Harvest Strategy - Responsive

Consultancy Report

March 2018

Marine Stewardship Council

Table of Contents

Glossary of abbreviations and technical terms

The views and opinions expressed in parts of this report are those of the consultant engaged for this report MER Consultants LLC and do not necessarily reflect the official policy or position of the Marine Stewardship Council.

Marine Stewardship Council.

Executive summary

The primary objective of this work is to clarify confusion in the term 'responsive' and evaluate the relationship between, and potential discrepancies, in the scoring of PI 1.2.1 and PI 1.2.2. In general, we believe the issues arise from two aspects of the evaluation structure and scoring. First there is redundancy in the overall structure of the scoring scheme and specifically in the scoring of the 'harvest strategy' PI and how this relates to the other elements/PIs (HCR, Assessment, and Monitoring). The second aspect which has created confusion is a lack of specificity in the term 'responsive' used in PI 1.2.1 and how it relates to similar terms in 1.2.2. In 1.2.2 the phrase "exploitation rate is reduced as the PRI is approached…" is clearly stating the need for a responsive approach but the specified response is in the 'exploitation rate' rather than the management measure (catch limit). We believe the confusion arises because there are various types of responsiveness and depending on one's interpretation discrepancies in scoring may result. For example, there can be situations where the regulations or HCR outputs are static yet the exploitation rate or allowed catch is responsive. Similarly, a constant effort policy implies constant exploitation rate yet the catches will fluctuate with stock size and is thus responsive. Decisions need to be made as to which kinds of responsive systems are acceptable and the scoring criteria may need to be revised to allow for different types of responsiveness.

To illustrate this point further, consider a static harvest strategy which has minimum sizes which are well above size at maturity or closed areas which protect 50% of the stock. As effort increases, the HCR is not responsive (i.e. regulations for minimum size; and size of closed areas, remain the same) but as exploitable stock is fished down the exploitation rate will be responsive and decrease. In the extreme, when everything outside the reserve has been fished out, the exploitation rate is the fraction of the population in the reserve that spills out into the open area.

A constant effort approach, is slightly different but if adequately evaluated and implemented, can also satisfy the need for a responsive HCR, albeit counter-intuitive to some. Constant effort implies constant exploitation rate which means catch will fluctuate with (be responsive to) stock size, but the exploitation rate won't respond to changes in stock size. So, this is weaker responsiveness than when exploitation rate varies with stock size. This, in our opinion, can be safe or precautionary and acceptable if the stock starts at a fairly high level, and is monitored, but could be imprudent if stock is at a low level. Thus, a requirement of this type of approach is an analysis or evaluation of the fishery which shows that it is highly likely that the stock is above the PRI (high probability of B>>Bmsy even though the fishery may not be achieving optimum yield or MSY).

As such, the intent of ensuring that B >Bmsy can be satisfied with management approaches that some people would consider non-responsive. An agreement on MSC intent and clarification of terminology is necessary.

In our discussion we propose some alternative wording and suggestions for addressing the issues surrounding redundancy in scoring and the meaning of the word 'responsive'. Ultimately however, the intent/desire of MSC and some agreement among experts on our interpretation of the issues needs to be evaluated before a final decision can be made. As such, we provide a detailed discussion of 'responsiveness' as our rationale and provide recommendations, alternative options, and a questionnaire for others to review our logic.

Background

Our consultancy was given the following background information on the origins of the issue at hand (taken directly from TOR's): *Led by a client from the Western and Central Pacific, the MSC has been receiving questions about how fisheries reach the scoring guidepost (SG) 80 level of scoring issue (si) a, within the Harvest Strategy Performance Indicator (PI) 1.2.1. To meet SG80 (an unconditional pass) the harvest strategy must be 'responsive to the state of the stock'.*

The SG80 language for PI 1.2.1. si (a) within the Fisheries Certification Requirements (FCR) v2.0 is: 'The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving stock management objectives reflected in PI 1.1.1 SG80.'

However, there is a lack of guidance in the standard about what 'responsive' means, with many assessments attributing responsiveness to relate to harvest control rules (HCRs). However, HCRs are scored separately to the harvest strategy in PI 1.2.2. Given the perceived lack of clarity in the standard, disagreement among teams and potential for 'double jeopardy' between PI 1.2.1. (HS) and PI 1.2.2. (HCRs), this problem was recently put toward the MSC Technical Advisory Board (TAB). Based off an analysis conducted by MSC and an outline of the problem within certified fishery assessments, the TAB has agreed that further work is required to address issues within the scoring of regarding PI 1.2.1 si (a).

Scope of work - Objectives

As written in the Terms of Reference: *The scope of work required to be completed by the consultant is to develop a report that will identify the issues relating to PI 1.2.1. In particular, the report will focus on the scoring of 'responsiveness' of harvest strategies (HS), what level of information is required to achieve a score of SG80 for PI 1.2.1. si (a) and provide recommendations to change/mitigate issues if they are identified.*

The SG80 language for PI 1.2.1. si (a) within the Fisheries Certification Requirements (FCR) v2.0 is:

'The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving stock management objectives reflected in PI 1.1.1 SG80.'

At present, there is a lack of guidance around what the nature of 'responsive' means in the context of meeting SG80, particularly with the relationship between scoring harvest control rules (HCRs) in PI 1.2.2.

This consultancy will focus on answering

3.1 Three Key Questions

1 Is a score of 80 for PI 1.2.2. (a 'well-defined' HCR) required for PI 1.2.1. si (a) to meet SG80 for 'responsive'?
2 If not, how can you demonstrate HS responsiveness without 'well-defined' HCRs (si a PI 1.2.2) or appropriate and effective tools (si c PI 1.2.2) to implement the HCR?
3 Can you demonstrate responsiveness/do you need to, if stock status has never required management intervention (e.g. B has always been >> Bmsy)?

3.1 Secondary Questions

1 How formalized do management measures/tools alternative to an HCR need to be in order to be considered 'responsive'?

2 Do such tools need to have the equivalent of management triggers?

3 Do the outcomes ensuing from triggers need to be pre-defined?

Discussion of terminology and concepts

4.1 Harvest Strategy Confusion and Redundancy

The term "harvest strategy" appears in multiple contexts (see Table SA4: PI 1.2.1): as a component (column 1), a PI (column 2) and as scoring issues (column 3). We found this confusing and believe the latter two uses of the term contribute to the problem that is the subject of this review. "Harvest strategy" as a PI refers to an overarching management framework consisting of the harvest strategy component which is then comprised by scoring components of harvest strategy design, harvest strategy monitoring, harvest strategy evaluation, and harvest strategy review. "Harvest strategy" as scoring issues are the components of the overarching harvest strategy framework. In "MSC Fisheries Certification Requirements and Guidance, ver. 20., October 2014" a harvest strategy is defined as:

> *"The combination of monitoring, stock assessment, harvest control rules and management actions, which may include an MP or an MP (implicit) and be tested by MSE."*

Hence questions arise as to whether the overarching strategy can be acceptable if one of the scoring issue components is not and, alternatively, if the overarching strategy can be unacceptable if all of the scoring issues are acceptable. In essence, there is a double counting because the scoring criterion of responsiveness is explicit in two of the four components that define the overarching strategy framework. We should also point out that a lack of clarity could also result in interpretation issues between reviewers. Consider the following table (from "MSC Fisheries Certification Requirements and Guidance, ver. 20., October 2014"):

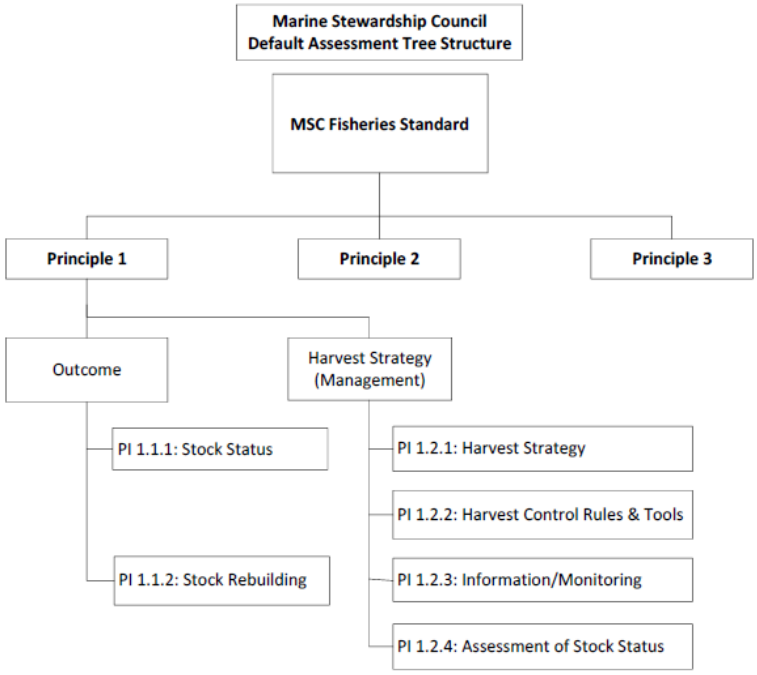
Table SA4: PI 1.2.1 Harvest strategy PISGs

Component	PI	Scoring issues	SG60	SG80	SG100
Harvest strategy (management)	Harvest strategy **1.2.1** There is a robust and precaution ary harvest strategy in place.	(a) Harvest strategy design ‼	The harvest strategy is **expected** to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy **work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80.

The SG80 scoring for 1.2.1 states that "the elements of the harvest strategy work together…" but there is no explicit reference to the PI or the Component which are both called "harvest strategy". The harvest strategy PI has elements of design, evaluation, monitoring and review, while the harvest strategy Component has elements of harvest strategy, harvest control rules, information/monitoring, and assessment of stock status. Since responsive in also included in the SG80 criterion we assume that the elements being referred to are those of the Component PI. We provide the figure below to illustrate how this results in a lack of independence in scoring of 1.2.1 – 1.2.4.

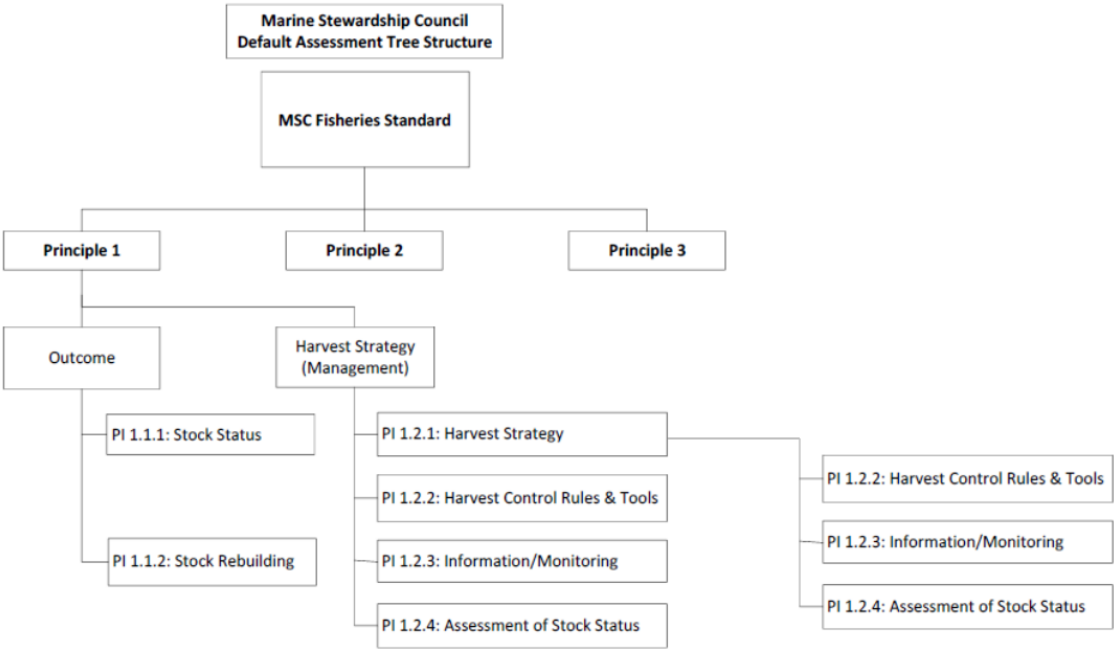
Default Tree Structure for Principle 1 as intended:

Figure SA1: Principle 1 Default Tree Structure



Tree Structure for Principle 1 in practice:

Figure SA1: Principle 1 Default Tree Structure



Harvest Strategies and Responsiveness

Depending on the context, harvest strategies can be described and categorized in many ways. The terms closed-loop, input control, output control, fixed exploitation rate, and constant escapement, are just a few examples of the range of terminology used to describe harvest strategies. Depending on the context, the

language used may focus on different aspects of the system. For example, a discussion on governance may focus on ability to monitor or manage stocks (input vs. output controls), while a discussion on developing HCRs may focus on terms like closed loop harvest strategies which focus on the link between assessment and HCRs. Regardless of the terminology used, to be precautionary one aspect or another of the harvest strategy must take the stock status into consideration and 'respond' if management intervention is necessary. Thus, given our task, we try to avoid using jargon and to highlight the concepts which are relevant to 'responsiveness' in the context of 'harvest strategies.'

Harvest Strategies and Responsiveness

For a harvest strategy to be directly responsive to stock status, the management actions (e.g., allowable catch, allowable effort, length of open season, size of the area open to fishing) must be tied to changes in stock abundance. Stock abundance can be in absolute terms but is usually in relative terms, i.e., an index of abundance such as derived from commercial catch rates or survey catches.

Strategies that are responsive to stock status can further be divided into those that are tied to biological reference points (B_{msy} or a proxy for B_{msy}; which we call Type I responsiveness) and those that are tied to an arbitrary reference point or to no reference point (Type II direct responsiveness). The first requires an estimate of B/B_{msy} (or $B/B_{msyproxy}$). An example of the second would be determining estimates of biomass relative to a reference year, e.g., B/B_{2010}).

Responsiveness is a desirable quality of a harvest strategy. However, MSC should think carefully about whether it wants to insist that all harvest strategies need to be directly responsive. The reason is simply that restricting consideration to directly responsive harvest strategies may be too restrictive, eliminating status quo management for example. This is recognized by MSC in its charge to the consultants when it asks about cases where "stock status has never required management intervention (e.g. B has always been >> B_{msy})". Examples of relevant passively responsive harvest strategies are described in the section below.

Harvest Strategies and Responsiveness

Some harvest strategies can be regarded as static rather than dynamic. We define two types of passively responsive harvest strategies: Type III and Type IV. These two types differ in the mechanism of passive response to stock size with responses in the exploitation rate for Type III and in the landings/catch for Type IV. To illustrate this consider two examples: 1) a Type III situation where a large marine reserve, say covering 50% of the stock area, is put in place and this reserve is entirely composed of habitat suitable for the target fished species; furthermore, all life stages make use of the marine reserve, and 2) An example of the Type IV situation would be a constant effective effort policy. Thus, for the Type IV example, if a fishery has had 20 boats fishing full time for 30 years, and the density of boats per square kilometer of fishing grounds is low compared to other areas with healthy fisheries, then a policy of maintaining effort at the equivalent of 20 full time boats using historical fishing practices should maintain the stock at a stable but unknown level believed to be above B_{msy}. If abundance declines, catch per unit effort should decline and, with constant effort, catch should decline thus being responsive to changes in stock size.

The static nature of these harvest strategies render them passively responsive – the amount of fishing effort and the size of the marine reserve are not regulated in response to changes in stock abundance. Rather, the harvest strategy is to maintain the status quo.

However, these static harvest strategies may be safe in the sense of affording adequate protection against overfishing if certain conditions are met. These conditions include: the stock is believed to never have been heavily exploited, there is adequate monitoring and enforcement of the regulations (no poaching, or no unreported fishing effort), and no "effort creep" (improvements in gear efficiency such that the effective effort increases over time even as the nominal effort (number of boats) remains constant). We note that

the MSC documentation talks explicitly about situations where a stock is believed to never have been heavily exploited.

Thus, there is a decision to be made as to whether a static, passively responsive harvest strategy is acceptable to the MSC. If so, then in any implementation there are should be scorable questions about whether the implementation of the harvest strategy is adequate.

Table 1 presents these concepts in table format and includes guidelines as to what would suffice as adequate given the general type of harvest control rule.

Non-responsive harvest strategies

A common example of a non-responsive harvest strategy is to set the allowable catch equal to the average catch in a window of time (or to a percentile of the catch history). (This is used in the United States for many stocks where the only available dataset is the catch history.) It can be seen that this strategy is non-responsive or, more accurately, responsive in the wrong direction. Thus, if catch is held constant but the stock declines then the exploitation rate rises which is not protective.

Table 1. Types of responsiveness. Responsive refers to changes in catch or induced exploitation rate as the stock size changes.

Type of Responsiveness	Definition	Requirement of Implementation
Type I: TAC depends on $B_{current}/B_{ref}$ (Direct response)	TAC set periodically as function of $B_{current}/B_{ref}$ i.e., based on how the stock is from the reference target where the reference target is a biological reference point (B_{msy} or a proxy for this)	Sophisticated and reliable assessment model.
Type II: TAC or effort depends on $B_{current}/B_{arbitrary}$ (Direct Response)	TAC set periodically as function of $B_{current}/B_{arbitrary}$, e.g., a stock index (e.g., CPUE) in relation to an arbitrary reference point such as the CPUE in a set of reference years when the stock was presumed to be healthy and at an optimal level. Note: there is no estimate of how much the reference cpue differs from the value when the stock is at equilibrium and producing MSY. A similar example to this would be annual effort is set according to the catch rate. Thus, increasing catch rate would permit an increase in effort while decreasing catch rate would cause a reduction in effort. This scheme ties effort and thus exploitation rate to stock size and is thus responsive, but it does not relate management to biological reference points (e.g., MSY)	$B_{arbitrary}$ needs to be set at safe level and thus, an analysis supporting $B>>B_{msy}$ needs to be conducted.
Type III: Passively responsive (Indirect Response)	A portion of the population is protected (e.g., in an MPA, by minimum size limits) such that as the unprotected portion of the population is fished down, the exploitation rate (on the entire population – protected and unprotected) declines. (In the extreme where everything in an open area is fished out, the exploitation rate becomes simply that fraction of the population in the protected area that spills out into the open area.)	For closed area, analysis of dynamics of population in closed area relative to open areas including movement; for min size, proportion of the stock which is protected.
Type IV: Passively responsive (Indirect Response)	Constant effort (constant exploitation rate) implying catch is responsive (directly proportional) to stock abundance	Assurance biomass started out high and thus, presumably, is still high; assurance nominal effort reflects effective effort (so that effort can be determined to be constant).
NON-responsive	A policy of constant catch, in the absence of information other than catches, is non-responsive to stock abundance and is responsive in the wrong direction to	Not safe in the absence of additional information.

	exploitation rate. That is, if stock goes down, the allowable catch does not change so the strategy is not responding to changes in abundance; however, as stock goes down, a constant catch implies an increase in exploitation rate which is the opposite of what is needed.	

Answers to Key Questions

Three Key Questions

Is a score of 80 for PI 1.2.2. (a 'well-defined' HCR) required for PI 1.2.1. si (a) to meet SG80 for 'responsive'

As pointed out in the discussion there is fundamental nesting of elements scores (i.e. 1.2.2 HCR; 1.2.3 Information/Monitoring; and 1.2.4 Assessment of stock status) in the scoring of 1.2.1. As such, the score for 1.2.1 should be close to the average of the scores for the elements with some adjustment for the interaction of the three and how well the 'elements work together towards achieving stock management objectives'. As the PIs are currently written and if we assume that the intent of the meaning of 'responsive' in 1.2.1 is the same as "exploitation rate is reduced as the PRI is approached" then this additional factor more closely ties the score of 1.2.2 to that of 1.2.1.

If we consider the weighting scheme and example presented in Table G3 in Fisheries Certification Requirements and Guidance (FCR) v2.0), one could calculate how much weight each element should be contributing to the score of 1.2.1, but we would recommend formalizing the scoring details once decisions are made as to interpretation of 'responsive' and our interpretation of the scoring structure. In short, it would be expected that a score of 80 for 1.2.2 would result in a score close to, but not necessarily equal or greater to a score of 80 in 1.2.1. For example, if the scores for 1.2.3 and 1.2.4 are both 100 and the score of 1.2.2 is 80, one might score 1.2.1 at of approximately the average (i.e 280/3= 93) of the scores for the elements. In this case, the differences in scores might also indicate that confidence in each element is not the same hampering their ability to 'work together.' Thus, it would be reasonable to suggest that a maximum score of 90 for 1.2.1 would be allowable if 1.2.2 is scored at a level of 80.

In the initial review of this draft report a direct clarification question was asked: Is a 'well-defined' HCR required to demonstrate a harvest strategy is 'responsive'? Our answer assumes the scoring guidelines and criteria are as currently written for PI 1.2.1 and PI 1.2.2. Let's start with the relevant MSC guidelines: The MSC Fisheries Certification Requirements and Guidance (ver. 20., October 2014) states that:

> *HCRs should be regarded as 'well-defined' in the sense required to achieve an 80 score when they exist in some written form that has been agreed by the management agency, ideally with stakeholders, and clearly state what actions will be taken at what specific trigger reference point levels.*
>
> *HCRs should be regarded as only 'generally understood' as required to achieve a 60 score in cases where they can be shown to have been applied in some way in the past, but have not been explicitly defined or agreed.*

The primary distinction between a score of 60 and a score of 80 is the level of formality and documentation of the HCRs. As we state in the answers in Section 5.2 (Subsequent Questions) which follows, we view the degree of formalization of management measures as un-related to their properties of responsiveness. For example, consider a 'generally understood' HCR in a small island nation where 20 fishers and fishing community have always understood that fishing north of 'Jagged Rock' is not allowed. In this small fishing community compliance is 100% due to the close knit culture, legends, or fear 'poison fish' (ciguatera) and 50% of the stock within the closed area is actually fully protected. Alternatively, consider a larger fishery where the HCR specifically states that "Fishing north of Jagged Rock (16.32453 N, etc.) is illegal" but compliance is lacking and only 25% of the stock is effectively protected. In one case, the HCR is 'well-documented' but less effective and therefor less responsive than the 'generally-understood' HCR in the other.

The previous example should be considered an exception and only intended to highlight a practical situation where a 'generally understood' HCR might out perform a 'well-defined' HCR. In the MSC specific context, however, the general rule should be for a well described HCR so that it can be fully evaluated. Without this requirement the possibility exists that the HCR may be understood in one way by the people applying for MSC certification, another way by the fishing or enforcement community, and even another interpretation in the MSC review process.

If not, how can you demonstrate HS responsiveness without 'well-defined' HCRs (si a PI 1.2.2) or appropriate and effective tools (si c PI 1.2.2) to implement the HCR?

We believe our discussion of 'responsive' in terms of harvest strategies in section 4, and our response to the clarification question in the previous section lays out the fundamental considerations for this question. As stated, the intent of 'responsiveness' in the MSC context needs to be clarified and guidance for interpretation and scoring needs to be developed. If MSC agrees with our interpretation of 'responsiveness' then the responsibility of proving a response in either exploitation rate or landings needs to be demonstrated for each harvest strategy. For non-dynamic and passively responsive management scenarios (e.g. minimum size or constant effort) the logic surrounding the determination that B>>Bmsy and the inclusion of an HCR that monitors an appropriate factor (e.g. undersize poaching or increases in effort) to trigger management measures (or at least triggering a review) should be considered a requirement.

Can you demonstrate responsiveness/do you need to, if stock status has never required management intervention (e.g. B has always been >> Bmsy)?

The question deals with situations where management intervention has not taken place because there hasn't been a need (e.g. B has always been >> Bmsy). We assume the proposition that B has always been high is well established. Then, the question is whether a control rule is needed, and whether it is necessary to demonstrate it is responsive.

In our opinion, a control rule is always needed in order to certify that a fishery is safe or precautionary. Without a plan to detect changes in the population and take remedial action if the stock declines, it is impossible to predict what will happen and thus one can't be certain the stock is protected.

However, the control rule need not be elaborate. The minimum requirement is that there be a trigger based on stock status that is associated with a remedial action. For example, no management actions might be contemplated unless an indicator of stock status (such as cpue or mean size) reaches a trigger point that causes a management action to reduce exploitation. This is non-responsive at high stock levels but responsive at low stock levels.

In the opinion of the consultants, it is necessary to demonstrate that the control rule is (sufficiently) responsive.

Secondary Questions

How formalized do management measures/tools alternative to an HCR need to be in order to be considered 'responsive'?

In our minds, the degree of formalization of management measures is un-related to their properties of responsiveness. However, any alternatives to an HCR or non-traditional tools should be required to be "precautionary" in nature and thus, defined explicitly so that its effectiveness can be evaluated. In some data-poor fisheries, however the management tools are so simple (e.g. fishing is only allowed on Tuesdays; only 4 people are allowed to fish) that 'formalization' would be an almost trivial task. Definitions and requirements for implementation likely need to be made for each class of HCR alternative (or response

type as in Table 1) to be defined. For example, a management system might be based on 1) status quo (constant) effort, 2) maintaining a sufficiently protective protected area, 3) adjusting annual allowed catch according to catch rate (without having estimates of where the stock abundance is in relation to reference points), 4) adjusting annual allowed effort according to catch rate, 5) maintaining a minimum harvestable size that protects all juveniles and some adults. The ability to consider management measures and tools as responsive starts will fully understanding how they work and thus, more complicated management measures will need to have more documentation of details and formalization.

Do such tools need to have the equivalent of management triggers?

The short answer is yes, but given the spectrum of potential management scenarios, a single answer that applies to all cases needs some clarification. As a rule, every system should have some sort of monitoring in place that insures the management scheme is effective at achieving its goals (as described in PI1.2.3). For example, at the data-rich and heavily monitored end of the spectrum, an assessment and management plan framework would be expected to include HCRs that modify exploitation rates according to changes in stock size. Although it may be expected that a data-rich/heavily responsive HCR scheme is less likely to result in situations where B is reduced below Bmsy, a management trigger is appropriate as a strong safety net for unexpected situations. One cannot exclude the possibility of changes in the parameters (e.g. new age/growth or stock recruit relationship) or assumptions (e.g. recruitment events inconsistent with assumption of constant recruitment) in the assessment model and determination of stock status changing instantaneously. As long as the assessment approach is valid, new conclusions based on improvements should fit into existing HCRs to reduce exploitation to recover to targets. In this case the trigger, could be set at values lower than MSY and result in additional management measures or closure of the fishery. This approach will maintain some consistency in regulations while providing extra protection in situations where recruitment could be significantly affected.

The situation is less clear when we consider a data-limited fishery for which a simple HCR is highly likely to result in the stock being above MSY. In these cases, and to be precautionary, some monitoring of the system needs to be conducted to ensure that the assumptions/conditions of the approach are met. For example, if the management strategy is based on maintaining constant effective effort and a technological improvement in fishing gear gives rise to concerns that effective effort has increased, then it would certainly be advisable to have a plan in place to deal with this. Similarly, in a case where extensive closed areas or de facto reserves protect a substantial portion of the stock, a change in enforcement capabilities and or other factors which results in the harvest of animals assumed to be protected in the development or justification of how the HCR's would change the exploitable portion of the stock. In these cases, once effective effort or vulnerable proportion of the stock is recalculated, a trigger to modify the HCR from the status quo of 12 boats to 10 boats, for example would be necessary to maintain the original effective effort allowed in the fishery. In the closed area example, a recalculation may show that now 75% of stock is vulnerable and a trigger for additional measures may be necessary.

In general, successful status quo HCRs intend to maintain a stable stock size at or above MSY without modifying rules, catch levels, or effort. These approaches are applicable in situations where data limitations preclude comprehensive assessments or extensive monitoring capabilities are lacking. In these cases a single data stream could be monitored to ensure that the assumptions of the HS/HCR is being met. In a constant effort scheme, monitoring of the number of vessels, number of days fishing, and changes in technology or gear could trigger additional measures. In a closed area scheme monitoring changes in enforcement capabilities, ecosystem health/environmental factors, and magnitude of poaching may trigger additional measures. The precautionary nature of these approaches lies in maintaining a stable system with a high likelihood of the stock being above Bmsy and given that complex assessments are not being conducted the trigger level should be more precautionary (B >= Bmsy) than in a more data rich scenario.

Do the outcomes ensuing from triggers need to be pre-defined?

The answer to this question was the only aspect of this project for which the two consultants had slightly different opinions. Both agreed that triggers should be a requirement, but one felt that a 'trigger' should only refer to something serious and therefor a planned detailed response is necessary. The other consultant felt that there could be exceptions to this rule in specific situations. For example, i in a data poor fishery which has been determined to be underexploiting the resource such that B>>>Bmsy and where fishing effort or fishing capacity in the system has demonstrated long term stability, it may not be necessary to specify the outcome of a trigger a priori. In this case, the trigger could simply state that a review of the HCR is warranted and provide managers with the ability to evaluate what has changed in the system and how best to deal with the situation. This is risk averse as long as B is truly well above Bmsy, the dynamics of the fishery aren't changing dramatically in a very short period of time (e.g. doubling of vessels in the fishery or substantial increases in poaching), and a short time frame for formalizing response is required.

Review of subset of MSC certified fisheries

Our initial review of the MSC subset provided to us was the the first indication of the potential different interpretations of the word 'responsive.' In many cases, we found it difficult to determine the exact interpretation that was being used, but it did appear that the two things highlighted in this report (i.e. potential lack of inclusion of passive/indirect harvest strategies and the direct link between the 'responsive' language in 1.2.1 and 1.2.2) were the root of most of the issues. Overall, and upon our initial evaluation of the scores, there did not appear to be glaring discrepancies or inconsistencies between the scores of 1.2.1 and 1.2.2. As we discussed, our interpretation of the language would suggest that the score of 1.2.1 in explicitly tied to the score of 1.2.2. Given the broader context of the 1.2.1 language (i.e. work together) our expectation was that scores would be closely tied to each other. Based on the summary of MSC subset off fisheries we make the following brief comments (original statement from consultancy information is indicated in bold):

- 79 assessments had a condition on either PI 1.2.1 and PI 1.2.2.
- 41 had a condition on PI 1.2.1.
- 73 had a condition on PI 1.2.2.
- Given the challenges in managing open ocean pelagic fisheries including, but not limited to obtaining and coordination information and management measures internationally, we did not find it surprising that "16 of these [subset of MSC certified fisheries] were either tuna or swordfish fisheries"
- We did not find 'Of the 79, 35 had a condition on both PI 1.2.1 and PI 1.2.2' to be of concern as the language of 1.2.1 and 1.2.2, given our interpretation, would be expected to result in similar scoring.
- 'Of the 79, 23 had an explicit link in their rationale between PI 1.2.1. si (a) and PI 1.2.2' is also not surprising given our interpretation of language overlap.
- The following two findings, where scores differed between 1.2.1 and 1.2.2 were of most interest:
    - 52 assessments had a condition on PI 1.2.2 but not PI 1.2.1 si (a)
    - 2 assessments had a condition in PI 1.2.1 si(a) but not PI 1.2.2

Given our interpretation of the issues we were not surprised that the most common situation when differences in scoring were observed was when 1.2.2 was lower than that of 1.2.1. The SG80:1.2.1 language includes 'work together' and depending on how one interprets how closely the 1.2.1 score is tied to the scores of the 1.2.2, 1.2.3, and 1.2.4 elements it is not unreasonable to assume that the lower score on 1.2.2 could be adjusted upward given solid performance on the other two elements.

The inverse, however, when score of 1.2.2 is greater than 1.2.1 was interesting as the redundancy in 'responsive' language would suggest that the scores for both 1.2.1 and 1.2.2 would be bolstered by a system scored as 'responsive' in 1.2.2. In this case, there was some aspect of the 'work together' component of 1.2.1 or in the implementation of the HCRs in 1.2.2 that deserved further investigation. We provide a few additional comments on this below.

Two MSC certified fisheries were selected and a brief rationale are provided below. In both cases, passive response management measures (e.g. effort controls and minimum sizes) are being used which we believed was the initial cause of the differences in scoring, but upon further investigation is appears that the root of the issue stems from significant uncertainty in stock status: "Recent changes to the stock assessment and reference points…" and "..work to update the HS, but….based on simple steady state surplus production assessment". Our brief review of the broader rationale suggests that the HCRs are believed to be valid and responsive but that the implementation is lacking due to the uncertainty in the assessments. As such, it does make sense that the score for the HCR could be higher than the overall HS. This situation highlights the need for clearer instructions on the linkages between scoring components once consensus on MSC intent and interpretation is achieved, and also supports our suggestion to include 'minimum criterion' or the like for each class of HCRs. In both cases, and given the HCRs being used, the criterion of demonstrating B>>Bmsy does not appear to be met and therefor the score of HCR would be reduced. To be clear, we are only pointing out what we perceive as the logic that was used and not suggesting these scores are incorrect. A much more detailed review of the specifics in the evaluation for each fishery would have to be conducted which is outside the scope of this work.

Fishery 1
PI 1.2.1. si (a) – SG60
Issue for the adoption of an updated harvest strategy. "*Recent changes to the stock assessment and reference points imply a need to re-evaluate the management strategy in order to ascertain if it can still be considered precautionary under the new stock perception*."
PI 1.2.2. si (a) and (c) – SG80
F is constrained by TAC setting and limits on days at sea. Allocation of days at sea include "*the basis of gear, mesh size and catch composition*." The "*evidence from the declining exploitation rates that the harvest control rules have begun to be effective*."

Fishery 2
PI 1.2.1. si (a) – SG60
There was work to update the HS, but at the time of assessment "the current harvest strategy is based on a simple steady state surplus production assessment."
PI 1.2.2. si (a) and (c) – SG80
Limit on total catch to 20,000 t. "*Harvest control rules include minimum catch size (both legal, 28 cm., and commercial, 32 cm), minimum mesh size (80 mm), log books, VMS, sales notes and FI monitoring at sea and on landing*."

Relevant Non-MSC fisheries

The consultants were asked to provide some examples of non-MSC certified fisheries where "where the development of 'responsive' harvest strategies has occurred in the absence of explicit HCRs." The examples below are obviously not exhaustive and intended to highlight the 'passively responsive' or 'indirect' type of HS that we outline in Table 1. We provide two country specific examples of places we have worked, or worked with data from these locations, without having verified the harvest strategies are still functioning as intended. Additionally, there is no implied or expressed approval for the success of the implementation of these harvest strategies. We provide the following examples for discussion purposes:

- *Minimum size, constant effort, status quo management (Passive/Indirect Approach*): A lobster fishery in the Caribbean (not MSC certified nor likely to seek export ability but relevant, nonetheless) began adopting stringent regulations in 1992: 1) Minimum size of 3 5/8" carapace length which is greater than all but a few other Caribbean nations - The minimum size in Florida and the US Virgin Islands is 3" and 3.25" respectively, 2) A closed season for harvest which is similar to that of Florida and the Bahamas – the US Virgin Islands does not have a closed harvest season, and 3) Total effort has been capped and at very low densities compared to other nations – current limit of 350 lobster traps in the country with each fisher being allotted 24 tagged traps. Effort has been held constant for many years suggesting stability. Furthermore, minimum legal size is larger than in most of all Caribbean countries and the density of fishers/km2 of shelf is low suggesting that the stock has always been above Bmsy.
- *Adaptive Management and Closed area strategy (Combination of Direct and Passive approaches):* Belize has adopted a large scale spatial management plan which comprehensively allows for spatially explicit management measures. While it may be possible that the closed areas alone could satisfy the Type IV indirect/passive response approach, difficulties in determining the current status of the stock preclude utilizing this as the sole management strategy. The government of Belize, in conjunction with a number of NGOs (and one of the authors of this report) determined that rather than wait for the day in which comprehensive assessments are possible an interim plan was developed. An adaptive management strategy for lobster and conch (the countries primary exports) was put in place following the Type II direct responsive approach. Rather than rely on one indicator reference point (e.g. CPUE) a management strategy evaluation was done to evaluate alternatives and a suite of indicators (e.g. CPUE, last year's catch, mean size, survey densities-conch) is currently being evaluated annually to increase/decrease annual TAC's based on how far each indicator is from a stable reference period. While this strategy is maintaining a sustainable catch, the stock status is unknown and additional work would have to be conducted to

demonstrate that B>>Bmsy before this approach could be viewed as precautionary in an MSY framework.

- *Minimum Size Alone (Type III):* This strategy is simply to maintain a minimum harvestable size that protects all juveniles and some portion of adults (i.e. minimum size is set well above size at maturity). We don't know of a fishery that currently relies solely or largely on this but have been involved in numerous discussions with managers considering this approach. Ransom Myers found that it's extremely difficult to crash a stock if you don't fish juveniles and reported that historically stocks that have collapsed under this approach have experienced higher than expected mortality on juveniles. Thus, a prerequisite of this approach would be to include fishery specific simulation studies to evaluate the necessary buffer between size at maturity and minimum size to protect against episodic events.
- *Taboo Fisheries/Temporal Closures:* Although fishery management has advanced dramatically since the days of the earliest South Pacific Taboo fishery management schemes the idea of temporal closures to cap effort still has some merit in unique situations. As a prerequisite, one must obviously demonstrate low effort in relationship to fishable area and long-term stability. In this case B>>Bmsy is assumed to be true. In Chile, we witnessed small fishing villages closing certain days of the week where no one was allowed to fish. The rationale was grounded in practical considerations that happen to align with sound fishery management logic. In one case, for example, a fleet of 10 boats was fishing from the only two villages in a long stretch of coast. The fisher community leader would pay close attention to the landings of his fishers and the distance they would have to travel to have a good days landing. This was an informal monitoring of CPUE and the resulting cost/benefit of a fishing trip. Any observed declines would result in a day or two a week where fishing was prohibited which is loosely based on the Type II response. Obviously, in the MSC framework, this would not be acceptable without more formal documentation and analysis, but we include to highlight that even the simplest harvest strategies in a very lightly exploited populations might satisfy responsiveness.

Conclusions, guidance and recommendations

Responsiveness

Regardless of the many decisions which need to be made to resolve the current concerns it is imperative that the intent and meaning of MSCs usage of the term 'responsive' be clarified. In this report we have described how management rules which appear static (e.g. minimum size) can have responsive behaviour in exploitation rates or landings even though the HCR outputs and overall harvest strategy do not change. We do not know if it was MSC's intent to include these passive response management strategies but even this potential difference in interpretation highlights the need for clarification. Simply stated, the term 'responsive' alone lacks the specificity necessary to avoid confusion or a lack of consistency in scoring.

Since the concept of 'responsiveness' is integral to a precautionary management strategy, the concept, in one form or another will be necessary to discuss acceptable management frameworks As such, we strongly recommend a guidance document on interpretations and scoring of the terminology that is used. Table 1 could serve as a strawman and be expanded upon pending comments from the expert reviewers. In addition, we suggest modifying the term 'responsive' in 1.2.1 to '…exploitation rate or landings is responsive to the state of the stock', and adding landings, or catch to the language in 1.2.2. Alternatively, instead of adding landings/catch, and depending on MSCs preference, the clarifier '(directly or indirectly)' could be added after 'responsive'. This would add the specificity necessary to be inclusive of simple, data-poor passively responsive management strategies. This would change the scoring elements from;

- 1.2.1 - SG80: The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving stock management objectives reflected in PI 1.1.1 SG80.
- 1.2.1 - SG100: The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in PI 1.1.1 SG80.

To,

- 1.2.1 - SG80: 'The elements of the harvest strategy work together towards achieving stock management objectives, and exploitation rate or catch is responsive to the state of the stock.
- 1.2.1 - SG100: The harvest strategy is designed to achieve stock management objectives reflected in PI 1.1.1 SG80 and exploitation rate or catch is responsive to the state of the stock.

Or alternatively (depending on MSCs preference in language):

- 1.2.1 - SG80: 'The elements of the harvest strategy work together towards achieving stock management objectives, and exploitation rate is responsive (directly or indirectly) to the state of the stock.
- 1.2.1 - SG100: The harvest strategy is designed to achieve stock management objectives reflected in PI 1.1.1 SG80 and exploitation rate is responsive (directly or indirectly) to the state of the stock.

We believe these wording changes, in conjunction with a guidance document and summary table similar to Table 1 will resolve the primary confusion surrounding the meaning of responsive.

Redundancy in Elements and Scoring

As we discussed earlier in this report there is a redundancy of elements in the overall scoring structure of Harvest Strategy PI in Principle 1. The question that MSC must ask itself is whether the lack of independence between the PI elements is intentional (albeit possibly by accident) or an unexpected outcome and whether correcting it is necessary. As defined PI 1.2.1 SG80 is [emphasis added]:

*The harvest strategy **is responsive** to the state of the stock and **the elements of the harvest strategy work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80.*

By definition the scoring of PI 1.2.1 is not independent of the elements (1.2.2-Harvest Control Rules; 1.2.3 - Information/Monitoring; and 1.2.4 - Assessment of Stock Status) that must work together to achieve stock management objectives. The inclusion of the scoring element based on 'responsive' in both 1.2.1 and 1.2.2 ties the scores even closer together for this element.

Table G3: Default weighting to be applied in using the default assessment tree

Principle Weight	Component Weight	PI		Weight within component and principle
One 1	Outcome 0.333	1.1.1	Stock Status	EITHER 1 0.333 OR 0.5 0.167
		1.1.2	Stock Rebuilding	EITHER 0 0 OR 0.5 0.167
	Management 0.667	1.2.1	Harvest Strategy	0.25 0.167
		1.2.2	Harvest Control Rules & Tools	0.25 0.167
		1.2.3	Information & Monitoring	0.25 0.167
		1.2.4	Assessment of Stock Status	0.25 0.167

If we use the same weighting scheme described in Table G3, each of the four PI's contribute 25% of the component score and 16.7% of the principle score. The repetition of the responsive element in 1.2.1 and 1.2.2 results in 50% of the component score and 33% of the principle score being directly affected. In other words, a poorly responsive approach would affect the scores in both 1.2.1 and 1.2.2. This, in essence, is an imbedded weighting system with greater weight being placed on the scoring element of 'responsiveness'. We suggest the following options:

Option 1: Leave structure as is and explain that the intent is to heavily weight 'responsiveness' in the component. Be transparent and provide examples of scoring.

Option 2: Remove the term responsive from 1.2.1 so the primary scoring element is based on **"…the elements of the harvest strategy work together …."** The revised SG80 1.2.1 could read as:

*1.2.1 - SG80. The **elements of the harvest strategy work together** towards [effectively] achieving stock management objectives reflected in PI 1.1.1 SG80.*

Our Preferred Approach

Given our interpretation of 'responsive' and how the scoring for the PIs is intended to work, we recommend the following:

- Develop a guidance document on the term 'responsive' that is consistent with MSC intent and feedback from fishery experts. This document should also include criteria or requirements for the use of different types of harvest strategies.
- Remove 'responsive' from the PI 1.2.1 SG80 and PI 1.2.1 SG100 levels to create independence in scoring of elements (option 2).
- Include response 'in catch', in addition to exploitation rate, to include passively responsive management systems. Alternatively, instead of adding 'in catch' the clarifier '(directly or indirectly)' could be added following 'reduced'.
- Our final recommendation for wording in the elements is as follows:
    - *1.2.1 - SG80. The **elements of the harvest strategy work together** towards [effectively] achieving stock management objectives reflected in PI 1.1.1 SG80.*
    - *1.2.1 - SG100: The harvest strategy is designed to achieve stock management objectives reflected in PI 1.1.1 SG80.*
    - *1.2.2 – SG60. Generally understood HCRs are in place or available that are expected to reduce the exploitation rate **or catch** as the point of recruitment impairment (PRI) is approached*
    - *1.2.2 - SG80. Well defined HCRs are in place that ensure that the exploitation rate **or catch** is reduced as the PRI is approached, are expected to keep the stock fluctuating around a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.*

Or alternatively (depending on MSCs preference in language):

- *1.2.1 - SG80: The elements of the harvest strategy work together towards achieving stock management objectives, and exploitation rate is responsive **(directly or indirectly)** to the state of the stock.*
- *1.2.1 - SG100: The harvest strategy is designed to achieve stock management objectives reflected in PI 1.1.1 SG80 and exploitation rate is responsive **(directly or indirectly)** to the state of the stock.*