Key questions to the panel on approaches to setting harvest levels for low trophic level species that take account of the needs of dependent predators and the wider ecosystem

A challenge in the management of South Africa's fisheries for small pelagic species, is how to achieve the potentially conflicting objectives of sustainable use and protecting biodiversity in practice. This is an important and sensitive question, marked by ongoing debates and uncertainties over the extent of impacts of fishing for anchovy and sardine on seabirds, African penguin in particular. The naturally high inter-annual variability in both species compounds the difficulties.

The questions to the panel can be split into three parts.

a) Use of the Smith et al. recommendation of 75% of B_0

i. In recent years, in the absence of a multi-species strategy developed for these fisheries, the default standard used by the MSC of a target biomass of $0.75B_0$ has been actively applied for sardine. Less attention has been given to anchovy because of the lower harvest rates for that species. However, questions have been raised as to whether it is appropriate to apply the Smith et al. curve, which was derived from ecosystem models, to output from a single-species, age-structured model (Doc. IWS/2025/EBFM/P2). One option would be to modify the currently applied single-species models to be consistent with the shape of the Smith et al. curve. The panel is asked to comment on this option. In particular, should local anchovy/sardine stock models be adjusted in the manner proposed in IWS/2025/EBFM/P2 in order to achieve consistency with Smith et al.'s (2011) 75%/20% trade-off suggestion?

ii. The stock assessment and operating models for anchovy and sardine used at present assume constant natural mortality rates, while the approach proposed by Bergh to getting a sustainable yield curve to follow a similar shape to that of Smith et al. requires natural mortality M to increase at high biomasses B. Is this possibility falsified if the single-species assessment provides an estimated M vs B relationship which is not statistically compatible with such an increase?

iii. If the Panel considers that modification of the sustainable yield curve by allowing for variable M would not be appropriate, an alternative could be to re-evaluate the trade-off between impacts on yield and on depletion of predators suggested by Smith et al (2011) under local conditions? Would that be a reasonable option and, if so, what is the recommended approach given limitations in local capacity to run ecosystem model scenarios in the short to medium term?

b) Development and application of a model, or models, of intermediate complexity for ecosystem assessments (MICE).

iv) After reviewing a number of different approaches, the SWG is of the opinion that the use of ecosystem modelling, particularly MICE, would be the best option in the longer-term. The design of a MICE requires addressing a number of questions. The important role of anchovy and sardine in the Southern Benguela, including for seabirds and some line fish species, is clear (see EBFM/P3, Table 1) but that of redeye is less so. From the information available in EBFM/P3 and BG2, should redeye be included in a MICE as a key LTL species that needs to be managed more conservatively than would otherwise be the case?

v) Different structures have been used for MICE developed for management purposes. Should preference be given to any particular type of MICE for statistical or other reasons, e.g. a population dynamics model, EwE form, or some other approach? Would there be value in developing more than one kind (if the capacity is available)?

vi) A spatially structured model would allow for some simulation of the spatial structure of predators and prey in the Southern Benguela but available capacity, in particular, could be

limiting. Does the panel have any comments on an approach to determining an optimal spatial structure and the trade-offs involved?

vii) By design, MICE limit the number of species included to those considered to have the most important interactions with the target species. Is there an optimal number of predator species that should be included, or an optimal range? Can any guidance be given on criteria for deciding on how many and which species should be included?

c) *Are there other, better options?*

viii) A number of different approaches have been considered for setting appropriate harvest levels (IWS/2025/EBFM/BG1), but the two described above have been identified as the best options for the present (the Smith et al. curve) and the future (MICE - when they can be developed and implemented). Does the panel have any suggestions for alternative approaches that would be feasible in the local context and potentially more reliable than these two?