CONSIDERING APPROPRIATE HARVEST LEVELS FOR LTL SPECIES THAT TAKE ACCOUNT OF THE NEED OF DEPENDENT PREDATORS AND THE WIDER ECOSYSTEM

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This document consists of the Chair's Summary of the deliberations and recommendations of the Ecosystem Inputs to Management Task Group (Cochrane, 2025a), with the addition of relevant legal background in the Introduction, and some added detail in the final section, "7. The Way Forward", for greater clarity.

1. *Introduction*

The legal obligation to ensure sustainable utilisation and protection of biodiversity is stated in the South African Constitution, the MLRA (Marine Living Resources Act 107 of 1998 (as amended)) and the National Environmental Management Act 107 of 1998 (as amended). The Objectives and Principles of the MLRA include: (a) The need to achieve optimum utilisation and ecologically sustainable development of marine living resources; (b) the need to conserve marine living resources for both present and future generations; and (f) the need to preserve marine biodiversity, amongst other related principles (Cochrane, 2022).

These obligations were applied in the matter between WWF South Africa and the (then) Department of Agriculture, Forestry and Fisheries on determination of TACs for the West Coast rock lobster fishery, heard in the Western Cape High Court in 2018.[1] In his judgement on that case, the presiding judge concluded that South African law requires *Inter alia*, that:

- "The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment";
- "The environment is held in public trust for the people; the beneficial use of environmental resources must serve the public interest; and the environment must be protected as the people's common heritage".

A challenge for the management of South Africa's fisheries for small pelagic species, is how to achieve these potentially conflicting objectives of sustainable use and protecting biodiversity in practice. The ongoing debate and uncertainties over impacts of fishing on seabirds, and African penguin in particular, have highlighted the importance of finding an acceptable solution to that challenge for the local fisheries for anchovy and sardine, and possibly also round herring.

Within that context, the Ecosystem Inputs to Management Task Group (EIMTG) was established by the SP-SWG with the objective of considering appropriate harvest levels for small pelagic forage fish species that take account of the need of dependent predators and the wider ecosystem.[2]

The Group met on four occasions between May and October. Discussions were informed by 13 documents written by members on the various approaches that were being considered (Appendix A). The main approaches that were considered as potentially providing guidance on appropriate harvest levels were:

[1] O. Rogers, Judgement Case No: 11478/18, The High Court of South Africa, 2018.

[2] The members of the EIMTG are: Kevern Cochrane (Chair), Fannie Shabangu (Convenor), Mike Bergh, Doug Butterworth, Janet Coetzee, Carryn de Moor, Alistair McInnes, Kolobe Mmonwa, Kelly Ortega Cisneros and Lynne Shannon

- Comparisons with harvest rates of other small pelagic species included in the RAM legacy database;
- The MSC default standard for key low trophic level species (LTL) of 75% of B_0 target biomass and the basis underpinning that standard (Smith et al. 2011; Pikitch et al., 2012 (the Lenfest Report));
- Ecosystem models and modelling;
- Information from other seabird-fisheries interaction studies;
- Examples of management approaches used in fisheries on LTL species from other regions that have been certified by MSC.

This document reports on EIMTG discussions and recommendations, structured according to these approaches.

2. *Comparisons with harvest rates of other small pelagic species*

It was agreed at the first meeting of the EIMTG that a comparison of the exploitation rates for South African anchovy and sardine with those of other small pelagic stocks captured in the RAM legacy database would be informative. At the request of the TG, Bergh and Horton produced a series of three documents (Bergh and Horton, 2025a, b, c). The first two of those summarised the types of information that are available in the database for anchovy, anchoveta, sardine and sardinella stocks.

The third, Bergh and Horton (2025c), reported that the RAM legacy database provides up to four different types of exploitation rate information for forage fish, but that information pertaining to them is sparse. The four types are:

- ER-calc-ratio; exploitation rate calculated from assessment total biomass and total catch/landings (units=ratio),
- ERbest-ratio; a general exploitation rate timeseries (units=ratio),
- ER-ratio; exploitation rate as the total catch/total biomass (units=ratio),
- ER-relative; exploitation rate as the total catch/total biomass (units=relative).

Bergh and Horton (2025c) presented box and whisker plots showing means and quartiles for the different stocks and exploitation rates (Figure 1).

After reviewing the plots shown in Figure 1, the TG agreed that they provide useful background information. A particular utility of this exercise was seen as providing a form of "red-face-test", in indicating whether current rates for SA small pelagics are outside the range of comparable sustainable rates elsewhere. Figure 1 indicates that South African exploitation rates are at the lower end of the spectrum, apart from the sardine West Coast component.

There was discussion about the relative usefulness of absolute values of exploitation rates, as shown in Bergh and Horton (2025), and exploitation rates as ratios of the target rate applied in each case (U_{target}). Hilborn et al. (2022) compared rates as ratios of U_{target}, which had values ranging from 0.08-1.73 for anchovy/anchoveta and from 0.06-0.69 for sardine/sardinella, suggesting that comparison of absolute values was difficult. It was also suggested that comparing ERs as ratios of U_{target} can be difficult too, unless the value of U_{target} and the rationale for selecting that target is known. In summary both absolute values and ratios can be useful, put into appropriate context.

Detailed examination of the specific context of individual fisheries would be required before consideration could be given to whether any of these could provide appropriate standards for the local fisheries.

3. *The MSC default standard for key low trophic level species and the underlying rationale*

a) The MSC standard

MSC published revised fisheries standards in 2024. The revision included changes in the standards for identifying stocks that must be assessed as LTL stocks, but standards for assessing the status of LTL stocks were essentially unchanged, apart from the change from spawning stock in Version 2 to B_0 or SSB_0 in Version 3.1 (Cochrane, 2025b).

In addition to the default standard of 75% of the B_0 or SSB_0 (SA2.2.14), MSC also allows for scoring LTL species on the basis of fishing mortality rate, if robust estimates of B_0 are not available. Those standards are listed in paragraph GSA2.2.16, which gives the highest score for the fishery if F is "highly likely" to have been below $0.5F_{MSY}$ or 0.5M (Cochrane, 2025c).

Enquiries to Michael Marriot (MSC, South Africa) and Keith Sainsbury (MSC Technical Advisory Board) indicated that no changes had been made to the 75% target level in the revised version. Reasons given for not making changes were that there had not been any new work that indicated the standard should be changed; and the MSC approach, or something similar, is being used by many management agencies in practice (Cochrane, 2025b).

b) Publications relevant to the MSC standards

Five scientific papers were identified at the first meeting of the TG as being most relevant to the MSC default standards. A summary of each of those was provided in FISHERIES/2025/JUL/EIMTG/01 (Bergh et al. 2025), as well as of any published refutations and responses to those papers, where applicable. The papers were:

i. Smith et al. (2011). Impacts of Fishing Low-Trophic Level Species on Marine Ecosystems (summarised by Bergh).

The paper reported on the results of applying three different ecosystem modelling techniques (EwE, OSMOSE, Atlantis) to 5 ecosystems with different numbers of species groups in each case.

The result most relevant to the MSC standard is the tradeoff between yield and impacts on other ecological groups as the fishing mortality on LTL stocks, and hence their level of depletion, increases (Figure 2). Those tradeoffs form the scientific basis for the MSC default standard of 75% of B_0.

ii. Pikitch et al. (2012), the Lenfest Report. Little Fish, Big Impact: Managing a Crucial Link in Ocean Food Webs (summarised by Cochrane).

The report used 72 Ecopath models to estimate the importance of forage fish to marine ecosystems. It covered a wide range of management options and their ecological and economic consequences. Of interest to the EIMTG was the overall recommendation that management of fisheries for forage fish should be based on the "Dependent Predator Performance Criterion". The criterion requires adoption of harvest strategies and management measures in order to ensure that there is a greater than 95 percent chance that fishing on forage fish will not deplete any dependent predator population to levels that would meet the IUCN "vulnerable" criteria.

The IUCN criterion is that a population is classified as vulnerable to extinction if it has declined by 50 percent or more in the previous 10 years or three generations, whichever is longer.

iii. Cury et al. (2011). Global seabird response to forage fish depletion--one-third for the birds (summarised by McInnes).

The research reported in the paper used data from 14 seabird species and concurrent prey abundance data from seven ecosystems. The results showed a consistent threshold in prey abundance below which seabird breeding success declines appreciably and becomes more variable; the average threshold across all species equates to one third of maximum recorded biomass of forage fish species. This paper is discussed further in Section 5 “Information from other seabird-fisheries interaction studies”.

iv. Hilborn et al. (2017). “When does fishing forage species affect their predators” (summarised by Butterworth).

The paper, in principle, addresses existing analyses of trophic models in general, but focusses heavily on the “Lenfest” analyses by Pikitch et al. (2012). It identifies four important factors that, the authors argue, if ignored will tend to result in exaggeration by trophic models of the impacts of fishing forage fish on their predators. The four factors are: the high level of natural variability of forage fish; the weak relationship between forage fish spawning stock size and recruitment, and the role of environmental productivity regimes; the size distribution of forage fish, their predators and subsequent size selective predation; and the changes in spatial distribution of forage fish as they influence the reproductive successes of predators.

v. Free et al. (2021). Evaluating impacts of forage fish abundance on marine predators (summarised by Cochrane).

Free et al. (2021) used prey-linked population models to estimate the impact of abundance of forage fish on the population growth rates of 45 marine predator populations. Their overall conclusion was that their analyses indicated that extra-precautionary limitations on the harvest levels of forage fish to maintain biomass well above MSY levels would rarely lead to detectable increases in the populations of marine predators. In the case of seabird and marine mammal populations, they suggested that spatio-temporal controls around breeding sites would be more likely to lead to higher predator populations than management aimed at higher prey abundance as a whole.

<u>c) Discussions on the Lenfest Report in Relation to Management of South Africa’s LTL Stocks</u>

Butterworth (2025) commented on the use of the IUCN “vulnerable” criterion as the basis of the Lenfest Report recommendations on application of the “Dependent Predator Performance Criterion” (Pikitch et al., 2012). He argued that the threshold of 50% of Bo is too stringent and, for example, would require suspension of fishing on many of SA’s fish populations (including hake), despite these not being considered to be under any serious threat from present fishing levels. He suggested that the Lenfest recommendations would need to be revised to correspond to a less stringent criterion if considered for local application.

In discussion by the EIMTG, it was noted that that criterion was intended to apply only to ‘dependent’ predators, with the definition of ‘dependent’ given in the Lenfest report. In addition, Lenfest considers the impact of fishing the prey on those dependent species (not the direct impacts of fishing the dependent species). Further discussion on which species would qualify as dependent predators and whether the IUCN vulnerable criteria would be too strict would be required if application of the

Lenfest recommendations was to be considered. Thus, the TG agreed that the proposal in doc 09 is moot at this time.

d) Potential Application of the Smith et al. tradeoff to South Africa's LTL Stocks.

Three documents were submitted by Bergh on the application of the Smith et al. (2011) results to the local LTL stocks.

The first of those, Bergh (2025a), superimposed a typical sardine-like yield curve on the Smith et al. (2011) graph that was designed to achieve, as for Smith et al. (2011), a B_{MSY}/K of about 37% (Figure 3). The document noted that the two curves have different shapes, with the Smith et al. (2011) curve being much more "flat-topped", and it was suggested that this raises comparability issues. It was pointed out, as an example, that the loss of yield at B/B_0 = 75% for that 'conventional' single-species sardine model was double (~40%) that shown in the Smith et al. (2011) graph.

Bergh therefore argued that either the trade-off recommended by Smith et al. (2011) must be revisited in the context of a single-species sardine population model, or the single-species model needs to be revised to conform to the shape of the curve in Smith et al.

Bergh (2025b) noted that the slope of the predator population response to depletion of the prey biomass in Smith et al. cannot be exported to other population models. He therefore concluded that it would be better to examine how to revise single-species sardine population models to conform to the behaviour shown in Figure 4 of Smith et al., and then to apply the Smith et al (2011) trade-off suggestion directly.

Bergh (2025c) suggested that changing the natural mortalities in a single-species sardine population model could be used in order to develop a model that conforms to the shape of the sustainable yield vs biomass curve presented by Smith et al (2011). The document presented a method for achieving that and demonstrated the extent to which natural mortality must be adjusted to achieve the main features of the results in Smith et al (2011).

In subsequent discussions, a caution was noted that the Smith et al. curve is derived from a meta-analysis across 11 species groups, and equivalent curves for individual species may differ from that general curve.

The following suggestion was raised to explore this approach further, if time permits:

a) Proceed to incorporate natural mortality dependence on biomass into the OM. To discuss with the TTG if SDD1 or SDD2 (doc FISHERIES/2025/SEP/SWG-PEL/49, or further alternatives) should remain a 'key' robustness test or part of a reference set of OMs.

b) Bergh to produce further results for lower h values closer to that estimated for RSA sardine, e.g. h=0.5 and h=0.3.

c) Test alternative OMs allowing for density dependent M at high B in addition to at low B. This may need to be achieved by using suitable priors for the relationship between natural mortality and biomass.

d) The capability to check the SY vs B relationship should be developed to ascertain conformity with the shape of Figure 4 of Smith et al (2011). This requires further discussion.

e) It might be easier to first check the workability of the method for anchovy, but aim for application to sardine later as part of the OMP revision.

This issue was referred to the SP-SWG and TTG for further consideration..

4. *Ecosystem Models and Modelling*

At the request of the EIMTG, Ortega-Cisneros and Shannon (2025) presented summaries of two papers on ecosystem modelling that incorporate the role of anchovy and sardine in the southern Benguela.

Ortega-Cisneros et al. (2018), "Evaluating the effects of climate change in the southern Benguela upwelling system using the Atlantis modelling framework", evaluated the individual and combined effects of climate change (warming) and fishing on the southern Benguela upwelling system using the Atlantis on the Benguela and Agulhas Currents (ABACuS) v2 end-to-end model under Representative Concentration Pathways (RCP) 2.6 (low emission) and 8.5 (high emission). The results indicate consistent negative effects of warming across most species and groups. Similarly, the combined effect of fishing and warming resulted in biomass decreases for all model species and groups, except for cephalopods, under both emission scenarios.

Shannon et al. (2020) "Exploring Temporal Variability in the Southern Benguela Ecosystem Over the Past Four Decades Using a Time-Dynamic Ecosystem Model" reported on the development of a new and updated model for the Southern Benguela, using time series from 1978-2015. Applying this model, sardine interactions with prey and predators were consistently found to be sensitive interactions in model fitting, accounting for at least 40% of the most sensitive trophic interactions in the modelled food web. Model fits to data were substantially improved when upwelling effects on large phytoplankton availability to zooplankton and small pelagic fish were incorporated, geographic shifts in sardine distribution were captured by means of altered availability of sardine to predators, corresponding vulnerabilities of prey to predators were estimated, and an additional, small, hypothetical forcing function was fitted to small phytoplankton production. African penguin and Cape gannet fits to data series were improved by incorporating a recently published bird Food Availability Index, although model fits of several fish groups then deteriorated, emphasising the need for additional empirical species-specific functional response studies.

Ortega-Cisneros and Shannon (2025) also reported on further work on ecosystem modelling that is currently underway. This includes a more detailed inspection of predator-prey dynamics in the Southern Benguela by improving the model fitting using newly available environmental layers from earth system models, and refined, locally-tuned environmental response functions (temperatures and oxygen). Simultaneously, spatially dynamic Ecospace modelling has been undertaken to improve the fit of the Southern Benguela Ecosim model to historical catch and abundance time series by capturing spatial trophodynamics and historical environmental conditions. These models will be used to explore the potential ecosystem dynamics of the Southern Benguela under projected (future) climate change scenarios.

The EIMTG agreed that ecosystem modelling could potentially provide valuable information on appropriate harvest levels for small pelagics in the longer-term. This would be considered in the new year.

5. Information from other seabird-fisheries interaction studies

McInnes at al. (2025) presented a preliminary review of scientific literature that considers the ecological needs of seabirds and other marine predators that feed on forage fish including small pelagics and krill. The papers covered were:

- Cury et al. (2011). Global seabird response to forage fish depletion--one-third for the birds;

- Hill et al. (2020). Reference points for predators will progress ecosystem-based management of fisheries;
- Koehn et al. (2021). A structured seabird population model reveals how alternative forage fish control rules benefit seabirds and fisheries;
- Hentati-Sundberg et al. (2021). A mechanistic framework to inform the spatial management of conflicting fisheries and top predators.
- Constable et al. (2023). A dynamic framework for assessing and managing risks to ecosystems from fisheries: demonstration for conserving the krill-based food web in Antarctica.
- Trathan. (2023). What is needed to implement a sustainable expansion of the Antarctic krill fishery in the Southern Ocean?

The document provided a short summary of the context, methods and major findings of each paper as well as the relevance of these findings to the management of the South African small pelagic fishery. It also included a comparative summary of key components of each study, included here as Table 1.

In discussions, a request was made that ecosystem reference points are incorporated directly into the harvest control rules for sardine and anchovy, but it was suggested that those could be incorporated into the performance statistics. It was also noted that incorporation of ecosystem reference points in the performance statistics is already being considered for the sardine-anchovy MSE.

6. Examples of management approaches used in fisheries on LTL species from other regions that have been certified by MSC.

Cochrane (2025c) presented seven examples of fisheries for key LTL species that have met the MSC standards for status of the stocks. The approaches used were grouped into three general categories

The first category was fisheries that have demonstrated adherence to the MSC defaults of a biomass target level of 75% of B_0 (SA2.2.14), or a fishing mortality of 0.5 Fmsy or lower (GSA2.2.16). Sardine caught in the Small Pelagic Fishery in Sonora, Gulf of California, was accepted as meeting the standard on the basis of the $F:F_{MSY}$ ratio being at or less than 0.5. In the Gulf of Mexico menhaden fishery, the Iberian sardine purse seine fishery and the QRILL Company Antarctic krill fishery, stock biomass was above 75% of what it would have been in the absence of fishing.

The sandeel and sprat in the DFPO, DPPO and SPFPO North Sea, Skagerrak and Kattegat sandeel, sprat and Norway pout fishery, as well as capelin caught in the ISF Iceland capelin fishery were considered key LTL species. The MSC assessment of the sprat, pout and sandeel fishery as LTL species considered the forage fish community as a whole in terms of the required standard, in contrast to assessing on a species-by-species basis. In both cases justification for meeting the LTL criterion was that predator needs are taken into account in assessment and management. However, in both cases there are some concerns about the reliability of the estimates of predator needs.

Management of the US Atlantic menhaden fishery uses ecological reference point (ERP) target and maximum threshold fishing mortalities, and a fecundity target, obtained from an EwE-based MICE, and considering impacts on striped bass, the most sensitive species to menhaden harvests.

There was discussion in the EIMTG on the potential value of looking at predator/prey interactions in the short- and long-term. To facilitate this discussion, examples were presented from the diet matrix and 1978 estimates of consumption of small pelagic species by major predators, and total consumption of the SP species, from Shannon et al. (2020).

The group agreed that more recent estimates of consumption would provide useful background information for the group in the short-term. A document is being prepared by Coetzee, Merkle and Shannon and will be presented to the next SWG-PEL meeting. That will show some results for consumption of round herring and potential impacts of increased round herring exploitation rates from a mini-update to the Shannon et al. (2020) EwE model.

There was general agreement that ecosystem modelling could potentially provide valuable information on appropriate harvest levels for small pelagics in the longer-term. From the example of the Atlantic menhaden fishery, the use of an EwE-based MICE and/or an alternative MICE for setting ecological reference points was identified as important in the South African context.

7. The Way Forward

The continued importance of taking dependent predators into account in management was stressed, with initial emphasis on seabirds.

It was agreed that, in the short-term, the Smith et al. $0.75B_0$ approach provided the best option for consideration of appropriate harvest levels for small pelagic forage fish species, with possible adjustments to M as referred to under 3 above. The argument for making use of the $0.75B_0$ target (as adopted by the MSC as a default), is that, in the current absence of a better science-based approach developed for the local fisheries and ecosystem, that option provides a default for key lower trophic level species that is used by the biggest global fisheries eco-certification programme and is widely accepted.

IWS/2025/EBFM/BG2 presents a proposal to change the natural mortalities in a single-species sardine population model to develop a model that conforms to the shape of the sustainable yield vs biomass curve recommended by Smith et al (2011), if the $0.75B_0$ target is applied.

The EIMTG agreed that the use of ecosystem modelling, particularly MICE (EwE MICE or alternative types of MICE), to help to inform selection of reference points for the local small pelagic fisheries should be considered in the longer-term. It was suggested that work on the use of ecosystem models should start next year and that it should be conducted under the auspices of the EIMTG, or an equivalent group, rather than through the TTG or directly under the SWG.

Some initial thoughts on the potential use of MICE for informing targets or thresholds for harvest rates (or other management indicators) to take into account impacts on predators of fishing on small pelagics are presented in IWS/2025/EBFM/BG3.

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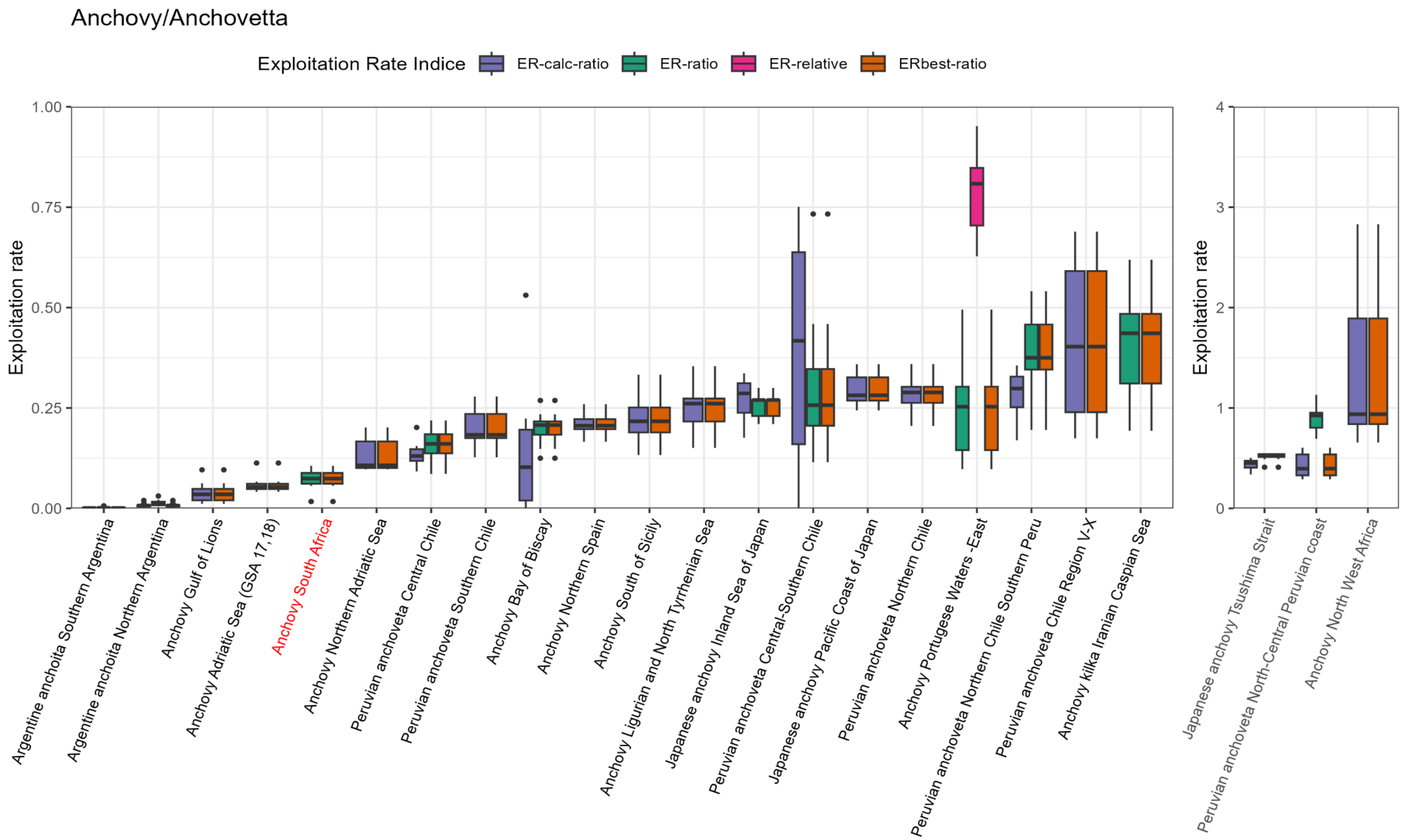
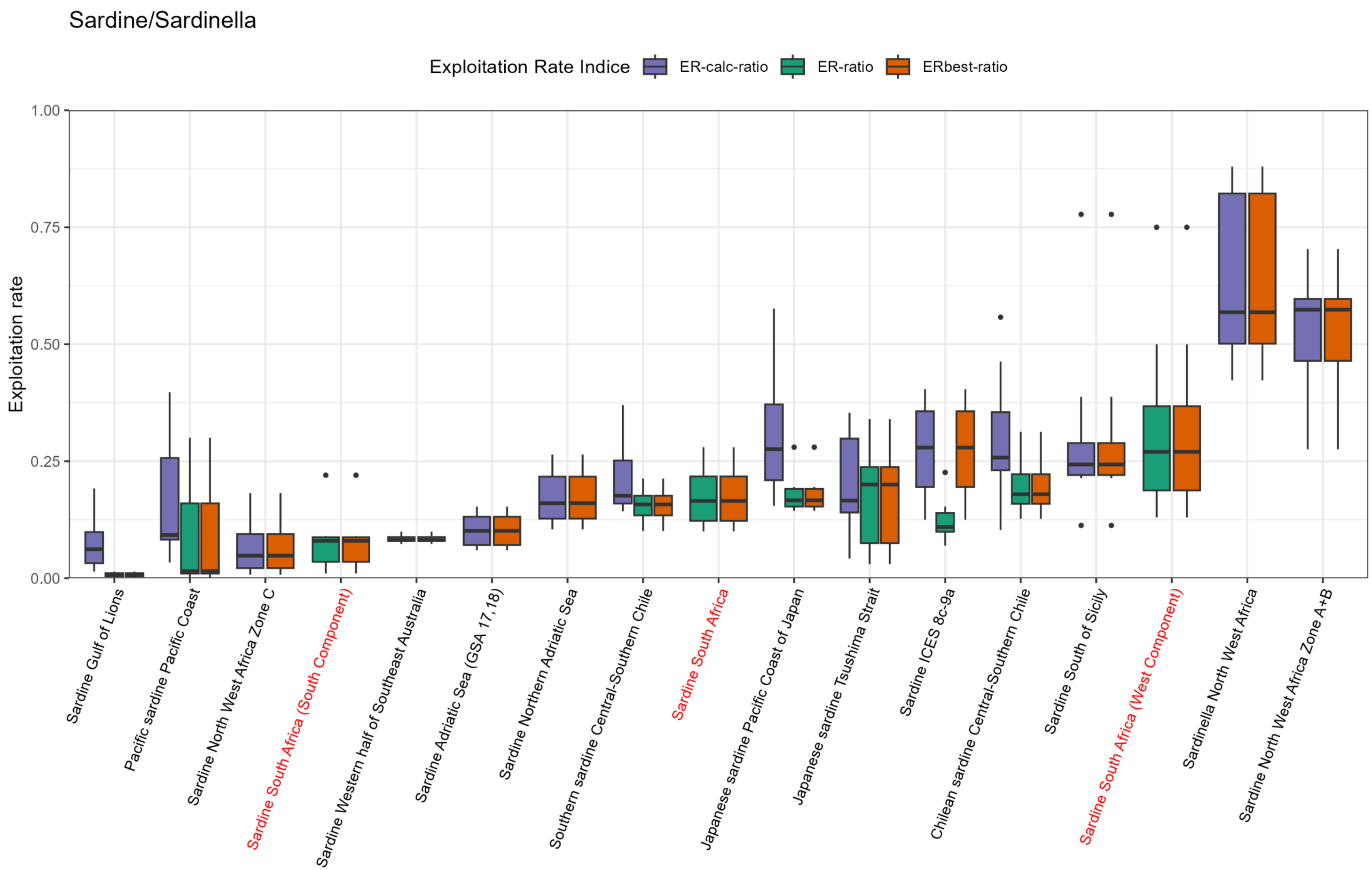


Figure 1. Exploitation rates of small pelagic stocks captured in the RAM legacy database (from Bergh and Horton, 2025c).



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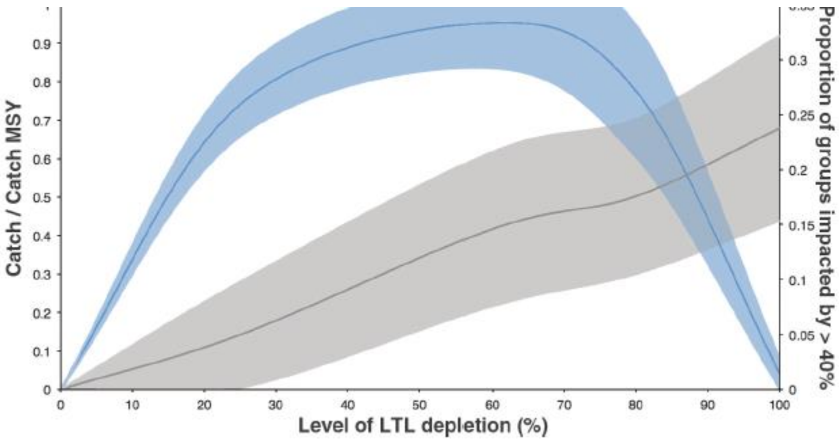

Figure 2. Results from Smith et al. (2011). The trade-off between yield (proportion of MSY) and ecological impact (proportion of other ecological groups whose biomass varies by more than 40%) as level of LTL depletion varies.

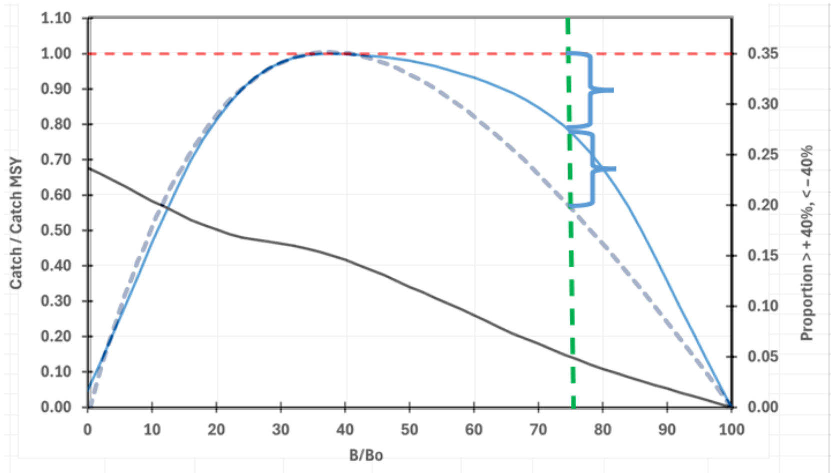

Figure 3. Plots of catch/MSY and % species groups impacted by more than 40% vs the biomass as a proportion of the unexploited biomass B_0. Blue dashed line is for a conventional sardine model, other lines as in Smith et al. (Bergh, 2025a).

Table 1. Key components of preliminary scientific literature review on fisheries management considerations for seabirds and their relevance to the Benguela Upwelling Ecosystem (BUE) (McInnes et al., 2025).

Reference	Predator		Prey type	Relationship affected	Fisheries Management Application	Score				Notes
	species	specialist/ generalist				Pred./ prey	Relat. affected	Fisheries mgmt relevance	Final	
Cury et al. 2011	African Penguin, Cape Gannet	specialist	anchovy, sardine	breeding success, foraging ecology	threshold of 1/3 of historical maximum combined anchovy, sardine	2	1	2	5	What are the arguments for and against using historical maxima?
Koehn et al. 2021	Generic seabird types based on life-history traits	both	anchovy, sardine	survival, breeding success	recommends moderate cutoff Harvest Control Rule	2	2	1	5	Uncertain if FMSY is tranferable to SA OMP context - if so can we simulate scenarios under proposed HCR?
Hentati-Sundberg et al. 2021	Common Guillemot, Razorbills	specialist/generalist	sprat, herring	breeding success, foraging ecology	threshold of 1/3 of historical maximum combined sprat, herring; B_{MSY}; fine-scale spatial management close to colonies	1	1	1	3	How comparable is the North Sea system (sprat and herring) to the Benguela Upwelling system? Is managing biomass at BMSY valid for sardine and anchovy?
Hill et al. 2020	6 case studies, including African Penguin	both	one case study looked at sardine	N/A examined whether feedback loops in management of fisheries used predator data	predator (limit) reference points	2	0	1	3	Are predator limit reference points implementable in the OMP? Provides overarching/theoretical principles with little practical guidance on how to change fisheries management.
Constable et al. 2023	Baleen whales, Adelie penguins, macaroni penguins, antarctic fur seals.	both	krill	prey availability	biomass allocated to fishing is influenced by the number of predators in an area that depend on it; framework designed to categorise risk across regions and then spread fishing impact based on dependent predators	1	2	2	5	Relationship score assumes survival is taken into account. Fisheries relevance score is assuming that we can spread fishing impact spatially across a finer scale.
Trathan 2023	Various marine predators dependent on Krill	both	krill		1. Integrate predator monitoring into performance indicators. 2. Ensure fishing effort does not undermine food availability for seabirds and other predators. 3. Agree on measurable performance indicators and associated ecological thresholds in advance. 4. Link thresholds to clear management responses (e.g., TAC reduction if seabird breeding success declines). 5. Apply the precautionary principle when uncertainty is high.	1	0	2	3	Guidelines are valid for any fisheries, but how are they implemented in our OMP? WG should agree on guidelines in the new OMP. Decision support framework?

Score system. **Predator/prey**: 1 – partially relevant to BUE, 2 – both predator and prey relevant to BUE; **Relationship affected**: 0 – not applicable, 1 – breeding parameters but no survival, 2 – survival included; **Fisheries management relevance**: 1 – partial precedent exists in OMP but uncertain if transferable, 2 - existing precedent exists in OMP.

Appendix A: Documents Prepared as Background for Task Group Discussions

Bergh, M. 2025a. Short and medium term actions for the EIMTG to consider in response to the Smith et al. (2011) suggested B/B0 target of 75%. FISHERIES/2025/SEP/EIMTG/10.

Bergh, M. 2025b. The feasibility of applying Smith et al's (2011) trade-off suggestion to a conventional sardine population model. FISHERIES/2025/SEP/EIMTG/11.

Bergh, M. 2025. Varying natural mortality to obtain SY:B relationships which are consistent with Smith et al. (2011). FISHERIES/2025/SEP/EIMTG/13.

Bergh, M., Butterworth, D.S., Cochrane, K.L. and McInnes, A. 2025. Parts A – D: Summaries of Selected Papers on Management of Low Trophic Level Species. FISHERIES/2025/JUL/EIMTG/01.

Bergh, M. and Horton, M. 2025a. Management related information extracted from the RAM legacy database for small pelagic stocks – submitted to the EIMTG. FISHERIES/2025/JUL/EIMTG/06.

Bergh, M. and Horton, M. 2025b. Description of available time series records for small-pelagic fish stocks in the RAM Legacy database. FISHERIES/2025/SEP/EIMTG/07.

Bergh, M. and Horton, M. 2025c. A summary of exploitation rate information available from the RAM Legacy Database for small pelagic fish stocks. FISHERIES/2025/OCT/EIMTG/12.

Butterworth, D.S. 2025. On the possible implementation of the recommendations of the Lenfest report. FISHERIES/2025/JUL/EIMTG/09.

Cochrane, K.L. 2025a. Key points from FISHERIES/2022/JUN/SWG-PEL/15-rev "Considerations for Reference Points for Setting TACs for Small Pelagic Species, Including General Ecosystem Requirements". FISHERIES/2025/JUL/EIMTG/02.

Cochrane, K.L. 2025b. The Basis of the MSC Standard for Lower Trophic Level Species. FISHERIES/2025/JUL/EIMTG/03.

Cochrane, K.L. 2025c. MSC Certified Fisheries on key LTL Species: Examples of how Requirements of SA2.2.14 or GSA2.2.16 are Met. FISHERIES/2025/SEP/EIMTG/08.

McInnes, A., Hagen, C. and P. Faure. 2025. Preliminary review of scientific literature that considers prey requirements of seabirds and other predators in fisheries management. FISHERIES/2025/JUL/EIMTG/05-rev.

Ortega-Cisneros, K. and Shannon, L.J. 2025. Summaries of Selected Papers on South African Ecosystem Models Incorporating Small Pelagic Species. FISHERIES/2025/Sep/EIMTG/04.