MARINE STEWARDSHIP COUNCIL – TECHNICAL ADVISORY BOARD
TAB DIRECTIVE SERIES

TAB Directive Number	Title	Date of Issue
TAB D-036 v1	Assessment of Low Trophic Level (LTL) Fisheries	15 August 2011
Decision Date: 12 July 2011 (TAB 19) Effective Date: 15 August 2011		

Documents Supplemented or Modified by this Directive

MSC Scheme Document	Status Change
Fisheries Assessment Methodology v2.1	Sections modified as listed

Intent

This document is provided to clarify MSC's expectations, as contained in the FAM v2.1, on the additional precaution that should be applied by fisheries in managing LTL species, as scored in the Reference Points PI 1.1.2.

Background

Low Trophic Level (LTL) species are those that occupy positions in an ecosystem that provide the basis of the food web for species at higher levels. Such species can hold a key role in ensuring the diversity and stability of the ecosystem.

Noting that MSC has not explicitly quantified its expectations in the existing requirements in FAM v2.1 pertaining to fisheries on LTL species, MSC funded research on LTL fisheries in 2009-10 (see summary details here) to determine the levels of precaution appropriate for these species. The research has confirmed the importance of managing LTL species at target levels above those considered appropriate for single species, particularly for species that are highly connected to other species in the ecosystem. In summary the project has shown that:

- Fishing on LTL species varies widely in its impacts on other parts of the ecosystem – some ecosystems showing little impact even when LTL species are heavily depleted and others showing high impacts even at low levels of exploitation.
- Depleting LTL species that comprise a substantial fraction of ecosystem biomass (5% or more of consumer biomass) always results in large impacts. Depletion of some less abundant species can sometimes also result in large impacts.
- Depleting LTL species that are highly connected in the food web (accounting for 4% or greater of all trophic connections by number) always results in large impacts
- Setting a target of 75% of unfished biomass for LTL species (25% depletion) reduces the impact on other species within the ecosystem by more than half while maintaining yields above 80% of the level that would be achieved with a target of 40% of unfished biomass. Such a target is usually achieved at fishing mortality rates less than half those needed to achieve MSY.

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On the basis of these results, together with the consultation, the MSC Technical Advisory Board has recommended that new guidance be provided relating to the specific assessment requirements of LTL fisheries.

As outlined above, the main focus of this new direction is on the stock biomass levels that should be maintained in the management of LTL species in order to allow for their critical roles in the wider ecosystem. These levels are scored in the reference points PI 1.1.2. This Directive does not provide new requirements for the harvest strategies that should be used to maintain stocks at these higher than normal levels. The management component of Principle 1 of the MSC assessment tree is however designed to score whether the existing control rules, management measures, information and assessment are adequate to achieve the levels defined in PI 1.1.2 and thereby avoid negative ecosystem impacts (see FAM paragraph 6.3.1b).

Direction

Implementation

1. The requirements specified in this Directive shall be effective from 15 August 2011 for fisheries that have not yet entered assessment, or are in assessment but have not yet held their site visit, by 15 August 2011.

Identification of key LTL species

2. Teams shall treat a species under assessment against Principle 1 as a key LTL species if:

    a. it is one of the species types listed in Appendix 1 and it meets one or more of the sub-criteria in Appendix 2.

        i. Teams shall provide evidence specifically addressing each of the sub-criteria in Appendix 2 to justify any decision to not define the species as a key LTL species in the ecosystem under assessment.
        ii. In the absence of sufficient evidence on any of the Appendix 2 sub-criteria, the team shall assume that a species of a type listed in Appendix 1 is a key LTL species.

    b. it is not one of the species types listed in Appendix 1, but it meets both of the criteria in Appendix 3.

        i. Teams shall provide evidence demonstrating that either of the Appendix 3 criteria are not met in order to justify a decision not to define it as a key LTL species in the ecosystem under assessment.

3. Teams shall determine whether a species is to be considered a key LTL species based on its status at the time of assessment. The determination shall be reviewed at each surveillance audit.

Scoring of key LTL species

4. Species identified as key LTL species shall be scored according to the guidance in the existing FAM paragraphs 6.2.26-28 and 6.3.1b subject to the revisions listed in Paragraph 5 and 6 below, and the supplementary requirements outlined in Paragraphs 7-11.

Revisions to existing FAM text to confirm expected treatment of key LTL species

5. References to “low trophic level species” are hereby revised as given below in the identified FAM v2 paragraphs:

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a. 6.2.14 revised to “key low trophic level species”
b. 6.2.26 a) revised to “key low trophic level species”
c. 6.2.26 b) revised to “key low trophic level species”
d. 6.2.26 c) revised to “key low trophic level species”
e. 6.2.27 (first two occurrences) revised to “key low trophic level species”
f. 6.2.27 (last occurrence) revised to “non-key low trophic level species”
g. 6.3.1 (both occurrences) revised to “key low trophic level species”

6. In Performance Indicator 1.1.2, the last scoring issue at SG80 is hereby revised to “For key low trophic level species, the limit and target reference points take into account the ecological role of the stock”.

Reference point requirements for key LTL species (B_{MSY}, B_{LIM}, TRP and LRP)

7. For key and non-key LTL species, default assumptions for B_{MSY} and B_{LIM}, which are reference points relevant in a single-species context, shall remain as given in FAM v2.1 paragraph 6.2.19.

8. When scoring PI 1.1.2 at SG60 (“Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category”), the expectations for Target Reference Points (TRP) and Limit Reference Points (LRP) for key LTL species shall be as given below:

    a. The default generic TRP for a key LTL species shall be set to allow for ecosystem needs substantially above the TRP determined according to FAM v2.1 paragraph 6.2.19 (subparagraphs a-d) in a single species context, and in any case it shall not be less than 40%B_0.
    b. The default generic LRP for a key LTL species shall be half the ‘ecosystem needs’ TRP (given in clause (a) above), and in any case it shall not be less than 20%B_0.
    c. In the case where the single species B_{LIM} is analytically determined, that value shall only be used as the LRP if it is greater than half the ‘ecosystem needs’ TRP.

9. When scoring the fourth scoring issue of PI 1.1.2 at SG80 (“For key low trophic level species, the limit and target reference points take into account the ecological role of the stock”), the expectations for key LTL species shall be as given below:

    a. The default TRP shall be 75% of the spawning stock level that would be expected in the absence of fishing, i.e. 75%B_0.

    b. A higher or lower TRP, down to the minimum allowed 40%B_0, may still achieve 80 level scores if it can be demonstrated, through the use of credible trophic models or robust empirical data for the fishery/ecosystem being assessed that the level adopted:

        i. Does not impact the abundance levels of more than 15% of the other species and trophic groups by more than 40% (compared to their state in the absence of fishing on the target LTL species); and
        ii. Does not reduce the abundance level of any other species or trophic group by more than 70%.

    c. The default LRP shall be half the ‘ecosystem needs’ TRP (as defined in clauses (a) and (b) above), and in any case it shall not be less than 20%B_0.
    d. In the case where the single species B_{LIM} is analytically determined, that value shall only be used as the LRP if it is greater than half the ‘ecosystem needs’ TRP.

10. Where surrogate (proxy) reference points are used in the management of a key LTL fishery (as allowed by FAM paragraphs 6.2.10, 6.2.18, 6.2.22, 6.2.31-36, 6.2.39), the

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target reference points used shall take into account the requirements outlined in paragraphs 7 to 9.

a. In the scoring rationale for PI 1.1.2, assessment teams shall show how any surrogate target reference points used are equivalent to the levels required in paragraphs 7 to 9.

11. Performance against these reference points shall be judged (in PI 1.1.1) in the context of recruitment variability typical for the given species in its ecosystem.

Use of the Risk-Based Framework in the assessment of key LTL species

12. Where a species under assessment against Principle 1 is determined to be a key LTL species, the use of the RBF shall not be permitted for its assessment against PI 1.1.1.

Guidance

13. Guidance relating to Appendix 1:
The MSC may, from time to time, modify the list of species in Appendix 1, where analyses indicate the consistency of other species with the criteria in Appendix 3.

14. Guidance relating to Paragraph 2:
Ways of demonstrating whether a species under assessment should be treated as a key LTL species may include the use of diet matrices to construct food webs and/or the use of ecosystem models that demonstrate the connection between species and trophic groups in the ecosystem.

a. With regard to the ecosystem role criterion in Appendix 2 and in criterion 2 in Appendix 3, it should be noted that a quantitative ecosystem model may not be required to address the sub-criteria, although if such a model exists and is regarded as "credible" it may be used to address these issues. "Credible" should be interpreted here to mean 1) publicly available and well documented, 2) fitted to time series data and 3) comprehensive (dealing with the whole ecosystem including all trophic levels). In the absence of a credible quantitative model, assessing the percent of connections will require ecosystem-specific understanding of the food web connections in the whole ecosystem based on a comprehensive species list that identifies links for major prey and predators, particularly dependent predators of the LTL species in question.

b. Where species are aggregated into trophic groups in ecosystem models, the degree of aggregation should adhere to the guidance provided in Fulton et al. (2003)[1] that 1) aggregations do not include serially linked groups (predators and prey) and 2) that aggregations are not across species, age classes or functional groups with rate constants that differ by more than 2- to 3- fold. Where possible, information about trophic connection should be based on empirical evidence of trophic dependence.

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[1] Fulton, E.A., Smith, A.D.M. and Johnson C.R., 2003. Effect of complexity on marine ecosystem models. Marine Ecology Progress Series 253: 1 – 16.

2 Cury, P., A. Bakun, R.J.M. Crawford. A. Jarre, R.A. Quinones, L.J. Shannon and H.M. Verheye (2000) Small pelagics in upwelling systems: patterns of interaction and structural changes in 'wasp waist' ecosystems. *ICES Journal of Marine Science* 57:603-619.
Cury, P., L. Shannon and Y.-J. Shin (2003) The functioning of marine ecosystems: a fisheries perspective. Pp103- 123 In *Responsible Fisheries in the Marine Ecosystem*, M. Sinclair and G. Valdimarsson (eds). FAO, Rome and CABI, Oxon UK.

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c. With regard to consideration of energy flows between the LTL species and its prey and predators in sub-criterion 1b in Appendix 2 (also in sub-criterion 2b in Appendix 3), this may be based on 1) empirical data, 2) credible quantitative models, and/or 3) information about the relative abundance of the LTL species in the ecosystem. Model-based results suggest that any LTL species that constitutes more than 5% of the consumer biomass in the ecosystem should be regarded as a key LTL species.

d. Regarding sub-criterion 1c in Appendix 2 (also sub-criterion 2c in Appendix 3), wasp-waisted food webs are described and defined by Cury et al. (2000, 2003)[2] as being "typically dominated by only one, or at most a few" LTL species that transfer a very large proportion of the total primary production through the lower part of the food web, that account for the vast majority of predator diets and that control the abundance of both the prey and the predators of these LTL species.

e. Where the target stock or stock component under assessment is widely distributed and is present in more than one ecosystem, the assessment of sub-criteria 1a-c in Appendix 2 (also sub-criteria 2a-c in Appendix 3) should focus on the ecosystem containing largest abundance of the species.

15. Guidance relating to Paragraph 3:
As an example, sardine would be considered a key LTL species in the southern Benguela current system but not in the northern Humboldt system in its current state (as at 2010); if the Humboldt were to shift to a sardine-based rather than an anchovy-based system, it would once again become a key LTL species in that ecosystem. As with other MSC guidance on ecosystem change (for instance relating to climate change, multi-decadal environmental cycles), CBs need to be aware of changes in ecosystem structure and productivity, and assess (in surveillance reports or in assessment / reassessment) the extent to which the fishery has taken these into account, for instance in the case of productivity by adjusting target/limit reference points, or in the case of ecosystem shifts such as above by reconsidering the species against the key LTL species definition.

16. Guidance relating to Paragraph 8:
At the SG60 level, fisheries are required to maintain stocks of key LTL species at levels that are sufficient to protect dependent parts of the ecosystem. These minimum requirements are intended to allow for the additional ecosystem demands on key LTL species, over and above their 'single-species' management objectives.

a. Fisheries on key LTL species that adopt target reference points less than $40\%B_0$ would not meet the SG60 requirement and thus may not be certified. An appropriate guide for the phrase "substantially above" would be $55\%B_0$, compared to the default assumption of $40\%B_0$ for B_{MSY}. For other situations where B_{MSY} is analytically determined to be lower or higher than 40%Bo, similar adjustments to the TRP would be appropriate. For example, if $B_{MSY}=30\%B_0$, a TRP of $45\%B_0$ could also achieve a 60 score. The TRP may not be set below the hard limit of $40\%B_0$, however, even in cases where B_{MSY} is estimated to be below $25\%B_0$.

b. Recognising that LTL species may have either steep or shallow stock recruitment relationships (see Myers et al, 1999[2], Table 1), associated with higher or lower productivity, analytical determination of an LRP in a single species context may suggest a level higher or lower than $½B_{MSY}$. However, in order to allow for additional ecosystem needs, departures from the default assumption of LRP=½TRP are only permissible if the single species analytical determination indicates that the LRP should be higher than this

[2] Myers, R.A., Bowen, K.G. and Barrowman, N.J., 1999. Maximum reproductive rate of fish at low population sizes. Can. J. Fish. Aquat. Sci. 56: 2404–2419.

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level. For instance, if B_{MSY}=30%B_0 and a single-species LRP is analytically determined to be 18%B_0, a TRP of 45%B_0 would be appropriate at SG60 and any LRP lower than 22.5%B_0 would not achieve a 60 score; however, if the single-species LRP was analytically determined to be 25%Bo, this LRP would achieve the SG60 score.

17. Guidance relating to Paragraphs 8 and 9:
Estimates for B_0 referred to in Paragraphs 8 and 9 can be determined using credible single species or ecosystem models or from robust empirical data such as fishery independent surveys. In the absence of robust estimates for B_0, target fishing mortality rates that would achieve the appropriate target biomass levels can be adopted. In these cases the likely relationship between fishing mortality rates and stock biomass levels should be considered in scoring PI 1.1.2, as outlined in Policy Advisory 12.

18. Guidance relating to Paragraph 11:
Environmental variability is not regarded as an issue that particularly affects fisheries based on key LTL species compared to non-LTL fisheries.

19. Guidance relating to Paragraph 12:
The MSC is currently developing special RBF requirements for key LTL species.

20. Guidance relating to the scoring of PI 2.1.1 (Retained species outcome)
FAM section 7.2.2 is hereby modified to include the following sentence before the current last sentence: 'Main retained species' should also include any LTL species that may be currently in a low abundance regime but may be expected to increase again in future to the point of becoming a key LTL species.

21. Guidance relating to the scoring of PI 2.5.1 (Ecosystem outcome)
PI 2.5.1 requires that "the fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function". FAM guidance section 7.6.3 confirms that such harm may reflect "depletion of top predators and trophic cascade through lower trophic levels caused by depletion of key prey species in 'wasp-waist' food webs. Assessments of the risks of "serious or irreversible harm" to the ecosystem in PI 2.5.1 may be made in reference to the maximum levels of impacts allowed under Paragraph 9b. While PI 1.1.2 scores the setting of TRPs and the theoretical evidence that they will achieve the allowed impact levels, PI 2.5.1 scores the evidence that such levels are being achieved in practice.

Appendix 1. Species types that are defined as "key LTL species" for the purposes of an MSC assessment. See ASFIS List of Species for species included in different families and orders (http://www.fao.org/fishery/collection/asfis/en).

- Family Ammodytidae (sandeels, sandlances)
- Family Clupeidae (herrings, menhaden, pilchards, sardines, sardinellas, sprats)
- Family Engraulidae (anchovies)
- Family Euphausiidae (krill)
- Family Myctophidae (lanternfish)
- Family Osmeridae (smelts, capelin)
- Genus Scomber (mackerels)
- Order Atheriniformes (silversides, sand smelts)
- Species *Trisopterus esmarkii* (Norway pout)

Appendix 2. Criteria for use in identifying species as "key LTL species" for the purposes of an MSC assessment where the species is listed in Appendix 1. Appendix 1 listed species shall be considered as 'key LTL' unless it can be shown that the stock under assessment does not meet any of the requirements listed below.

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1. In its adult life cycle phase, the species holds a key role in the ecosystem, defined as follows:
    a. there is a large trophic connection between this species and others in terms of a large number of connections (4% or greater of all trophic connections) in the ecosystem; or
    b. there is a large volume of energy (i.e. a large proportion of the total energy in the ecosystem) passing between this species and both higher and lower trophic levels in the food chain; or
    c. there are few other species at this trophic level through which energy can be transmitted from lower to higher trophic levels (i.e. the ecosystem is 'wasp-waisted').

Appendix 3. Criteria for use in identifying species as "key LTL species" for the purposes of an MSC assessment where the species is *not* listed in Appendix 1. Species which are not listed in Appendix 1 shall be considered as key LTL species if the stock under assessment meets both of the criteria listed below in full (i.e. including all of criterion 1 and one or more of sub-criteria 2a, 2b and 2c).

1. The species feeds predominantly on plankton; has a trophic level of about 3 (but potentially ranging from 2 to 4); is characterised by small body size, early maturity, high fecundity and short life span (default values: <30cm long as adults, mean age at maturity <= 2, >10,000 eggs/spawning, maximum age <10 years respectively); and forms dense schools.

2. In its adult life cycle phase, the species holds a key role in the ecosystem, defined as follows:
    a. there is a large trophic connection between this species and others in terms of a large number of connections (4% or greater of all trophic connections) in the ecosystem; or
    b. there is a large volume of energy (i.e. a large proportion of the total energy in the ecosystem) passing between this species and both higher and lower trophic levels in the food chain; or
    c. there are few other species at this trophic level through which energy can be transmitted from lower to higher trophic levels (i.e. the ecosystem is 'wasp-waisted').

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