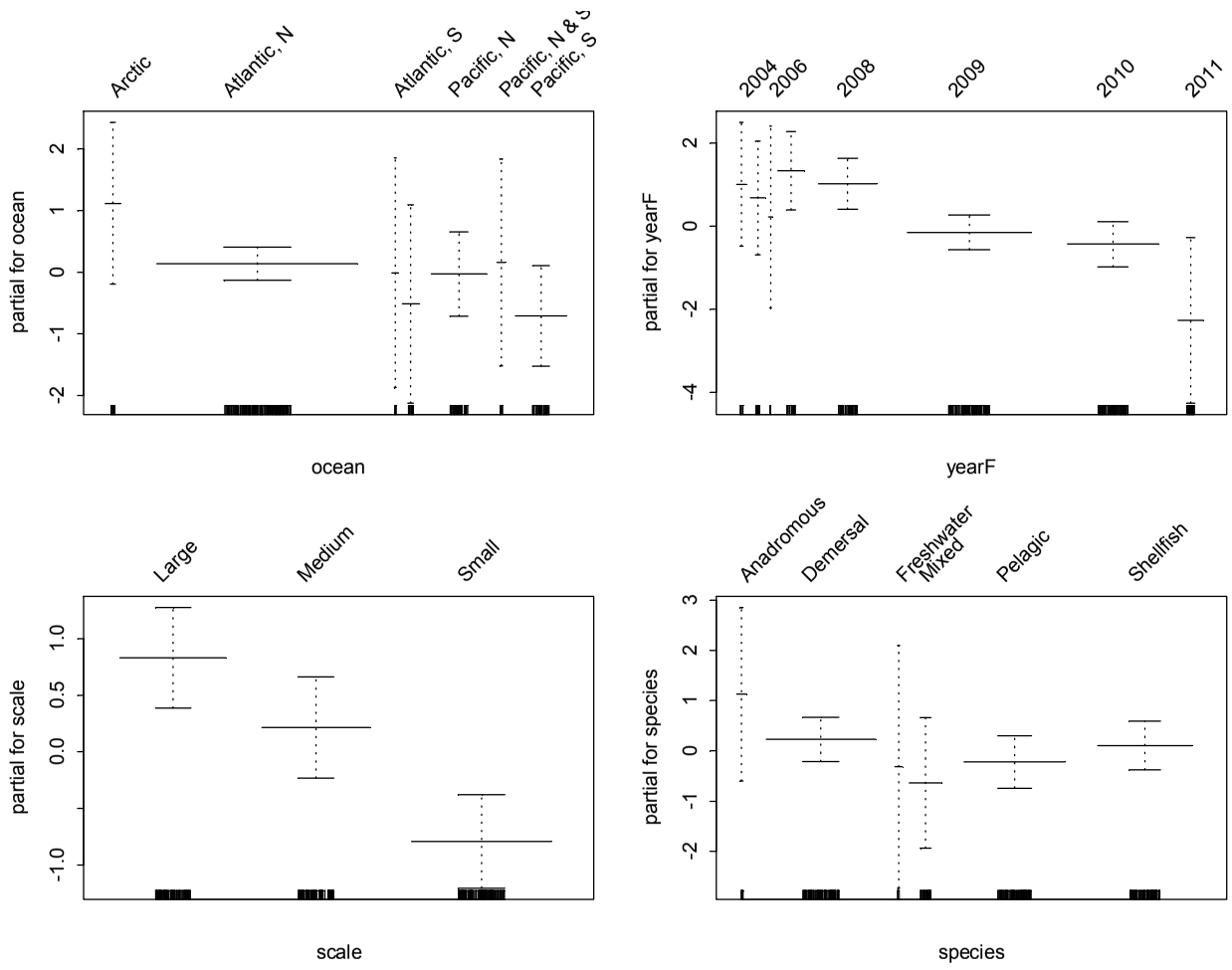


Figure 19. Trends in individual terms in the generalised linear model on the probability that a fishery, if recommended or recommended with caution to proceed to full assessment, will actually proceed, plotted using the plot.gam function of Splus

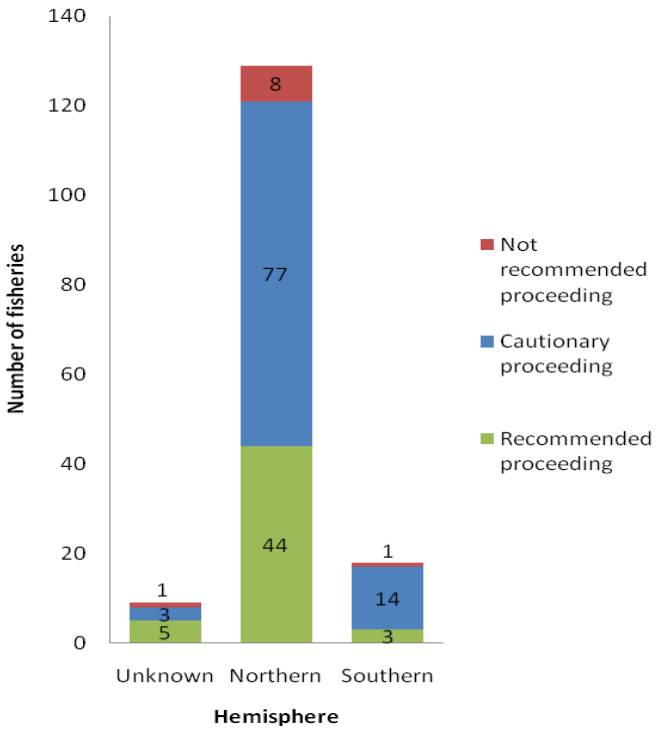


Figure 20. Fisheries entering full assessment by hemisphere

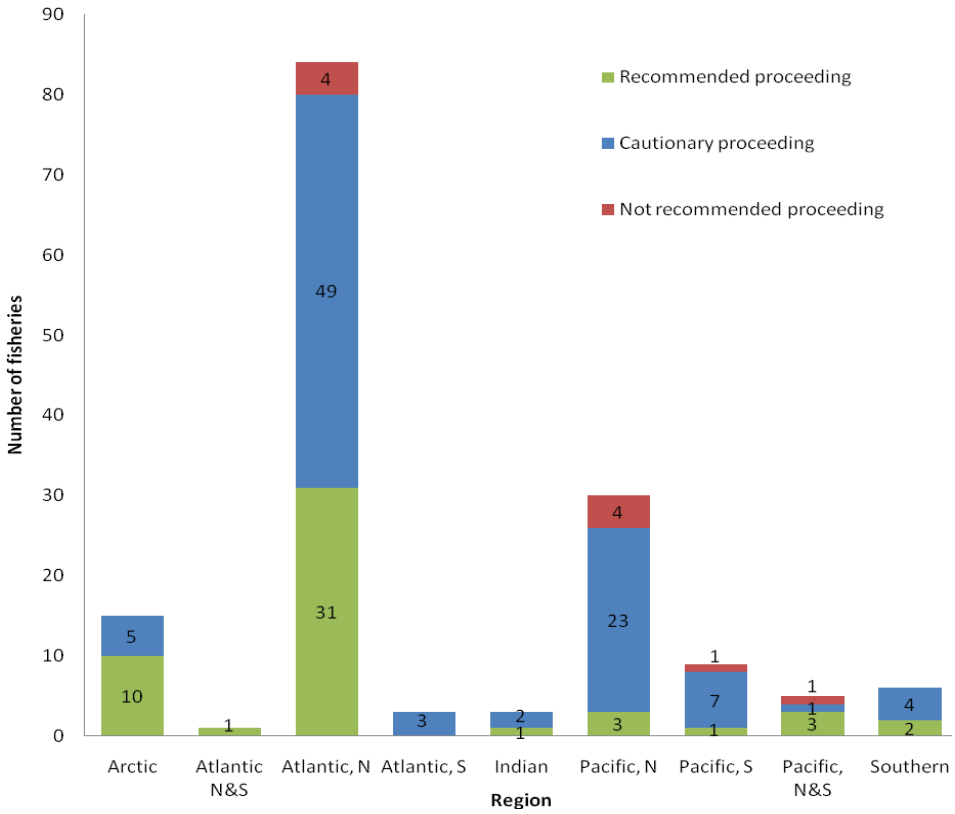


Figure 21. Fisheries entering full assessment by oceanic region (n=156)

Finally, when we look at the species composition of all pre-assessed fisheries (Figure 22), we discover that the proportions of demersal (29.1%), pelagic (26.4%) and shellfish (crustaceans and molluscs) (23.9%) are relatively similar. The next largest grouping is mixed species (14.6%) which combines two or more of the previous categories (i.e., demersal, pelagic or shellfish). There were also small proportions of anadromous species, mainly salmon (3.8%), and freshwater species (1.6%) pre-assessed.

Of those that moved forward into full assessment for certification against the MSC standard (Figure 23), demersal species represents the largest proportion by about a third, followed by shellfish and pelagic species.

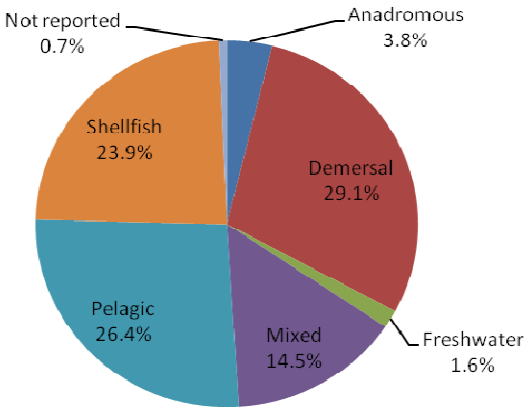


Figure 22. All pre-assessed fisheries by species composition (n=447)

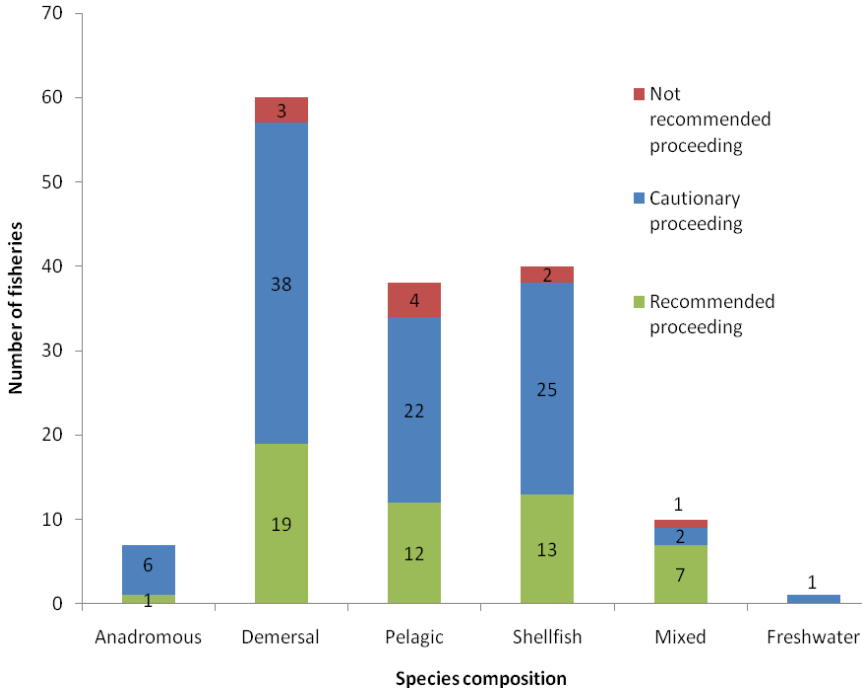


Figure 23. Species composition of fisheries proceeding to full assessment (n=156)

4.2.1. Data uncertainties

It is clear that the project team did not receive information about every fishery that has engaged in some way with the MSC certification programme. In the earliest days of the MSC, the first fisheries engaging with the programme were treated more like feasibility or pilot studies, so some of the data may not have been captured by consultants who subsequently became accredited certifiers. Indeed, some consultants involved in early testing of MSC assessment and certification methodologies may not have become certifiers at all. The MSC has records relating to these studies from the late 1990s, but most pre-date the creation of the MSC as an independent organisation, so some of the data is unlikely to be represented here. Similarly, since formalisation of methodologies and MSC's independence as a third-party ecolabelling programme, some CBs have ceased to trade or did not respond to the project team's request for pre-assessment information. These factors account for potential discrepancies in the number of fisheries undergoing pre-assessment each year and the total number. Other issues affecting the total, suggesting that the number of fisheries engaging with the MSC certification programme is likely to be higher than presented here, include the fact that pre-assessments are not mandatory; using CBs for pre-assessments or other related work is not compulsory for clients; and, that only CB data were available for the study. These circumstances indicate that any fishery clients who commissioned consultants rather than CBs to determine the feasibility of their fishery proceeding into full assessment means such fisheries will also not be represented in this data set.

Within the data set itself, there are uncertainties. As has already been noted in this chapter, CBs interpreted the data key differently. But other factors have influenced the data quality. For example, in calculating the number of fisheries, different approaches may have been taken to counting 'units of certification' (i.e., counting a fishery as the certification unit, which may include everyone fishing in a fishery, or not). Similarly, MSC's certification methodology changed in relation to harmonising fishery assessments, this may have influenced the numbers presented by CBs. Alternatively, the fishery client may have changed the unit of certification after pre-assessment or even after the full assessment process began. Other factors influencing the quality of the data include: incomplete fields on the data form; variable, inconsistent, or mis-coding; mixed species fisheries being counted as a single fishery, or the converse, each species within a mixed fishery being counted as a fishery; use of different CBs by fishery clients for pre- and full assessment; 2011 data submitted by minority of CBs (not requested by project team); subsequent actions by fishery client unknown by pre-assessing CB.

Any future analysis of aggregated pre-assessment data will be made more robust by the cleaning up of as many as possible of these data uncertainties. Such uncertainties may be resolved for new pre-assessments by new data collection protocols implemented in 2011 by the MSC, along with the TAB Directive for CBs requiring submission to the MSC of pre-assessment reports for fisheries entering full assessment. These should help create a more robust baseline of general information about pre-assessment outcomes and subsequent actions taken by fishery certification clients and CBs.

5. PRE-CERTIFICATION SAMPLE ANALYSIS

This section of the report looks at changes which have taken place in the fisheries in the pre-assessment phase.

5.1. Synopsis

As described in the Methodology (section 3), we examined trends in scores and indicators. The pre-assessments do not allocate a specific score to PIs. Instead, they provide guidance on where issues have been identified, and in many cases indicate the gross likely performance of a PI, within scoring categories of <60, 60-79 or ≥ 80. Where score categories were assigned by CBs, these were used. Where they were not, the following assumptions have been made:

- Where no issues were raised we assigned the PI a score category of ≥ 80;
- Where issues were raised but the fishery was still advised to proceed straight to full assessment a score category of 60-79 was assumed;
- Where significant issues were raised with recommendations to address them prior to entering full assessment a score category of <60 was assigned.

Summary results are presented in Table 8. Based on the results of section 4 above, it appears that a fishery's recommendation category (i.e. recommended, recommended with caution or not recommended to proceed to full assessment) may be important in consideration of the pre-assessment data. In total, 16 of the 21 pre-assessment reports recommended that the fishery could proceed straight into full assessment; while five were advised to address specific issues prior to entering full assessment (Table 9). For these latter five fisheries the issues delaying entry to full assessment were Principle 1 related.

Table 8. Summary scores for each fishery at pre-assessment

KEY: Red = <60; Orange = >60-<80; Green = >80.

The fisheries included within this pre-assessment analysis have been given a code (a-u) to protect confidentiality of pre-assessments.

Unit of certification[11]	Score at pre-assessment by PI							
	1.1.1	1.1.2	1.1.3	2.1.1	2.2.1	2.3.1	2.4.1	2.5.1
a	60-79	≥ 80	≥ 80	≥ 80	≥ 80	≥ 80	≥ 80	≥ 80
b	60-79	≥ 80		60-79	60-79	≥ 80	60-79	60-79
c	≥ 80	≥ 80		≥ 80	60-79	≥ 80	60-79	≥ 80
d	≥ 80	≥ 80		≥ 80	≥ 80	60-79	≥ 80	≥ 80
e	≥ 80	≥ 80		≥ 80	≥ 80	60-79	≥ 80	≥ 80
f	≥ 80	≥ 80		≥ 80	≥ 80	60-79	≥ 80	≥ 80
g	60-79	<60		≥ 80	≥ 80	≥ 80	≥ 80	≥ 80
h	60-79	<60		≥ 80	≥ 80	≥ 80	≥ 80	≥ 80
i	60-79	<60		≥ 80	≥ 80	≥ 80	≥ 80	≥ 80
j	60-79	<60		≥ 80	≥ 80	≥ 80	≥ 80	≥ 80
k	≥ 80	≥ 80		60-79	60-79	≥ 80	≥ 80	≥ 80
l	≥ 80	≥ 80		60-79	60-79	≥ 80	≥ 80	≥ 80
m	≥ 80	≥ 80		60-79	60-79	≥ 80	≥ 80	≥ 80
n	≥ 80	≥ 80		60-79	60-79	≥ 80	≥ 80	≥ 80
o	≥ 80	≥ 80		60-79	60-79	≥ 80	≥ 80	≥ 80
p	≥ 80	≥ 80		60-79	60-79	≥ 80	≥ 80	≥ 80
q	60-79	<60		≥ 80	60-79	≥ 80	≥ 80	60-79
r	≥ 80	≥ 80		≥ 80	60-79	≥ 80	≥ 80	≥ 80
s	≥ 80	≥ 80		60-79	60-79	60-79	60-79	60-79
t	≥ 80	≥ 80		≥ 80	≥ 80	≥ 80	≥ 80	≥ 80
u	≥ 80	≥ 80		60-79	≥ 80	≥ 80	≥ 80	≥ 80
w	60-79	60-79		≥ 80	≥ 80	≥ 80	≥ 80	≥ 80
x	60-79	<60		≥ 80	≥ 80	≥ 80	≥ 80	≥ 80
y	≥ 80	≥ 80		≥ 80	≥ 80	≥ 80	60-79	≥ 80
z	≥ 80	≥ 80		60-79	≥ 80	≥ 80	≥ 80	≥ 80
aa	<60	<60		≥ 80	≥ 80	≥ 80	≥ 80	≥ 80
bb	≥ 80	60-79		≥ 80	≥ 80	≥ 80	≥ 80	≥ 80
cc	60-79	≥ 80		≥ 80	≥ 80	60-79	≥ 80	60-79
dd	≥ 80	60-79		≥ 80	60-79	60-79	≥ 80	60-79
ee	60-79	<60		≥ 80	≥ 80	60-79	60-79	60-79

[11] This includes multiple gears, stocks etc. and is not strictly per fishery unit.

Table 9. Overall recommendations of pre-assessment for sample of fisheries

Fishery code	Proceed straight to full assessment	Recommendations made	Address issues prior to entering full assessment
a	✓	✓ PRINCIPLE 1	
b	✓	✓ PRINCIPLE 2	
c	✓	✓ PRINCIPLE 1 & PRINCIPLE 2	
d	✓	✓ PRINCIPLE 1	
e	✓	✓ PRINCIPLE 1 & PRINCIPLE 2	
f		✓ PRINCIPLE 1 ref pts & stock assessment	✓
g	✓	✓ PRINCIPLE 2	
h		✓ PRINCIPLE 1 ref pts & stock assessment	✓
i	✓		
j	✓	✓ PRINCIPLE 1 & PRINCIPLE 2	
k	✓	✓ PRINCIPLE 1	
l	✓	✓ PRINCIPLE 2	
m	✓	✓ PRINCIPLE 1 & PRINCIPLE 2	
n		✓ PRINCIPLE 1 stock status	✓
o	✓	✓ PRINCIPLE 2	
p	✓	✓ PRINCIPLE 2	
q		✓ PRINCIPLE 1 ref pts & stock assessment	✓
r	✓	✓ PRINCIPLE 1	
s	✓	✓ PRINCIPLE 1 & PRINCIPLE 2	
t	✓	✓ PRINCIPLE 1 & PRINCIPLE 2	
u		✓ PRINCIPLE 1 & PRINCIPLE 2	✓
Total number of fisheries in each category	**16**	**21**	**5**

The graphs throughout the remainder of this and the next chapter have consistent colour coding in relation to the change in score from pre to full certification (Table 10).

Table 10. Colour coding for presentation of results

Boundary change		Colour code
<60 to ≥ 80	Fail to unconditional pass	Dark green
<60 to 60-79	Fail to conditional pass	Green
60-79 to ≥ 80	Conditional pass to unconditional pass	Light green
Remains ≥ 80	Remains within unconditional pass	Blue
Remains 60-79	Remains within conditional pass	Light blue
≥ 80 to 60-79	Unconditional pass to conditional pass	Orange

The majority of outcome status performance indicators assessed at pre-assessment remained within the same scoring range when assessed at point of certification. Approximately 59% of the PIs remained greater than or equal to 80, signifying that the PI was already considered sustainable before entering the MSC pre-assessment process. This is represented as blue in Figure 24. An additional 15% of PIs remained within the 60-79 scoring range (represented as light blue in Figure 24) indicating that the issue was raised at pre-assessment, but not addressed sufficiently to allow an unconditional pass at point of certification. Some improvements within these categories can be identified through stakeholder consultation, which will be discussed later in this report.

Improvements were seen in 18% of the 168 PIs studied across the 21 fisheries (shown in shades of green in Figure 24. Five PIs increased from a fail to an unconditional pass and four PIs increased from a fail to conditional pass. The remaining 22 PIs (13%) improved from a conditional to unconditional pass. The attribution of change for these PIs is discussed in section 5.2 and 5.3. Of the improvements recorded, approximately half were cited as being a result of the MSC, with the remainder attributed to other stakeholders or management systems independent of MSC.

8% of the PIs studied appeared to decrease in score (shown as orange) (Figure 24). This was primarily due to the issue which triggered a condition for the PI not being fully understood at time of pre-assessment. In most cases either better understanding of the MSC methodology by assessment team members or provision of further information during the main assessment process where the cause for the decrease in score. The detailed main assessment process is therefore picking up issues that were not necessarily thought to be of concern or even considered at pre-assessment. Given the level of effort and time spent at pre-assessment compared to main assessment, this result is to be expected. The change from unconditional to conditional pass for each PI therefore does not necessarily represent a decrease in the outcome status indicator trend. Overall of the sample of 21 fisheries studied 59% of PIs were considered to be in the unconditional pass category (≥ 80) at the start of the pre-assessment; an additional 18% become ≥ 80 between pre-assessment and point of certification; and 23% of PIs required a condition.

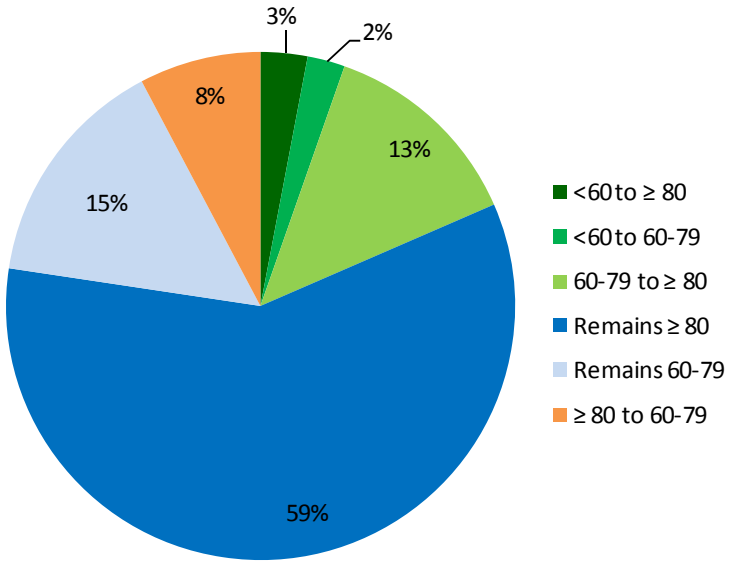


Figure 24. Change between pre-assessment and certification score, amalgamated for all outcome status performance indicators (n=168) across the sample of 21 fisheries

The change in score category between pre-assessment and point of certification for individual Principle 1 and Principle 2 PIs is presented in Figure 25.

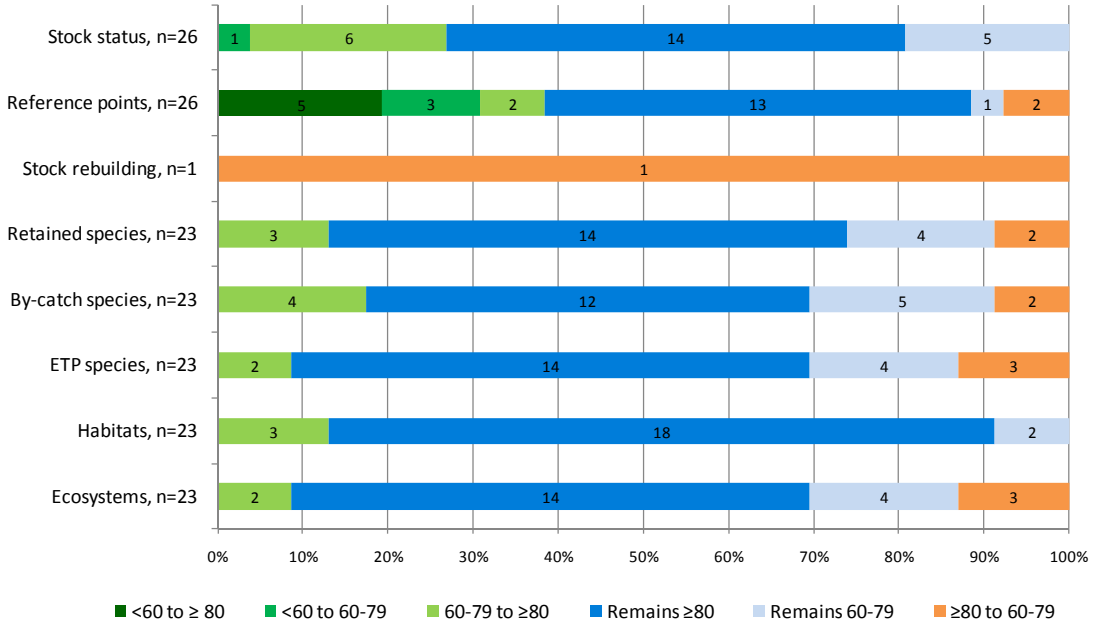


Figure 25. Change between pre-assessment and certification score, across the sample of 21 fisheries presented by performance indicator

The number of PIs within each Principle 1 and Principle 2 category varied due to the number of fisheries that assessed that category, as well as how the PIs were mapped to the standard FAM assessment. For example, only one of the fisheries studied scored stock rebuilding. For stock status three of the fisheries studied had more than one unit of certification (UoC) for target species – two fisheries had two stock status UoCs and one fishery had four. The total number of stock status PIs for the 21 fisheries was therefore 26. The percentages shown in Figure 25 therefore relate to the proportion within that PI i.e. for stock status 14 of the 26 PIs studied (54%) remained ≥ 80. For stock rebuilding the only PI studied moved from ≥ 80 to 60-79.

5.2. Stock status: Principle 1

5.2.1. Stock status and stock rebuilding

The majority of pelagic species (60%) remained within the unconditional pass category (≥ 80) between pre-assessment and certification; 40% remained within the conditional pass category (60-79). The Spawning Stock Biomass (SSB) trend (as presented in the discussion, see **Table 12**) did not compare with the PI trend and SSB's are seen to increase and decrease while the PI trend remains constant. Consultation indicates that one of the pelagic fisheries within the 'remains ≥ 80' category felt an improved stock status occurred between pre-assessment and certification. This was due to a reduced fishing mortality over this period as the result of a slight change in the management plan, but not attributable to the MSC process.

The stock status for all four demersal species stocks were considered to be within the unconditional pass category (≥80) at time of pre-assessment.

The stock status PI score increased for three out of eight shellfish species studied. For one fishery this was due to a better understanding of the risk of the fishery, rather than any specific positive change, although the SSB trend is seen to increase over the period from pre-assessment to point of

certification. Consultation has found that from the onset the MSC process has incentivised the uptake of new management and facilitation of research by the fishermen - these measures were already in place, but the MSC process has acted as a catalyst to adopting such changes in this fishery.

Another shellfish fishery saw an increase in stock status PI score, however formal stock assessments has not been undertaken regularly and therefore the SSB trend is unknown. This fishery attributes this change as a result of the MSC process, with fishers becoming distinctly more aware of the benefits of sustainability, maintaining biodiversity and responsible management practises, although it is difficult to determine if this translates to a real outcome improvement.

Although there was some correspondence between the change in score and the change in an indicator this was not consistent. This is because a change in score between pre-assessment and full assessment may be caused by increased information – increasing the certainty that the stock is sustainable – or a real change in the trend in SSB, or other stock indicator proxy. For instance, one mixed fishery has an increased PI trend due to more detailed assessments being undertaken from pre-assessment to certification allowing a better understanding of the fisheries. Stakeholder consultation attributes this to a change in management approach and research plans at a national level, and not in response to the MSC.

Of all the Principle 1 PIs, stock status had the most fisheries (5 out of 26) which remained within the conditional pass category (60-79). One possible explanation of this is that it may be difficult for the fishery to influence stock status between pre-assessment and certification, perhaps due to the short timeframe between pre-assessment and certification; or that it may be easier to identify a specific problem with stock status, compared to the other PIs. The majority of these conditional passes were for pelagic species, as well as two shellfish species. Consultation with these fisheries did not indicate an improvement in stock status within the conditional pass category between pre-assessment and certification. However, although we examined the dataset for consistent trends between fishery types (pelagic, demersal etc) the dataset was too small to generate meaningful results.

Only one of the stocks required scoring for stock rebuilding. The stock status and stock rebuilding PIs were analysed based on the scale of landings, scale of vessels and geographic location but no specific trends were identified.

5.2.2. Reference points

The PI trend for reference points is presented in Figure 26. Improvements in the pelagic reference points are evident for two pelagic fisheries. One received an automatic score of 80 at point of certification due to the assessment using RBF[12], the other had no formal reference points defined at time of pre-assessment, but had introduced them by time of full assessment.

[12] RBF is a set of assessment methods contained in the FAM, it is used where sufficient data is not available for the assessment. For more details about the RBF process please refer to: http://www.msc.org/about-us/standards/methodologies/fam/msc-risk-based-framework

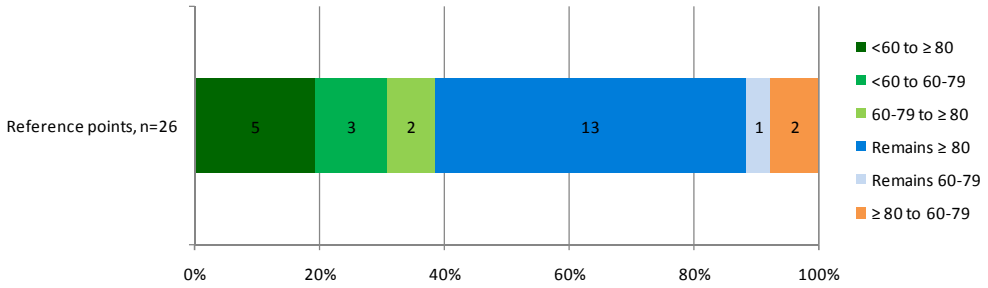


Figure 26. Reference points PI trend

Improvements in 4 out of the 8 shellfish fisheries were observed for reference points. One shellfish fishery saw a change in management approach over this period, which was not directly attributable to the MSC process. Before the pre-assessment process the fisheries management authorities recognised the need for improved management for three fisheries, including the MSC fishery. A data poor fisheries workshop was held to discuss future management and research needs and the instigation of reference points was a result of this workshop and subsequently introduced by fisheries managers. It was considered that the MSC process did play a role in incentivising the implementation of these management measures with fishers and also provided impetus for further research to be undertaken (as a result of conditions set at main assessment).

Another shellfish fishery also improved from a conditional to unconditional pass between pre-assessment and point of certification. In this instance the Department of Fish and Wildlife had been working towards better fisheries management systems for the past 22 years. The development of reference points had not been a high priority due to the nature of the fishery. However, during the period between pre-assessment and main assessment more detailed thought was given to putting a system together for management. Despite this, the change in score from pre-assessment to certification was due to the assessment team gaining a better understanding of the nature and the risks of the fishery to the target species. No management changes were actually made during this period.

The third shellfish fishery that also improved the score for this PI did so during the seven years between pre-assessment and certification. The pre-assessment identified the need for mechanisms to identify when a fishery becomes depleted and this PI moved from having no reference points in place to a conditional pass at point of certification.

Reference points for all four demersal stocks remained within the unconditional pass category (≥ 80) between pre-assessment and certification.

Reference points for two PIs decreased from unconditional to conditional pass. In these cases the decreased score was due to the issue not being raised at pre-assessment stage.

5.3. Ecosystem: Principle 2

The change in pre-assessment to certification for Principle 2 PIs has been sorted based on gear type as follows and presented in Figure 27:

- Trawl: pelagic and demersal trawl;
- Nets: drift, trammel and ring nets;
- Line: handline, longline and pole & line;
- Other: hand gathered and dredge.

The amalgamated scores for Principle 2 PIs are presented in Figure 25.

Indicator data has not been assessed for any of the Principle 2 PIs since species specific assessments were rarely undertaken at pre-assessment stage for retained, bycatch and ETP species. It was not possible to correlate any trends in species or habitat specific indicators between pre-assessment and main assessment since a robust baseline was not reported at pre-assessment stage.

Throughout all Principle 2 PIs the potting gear type remains within the unconditional pass category from start of pre-assessment process; this is to be expected with a gear type that is relatively less intrusive to the ecosystem.

5.3.1. Retained and bycatch species

13% of the retained and 17% of the bycatch species PIs assessed showed some form of improvement (Figure 25). The majority of these were for trawl fisheries, followed by line and net fisheries (Figure 27). A chi-square test of independence was performed to examine the relation between gear and score changes for retained and bycatch from pre-assessment to certification. The relation between these variables was not significant, X^2 (2, n = 46) = 15.73, p = 0.204.

Positive change in one European fishery occurred as a result of EU legislation requiring reporting of 'skates and rays' to species level which improved the understanding of the impact to these retained species. In another fishery the pre-assessment raised concern over the interaction with elasmobranchs and benthic organisms, however adequate information was provided during main assessment to allow an unconditional pass.

Improvements also occurred in a shellfish trawl fishery in relation to bycatch where bycatch reduction measures had been explored since 1994. In 2001 seasonal closed areas were introduced to protect a sensitive bycatch species, in 2003 these became total annual closures. So while the MSC pre-assessment process did not instigate further bycatch reduction measures, it did catalyse the process and incentive for implementation within the fishery. It is also noted that the involvement of this fishery in the MSC has provided some assistance in securing funding for ongoing research into the wider environmental impacts including bycatch reduction methods.

Improvements also occurred in a shellfish trawl fishery in relation to bycatch where bycatch reduction measures had been explored since 1994. In 2001 seasonal closed areas were introduced to protect a sensitive bycatch species, in 2003 these became total annual closures. So while the MSC pre-assessment process did not instigate further bycatch reduction measures, it did catalyse the process and incentive for implementation within the fishery. It is also noted that the involvement of this fishery in the MSC has provided some assistance in securing funding for ongoing research into the wider environmental impacts including bycatch reduction methods.

Improvements in one line fishery occurred for both retained and bycatch species with impact of rays and under-reporting of bycatch raised at pre-assessment, but not requiring conditions at certification.

Mortality of slippage within one pelagic fishery was raised at pre-assessment, but this did not require a condition at certification due to adequate understanding and knowledge gained during the main assessment.

The two drift net fisheries targeting pelagic species both resulted in conditions for retained and bycatch which were not identified at pre-assessment. This was due to further information being required to quantitatively assess the level and species associated with this fishery. Another mixed fishery also did not raise any issues for retained or bycatch species at time of pre-assessment, but they also received a conditional pass at certification. In these three cases the apparent decrease in score was due to the issue not being raised at pre-assessment.

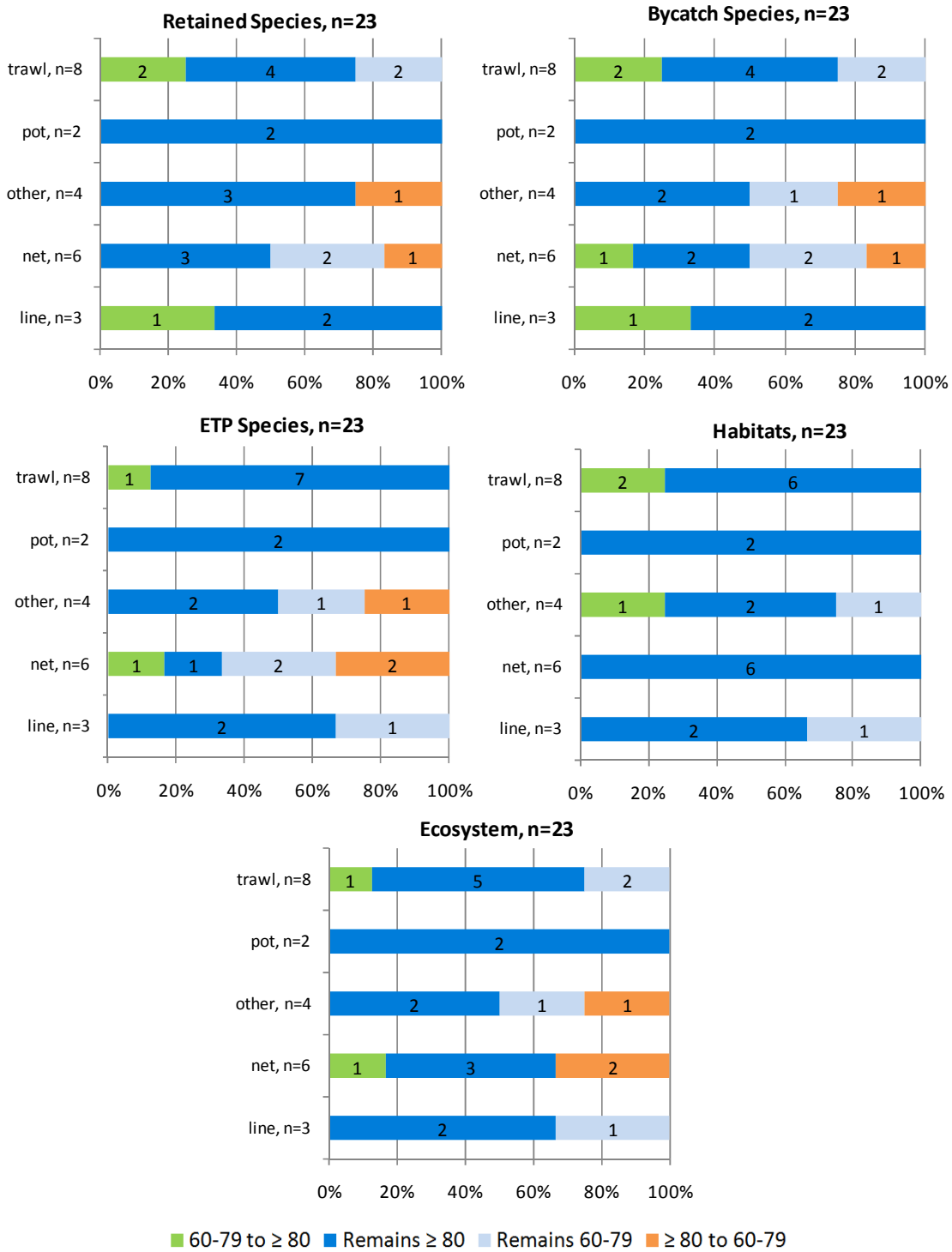


Figure 27. Change between pre-assessment and certification score, across the sample of 20 fisheries presented by Principle 2 performance indicator and gear type
(the labels within the bar chart indicate the number of PIs for each category)

Five of the trawl fisheries remained within the conditional pass category, including demersal and pelagic species. The pre-assessment for one of these fisheries put forward focus points in relation to improvements in data and information. Consultation indicates that some action was taken between

pre-assessment and certification, but this was primarily in response to legislation introduced by the national Fisheries Board which has required on board observer coverage for all fisheries since 2000. Although not part of improvements between pre-assessment and certification, conditions raised as part of the certification increased the need for data sampling within this fishery and so the associated vessels have increased their cooperation with scientists to enable research, for example for one week of the year the vessels dedicate themselves to scientific survey.

One pelagic fishery was assessed to be within the unconditional pass category at pre-assessment, but improvements have been made for retained and bycatch within this unconditional pass category. Again, this was focused on improved data recording which was collected in response to recommendations at pre-assessment and therefore attributable to the MSC process, although did not change the actual outcome status.

5.3.2. Endangered, Threatened and Protected (ETP) species

Overall 9% of the Endangered, Threatened and Protected (ETP) PIs studied improved from a conditional to unconditional pass between pre-assessment and certification (Figure 25). Improvements occurred in two pelagic drift net fisheries where potential interactions were highlighted for shad and ray species. Further understanding gained at main assessment resulted in an unconditional pass for these fisheries. A similar type of improvement was also seen for a demersal long line fishery where concern over nesting birds was raised at pre-assessment, but no condition raised at certification.

Two fisheries required ETP conditions at certification, but these issues were not raised at pre-assessment. For one shellfish fishery the condition was set for indirect impact on birds; however pre-assessment did not consider impacts on birds applicable and the change in score is likely due to the assessment team having a better understanding of the MSC methodology. It is understood that for the other demersal fishery the main assessment undertook consultation with key NGOs and gave due regard to the issue raised by these NGO's. This better understanding of impacts resulted in the ETP PI requiring a condition at certification.

Two fisheries recognised the potential ETP impact at pre-assessment, but this remained a factor for the main assessment with conditions opened for these PIs. One other fishery also remained within the conditional pass category, although consultation indicates that an improvement was felt to occur in this fishery between pre-assessment and certification due to an observed increase in birdlife.

The majority (61%) of ETP PIs remained within the unconditional pass category between pre-assessment and certification, although three fisheries did report an improvement within this category. One fishery undertook further research which improved the knowledge of indirect effects to ETP species, particularly land based and coastal species which have more limited accessibility to the target species. As with retained and bycatch species another fishery felt improvements were made in relation to data recording for ETP interactions. And finally a European trawl fishery improved, but this was due to EU legislation which established the common skate as an ETP species and is more applicable to management than outcome status.

5.3.3. Habitats

Very little change was recorded between pre-assessment and main assessment for habitat outcome status, predominately because 78% of PIs were already considered to be within the unconditional pass category. Three fisheries were considered to improve with a lack of knowledge highlighted at pre-assessment. Consultation indicates that a research project 'habitat-cam' is studying habitat impacts for one of these fisheries. It is unknown if this commenced between pre-assessment and certification, the research was included within a research plan and not specifically instigated due to

MSC, although the MSC process is thought to have acted as a catalyst for the implementation of the research.

Two fisheries remained within the conditional pass category (Figure 25). . One of these reports an improvement within this category between pre-assessment and certification, attributing this to new national legislation.

5.3.4. Ecosystems

Little change was seen in the ecosystem PI with 61% remaining within the unconditional pass category between pre-assessment and certification (Figure 25). Positive change is seen in one shellfish fishery with surveys undertaken to explore variation of spatial distribution of environmental effects, providing improved knowledge and understanding of ecosystem models for the region. This research was already planned and not instigated due to the MSC process, but it was felt that the presence of MSC accelerated the process.

A European pelagic fishery also improved with trophic effects and dependence of many species on the target species as food source highlighted at pre-assessment, but not requiring a condition at certification. This was due to an improved understanding of the assessment team during main assessment.

Four fisheries remained within the conditional pass category and one of these reported an improvement during this timescale. Increased management of the mangrove ecosystem occurred and the MSC was felt to act as a catalyst for support from scientific institutes, donor agencies and NGO's.

Two fisheries that remained within the unconditional pass (≥ 80) category also felt improvements occurred in the ecosystem PI and both related to new research being undertaken (from interviews). . For one this is due to the establishment of Natura 2000 sites and the required management for interactions with these sites introduced from spring 2008. Such strategies include annual impact assessments and management evaluation; research into indirect impacts especially potential effect on fish eating birds; adaptive management introduced to the fishery whereby licenses to fish in the area are reviewed annually in line with results from impact assessment and; strategy to reduce disturbance of birds including having a maximum number of vessels in a certain area at any one time. While MSC was not the driver for any of these improvements, it is thought to have perhaps accelerated the rate of change and stimulated fishermen to ensure adequate implementation of new measures.

5.4. Discussion of pre-assessment findings

5.4.1. Trends in PI score

The majority of performance indicators studied across the sample of 21 fisheries did not change scoring category between pre-assessment and certification. The majority of these were assessed as being within the unconditional pass category at the start of the pre-assessment process. For a smaller proportion of those that did not change issues had been raised at pre-assessment, but not adequately dealt with to reach an unconditional pass at certification. Four PIs in this 'remains 60-79' category were felt by stakeholders to start making some improvements between pre-assessment and certification.

Overall 18% of the PIs analysed across 21 fisheries improved in PI score between pre-assessment and certification, equating to 31 out of 168 PIs (Table 11). The majority of these improvements were evident in the sample of fisheries certified from 2006-2010, compared with those certified from

2001-2005, however this was not found to be statistically significant (X^2= 4.89, n=168, p = 0.087). The improvements occurred equally across Principle 1 and 2 indicators.

Table 11. Summary of PI changes (constant, decrease and increase) between pre-assessment and certification by PI and year of certification

	2001-2005			2006-2010			Total		
Performance Indicator	Constant	Decrease	Increase	Constant	Decrease	Increase	Constant	Decrease	Increase
1.1.1 Stock status	7			12		7	19		7
1.1.2 Reference points	7			7	2	10	14	2	10
1.1.3 Stock rebuilding					1			1	
2.1.1 Retained species	4	1	1	14	1	2	18	2	3
2.2.1 Bycatch species	4	1	1	13	1	3	17	2	4
2.3.1 ETP species	5		1	13	3	1	18	3	2
2.4.1 Habitats	5		1	15		2	20		3
2.5.1 Ecosystems	6			12	3	2	18	3	2
Total	38	2	4	86	11	27	124	13	31
% of total PIs	22.6%	1.2%	2.4%	51.2%	6.5%	16.1%	73.8%	7.7%	18.5%

The highest level of positive change occurred in the reference points PI; 11 species within the sample of fisheries had issues raised at pre-assessment for this PI and 9 of these were addressed sufficiently for an unconditional pass at certification. In Principle 2 the most improvements were made for retained, bycatch and ETP species. These were predominately related to improvements in data recording and/or improvements in the assessment team's understanding of both the risk of the fishery and the MSC methodology.

There was no consistent pattern between PI score trends and date of assessment, but there was between trends and the recommendation given at assessment. For a full recommendation, the proportion of outcome PIs scoring >80 remained at about 65% from pre-assessment to assessment. For the cautionary recommendation, the proportion of PIs scoring >80 increased from 41% at pre-assessment to 76% at assessment. This different was highly significant; the five fisheries that received a cautionary recommendation increased in PI score significantly more than the remainder 16 fisheries (X^2 (2, n = 168) = 36.03, p <0.0001). This relationship is explored further in Section 9.

5.4.2. Relationship between indicators and PI scores

To examine whether these trends in PI score discussed in section 5.4.1 represented actual changes on the water, the indicators themselves were examined. ***This was only possible for stock status where data indicating the actual changes in stock biomass were obtained from reviewing recent and past stock assessments.*** Changes which took place between the pre-assessment and time of certification are summarised in Table 12 and Table 13.

Where raw indicator data were available, these were analysed as a regression over the time period and the resulting correlation coefficient was used to define the type of change taking place. If r^2 ≥0.6, there was considered to be a positive or negative trend for the purposes of this study, even though the 10% critical value of r^2 with n=4 (Table 13) is 0.81If r^2 <0.6, then the stock was considered to have remained constant over the period. A constant trend was also assumed where n=2. Table 12 provides a summary of these data.

Table 12. Summary of PI trend (stock status) and indicator trend (SSB) showing number of fisheries in each category

PI (stock status trend)	Indicator (SSB) trend			
	no trend	increase	decrease	unknown
<60 to 60-79				1
60-79 to ≥ 80	1	3	1	1
Remains 60-79	4			1
Remains ≥ 80	7	2	4	1

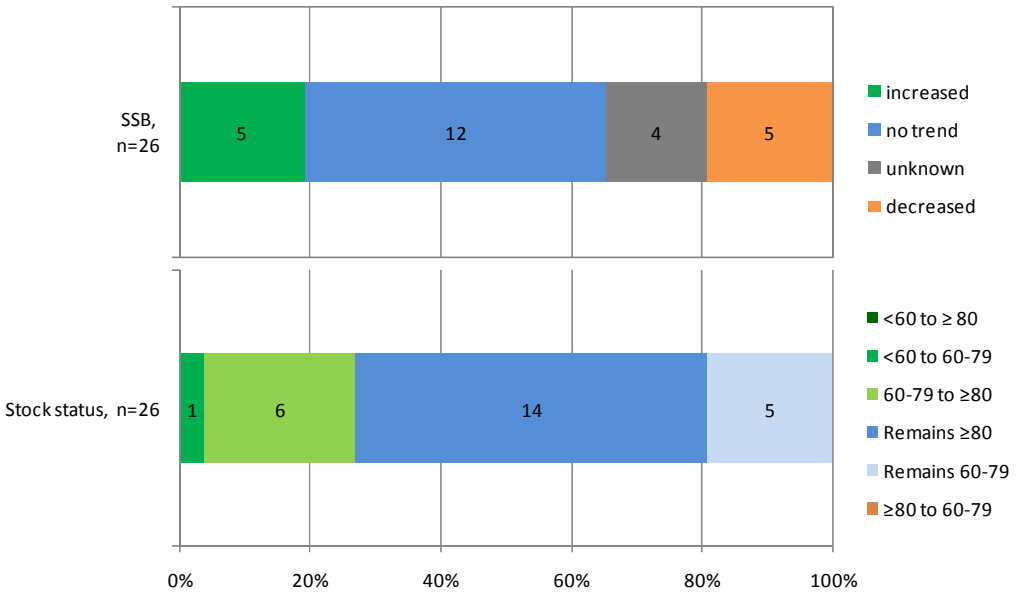


Figure 28: Spawning Stock Biomass indicator trend (top), based on comparing SSB at time of pre-assessment and point of certification, and stock status PI score trend (bottom)

Table 13. Changes in PI scores and indicator data for stock biomass between Pre-Assessment and Assessment
Bold indicates fisheries that received a cautionary recommendation at pre-assessment.

Fishery	PA PI score	PI score at certification	Indicator data trend	r^2	n	Pre-assessment – certification
c	≥80	≥80	decreased	-	-	2000-2001-
k	≥80	≥80	constant	-1	2	2000-2001
j	≥80	≥80	decreased	-0.95	5	2000-2004
i	≥80	≥80	constant	0.32	5	2002-2005
f (species 1-4)	**60-79**	**≥80**	**Mixed**	**-**	**-**	**2003-2008**
d	≥80	≥80	increased	0.81	3	2003-2005
e (species 1)	≥80	≥80	increased	0.75	3	2003-2005
e (species 2)	≥80	≥80	constant	-0.11	3	2003-2005
b	60-79	60-79	constant	-0.16	4	2003-2006
q	**<60**	**60-79**	**unknown**	**-**	**-**	**2003-2010**
g (stock 1)	≥80	≥80	decreased	-0.73	5	2004-2008

g (stock 2)	≥80	≥80	constant	0.04	5	2004-2008
n	**60-79**	**60-79**	**unknown**	**-**	**-**	**2004-2010**
h	**60-79**	**≥80**	**increased**	**0.64**	**4**	**2004-2007**
a	60-79	60-79	constant	-1	2	2007-2008
s	60-79	≥80	unknown	-	-	2007-2009
t	≥80	≥80	decreased	-0.87	4	2007-2010
o	≥80	≥80	unknown	-	-	2008-2010
r	≥80	≥80	constant	-	-	2008-2009
m	60-79	60-79	constant	0	2	2008-2009
l	≥80	≥80	constant	0.00000004	3	2008-2010
p	≥80	≥80	constant	-1	2	2009-2010

5.4.3. Attribution of change

The level of change in performance indicators and the overall attribution of change, derived from the stakeholder consultation, is shown in Figure 29. Figure 29 and Figure 30 are both based on stakeholder consultation focused specifically on why changes occurred between pre-assessment and certification. Figure 29 once again highlights that the majority of PIs did not change during the pre-assessment to main assessment process. Of the improvements recorded, approximately half were cited as being a result of the MSC, with the remainder attributed to other stakeholders or management systems independent of MSC.

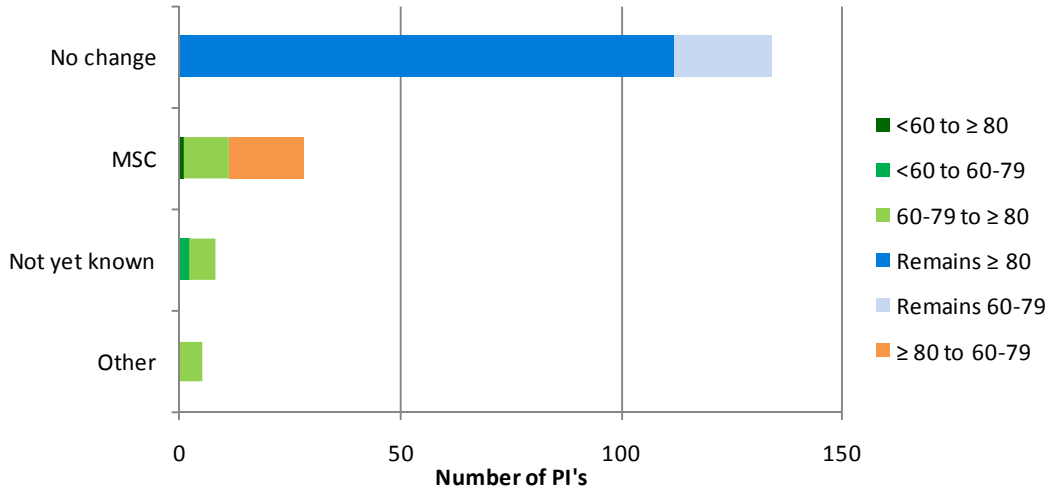


Figure 29. Change in performance indicators (PIs) between pre-assessment and certification, across the sample of 20 fisheries, indicating attribution of change

The specific reasons for attribution of change are presented in Figure 30. All of the PIs that underwent a negative change in score were due to the issues not being identified at pre-assessment stage. This was not due to any negative change within the fishery but simply the result of a robust, detailed analysis being undertaken during the main assessment.

Similarly some of the positive changes were a result of the fishery providing further clarification or knowledge to issues raised at pre-assessment to justify an unconditional pass and not due to any

material change to the status outcome for that PI. The improved knowledge gained by the assessment team of the MSC methodology also resulted in improved scores, as did the development of the MSC methodology itself, in particular the introduction of the Risk Based Framework (RBF).

One fishery cited the MSC process as the sole reason for positive change by raising awareness and improving the actions of the fishers between pre-assessment and certification. Two fisheries cited new research as the rationale for positive change, both of which were for Principle 2 PIs (habitats and ecosystem). In each case the research had already been planned, although the MSC process was felt to positively incentivise the co-operation of the fishing industry and the securing of funds for the research.

All except one of the five improvements achieved through actions independent of MSC were for Principle 1 PIs. This suggests that Principle 1 may be more difficult for clients to influence between pre-assessment and certification, although care must be taken in this interpretation due to the small sample size. Change in legislation, change in management approach of fisheries authorities and independent stock advice were cited as the reasons for improvement unconnected to MSC.

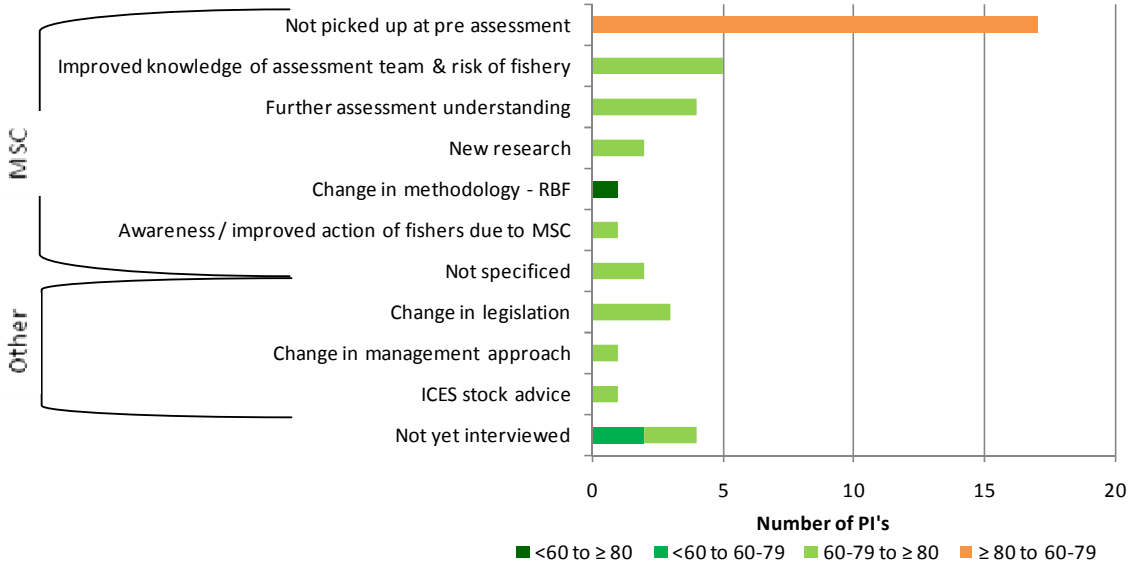


Figure 30. Detailed attribution of change for performance indicators (PIs) that changed score between pre-assessment and certification, across the sample of 21 fisheries

6. POST-CERTIFICATION SAMPLE ANALYSIS

This section reviews outcome changes which have taken place in Principles 1 and 2 in the post-certification sample of fisheries since their certification date. The correspondence between PI scores and observed indicator data trends are first assessed and then the trends in PI scores are evaluated. The influence of the MSC on the changes which have taken place during this period is assessed by analysing conditions and this is followed up in Section 7 by reviewing stakeholder opinions regarding causes of change.

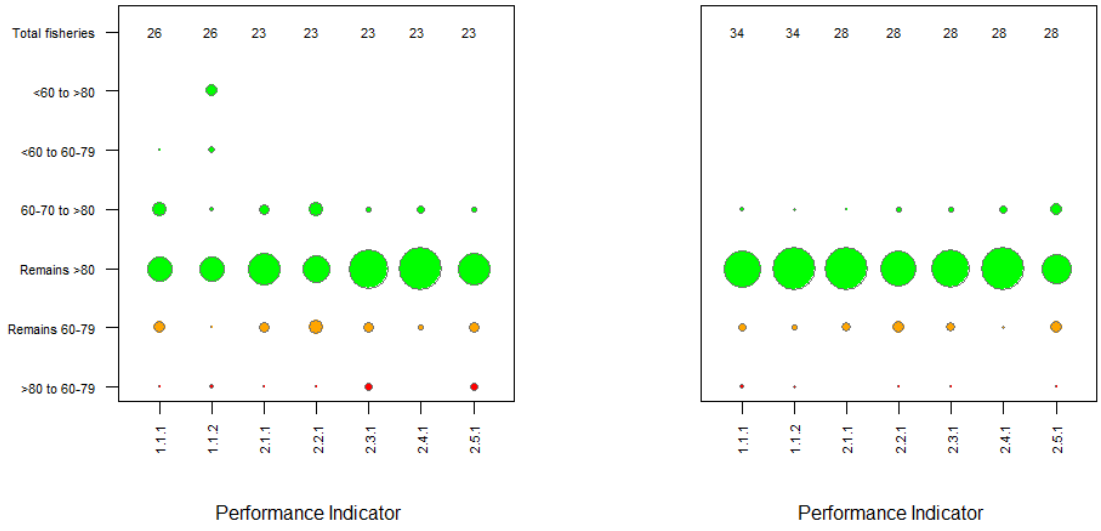
6.1. Synopsis

Scores allocated to PIs were significantly associated with changes in the observed data for both Principles 1 and 2, although less quantitative information was available for Principle 2 and so these were based on observed qualitative changes.

The majority of PI scores were above 80 at their final assessment (Figure 31) across both Principles, with most scores remaining at a consistently high level throughout the certification period. The improvements in stock status PI scores roughly balance the negative trends. Nevertheless, stock management has improved overall and institutions are in place to deal with downturns more quickly, although environmental fluctuations still have a large impact on stock biomass. Reference points have been improved and have been established with greater rigour through requirements to meet international standards and the use of external peer review.

For Principle 1, outcome conditions result in outcome gains, whether they are closed as the indicator increases or if they are closed due to a management change which has a longer term impact. Positive stock changes and improvements to management take place both related and unrelated to the MSC, but drivers are difficult to distinguish between. Stakeholders in the fishery attributed 30% of positive changes in stocks to the MSC programme. The new FAM has resulted in a higher percentage of fisheries with conditions open related to stocks, indicating the changes which have taken place in the methods of assessment. As closure of outcome conditions is significantly associated with positive changes, the increased number of conditions is likely to result in positive changes on closure.

There was a lack of quantitative information on Principle 2 indicators. In certain situations impacts were either assumed to be low where applicable (e.g. pelagic fisheries were assumed to have low impact on habitats) or were allocated low PI scores based on risk rather than actual high negative impacts. In this way, fisheries were scored using the precautionary approach to fisheries management. Conditions were raised requiring action to be taken in the form of data collection, monitoring and improved assessments. Environmental risk assessments as a requirement of MSC conditions often resulted in awareness and attention focussed on issues which had not previously been considered as of potential concern, and in other cases simply increased awareness of issues that were already known. Closure of these conditions and subsequent increase in PI scores were related to a reduction in ecosystem impacts but also to a reduction in uncertainty of the extent of impact. This change of climate, to one of improved information, led to changes in management through the implementation of various mitigation measures. It is assumed that these changes will ultimately result in an improvement in the ecosystem indicator. At the present time, however, most fisheries have not been tracked over a substantial timeframe other than the duration of the condition itself; therefore in some cases expected changes have not yet been recorded.



a) b)

Figure 31. Changes in scores for performance indicators: (a) from pre-assessment to certification, (b) from certification to final surveillance.
Note: the size of the circle is proportional to the number of PIs in each category. The colour codes are L green = an increase in score or no changes in score that was ≥80, orange = no change in a score that was initially >60 and <80 (i.e. a conditional pass); red = a decrease in score from ≥80 to 60-79 (i.e. a new conditional pass).

6.2. Stock status: Principle 1

6.2.1. Indicator data

Analysis of stock abundance indices (details in Part 2 of the report) indicated that approximately 18% of fisheries displayed a decline in stock biomass and a similar percentage (21%) increased. The fisheries that decreased in biomass were northern stocks of the Western Australia rock lobster, Hastings pelagic herring, Loch Torridon *nephrops*, Burry inlet cockles, Lakes and Coorong perch and South Georgia Patagonian toothfish.

The toothfish, perch and rock lobster remained above limit reference points and herring abundance has increased since the final surveillance audit, however the Burry inlet cockles declined below precautionary limits because of the alien parasite induced mortality and the stock biomass of *nephrops* is unclear but thought to be low and declining. In this fishery, certification has been suspended for the time being because of its inability to comply with stock status requirements due to fishing beyond the control of the certification client. Information used to make the judgement as to whether stocks had increased, decreased or remained constant over the certification period is found in Part 2 of the report. Increases in abundance were seen in Hastings fleet pelagic mackerel, North Pacific American albacore, Gulf of Alaska pollock, New Zealand hoki, Oregon pink shrimp, Southwest handline mackerel and North Pacific halibut. In both the hoki and the pollock fisheries the increases in stock abundance were associated with a reduction in Total Allowable Catch over the same time period. The increase in albacore was not associated with any management changes and is more likely to be due to improved recruitment during that time (Hough pers. comm.). Changes in the stock biomass indicator data were analysed by categories including date of certification, species

group, fishery scale, management region and proportion of stock certified, however there were no significant trends.

6.2.2. Relationship between PI scores and indicator data

Changes in indicator data and corresponding changes in PI scores allocated at certification and later are summarised for stock biomass (Table 14), the performance indicator for which the most comprehensive quantitative data were available. Further details are provided in Table 15. Significant trends in an indicator corresponded with changes in PI scores (χ^2, $p<0.01$). This suggests that changes in PI scores are significantly associated with a corresponding change in the indicator data and so are useful for tracking changes in real outcome indicators.

Table 14. Summary of trends in stock status performance indicators and trends in stock biomass indices.

Row Labels	decrease	increase	no trend	Total
≥80 to 60-79	2	1		3
60-79 to ≥80		3		3
Remains ≥80	4	3	16	23
remains 60-79			5	5

Table 15. Changes in PI scores and indicator data for stock biomass (1.1.1) over the certification period
Further details of abundance indices used and their sources can be found in Part 2. NS = not significant

Fishery	Initial PI score	Final PI score	% change in PI scores	% change in indicator data	Indicator data trend	Notes	R	n	p
AF North Sea herring	75	-	0.0%	0.0%	no significant trend		0.91	3	NS
American albacore (NP)	75	80	6.7%	81.8%	increase	"best available evidence that the stock is now doing well" SR 2009	1.00	3	p<0.05
American albacore (SP)	100	-	0.0%		no significant trend	"No significant changes occurred in the fishery intervening period between assessment and surveillances" (2007-2009)	unknown		
Australian mackerel icefish	75	75	6.7%	0.0%	no significant trend	(increase attributed to an underestimation in 2008)	constant		
BSAI Pollock	80	90	12.5%	0.0%	no significant trend		-0.12	6	NS
Burry inlet cockles	100	75	-25.0%		no significant trend	All sources indicate a decline in biomass	decrease		
Canadian Northern prawn trawl (5,6,7)	95	-	0.0%	0.0%	no significant trend		no change (very short time period)		
Canadian Northern prawn trawl (13,14,15)	95	-	0.0%	0.0%	no significant trend		no change (very short time period)		
GOA Pollock	70	90	28.6%	78.1%	increase		0.82	6	<0.05
Hastings fleet Dover sole	90	-	0.0%	0.0%	no significant trend		0.48	5	NS
Hastings fleet pelagic (herring)	90	75	-16.7%	-37.5%	decrease		-0.94	4	p<0.1
Hastings fleet pelagic (mackerel)	90	75	-16.7%	18.3%	increase		1.00	4	p<0.01
Lake Hjälmaren pikeperch	95	-	0.0%	0.0%	no significant trend	Best information available suggests stock status has not changed	constant		
Loch Torridon Nephrops	90	80	-11.1%	-33.7%	decrease	(suspended since 2011)	-0.93	6	p<0.01
Norway North Sea Saithe (NEA)	90	100	11.1%	0.0%	no significant trend		-0.94	3	NS
Norway North Sea Saithe (NS)	80	100	25.0%	0.0%	no significant trend	Best available information indicates a decline	-0.82	3	NS
Oregon pink shrimp	80	-	0.0%	153.3%	increase		0.96	4	p<0.05
Patagonian scallop	70	-	0.0%	0.0%	no significant trend		0.64	4	NS

Fishery	Initial PI score	Final PI score	% change in PI scores	% change in indicator data	Indicator data trend	Notes	R	n	p
PFTA North Sea herring	90	80	-11.1%	0.0%	no significant trend		-0.46	6	NS
SA hake trawl *(M. Paradoxus)*	60	65	0.0%	0.0%	no significant trend	stakeholder comments indicate it is increasing and data only available until 2007	-0.27	7	NS
SA hake trawl (*M.capensis)*	80	85	0.0%	0.0%	no significant trend	stakeholder comments indicate it is increasing and data only available until 2007	-0.02	7	NS
SG patagonian toothfish longline	100	100	0.0%	-26.5%	decrease		-0.77	8	p<0.05
SPSG North sea herring	75	75	0.0%	0.0%	no significant trend		0.91	n3	NS
SW handline mackerel	100	90	-10.0%	39.3%	increase		0.88	9	p<0.01
US N.Pacific halibut	100	-	0.0%	30.8%	increase		0.93	5	P<0.05
US N.Pacific sablefish	80	-	12.5%	0.0%	no significant trend		0.56	5	NS
WA rock lobster (north)	95	80	-15.8%	-80.9%	decrease	North	0.59	11	p<0.1
WA rock lobster (south)	95	80	-15.8%	0.0%	no significant trend	South	-0.19	11	NS
WA rock lobster (Abrolhos)	95	80	-15.8%	0.0%	no significant trend	Abrolhos	0.13	11	NS
New Zealand Hoki	Pass (60)	80/90	33.3%	36.7%	increase	from reassessment to final surveillance	0.99	5	p<0.01
Lakes and Coorong - mulloway	85	-	0.0%	0.0%	no significant trend	mulloway	-0.98	3	NS
Lakes and Coorong - mullet	85	-	0.0%	0.0%	no significant trend	mullet	-0.94	3	NS
Lakes and Coorong - perch	85	-	0.0%	-57.1%	decrease	perch	-0.99	3	p<0.1
Lakes and Coorong - goolwa cockles	85	85	0.0%	0.0%	no significant trend			2	NS

6.2.3. PI scores

Stock status

Figure 32 shows the changes in PI scores over the certification period. The earliest and most recent PI scores were compared regardless of whether these were from assessment reports or surveillance audits. If there was no re-scoring of the PI over the timeframe of the certification, then a constant score was assumed (see Part 2 of the report for details of score changes throughout the certification lifetime of each fishery). Although 25 units of certification were included in this task, the sample size in Figure 32 was 34 as separate stocks were sometimes covered under one umbrella certification unit. This included the two saithe stocks (North sea and Northeast Arctic) the Hastings pelagic herring and mackerel, the north, south and Abrolhos WA rock lobster stocks, the two Canadian prawn stocks, the two South African hake species and the four Lakes and Coorong species (golden perch, Goolwa cockles, mullet and mulloway).

Of this sample, three fisheries declined from 80-100 to 60-79. One of these was Burry inlet cockles which has had ongoing mass mortality events due to unknown causes (Stillman *et al*., 2010), recently been reported to be due to an alien parasite (BBC, 2011). The other two were Hastings fleet pelagic, in which herring stocks declined due to an extended period of low recruitment. Spawning stock biomass has now recovered to the precautionary level, however as the final surveillance audit available for review (at the time this study commenced) was 2008 (there were no further reports for this fishery at the time this study commenced), this improvement had not yet been reflected in the PI scores.

Five fisheries had a condition open at both points in time (i.e. were scored between 60 and 79); SPSG Ltd North Sea herring, Astrid Fiske North Sea herring, Patagonian scallop, Australian mackerel icefish and South African hake trawl. The recruitment issues of North Sea have already been mentioned, which is why the conditions remained open in the cases of the herring, but these are likely to be closed by the time of the next audits. The Patagonian scallop and icefish remained with unclosed conditions because audits indicated that stock assessment estimates (as well as their associated reference points) needed improving and improved uncertainty estimates were required. So these low scores were based on assessment of risk rather than on a known low stock status. The *M. paradoxus* stock in the South African hake fishery is still below the biomass associated with MSY and so retained a low score throughout the certification period.

Three fisheries had a condition closed with no others raised (i.e. moved from 60-79 to 80-100). These were the North Pacific American albacore, NZ hoki and the GoA pollock, which were all associated with increase in biomass (although with hoki this was only from the re-assessment period onwards – see Part 2 of the report for details).

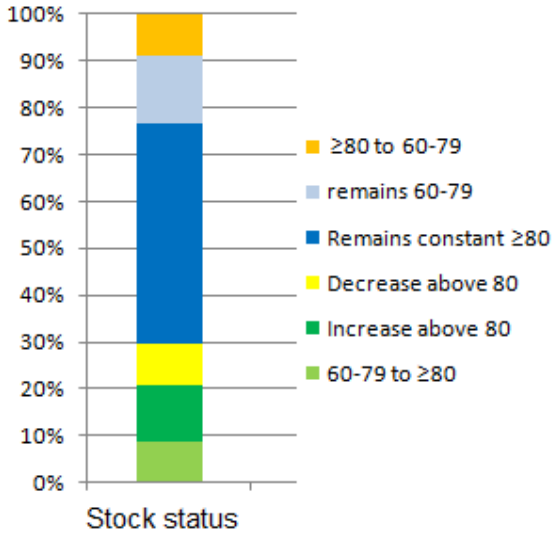


Figure 32. Change in PI scores for stock status over the certification period.
Note: this was the first available score (either at assessment or in a later surveillance audit) compared to the final available score (either at reassessment or the most recent surveillance audit). n=34. There were no fisheries in the 'improved within 60-80' category.

Reference points

Outcome performance indicators related to reference points were defined as those related to whether appropriate reference points were in place. Figure 33 shows changes that have taken place in PI scores related to reference points over the certification period. The change in scores was analysed using the same method as undertaken for stock status, however as multiple performance indicators were sometimes used describing outcome changes in reference point indicators, in these situations the lowest score was used for each point in time and were then compared. Approximately 82% of fisheries were above 80 by the times of the final score. Four fisheries maintained a score between 60 and 79 (Patagonian scallops and Australian mackerel icefish, Canadian prawn area 13/14/15 and Goolwa cockles). The scallop and icefish scores are consistent with the scoring of stock biomass because stock evaluation estimates need improving and likewise with reference points. This has therefore been scored according to the precautionary approach until uncertainty estimates have been established with greater rigour. The Canadian prawn (area 5/6/7) and Lake Hj□lmaren pikeperch both improved their reference point scores from <80 to >80.

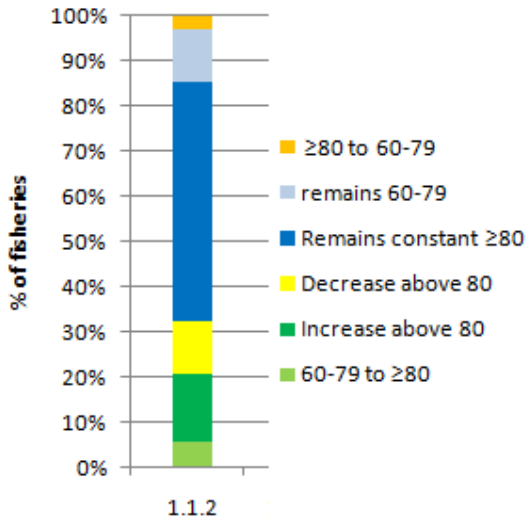


Figure 33. Change in PI scores for reference points over the certification period (n=34)

The single fishery in which the PI score decreased to below 80 was the South African hake trawl fishery. This was not due to a change in the reference limit point (which is the lower 95% confidence interval of the recovery trajectory), but due to increased research highlighting that it is a variable reference point and that at its lowest point, stock levels could potentially be below that accepted as avoiding the risk of recruitment failure. A condition was therefore raised as a precautionary measure.

Consultation with stakeholders of this fishery confirmed that not using Maximum Sustainable Yield (MSY) limit reference points was a conscious decision made by the fishery. They had weighed up the advantages and disadvantages, including social criteria, and concluded that using MSY limit reference points would create too much unemployment. Instead, the variable limit reference point is being used to sustain a more gradual recovery of stock biomass so that too many fishers are out of employment. Nevertheless, the condition is associated with a one year timeframe for closure.

All outcome conditions related to reference points which were closed were due to outcome gains (Figure 35) (however this is of a sample of 3 closed outcome conditions). This is likely to be because it is an indicator which can be addressed immediately as the direct result of an action compared with the longer timeframe associated with waiting for a stock or certain ETP species to recover. This positive impact of the MSC on reference points was highlighted in the stakeholder consultation, in which many respondents mentioned positive changes to reference points and increased certainty about levels which was brought about through new research and international peer review, even in cases where conditions had not been raised.

6.2.4. Attribution of change

To understand why these changes were seen in stock biomass, related outcome conditions were reviewed. Figure 34 shows a summary of the number of conditions raised for each FAM indicator relating to stock status over the entire certification period. This indicates that the majority of conditions raised were related to stock status. Of conditions relating to stock status, 31% were closed, for reference points 27% were closed and for stock rebuilding 50% were closed.

Figure 34. Number of conditions raised and closed throughout the certification life time of each fishery in each FAM PI.

In order to determine whether outcome gains were made on closure of outcome conditions, trends in stock status (indicator data) were analysed with respect to whether an outcome condition was closed or not. Five fisheries had a condition closed relating to stock status. Of these, 3 conditions were closed due to an outcome change and 2 were closed due to a change in management (Figure 35). When trends in the indicator data were analysed, results showed that 3 out of 5 fisheries with a closed condition resulted in increased stock status, so even the condition which was closed due to a management gain still resulted in an improvement in the outcome indicator later on.

In a generalised linear model with binomial errors, there was a significant probability (p=0.02) that closure of an outcome condition related to stock biomass would be associated with an increase in stock biomass. This suggests that closure of outcome conditions have outcome impacts. Although outcome conditions may not be closed because of outcome effects, they may still result in outcome effects later on.

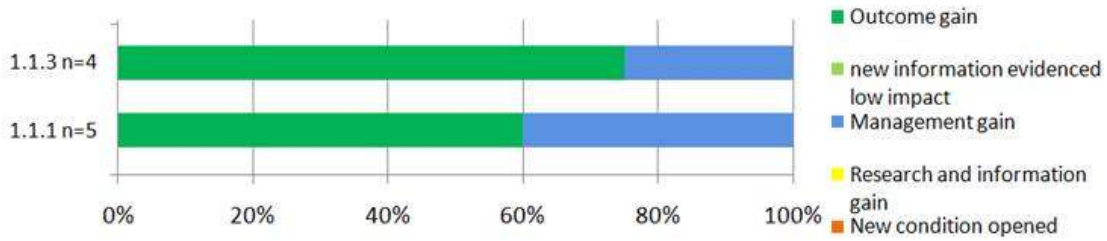


Figure 35. Reasons for closure of conditions related to outcome PIs
Note: 1.1.3 = stock rebuilding, 1.1.1 = stock status.

These results indicate that outcome gains are indeed made with closure of outcome conditions. To further explore the causality and attribution of these changes, stakeholders were asked for their views on the causes and drivers of change within the fishery related to stock biomass. Conditions were identified in stakeholder surveys as one of the key mechanisms via which the MSC brings about change.

Stakeholders attributed the majority of changes in stock biomass to changes in management approaches and fishing practices or effort levels that were not linked to the MSC (Figure 36). However, a significant proportion of respondents (32%) attributed improvement in stock status to MSC certification, in three categories: additional research, changes in management and changes in fishing practices. Thus the MSC, while not being seen as the main driver of change, is a significant driver in the eyes of many stakeholders.

Even in situations where an improvement in stock status was not seen, stakeholders frequently mentioned improvements in management and information used for management - such as a greater robustness in uncertainty estimates, better stock assessment and better management processes in places to deal with stock fluctuations if they occurred – as being key contributions of the MSC certification.

Of the responses provided for increases in stock biomass, fewer than 10% were attributed to some form of MSC involvement (Figure 37). Declines in biomass were generally considered to be completely unrelated to the MSC, predominantly due to environmental factors which influenced stocks in both directions through natural fluctuations in recruitment (this resulted in positive changes to American albacore stocks in the North Pacific and negative changes to fisheries such as North Sea herring). The exception was Loch Torridon, where the negative trend was considered to be potentially partly related to the MSC. This was due to an influx in fishers and fishing effort took place after certification as the Code of Conduct was only voluntary. The reason for the influx of fishers was thought to be due to the closure of the area to trawlers, increasing the attractiveness for creel fishers, which the publicity that surrounded the MSC certification contributed to. This fishery has however now been suspended from the MSC programme for the time being until changes take place. This suspension of certification highlights the fact that the MSC programme is an ongoing process of involvement with a fishery and that the fishery must continually meet or exceed standards to remain certified.

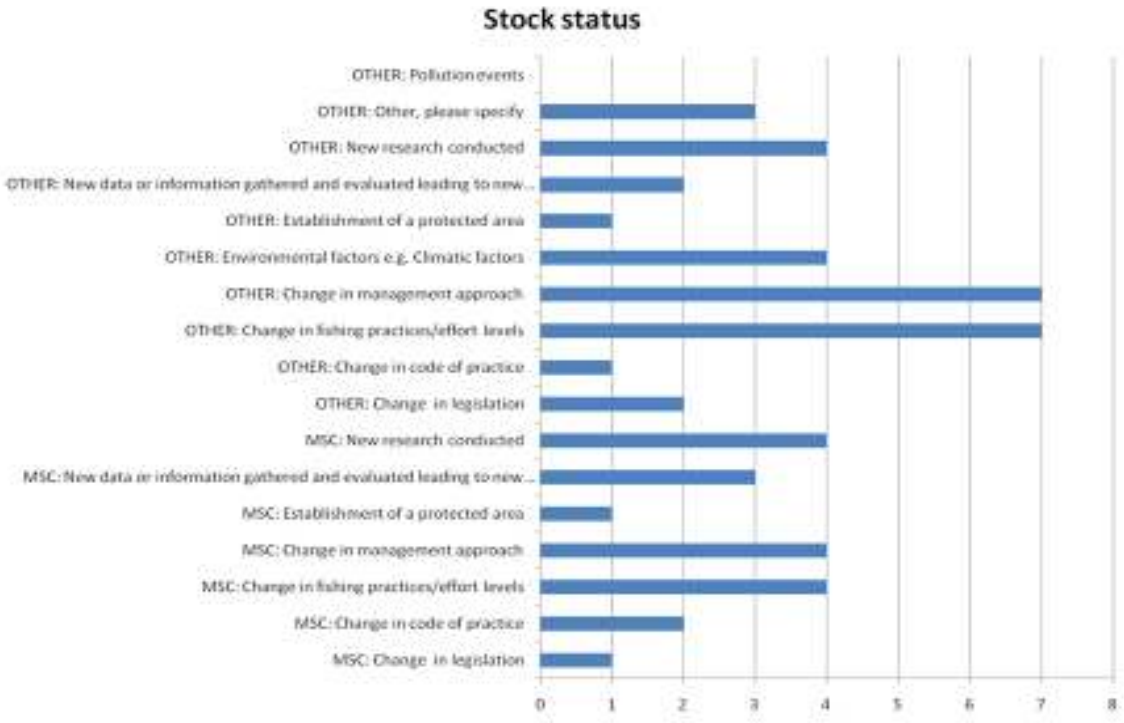


Figure 36. Attribution of change related to increases in stock biomass
Responses from 40 stakeholder interviews; interviewees were instructed to tick as many categories that they thought applied

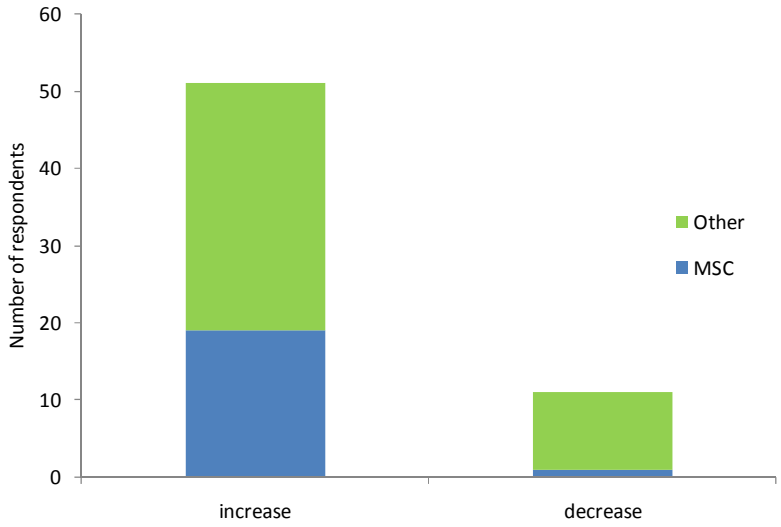


Figure 37. Attribution of changes to stock biomass (responses from 43 stakeholder interviews)

6.3. Ecosystem: Principle 2

6.3.1. Correspondence between indicator data and PI scores

Although improvements were seen in 12% of PI scores for Principle 2, very few of these were directly linked to statistically significant improvements in trends in indicator data, with only 3 cases where there were enough data to demonstrate significant reductions in ecosystem impacts (specifically reductions in bycatch and threat to ETP species in these cases). Qualitative changes in Principle 2 indicators were compared to changes in PI scores (Table 16), and showed a significant correlation (χ^2 $p<0.01$). In this table, indirect effects were considered as outcome indicator changes (e.g. implementation of exclusion devices, increased MPA coverage, reduction in gear loss and overall effort) in order to utilise the available data. The details of PI score changes and indicator trends in these fisheries are provided in Annex B (Tables B1 to B5). There were 6 fisheries in which positive changes were documented but the score remained between 60 and 79, indicating that although improvement had occurred, the fishery had not reached the level required by the 80 scoring guidelines.

An improvement in PI score for Principle 2 outcome indicators was also often related to a corresponding reduction in uncertainty of the environmental impacts of the fishery. This relationship was significant in a generalised linear model with binomial errors relating change in PI score to reduced uncertainty ($p<0.02$) (Figure 38). This indicates that the MSC process follows a precautionary approach, scoring by risk as well as actual impact.

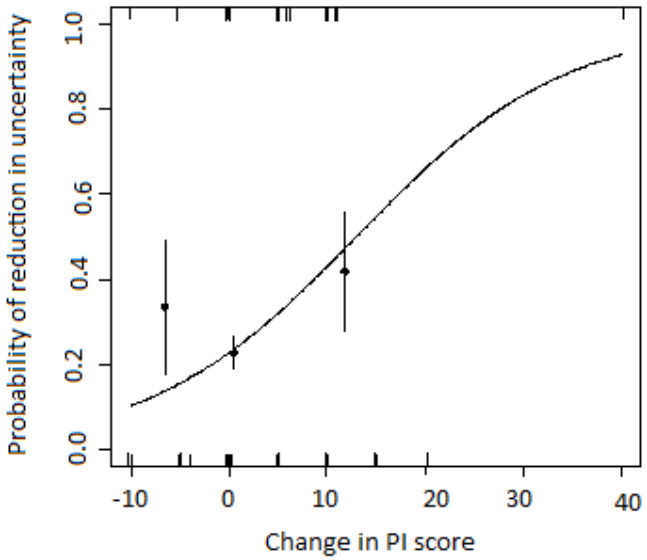


Figure 38. Reduction in uncertainty and PI score (n=141)

Table 16. Occurrence of trends in indicator and changes in uncertainty against changes in score of a fishery during the post certification period

PI trend (PRINCIPLE 2)	Post-assessment indicator trend				Post-assessment uncertainty trend	
PI change	negative	positive	no recorded change	unknown	No change	Reduced
≥80 to 60-79	1	1	1		3	
60-79 to ≥80		7	7		3	11
remains ≥80		12	82	3	85	12
remains 60-79		6	14	7	14	13

Note: Fisheries with no initial PI score were not included and multiple trends were present in certain fisheries (e.g. reducing catches of one bycatch species and increasing catches of another) so n = 119.

6.3.2. PI score trends

In Principle 2, PI scores were reviewed together as there were often overlaps between FAM indicator categories, and a single condition was often related to more than one, e.g. ETP species formed part of the bycatch and its removal was also considered to have an effect on the ecosystem. Changes in PI scores for retained species, bycatch, ETP species, habitats and ecosystems are shown in Figure 39. As there were a number of PIs for each of these five FAM PIs, the lowest scores in each category were compared. Because of this, little emphasis was placed on the exact score changes and instead the focus was boundary changes above and below 80 (i.e. where a condition was raised and not). Figure 39 indicates that 75-92% of fisheries had a final score within the 80-100 category. The following section refers to Figure 39.

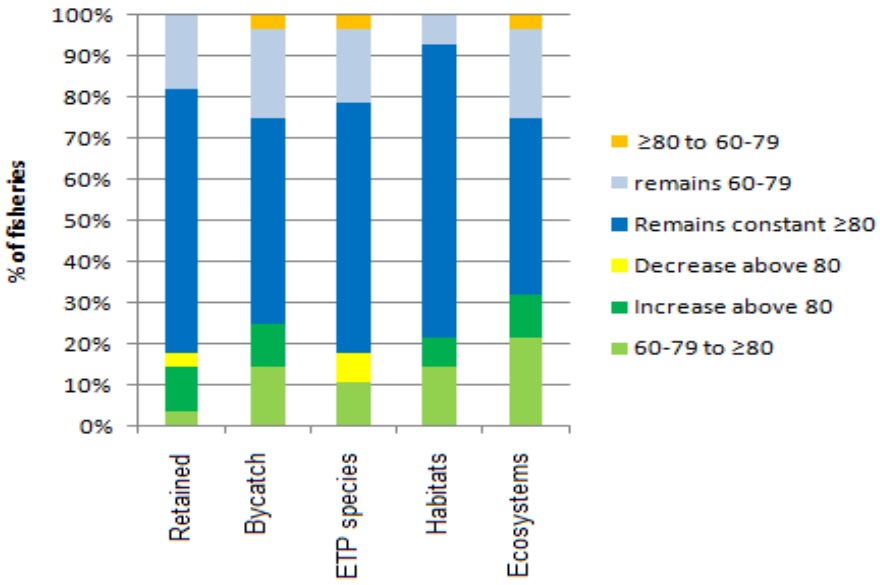


Figure 39. Change in PI scores for Principle 2 indicators over the certification period (n=28)

Retained species

The Hastings herring and mackerel fishery was the only fishery to have a condition closed relating to retained species. This condition required regular monitoring to be set up and was closed when this was achieved. No new conditions were opened, but Lakes and Coorong, US North Pacific halibut and Norway saithe had open conditions throughout their certification period due to lack of information on the extent of retained bycatch in all cases.

Bycatch

In the Hastings fleet Dover sole fishery, the PI score reduced to below 80. Discards of cod had been increasing over the certification period and so a condition was raised to address this which included the requirement of a reduction in discarding as well as increased monitoring due to inadequate reporting. Of the fisheries which remained within the 60-80 category, all are within the timeframe required for closure of the condition and are on target to reach their outcomes according to surveillance reports (Norway North Sea saithe, North Pacific halibut, NZ hoki and Lakes and Coorong).

The three fisheries which increased to a score of over 80 were Hastings fleet pelagic, where a condition was opened requiring regular recording of bycatch, Burry inlet cockles and the PFTA North Sea herring, both due to lack of information on the extent of discarding. The scores were raised due to new evidence of low impacts and implementation of a monitoring programme in the Hastings fleet pelagic fishery.

Endangered, threatened and protected species

One fishery had a reduced score for ETP species over the certification period. This was the Western Australia rock lobster where impacts were ascertained where they hadn't previously been identified. These have been addressed by using Sea Lion Exclusion Devices and implementation of a ban using baitbands (interact with dusky whalers) and conditions only remain open because of data requirements on sea lion bycatch rate for the most recent season. Catch rates are assumed to be

low, but here the precautionary approach has been used for scoring so until evidence is available it will not be re-scored.

Fisheries remaining in the 60-80 scoring category were the Bering Sea and Aleutian Islands Pollock, GOA pollock, Norway saithe and North Pacific halibut. Conditions remained open relating to the effects of the Bering Sea and Aleutian Islands Pollock fishery on Steller sea lions and Chinook salmon as the level of threat the fishery posed to stocks had not been sufficiently determined. The impact of the Norway North Sea saithe fisheries has not been quantified and so a condition was raised to initiate sampling programmes. Harbour porpoise are the only mammal species of concern and the effect of the fishery on birds, fish, skates and rays is unknown. The condition raised for US North Pacific halibut was related to the risk assessment, particularly with regard to scavenging marine mammals, the capture figures of which are unknown. For GOA pollock, the condition was closed in 2007 when impacts were considered to have been monitored adequately, however a condition requiring more information has since been raised, so the PI score remains below 80.

Habitats

No fisheries had new conditions opened related to habitats over the certification period. Three fisheries had conditions which remained open. One of these was New Zealand hoki, which was allocated a low score based on the lack of information proving there were no unacceptable impacts on benthic habitats. South African hake had a condition opened in 2004 which was closed in 2008 and re-opened in 2010 because impacts were not considered well defined and information inadequate. Canadian prawn also maintained an open condition as there was little evidence to demonstrate that impacts are low. The Patagonian toothfish, BSAI and GOA pollock fisheries all had conditions closed during the certification period due to the reduction in TAC in all three fisheries and the implementation of exclusion zones in the toothfish fishery.

Ecosystems

One fishery (the rock lobster) had a PI score related to ecosystems which declined from >80 to 60-80. In this fishery a condition was opened late on in certification, related to bait bands (also related to ETP species), but remains open until evidence of impacts is found, indicating a precautionary approach to scoring has been taken. This is an example of an old fishery where impacts have been picked up later on in certification through an EIA as an MSc requirement.

Fisheries in which a condition remained open were the Canadian northern prawn, Lakes and Coorong, New Zealand hoki, Norway saithe and South African hake. These were again due to lack of information regarding the level of current impacts. For Canadian prawn the acceptability of current impacts of biological diversity, community structure and productivity is still to be assessed, for hoki there is a lack of information and research on aspect other than related to setting the TAC and for hake there is lack of information specifically regarding benthic habitats.

Fisheries in which a condition was closed included the icefish, both pollock fisheries, Oregon shrimp and toothfish. In the icefish fishery there was a reduction in uncertainty associated with ongoing observer and research programmes and ERAs, the reduction in TAC in both pollock fisheries was assumed to have a positive impact on the ecosystems, greater awareness of the impacts was achieved in the shrimp fishery and the issue of discarded hooks has been largely eliminated int eh toothfish fishery.

The changes in PI score were also analysed by gear type (Figure 40). This showed that improvements occurred in demersal trawl fisheries for all indicators; longline fisheries showed improvements relating to bycatch and ETP species; and passive fisheries showed improvement related to bycatch, ETP species and ecosystems. These improvements were generally linked to the presence of conditions.

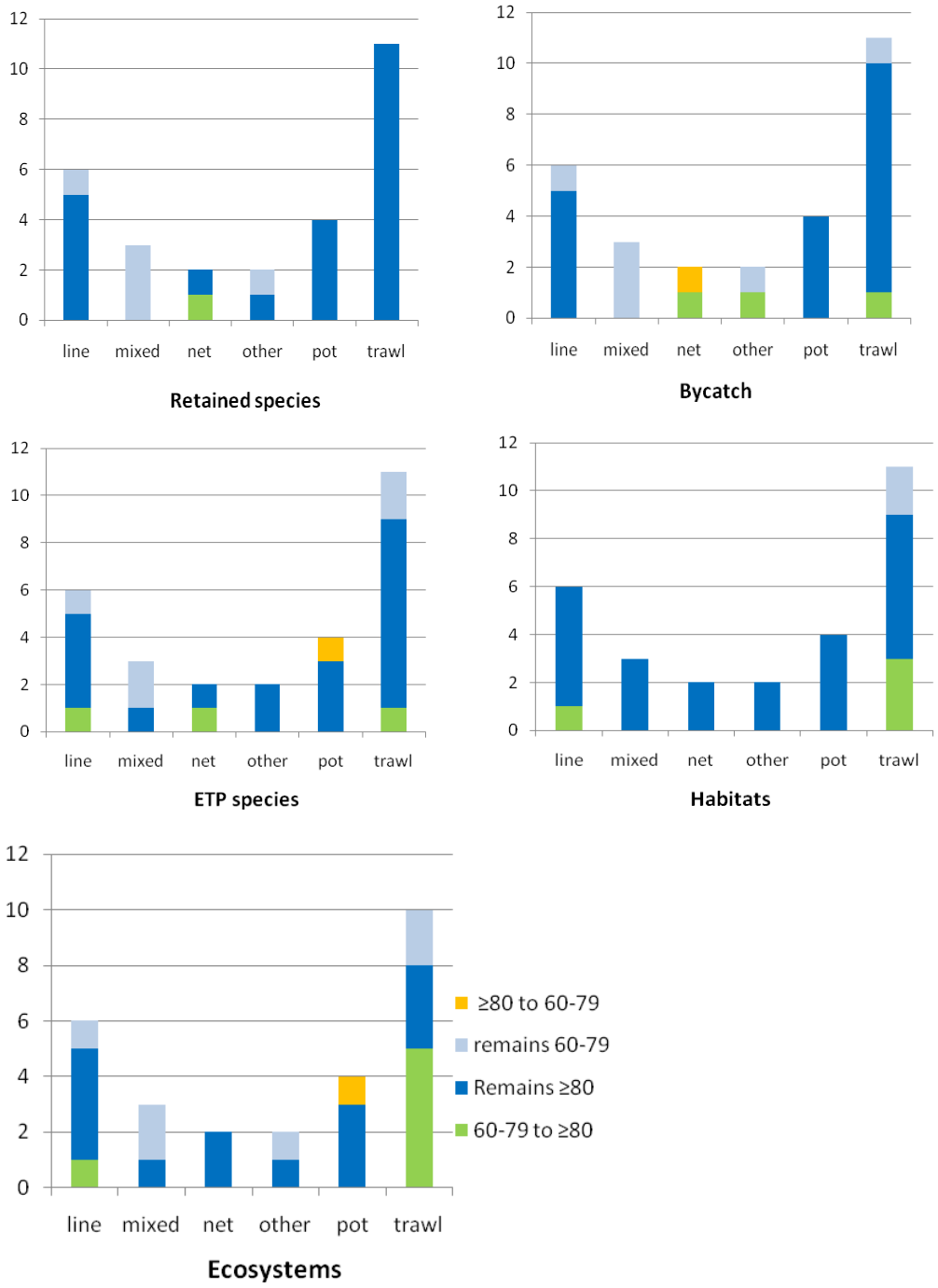


Figure 40. Change in PI scores for Principle 2 by gear (mixed = Lakes and Coorong)

Figure 41 shows the number of conditions raised and closed for each Principle 2 indicator over the certification period. The majority of conditions were raised regarding ecosystems and ETP species, and these also had a high rate of closure (54% and 56% closed respectively).

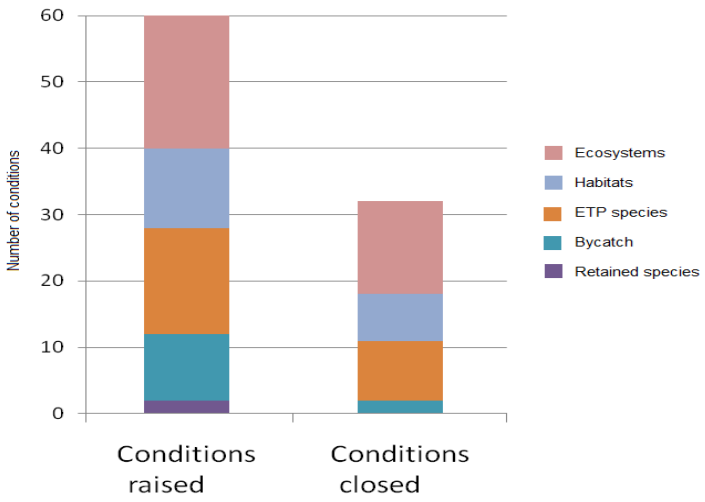


Figure 41. Number of conditions raised and closed for each indicator throughout the lifetime of each fishery's certification (from time of certification)

A common reason for closure of outcome conditions related to Principle 2 was where new information resulted in increased certainty of there being a low impact. This was usually because of improvements in monitoring or additional research. Consequently, many of these conditions were closed out due to improvements in information and research rather than in 'outcome' indicators. This is in contrast to the situation for Principle 1 where outcome-related conditions were always closed due to management or outcome gains (Figure 42).

This illustrates a key finding for Principle 2: conditions related to outcome PIs are often raised where impacts are unknown (potentially high) rather than known to be damaging to the environment. This demonstrates the use of the precautionary approach in scoring of Principle 2 PIs. At the time of certification, baseline levels had yet to be established for many of these indicators and so although conditions were raised regarding an outcome PI, they often specified research requirements involving improved monitoring and evaluation of risks.

Closure of conditions resulting from increased certainty of low environmental impact was most common for bycatch and ETP species. Often management changes were also made (e.g. implementation of escape panels), however these were not considered to be 'outcome gains' which would technically be a reduction in the bycatch. This may take longer to achieve as a time delay is required to allow for monitoring and evaluation. Monitoring may be infrequent such as where research conducted prior to implementation of a new measure indicated effectiveness and so further evidence has not been a priority.

These results were confirmed through the stakeholder consultation during which respondents mentioned that while stock management had generally already been a key concern prior to MSC involvement and was therefore fairly well-researched in many cases, Principle 2 indicators were more often under-researched and stakeholders were unaware of the impacts or even the potential for the fishery to have impacts in these areas. Stakeholders reported that the MSC had raised

awareness about Principle 2 impacts in particular. Although stakeholders may have been aware of certain ecosystem impacts, it was noted that the comprehensive nature of the MSC FAM had highlighted other ecosystem impacts which had not been previously been considered.

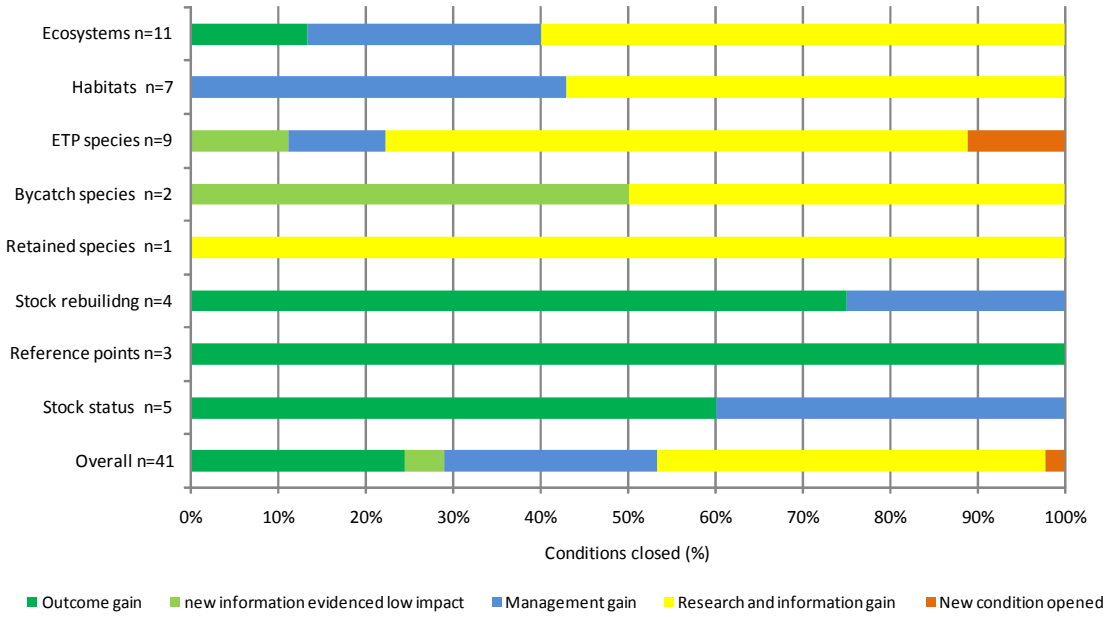


Figure 42. Reasons for closure of conditions related to outcome PIs, highlighting the difference in reasons for closure of conditions for Principles 1 and 2

7. STAKEHOLDER CONSULTATION

The stakeholder consultation was used to clarify points that arose during the desk based case studies during the post certification analysis and to produce a clearer picture of attribution of change for analysis. This section provides a general overview and results of the survey undertaken with 46 stakeholders across 39 different fisheries. The consultation exercise had a 55% success rate of people who responded to being interviewed by the team (see Table 17). The stakeholders interviewed included industry, management authorities, independent scientific bodies and NGOs. For most fisheries two stakeholder types were interviewed, in some cases three and in others just one, depending on response rates within each fishery. The aim to inform post certification assessment was to consult stakeholders across environment, science and management or industry to obtain three potentially different perspectives across the full spectrum. The aim for pre-assessment was to consult the client and the lead assessor or CB.

Table 17. Summary of number of respondents from each category

	(a) Environment (NGO; client; charity/trust)	(b) Independent (CB; independent scientist)	(c) Fishery related (management; industry; client)
Frequency in pre-certification	Not targeted	6 (out of a possible 9)	6 (out of a possible 9)
Frequency in post-certification	12 (/26)	14 (out of a possible 26)	15 (out of a possible 26)

Figure 43 demonstrates that the answers given by the respondents did not vary significantly between those representing the fisheries, environmental organisations or independent respondents.

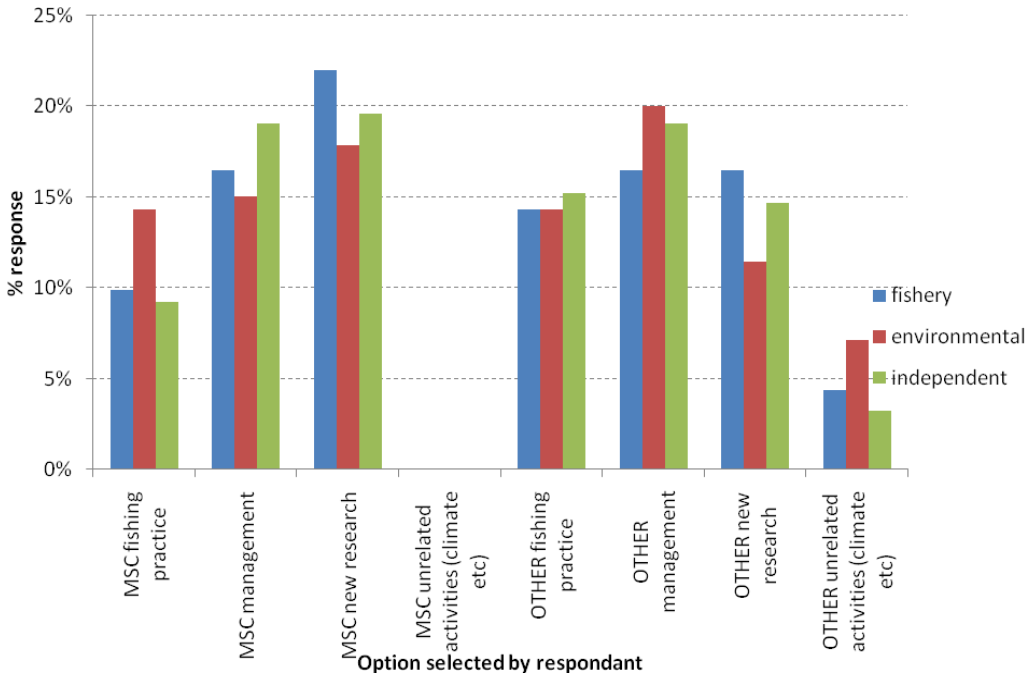


Figure 43. Options selected by respondents as reason for change in a fishery

The specific attribution of change for each of the fisheries has been discussed qualitatively throughout the pre-assessment and post certification results sections. The full questionnaire is presented in Annex B and the stakeholder list of contacts in Annex C.

The consultation exercise included a total of 15 questions. Of these questions, the last 5 related specifically to the wider impacts of certification. The remaining 10 were used to support the findings of the pre-certification and post-certification analyses (Sections 5 and 6).

7.1. Outcomes and attribution

Question 2 asked *"Have changes taken place in the fishery?"* by outcome type (e.g. stock, bycatch) and then asked interviewees to indicate whether this change was improvement, deterioration or no change and what was the key driver. Some of these results have been presented in Figure 36. The full responses are presented below.

Figure 44 shows the number of interviewees that considered the fishery had either improved, deteriorated or not changed for each of the PIs. Nearly 50% of those asked, thought that the fisheries had improved with regards to the bycatch situation. Approximately one third of respondents thought that there had been improved situation for stock status, stock rebuilding, reference points, ETP species, habitats and ecosystems. Situation of deterioration were only considered to have occurred in four PIs: stock status, retained species, bycatch and ecosystems – with stock status believed to be the one with the most fisheries who had a deteriorating situation in 11 out of 43 statements. These figures are fairly consistent with the indicator data analysis (Table 15). In all PIs, except bycatch the highest level of response was that no change had occurred since certification.

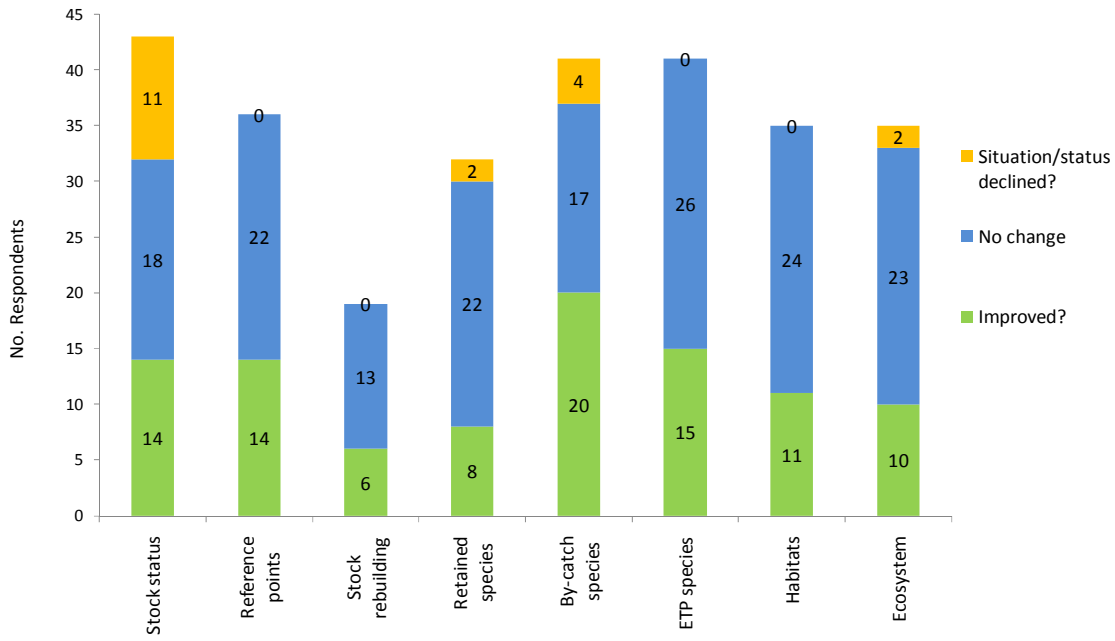


Figure 44. Responses to the question 'has the situation in the fishery improved, deteriorated or not changed with respect to various outcomes post certification'
(n=46, however not all stakeholders answered all of the questions)

Table 18 breaks down the responses of positive improvement into the different mechanisms for change that were put forward in the questionnaire. The number of respondents who attributed the mechanisms to the MSC and the 'other' stakeholder category were fairly evenly distributed, 114 and 121 respectively. This close result may be due to the fact that often both were ticked because the MSC are viewed as playing a part in other changes, and that many parties were contributing to changes occurring in the fisheries.

From the options of different mechanisms of change made overall, the option which was selected the most – 29 times - was "new research conducted" under the MSC. The option for 'other' sources initiating new research was checked 18 times. The results were consistent with the similar mechanism "New data or information gathered and evaluated leading to new understanding" with MSC being confirmed as the source compared with 15 for 'other'. This is also demonstrated in Figure 45.

The 'other' stakeholders were considered to be behind the legislative changes which were leading to improvements in 10 out of 12 of the attributions. The MSC was considered to be causing more improvements through affecting changes in codes of practice 16 out of the 22 instances where change has been caused by a CoP. Of these occasions, 19 out of 22 of them were viewed to have brought about improvements in Principle 2.

Changes in management practices/effort levels where referred to 35 times as bringing about improvement; 13 out of 35 times as a result of the MSC. This mechanism of change was quoted in total 14 times in Principle 1 and 21 times in Principle 2.

Change in management approach was attributed to improvements mostly to Principle 1, 27 out of a total of 44 times; of which was attributed to the MSC 20 times.

Table 18. Indications of attribution by all respondents identifying positive changes in outcome PIs

Attribution	Stock status	Reference points	Stock rebuilding	Retained species	Bycatch species	ETP species	Habitats	Ecosystem
MSC: Change in legislation	1	0	0	0	0	1	0	0
MSC: Change in code of practice	2	0	0	2	5	6	0	1
MSC: Change in fishing practices/effort levels	4	0	0	0	4	4	1	0
MSC: Change in management approach	4	7	1	1	1	5	1	0
MSC: Establishment of a protected area	1	0	0	0	4	1	2	3
MSC: New data or information gathered and evaluated leading to new understanding	3	3	0	1	3	4	4	4
MSC: New research conducted	4	2	1	1	3	5	8	6
OTHER: Change in legislation	2	1	1	1	3	3	0	0
OTHER: Change in code of practice	1	0	0	0	2	2	0	1
OTHER: Change in fishing practices/effort levels	7	1	2	1	6	4	3	1
OTHER: Change in management approach	7	5	3	1	3	4	1	0
OTHER: Environmental factors e.g. Climatic factors	5	0	0	0	3	0	0	0
OTHER: Establishment of a protected area	1	0	1	0	4	2	0	1
OTHER: New data or information gathered and evaluated leading to new understanding	2	4	1	1	1	2	2	2

OTHER: New research conducted	4	2	0	1	1	5	5	1
OTHER: Other, please specify	3	1	0	0	0	0	0	0
OTHER: Pollution events	0	0	0	0	0	0	0	0
Total	51	26	10	10	43	48	27	20
MSC	19	12	2	5	20	26	16	14
Other	32	14	8	5	23	22	11	6
Attribution of increases to MSC	37%	46%	20%	50%	47%	54%	59%	70%

Overall by principle, there was more change attributed to the 'other' category for Principle 1 - other = 53, MSC = 70 (Table 20). The results indicate that the proportion of improved change attributed to the MSC was higher in Principle 2, in all five 2 PIs the proportion was between 47-70% than Principle 1, between 20-46% (Figure 45). This graph also shows the few incidences whereby the MSC were believed to have caused deterioration in the situation; this was in the PIs stock status and bycatch only.

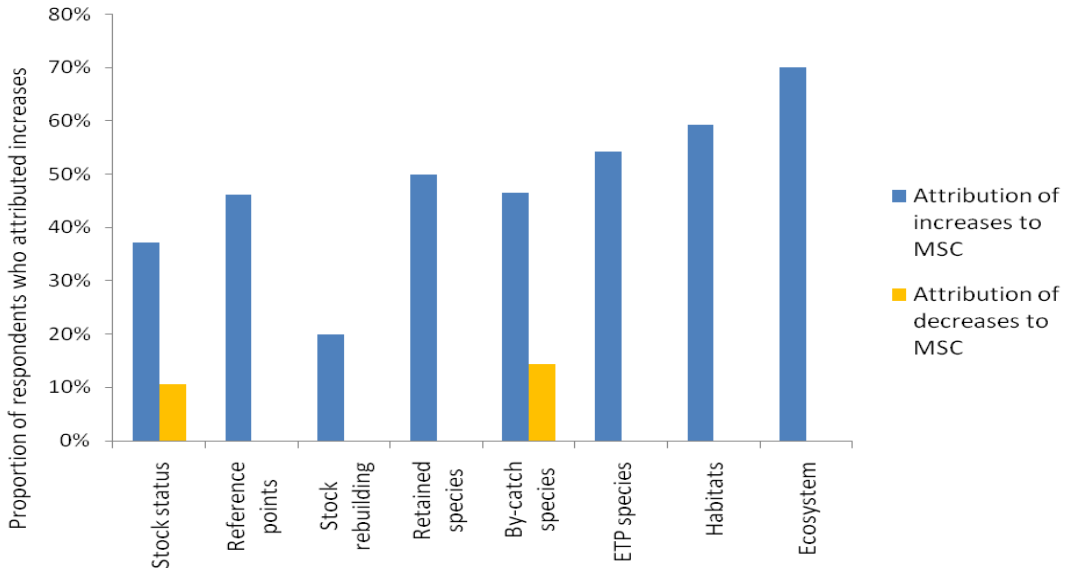


Figure 45. Proportion of respondents attributing increases/improvements to the MSC by FAM PI
This graph includes the data from those respondents who answered that there *had* been an improvement, thus shows the proportion of those improvements which was attributed to the MSC.

7.2. Timing of changes

Question 5 asked "*When were these changes occurring?*" giving two options: A) between pre-assessment and assessment? Or B) after certification date? The results (Figure 48) show that most stakeholders consider changes to have happened after certification. The majority found no change between pre and main assessment and a quarter believed the MSC process improved the fishery's impact on stock and environment. A higher level of improvements (over a third) were said to occur after certification date.

10% of the respondents believed changes occurred before the fishery's involved in MSC, 19% believed the changes occurred during pre-assessment to point of certification and 19% believed they occurred after certification (Figure 46).

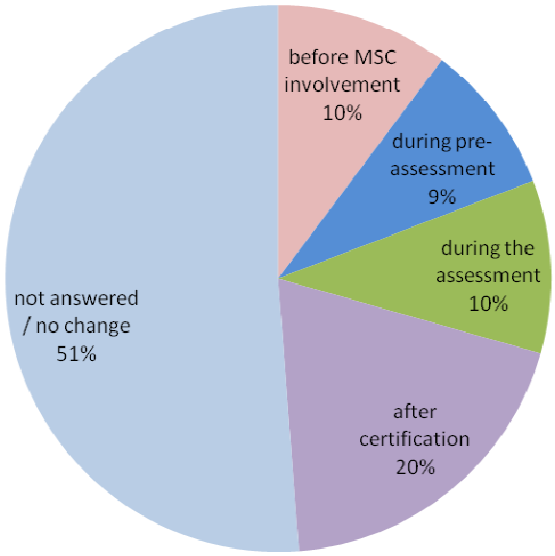


Figure 46. Consultation answers to the question "when were these changes occurring?" (n=46, number of persons interviewed)

Figure 47 shows responses of the same nature as to that in Figure 44 but for the pre-certification period rather that the post-certification period. Both demonstrate that respondents believe most improvements have been made in the ETP and bycatch indicators.

Figure 48 consolidates these two graphs to demonstrate that overall respondents believed that more improvements had occurred after certification than in the pre-assessment stage (34% versus 25%). More occasions where indicators had deteriorated were noted by respondents in the phase following certification than the pre-assessment phase (10% compared to 3%). This could be due to the length of this period in time e.g. average pre-assessment stage over all pre-assessments is 2.8 years, whereas the post-certification periods for most of the fisheries were longer than this.

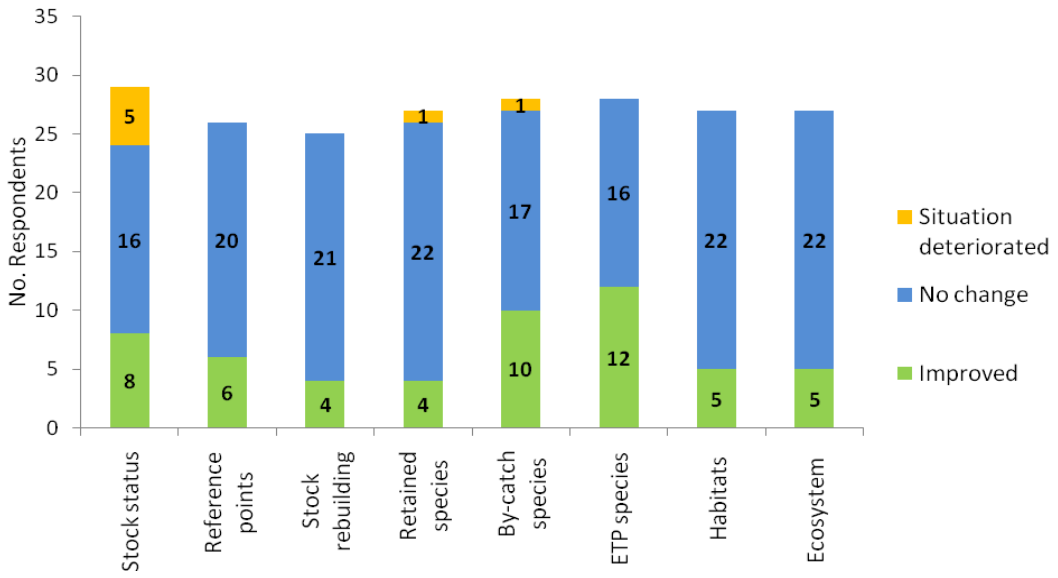


Figure 47. Consultation answers to the question 'between pre-assessment and certification date, have changes taken place in the fishery (stock/environmental)?' presented per performance indicator
(n=46, however not all stakeholders answered all of the questions due varying degrees of knowledge and expertise on different topics on different indicators).

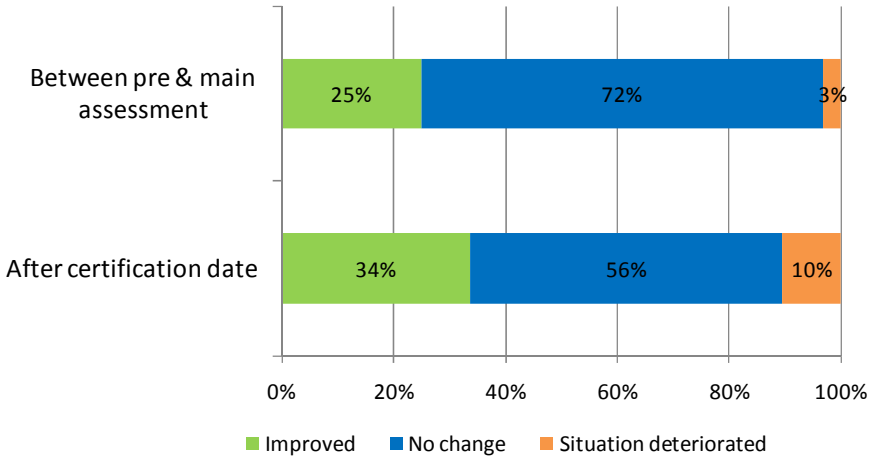


Figure 48. Consultation answers to the question 'between pre-assessment and certification date, and after certification, have changes taken place in the fishery (stock/environmental)?'
(n=53, number of interviews)

7.3. The level of influence of the MSC

As shown in Figure 46, over half of the respondents believed that there was no change in the fishery due to MSC and this corresponds well with the proportion (56%) that also believed the MSC has no influence on the fishery (Figure 49).

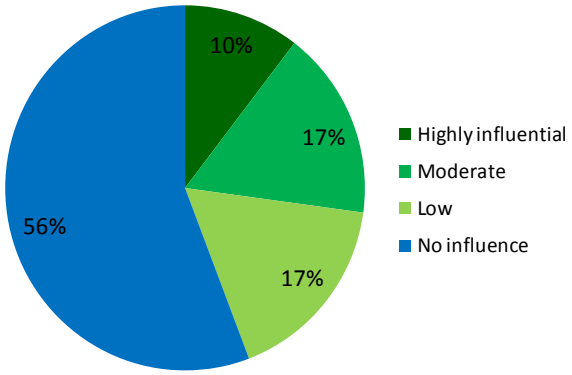


Figure 49. Consultation answers to the question 'what level of influence has the MSC certification had on the fishery?'
(n=46, persons interviewed)

Figure 49 indicates that 44% of respondents felt the MSC had some level of influence on the fishery, with 10% believing the MSC to be highly influential. Figure 50 presents the same results per performance indicator. Those that cited a high influence did so predominately for the reference points and ETP PIs. While overall MSC was found to have the most influence on the stock status PI. This was somewhat unexpected when compared to previous results focused on change in PI score. However, this is likely to be due to consultees giving more focus to the entire Principle 1 when answering questions about improvement in stock status, therefore taking management and harvest control rules into consideration, as well as the better level of understanding as to why management of the stock is important.

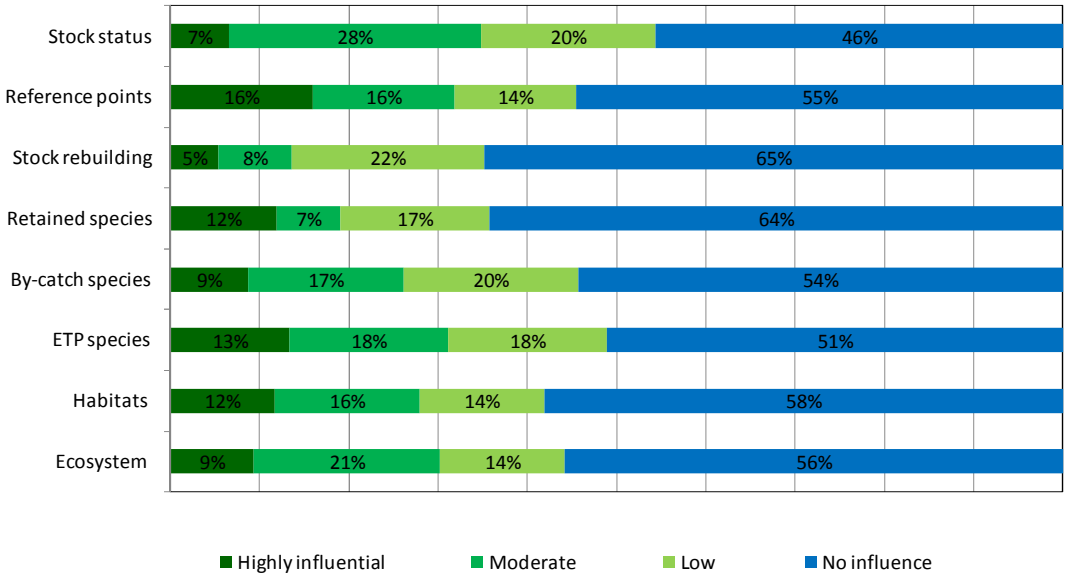


Figure 50. Consultation answers to the question 'what level of influence has the MSC certification had on the fishery?' per performance indicator
(n=46, persons interviewed)

8. WIDER IMPACTS OF THE MSC PROGRAMME

The section brings together all of the work conducted which aimed to explore the wider impacts that the MSC certification programme may be having on fisheries management and the sustainability of ocean systems beyond the immediate boundaries of certified fisheries.

8.1. Stakeholder viewpoints about MSC's wider impacts

We took the opportunity during the questionnaire/survey phase of the research to expand our inquiry with stakeholders from the certified fisheries analysed in the post-certification analysis, who represent a broad spectrum of interests found in fisheries (industry, NGOs, science, management and the certification community). Questions were asked to prompt discussion about stakeholders' viewpoints about whether there has been the wider impacts resulting from the MSC programme on anything relating to the management of, operations in, or research into non-certified fisheries. The information we present here is qualitative, coming from semi-structured interviews. The range of opinion sought results in a cross-section of views offering interesting insights into the influence and potential impact of the MSC programme on the wider environment. A majority of stakeholders who responded to questions about MSC's wider impacts reported that MSC certification of a particular fishery led directly to, or significantly influenced changes in non-certified fisheries, or made some contribution to our understanding of the sustainability of ocean ecosystems. These wider influences have been divided into five categories:

1. **Research** – acceleration, focus or expansion of scope.
2. **Fisheries management** – changes in non-certified fisheries.
3. **Attitudes, mindsets, awareness** – changes leading to higher management or voluntary standards.
4. **Holistic approaches** – management becoming or staying focused on wider environmental concerns.
5. **Stakeholder engagement** – improved working relationships leading to positive outcomes.

Many stakeholders emphasised their belief that the MSC was not solely responsible for many of the changes expressed. Rather, many expressed the idea that the MSC was an influencing factor within a landscape of change. Some were more emphatic about their beliefs that without the MSC certain changes would not have happened. Table 19 sets out a summary of stakeholders' views, paraphrased, organised by the five categories described above.

Table 19. Stakeholder opinions about the wider impacts of the MSC certification programme on non-certified fisheries and sustainable ocean ecosystems

Wider impact	Fisheries	Comments
Research **MSC certification helps to accelerate, focus or expand the scope of research in certified fisheries to take in ecosystem considerations**	Antarctic Krill Alaskan pollock New Zealand Hoki Loch Torridon (Scotland) South Georgia toothfish Australian mackerel icefish South African hake Oregon Pink shrimp North Pacific Sablefish	Habitat research was most frequently mentioned as that where the MSC programme has had most influence – either in parallel with researchers, or acting as a catalyst for research. Although researching the wider environment generally was also mentioned. The MSC certification helped some stakeholders access research funds or have more of a say about how funds might be spent.
Research **MSC certification leads to other fisheries investing in research in order to become certified**	New Zealand Hoki Atlantic Red crab Canadian prawn	NZ hoki ➢ ling, hake, southern blue whiting. Red crab ➢ Louisiana blue crab. Other (non-specified) fisheries.
Fisheries management **MSC certification leads to changes in management in non-certified fisheries**	South African hake Patagonian scallop Canadian prawn South Georgia toothfish NZ hoki Norway NS Saithe	Pre-emptive controls on other species. Influenced introduction of better hake regulations. Wider access to other fisheries. Strong influence on the implementation of habitat protection measures. Partial influence on creation of Benthic Protection Zones (see Section 9.2). Habitat protections for wider saithe fisheries ; protections for bycatch species (common skate).
Attitudes, mindsets, awareness **MSC certification leads to psychological and sociological changes rippling outwards to people engaged in non-certified fisheries**	North Sea herring Lake Hjälmaren (Sweden) Danish blue shell mussel Sablefish South African hake Astrid Fiske herring (NS) Norway NS Saithe Albacore (Pacific)	Attitudes to setting TACs and quotas become more conservative. Awareness of other fishers raised and mindsets change in non-certified fisheries towards taking into account wider environmental considerations, some of whom are motivated to seek certification, some who are not. Attitudes change towards bycatch management and adopting voluntary codes of practice in non-certified fisheries, or adopting more precautionary management (e.g., Baltic cod fishery). Raising awareness in other fisheries when ICES changes reference points in response to certification. Pressure on RFMO to adopt Harvest Control Rules.
Holistic approaches **MSC certification leads to management becoming more holistic in its approach**	Canadian prawn Pacific halibut South African hake	Stakeholders remarked that certification has led to fisheries managers and management either becoming focused upon or remaining open to taking the wider impact of fisheries on the environment into consideration in management decisions.
Stakeholder engagement **MSC certification leads to**	Patagonian scallop	In New Zealand there is a long history of stakeholder engagement pre-dating MSC certification, but in the

Wider impact	Fisheries	Comments
co-management, better working relationships, the once marginalised having stronger voices within the management process	NZ hoki NS herring	wake of hoki certification, the industry has been able to take a more active role in determining how research funds have been spent; proactively sought to protect benthic habitats and worked on deepwater species management plans with the Ministry – some of this motivated by reasons not connected to MSC, but other initiatives with the certification of other deepwater species in mind. More Dutch fisheries want certification, the result being that NGOs in the management process are experiencing having more influence over the management process than before – their voices are being heard more.

Not all stakeholders had positive things to say about the influence of the MSC programme. In the context of wider impacts on the environment or non-certified fisheries, two opinions about outcomes are noteworthy:

- The Loch Torridon *nephrops* certification is thought to have led directly to the interest and subsequent influx of non-certified fishers who did not sign up to or abide by the terms of the voluntary management plan. This in turn was suggested as a key reason for the decline in the fishery and subsequent suspension of certification. Feelings of being let down by the MSC were expressed, believed to be due to MSC's focus upon only fisheries using the logo (the catch from the Loch Torridon *nephrops* was predominantly sold in Spain, without the use of the MSC logo on products).
- In relation to the north east Atlantic mackerel fishery there is a view that the MSC certification had led to too conservative an approach to setting TACs and quotas, resulting in non-certified fisheries from other countries (e.g., Iceland, the Faroe Islands, Russia) appropriating large portions of the catch, developing big fisheries and export markets.

In conclusion, an overwhelming majority (78%) of stakeholders who responded to questions about the wider impact of the MSC did acknowledge that the MSC leads to actions or outcomes outside the strict boundaries of a certified fishery. These may impact upon the sustainability of ocean ecosystems in the long term, either through direct action or through more subtle influences working on the people dynamics within the system, leading to outcomes filtering through in more complex ways. In the next section, some potential hypotheses about the kinds of changes that might be seen are explored, developing the scenarios that describe specific impact pathways and how they may be inquired into.

8.2. Exploring methods to understand and analyse wider impacts

A number of 'theories of change' were identified regarding how the MSC programme might have wider impacts on fisheries management and on sustainable ocean ecosystems. For each theory of change, a potential example is discussed as a test case, using it to identify the data that would be needed and are available to test the theory, what analysis would be undertaken, and what data would be collected in the future to monitor impact.

8.2.1. Theory of change 1: Reduction in bycatch

This theory of change hypothesises that the solution of a bycatch issue in an MSC-certified fishery will result in improved management of bycatch species in all similar fisheries under the control of

the same management authorities, leading to conservation gain for those bycatch species generally (Figure 51).

To explore this theory, the South African hake fishery was considered, which had conditions raised against Principle 2 in relation to bycatch of both fish and seabirds: introduce bycatch management plans for bycatch species; and determine the extent of interactions with seabirds and to implement appropriate mitigation measures where trawl fishing constitutes an important component of total mortality on protected or threatened populations.

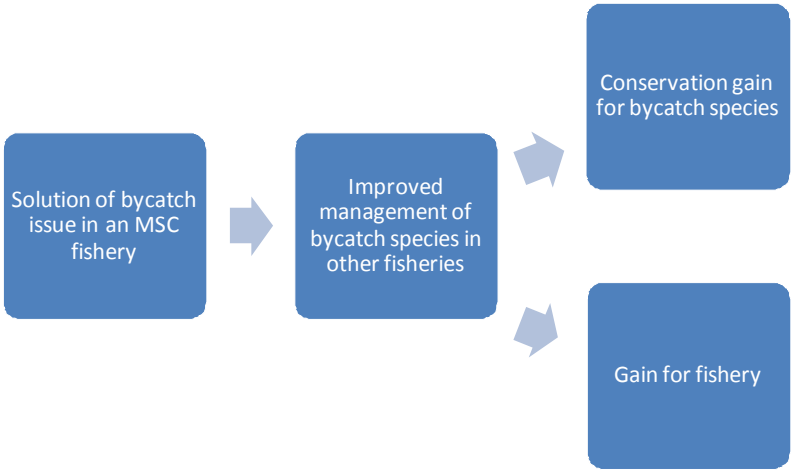


Figure 51. Theory of change for how solving a bycatch problem in an MSC-certified fishery can lead to wider conservation gains

A number of possible indicators for evaluating these changes were considered, including:

- Compliance with bycatch regulations in certified and potentially also in non-certified fisheries (expecting improved compliance across all fisheries due to increased awareness of the industry). This was rejected as any change would be difficult to attribute to MSC specifically, compared to the impact of wider NGO-led awareness-raising programmes.
- Level of activity of working groups on ecosystem effects. This was also rejected as level of activity (frequency of meetings etc) may depend on numerous other factors.
- Permit conditions relating to bycatch reduction measures and bycatch limits, before and after certification, in both certified and non-certified fisheries. This was considered to be the most promising indicator.
- In the South African hake fishery, permit conditions were obtained and anlaysed from 2008-2011, in both the deep-sea trawl fishery (certified in 2004, recertified in 2010) and the inshore trawl fishery for hake and sole (not certified) (Table 20).

Table 20 Permit conditions in the South African hake fisheries 2008-2011

Measure type	Fishery	2008	2009	2010	2011
Tori lines to reduce seabird interactions	Deep-sea hake	Tori lines must be used during trawling	→	→	→
	Inshore hake (deep)	Tori lines must be used during trawling	→	→	→
	Inshore hake (inshore)	Tori lines encouraged	→	→	No reference to tori lines
Offal management to reduce seabird interactions	Deep-sea hake	Should not discard offal during shooting of trawl	→	→	Management of offal discard is being investigated as an additional measure
	Inshore hake (deep)	Should not discard offal during shooting of trawl	→	→	Management of offal discard is being investigated as an additional measure
	Inshore hake (inshore)	Should not discard offal during shooting of trawl	→	→	Management of offal discard is being investigated as an additional measure
Bycatch limits on fish species	Deep-sea hake	Limits on bycatch (kingclip, monkfish) specified by vessel in annex	Limits on bycatch (kingclip, monkfish) not to exceed 1998-2002 levels	→	→
	Inshore hake (deep) Inshore hake (inshore)	Limits on bycatch (kingclip, kob, monkfish) specified by vessel in annex	Limits on bycatch (kingclip, kob, monkfish) not to exceed 1998-2002 levels (kob 80%)	→	→

Note: → = same as previous year

Tracking changes in permit conditions related to conditions raised in the certification is a promising approach, as it can clearly be seen when different measures were brought in to each fishery, and it can be established whether those measures can be related to certification conditions, by observation and interview. In the South African hake fishery, by 2008, several measures to reduce the impact of the fishery on both seabird and fish bycatch species had already been introduced in the certified fishery (deep-sea trawl). Furthermore, permit conditions in the certified deep-sea hake trawl fishery were repeated in the permit conditions for the not certified inshore hake trawl fishery, for vessels operating in the deep-sea area. Similar but in some cases less stringent permit conditions were also present for vessels operating in shallower waters in the inshore fishery (e.g. use of tori lines encouraged rather than mandatory).

Any changes in permit conditions would have been brought in soon after the fishery was certified in 2004. Therefore it would be necessary to track permit conditions pre- and post-certification, and over a relatively short time period (perhaps 3 years pre-certification and up to 5 years post-certification), which was unfortunately unavailable for this analysis. This would capture any changes made prior to certification to address issues that may have been raised in a pre-assessment, and would capture and changes made as a result of conditions raised in the certification. By looking at the time period spanning certification, it would hopefully be possible to tease out general trends towards more of an ecosystem-based approach to management, and changes brought in specifically as a result of MSC. This could be confirmed through interviews.

Analysis of the permit conditions between certified and non-certified fisheries is also informative for considering how changes to certified fisheries have also been applied in wider fisheries.

8.2.2. Theory of change 2: Improvement in stock management

This theory of change (Figure 52) posits that an MSC-certified fishery that solves an issue related to management (Principle 1), that was identified with a condition or conditions raised against it, can result not only in an improvement in management of the certified target stock, but also of other stocks if such improvements in management practices are subsequently implemented by the management authority in other fisheries and for other stocks.

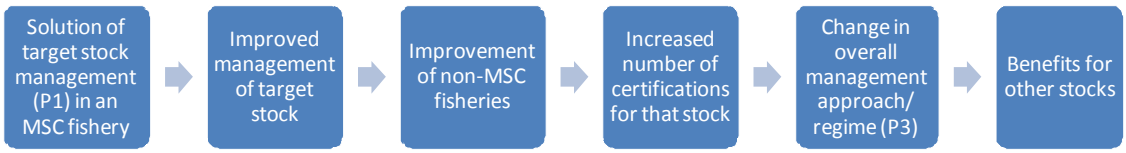


Figure 52. Theory of change for how solving a stock management problem in an MSC-certified fishery can lead to changes in management practice and benefits for other fisheries

Once one fishery targeting a particular stock has been certified, others are likely to follow suit, and may well learn from the issues raised in the initial certification. Therefore, one might expect to observe an improvement over time in new certifications for fisheries targeting that same stock, as they may have already addressed issues that resulted in conditions being raised in earlier certifications.

This theory of change was tested with the North Sea herring fisheries, seven of which have been certified to date:

- Hastings fleet pelagic herring and mackerel (certified 2005)
- Pelagic Freezer Trawler Association North Sea herring (Netherlands) (certified 2005)
- Astrid Fiske North Sea herring (certified 2008)
- Scottish Pelagic Sustainability Group Ltd North Sea herring (certified 2008)
- Danish Pelagic Producers Organisation North Sea herring (certified 2009)
- Norway North Sea and Skagerrak herring (certified 2009)
- SPPO North Sea herring (Sweden) (certified 2010)

The data that could be used to test this would be the score for each Principle, the number of conditions raised against each Principle, and the number of PIs scoring <80 for each Principle.

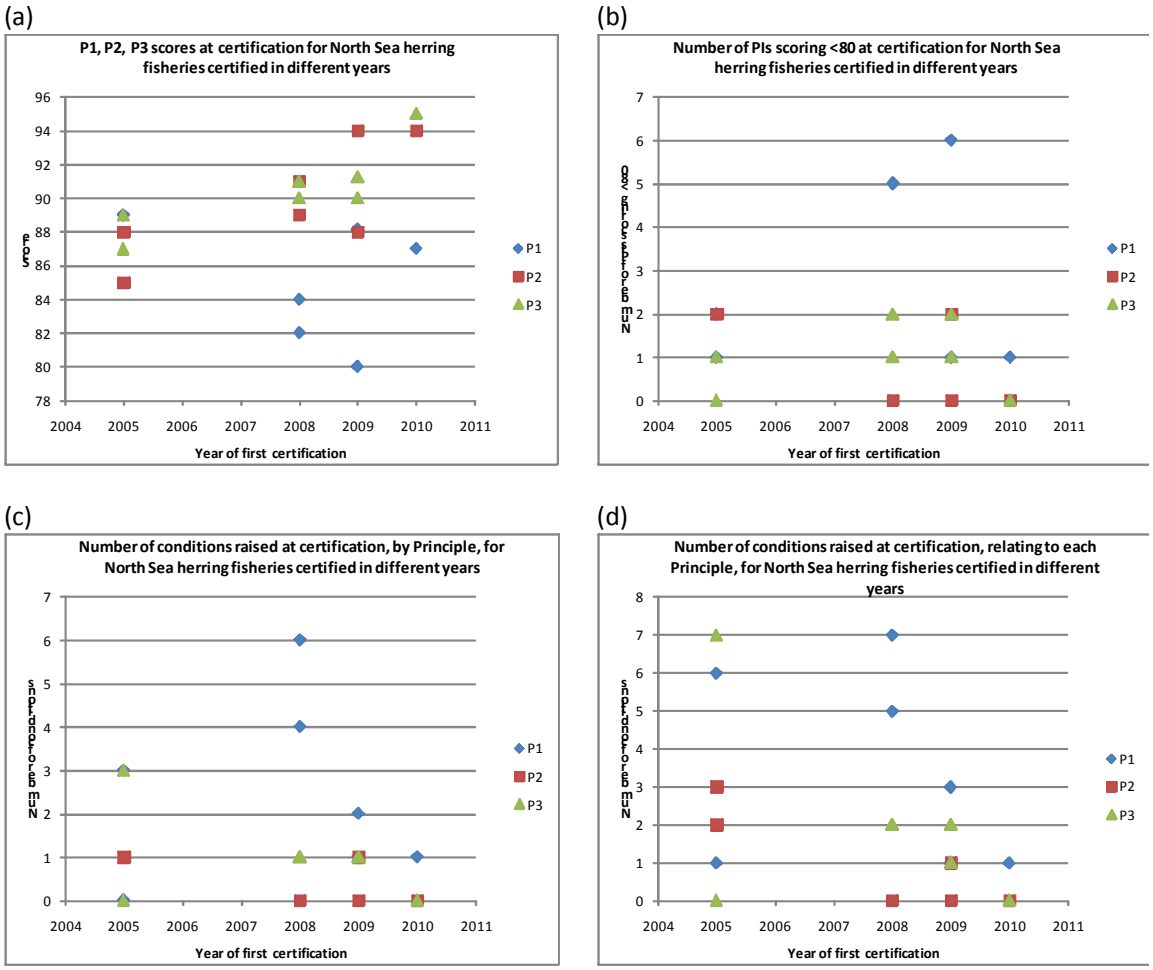


Figure 53. Comparison of the performance of North Sea herring fisheries at certification, by date of certification[13]
(a) Principle 1, Principle 2 and Principle 3 scores; (b) Number of PIs scoring <80 by Principle; (c) Number of conditions raised by Principle (each condition assigned only to one Principle); (d) Number of conditions raised by Principle (each condition assigned to all relevant Principles, where there were PIs that scored <80)

There has been an increase in the overall scores at certification for Principle 2 and Principle 3 over time, with fisheries certified later gaining higher scores (Figure 53(a)). This indicates that the later fisheries to be certified may have 'learnt' from the previous assessments, and improved their own performance in certain areas. However, for Principle 1 scores, there is no discernable trend over time, with the scores decreasing slightly over time. This may be related to more and updated information on stock status coming to light, and stock assessments being revised, resulting in lower scoring for this aspect.

There is no real trend in the number of Performance Indicators scoring less than 80 over time (Figure 53(b)). For Principle 1, the number of PIs scoring less than 80 increases, and then drops down again in the 2010 assessment. There is quite high variability in the number of PIs scoring less than 80 for

[13] There were seven "fisheries" certified within the herring stock, and so there are seven points on each graph for each of the three Principles (sometimes these points overlapped and therefore are not all of the points are visible).

Principle 1 in the various assessments. This may be related to different certification bodies conducting the assessments, and different assessment trees being used, which may have different numbers of PIs.

In relation to the number of conditions raised against each Principle (assigning each condition to one Principle only), there has been a reduction in the number of conditions raised against Principle 1 and Principle 3 in recent years (Figure 53(c)). There is no apparent trend relating to Principle 2. However, in several assessments, conditions were raised that address several PIs that scored below 80, sometimes across different Principles. Therefore the number of conditions per Principle *per se* may not be the most appropriate indicator to use.

There has been a decline in the number of conditions raised that are relevant to Principle 1, Principle 2 and Principle 3 (assigning each condition to all relevant Principles) (Figure 53(d)). This analysis counts some conditions more than once, where they are relevant to PIs that scored <80 in more than one Principle.

The above data indicate that there may have been some 'learning' by fisheries from earlier certification processes, which has resulted in higher scores for Principles 2 and 3, and fewer conditions raised at certification for Principles 1 and 3, for those fisheries that were certified later. There has been a general reduction in the number of conditions raised, particularly in the last few years (2008-2010).

There are some confounding factors in conducting this analysis — one condition may relate to more than one PI and to more than one Principle, and the assessment trees used in earlier assessments vary from fishery to fishery. Hence, the number of potential PIs that could score <80, and the number of conditions that might be raised as a result, vary between assessments. This should be less of an issue under the revised FAM, which uses a harmonised assessment tree for all assessments.

Overall, for this theory of change, the most appropriate indicators appear to be the score for each Principle at certification, and the number of conditions raised against each Principle (counting each condition against each relevant Principle, where there was a PI score <80). These should be monitored for future analysis of this theory.

The final steps of the theory of change, linking management improvements through to changes in the management regime on other stocks, are more difficult to trace and assess. However, in the interviews conducted in this study, several respondents from the herring fisheries studied indicated that, although numerous factors and influences were at play in any changes made to the fisheries, the more precautionary management approach adopted in the herring fisheries was being observed in other fisheries such as the Baltic cod fishery. In the herring fisheries, NGOs were able to use MSC to exert pressure on management and industry to set more precautionary quotas, and industry were less likely to raise their voice against management that followed scientific advice for quota levels, than if MSC had not been involved.

If changes in management approach in an MSC-certified fishery lead to changes in the management of other stocks by the same authority, it might be expected for there to be more certifications for other fisheries and stocks under that management authority. However, these changes are likely to occur over a long time frame (10+ years) and are likely to require some anecdotal evidence to explore the link between MSC and the improvements in management approach on one stock, and understand how that change was transferred across to management of other stocks.

8.2.3. Theory of change 3: Improvements in other fisheries through economic incentives

The economic incentives theory of change (Figure 54) hypothesises that a certification in one fishery, resulting in MSC-certified product being available in the global marketplace, and demanded by

retailers and consumers, results in increased demand for MSC product. Competing fisheries (e.g. fisheries for the same species in other ocean regions, which sell product to the same markets, or fisheries for similar species, e.g. whitefish), may suffer or fear suffering reduced demand for their non-certified product as a result, and make changes in their fisheries in order to achieve certification as well.

Figure 54. Theory of change economic incentives can encourage non-certified fisheries to make improvements to become certified

Once one fishery has been certified, others might be expected to follow suit, therefore one might expect to see an increase in certifications for similar fisheries or similar species, following an initial certification.

This theory was tested with Pacific and Atlantic cod.

As of May 2011, five cod fisheries had been certified:

- Bering Sea and Aleutian Islands Pacific cod (certified 22.01.2010);
- Gulf of Alaska Pacific cod (certified 22.01.2010);
- DFPO Denmark Eastern Baltic cod (certified 22.01.2010) (certified 05.04.2011);
- Norway North East Arctic offshore cod (certified 26.04.2011);
- Barents Sea cod and haddock (certified 24.11.2010).

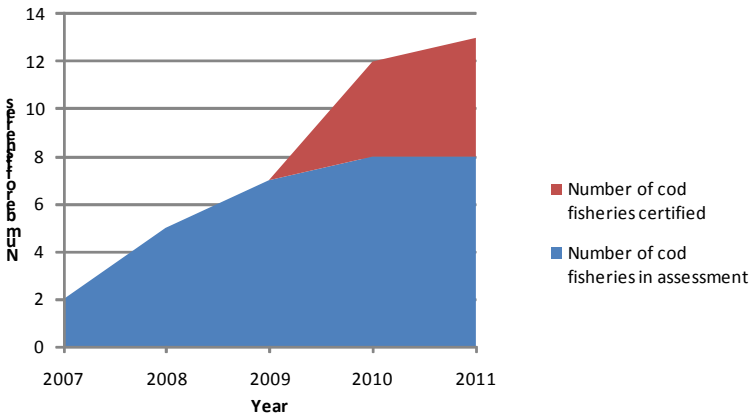
A further nine were in assessment:

- Norway North East Arctic inshore cod (entered full assessment 03.09.2008);
- Germany Eastern Baltic cod (entered full assessment 17.11.2009);
- Fiskbranschens Sweden Eastern Baltic cod (entered full assessment 04.01.2010);
- Atlantic cod, haddock and wolffish longline, handline and Danish seine (entered full assessment 27.04.2010);
- Küstenfischer Nord eG Heiligenhafen Germany Eastern Baltic cod (entered full assessment 27.07.2010);
- Comapeche and Euronor cod and haddock (entered full assessment 02.09.2010);
- IGP Icelandic cod (entered full assessment 26.10.2010);
- Pescafria-Pesquera Rodriguez Barents Sea cod (entered full assessment 11.01.2011);
- UK Fisheries Ltd/DFFU/Dogger bank Northeast Arctic cod, haddock and saithe (entered full assessment 13.01.2011).

Even before any cod fisheries became certified, there was a steady increase in the number of cod fisheries involved in the MSC programme (Figure 55(a)). This may be due to fisheries anticipating future competition from certified fisheries, and initiating the process themselves as well. This suggests that there will not be a clear signal of competition between certified and non-certified

fisheries once some fisheries gain certification. In some cases, knowledge that a fishery is undergoing assessment is sufficient for processors and retailers in the short term, so they would not necessarily switch supplies from non-certified to certified sources, if their sources are undergoing certification. Nevertheless, it is interesting to note that there was a peak in the number of fisheries entering assessment in 2010, the year that the first two cod fisheries gained certification.

(a)



(b)

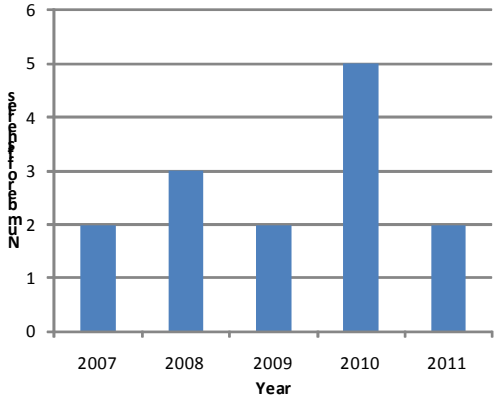


Figure 55. Number of cod fisheries involved in the MSC programme by year (2007–2011)
(a) Number of certified cod fisheries and number of cod fisheries undergoing assessment, by year; (b) Number of cod fisheries entering assessment each year.
Note: Number of fisheries counted as of 31 December each year, except for 2011, which reflects the number of fisheries up to 09 May.

To expand this analysis to consider the type of competition effects and economic incentives at play would require analysis of detailed and specific price and sales volumes data from the individual fisheries. These data are not currently available to analyse and would have to be obtained from the individual fisheries. However, the following indicators would be interesting to explore:

- Landed price per kg in certified fisheries vs non-certified fisheries. Is there a price differential between certified and non-certified produce that would act as an incentive for certification?
- Sales volumes by fishery (certified and non-certified) over time. When one fishery becomes certified, does this correspond with a drop in sales from non-certified fisheries, causing a market access incentive for certification?

While it may be possible to obtain sales volumes from MSC-certified fisheries, obtaining sales volumes from fisheries that are not engaged in the programme is likely to be more problematic.

Import and export data were also considered, but these are unlikely to show sufficient resolution to be able to distinguish individual fisheries.

8.2.4. Theory of change 4: Improvements in habitats

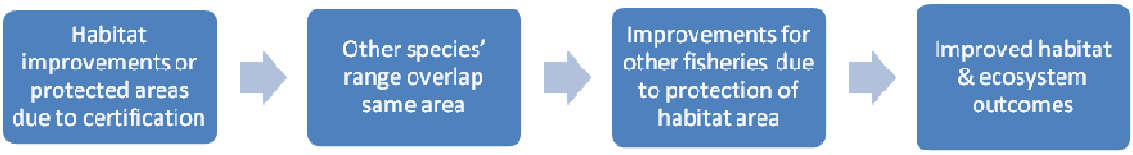


Figure 56. Theory of change for how protecting habitats in an MSC-certified fishery can lead to positive impacts for other species, non-certified fisheries and the wider ecological environment

This theory of change (Figure 55) posits that were certification (either the result of direct conditions or action indirectly influenced by certification conditions) to lead to the protection or improvement of habitat, then wider environmental impacts may be detectable outside the immediate habitat or beyond the so-called boundaries of the certified fishery. Hypothetically, protecting or improving habitats in which multiple (certified and non-certified) species' ranges overlap may lead to improvements in non-certified fisheries. If habitat protection or improvement becomes a feature of a certified fishery's management regime, this may lead to the collection of better information from any directed monitoring or research to support the management of any protected habitats or management of the fishery itself. This could lead to reduced uncertainty (i.e., lower risk) for management decision-makers about the certified fishery and other fisheries, particularly if data and information are collected about species and fishing effort whose distribution overlaps with areas of protected habitat. Ultimately, the existence of protected or improved habitats may lead to positive impacts on the overall ecological health and status of protected areas and beyond, spilling out to effect positive change in the wider marine environment.

Detecting and monitoring such impacts is challenging and there are many variables that would need to be accounted for, not least of which would include biophysical parameters about species and habitats, as well as the peculiarities of relevant fisheries' management regime(s), catch and effort distribution and related technological considerations and potentially knowledge of fisher behaviour. However, there may be scope to draw some conclusions about the connection between habitat protection or improvement and wider environmental impacts without having to mount expensive at-sea research that physically samples the habitats and fisheries in question.

To illustrate a potential example, New Zealand fisheries were examined where, for almost a decade, the deepwater trawl fishery for hoki has been the only MSC certified fishery within the country's EEZ. By 2011, there are a number of other NZ fisheries undergoing full assessment against the MSC standard, including fisheries for deepwater species whose distribution overlaps with hoki – ling, hake and southern blue whiting. Some of the preferred habitat and distribution of these species, to a greater or lesser extent, also overlap with Benthic Protection Areas (BPAs) established by law in 2007 by the NZ Ministry of Fisheries based upon initial proposals made in 2005 by NZ's deepwater fishing industry (DWG, 2009) (Figure 57).

First however, the context for such analysis needs to be clarified, particularly about whether any environmental impact 'claim' about habitats can be made in relation to the hoki fishery from an MSC MSC perspective. In '*Net Benefits*' (MSC, 2009), George Clement, a member of the NZ fishing industry's DeepWater Group, when interviewed about the benefits of the hoki certification suggested that while he did not consider MSC certification the direct cause for creating BPAs in New Zealand's EEZ, there was a correlation. He suggested that MSC certification helped to strengthen and

systematise intentions that were already there. The initial hoki certification and subsequent surveillance audits resulted in conditions requiring the interactions between the fishery and seabed habitats receive further management and research consideration from the certification clients (i.e., the industry). So, while the industry is reluctant to attribute the cause of these environmental protections to the hoki certification alone, their representative does acknowledge the connection (ibid). This loose connection is confirmed by Jonathan Peacey, former head of the NZ Ministry of Fisheries deepwater management team. He acknowledges that habitat-related certification conditions were imposed but other driving forces that had nothing to do with the MSC also existed urging the development of Marine Protected Areas (MPAs) and which significantly influenced the development of the BPAs. He suggests, however, that the influence of the MSC's programme may have brought issues into clearer focus and some change may have been initiated faster than might have otherwise been. So while the MSC certification may have been an influencing factor, the industry was also responding to both the fisheries management and marine conservation political environment and related policy developments which were moving in parallel. Thus, it is impossible to attribute any change solely to one programme, nor to carve it up quantitatively with any degree of credibility. Peacey was clear, however, that the industry acted proactively and the result was, with some negotiation with the Ministry of Fisheries, around 30% of all NZ's benthic habitat becoming protected from the impacts of fishing, including around 10% of areas representative of designated classes of habitat.

With the clear understanding that the impacts are not 100% attributable to the MSC, the analyses that might be possible under the habitat theory of change can begin explored based upon NZ's deepwater fisheries and habitats. Thus, the example presented here serves as a potential model for other fishery analyses in the context of such habitat protection and/or improvement.

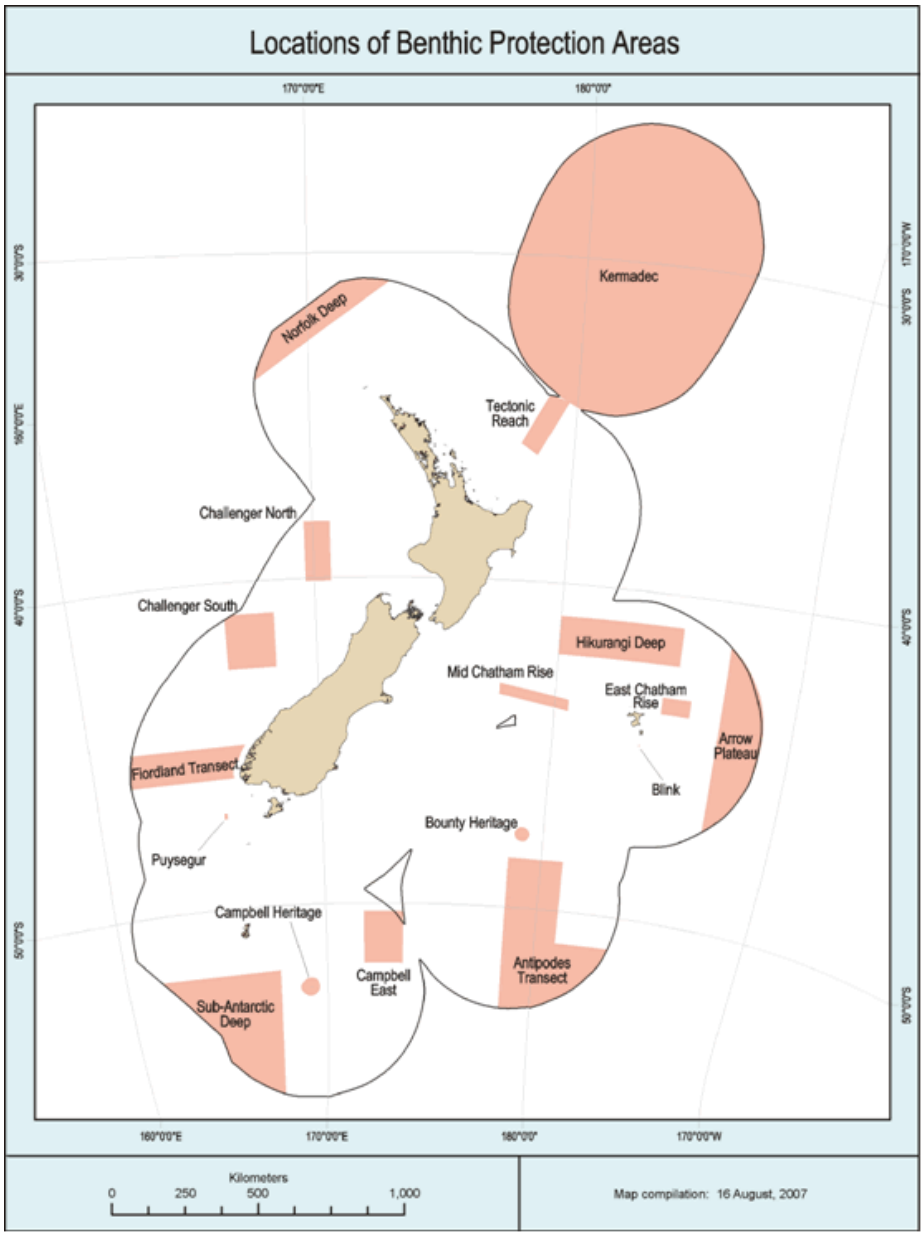


Figure 57. New Zealand's Benthic Protection Areas. Source: www.fish.govt.nz/en-nz/Environment/

Figure 57 shows where NZ's benthic protection areas are.

By overlaying abundance and catch distributions of species of interest with the BPA map, it is possible to visualise the potential analyses to detect wider impacts upon species and therefore other non-certified fisheries.

To explore this, the annual distribution of hoki and ling are plotted over the boundaries of the BPAs (Figure 58 and Figure 59 respectively). Extending this idea further, data are available to show the annual distribution and average annual catches of hake in the last 10 years, plotted with the boundaries of the BPAs. It then seems, therefore, to be a reasonable hypothesis, assuming there are both baseline and physical data, that it would be possible to determine over time whether any impacts on size or age, distribution or overall abundance result for the range of deepwater species that can be correlated to the creation of the BPAs.

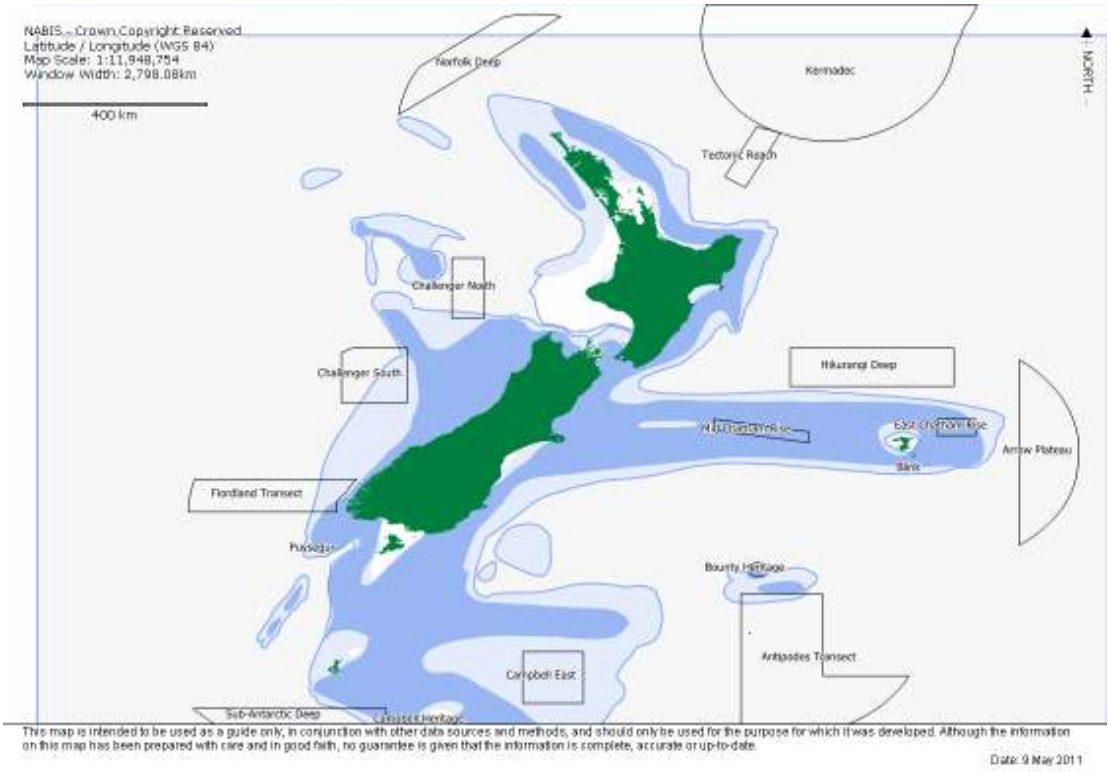


Figure 58. Hoki distribution (in blue) overlaid on BPAs. Source: NZ Ministry of Fisheries NABIS database

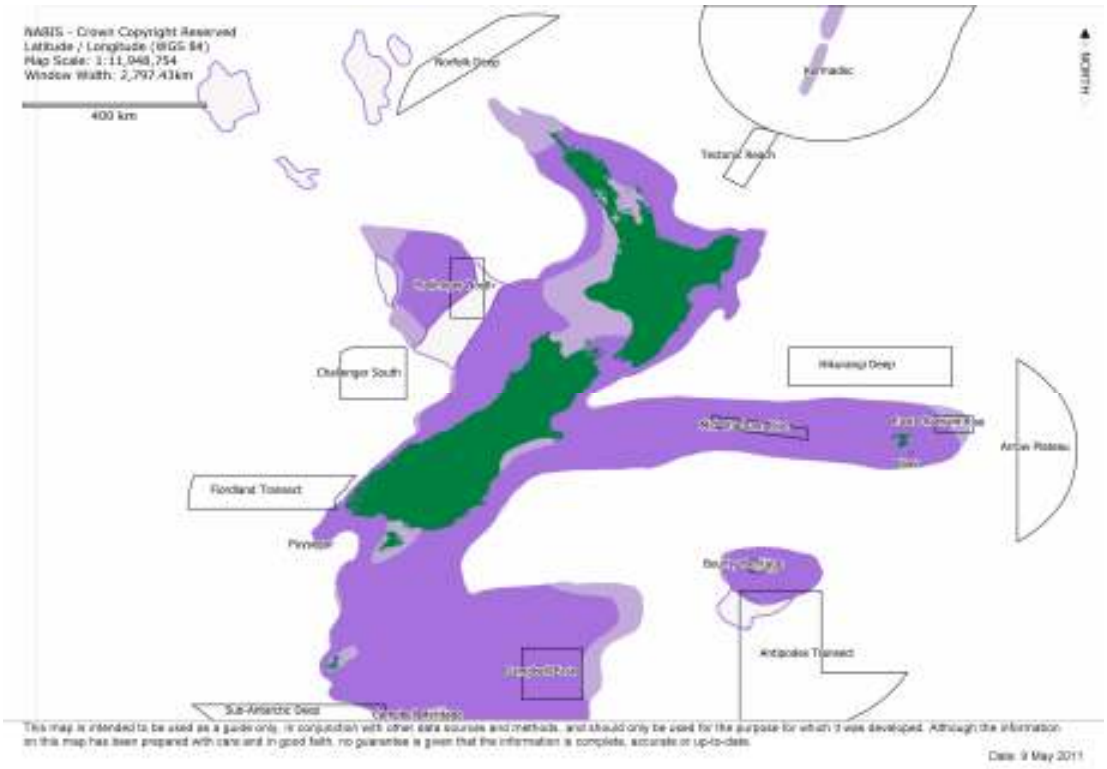


Figure 59. Ling distribution (in purple) overlaid on BPAs
Source: as above

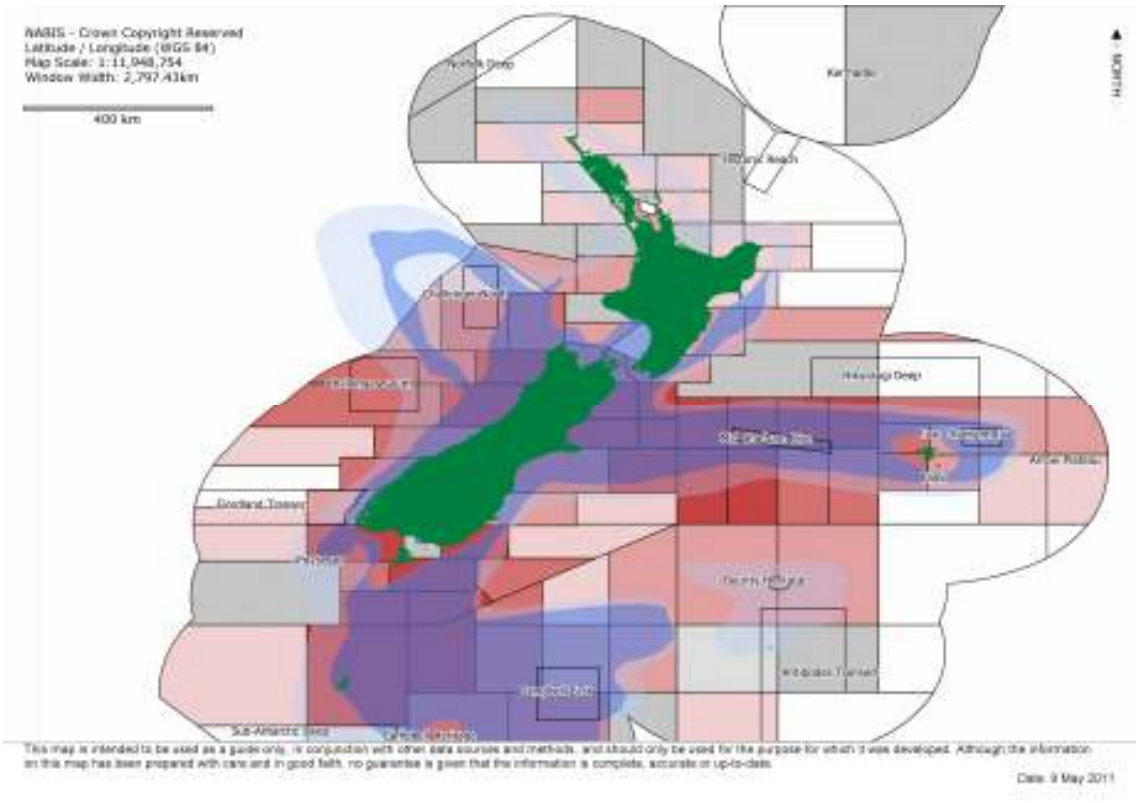


Figure 60. Abundance (blue) and 10 year average catch (red) distribution of hake in NZ waters, overlaid on BPAs
Source: as above

The suite of certification conditions in the hoki re-assessment in 2007 relating to habitats ranged from the need to conduct more research on certain habitats to improve the understanding of the risks posed to, and impacts upon, habitats by the hoki fishery. Analysis was commissioned by the DeepWater Group (the hoki certification client) and presented to the certification body Moody Marine in support of the Group's efforts in the hoki fishery to reduce uncertainty and sign off on certification conditions. These analyses mapped the footprint of fishing effort in the hoki fishery, as well as other trawl fishing effort targeting commercially important deepwater species like ling, which helped improve understanding of benthic impacts (Punt *et al*, 2011). By adding historical fishing effort to the information on habitat, species distribution and catch, a picture begins to emerge of the deeper inquiries that may be possible to determine whether actual change is occurring from an environmental perspective.

It is reasonable to hypothesise that previously fished (e.g., trawled) areas of habitat, now protected, may change as a result of protection. Indeed, there is mounting evidence for positive ecological impacts in tropical and temperate nearshore areas on species richness, population density, fish size and abundance from the protection of marine areas (Fisher & Frank, 2002). Studies reveal that spill-over into adjacent areas also occurs, with the combined effects resulting in rapid, positive, cumulative impacts on biodiversity both inside and outside such protected areas (ibid). However, long-term changes associated with offshore deepwater species and habitats may be more challenging to research and understand, particularly if species are mobile and not strongly associated with specific habitats (Kaiser *et al*, 2007). Despite this, research in the north east Atlantic suggests that deeper water abundance (in unfished depths) of some species such as orange roughy is vulnerable to shallower water fishing impacts (Bailey *et al*, 2009). This in turn suggests that the

reverse may be true: protecting species from impact in certain representative habitats may positively impact their abundance outside the immediate area of protection. Investigating, either through direct observation or modelling, long-term temporal and spatial patterns in fish distribution, community structure, species richness and abundance may reveal insights into the impacts resulting from habitat improvements or protection resulting from certification. Factors that complicate any analysis (apart from cost and feasibility) will come from a range of sources from within such dynamically complex ecosystems, including the size of area, species range and movement through different life phases, population dynamics of species of interest, functional relationships within the community, the relative resilience of the community and the impacts of community disturbance on pre-protected habitats (Mangel & Levin, 2004).

Ultimately, an MSC monitoring and evaluation programme about the impacts of the MSC certification programme could monitor the habitats PIs in certified fisheries for changes in levels of information and management over time. Increases in information would tend to indicate reducing uncertainty. Delving into changes in fisheries in relation to management PIs would indicate whether management responds to higher levels of information, or applies precautionary management in the absence of certainty. Similarly, monitoring trends in the habitats outcome PIs may also indicate change. In other words, this means performing the sort of analysis demonstrated in this project for the post-certification analysis. To examine wider impacts beyond certified fisheries, the MSC cannot realistically (cost-effectively) establish indicators to monitor non-certified fisheries, but could periodically commission independent research to explore analyses suggested in this section, i.e., explore whether habitat improvements or protections in a certified fishery lead to improved outcomes in the fishery itself, and in turn, whether these improvements spill over into other fisheries whose target species distribution overlaps with areas of habitat management, or on the functioning ecology of the surrounding ecosystem.

9. DISCUSSION

9.1. Overview of pre and post certification findings

Our results suggest that improvements in environmental performance within MSC certified fisheries take place both prior to and after certification. Fishery certification clients in receipt of a pre-assessment report which advises that their fishery is likely to meet the MSC standard appear rarely to make improvements prior to going to full assessment. On the other hand, where a pre-assessment has identified significant weaknesses in a fishery, there is a need to address these prior to assessment.

A clear finding across the pre-assessment and post-certification analyses has been the high proportion of fisheries which showed no change in outcome PIs, either positive or negative. The vast majority of these were already at acceptable levels, indicating that very often the MSC certificate is a demonstration of best practice which is already occurring and that in many situations no changes are to be expected.

Another strong feature of the analysis has been the identification of where both increases and declines in PI score and indicators have occurred. On the whole, there were more outcome gains than losses in Principle 1 reference points and Principle 2 ecosystem indicators over the whole period of MSC involvement with the fishery. There appear to be more declines in indicator in stock status, although the losses did not outweigh the gains. Stock management has improved in general, but environmental fluctuations still have a large influence on stock levels.

Stakeholders identified that the MSC had a positive influence on outcome status in about 35% of fisheries, often commenting that although the stock itself may not have increased within the years of certification, better assessments had resulted in improved management and processes which were better able to deal with fluctuations in a precautionary way. Analysis of the outcome evidence shows that reference points have been improved to meet international requirements with improvements taking place throughout the pre-assessment phase and certification period, and this was confirmed through the stakeholder consultation in which 45% of respondents attributed improvements to the MSC.

Assessment of Principle 2 impacts generally appeared to be at an earlier stage in research and management than for Principle 1. Many fisheries have become more aware of their Principle 2 ecosystem impacts since MSC involvement began. Reductions in PI scores from pre-assessment to certification are often because the PI is not fully understood at time of pre-assessment rather than there being a real negative trend. Similarly, precautionary low PI scores are given during the certification period in the many cases where impacts cannot be determined. Understanding improves over time from pre-assessment to the more comprehensive full assessment and through the implementation of conditions, which although are related to outcome PIs, generally specify monitoring and research requirements as actions to be fulfilled before the condition can be closed (Figure 61). In these situations increased research establishes baseline data regarding levels of impact on which management measures may later be based and from which outcome gains are expected to arise later on.

The improvements which have taken place within the MSC process itself are also apparent from this study. In the pre-assessment stages, more improvements were seen in fisheries in more recent years compared with earlier in the process. Many issues that are raised are not new problems that have begun since the MSC became involved, but are instead indicative of the improved comprehensiveness of the MSC methodology in raising awareness of previously undetected issues. As fisheries interact with dynamic environmental systems, changes do occur which may be unrelated to the MSC, some of which may be negative and some of which may be positive. The MSC however

follows a precautionary approach whereby an improved understanding of fishery effects on fish stocks and their ecosystems is developed over time so that the fishery is better prepared to deal with the uncertainties arising.

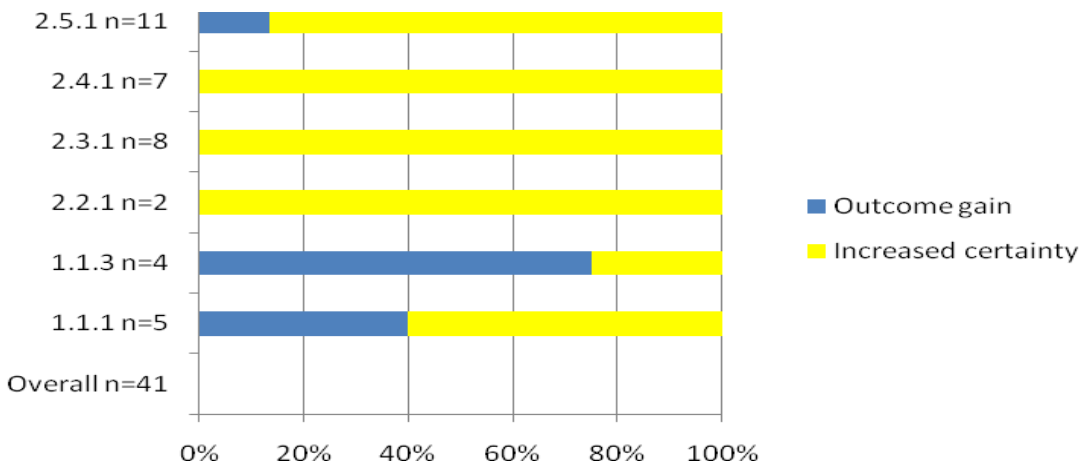


Figure 61: Reasons for closure of conditions related to outcome PIs

9.2. Assessing improvement in certified products: the case of the FSC

Whether assessments are made against social or environmental standards, ecolabelling of products is gaining momentum in many different sectors. The Forest Stewardship Council has been established and certifying sustainable forestry products since 1993, several years before the MSC. It uses similar processes and has similar goals to that of the MSC plus it has a slightly longer track of certifications to analyse. Additionally, benefits may be easier to assess given that the environment is terrestrial and the standards are assessing sedentary products. A review of available literature was conducted to investigate whether the FSC has identified any processes to quantify viable improvements from the certified forests and whether it has been able to attribute any of these improvements to the programme itself.

There have been various studies and investigations over the years to try and assess impacts and attribution of change of sustainable development. Peña-Carlos *et al.* (2009) used a similar method to this study and assessed the impacts by using the corrective action requests (CARs) as an indicator. Their results indicate that issues raised in CARs result in an improvement of standards (within FSC) and that CAR analysis is an appropriate tool for evaluating the impact of the programme due to their traceability through time. It also found that certification improves the long term economic viability of the unit of certification as well as having positive impacts across all areas e.g. economic, social and environmental. Long term sustainability was an area that was seen to benefit largely for certification due to the monitoring and incorporation of these results into the management policies. A learning process for the programme was also commented on. The report also demonstrated that it was common for new criteria to come up in subsequent reports to the main assessment.

Bass *et al.* (2001) comment that the most common conditions placed on the certificates are not outcome based, this supports our findings and shows alignment between the certification systems. For the FSC, the most common conditions are regarding: management plans and supporting documents; monitoring and assessment; written environmental impact guidelines; ETP and

representative habitat areas should be protected. The study notes that for the system to improve management of the resource more uniformly rather than just supporting the 'elite', methods for reaching the poorer producers are required.

Ozinga (2004) states that there have been noticeable improvements in the forestry sector i.e. increased consumer demand for sustainable product, improved management and improved working conditions. Yet on the other hand, the very intention for the certification schemes was driven because of the worldwide loss of tropical forests and most of the certified forests are in the developed countries (Ozinga 20004, Leslie 2004). Here the FSC also shares a theme with the MSC, with most of the certified fisheries being within 'developed' regions, however in contrast possibly to the FSC circumstances the sustainability of these fisheries (e.g. EU) has also been a cause for concern. Ozinga (2004) proposes the weakness in the schemes by distracting from the urgency about forestry degradation. Thus a problem exists for the programmes to uphold their credibility and translate their concepts into real improvements as little research has been completed to prove this. The study supports the view that certification increases communication amongst stakeholders and brings about agreement on what sustainable management would be.

Peña-Claros and Bongers (2010) reiterate the lack of measurements and analyses regarding on-the-ground impacts, especially in instances of comparisons before and after certification or comparisons of certified areas with non-certified areas. Our wider impacts section provides the basis for this type of research within the MSC. Peña-Claros and Bongers (2010) also mention that forest managers share the issue with fisheries of providing actual impacts on biodiversity and highlights the ability of analysis of CARs to demonstrate improvement.

Van Kuijk *et al.* (2009) states that "forest management practices associated with forest certification appear to benefit biodiversity in managed forests". However, scientists still need to provide quantitative, field-based evidence of species responses to forest management practices to provide a basis for assessing the effectiveness of the practices associated with certification.

9.3. Timelines of improvement in MSC fisheries

The full data set including the pre-assessment and post-certification sample fisheries (see Table 6 for list) was analysed to see how the PRINCIPLE 1 and PRINCIPLE 2 PIs performed across the whole assessment path. The two datasets are not identical, as the pre-assessment dataset comprises 21 fisheries, and the post-assessment dataset comprises 25 fisheries of which only 12 overlap. Nevertheless there was no significant difference between estimates of the proportion of outcome PIs scoring >80 arising from the pre-assessment and full assessment samples.

The results presented in section 5 demonstrated that more improvement of outcome PIs was seen from fisheries with a cautionary recommendation to proceed than an unconditional recommendation. These improvements bring them up to the starting point for full assessment results, which are indicated here as about 70% of outcome PIs scoring ≥80. Fisheries receiving an unconditional recommendation do not improve significantly between pre-assessment and assessment. This is not particularly surprising, given that these fisheries have been effectively told that they are "good to go". Making specific improvements in this circumstance would be inefficient, particularly as it is understood by clients that definitive recommendations (and conditions) will only arise from a full assessment. On the other hand, a fishery that does not act to fix the problems identified in a cautionary pre-assessment runs the risk of failing.

The full dataset of assessed fisheries showed an increase from approximately 70% of FAM PIs scoring ≥80 at year 0 (assessment) to 91% at the 5 year interval. Following re-assessment (which took place on average in year 6), the percentage dropped to 71%, however the sample size was reduced to only 6 fisheries by this stage (Figure 62). According to these data it would take in excess of 6 years for all

of the fisheries in the programme to achieve 100% of the PIs to score ≥80, however as these are natural fluctuating systems it is unlikely that 100% would ever be reached, but that a high asymptote would be reached and maintained with minor variations over time.

There are several possible explanations for the drop from year 5 to year 6. This may represent the changes in scoring and standards which have taken place, either due to improvements in MSC guidelines or inappropriate application of guidelines in the early fisheries. New issues may also have arisen, such as previously unidentified bycatch problems. Stocks could also have fluctuated, as observed for hoki. The detailed examination of trends in PIs and indicators presented in showed that declines in performance have been seen particularly in Principle 1.

Whatever the cause, the more recent assessments are almost certainly more consistent from the point of view of application of the MSC standard. We therefore investigated the consequences of removing older fisheries from the data set (pre-2001). In this analysis the main difference was an increase in year 6 from around 70% to 80%, however as the sample size was reduced (to 2 fisheries in year 6) the uncertainty was increased further.

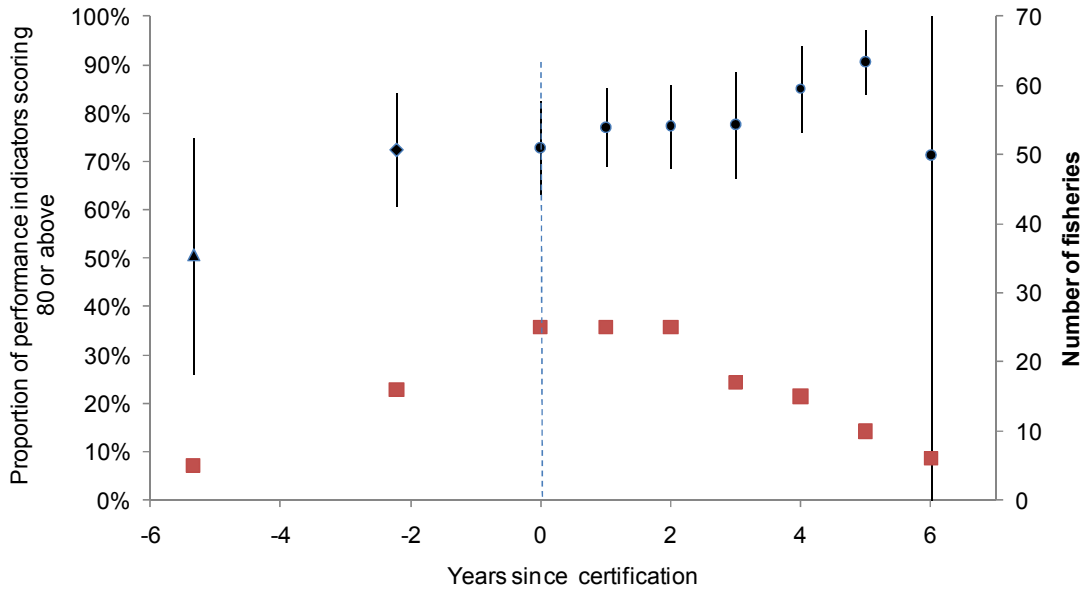


Figure 62: Percentage of total FAM PIs ≥80[14] using full data set of fisheries
Note: stock rebuilding was not included to avoid duplication of stock status scores. 95% binomial CIs on proportions are shown (Zar, 1999). The decline in performance in year 6 is predominantly due to the presence of the earliest certified fisheries, and although it may be expected that some fisheries will continue to attract new conditions after re-assessment, this situation may improve as these older fisheries are joined by the newer assessments.
Red squares = number of sample fisheries at each point in time; triangle = fisheries receiving recommendations at pre-assessment; diamond = fisheries receiving no recommendations at pre-assessment; blue circles =fisheries in post-certification sample. Points before zero are from the pre-assessment sample.

These data were produced by considering only whether a FAM PI scored below 80 or not, in which case it would have attracted a condition. Since closure of conditions is a requirement of the MSC

[14] This indicates that all individual PIs scored above 80 within each FAM PI. If even one PI was below 80, the whole FAM PI was treated as below 80

system it is perhaps not surprising that this indicates significant improvement. Nevertheless, as a significant relationship has been found between closure of conditions and positive change in outcome indicator data, it can be concluded that this trend in FAM PI scores would be associated with a corresponding trend in the indicators themselves.

Although there is some evidence in our data (Table 11, Table 14 and Annex B) that improvements in score are accompanied by improvements in an indicator (i.e. improvements on the water) this appears to be the case for fewer than 50% of PIs. The statistical correlation between PI score and indicator trend is strong and significant for stock status but correlations with other outcome indicators cannot be made due to a lack of consistent and detailed data for those other outcome indicators. For PRINCIPLE 2, an improving score appears to be primarily generated by the provision of more information. This is consistent with the MSC system, which expresses itself in terms of the precautionary approach; low scores are given for certain poor outcomes, or uncertain outcomes. Often, the provision of new information, management systems etc, generated in response to a pre-assessment cautionary recommendation or a post-certification condition has been sufficient to decrease uncertainty to the level where an 80 score can be achieved. This has been particularly apparent for Principle 2 indicators, in which almost all conditions are closed due to increased certainty (Figure 61).

9.4. Tracking improvement in MSC fisheries

The pre-assessment improvements particularly of those fisheries in the cautionary pre-assessment category (some 2/3 of all pre-assessed fisheries that move through to full assessment) will help to track the real progress being made by those fisheries to raise themselves to the level where full assessment is achievable. This may be expected to deliver, based on our results, an increase of over 20% of PIs achieving the MSC best practice standard of a score of ≥80.

Achievement of the additional 20% increase in PIs scoring >80 will happen during post-certification satisfaction of conditions. The relationship between PI changes – achieved during condition closure – and real changes in the fishery should be monitored through two mechanisms: correlations between scores and outcome indicators, which are particularly appropriate for stock status, but may be appropriate for other indicators in Principle 2, although these are unlikely to be a consistent indicator for all fisheries; and understanding the improvements in knowledge or management that reduce uncertainty that allow increased confidence that the fishery is not causing unsustainable impacts on the ecosystem.

Whether fishers will seek to make improvements to a poorly performing fishery to enable it to meet a certification standard is likely to depend not just on how easy it is to make those improvements, but also the gain that they will experience, which in MSC fisheries can be an increase in product price (Roheim et al. 2011), improved market access or external validation of reputation/performance. Fisheries may need external technical and financial assistance to create these improvements. WWF and the Sustainable Fisheries Partnership are engaged in a number of Fisheries Improvement Plans, which have the ultimate goal of ensuring the fishery performs at a level consistent with an unconditional pass of the MSC standard. It may take several years to improve key elements of a fishery so that it is performing at a level consistent with the standard and is able to undergo full MSC assessment.

It is worth noting that the MSC is still a relatively young organisation, and that to date the majority of fisheries achieving certification have been those given cautionary or fully recommended pre-assessments. Although our results clearly indicate that greater improvements can be expected from the lower performing fisheries, the difficulty of generating those improvements will also be greater. Furthermore, our sample of post-assessment fisheries was necessarily restricted to the fisheries that have been in the programme long enough to make analysis meaningful, but this meant that they

included the earliest fisheries to enter the programme. These fisheries experienced the most rapid learning phase of the MSC's existence, and some had to make significant adjustments at re-assessment to align themselves with improved MSC procedures and methodologies. The continual improvements made within programs such as the MSC makes comparisons over extended time periods difficult.

Finally, the point beyond first re-assessment should be monitored carefully, to ensure that the increase in performance towards the end of the first certification period is not artificially created by CBs being required to close out conditions. Over the next few years it will be important to demonstrate that the result obtained in this report (the general improvement throughout the certification process until year 6) is, indeed, a legacy of the inconsistent application of MSC standards, and a lack of consistent guidance, in the early fisheries. The results described above clearly identify some methods that could be developed further and our examination of the wider impacts of MSC certification has suggested that a fruitful area of monitoring may be along the lines of the various hypotheses identified in Section 8.

9.5. Conclusions

Overall, results indicate that significant numbers of fisheries are finishing the pre-assessment process with recommendation to proceed, but with caution. These fisheries are making the largest improvements prior to certification, whereas those receiving straightforward recommendations to proceed have not made similar improvements as they appear to have little incentive to make any changes prior to full assessment. The greatest quantified outcome changes are being made in stock status, the PI which has been most closely monitored over time and for which most information is available. The most significant improvements in fisheries are being made post-certification and are linked to specific conditions.

In Principle 2 outcomes, there are some examples of 'on the water' improvements, such as reduction of bird bycatch in South Africa hake, reduction of bycatch of Chinook salmon in the Gulf of Alaska pollock, reduction of effort in Bering Sea and Aleutian Islands pollock, reduced bird mortality in the Patagonian toothfish fishery in addition to the elimination of the discarding of hooks and implementation of protected areas. However, the majority of low scores are associated with uncertainty about impacts, and improvements in scores are a result of increased certainty that impacts are low (through improved research as well as implementation of management measures).

After certification, fisheries continue to improve, encouraged by the use of conditions. The trend in improvement can be tracked through changes in PI scores across fisheries which suggests that fisheries receiving a conditional pre-assessment recommendation will improve from approximately 50% of their outcome PIs scoring ≥80 at pre-assessment to approximately 70% of outcome PIs scoring ≥80 at certification, and will make further improvements over the subsequent 5-10 years until some 90% of outcome PIs score ≥80.

There is wide acceptance that ecolabel certification schemes such as the MSC increase major buyer and consumer awareness and provide tools to turn awareness into action, improve dialogue between stakeholders, and foster significant change in attitude in the management of natural resources, particularly in raising awareness of ecosystem impacts of fisheries (Ozinga, 2004). Many stakeholders coming from different interest groups cited engagement in the MSC programme as useful for advancing their interests and in improving the management of the fishery. The fact that about half of the interventions leading to improvements in fisheries were attributed to the activity of certification suggests that stakeholders perceive the programme to generate positive benefits. In summary, analysis of the evidence and stakeholder views confirms that gains occur during MSC involvement with a fishery.

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ANNEX A: LIST OF MSC CERTIFIED FISHERIES (AS OF JUNE 2010)

MSC certified fisheries	No. fisheries	Cert. Date	Landings(t)
Aker Biomarine Antarctic krill	1	June 2010	-
Alaska salmon	5	Sept 2000 (1) / Nov 2007 (2)	287,000
American Albacore Fishing Association Pacific albacore tuna - north	1	Aug 2007	5,000
American Albacore Fishing Association Pacific albacore tuna - south	1	Aug 2007	5,000
American Western Fish Boat Owners Association (WFOA) North Pacific albacore tuna	1	Mar 2010	10,200
Astrid Fiske North Sea herring	1	Jun 2008	-
Atlantic deep sea red crab	1	Sept 2009	2,688
Australia mackerel icefish	1	March 2006	1,200
Bering Sea and Aleutian Islands Alaska (Pacific) cod - freezer longline	1	Feb 2006	48,000
Bering Sea and Aleutian Islands flatfish	5	June 2010	266,000
Bering Sea and Aleutian Islands Pacific cod	1	Jan 2010	168,780
Bering Sea/Aleutian Islands pollock	1	Feb 2005 (1) / Jan 2009 (*)	1,000,000
Burry Inlet cockles	1	Apr 2001 (1) / Feb 2007 (2)	3,500
Canada northern prawn	1	Aug 2008	68,000
Canada Pacific halibut (British Columbia)	1	Sept 2009	5,277
Canadian Highly Migratory Species Foundation (CHMSF) British Columbia North Pacific albacore tuna	1	March 2010	6,056
Danish Pelagic Producers Organisation Atlanto Scandian herring	1	Jul 2009	32,301
Danish Pelagic Producers Organisation North East Atlantic mackerel	1	Jul 2009	24,024
Danish Pelagic Producers Organisation North Sea herring	1	Jul 2009	26,195
Denmark blue shell mussel	1	Jan 2010	30,000
Domstein Longliner Partners North East Arctic cod	1	Feb 2009	5,000
Domstein Longliner Partners North East Arctic haddock	1	Feb 2009	3,000
Dutch Organisation (DFO) gill net sole	1	Nov 2009	168
Eastern Canada offshore lobster	1	Jun 2010	720
Eastern Canada offshore scallop fishery	1	Mar 2010	6,725
Ekofish Group-North Sea twin rigged otter trawl plaice	1	Jun 2009	2,500
Euronor saithe	1	Mar 2010	16,767
Faroese Pelagic Organization (FPO) Atlanto-Scandian herring	1	Mar 2010	74,606
Germany North Sea saithe trawl	1	Oct 2008	9,700
Gulf of Alaska flatfish	5	Jun 2010	81,220
Gulf of Alaska Pacific cod	1	Jan 2010	59,563
Gulf of Alaska pollock	1	Apr 2005 (1) / Jan 2009 (*)	51,940
Gulf of St. Lawrence northern shrimp	1	Sept 2008	28,800
Gulf of St. Lawrence northern shrimp trawl fishery Esquiman Channel	1	Mar 2009	8,867
Hastings fleet Dover sole (trammel net)	1	Sept 2005	72
Hastings fleet Dover sole trawl and gill-net	1	Jul 2009	1,370
Hastings fleet pelagic herring and mackerel	2	Sept 2005	10
Irish Pelagic Sustainability Group (IPSG) western mackerel pelagic trawl	1	Aug 2009	53,940
Iturup Island pink and chum salmon	2	Sept 2009	47,000
Kyoto Danish Seine Fishery Federation snow crab and flathead flounder	2	Sept 2008	220
Lake Hjälmaren pikeperch fish-trap and gillnet	1	Aug 2006	166

Lakes and Coorong, South Australia	1	Jun 2008	-
Loch Torridon nephrops creel fishery	1	Jul 2008	120
New Zealand hoki	1	Mar 2001 (1) / Oct 2007 (2)	91,040
North East Atlantic mackerel pelagic trawl, purse-seine and handline	1	Apr 2009	131,965
North Eastern Sea Committee sea bass	1	Dec 2007	7
Norway North East Arctic offshore cod	1	Apr 2010	-
Norway North East Arctic offshore haddock	1	Apr 2010	-
Norway North East Arctic saithe	1	Jun 2008	296,000
Norway North Sea and Skagerrak herring	1	Apr 2009	104,563
Norway North Sea saithe	1	Jun 2008	296,000
Norway spring spawning herring	1	Apr 2009	926,000
Oregon pink shrimp	1	Dec 2007	5,700
Pacific hake mid-water trawl	1	Oct 2009	185,000
Patagonian scallop	1	Dec 2006	42,000
Pelagic Freezer-Trawler Association North East Atlantic mackerel pelagic trawl	1	Jul 2009	50,824
Pelagic Freezer-Trawler Association North Sea herring	1	May 2006	160,000
Portugal sardine purse seine	1	Jan 2010	78,000
Scottish Pelagic Sustainability Group Ltd Atlanto Scandian herring	1	Mar 2010	1,643,000
Scottish Pelagic Sustainability Group Ltd (SPSG) North Sea herring	1	Jul 2008	15,000
Scottish Pelagic Sustainability Group Ltd western component of north east Atlantic mackerel	1	Jan 2009	140,000
South Africa hake trawl	2	Apr 2004 (1) / Mar 2010 (2)	134,000
South Georgia Patagonian toothfish longline	1	Mar 2004 (1) / Sept 2009 (2)	3,500
South-west handline mackerel	1	Aug 2001 (1) / Feb 2007 (2)	1,750
SPPO North Sea herring	1	May 2010	15,448
Stornoway nephrops trawl	1	Apr 2009	17,676
Tosakatsuo Suisan pole and line skipjack tuna	1	Nov 2009	4,000
US North Pacific halibut	1	Apr 2006	24,000
US North Pacific sablefish	1	May 2006	18,100
Vietnam Ben Tre clam hand gathered	1	Nov 2009	8,660
Western Australia rock lobster	1	Mar 2000 (1) / Dec 2006 (2)	10,750

MSC fisheries in assessment	No. fisheries	Commencement date	Landings(t)
Annette Islands Reserve salmon	5	Nov 2009	2,948
Argentina Hoki	1	Dec 2009	110,267
Atlantic cod, haddock and wolffish longline, handline and Danish seine	3	Apr 2009	225,000
Barents Sea cod and Barents Sea haddock	2	Dec 2008	-
Blackwater native oyster	1	Jul 2009	60
Bristol Channel ray	6	Nov 2009	550
Bristol Channel sea bass	1	Jun 2009	-
British Columbia pink and chum salmon	7	Feb 2008	15,000
British Columbia sockeye salmon	4	Jun 2003	-
British Columbia spiny dogfish	1	Apr 2008	-
C&WSTG English Channel megrim, monk and sole beam trawl	4	Jan 2010	2,400
Canada offshore northern and striped shrimp	2	Jun 2009	-
Canada sablefish	1	Nov 2008	-
Canada Scotia-Fundy haddock	1	May 2009	-
Chile hake trawl	1	June 2010	26,355
Clyde nephrops creel	1	Aug 2007	-
Clyde nephrops trawl	1	Aug 2007	-
Cooperative Fishery Organisation (CVO) North Sea plaice and sole	2	Apr 2010	40,000
Cornish hake gill net	1	Apr 2010	28,879

Cornwall sardine, UK	1	Dec 2007	-
Denmark Eastern-Baltic cod	1	Aug 2009	5,486
Denmark North Sea plaice	1	Aug 2009	6,931
Denmark saithe	1	Aug 2009	7,097
Dutch rod and line fishery for sea bass	1	Mar 2010	100
Faroe Islands queen scallop	1	May 2008	4,360
Faroese Pelagic Organization (FPO) North East Atlantic mackerel	1	Mar 2009	-
Germany Eastern and Western Baltic cod	1	Nov 2009	3,200
Germany North Sea brown shrimp	1	Jan 2010	11,004
Gulf of California, Mexico – sardine	1	Oct 2009	-
Irish Pelagic Sustainability Association (IPSA) Western mackerel	1	Oct 2008	6,500
Isle of Man queen scallop trawl and dredge	1	Aug 2008	-
Japanese scallop hanging and seabed enhanced fisheries	2	Apr 2010	433,000
Limfjord blue shell mussel (rope grown)	1	Jun 2009	-
Limfjord blue shell mussel and oyster dredge fisheries	1	Jun 2009	-
Maine Lobster trap fishery	1	Dec 2008	-
Maldives pole & line and handline tuna	3	Jul 2009	117,000
Maryland striped bass	1	May 2005	879
Mexico Baja California Pole and Line yellowfin and skipjack tuna	1	May 2010	555
Mexico Baja California red rock lobster	1	Apr 2004 (1) / May 2009 (*)	1,300
NAFO Division 4R Atlantic herring purse seine	1	Apr 2010	13,000
Netherlands blue shell mussel	1	Dec 2009	36,800
Netherlands suspended culture mussel	1	Jan 2010	900
New Zealand albacore tuna troll fishery	1	Apr 2009	3,000
New Zealand EEZ hake trawl fishery	1	May 2009	12,544
New Zealand EEZ ling trawl and longline fishery	1	May 2009	17,946
New Zealand EEZ southern blue whiting pelagic trawl fishery	1	May 2009	36,800
New Zealand southern scallop	1	May 2009	747
Normandy and Jersey lobster	1	Oct 2009	282
North East England lobster pot fishery	1	Jun 2010	518
North Menai Strait mussel	1	Apr 2009	-
North Sea brown shrimp	1	Apr 2007	35,000
North West Atlantic Canada longline and harpoon swordfish	1	Feb 2009	-
Norway North East Arctic inshore cod	1	Sept 2008	174,413
Norway North East Arctic inshore haddock	1	Sept 2008	76,500
OCI Grand Bank yellowtail flounder trawl	1	Mar 2009	-
Oregon Dungeness crab	1	Aug 2004	-
Osprey Trawlers North Sea twin-rigged plaice	1	Oct 2009	2,000
Pelagic Freezer-Trawler Association Atlanto-Scandian herring pelagic trawl	1	Nov 2009	36,933
PNA Western and Central Pacific skipjack tuna	1	Apr 2010	550,000
Ross Sea toothfish longline	1	Nov 2007	3,300
Russia Bering Sea pollock	1	Sept 2008	-
Russia Sea of Okhotsk pollock	1	Sept 2008	-
SARPC toothfish	1	Oct 2009	5,800
Scapêche and Compagnie de Pêche de St. Malo saithe	1	Sept 2009	3,179
Scottish Sustainable Accreditation Group (SFSAG) North Sea haddock	1	Jan 2009	18,000
Scottish Sustainable Accreditation Group (SFSAG) North Sea nephrops	1	Jan 2008	26,144
Shetland Inshore brown crab, velvet crab and European lobster potting fishery & the Shetland Inshore scallop dredging fishery	2	May 2010	-

Sian Ka'an and Banco Chinchorro Biosphere Reserves spiny lobster	1	Jan 2009	-
Skagerrak, Kattegat and Norwegian Deeps prawn	1	Aug 2008	-
South Brittany sardine purse seine	1	Feb 2009	-
South Georgia icefish pelagic trawl	1	Jan 2008	-
Southeast US North Atlantic big eye tuna and yellowfin tuna	1	Apr 2010	800
Southeast US North Atlantic swordfish	1	Apr 2010	2,350
Southern North Sea nephrops	1	Feb 2008	4,000
Southern red king crab bottom trap, Argentina.	1	Dec 2009	367
Spencer Gulf king prawn	1	Jun 2010	2,024
SPPO Baltic herring and sprats	2	Mar 2008	-
SPPO North East Atlantic mackerel	1	Mar 2010	4,438
St. Helena pole & line and rod & line yellowfin, bigeye, albacore and skipjack tuna	4	Feb 2009	-
Suriname Atlantic seabob shrimp	1	Jun 2009	-
Sweden Eastern and Western Baltic cod	1	Dec 2009	12,000
Tristan da Cunha rock lobster	1	Jan 2010	434
UK Fisheries/DFFU/Doggerbank Group saithe	1	Aug 2009	2,500
US Atlantic sea scallop	1	Apr 2010	26,500
West Greenland coldwater prawn	1	Feb 2008	-
Western Baltic spring spawning herring	1	Oct 2008	-

ANNEX B: SUPPORTING INFORMATION FOR PRINCIPLE 2 INDICATORS

Table B. Changes in retained species scores, indicator data and level of uncertainty over the certification period
"-" indicates that the fishery has not been re-scored at the time of writing and we assume that the score remains the same

Fishery	Initial PI score	Final PI score	Change in PI scores	Indicator data status	Indicator data trend	Summary indicator trend	trend in uncertainty	Certification period (at the time of writing)
AF North Sea herring	100	-	0.00%	Risk judged to be negligible	no recorded change	no recorded change	no recorded change	2008-2010
American albacore (NP)	90	-	0.00%	Catches of non-target species are extremely limited	no recorded change	no recorded change	no recorded change	2007-2009
American albacore (SP)	85	-	0.00%	Catches of non-target species are extremely limited	no recorded change	no recorded change	no recorded change	2007-2009
Australian mackerel icefish	85	-	0.00%	Discarding of species subject to a quota is prohibited	no recorded change	no recorded change	no recorded change	2006-2010
BSAI Pollock	95	85	-10.53%	Bycatch is predominantly prohibited species which must be returned to the sea	no recorded change	no recorded change	no recorded change	2005-2010
Burry inlet cockles	100	100	0.00%	No significant impacts on non-target species -highly selective fishery	no recorded change	no recorded change	no change, impacts known	2000-2010
Canadian Northern prawn trawl	95	-	0.00%	Bycatch is low (~2%), no change	no recorded change	no recorded change	no recorded change	2008-2010
GOA Pollock	90	90	0.00%	Bycatch is predominantly prohibited species which must be returned to the sea	no recorded change	no recorded change	no recorded change	2005-2010
Hastings fleet Dover sole	85	-	0.00%	No recorded change	no recorded change	no recorded change	no recorded change	2005-2009
Hastings fleet pelagic	70	80	14.29%	There are indications that catch of non-target species is low, but no direct information is available for the fishery	no recorded change	no recorded change	regular recording of bycatch has been undertaken, so uncertainty is being reduced	2005-2008

Fishery	Initial PI score	Final PI score	Change in PI scores	Indicator data status	Indicator data trend	Summary indicator trend	trend in uncertainty	Certification period (at the time of writing)
Lake Hjälmaren pikeperch fishtrap	90	-90	0.00%	There are no indications that any of the non-target species that are landed are fished at unsustainable levels	no recorded change	no recorded change	no recorded change	2006-2009
Lake Hj□lmaren pikeperch gillnet	90	90	0.00%	As above	no recorded change	no recorded change	no recorded change	2006-2009
Loch Torridon Nephrops	85	90	5.88%	Commercially exploited species make up a very small proportion of bycatch	no recorded change	no recorded change	decreasing based on impact studies	2002-2010
Norway North Sea Saithe gillnet	75	75	0.00%	Bycatch is known to be low in all fisheries but had not been quantified at certification	no recorded change	no recorded change	new regulations regarding quantifying bycatch implemented in 2009	2008-2010
Norway North Sea Saithe purse seine and hook	75	75	0.00%	As above	no recorded change	no recorded change	as above	2008-2010
Norway North Sea Saithe trawl and demersal	75	75	0.00%	As above	no recorded change	no recorded change	as above	2008-2010
Oregon pink shrimp	85	-	0.00%	As above	bycatch reduced by 97%	positive	no recorded change	2007-2010
Patagonian scallop	90	-	0.00%	Non-capture mortality is minimial <10%	no recorded change	no recorded change	no recorded change	2006-2009
PFTA North Sea herring	95	-	0.00%	Low (2.3% of catch)	no recorded change	no recorded change	no recorded change	2005-2010
SA hake trawl	90	90	-16.67%	Bycatch is high and led to overfishing.	West coast stocks have recovered, whereas south coast stocks have not	no recorded change	increased uncertainty	2004-2010
SG patagonian toothfish longline	80	90	12.50%	Impacts considered to be of low significance	no recorded change	no recorded change	no change - low uncertainty	2002-2009

Fishery	Initial PI score	Final PI score	Change in PI scores	Indicator data status	Indicator data trend	Summary indicator trend	trend in uncertainty	Certification period (at the time of writing)
SPSG North sea herring	100	-	0.00%	Non-target fish catch is low	no recorded change	no recorded change	uncertainty is low, no changes recorded	2008-2010
SW handline mackerel	80	80	0.00%	Extremely low levels on non-target species caught	no recorded change	no recorded change	no recorded change - no records kept, but extremely rare so not required	2001-2009
US N.Pacific halibut	70	-	0.00%	Quantities not recorded	unknown	unknown	uncertainty is high. Information is being gathered, but has not progressed enough for closure of the condition	2006-2010
US N.Pacific sablefish	80	-	0.00%	Impact on halibut is low - data available	no recorded change	no recorded change	no recorded change	2006-2010
WA rock lobster	PASS	-	-	Some reported catches of octopus	no recorded change in catch levels	no recorded change	reduced uncertainty as monitoring of the octopus stock status is now taking place	2000-2010
New Zealand Hoki	-	85	-	Bycatch is generally <5% and bycatch stocks are above acceptable biomass limits	no recorded change	no recorded change	no recorded change	2001-2009
Lakes and Coorong	-	-	Only minor risks	Initially no available data on bycatch risks	no recorded change	no recorded change	reduced as data now exist	2008-2010

Table B2. Changes in bycatch scores, indicator data and level of uncertainty over the certification period
"-" indicates that the fishery has not been re-scored at the time of writing and we assume that the score remains the same

Fishery	Initial PI score	Final PI score	Change in PI scores	Indicator data status	Indicator data trend	Summary indicator trend	trend in uncertainty	r	n	p	Certification period (at the time of writing)
AF North Sea herring	80	-	0.00%	Slippage is rare	slippage has reduced	positive	no recorded change				2008-2010
American albacore (NP)	95	-	0.00%	Minimal high-grading. Average discard rate for highly migratory species troll fisheries = 0.1% globally	no recorded change	no recorded change	no recorded change				2007-2009
American albacore (SP)	85	-	0.00%	Minimal high-grading. Average discard rate for highly migratory species troll fisheries = 0.1% globally	no recorded change	no recorded change	no recorded change				2007-2009
Australian mackerel icefish	85	-	0.00%	The status of byproduct species is uncertain	no recorded change	no recorded change	no recorded change				2006-2010
BSAI Pollock	-	90	-	Overall - reduction in TAC likely to influence bycatch	herring - decrease	positive	no recorded change	-0.99	5	<0.01	2005-2010
BSAI Pollock	-	90	-!	Overall - reduction in TAC likely to influence bycatch	halibut - increase	negative	no recorded change	0.791	5	>0.1	2005-2010
BSAI Pollock	-	90	-	Overall - reduction in TAC likely to influence bycatch	Chinook salmon - decrease	positive	no recorded change	-0.62	5	>0.1	2005-2010
BSAI Pollock	-	90	-	Overall - reduction in TAC likely to influence bycatch	other salmon - decrease	positive	no recorded change	-0.89	5	<0.01	2005-2010
BSAI Pollock	-	90	-	Overall - reduction in TAC likely to influence bycatch	red king crab - increase	negative	no recorded change	0.77	5	>0.1	2005-2010
BSAI Pollock	-	90	-	Overall - reduction in TAC likely to influence bycatch	other king crab - increase	negative	no recorded change	0.20	5	>0.1	2005-2010
BSAI Pollock	-	90	-	Overall - reduction in TAC likely to influence bycatch	bairdi crab	no recorded change	no recorded change	0.028	5	>0.1	2005-2010
BSAI Pollock	-	90	-	Overall - reduction in TAC likely to influence bycatch	opilio crab - increase	negative	no recorded change	0.609	5	>0.1	2005-2010

Fishery	Initial PI score	Final PI score	Change in PI scores	Indicator data status	Indicator data trend	Summary indicator trend	trend in uncertainty	r	n	p	Certification period (at the time of writing)
Burry inlet cockles	60	100	66.67%	The level of incidental mortality from riddled discards has not been measured, but studies in other areas suggest it is low	no recorded change	no recorded change	More information suggesting high survival rate of discards				2000-2010
Canadian Northern prawn trawl	90	-	0.00%	Discarding is low and virtually all catch is landed (both regions)	no recorded change	no recorded change	no recorded change				2008-2010
GOA Pollock	-	80	-	Overall - reduction in TAC likely to influence bycatch	halibut - increase	negative	no recorded change	0.793	4	>0.1	2005-2010
GOA Pollock	-	80	-	Overall - reduction in TAC likely to influence bycatch	herring - decrease	positive	no recorded change	-0.40	4	>0.1	2005-2010
GOA Pollock	-	80	-	Overall - reduction in TAC likely to influence bycatch	bairdi tanner crab - decrease	positive	no recorded change	-0.21	4	>0.1	2005-2011
GOA Pollock	-	80	-	Overall - reduction in TAC likely to influence bycatch	non-chinook salmon	no recorded change	no recorded change	-0.11	4	>0.1	2005-2012
Hastings fleet Dover sole	80	75	-6.25%		Increasing discarding of cod	negative	(reporting inadequate and more detailed monitoring required)				2005-2009
Hastings fleet pelagic	75	80	6.67%	There are indications that catch of non-target species is low, but no direct information is available for the fishery	no recorded change	no recorded change	regular recording of bycatch has been undertaken, so uncertainty is being reduced				2005-2008
Lake Hjälmaren pikeperch fishtrap	95	-	5.26%	There are no indications that any of the non-target species that are landed are fished at unsustainable levels	no recorded change	no recorded change	no recorded change				2006-2009
Lake Hjalmeren pikeperch gillnet	95		5.26%	As above	no recorded change	no recorded change	no recorded change				2006-2009
Loch Torridon Nephrops	85	90	5.88%	Low discard rate due to selective nature of the creels.	no recorded change	no recorded change	decreasing based on impact studies				2002-2010

Fishery	Initial PI score	Final PI score	Change in PI scores	Indicator data status	Indicator data trend	Summary indicator trend	trend in uncertainty	r	n	p	Certification period (at the time of writing)
Norway North Sea Saithe gillnet	75	-	0.00%	Discarding is illegal but there are no quantitative data on this	no recorded change	no recorded change	new regulations regarding quantifying bycatch implemented in 2009				2008-2010
Norway North Sea Saithe purse seine	75	-	0.00%	As above	no recorded change	no recorded change					2008-2010
Norway North Sea Saithe trawl and demersal seine	75	-	0.00%	As above	no recorded change	no recorded change					2008-2010
Oregon pink shrimp	80	-	0.00%	No recorded change	bycatch reduced by 97%	positive	no recorded change				2007-2010
Patagonian scallop	90	-	0.00%	No recorded change	non-capture mortality is minimal <10%	no recorded change	no recorded change				2006-2009
PFTA North Sea herring	70	85	21.43%	Discarding is low	Discarding is low	no recorded change	no recorded change				2005-2010
SA hake trawl	80	80	-6.25%	Bycatch is high and led to overfishing.	West coast stocks have recovered, whereas south coast stocks have not	no recorded change	no recorded change				2004-2010
SG Patagonian toothfish longline	80	90	12.50%	There is negligible intentional discard of the target species	no recorded change	no recorded change	no recorded change - impact is low				2002-2009
SPSG North sea herring	80	-	0.00%	Non-target fish catch is low, discarding is illegal but slippage may occur	no recorded change	no recorded change	uncertainty in amount of slippage is medium, but no recorded change in uncertainty				2008-2010
SW handline mackerel	90	90	0.00%	Extremely low levels on non-target species caught	no recorded change	no recorded change	no recorded change - no records kept, but extremely rare so not required				2001-2009

Fishery	Initial PI score	Final PI score	Change in PI scores	Indicator data status	Indicator data trend	Summary indicator trend	trend in uncertainty	r	n	p	Certification period (at the time of writing)
US N. Pacific halibut	70	-	0.00%	Quantities not recorded	unknown	unknown	uncertainty is high. Information is being gathered, but has not progressed enough for closure of the condition				2006-2010
US N. Pacific sablefish	80	-	0.00%	Bycatch of grenadier of concern to stock status; catch of seabirds is 17% of total catch	bycatch of grenadiers is of concern, but has reduced from 83% of total bycatch to 31%; bird bycatch is decreasing and anticipated to decrease more with new mitigations measures implemented	positive	no recorded change				2006-2010
WA rock lobster	80	-	0.00%	Impact on sealions was accorded a medium risk in the ERA	SLEDS have been implemented so impacts should have been reduced	positive	no recorded change				2000-2010
New Zealand Hoki	75	75	0.00%	Bycatch is generally <5% and bycatch stocks are above acceptable biomass limits	no recorded change	no recorded change	no recorded change				2001-2009
Lakes and Coorong	75	-	0.00%	Initially no available data on bycatch risks	no recorded change	no recorded change	reduced as data now exist				2008-2010

Table B3. Changes in ETP species scores, indicator data and level of uncertainty over the certification period

"-" indicates that the fishery has not been re-scored at the time of writing and we assume that the score remains the same

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	Summary indicator trend	trend in uncertainty	r	n	p	Certification period (used in this study)
AF North Sea herring	100	-	0.00%	Interactions are rare	no recorded change	no recorded change	no recorded change				2008-2010
American albacore (NP)	95	-	0.00%	No significant impacts identified	no recorded change	no recorded change	no recorded change				2007-2009
American albacore (SP)	95	-	0.00%	No significant impacts identified	no recorded change	no recorded change	no recorded change				2007-2009
Australian mackerel icefish	80		0.00%	Few reported bird or mammal interactions	no recorded change	no recorded change	no recorded change				2006-2010
BSAI Pollock	79	75	-5.06%	Impacts not fully quantified, but reduction in TAC has taken place	Chinook salmon	positive	no recorded change	-0.62	5	<0.1	2005-2010
				Impacts not fully quantified, but reduction in TAC has taken place	Steller sea lion	positive	no recorded change	-0.91	5	<0.05	2005-2010
Burry inlet cockles	95	95	0.00%	Ongoing debate as to the impact of the cockle shell fishery on the declining populations of the oystercatcher	unknown	unknown	Decreasing				2000-2010
Canadian Northern prawn trawl	90	-	0.00%	No assessment of whether level of bycatch of Atlantic cod and winter skate is acceptable	unknown	unknown	no recorded change				2008-2010

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	Summary indicator trend	trend in uncertainty	r	n	p	Certification period (used in this study)
GOA Pollock	79	85	7.59%	No recorded change, but reduction in TAC likely to reduce impacts	chinook salmon	positive	decreased as condition was closed in 2007 when impacts were considered to have been monitored adequately and a solution implemented. However new condition requiring more information was raised	-0.39	4	>0.1	2005-2010
Hastings fleet Dover sole	75	80	6.67%	Fishery considered a low threat except there were concerns about lack of information on shad	no recorded change	no recorded change	reduced - interactions with shad estimated and considered not to be a threat				2005-2009
Hastings fleet pelagic	90	-	0.00%	Very low rates of interactions indicate the fishery does not pose a threat to ETP species	no recorded change	no recorded change	no recorded change				2005-2008
Lake Hjälmaren pikeperch fishtrap	80	-	0.00%	ETP species are caught very seldomly and are usually released alive	no recorded change	no recorded change	no recorded change				2006-2009
Lake Hjälmaren pikeperch gillnet	80		0.00%	As above	no recorded change	no recorded change	no recorded change				2006-2009
Loch Torridon Nephrops	95	90	-5.26%	Impacts are minimal and not significant	no recorded change	no recorded change	reduced				2002-2010
Norway North Sea Saithe gillnet	75	-	0.00%	Impacts have not been quantified on species of potential concern (elasmobranchs)	unknown	unknown	no recorded change				2008-2010

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	Summary indicator trend	trend in uncertainty	r	n	p	Certification period (used in this study)
Norway North Sea Saithe purse seine	85		0.00%	As above	unknown	unknown	unknown				2008-2010
Norway North Sea Saithe trawl and demersal seine	75		0.00%	As above	unknown	unknown	unknown				2008-2010
Oregon pink shrimp	90	-	0.00%	Combination of mandatory monitoring and excluders has minimised interactions between the fishery and ETP species	no recorded change	positive	decreased with reporting required				2007-2010
Patagonian scallop	95	-	0.00%	No reptiles, birds or mammals have been caught in the fishery and very few fish have been captured	no recorded change	no recorded change	no recorded change				2006-2009
PFTA North Sea herring	85	-	0.00%	Low interaction with ETP species	low interaction with ETP species	no recorded change	no recorded change				2005-2010
SA hake trawl	90	80	-11.11%	Seal mortality is low; low threats to birds	catch rates of albatross have declined by >80% in both summer and winter discard periods (majority black browed), however total bird catch rates have decreased by 67% in the summer but increased by 10% in the winter discard	positive	prior to certification, the number of birds killed by the trawl fishery was unknown				2004-2010

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	Summary indicator trend	trend in uncertainty	r	n	p	Certification period (used in this study)
					period. Measures have been implemented to reduce this further						
SG patagonian toothfish longline	75	95	26.67%	Mortalities of threatened species associated with the licensed fishery are negligible	reduction in seabird mortality	positive	no recorded change				2002-2009
SPSG North sea herring	100	-	0.00%	Interactions between fishery and ETP species is very low	no recorded change	no recorded change	no recorded change				2008-2010
SW handline mackerel	90	90	0.00%	No significant impacts identified	no recorded change	no recorded change	no recorded change				2001-2009
US N.Pacific halibut	75	-	0.00%	Currently low	overall groundfish fisheries - reduction of 83% in albatross bycatch	positive	no recorded change				2006-2010
US N.Pacific sablefish	85	-	0.00%	Interaction level estimated to be low enough for the population to recover	levels of short-tailed albatross are recovering without need for reduction in fishery interactions	no recorded change	no recorded change				2006-2010
WA rock lobster	PASS	75	-6.25%	Risk to sealions considered to be low, however there has been no independent verification so condition remains open	reduced with implementation of SLEDS	positive	no independent verification on marine mammal interactions in 08-09 so condition remains open				2000-2010
New Zealand Hoki	pass	85	0.00%	Catches of ETP Seabird species are occasional	catches of ETP seabird species are declining	positive	decreasing uncertainty	-0.59	8	>0.1	2001-2009
				Catches of fur seals are occasional	catches of fur seals species are declining	positive	decreasing uncertainty	0.20	8	>0.1	2001-2009

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	Summary indicator trend	trend in uncertainty	r	n	p	Certification period (used in this study)
				Catches of ETP fish species are occasional	catches of ETP fish species are declining	positive	no recorded change - high level of certainty				2001-2009
Lakes and Coorong	80	-		Impacts low	no recorded changes	no recorded change	no recorded changes				2008-2010

Table B4. Changes in habitat scores, indicator data and level of uncertainty over the certification period
"-" indicates that the fishery has not been re-scored at the time of writing and we assume that the score remains the same

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	summary indicator trend	trend in uncertainty	Certification period (used in this study)
AF North Sea herring	95	95	0.00%	Pelagic fishery reported to have no interaction with seabed	no recorded change	no recorded change	no recorded change	2008-2010
American albacore (NP)	90	90	0.00%	No contact with the seabed and no known physical impacts due to fishing gears	no recorded change	no recorded change	no recorded change	2007-2009
American albacore (SP)	95	95	0.00%	Pelagic fishery assumed to have no impacts, so accordingly no studies have been undertaken or are considered appropriate	no recorded change	no recorded change	no recorded change	2007-2009
Australian mackerel icefish	80	-	-	Relatively small proportion of the HIMI EEZ is fished and in fished areas benthic bycatch rates are low. Preliminary assessment work indicates sufficient unfished areas in each physiological classification of invertebrate assemblages and trawl gear is designed to minimise impacts	no recorded change	no recorded change	no recorded change	2006-2010
BSAI Pollock	79	85	7.59%	Pelagic gear not considered to be causing irreversible damage to the habitat structure and function,	positive	no recorded change	uncertainty decreased with the information gained	2005-2010

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	summary indicator trend	trend in uncertainty	Certification period (used in this study)
				possibility of gear loss, but reduced TAC likely to reduce impacts			on impact of gear loss on sealions and birds	
Burry inlet cockles	80	90	12.50%	Data from other areas suggests the impacts of hand raking on habitat are low	no recorded change	no recorded change	no recorded change	2000-2010
Canadian Northern prawn trawl	65	65	0.00%	Effort is concentrated so impacts are thought to be low, however there is little evidence which demonstrates this	no recorded change	no recorded change	ongoing work to assess impacts	2008-2010
GOA Pollock	79	90	13.92%	Impacts are considered acceptable	reduction in TAC assumed to reduce impact on habitat	positive	reduced - impact considered to have been determined by 2006	2005-2010
Hastings fleet Dover sole	90	90	0.00%	Pelagic gear does not impact with habitat and gear loss is unusual	no recorded change	no recorded change	no recorded change	2005-2009
Hastings fleet pelagic	95	95	0.00%	Pelagic gear are considered to have negligible impacts	no recorded change	no recorded change	no recorded change	2005-2008
Lake Hjälmaren pikeperch fishtrap	95	95	0.00%	The sensitivity of habitats to fishing operations is considered to be very low and not significant	no recorded change	no recorded change	no recorded change	2006-2009
Lake Hjälmaren pikeperch gillnet	95	95	0.00%	As above	no recorded change	no recorded change	no recorded change	2006-2009
Loch Torridon Nephrops	90	90	0.00%	Impacts insignificant	no recorded change	no recorded change	no recorded change	2002-2010
Norway North Sea Saithe gillnet	80	80	0.00%	Trawling impacts are restricted to certain areas of the sea bed and other gear types do not affect the habitat	no recorded change	no recorded change	no recorded change	2008-2010
Norway North Sea Saithe purse seine	90	90	0.00%	As above	no recorded change	no recorded change	no recorded change	2008-2009

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	summary indicator trend	trend in uncertainty	Certification period (used in this study)
Norway North Sea Saithe trawl and demersal seine	80	80	0.00%	As above	no recorded change	no recorded change	no recorded change	2008-2009
Oregon pink shrimp	80	80	0.00%	Habitats within the shrimp grounds have only shown small adverse effects resulting from fishing	no recorded change	no recorded change	no recorded change	2007-2010
Patagonian scallop	80	80	0.00%	Very low impact. Discarded shells beneficial for biodiversity	no recorded change	no recorded change	no recorded change	2006-2009
PFTA North Sea herring	90	90	0.00%	Pelagic fishery assumed to have no impacts, so accordingly no studies have been undertaken or are considered appropriate	no recorded change	no recorded change	no recorded change	2005-2010
SA hake trawl	60	75	25.00%	Unacceptable impacts have been identified so management measures are in place in light of these	increased area protected so habitat impacts assumed to have reduced	positive	no recorded change	2004-2010
SG Patagonian toothfish longline	75	85	13.33%	Impacts of longlines assumed to be small	Reduction in effort and implementation of exclusion zones assumed to have had positive impact	positive	no recorded change	2002-2009
SPSG North sea herring	90	90	0.00%	Impacts are low	no recorded change	no recorded change	uncertainty is low - no recorded change	2008-2010
SW handline mackerel	90	90	0.00%	Pelagic fishery assumed to have no impacts, so accordingly no studies have been undertaken or are considered appropriate	no recorded change	no recorded change	no recorded change	2001-2009
US N.Pacific halibut	80	80	0.00%	Assumed to be low	Effort has reduced, so it is assumed that impacts have also reduced	positive	no recorded change	2006-2010

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	summary indicator trend	trend in uncertainty	Certification period (used in this study)
US N.Pacific sablefish	80	80	0.00%	Assumed to be low	no recorded change	no recorded change	no recorded change	2006-2010
WA rock lobster	80	80	0.00%	Assumed to be low as traps are likely to have limited impact on habitats.	no recorded change	no recorded change	no recorded change - impacts have not been estimated	2000-2010
New Zealand Hoki	75	75		Unknown - more information needed	Number of bottom trawls has decreased significantly and exclusion zones in place	positive	no recorded change - still uncertain	2001-2009
Lakes and Coorong	85	85		Pelagic gears except for hand rakes which are not considered to cause major habitat damage	no recorded change	no recorded change	no recorded change	2008-2010

Table B5. Changes in ecosystem scores, indicator data and level of uncertainty over the certification period
"-" indicates that the fishery has not been re-scored at the time of writing and we assume that the score remains the same.

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	summary indicator trend	trend in uncertainty	Certification period (used in this study)
AF North Sea herring	85	-	0.00%	The fishery is thought to have limited impact on the ecosystem.	no recorded change	no recorded change	no recorded change	2008-2010
American albacore (NP)	80	-	0.00%	The fishery has minimal, if any, impact on the ecosystem	no recorded change	no recorded change	no recorded change	2007-2009
American albacore (SP)	80	-	0.00%	Ecosystem modelling suggests no predictable unacceptable impacts of the fishery	no recorded change	no recorded change	no recorded change	2007-2009
Australian mackerel icefish	75	80	6.67%	Low impact	no recorded change	no recorded change	reduced due to ongoing observer and research programmes and ERA	2006-2010
BSAI Pollock	79	90	13.92%	Low impact	Reduction in TAC reduces impacts	positive	research result provided evidence of no significant impacts	2005-2010
Burry inlet cockles	80	90	12.5%	The effects of hand-gathering on non-target benthic species and ecosystem structure are minor and recovery is rapid	no recorded change	no recorded change	reducing due to ongoing modelling work of cockle/mussel/oyster catcher/fishery interactions	2000-2010
Canadian Northern prawn trawl	75	-	0.00%	Acceptability of current impacts of fishery on biological diversity, community structure and productivity are unknown	unknown	unknown	ongoing work	2008-2010
GOA Pollock	79	90	13.92%	Research needed into impacts on SSL, but reduction in TAC likely to reduce impacts	Reduction in TAC reduces impacts	positive	continuing extensive effort to understand the effect of the pollock fishery on steller sea lion	2005-2010
Hastings fleet Dover sole	80	80	0.00%	No negative impacts	no recorded change	no recorded change	no recorded change	2005-2009
Hastings fleet pelagic	80	-	0.00%	No unacceptable impacts identified	no recorded change	no recorded change	no recorded change	2005-2008

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	summary indicator trend	trend in uncertainty	Certification period (used in this study)
Lake Hjälmaren pikeperch fishtrap	80	-	0.00%	Information available suggests no significant changes in ecosystem structure and function due to the fishery	no recorded change	no recorded change	no recorded change	2006-2009
Lake Hjälmaren pikeperch gillnet	80	-	0.00%	As above	no recorded change	no recorded change	no recorded change	2006-2009
Loch Torridon Nephrops	90	85	-5.56%	The fishery has not been identified as affecting biological diversity and productivity to unacceptable levels	no recorded change	no recorded change	reduced due to studies by Scottish Natural Heritage	2002-2010
Norway North Sea Saithe gillnet	75	75	0.00%	Lack of data on the removal of non-target species, but handline and seine nets are assumed to have low impacts	no recorded change	no recorded change	no recorded change	2008-2010
Norway North Sea Saithe purse seine	80	80	0.00%	As above	no recorded change	no recorded change	no recorded change	2008-2010
Norway North Sea Saithe trawl and demersal seine	75	75	0.00%	As above	no recorded change	no recorded change	no recorded change	2008-2010
Oregon pink shrimp	75	-	0.00%	The ocean shrimp fishery is thought to cause few direct impacts	no recorded change	no recorded change	no recorded change	2007-2010
Patagonian scallop	95	-	0.00%-	No appreciable impacts on the ecosystem	no recorded change	no recorded change	no recorded change	2006-2009
PFTA North Sea herring	90	-	0.00%	No unacceptable impacts have been determined	no recorded change	no recorded change	no recorded change	2005-2010
SA hake trawl	70	75	7.14%	Unacceptable impacts have been identified so management measures are in place in light of these	more closed areas assumed to have positive impact	positive	significant work has been undertaken in determining the ecosystem impacts of the trawl fishery in terms	2004-2010

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	summary indicator trend	trend in uncertainty	Certification period (used in this study)
							of bycatches, general trophic effects, benthic habitat effects and interactions with seabirds	
SG patagonian toothfish longline	75	80	6.67%	impacts are at an acceptable level	The issue of discarded hooks has now largely been eliminated	positive	reduction - ecosystem models have now been developed	2002-2009
SPSG North sea herring	80	-	0.00%	no evidence of ecosystem impacts	no recorded change	no recorded change	no recorded change	2008-2010
SW handline mackerel	80	85	6.25%	no evidence of significant ecosystem impacts	no recorded change	no recorded change	no recorded change	2001-2009
US N.Pacific halibut	75	75	0.00%	assumed to be low	no recorded change	no recorded change	no recorded change	2006-2010
US N.Pacific sablefish	80	80	0.00%	low impact	habitat loss/degradation assumed to have decreased due to to reduction in number of hooks deployed	positive	no recorded change	2006-2010
WA rock lobster	80	70	0.00%	assumed to be low as stocks are high, have broad dietary preferences and weak interactions with predators	no recorded change	no recorded change	no substantive evidence has been presented for assessment about the impacts of the fishery	2000-2010
New Zealand Hoki	75	75	0.00%	unknown	unknown	unknown	no quantitative assessments on the extent of the impact	2001-2009
Lakes and Coorong	75	-	-	lack of evidence of impacts	unknown	unknown	no recorded change	2008-2010
Fishery	**Initial PI score**	**Final PI score**	**% change in PI scores**	**Indicator data status**	**Indicator data trend**	**summary indicator trend**	**trend in uncertainty**	**Certification period (used in this study)**
AF North Sea herring	85	-	0.00%	The fishery is thought to have limited impact on the ecosystem.	no recorded change	no recorded change	no recorded change	2008-2010

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	summary indicator trend	trend in uncertainty	Certification period (used in this study)
American albacore (NP)	80	-	0.00%	The fishery has minimal, if any, impact on the ecosystem	no recorded change	no recorded change	no recorded change	2007-2009
American albacore (SP)	80	-	0.00%	Ecosystem modelling suggests no predictable unacceptable impacts of the fishery	no recorded change	no recorded change	no recorded change	2007-2009
Australian mackerel icefish	75	80	6.67%	Low impact	no recorded change	no recorded change	reduced due to ongoing observer and research programmes and ERA	2006-2010
BSAI Pollock	79	90	13.92%	Low impact	Reduction in TAC reduces impacts	positive	research result provided evidence of no significant impacts	2005-2010
Burry inlet cockles	80	90	12.5%	The effects of hand-gathering on non-target benthic species and ecosystem structure are minor and recovery is rapid	no recorded change	no recorded change	reducing due to ongoing modelling work of cockle/mussel/oyster catcher/fishery interactions	2000-2010
Canadian Northern prawn trawl	75	-	0.00%	Acceptability of current impacts of fishery on biological diversity, community structure and productivity are unknown	unknown	unknown	ongoing work	2008-2010
GOA Pollock	79	90	13.92%	Research needed into impacts on SSL, but reduction in TAC likely to reduce impacts	Reduction in TAC reduces impacts	positive	continuing extensive effort to understand the effect of the pollock fishery on steller sea lion	2005-2010
Hastings fleet Dover sole	80	80	0.00%	No negative impacts	no recorded change	no recorded change	no recorded change	2005-2009
Hastings fleet pelagic	80	-	0.00%	No unacceptable impacts identified	no recorded change	no recorded change	no recorded change	2005-2008
Lake Hjälmaren pikeperch fishtrap	80	-	0.00%	Information available suggests no significant changes in ecosystem structure and function due to the fishery	no recorded change	no recorded change	no recorded change	2006-2009

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	summary indicator trend	trend in uncertainty	Certification period (used in this study)
Lake Hjälmaren pikeperch gillnet	80	-	0.00%	As above	no recorded change	no recorded change	no recorded change	2006-2009
Loch Torridon Nephrops	90	85	-5.56%	The fishery has not been identified as affecting biological diversity and productivity to unacceptable levels	no recorded change	no recorded change	reduced due to studies by Scottish Natural Heritage	2002-2010
Norway North Sea Saithe gillnet	75	75	0.00%	Lack of data on the removal of non-target species, but handline and seine nets are assumed to have low impacts	no recorded change	no recorded change	no recorded change	2008-2010
Norway North Sea Saithe purse seine	80	80	0.00%	As above	no recorded change	no recorded change	no recorded change	2008-2010
Norway North Sea Saithe trawl and demersal seine	75	75	0.00%	As above	no recorded change	no recorded change	no recorded change	2008-2010
Oregon pink shrimp	75	80	6.67%	The ocean shrimp fishery is thought to cause few direct impacts	no recorded change	no recorded change	no recorded change	2007-2010
Patagonian scallop	95	-	0.00%-	No appreciable impacts on the ecosystem	no recorded change	no recorded change	no recorded change	2006-2009
PFTA North Sea herring	90	-	0.00%	No unacceptable impacts have been determined	no recorded change	no recorded change	no recorded change	2005-2010
SA hake trawl	70	75	7.14%	Unacceptable impacts have been identified so management measures are in place in light of these	more closed areas assumed to have positive impact	positive	significant work has been undertaken in determining the ecosystem impacts of the trawl fishery in terms of bycatches, general trophic effects, benthic habitat effects and interactions with seabirds	2004-2010

Fishery	Initial PI score	Final PI score	% change in PI scores	Indicator data status	Indicator data trend	summary indicator trend	trend in uncertainty	Certification period (used in this study)
SG patagonian toothfish longline	75	80	6.67%	impacts are at an acceptable level	The issue of discarded hooks has now largely been eliminated	positive	reduction - ecosystem models have now been developed	2002-2009
SPSG North sea herring	80	-	0.00%	no evidence of ecosystem impacts	no recorded change	no recorded change	no recorded change	2008-2010
SW handline mackerel	80	85	6.25%	no evidence of significant ecosystem impacts	no recorded change	no recorded change	no recorded change	2001-2009
US N.Pacific halibut	75	75	0.00%	assumed to be low	no recorded change	no recorded change	no recorded change	2006-2010
US N.Pacific sablefish	80	80	0.00%	low impact	habitat loss/degradation assumed to have decreased due to to reduction in number of hooks deployed	positive	no recorded change	2006-2010
WA rock lobster	80	70	0.00%	assumed to be low as stocks are high, have broad dietary preferences and weak interactions with predators	no recorded change	no recorded change	no substantive evidence has been presented for assessment about the impacts of the fishery	2000-2010
New Zealand Hoki	75	75	0.00%	unknown	unknown	unknown	no quantitative assessments on the extent of the impact	2001-2009
Lakes and Coorong	75	-	-	lack of evidence of impacts	unknown	unknown	no recorded change	2008-2010

ANNEX C: STAKEHOLDER CONSULTATION QUESTIONNAIRE

	Completed by:		[INSERT]		KEY:	1 = Check/Yes			
	Date:		[INSERT]			0 = Nil/No/Not applicable			
	Organisation and person interviewed:		[INSERT]						
1	**Which stakeholder category?**								
	a) Environment		e.g. NGO; client; charity/trust.						
	b) Independent		e.g. CB; independent scientist.						
	c) Fishery related		e.g. Management, industry, client						
2	**Since the certification date, have changes taken place in the fishery (stock/environmental)? Please tick as many boxes that apply below…**								
		Stock status	**Reference points**	**Stock rebuilding**	**Retained species**	**Bycatch species**	**ETP species**	**Habitats**	**Ecosystem**
	Improved?								
	Situation deteriorated?								
	No change								
3	**Have any other changes taken place? If so, please describe these…**								
	Yes		(1) Description:		(2) Description:		(3) Description:		
	No								
4	**What or who would you attribute the changes to? Please tick as many boxes that apply below…**								
		Stock status	**Reference points**	**Stock rebuilding**	**Retained species**	**Bycatch species**	**ETP species**	**Habitats**	**Ecosystem**
MSC	Change in legislation								

	Change in code of practice								
	Establishment of a protected area								
	Change in fishing practices/effort levels								
	New research conducted								
	New data or information gathered and evaluated leading to new understanding								
	Change in management approach								
		Stock status	**Reference points**	**Stock rebuilding**	**Retained species**	**Bycatch species**	**ETP species**	**Habitats**	**Ecosystem**
As a result of other stakeholder influence:	Change in legislation								
	Change in code of practice								
	Establishment of a protected area								
	Change in fishing practices/effort levels								
	New research conducted								
	New data or information gathered and evaluated leading to new understanding								
	Change in management approach								
Other:	Pollution events								
	Environmental factors e.g. Climatic factors								

	Other, please specify									

5	When were these changes occurring?									
		Stock status	Reference points	Stock rebuilding	Retained species	Bycatch species	ETP species	Habitats	Ecosystem	Other
	a) before MSC involvement began									
	b) during pre-assessment									
	c) during the assessment									
	d) After certification									

6	If there has been no environmental change occurring in the fishery since certification, is this because...			
	a) stocks were at sustainable level			
	b) no negative ecosystem impacts			
	c) fishery already managed sustainably			
	d) other		Description:	

7	What level of influence has the MSC certification had on the fishery?									
		Stock status	Reference points	Stock rebuilding	Retained species	Bycatch species	ETP species	Habitats (please define)	Ecosystem	Other change (identified in question 11)
	No influence									
	Low									
	Moderate									
	Highly influential									

	If there were no conditions raised against the PIs (in this study) skip questions 8 and 9								
8	If a condition was closed out did this result in a positive improvement?								
		Stock status	Reference points	Stock rebuilding	Retained species	Bycatch species	ETP species	Habitats	Ecosystem
	Yes								

	No								

9	If 'no' to question 8, why was there no improvement once the condition was closed?								
		Stock status	Reference points	Stock rebuilding	Retained species	Bycatch species	ETP species	Habitats	Ecosystem
	a) change occurring in spite of condition								
	b) condition goalposts changed								
	c) other?....								

10	In your opinion, was the MSC the main driver of the improvement?								
		Stock status	Reference points	Stock rebuilding	Retained species	Bycatch species	ETP species	Habitats	Ecosystem
	a) Yes								
	b) It was occurring already								
	c) another institution driving the change (please specify using comments box)								

11	What do you think are the wider environmental effects that the MSC programme has contributed to in this fishery? Please list...					
	None					
	Yes there have been effects					
			Approx. date of effect:			Approx. date of effect:
	Description of impact 1:			Description of impact 4:		
	Description of impact 2:			Description of impact 5:		
	Description of impact 3:			Description of impact 6:		

12	**What effect has the MSC on your actions? (Open answer)**				
	Description:				
13	**What has the presence of the MSC meant to the change process? e.g. Has it been a barrier to change? Commercial incentive e.g. Price premium? Catalyst? Tool for enabling environmental sustainability?**				
	Initially		Please Describe:		
	Now		Please Describe:		
14	**What thoughts do you have about the influence the MSC programme has had on the adoption of better fisheries management practices in fisheries that are NOT currently engaged in the MSC programme?**				
	No influence				
	Influence (insert below)				
	Name/title (1)		Name/title (2)		Name/title (3)	
	Description of influence (1)		Description of influence (2)		Description of influence (3)	
15	**What management or other strategies have you applied that you think will LEAD to future impacts on the environmental sustainability of the fishery? E.g., codes of practice; bycatch solutions; management regulations at international level; etc.**				
	No strategy				
	Strategy				
	Description of strategy (1)		Description of strategy (2)		Description of strategy (3)	
	Description of impact of strategy (1)		Description of impact of strategy (2)		Description of impact of strategy (3)	

ANNEX D: STAKEHOLDER CONTACTS

#	Fisheries	Stakeholder		
		a) Environment (NGO; client; charity/trust)	b) Independent (CB; independent scientist)	c) Fishery related (Management, industry, client)
1	American Albacore Fishing Association Pacific (North)	Meredith Lopuch, WWF (declined); Victor Restrepa ISSF (interviewed)	Andrew Hough, Moody Marine (interviewed)	Natalie Webster, American Albacore Fishing Association (no response)
2	American Albacore Fishing Association Pacific (South Pacific)	Meredith Lopuch, WWF (declined); Victor Restrepa ISSF (interviewed)	Andrew Hough, Moody Marine (interviewed)	Natalie Webster, American Albacore Fishing Association (no response)
3	Astrid Fiske North Sea Herring Fishery (formerly the NS Herring Swedish Pelagic Fishery)	Inger Naslund, WWF Sweden (interviewed)		Werner Larsson, Astrid Fiske (no response) Max Cardinale, Swedish Board of Fisheries (interviewed)
4	Australian Mackerel Icefish	Peter Trott, WWF AU (interviewed)	Peter Neave, Sub-Antarctic Fisheries Assessment Group (interviewed)	David Carter - Austral Fisheries Pty Ltd (no response)
5	Bering Sea and Aleutian Islands (BS/AI) Pollock Fishery	Bruce Robson, WWF Fishery Consultant (interviewed)	Dr Chet Chaffee Fishery assessment (no response)	David Witherell, North Pacific Fisheries Management Council (interviewed)
7	Burry Inlet Cockles	T Jenkins, Countryside Council for Wales (no response)	Terry Holt, CMACS (no response); Andy Hough, Moody Marine (interviewed)	Phil Coates, South Wales Sea Fisheries Committee (interviewed)
8	Canadian Northern Prawn Trawl Fishery	Mark Butler EAC (no response)	Dave Orr, DFO (interviewed)	E. Derek Butler, Association of seafood producers (interviewed)
9	Gulf of Alaska Pollock		Paul Knapman, Moody Marine Limited (no response)	Edward J. Richardson, At-sea Processors Association (survey completed); Jim Gilmore, At-sea Processors Association (declined)
10	Hastings fleet Dover sole (trammel net)	David Fraser, Natural England (no response)	Richard Millner, Cefas (no response)	Paul Joy, Hastings Fishery Management Group (interviewed)
11	Hastings Fleet Pelagic Fishery	David Fraser, Natural England (no response)	Richard Millner, Cefas (no response)	Paul Joy, Hastings Fishery Management Group (interviewed)
12	Lake Hjälmaren pikeperch fish-trap and gill net	Inger Naslund, WWF (interviewed)	Andy Hough, Moody Marine (interviewed)	Per Nyberg, National Board of Fisheries (no response); Ulrika Beier, National Board of Fisheries (interviewed)
13	Lakes and Coorong Fisheries Southern Australia	Simon Oster, Dept. Environment and Natural Resources (no response)	Tim Ward and Greg Ferguson, South Australian Research and Development Institute (interviewed)	Neil McDonald CEO Lakes and Coorong Management Committee (no response)

#	Fisheries	Stakeholder		
		a) Environment (NGO; client; charity/trust)	b) Independent (CB; independent scientist)	c) Fishery related (Management, industry, client)
14	Loch Torridon nephrops creel fishery	David Donnan, Scottish National Heritage (interviewed)	Jim Atkinson, UMBS (no response)	Karen Starr, Shieldaig Export Company Limited (interviewed)
15	New Zealand hoki	Bob Zuur WWF NZ (interviewed)	Rosie Hirst and Suze Baird - NIWA (interviewed)	George Clement, Deepwater Group Ltd (no response)
16	Norway North Sea saithe	Nina Jensen, WWF Norway (interviewed)	Jan Ivar Marak, Norwegian Seafood Industry (no response); Ingolf Rottingen, Institute of Marine Research Norway (requested formal submission)	Sandhya Chaudhury, Det Norske Veritas (declined)
17	Oregon Pink Shrimp	Brad Pettinger, Oregon Trawl Commission (no response)	Bob Hannah, Oregon Department of Fish and Wildlife (interviewed)	Steve Jones, Oregon Department of Fish and Wildlife (interviewed)
18	Patagonian scallop	Ernesto Godelman, Cedepasca and SFP (interviewed)	Mario Lasta, National Institute of Fisheries Research and Development (no response)	JM (Lobo) Orensanz (declined)
19	Pelagic Freezer-Trawler Association North Sea herring	Christine Absil, The North Sea Foundation (interviewed)	Mark Dickey-Collas, IMARES (interviewed)	Anon (interviewed)
20	Scottish Pelagic Sustainability Group Ltd (SPSG) North Sea herring	Derek Duthie, SPSG Ltd (declined)	Tristan Southall (declined), Crick Carelton, Nautilus Consultants (interviewed)	Christine Absil, North Sea Foundation (no response)
21	South Africa hake trawl	Samantha Petersen, WWF (interviewed)	Doug Butterworth, MCM (interviewed)	Mr. Roy Bross, South African Deep-Sea Trawling Industry Association (interviewed)
22	South Georgia Patagonian toothfish longline	Harriet Hall, previous Director of Fisheries (declined); Dr Martin Collins, Director of Fisheries (interviewed)	Gerry Leape, Pew (no response)	
23	South-west handline mackerel	S Cadman, Cornwall Sea Fisheries Committee (interviewed)	B Roel, Cefas (no response)	D Muirhead, A Pascoe, N de Rozarieux, South West Handline Fishermen's Association (no response)
24	US North Pacific halibut	Bob Alverson Fishing Vessel Owners' Association (no response)	Steven Hare, IPHC (no response)	Bruce Leaman, International Pacific Halibut Commission (interviewed)
25	US North Pacific sablefish	Bob Alverson Fishing Vessel Owners' Association (no response)	Dana Hanselman, NMFS (interviewed)	David Witherell, North Pacific Fisheries Management Council (interviewed)
26	Western Australia rock lobster	Peter Trott, WWF (no response)	Adrienne Vincent, SCS (no response); Sabine Daume, SCS (interviewed)	Rhys Brown, Western Australia Department of Fisheries (interviewed)

#	Fisheries	Stakeholder		
		a) Environment (NGO; client; charity/trust)	b) Independent (CB; independent scientist)	c) Fishery related (Management, industry, client)
27	Aker biomarine Antarctic Krill		Graham Pilling, Cefas (interviewed)	Sigve Nordrum, Aker Biomarine (interviewed)
29	Atlantic deep sea red crab		Joseph DeAlteris, University of Rhode Island (interviewed)	Jon Williams, New England Red Crab Harvesters Association (no response)
30	Cornish sardine		Graham Pilling, Cefas (interviewed)	Stefan Glinski, Cornish Sardine Management Association (interviewed)
31	Denmark blue shell mussel		Per Dolmer, National institute of Aquatic Resources (interviewed)	Soren MattesenVislund Muslinge Industri (interviewed)
32	Euronor saithe		Jo Gascoigne, MEP (interviewed)	Bruno Leduc, Euronor (interviewed)
34	Oregon Dungeness Crab		Dr. Louis W. Botsford, Department of Wildlife, Fish, and Conservation Biology, University of California (no response)	Nick Furman, Oregon Dungeness Crab Commission (no response)
36	Portuguese sardine purse seine fishery		Ian Scott, Moody Marine (no response)	Mr Jorge, ANOPCERCO, the National Association of Purse Seine Producer Organisations (no response)
37	tosakatsuo suisan pole and line skipjack		Jo Akroyd, lead assessor (declined); Joseph Powers Coastal Fisheries Institute Marine Resource Assessment, Louisiana State University (no response)	Mr Hiroyuki Myojin, Tosakatsuo Suisan Co., Japan (no response)
39	Vietnam Ben Tre clam hand gathered		Erik Keus, Danida Provincial Adviser (interviewed)	Tran Thi Thu Nga, Ben Tre Peoples Committee Department of Fisheries (interviewed)

REPORT PART 2: FISHERY CASE STUDIES

Part 2 of the report includes the following case studies:

1. American Albacore Fishing Association Pacific (North)
2. American Albacore Fishing Association Pacific (South Pacific)
3. Astrid Fiske North Sea Herring Fishery (formerly the NS Herring Swedish Pelagic)
4. Australian Mackerel Icefish
5. Bering Sea and Aleutian Islands Pollock Fishery
6. Burry Inlet Cockles
7. Canadian Northern Prawn Trawl Fishery
8. Gulf of Alaska Pollock
9. Hastings fleet Dover sole (trammel net)
10. Hastings Fleet Pelagic Fishery herring & mackerel
11. Lake Hjälmaren pikeperch fish-trap and gillnet
12. Lakes and Coorong Fisheries Southern Australia
13. Loch Torridon nephrops creel fishery
14. New Zealand hoki
15. Norway North Sea saithe
16. Oregon Pink Shrimp
17. Patagonian scallop
18. Pelagic Freezer-Trawler Association North Sea herring
19. Scottish Pelagic Sustainability Group Ltd (SPSG) North Sea herring
20. South Africa hake trawl
21. South Georgia Patagonian toothfish longline
22. South-west handline mackerel
23. US North Pacific halibut
24. US North Pacific sablefish
25. Western Australia rock lobster
26. Aker Biomarine Antarctic Krill
27. Atlantic deep sea red crab
28. Canada sablefish
29. Cornish sardine
30. Denmark blue shell mussel
31. Dutch Fish Organisation Gillnet sole
32. Euronor saithe
33. Iturup Island pink and chum salmon
34. Oregon Dungeness Crab
35. Portugal sardine purse seine
36. Tosakatsuo suisan pole and line skipjack
37. Vietnam Ben Tre clam hand gathered