

A proposed structured framework for providing scientific advice on possible responses to the decline in the numbers of African penguins

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SUMMARY

Legislation alone provides insufficient operational guidance to yield an unambiguous outcome for scientific advice on a management response to the current decline in penguin abundance. Decisions will require trade-off choices to be made by decision makers, who will need soundly-based scientific information, provided in a format that is well-structured and readily comprehensible, to assist in making those decisions. A Risk Analysis approach is proposed for this, whereby the consequences of combinations of alternative hypotheses for the penguin decline and possible management responses are compared within a matrix framework. The responsibilities of scientists in providing the information for inclusion in such a matrix are set out.

Keywords: decline hypothesis, penguin, risk analysis, scientific advice, trade-off

Introduction

Fisheries science is inexact, so that there can be room for legitimate differences of scientific views on some (though not all) issues. This can lead to obvious difficulties when decision makers seek scientific advice on matters where there are such different views, and these views have differing implications for what is the most appropriate management response to a problematic situation – specifically here the serious decline in numbers of African penguins.

Legislation generally offers little by way of specific assistance in such circumstances. Such policy documents (e.g. Acts of Parliament) generally indicate only broad intents, which in isolation are insufficient to help at the implementation level. At that level quantitative trade-offs and associated decisions become needed, and consequently much greater specificity is required, i.e. operational definitions are needed. The following Acts have been suggested as of relevance to the issue of the penguin decline: the National Environmental Management Act (NEMA), the Marine Living Resources Act (MLRA), the National Environmental Management: Biodiversity Act, the Marine Spatial Planning Act, National Environmental Management: Protected Areas Act as well as the National Environmental Management: Integrated Coastal Management Act. Certainly, concepts listed in these Acts have pertinence, but the Acts themselves do not offer definitions of such concepts at the operational level which is needed to guide specific recommendations. For example, the Precautionary Approach (set out in the 1992 Rio Declaration) is required to be applied under a number of these Acts, but the associated statement in the Rio Declaration recognizes that such applications will involve trade-offs (measures are to be “cost-effective”), so that possible applications will generally first require appropriate analyses.

Thus, for example, while circumstances may sometimes be sufficiently clear as to make it self-evident that a Precautionary Approach is **not** being followed, this is already not the case in this penguin situation: areas around most of the major breeding colonies have been closed to pelagic fishing for 50% of the time for more than a decade in what is obviously, *inter alia*, a precautionary measure. The real question, therefore, is different: **Is that “precautionary enough”?** Absence of local operational guidance on this would, however, not be that surprising, as the quantitative guidelines which answering this question requires are scarcely specified anywhere worldwide.

The Minister is reported to have requested that scientific advice on this matter be grounded in the management principles of the promotion of conservation, sustainable use of natural resources, and the precautionary principle. As pointed out above though, none of these (either separately or together) prescribe a unique outcome, particularly in the absences of operational definitions. Trade-offs need to be made. Ultimately such trade-off choices are the responsibility of decision makers – finally the Minister in this instance. The responsibility of scientists is to provide the soundly-based scientific information needed to inform such trade-off decisions in a structured and readily comprehensible manner.

Risk Analysis – a structured framework for scientific advice

The penguin situation above is not unique in fisheries science and management, and there is already a widely-advocated structured framework available to address it, which is usually referred to as “Risk Analysis”. It consists of the preparation of a matrix as illustrated in the simple example below:

		Alternative hypotheses		Probability weighted consequences
		Hypothesis 1	Hypothesis 2	
	Probabilities	$p(H1)$	$p(H2)$	
Alternative Management Responses	Response 1	<i>Consequences(R1,H1)</i>	<i>Consequences(R1,H2)</i>	<i>Weighted consequences(R1)</i>
	Response 2	<i>Consequences(R2,H1)</i>	<i>Consequences(R2,H2)</i>	<i>Weighted consequences(R2)</i>

Naturally there can be more than two hypotheses and more than two possible management responses. For example, for the penguin situation, one might include (where these possibilities are stated only in brief here):

Hypotheses (see also Butterworth, 2021)

- H1: Forage food shortage has caused some or all of the penguin decline
H2: Fishing in the neighbourhood of breeding colonies has caused some or all of the penguin decline
H3: Loss of optimal nesting habitat has caused some or all of the penguin decline
H4: Competition with an increased seal population has caused some or all of the penguin decline

Possible Management Responses

- R1: No action
R2: Reduce pelagic fishing TACs by x%
R3: Close neighbourhoods around some or all penguin colonies to pelagic fishing
R4: Provide more suitable nesting sites
R5: Cull y% of the seal population

Consequences

Each cell in the matrix needs to be completed to give best quantitative estimates of the consequences (some positive, some negative) for the key entities involved, including:

- The penguin population in the future
- Seals
- The fishing industry
- Tourism

Scientists' responsibilities

In constructing this matrix, scientists have certain specific responsibilities:

- 1) Spelling out the key alternative Hypotheses (for the causes of the penguin decline) in detail.
- 2) Listing clearly the possible alternative management responses to be evaluated (aided by inputs from stakeholders and managers).
- 3) Evaluating entries for the Consequences cells of the matrix. These must be based on sound quantitative analyses, which should ideally be independently peer-reviewed.
- 4) Evaluating probabilities for the different hypotheses listed, based on quantitative analyses (see also Butterworth, 2021). It is possible here that different groups of scientists may reach different conclusions through the use of different (but still defensible) analyses. Furthermore, for the associated weighting process, an alternative matrix may need development where the different hypotheses are listed/combined in manner that each excludes any one of the others, so that the probabilities given sum to 1.

Reference

Butterworth, DS. 2021. The Penguin decline – where should most analysis effort *really* be focused? DEFF document FISHERIES/2021/MAR/SWG-PEL/10. 4 pp.