IN THE HIGH COURT OF SOUTH AFRICA
GAUTENG DIVISION, PRETORIA

Case No: 2024-029857

In the matter between:

BIRDLIFE SOUTH AFRICA	First Applicant
SOUTH AFRICAN FOUNDATION FOR THE CONSERVATION OF COASTAL BIRDS	Second Applicant

and

THE MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT	First Respondent
THE DEPUTY DIRECTOR-GENERAL: FISHERIES MANAGEMENT, DEPARTMENT OF FORESTRY, FISHERIES AND THE ENVIRONMENT	Second Respondent
THE DEPUTY DIRECTOR-GENERAL: OCEANS AND COASTS, DEPARTMENT OF FORESTRY, FISHERIES AND THE ENVIRONMENT	Third Respondent
THE SOUTH AFRICAN PELAGIC FISHING INDUSTRY ASSOCIATION	Fourth Respondent
EASTERN CAPE PELAGIC ASSOCIATION	Fifth Respondent

FOURTH AND FIFTH RESPONDENTS' ANSWERING AFFIDAVIT

S.S.

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I, the undersigned

MICHAEL COPELAND

do hereby make oath and state that:

1. I am the Chairperson of the South African Pelagic Fishing Industry Association ("**SAPFIA**") and am duly authorised to depose to this answering affidavit on behalf of SAPFIA.

2. The answering affidavit is delivered on behalf of both SAPFIA and the Fifth Respondent ("**the ECPA**"), and is accompanied by the confirmatory and supporting affidavit of Mr Redah de Maine on behalf of the ECPA. I shall refer to SAPFIA and the ECPA collectively as "**the Industry Respondents**".

3. The expert affidavit of Dr Michael Olaf Bergh of OLSPS Marine ("**Dr Bergh**") also accompanies this answering affidavit.

4. The facts stated in this affidavit are true and correct and fall within my personal knowledge unless otherwise apparent from the context.

INTRODUCTION AND OVERVIEW

5. The Applicants have brought an application for judicial review in terms of the Promotion of Administrative Justice Act, 2000 ("**PAJA**"), alternatively the principle of legality, against a decision taken by the First Respondent ("**the Minister**") on 23 July 2023.

6. There are areas adjacent to six of the islands off the South African coast where African penguins[1] breed which are currently closed to small pelagic fishing, as a measure to conserve the penguins. The closures are referred to as "island closures" or "fishing area closures". The current island closures have been in place since September 2022, and their duration was extended when the Minister made the decision of 23 July 2023 ("**the Interim Closures**").

7. The Applicants ask that the Court review and set aside the Minister's decision, and that the Court substitutes the Minister's decision by, instead of the Interim Closures, imposing differently delineated and greater extents of island closures adjacent to those six islands in accordance with maps attached to the amended notice of motion,[2] as proposed by the Applicants, for a ten-year period, subject to review after six years ("**the Applicants' proposed closures**").

8. The Minister's decision was taken following a report by an International Review Panel of Experts which had been appointed by the Minister in 2022 to advise on proposed fishing area closures ("**the Panel**").

9. Given the decline of the numbers of adult penguins, in 2008, a study was initiated to assess the effects of closing areas off the breeding colonies to pelagic fishing (the Island Closure Experiment ("**ICE**")), so as to reduce competition for food between penguins and fishers.[3]

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[1] Any reference to penguins in this affidavit are to African penguins.

[2] Prayer 3 of the amended notice of motion record p.2 and annexure "1" to the amended notice of motion record p.8 (the maps for each island).

[3] The ICE was initiated in 2008. It involved four important breeding sites, namely Dassen Island and Robben Island on the west coast, and St Croix and Bird Island in Algoa Bay. It involved an opening and closing regime of two paired islands (Dassen/Robben and St Croix/Bird) designed to optimise the outcome of the experiment. The alternating opening and closing regimes around the islands effectively closed the islands to purse seine fishing for 50% of the time within a 20km radius around the islands.

10. After completion of the ICE in 2019, there was scientific debate and disagreement about interpretation of the ICE results. Various processes were established, namely a Governance Forum, Extended Task Team and the Consultative Advisory Forum, to consider island closures. The interpretation of the ICE results and the recommendations for the basis of fishing area closures remained contested. Hence, as proposed by both the conservation sector and the pelagic fishing industry sector, the Minister appointed the Panel.

11. The key terms of reference for the Panel included (i) reviewing and interpreting whether the ICE results indicates a benefit to penguins from fishing area closures (ii) assessing the merits of different proposed methods to delineate important penguin foraging habitat; (iii) if there is a benefit to penguins from island closures, recommending a "trade-off mechanism" between benefits to penguins, on the one hand, and economic costs to the pelagic fishery and the economy, on the other hand, and (iv) to make recommendations on specific island closures, with delineations and maps, per island.

12. The executive summary of the Panel report includes the following important findings:-

    12.1 The ICE has been successful in demonstrating for the west colonies of Dassen and Robben Islands that excluding fishing around island breeding colonies is likely to reduce the rate of decline in the penguin population to a small extent;

    12.2 Closure of purse-seine (pelagic) fisheries around penguin colonies will provide only a small part of the measures required to slow or reverse the population decline of the African penguins;

12.3 There is a trade-off between the benefits to penguins, on the one hand, and the economic cost to the pelagic fishing industry and the economy, on the other, in deciding whether to impose island closures and, if so, the delineations of any such closures. A trade-off decision is a policy matter.

12.4 The Panel report outlines some aspects that could form part of a decision-making framework to identify island closure options that could provide an acceptable trade-off between benefits to penguins and costs to the pelagic fishing industry;

12.5 Ongoing attempts at consensus closure options among the pelagic fishing and conservation sectors are encouraged.

13. The crux of the Applicants' case is that:-

13.1 the Panel recommended (i) that island closures are an appropriate conservation measure (ii) that the appropriate method for delineating important penguin foraging habit is the so-called "mIBA-ARS" (Marine Important Bird Area – Area Restricted Search) and (iii) an appropriate trade-off mechanism to be used by the Minister when deciding which particular delineation of island closures to impose around each breeding colony.

13.2 the Minister's decision is irrational because the Minister accepted the Panel's recommendation that island closures are a meaningful conservation intervention, but then ignored the recommendations in respect of mIBA-ARS and the Panel's trade-off mechanism, and relied, instead, on consensus being reached between the conservation and pelagic industry sectors on island closures, failing which the Interim Closures would be extended for ten years, with a review period after 6 years.

13.3 the Minister's decision is otherwise unlawful and unconstitutional because it breaches various legal provisions.

14. However, the Applicants' case has numerous fundamental flaws.

15. First, it is premised on an incorrect interpretation of the Panel report.

15.1 As a starting point, the Panel simply did not make the recommendations that the Applicants rely upon. The Panel ultimately did not deliver on all the aspects in the Terms of Reference. It also did not recommend that island closures must be imposed, and it certainly did not provide delineations and maps for island closures.

15.2 The Applicants ignore that the Panel found that the benefits of island closures are small, that island closures alone will not halt the decline of the penguin population, and that other drivers of the penguin decline must be researched and mitigated.

15.3 Furthermore, the Panel report simply did not provide a complete framework for decision-making about island closures. Although gains were made by the Panel in settling some of the scientific debates, the Panel report did not place the Minister in a position to yet determine penguins' core foraging areas and to take a trade-off decision.

15.4 To the extent that the Panel made "recommendations" in respect of methods to determine penguins' core foraging areas, and to take a trade-off decision, it found that further research and data gathering would be required in order to take forward the aspects identified in the Panel's report. Importantly,:-

15.4.1 Although the Panel did find that analyses delineating mIBA-ARS represent the best scientific basis for delineating the core area of

foraging habits of the penguin during breeding, it also found that mIBA-ARS should first be validated by means of dive data before being used in trade-off analyses to provide objective identification of foraging locations of penguins, rather than commuting or travelling locations. As Dr Bergh explains in his expert affidavit, to be consistent with the Panel's recommendations, it is essential to use dive data in the calculation of the mIBA-ARS areas.

15.4.2 Contrary to the Applicants' case, the Panel did not specify the details of trade-off analysis approaches that should be used, and a methodology for a trade-off decision therefore still needs to be developed.

15.4.3 Further data gathering is required for purposes of the Opportunity Based Model (OBM), which produces estimates of the loss of catch as a result of different island closures, and which is then used to estimate economic loss to the pelagic fishing industry and the economy.

16. Second, in the light of the Panel's report and the available scientific knowledge, it was rational for the Minister to extend the Interim Closures (which had been in place since September 2022) for at least the following reasons.

16.1 The Panel's report did not put the Minister in a position in June 2023, to make a determination of new delineations for closure areas. On the contrary, the Panel report explained what more needed to be done before new closure areas could be determined.

16.2 The Minister's decision allowed for consensus not in abdication of her responsibility, but in recognition that the Panel's report did not equip her to

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finally determine new closure areas. So, she provided a further opportunity for the two main interest groups to find consensus about new delineations of the closure areas. If that could be achieved, then those agreed closures could be implemented. But if there was no agreement, then the Panel's proposals for further data to be collected and further research to be done, including on other causes of penguin decline, would have to take place, to enable a further review to be done in six years' time.

16.3 The Minister's decision provides for a review of the Interim Closures after six years, recognizing that further research needs to take place, including in respect of the mIBA-ARS and any trade-off mechanism, as well as in respect of other causes of the penguin decline. The Minister's decision does *not* preclude a further decision in respect of island closures being taken sooner than the six-year review period, once further research has been done.

16.4 The Interim Closures are not "meaningless" as a measure to conserve penguins. The Applicants contend that they are, because they do not correspond with the Applicants' proposed closures. But Dr Bergh has undertaken an analysis of a comparison between the Interim Closures and the Applicants' proposed closures based on areal extents of the areas. In Dr Bergh's analysis (i) the sum of the areas of the Interim Closures is 70% of the sum of the Applicants' proposed closures, and (ii) the <u>overlap</u> between the Applicants' proposed closures and the Interim Closures is between 55% and 65%. Within the limitation of using area as a proxy for benefit to penguins, Dr Bergh concludes that the Interim Closures already confer 65% of the benefit to penguins that would be conferred by the Applicants' proposed closures.

17. The Applicants have also not made out a case for the relief that they seek, including the extraordinary and far-reaching substitution relief of asking the Court to impose the Applicants' proposed closures for the following reasons.

17.1 The Panel itself found that a decision pertaining to island closures is a policy matter. Policy decisions are not the proper preserve of the courts.

17.2 Contrary to the Applicants' claims, their proposed closures are by no means uncontentious or a foregone conclusion. The premise of the Applicants' case for substitution relief is that their proposed closures are simply the result of applying what they contend are the Panel's recommendations in respect of island closures, the delineation of penguin foraging habitats, and the trade-off mechanism. But that is not the case. The Panel's report cannot just be plugged into a map drawing programme to generate new closure areas because the report, itself, recognised that much more work needs to be done to verify data and to analyse the impact of closures on the fishing industries and local communities. It is therefore not possible for this Court to substitute the Minister's decision with the Applicants' proposed island closures because those closures are scientifically unverified, contentious and incomplete.

17.3 As Dr Bergh's expert evidence shows, the Applicants' methods suffer two fatal flaws.

17.3.1 First, their own analyses of what they contend to be merely the application of the mIBA-ARS and trade-off mechanism are scientifically unreliable and cannot form the basis for decision-making about island closures.

17.3.2 Second, not all the Applicants' proposed closures (per island) are even based on their own mIBA-ARS and trade-off mechanism.

17.4 Furthermore, the economic impact of the substitution remedy on the pelagic fishing industry is eye-wateringly high. As Dr Bergh shows in his expert report, based on currently available data, the estimated direct cost to the pelagic fishing industry of the Applicants' proposed closures is R114% greater than those of the Interim Closures. This is because the direct costs of the Interim Closures to the Industry are around R90,000,000 per annum: whereas the cost of the Applicants' proposed closures is as much as around R190,000,000 per annum viz. more than double. The pelagic fishing industry will be crippled by the Applicants' proposed closures. It could therefore never be just and equitable to impose a remedy in this case that would have such a serious negative impact on the industry.

17.5 The Applicants also make no attempt to quantify the difference in benefits to penguins between the Interim Closures and their proposed closures. In other words, they ask for this Court to impose, by judicial fiat, new closure areas around six islands that are going to cost the pelagic fishing industry over a further R100 million each year (i.e. above the Interim Closures) but have not even told this Court what the actual impact of those new closures will be for penguins, when compared with the current Interim Closures. This is not an insignificant omission. The Panel found that excluding fishing around island breeding colonies is likely to reduce the rate of decline in the penguin population *only to a small extent*. The Panel's view was, therefore, that while there are some benefits from closures, those benefits are small. However, despite the benefits of closures being only small, the Applicants have made no attempt to explain to the Court what actual difference the Applicants'

proposed closures are going to make over and above the existing Interim Closures. And yet, they want the Court to impose their proposed closures, that are going to cost the industry more than R100 million annually, without any indication by the Applicants of what the actual benefit of those larger closure areas are going to be for halting the decline of the penguin population. This is a fatal omission from their founding case for substitution.

17.6 Finally, for all the reasons highlighted above, this is simply not a case in which the Court can take over the role of the Minister in navigating this scientifically complex, polycentric, and policy-laden act of balancing the concerns of the conservation sector, on the one hand, and the businesses whose future depends on fishing, on the other. That is a role to be played by the expert decision-makers within the Department, who have the unenviable task of weighing all these competing considerations.

18. For all the reasons that the Applicants' case for substitution relief is fatally flawed, their case for the interim imposition of their proposed closures, pending a remittal of the impugned decision to the Minister, is also flawed. There simply is no basis on which this Court can impose the Applicants' proposed closures around the six islands even on a temporary basis because their proposed closures are scientifically contentious, disputed and incomplete.

19. In the light of the above, the application should be dismissed, not because the impact of fishing on the declining penguin population is not important, but in order to leave the Interim Closures in place so that the necessary work can be done to obtain further data, quantify the impact on industry and local communities, and then conduct a properly informed trade-off analysis to establish the optimum area for closures that adequately balances the benefits to penguins against the damage to the pelagic fishing industry.

20. The remainder of this answering affidavit is structured as follows:

20.1 I first deal with relevant factual background, namely:-

20.1.1 information about the pelagic fishing industry in South Africa;

20.1.2 the report and findings of the Panel;

20.1.3 the Minister's decision, and events subsequent to the taking of that decision, which evidence that the interpretation and implementation of the Panel report is contested, and that further work is required to take forward the Panel's outcomes.

20.2 I then deal with the Industry Respondents' opposition to the Applicants' grounds of review.

20.3 Thereafter, I deal with the Industry Respondents' opposition to the relief sought by the Applicants, including the extraordinary and far-reaching substitutionary relief, and alternative relief of remittal subject to directions (which we contend are not capable of implementation).

20.4 Lastly, to the extent necessary, I respond to the founding papers on a paragraph-by-paragraph basis.

FACTUAL BACKGROUND

The pelagic industry

21. The small pelagic fishery sector is an industrial-scale fishery that was initiated off the West Coast in the late 1940s using purse-seine nets to target adult sardine, horse mackerel and chub mackerel. Declining catches of these species during the mid-1960s

resulted in the fishery switching to smaller meshed nets to target anchovy. This species has largely dominated landings since. A third small pelagic fish, West Coast red eye, also known as round herring, has been targeted since the 1970s. Because both sardine and round herring juveniles form mixed schools with anchovy juveniles, the former two species are taken as bycatch in anchovy fishing operations. Small quantities of the two mackerel species are currently taken as bycatches in this sector, but these are negligible compared to initial high catches.

22. The small pelagic sector is South Africa's largest in terms of catch with average annual catches of around 380 000 tonne over the period 1950–2020, of which 80% has been anchovy and sardine (directed and bycatch combined). The number of vessels actively involved in the sector has consistently declined from 95 in 2006 to 64 in 2020 and 62 in 2021.

23. Sardines are canned for human consumption and pet food, and packed and frozen for bait, with most of the canneries on the West Coast and most of the bait packing facilities on the South and East coasts. The other species (so-called 'industrial fish') are reduced to fishmeal, fish oil and fish paste in large factories mostly on the West Coast, with a recently constructed factory on the South Coast. This difference in product type means that one tonne of canned sardine is around 5 times as valuable as one tonne of industrial fish.

24. It is significant that the Total Allowable Catch (determined under the Marine Living Resources Act, 18 of 1998 annually as being the overall limit of catch) for targeted catches of sardines has increased dramatically in the last three years: 2022 : directed sardine TAC 33350 tons (with a maximum of 15350 MT of this to be caught on the West Coast), 2023: : directed sardine TAC 40500 tons (a maximum of 15500 MT of this to be caught on the West Coast) and 2024: : directed sardine TAC 65000 tons (a

maximum of 27000 MT of this to be caught on the West Coast)[4]. The amounts of juveline and adult sardine that may be caught include additional amounts which take the total allocation of sardine which may be caught in 2024 to 89 000 MT, which now includes juvenile and adult sardines and whether the sardine was caught by directed fishing or as a by-catch of fishing directed at other species. These catch allocations are based on scientific calculations which rely heavily on biannual surveys carried out at sea by DFFE using hydroacoustic techniques, and the recent increases just documented follow a marked increase in the sardine population biomass as estimated from these surveys over recent years.

25. In addition to being the largest of South Africa's fisheries, the small pelagic sector is the country's second-most important in terms of value, with an estimated wholesale catch value of R2.4 billion in 2014, and sitting at around R5.5 billion at present.

26. The sector employs approximately 5 800 people. Of these, 4 300 are employed on a permanent basis and 1 500 on a seasonal basis. 95% of workers in this sector are historically disadvantaged persons. The market value of the 62 vessels operating in this sector is about R1.1 billion (with the average vessel being worth about R17 million).

27. The sector is capital intensive, with operators having to invest in, *inter-alia*, vessels, together with processing and marketing infrastructure, and is thus not suitable for the small-scale fishing operators. In 2021, there were 26 Fish Processing Establishments (FPEs) associated with the small pelagic sector. Of these, five are large, combined fishmeal and canning plants that were owned by previous right holders, and one is a cannery-only plant not owned by a previous right holder.

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[4] The terms tons, tonnes, MT or metric tons all refer to units of 1000 kg of fish. Hence 15 MT is equivalent to 15 tons, and to 15 tonnes, and to 15000 kilograms.

28. In 2022 black ownership in the small pelagic fishing sector exceeded 95% and female participation is about 50%. The sector is therefore a rare example of a substantially internally transformed component of the economy. It is this sector, and the local communities that it supports, that is directly impacted by the island closures that are the subject matter of this review application.

The Panel

29. On 28 October 2022 the Minister published a notice in the Government *Gazette*, calling for nominations for the establishment of a Panel of Experts to Advise on proposed fishing-area closures adjacent to South Africa's African Penguin Breeding colonies and the decline in the penguin population.[5] The Panel's terms of Reference and expected scope of work were set out in the schedule to the notice ("**the TOR**").[6]

30. The TOR outlined the background to the establishment of the Panel, namely the substantial decrease in the number of adult penguins particularly in the early to mid-2000s, the establishment of the Island Closure Experiment ("**ICE**") in 2008 to assess the effects of closure to purse-seine fishing around penguin breeding colonies, and the subsequent contestations between scientists and stakeholders about the interpretation of the results of the ICE, including in the prior processes of the Governance Forum, and the Minister's Consultative Advisory Forum for Marine Living Resources.

31. The TOR specified a wide-range of objectives,[7] outcomes and recommendations.[8] Importantly, for present purposes, one of the recommendations was:[9]

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[5] "AM 13" record pp.304 – 315.

[6] "AM 13" record pp.307 – 315.

[7] "AM13" section 2 record pp.308 – 309.

[8] "AM13" section 5 record pp.310 – 311.

[9] "AM 13" section 5(d) record p.310.

> "Make specific recommendations on trade-off mechanisms for island closures in the event that the Panel finds that the results of ICE and other evidence demonstrate that island closures are likely to benefit penguins, including specific areas and durations. In addition to recommendations on trade-off mechanisms, the Panel must preferably advise on biologically meaningful penguin habitat extents for fishery limitations per island, recommendations must be spatially and temporally explicit and provided on a map. [DFFE will provide mapping capacity]."

32. The Applicants create the impression that the Panel fulfilled all the objectives, outcomes, and recommendations, specified in the TOR. The crux of their case is based on construing the Panel as having made a firm set of clear and readily implementable recommendations (the details of which are dealt with below) which the Minister was obliged to have followed and which would – on the Applicants' version – have resulted in island closures that track the maps produced by their expert, Ms Weideman, and attached to the Amended Notice of Motion as "1".

33. But the Applicants' case is fundamentally flawed. The Panel simply did not make the recommendations that the Applicants say it did.

34. The Panel found that (i) there is broad agreement that the recent observed decline in African penguin numbers both locally and regionally may be due to a number of factors,[10] (ii) the ICE was designed to quantify the impact of sardine and anchovy fishing in the vicinity of penguin breeding islands, and the body of evidence presented to the Panel suggests that this is a contributing factor, <u>but the magnitude of the impacts appears small and could explain only a small part of the recent declines in penguin numbers</u>[11] (own emphasis); (iii) future research is needed to address each of the possible drivers and the effects of several drivers could be explored by developing an

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[10] "AM 14" section 6.3 record p.357.

[11] "AM 14" section 6.3 record p.357.

integrated ecosystem model, such as MICE (Model of Intermediate Complexity for Ecosystem assessments).[12]

35. The Panel further found that future closures of forage fishing around penguin colonies would be likely to benefit penguin conservation, but would need to be part of a much larger package of conservation measures. Such closures alone would be unlikely to reverse the current decline in penguin population numbers.[13]

36. The next important set of relevant findings made by the Panel is in respect of what the Panel referred to as "trade-off".

37. The Panel found that there is a trade-off to consider when making decisions about potential fishing closures adjacent to South Africa's African penguin breeding colonies. By its very nature, a trade-off recognises that there are a set of competing interests at stake and any decision will be sub-optimal for any one of those interest groups. The Panel identified two trade-off axes, namely: (i) the benefits to penguins of the closures and (ii) the cost (economic and social) to the fishing industry and the communities where fishing and processing operations are based.[14]

38. Importantly, the Panel also found that the trade-off decision on closures is a policy matter, related to the conservation, economic and social goals and objectives for South Africa.[15] The Panel expressly refrained from recommending any specific outcomes on a trade-off. It recognised that this was outside the scope of its mandate.[16] Instead, it outlined some aspects that could form part of a decision-making framework to identify

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[12] "AM 14" section 6.3 record p.357.

[13] "AM 14" section 7.1 last bullet record p.359.

[14] "AM14" executive summary bullet 5 record p.323, section 4.1 record p.348, section 7.3 bullet 1 record p.361.

[15] "AM14" executive summary bullet 5 record p.323.

[16] "AM 14" section 4.1 record p.348.

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closure options that would provide an acceptable trade-off between benefits to penguins and costs to the industry.[17]

39. The Panel identified further research that needs to be done and tasks that need to be performed in order for this polycentric decision-making to be advanced.[18] Table 7.1 of the Panel report is a prioritized summary of research and other tasks: short term tasks pertain to the next 1-2 years, medium tasks to the next 2-5 years and long terms tasks, over the next 6+ years.[19] This research is required in order to devise a properly informed trade-off calculation. In other words, before a decision can be made about where the trade-off equilibrium should be set, at least the further research identified by the Panel should be conducted. This is necessary so that the trade-off decision is properly informed with the relevant inputs and the full extent of its impact on both axes is understood.

40. Section 4 of the Panel report deals with the criteria and approaches for evaluating trade-offs between benefits to penguins and costs to fishery. One of the relevant aspects dealt with is quantifying the at-sea habitat area,[20] and another relevant aspect is the "trade-off space".[21] Each of those are important for present purposes.

41. The purpose of closing areas around penguin colonies is to protect penguin foraging habitat from removal of forage fish by fishing vessels by preventing purse seine fishing operations from operating in their habitat.[22]

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[17] "AM14" executive summary bullet 5 record p.323.

[18] "AM 14" section 6 record pp.357 – 358, section 7.1 record p. 360.

[19] 'AM 14" section 7.1 record p. 360.

[20] "AM 14" section 4.3 record pp.349 – 350.

[21] "AM 14" section 4.4 record pp.351 – 353.

[22] "AM 14" section 4.3 record p.349.

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42. The at-sea habitat used by seabirds whilst foraging varies throughout the year and shows variability in respect of their life history constraints. Some areas are preferred, given the availability of prey.[23] Determining such preferred areas is important, especially if resource competition with fisheries is a concern.[24] Estimating areas of preferred foraging habitat can be achieved through numerical spatial analysis of telemetry (tracking) data.[25]

43. The Panel recommended that analyses delineating marine Important Bird Areas (mIBAs) using Area Restricted Search (ARS) methods represent the best scientific basis for delineating the preferred foraging habitats during breeding, and that penguin foraging areas should be quantified for trade-off analysis delineating mIBAs using ARS methods.[26]

44. However, the Panel also recommended that further validation of mIBAs should occur, in particular, using dive data that provide objective identification of foraging locations, rather than commuting or travelling locations.[27] As Dr Bergh explains in his expert affidavit, to be consistent with the Panel's recommendations, it is essential to use dive data in the calculation of the mIBA-ARS areas.

45. Of particular relevance to trade-offs is the following findings of the Panel:[28]

> "The impacts to the fishing industry can be evaluated using an "opportunity-based model" (OBM) that predicts the proportion of the catch of pelagic fish in closure areas that cannot be replaced by fishing outside these areas, together with a Social Accounting Matrix (SAM) model that converts "lost

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[23] As above.

[24] As above.

[25] As above.

[26] "AW 14" section 4.3 record p.349, section 7.3 bullet 7 record p.361.

[27] "AW 14" section 4.3 record pp. 349 – 350, section 6.2 record p. 357, table 7.1 item 2 record p. 360.

[28] Executive summary bullets 7 and 8, record p.323.

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catch" into economic impacts (loss of GDP and jobs) on the fishery, suppliers of goods and services to the fishing industry and the broader economy. The OBM and SAM model can be used to rank closure options in terms of economic effects but the OBM likely overestimates the potential lost opportunities outside the closed area on a given day. The Panel remains concerned about: (i) the lack of information on how the closures impact fishing costs and fishing behaviour; (ii) the ability of the SAM model to adequately attribute impacts at the scale of fishing communities; and (iii) that there are social impacts that are not estimated using the SAM, but are important in any trade-off analysis."

"Evidence suggests that catches from within closure areas will be more difficult to replace around Dyer Island and St Croix Island than around the other five colonies with important breeding populations. Evidence also suggests that levels of lost catches can be reduced, if closures around penguin preferred habitats are well designed."

46. A number of further research and other tasks are set out in respect of refining the estimation of effects of closures on catches, GDP and jobs.[29]

47. Section 3 of the Panel Report deals with the basis for evaluating fishing impacts of closures. Section 3.1 deals with the Opportunity Based Model (OBM) estimates of lost catch[30] and section 3.2 deals with the SAM model.

48. The OBM was used to estimate the impact of closures on catches by the South African pelagic fisheries targeting anchovies and sardine: it quantifies the impacts of closures under the assumption that catches that occurred in the closed area when it was open are a measure of the catches that would have occurred if the closed area was not closed.[31] Unlike the early literature on the impacts of marine reserves on catches, which assumed that all catches would be lost when an area is closed, the OBM

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[29] Section 6.1 record p.357 and table 7.1 record p.360.

[30] "AW 14" record pp.344 – 345.

[31] "AW 14" section 3.2 record p.344.

introduces a set of rules to capture potential behavioural responses of the fleet to closures.[32] These rules include how to replace catches taken within closures with alternative catch opportunities.[33]

49. The Panel concluded that the OBM, to the extent that it had been developed at that time, likely overestimates the effects of closure on lost catches given the algorithms used to decide whether a catch in a proposed closure area can be replaced or not.[34]

50. What this all means is that, far from identifying a method that could simply be plugged into a map-drawing programme to produce closure areas for each island that met the trade-off objectives, the Panel in fact concluded that a great deal more research needed to be done before the inputs would be adequate to generate revised closure areas.

The Minister's impugned decision

51. On 23 July 2023 the Minister took a policy decision, after having received the Panel's report. A copy of the decision – including the Naidoo memo - is "SFA 9" (record pp. 999 – 1003 ("**the Minister's decision**").

52. The Minister's decision recorded the following:-

    52.1 At the time that the Minister made the decision, the Interim Closures that had been in place were about to expire. They had been put in place only until the end of July 2023. So, unless they were extended, there would be no protection at all for penguins in their foraging areas around the relevant islands.

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[32] As above.

[33] As above.

[34] "AW14" section 7.2 record p.359 (bullet 4), section 7.3 bullet 9 sub bullet 4 record p.361.

52.2 While there was a benefit to penguins from the island closures, the benefits were small relative to the observed decreases in the penguin populations in recent decades.

52.3 The Interim Closures would nonetheless be extended as they were considered to be an appropriate intervention in the conservation and management of the African penguin.

52.4 Island closures were established for the six penguin colonies: Dassen Island, Robben Island, Stoney Point, Dyer Island, St Croix Island and Bird Island.

52.5 They would be implemented for a minimum of ten (10) years with a mandatory review after six (6) years of implementation and data collection. I pause to highlight here that the Minister's decision expressly recognised the need for further data collection to be done because she linked the review of the Island Closures to the further data collection that would take place over the next six years.

52.6 The Minister then left open the possibility that the conservation and fishing sectors may be able to reach agreement on the delineation of closure areas different to the Interim Closure areas. She gave a period of time (six months) within which the two interest-groups could endeavour to find each other. But if they did not, she recorded that the Interim Closures would continue while the further data collection and research was done.

Relevant events after the Minister's decision: contested interpretations of the Panel report and further steps taken in the light of the Panel report

53. After the Panel's report was released, different and contested interpretations of the Panel's report, and the way forward, arose.

Mr Naidoo of the DFFE's interpretation

54. In response to email queries from Lauren Waller of the Endangered Wildlife Trust (EWT)[35] and Lorien Pichegru, an academic from Nelson Mandela University (who describes herself as a member of the Conservation Sector Group),[36] Mr Naidoo of the DFFE gave his views of the Minister's decision and the Panel's report. The views he expressed included that:[37]

    54.1 The Interim Closures would remain in place, unless replaced by a consensus agreement (per colony) and/or in 6 years when a review had taken place;

    54.2 The Panel report pointed to a few key aspects/ recommendations such as the ARS for mIBAs, or different ways to calculate fishery impact, which would be explored in the six-year period (i.e. the review period in the Minister's decision).

55. Mr Naidoo of the DFFE had engagements with the CSG and SAPFIA in terms of which it was envisaged that there would be a joint meeting between the DFFE, the CSG and the representatives of the fisheries sector, with the CSG and fisheries sector presenting their respective documents commenting on the Panel report.

56. As set out below, the CSG and SAPFIA duly presented their respective submissions to the Minister.

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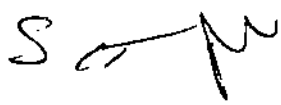
[35] "AM 55" record p.703.

[36] "AM 57" record pp.717 – 718.

[37] "AM 55" record p.701, "AM 57" record pp. 716 – 717.



The Conservation Sector Group's interpretation submitted to the Minister in October 2023

57. On 17 October 2023, a letter was addressed to the Minister on behalf of the Conservation Sector Group, represented by Birdlife, EWT, Prof Pichegru, SANCCOB, and WWF-SA, attaching an assessment of the potential for interim purse-seine restrictions to alleviate resource competition around African penguin colonies ("**the CSG Assessment**").[38]

58. In essence, the stance taken was that the Panel had made recommendations in respect of the methodology for "closure designs", and/or recommendations for a trade-off mechanism that would help identify closure extents that would maximise benefits to African penguins while minimising costs to the purse-seine industry. Section 4.1 of the CSG Assessment sets out what the authors considered to be the methods recommended by the Panel.[39]

59. In broad terms, they interpreted the Panel report as recommending:

    59.1 A trade-off mechanism i.e. measuring benefits to African penguins versus relative costs to fisheries;[40]

    59.2 The use of a trade-off curve to select closures that minimise societal costs and maximise benefits to African penguins. "*The point at which the change in African penguin benefits matches the changes in cost to society (based on the*

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[38] "AM 63" record pp. 766 – 767 (the letter) and pp. 768 – 779 (the CSG Assessment).

[39] "AM 63" pp.771 – 772.

[40] "AM 63" CSG Assessment para 4.1.5 record p.771.

OBM model) is recommended as a potential reference point to guide the selection of optimal closures";[41]

59.3 Closures based on the mIBAs-ARS methodology represents the best scientific basis for delineating preferred foraging areas during breeding.[42]

60. The CSG Assessment then purports to apply this so-called "recommended trade-off methodology" to three (out of the six) colonies: Dassen Island, Stony Point and Robben Island. St Croix Island and Bird Island were excluded because they had amended permits in place with effect from 1 September 2023 (this pertains to the ECPA agreement which is dealt with below) and Dyer Island was excluded because the split-zone configuration currently in place as the interim closure around Dyer Island required updated fisheries cost data.[43]

61. The CSG Assessment states that for each colony, they have compared the relative costs to fisheries against: (a) African Penguins full foraging range without outliers (i.e. UD90),[44] (b) African Penguins' core foraging area (i.e. mIBA – ARS), (c) the interim closures; and (d) 20 km closures used during the ICE.[45]

62. For each of those colonies, (i) maps were produced showing each of these closure options in relation to African penguin foraging tracks (from GPS data attached on chick-

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[41] "AM 63" CSG Assessment para 4.1.1 record p.771.

[42] "AM 63" CSG Assessment para 3.6 record p.770.

[43] "AM 63" CSG Assessment para 2.4 record p.769.

[44] "AM 63" Footnote 19 record p.771 states that UD90 refers to mIBA using a 90% kernel utilization distribution (see McInnes, A.M., Weideman, E.,Waller, L. Sherley, R., Pichegru, L., Ludynia, K. Hagen, C., Barham, P., Smith, C. Kock, A., and Carpenter-Kling, T. (2023) Purse Seine Fisheries closure configurations for African Penguin conservation: methods and considerations for optimal closure designs. Document FP/PANEL/WP/09 presented to Panel in June 2023).

[45] "AM 63" CGS Assessment para 4.1.6 record p.771.

rearing African penguins)[46] and (ii) trade-off curves were provided which were stated to "show the area of each closure versus the estimated cost to industry following methods recommended by the IRPR."[47] Maps (but not trade off curves) were also provided for Dyer Island, St Croix Island and Bird Island.[48]

63. For the three colonies, the CSG Assessment recommended that the mIBA-ARS closure option be used.[49]

64. As set out below, SAPFIA interpreted the Panel report differently to the interpretation advanced in the CSG Assessment, and also had further comments in respect of flaws and shortcomings in the CSG's methodology.

SAPFIA's interpretation: initial comments and views on the Panel report and on the trade-off between the costs and benefits of island closure submitted to the Minister in November 2023

65. On 14 November 2024, Mr Naidoo circulated a document entitled SAPFIA's initial comments and view on the Panel report and on the trade-off between the costs and benefits of island closure dated 13 November 2023 ("**the SAPFIA initial comments**") and a tentative agenda for the meeting.[50]

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[46] "AM 63" CGS Assessment Figure 1A record p.773 (Dassen Island map), Figure 2A record p.774 (Robben Island map), Figure 3A record p.776 (Stony Point map).

[47] "AM 63" CGS Assessment para 2.6 record p.770, Figure 1B record p.773 (Dassen Island curve), Figure 2B record p.775 (Robben Island curve) and Figure 3B record p.776 (Stony point curve).

[48] "AM 63" CGS Assessment, Figures 4, 5 and 6 record pp.777 – 778.

[49] "AM 63" CGS Assessment, para 4.2.1 (e) record p.773, para 4.2.2 (f) record p.774, para 4.2.3 (c) record p.775.

[50] "AM 69" record p.804 (the email) and pp.807 – 820 (the SAPFIA initial comments).

66. The SAPFIA initial comments reflected that SAPFIA intended to submit a more detailed written response at a later date, but also made a number of comments and submissions.

67. The following day, the CSG sent an email to Mr Naidoo, expressing the view that it was premature to meet to present the respective analyses because SAPFIA's document indicated that a more detailed response was to follow.[51]

68. On 27 November 2023, I sent an email to the Minister attaching SAPFIA's more detailed response to the Panel report and the CSG Assessment ("**the SAPFIA comments**").

69. I subsequently became aware that the SAPFIA comments had not been made available to all relevant stakeholders. On 19 December 2023, I sent the SAPFIA comments to the CSG (through Alastair McInnes).[52]

70. The SAPFIA comments dealt with the key pertinent conclusions of the Panel in respect of (i) benefits of island closure to penguins (ii) the economic costs of island closures to the small pelagic fishery (iii) the trade-off between benefits to penguins and economic cost to the small pelagic fishery and (iv) recommendations for further research;[53] made comments on the CSG Assessment; [54] and provided a discussion and conclusion, together with a trade-off assessment of benefits to penguins and the economic costs of island closures (which differs from the CSG Assessment).[55]

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[51] "AM 70" record p.821.

[52] "AM76" cover email record p.868, the SAPFIA comments record pp. 869 – 887.

[53] "AM 76" SAPFIA initial comments section 2 record pp. 871 – 875.

[54] "AM 76" SAPFIA initial comments section 3 record pp. 875 – 876.

[55] "AM 76" SAPFIA comments section 4 record p.876 – 877 and section 6/Appendix A record pp. 878 – 882.

71. A few of the key submissions made in the SAPFIA comments, which are relevant to these proceedings, are summarised below.

72. SAPFIA indicated that it accepted the Minister's decision as a basis for moving forward, pending the ability to make a defensible trade-off decision, and that SAPFIA understood the Minister's decision to be the definitive position of the government as guided by the current state of knowledge.[56]

73. In respect of benefits of island closures to penguins, the Panel found that overall, the results of the ICE for Dassen and Robben Islands indicate that fishing closures around the penguin breeding colonies are likely to have a positive impact on population growth rates, but that the impacts may be small, in the range 0.71% - 1.51% (expressed in units of annual population growth rate). These impacts are small relative to the estimated rates of reduction in penguin abundance for these two colonies over recent years". [57] The use of these results to infer the benefits would require extrapolation of results from only two West Coast islands to four other breeding sites which is less than satisfactory, particularly given the Panel's recommendations that trade-off decisions should be specific to each breeding site/ island.[58]

74. In respect of industry costs, the Panel was critical of SAPFIA's cost estimates and concluded that they were likely over-estimates, although no estimate or indication was given of the extent of the overestimation.[59] SAPFIA had carried out further work into

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[56] "AM 76" SAPFIA comments summary first para on record p. 870, section 4 record p.876 – 877, section 4 last para record p.876 and first para record p.877.

[57] "AM 76" SAPFIA comments para 2.1 record p.871, quoting section 2.3.2 of the Panel report record.p.338.

[58] "AM 76" section 2.1 bullet point 1 record p.871.

[59] "AM 76" section 1 p.869, section 2.2 record p.872.

the question of the irreplaceability of the catch which showed a larger scale of the search area, strengthening the original OBM calculations of irreplaceability.[60]

75. In respect of mIBA-ARS: it is a concept which provides an improved basis for specifying closure areas based on separating transiting and food-searching behaviour,[61] the Panel's comments on mIBAs – ARS must be understood in combination with their recommendations for improving the telemetry data and its analysis (i.e. including using dive data)[62] and the Panel stated that further validation of mIBAs should occur, but generally offered limited comments regarding specifying mIBAs.[63]

76. In commenting on the CSG Assessment, it was pointed out that (i) the CSG Assessment had not updated the mIBAs-ARS estimates based on the recommendations of the Panel, specifically the required use of dive data, [64] (ii) the authors acknowledge that they do not have sufficient information for a quantitative trade-off analysis: "Identification of the point at which the change in African Penguin benefits matches the change in costs to society could not be assessed quantitatively due to a lack of corresponding fisheries cost data which could facilitate fitting a curve to different closure options related to penguin tracking data,"[65] (iii) their arguments for the 3 breeding colonies are based on qualitative arguments and are therefore not based on the Panel's recommendations[66] (iv) the statement that the Interim Closures have little to no benefit for African Penguins in terms of reducing current resource pressure was not substantiated by estimates of benefit due to these closures, nor was

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[60] As above.

[61] "AM 76" section 2.3 record p.873.

[62] As above.

[63] "SM 76" section 1 record p.869.

[64] "AM 76" section 3 record p.875, quoting section 4.1.10 of the CSG Assessment record p.772.

[65] As above.

[66] As above.

the claimed increase in these benefits for the proposed mIBAs – ARS closures substantiated, (v) ultimately, a trade off calculation requires some quantification of these amounts as well as associated cost estimates in absolute terms.[67]

77. I pause here to emphasise that these very deficiencies in the CSG Assessment were highlighted by the Industry Respondents before this application was launched but remain unaddressed in the present review application.

78. Returning to the SAPFIA comments, SAPFIA then undertook an assessment of the benefits to penguins and the economic costs of island closures. However, I do not repeat those here because Dr Bergh has subsequently carried out an updated and more fine-grained analysis, which is dealt with below.

79. In conclusion, SAPFIA indicated that[68] (i) it accepts the Minister's decision as a basis for moving forward pending the ability to make a defensible trade off decision which first requires cost estimates (ii) SAPFIA's view is that such a trade-off decision should be considered only once there has been, as a minimum, a material improvement in the estimates of economic impacts (iii) given that the Panel has confirmed that the impact of fishing around breeding islands is small, attention should focus instead on determining the real reasons for the decline of the penguin population; the MICE approach seems critical and recent work in this regard needs to be used to refocus attention which has been unduly directed at the role of fishing near to penguin breeding sites (iv) data on penguin breeding levels per month at each colony should be made available, since it may be possible to mitigate the economic impact of closures by focussing closures on periods of high breeding intensity only.

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[67] "AM 76" section 3 record p.876.

[68] "AM 76" Section 4 record pp.876 – 877.

Further steps in the light of the Panel's report

80. As set out above, steps were taken by the CSG, the Industry Respondents, and the DFFE to interpret the Panel's report, including the CSG assessment and the SAPFIA comments.

81. There were also other steps taken in the light of the Panel's report, including to investigate other causes of the penguin decline under the Small Pelagic Scientific Working Group ("**SPSWG**") processes, by SAPFIA to obtain data used by the CSG for purposes of taking forward the scientific deliberations, and by the DFFE to establish a Penguin Scientific Task Team/ Working Group ("**PSWG**").

Taking forward the MICE-related findings of the Panel

82. On 8 November 2023, Professor Doug Butterworth, a member of the SPWG, and Andrea Ross-Gillespie, an observer member of the SPWG, both from the Marine Resource Assessment and Management Group, Department of Mathematics and Applied Mathematics, University of Cape Town ("**MARAM**") tabled a document entitled "Exploration of a MICE approach to evaluate the impact of fish abundance on penguin survival" for comment at a meeting of the SPSWG (the document reference is PEL/25). I am an observer member of the SPSWG and was present at that meeting. Mr McIness from Birdlife (the deponent to the founding affidavit) and Lauren Waller of EWT are also observer members and were present at the meeting.

83. Thereafter, PEL/25 was updated in response to comments and, as requested at the 8 November 2023 SPSWG meeting, a document was prepared by those authors, providing an explanation of the motivation and framework for MICE approaches to examine possible reasons for the penguin decline (the document reference is 2024 PEL/02).

84. On 16 February 2024, Doug Butterworth and Andrea Ross-Gillespie circulated an email with a further update of PEL 25 (PEL/25 rev) in response to further suggestions received, requested further comments, and stated that they looked forward to collaborative discussions on this in the PSWG whose formation by DFFE they understood to be imminent. A copy of the email is annexed marked "**MC 1**". The addressees - amongst many others - include Mr McInnes of Birdlife and Lauren Waller of EWT.

85. On 19 February 2024, Mr Fannie Shabangu of the DFFE sent out the first communication of the SPSWG for 2024 to the full SPSWG, which included attaching copies of PEL/25 Rev and 2024 PEL/02. A copy of the email is annexed marked "**MC 2**" and copies of the documents attached to the email are annexed marked "**MC 3**", "**MC 4**" ("**the 2024 MICE documents**") and "**MC 5**" respectively.

86. Both the 2024 MICE documents reflect that they will be tabled and discussed at the PSSWG that is under formation by the DFFE.

87. The document "Motivation for and fundamentals of present MICE approaches to investigate possible causes of the decline in penguin abundance" (PEL/02) refers (amongst other aspects) to the Panel's findings that fishing closures around the breeding colonies, while likely to have some positive impact on penguin population growth rates, have only a small impact relative to the estimated relative reductions in penguin abundance, and the Minister's statement that fishing limitation around breeding colonies only addresses one aspect to combat the high rate of penguin decline and is no miracle intervention."[69] PEL/02 points out that:-

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[69] PEL/02 pp. 1-2

87.1 this further accentuates the need to try and identify, and if possible, ameliorate, the factors for most of the penguin decline, which in turn requires models that attempt to incorporate the impacts of changes to the environment for penguins, and of other predator and prey species on penguins; and

87.2 the Panel suggested exploration of possible causes of the decline using a MICE approach.

88. Reference is made in PEL/02 to three possibilities for important causes underlying the penguin decline that have been put forward and analysed initially being:- [70]

88.1 The effect of fishing on forage food availability for penguins throughout the entirety of their range;

88.2 A reduction in optimal breeding habitat as a result of the removal over time of guano covering of islands where penguins nest;

88.3 Competition with seals – both through predation (not all of which might be observed directly) and indirectly through competition for the same sources of food.

89. In respect of the "Where next", it is motivated that PEL/02, together with its companion papers, being PEL25/Rev and "A MICEe approach to scoping the possible impact of guano harvests on trends in penguin document", [71] need further discussion in pertinent DFFE fora to provide feedback, and to identify the most effective and efficient ways to address possible major causes of penguin decline using the MICE approach.

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[70] PEL/02 p.5.

[71] PEL/02 references p.8, fifth reference.

90. The 2024 MICE documents provide results of particular importance in understanding what are (and are not) important causes of the penguin decline.

Birdlife's refusal of SAPFIA's request for data for purposes of further scientific deliberations

91. Following on from the Panel's report, the Minister's decision, and the CSG Assessment, Dr Bergh (on behalf of SAPFIA) requested data from the DFFE and the CSG in order to progress the research and tasks identified in the Panel report, to be deal with at the to-be-established PSWG.

92. It is important to place this request in context. Prior to the Panel's report being issued, Dr Bergh / OLSPS Marine had been given access to data and software in terms of a data sharing agreement between OLSPS Marine and Birdlife, Dr Lauren Waller, Dr Richard Sherley, Dr Lorien Pichegru and Dr McIness. The data information that was shared was African penguin tracking data from the Dassen island, Robben Island, Stony Point, Dyer Island, S Croix Island, and Bird Island Colonies and (ii) the R code to create core foraging areas, i.e. the Marine Important Bird Areas (mIBAs) ("**the 2023 shared data**"). The data sharing agreement required the shared data to be deleted from OLSPS Marine's computers in July 2023.

93. On 18 December 2023, Dr Bergh sent an email to Mr Naidoo of the DFFE, copied to me, setting out the above. Given that the Panel's report included recommendations on how to calculate mIBAs, he requested the DFFE to make the relevant data available to the participants in the scientific deliberations, because there were critical investigations that needed to be done and which hinged on these data. Mr Naidoo responded on 19 December 2023, amongst other aspects, indicating that he agreed that all data must be shared with all participants, so that all can undertake their further work towards implementing and improving on the Panel's recommendations, pointing out that some complications may arise where data owners place restrictions on data,

that analyses based on data that are not to be shared cannot be used in management / policy discussions, and that there would be some basic points in the terms of reference for the to-be-established combined PSWG. A copy of the email chain is annexed marked "**MC 6**".

94. In a letter dated 14 January 2024, the Minister responded to the SAPFIA comments and indicated that the DFFE would share with SAPFIA all the DFFE's data and observations that SAPFIA required. A copy of the letter of 14 January 2024 is annexed marked "**MC 7**".

95. In the light of the Minister's letter, email exchanges ensued between the DFFE and Dr Bergh on behalf of SAPFIA in respect of data required by SAPFIA.

96. Of particular relevance to this application is that Dr Bergh on behalf of SAPFIA requested information from the DFFE in respect of the mIBAs so that an independent scientist could understand how the mIBAs are calculated and to repeat those calculations to check their veracity, as is the standard scientific process.

97. The DFFE indicated to SAPFIA that the tracking data are held by Birdlife and Dr Sherley, but that the DFFE would send them a request.

98. On 8 February 2024, a response from McInnes of 5 February 2024 was relayed to Dr Bergh through Dr Makhado of DFFE, indicating that they were not in a position to provide this data which had been made available for the specific purposes of the Panel process and subject to a Non-Disclosure Agreement outside a formal review process which includes seabird biologists, the purpose of the data request was not clear to them, and that they were reluctant to share data which is currently the subject of imminent peer review and publication. A copy of the email thread is annexed marked "**MC 8**".

99. I sent detailed follow-up correspondence to the DFFE on 13 February 2024, setting out the above events in respect of the need for the data, a copy of which is annexed marked "**MC 9**".

100. To date, the data has not been shared. The refusal to share the data is a real inhibitor to the ability of the experts to continue to do the work that the Panel identified as necessary. The Applicants have brought this application on an urgent basis, yet, they have not shared the data as soon and as transparently, as possible.

The Minister's response of 14 January 2024 to SAPFIA: the way forward and DFFE steps to establish a Penguin Scientific Task Team

101. In the Minister's letter of 14 January 2024 ("MC 7"), the Minister (amongst other aspects):

101.1 noted the considerations in the SAPFIA comments, in particular the specific responses on the CSG Assessment where SAPFIA outlined its preference for a more quantitative assessment approach to estimates of benefits to penguins, as well as the improvements needed on the cost to fisheries assessments and updating mIBAs prior to using the trade-off method suggested by the Panel;

101.2 agreed that the additional work must include the use of MICE to assess the contributing pressure on African penguins, such as previous devastating oil spills and seals predation;

101.3 noted SAPFIA's conclusions on the preparatory work required before using the trade-off method suggested by the Panel and stated that the internal team of Fisheries, Oceans and Coasts, and SANParks scientists would continue to engage with SAPFIA's science representatives on this work and future planned work on penguin conservation interventions;

101.4 stated that co-operative and inclusive scientific analyses across the DFFE; and Fisheries and Conservation Scientists would allow for more opportunities regarding agreed or at least consolidated methods and policy advice.

102. On 21 February 2024, the DFFE sent an email to stakeholders, notifying them that, in the light of the Minister's decision and the Panel report, as a way forward, the DFFE would establish a Penguin Scientific Task Team.

103. The Minister's January 2024 letter and the DFFE's subsequent February 2024 email are important events in the timeline leading up to this application.

104. They both reveal that the Minister understood the work of the Panel to require further important research and data collection to be done before new closure areas could be determined.

105. Thereafter, the Applicants launched this litigation, even though there was objectively contestation about the interpretation of the Panel's report, and a need for further engagement and research to take place in respect of the Panel's outcomes. Unfortunately, it seems that the launching of this litigation resulted in a delay in, or halted, the establishment of a Penguin Task Team.

INDUSTRY RESPONDENTS' OPPOSITION TO THE APPLICANTS' GROUNDS OF REVIEW

106. In this section of the answering affidavit, the Industry Respondents set out their opposition to the Applicants' grounds of review. The Industry Respondents focus on the opposition that arises from the interpretation of the Panel's report, the Industry Respondents' position as a stakeholder, and the expert evidence of Dr Bergh.

First ground of review: alleged irrationality

107. The Applicants allege that the Minister's decision was irrational because:

107.1 the Panel was established for the purpose of assessing the available scientific evidence to establish whether island closures are an appropriate conservation measure and recommending an appropriate trade-off mechanism for identifying which of the potential closure delineations around each breeding island struck an optimal trade-off between protecting African penguins and minimising impact to industry;[72]

107.2 the Panel duly found that island closures are an appropriate conservation measure and recommended a scientifically defensible trade-off mechanism that incorporates: (1) the mIBA-ARS method as the best available method for purposes of identifying African penguins' preferred foraging areas; and (2) relative use of the OBM model to compare the impact of the different delineations on the industry in light of the existing and available "costs" data The Minister's decision bears no relation to this recommendation;[73]

107.3 Having recognised the Panel's finding that island closures are an effective conservation measure, the Minister ignored the recommended trade-off mechanism for delineating appropriate island closures;[74]

107.4 The Interim Closures are not informed by the best available science-based conservation measures, fail to reduce competition between Industry and African penguins, and accordingly fail to serve as a mitigation measure to

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[72] SFA para 76.1 record p.933.

[73] SFA para 76.2 record pp.933 - 934.

[74] SFA para 76.3 record p.934.

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address the adequacy of the African penguin's access to prey – ultimately to serve as a measure to mitigate and prevent further population decline.[75]

107.5 It was contemplated by the Minister that the Panel's recommendations were sought to advise the Minister on how to resolve the impasse between penguin scientists and conservationists, on the one hand, and fisheries scientists and industry, on the other; the Panel produced such recommendations, and rather than applying the recommended trade-off decision, the Minister left the determination of island closure delineations to "agreement" between the conservation sector and the industry.[76]

108. In what follows below, the Industry Respondents:-

108.1 deal with the fundamental flaws in the Applicants' interpretation of the findings of the Panel;

108.2 place Dr Bergh's expert evidence before the Court which, amongst other aspects:

108.2.1 shows that the Applicants' underlying methods and rationales in respect of the mIBA-ARS and trade-off mechanism are subjective and incomplete, such that they would not pass any reasonably objective and independent scientific assessment and cannot form the basis for decision-making about island closures,

108.2.2 shows that the Interim Closures are not "meaningless" for conservation of penguins (as contended by the Applicants),

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[75] SFA para 76.7 record p.935.

[76] SFA para 87 record pp.938 – 939.

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108.2.3 compares the benefits to penguins and costs to the pelagic industry and the economy between the Interim Closures and the Applicants' proposed closures, and

108.2.4 assesses the Applicants' proposed closures per island,

108.3 show why, on the face of it, the Minister's decision was entirely rational.

The fundamental flaws in the Applicants' interpretation of the findings of the Panel

109. In paragraph 114 of the founding affidavit[77] the Applicants contend that the Panel recommended:

109.1 First, that island closures are an appropriate conservation intervention;

109.2 Second, that the appropriate method for delineating important foraging habitat is mIBA-ARS;

109.3 Third, an appropriate "trade-off mechanism" to be used by the Minister when deciding which particular delineation to impose around each specific breeding colony.

110. The Industry Respondents deny the allegations in section 114.1 of the founding affidavit that: *"the Panel recommended that island closures were an appropriate conservation intervention. This should have settled debated regarding whether small-pelagic no-take areas around African penguin breeding colonies should be implemented. As indicated below, the Minister's decision accepted this recommendation. Whether or not closures should be implemented is thus not subject to dispute."*

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[77] Record pp.72 – 73.

111. The Panel considered the design, implementation and interpretation of the ICE and concluded that:- [78]

111.1 The results of the ICE for Dassen and Robben Islands indicate that fishing closures around the breeding colonies are likely to have a positive impact on population growth rates, but that the impacts may be small, in the range of 0.71 – 1.51% (expressed in units of annual population growth rate). These impacts are small relative to the estimated relative reductions in penguin abundance for these two colonies over the period 2005 – 2022, which were estimated by the Panel at -13% p.a. for Dassen Island and -10% p.a. for Robben Island, using abundance data provided to the Panel;

111.2 Future closures of forage-fish fishing around penguin colonies would be likely to benefit penguin conservation, but should be part of a larger package of conservation measures as such closures alone would be unlikely to reverse the current decline in the population numbers.

112. It is evident from the Panel's report that its view was that the ultimate decision whether to impose island closures is a policy decision which involves a trade-off, and that further research is needed for purposes of that balancing exercise (as dealt with below). The Panel certainly did not engage in any balancing exercise between benefits of island closure to penguins and the impacts of closure on the fishing industry and economic and social goals.

113. Whilst closures <u>may</u> indeed provide some positive conservation intervention, it does not follow that they therefore <u>must</u> be implemented. A trade off decision is required – if the benefit is small, it may not justify the associated costs.

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[78] Section 2.3.2 record p.338; section 7.1 record p. 359.

114. Next, the Applicants contend that the Panel "recommended" that the appropriate method to delineating important penguin foraging habitat is "mIBA – ARS" (marine Important Bird Areas – Area Restricted Search) and that the Panel thus settled what should define "valuable area for African penguins" when the Minister considered how to balance African penguin needs with "Industry Interests" (para 114.2).

115. The Panel did find that analyses delineating MIBAs using ARS methods represent the best scientific basis for delineating the preferred foraging habits during breeding.

116. However, the Industry Respondents deny that "the recommendation was made without qualification…" and that the Panel thus settled what should define a "valuable area for African penguins". On the contrary, the Panel also found that further research must be carried out to validate the mIBA-ARS areas using dive data to provide objective identification of foraging locations, rather than commuting or travelling locations. This means that in order to be consistent with the Panel's recommendations, dive data must be used in the determination of the mIBA-ARS area delineations. The Panel also recommended that between-year variation in mIBA should be explored.[79] The Applicants' have not made out any case that such validation has occurred, and that dive data has been used.

117. The Applicants then contend that:-[80]

117.1 the Panel recommended a specific trade off-mechanism to be used by the Minister when deciding which particular delineation to impose around each specific breeding colony;

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[79] "AM 14" section 4.3 record p.350, section 6.2 record p.357, table 7.1 Task 2 record p.360.

[80] Para 114.3 record p.73.

117.2 the Panel's recommendation allowed for a comparison of relative costs to industry and benefits to African penguins for the primary delineation proposals submitted by the Conservation Sector, Industry and DFFE to date (including the original 20km delineations of the ICE, the DFFE 2021 closures presented at the commencement of the ETT, CAF delineations, the delineations imposed as interim closures, and delineations based on miBA – ARS as calculated by the Conservation Sector Group);

117.3 the recommended trade-off mechanism accounted for the existing state of scientific and fisheries data to enable biologically meaningful closures to be imposed at the commencement of the monitoring period;

117.4 it is this particular recommendation which has not been followed by the Minister and which is central to the relief sought in these proceedings.

118. But, for the reasons given below, and in Dr Bergh's affidavit, the Industry Respondents deny all these contentions.

119. The Panel did not provide a complete specification of a basis for the Minister to compute a trade-off. The executive summary of the Panel report expressly states the following:[81]

> "The trade-off among closure options is a policy decision related to conservation, economic and social goals and objectives for South Africa. This report outlines some aspects that could form part of a decision-making framework to identify the closure options that will provide the best outcomes for penguins given some level of cost to the industry" (own emphasis).

120. The Panel did not in section 4.4 of the Panel report, or elsewhere, provide a "clear mechanism" for identifying optimal no-take zones. This is evident from their use of the

[81] Bullet point 6, record p.323.

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wording "some aspects" and "could form" in the following excerpt from their Executive Summary (page 8 bullet point 5):

> "The trade-off among closure options is a policy decision related to conservation, economic and social goals and objectives for South Africa. This report outlines **some aspects** that **could form** part of a decision-making framework to identify the closure options that will provide the best outcomes for penguins given some level of cost to the fishing industry" (own emphasis).

and their statements in section 4.4 which use terminology such as "One way", "could demonstrate" and "one approach", viz.:

> "**One way** to explore the trade-off between expected benefits to penguins and impacts on fishing is via trade-off plots (see, Hilborn et al. (2021) and Halpern et al. (2013) for examples of trade-off analyses)".
>
> "A trade-off curve (e.g., Figure 4.3) **could demonstrate**..."
>
> > "**One approach** (if curves such as those in Figure 4.6 can be created) is to find the point at which the change in penguin benefits (by increasing closures) matches the change in costs to society".

121. The Minister's decision was taken, after having received the report from the Panel. But contrary to the Applicants' claim, it was not possible for the Minister to have made a quantitative trade-off decision based on the outcomes from the Panel. There is still considerable research work that first needs to be completed, and the Panel did not specify the details of trade-off analysis approaches that should be used. Keeping the Interim Closures in place while this further work is done, was therefore entirely rational.

Dr Bergh's expert evidence

122. The salient aspects of the evidence in Dr Bergh's accompanying expert affidavit are outlined below.

123. His evidence is relevant to two aspects of this case. The first is in relation to remedy because his analysis shows that the Applicants' own proposed closure delineations are contentious, disputed and incomplete. They therefore cannot form the basis for any remedy granted by this court.

124. The second is in relation to the rationality of the Minister's decision. Dr Bergh's analysis shows just how flawed the Applicants' approach to their proposed closures is. Their own flaws reveal why it was entirely rational for the Minister to await the further research, analysis and data that the Panel said was required, before adopting different closure delineations to the Interim Closures.

The Applicants' scientifically unreliable methods

125. In Dr Bergh's opinion, the Applicants' underlying *rationales* and methods are subjective and incomplete, such that they would not pass any reasonable and independent scientific assessment. [82] He explains these views in relation to, first, mIBA-ARS, and then the trade-off mechanisms.

(i) mIBA-ARS

126. The Applicants' expert, Dr Weideman, creates the impression that her determination of the mIBA-ARS (core foraging range) (and UD90 – preferred foraging range) is in accordance with the mIBA-ARS method as "endorsed by the Panel" and that there is

[82] As summarized in paragraph 13 of Dr Bergh's affidavit.

no scientific dispute about the method.[83] However, that is not correct for, at least, the following reasons:-

126.1 Dive data validation requirement: [84] The Panel found that the use of dive data are essential to reliably determine mIBA-ARS based closed areas. To Dr Bergh's knowledge, this 'dive data based' validation of mIBA-ARS area closure options has not been carried out, no technical document outlining such a dive data-based validation is available, and therefore there are no available dive data validated mIBA-ARS based area delineations that could be used in cost/benefit trade-offs to determine island closures.

126.2 Problems with and uncertainties in the mIBA-ARS method used by the Applicants, including in the determination of the "smoothing parameter h": [85] The scale of the area encompassed by mIBA-ARS is very sensitive to the value of the smoothing parameter h used in the application of the method 'mIBA-ARS'. There is no cogent explanation given by Weideman or in her supporting references for the basis of the choice of h for calculating the mIBA-ARS delineations. It is thus not possible to ascertain the reliability of the values of h used and hence of the resulting areal delineations.

126.3 BLSA's refusal to make the underlying computer code and telemetry data available:[86] After the Panel report was released, despite a request from SAPFIA to the DFFE, neither the underlying computer code, nor the associated penguin telemetry data used, have been made available by the

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[83] Dr Bergh, paragraph 60.

[84] Dr Bergh, paragraph 61.

[85] Dr Bergh, paragraphs 62 – 72.

[86] Dr Bergh, paragraphs 73 – 75.

Applicants to all participants in the scientific and management deliberations held under the auspices of DFFE. It is standard in many marine resource management deliberations and fora around the world that the data upon which management-related proposals are based are publicly available to allow for independent cross-checking and potential falsification (a core tenet of the scientific method). There has been insufficient access to these data to independently verify the reliability of the mIBA-ARS results (as well as those for UD90).

(ii) The trade-off mechanism

127. There are a number of difficulties with Weideman's application of a trade-off mechanism.[87] Nowhere in Weideman is it explained how the trade-off curves have been constructed.[88] The standard scientific approach would be to specify the function of the curve, and estimate the function parameters by a minimisation procedure, but this does not seem to have been done.[89] The shape of this curve is a key determinant of the 'balance point' that is referred to in Weideman.[90] Therefore, the basis for any optimal closed area determined by this method is as unclear and unsupported as the specific trade-off curve upon which it is based.[91]

128. The shape of the trade-off relationship between costs and benefits is a key determinant of the final optimal closure area.[92] Weideman does not appear to have applied

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[87] Dr Bergh, paragraph 78.

[88] Dr Bergh, paragraph 79.

[89] As above.

[90] As above.

[91] As above.

[92] Dr Bergh, paragraph 13.5.

recognisable statistical methods to draw these curves.[93] From an inspection of the graphs presented in Weideman, her trade-off curves contain unexplained features which are arbitrary or subjective, such that it is very likely that another independent analyst would arrive at a different curve and hence a different optimal closed area.[94]

129. In respect of some islands, the Applicants' proposed closures are not consistent with the trade-off methodology described and proposed in Weideman.[95] An important example of this is that, although for Dassen Island Figure 5 of Weideman[96] shows that, depending on species, the CAF or DFFE closure options are actually closer to the optimal closed area than the mIBA-ARS closure option, she (and hence the Applicants) nonetheless recommends the mIBA-ARS closure.[97]

130. Apart from Figures 9 and 11, which show the penguin utility scores and not the economic costs associated with the Interim Closures, the trade-off considerations in Weideman do not include the Interim Closures.[98] This is a glaring omission.[99]

The Interim Closures are not meaningless

131. Dr Bergh has used the areal extent of the closure areas to compare the Interim Closures and the Applicants' proposed closures. [100] He has conducted this comparison in order to provide an indication of the relative scale of the Interim Closures in relation to the Applicants' proposed island closures. This is a critical component of the

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[93] As above.

[94] As above.

[95] Dr Bergh, paragraph 13.6.

[96] Record page 188.

[97] Dr Bergh, paragraph 13.6.

[98] Dr Bergh, paragraph 81.

[99] As above.

[100] Dr Bergh, paragraphs 82 - 89.

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Applicants' case and yet does not appear anywhere in their founding papers. The reason this is critical to the Applicants' case is because their case is ultimately about why the Interim Closures are not good enough and why their proposed closures are a foregone conclusion. In other words, their case is that the law requires the closures to be as large as their proposed closures and that the Interim Closures are unlawful because they are inadequate. But, in order for this to be their case, they needed to have provided this Court with some understanding of the difference between the impact on penguin decline of maintaining the Interim Closures (while the necessary further research is done and data is collected), as compared with imposing their proposed closures.

132. Unless the Court knows what the difference is between these two alternatives, it has no way of establishing what the relative benefit of the proposed closures is to penguins, as compared with their cost to the small pelagic fishing industry. But the Applicants have not even explained to the Court what the extent of that alleged benefit to penguins is.

133. Table 13 in Dr Bergh's affidavit shows that the sum of the areas of all Interim Closures is 70% of the sum of the areas of all the Applicants' proposed closures. Table 14 in Dr Bergh's affidavit shows that the sum of the overlap of the Applicants' proposed island closures and Interim Closures is 55% of the sum of all Applicants' proposed island closure areas (without recognition of any benefit from the Outer Area at Dyer Island). When 42% of the Outer Area at Dyer Island is assumed to be closed, then this value of 55% increases to 65%.[101]

[101] Dr Bergh, paragraph 84.

134. Within the limitation of using area as a proxy for benefit to penguins, Dr Bergh concludes from the above that the Interim Closures may confer 65% of the benefit to penguins that could be conferred by the Applicants' proposed closures.[102]

135. By considering only the area from the Interim Closures that **overlap** with the Applicants' proposed closures as conferring a benefit to penguins, Dr Bergh is being conservative because there are areas encompassed by the Interim Closures which are not encompassed by the Applicants' proposed closures which are nevertheless foraging areas for penguins.[103]

136. What this means is that the more than half of the alleged benefit for penguins of the proposed closures is already being achieved by the Interim Closures. In order to contend, as the Applicants' must for their substitution remedy, that the law demands that this Court imposes the proposed closures around the six islands, the Applicants at least ought to have explained to the Court what the relative benefit is to penguins of the further 35% closures they propose. But they have failed to do so and so they have not equipped the Court to balance that alleged further benefit, as against the impact of increasing the closure areas on the small pelagic fishing industry and the local communities they support.

137. I deal with this issue further in the next section.

Comparing the benefits to penguins and costs to the pelagic industry and the economy between the Interim Closures and the Applicants' proposed closures

138. Neither the Founding Affidavit, nor Weideman, compares the costs and benefits between the Interim Closures and the Applicants' proposed closures.

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[102] Dr Bergh, paragraph 85.

[103] Dr Bergh, paragraph 87.

139. Based on the results of the ICE at Dassen and Robben Islands, the Panel report noted that the benefit to penguins of island closures is between 0.71% and 1.51% of the population.[104] These estimates of between 0.71% and 1.51% are based only on penguin benefits estimated for Dassen and Robben Islands where fishing is predominantly for anchovy.[105] In assessing the benefits to penguins at the other four sites (Stony Point, Dyer Island, St Croix Island, Bird Island), where directed sardine is a very important and frequently the dominant species caught, extensive and uncertain extrapolations must be made.[106] Thus, the amount of information available to support the estimates of benefits to penguins at all six breeding sites is very limited.[107]

140. When Dr Bergh refers to the "benefits" 'to penguins', these benefits are expressed as 'breeding pairs per annum'.[108] In other words, it is the number of penguins that, save for the implementation of island closures, would otherwise have died.[109]

141. Dr Bergh estimates that the benefit to penguins of the Interim Closures is 29 to 62 breeding pairs per annum, and for the Applicants' proposed closures is 50 to 106 breeding pairs per annum. [110] In his view, the broad indication that the benefits to penguins from the Interim Closures are substantial in relation to the Applicants' proposed closures is inescapable.[111] These benefits are small when compared to the absolute rate of decline in the penguin population which is in the order of 800 breeding pairs per annum (the estimate differs depending on how one calculates that rate of

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[104] De Bergh, paragraph 20.

[105] As above.

[106] As above.

[107] As above.

[108] Dr Bergh, paragraph 22.

[109] As above.

[110] Dr Bergh, paragraphs 29, 30, 31 and 53.

[111] Dr Bergh, paragraph 53.

decline – e.g. the period over which one views the trend, and whether colony specific or aggregated population level calculations are used, but in general the results will all be in the ball park of about 800).[112]

142. In his view, while a number of uncertain assumptions must be made to estimate these benefits to penguins, the broad indication that there are substantial benefits to penguins from the Interim Closures in comparison to those for the Applicants' proposed closures is inescapable. [113]

143. In the expert evidence, Dr Bergh has calculated the catch and economic losses using the Opportunity Based Model (OBM).[114] The OBM produces estimates of the loss of catch as a result of different island closures. This direct loss can be converted to a value by multiplication by the unit value of product. This reflects the "direct" lost value per annum.

144. For the six island closure options, the direct cost of the Interim Closures to the pelagic fishing industry are ZAR 89,000,000 (rounded up), and for the Applicants' proposed closures the costs are ZAR 190,000,000 (rounded up).[115] The direct costs of the proposed closures are therefore 114% greater, i.e. more than double, than the Interim Closures.

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[112] As above.

[113] Dr Bergh, paragraph 15.

[114] Dr Bergh, paragraphs 32 – 51. SAPFIA and Dr Bergh note the Panel's comments (i) that the OBM and SAM are appropriate methods for estimating costs to the fishery but their results should be considered primarily in a relative sense and as measures of short-run impacts and that (ii) the OBM likely overestimates the loss in catches due to closures, to an unquantified extent, given its assumptions related to the set of opportunities that are available to replace catches in closures, particularly those considered "irreplaceable" because all of the catch on a given day occurred inside a closure. In the SAPFIA comments, SAPFIA further noted that it was engaging in further work to investigate and improve the OBM, including the search behaviour of the pelagic fleet and irreplaceability of the catch. Dr Bergh's analysis uses the OBM, as it is the best available current analysis of the economic cost of the closures, whilst acknowledging that additional work is required which has not yet been done (and which will still take some time to do).

[115] Dr Bergh, paragraphs 14 and 52.

145. Based on Urban Econ (2023) the loss of jobs is 4.18 jobs for every R 1 million of direct loss to the pelagic fishing industry.[116] Using this value, the number of jobs lost varies, depending on the closure option.[117] For the Interim Closures, the estimated number of jobs lost is 371 and for the Applicants' proposed closures, it is 794 jobs lost.[118]

146. Dr Bergh has conducted these projected percentage benefits to penguins, as compared to costs to the industry, in order to illustrate a simple point in these review proceedings. Any increase in the areas of closure has a direct impact on the small pelagic fishing industry. It is therefore necessary for a decision-maker who is deciding whether to extend the Interim Closures both to know the relative benefit to penguins in expanding the areas, and to assess the impact of that expansion on the industry most affected by them. This analysis is completely lacking from the Applicants' founding papers. It makes their case for substitution relief not only stillborn, but also exposes that this could never be the type of case in which a Court would substitute a decision of an expert decision-maker like the Minister. The cost-benefit analysis is too complex and policy-laden that it is the type of decision that must be left to the administrative functionaries and not the courts.

Assessing the Applicants' proposed closures per island

147. In paragraphs 165 to 183 of the founding affidavit, the Applicants expand on what they allege are the shortcomings of the Interim Closures, and refer to Weideman as explaining the underlying methods used which support the analysis. They then deal with each island closure in turn. Those paragraphs assume that the mIBA-ARS areas used and those outlined in Weideman's affidavit are consistent with the Panel's

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[116] Dr Bergh, paragraph 55.

[117] As above.

[118] As above.

recommendations and are based on best available science. In Dr Bergh's affidavit in response to Weideman he points out, however, that there are fundamental flaws in the Applicants' analysis and arguments which mean that their results cannot form the basis for final decisions about island closures at this stage.

148. I set out a summary of Dr Bergh's expert analysis in the sections that follow and I do so in respect of each proposed island closure.

Dassen Island[119]

149. The Interim Closure is based on the DFFE 2021 proposal.

150. The Applicants seek a closure based on their mIBA-ARS delineation, and contend that "contrary to Panel recommendations", the Interim Closure does not adequately represent the penguin foraging area.

151. The Interim Closure at Dassen Island is 941 km^2 in extent.

152. The mIBA-ARS proposed by the Applicants is 550 km^2 in extent.

153. The Interim Closure includes 504.4 km^2 of the mIBA-ARS's 550 km^2 proposed by the Applicants. 504.4 out of 550 km^2 amounts to 91.8%. This means that the Interim Closure at Dassen Island already accounts for 91.8% of the Applicants' proposed island closure there.

154. The penguin utility score for the Interim Closure at Dassen Island has not been determined, but the Interim Closure's large areal extent suggests that its penguin utility score would be substantial.

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[119] Dr Bergh, paragraphs 142 - 147.

155. In any final trade-off deliberation, the costs of closures would need to be weighed against the benefits to penguins. It may well be that some compromise is required which would involve keeping certain parts of the mIBA-ARS proposed by the Applicants open for fishing. That the Interim Closure excludes a small portion of the Applicants' proposed closure might well be the result of a reasonable trade-off between costs and benefits.

156. The Applicants allege that this Interim Closure is inconsistent with using the best available science to inform environmental management decisions because DFFE 2021 used an outdated method for delineating penguin foraging areas.

157. But this criticism of the Applicants is inconsistent with Weideman's own later evidence where she proposes DFFE 2021 closures at Dyer and St Croix Islands.

158. The Panel also recommended that mIBA-ARS areas should be validated by the use of dive data. But this has not yet be done. Therefore, neither the DFFE 2021, nor the Applicants' proposed closure, follow the Panel's recommendation.

159. Furthermore, in paragraph 167 of the founding affidavit, the Applicants rely on a qualitative argument about movement of juvenile anchovies southward between autumn and winter. This is a further factor which they say should have a bearing on the extent of a closure, but this is a factor that is not accounted for in the mIBA-ARS. This means that when it suits the Applicants' case, they argue for mIBA-ARS informed closure areas, but they are also willing to depart from them when it suits their objectives. This is not a scientifically rigorous method for delineating closure areas.

Robben Island[120]

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[120] Dr Bergh, paragraphs 148 – 150.

160. The Applicants allege that this Interim Closure "is not really a closure at all". That is incorrect.

161. The areal extent of the Interim Closure is 227.3 km,^{2} and the areal extent of the Applicants' mIBA-ARS proposal is 418.6 km^2. The area of overlap is 177.2 km^2 which is 42.3% of the Applicants' proposed 418.6 km^2. The map (record p.96) shows that the blue area (the Interim Closure) overlaps with the dark green area (Core foraging area / mIBA-ARS) to a considerable extent.

162. The Applicants refer to the Interim Closure as being a "mere" 41% of African penguins preferred foraging area and that it covers a "fraction" of the foraging area. Whether it is too small or not should be the subject of an informed and scientifically substantiated quantitative trade-off calculation between costs and benefits. Dr Bergh's affidavit in response to Weideman shows that such a trade-off has not, and could not have been, carried out to date. Further preparatory work is needed including the dive data validation of the mIBA-ARS proposals and further work on the OBM, as well as the use of a numerically logical and robust trade-off calculation procedure.

Dyer Island[121]

163. The Interim Closure at Dyer Island closes an area of 255.3 km^2 ('Inner Area') to small pelagic fishing and a further 1039.1 km^2 ('Outer Area') to fishing by small pelagic vessels larger than 26 m in length.

164. The Applicants' proposed closure covers 1294.3 km^2.

165. The overlap between the Applicants' proposed closure, and the Interim Closure Inner Area is 255.3 km^2, which is 19.7% of the Applicants' proposed closure.

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[121] Dr Bergh, paragraphs 151 – 154.

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166. Vessels larger than 26 metres in length account for about 42% of catches in the general area of Dyer n Island. It surely follows that these vessel exclusions in the 1039.1 km^2 'Outer Area' are beneficial for penguins, since if the mechanism which drives the negative impact on penguins is the competition between penguins and fishing vessels for fish, then the benefits for penguins must surely be related in some way to the scale of catch by fishing vessels.

167. If one assumes that removing 42% of the catch from the 1039 km^2 "Outer Area" provides 42% of the benefit to penguins that would result from complete closure, then one could express this benefit as complete closure of 0.42 x 1039.1 = 436.4 km^2. This suggests that the effect of this Interim Closure at Dyer Island is equivalent to closing an area of (436.4+255.3) km^2, or 691.7 km^2, which is 53% of the Applicants' proposed closure of 1294.3 km^2. This is not insubstantial or immaterial.

168. Catches by vessels larger than 26 m account for about 42% of catches in the vicinity of Dyer Island. This means that when the excluded fishing vessels are added to the Interim Closure area at Dyer Island, the total effective closure is as much as 53% of the Applicants' proposed closure.

Stony Point[122]

169. The areal extent of the Interim Closure at Stony Point is 84 $km.^2$ and the areal extent of the Applicants' proposed closure is 269.7 km^2. The overlap area is 81.7 km^2 which is 30.3% of the Applicants' proposed closure of 269.7 km^2.

170. The statement that the Interim Closure "*cannot possibly help conserve these African Penguins through improving adequate prey availability*" is incorrect. The benefits must at least be in proportion to the proportion of the "mIBA-ARS" that is closed.

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[122] Dr Bergh, paragraphs 155 – 156.

St Croix[123]

171. The areal extent of the Interim Closure at St Croix Island is 579.8 km^2 and the areal extent of the Applicants' closure proposal is 809.2 km^2. The overlap area is 579.8 km^2 which is 71.7% of the Applicants' proposed closure of 809.2 km^2. The 50% referred to in paragraph 177 is, presumably, the Interim Closure area as a % of the mIBA-ARS. But, the Applicants propose the DFFE 2021 option.

172. Figure 11, paragraph 38 of Weideman's affidavit argues for an optimal trade-off closer to DFFE 2021 than to mIBA-ARS, and shows the following penguin utility scores (by inspection of the graphs[124]):

172.1 Interim Closure (the vertical dashed line): ~0.60

172.2 DFFE 2021: ~0.75

172.3 mIBA-ARS: ~0.87,

173. This means that the benefit to penguins from the Interim Closures is about 0.60/0.75 = 80% of that of the Applicants' proposed closure, being the DFFE 2021 closure proposal. The statement that "*the Interim Closure covers only 50% of African Penguins' preferred foraging area*" is based on area, and not on penguin utility score. In assessing the benefits of the Interim Closures in relation to those of the Applicants' proposed closures, the value of 80% of the penguin utility score is the applicable estimate that should be used (i.e. the benefits from the Interim Closures are 80% of those derived from the Applicants' proposed closures) and not the 50% mentioned in

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[123] Dr Bergh, paragraphs 157 – 158.

[124] The term 'by inspection' means that without having the actual values that were used to do the plot the best that is possible is to read values off the graph and there may be some small errors that this introduces when compared with the original unavailable values.

paragraph 177 of the founding affidavit. Area is a basis for comparison only as a last resort. The Applicants' case is built on Weideman whose basis is the penguin utility score. Where Dr Bergh uses area he uses this only for his conclusions when penguin utility score data are not available, and he comments that area is a more conservative approach, as evidenced by this example.

174. Figure 11 of the Weideman affidavit shows a penguin utility score of maybe 0.65 for the ICE 20 km closure option (based on crude inspection of Figure 11). Figure 11 also shows a penguin utility score of 0.60 for the Interim Closures. Whether 60% or 65% is sufficient must be "judged" in the context of a trade-off analysis. It is entirely possible that the nature of this trade-off (yet to be undertaken) is such that 100% protection for penguins is not optimal and that some compromise between economic costs and benefits for penguins must be reached.

Bird Island[125]

175. The areal extent of the Interim Closure at Bird Island is 836.8 km^2 and the areal extent of the Applicants' proposed closure, being that of the 20 km ICE closure is 831.3 km^2. The overlap area is 693.6 km^2 which is 83.4% of the Applicants' proposed 831.3 km^2.

176. The Applicants are being inconsistent by proposing the 20 km ICE closure at Bird Island. Weideman is also inconsistent with the trade-off methodology she has developed because it is clear from Figure 11 of her affidavit that ICE 20 km is not optimal in her paradigm because the ICE 20 km has a larger cost to industry and a smaller benefit to penguins than options mIBA-ARS and DFFE 2021.

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[125] Dr Bergh, paragraphs 159 – 160.

Island Closures where there are already Marine Protected Areas in place[126]

177. The Applicants create the impression that island closures in areas, which are already Marine Protected Areas (**MPAs**), have little benefit to penguins. They are therefore arguing that the benefit comparison which is relevant is the benefit to penguins from the Applicants' proposed closures, minus the benefit that is derived from the MPAs. The estimate made by Dr Bergh in his affidavit, viz. that the benefit is between 50 and 106 breeding penguin pairs per annum, is based on the comparison between the situation were the Applicants' proposed closures to be adopted, compared to **no closures at all (viz. no MPAs as well)**. By the Applicants' logic, had, for illustrative purposes, the mIBA-ARS been declared an MPA in say January of 2024 at Dassen Island, then to now contemplate fishing closures of the mIBA-ARS as a closure would imply no additional benefit to penguins relative to the status quo MPA situation. The benefits derived from MPAs are part of the benefits to penguins that need to be included in the trade-off determination. This is particularly the case for MPAs that were promulgated recently because they would be benefits that can be measured in relation to the trend in the penguin population over a period which predominantly did not have these MPAs in place. In addition there are costs to the industry that are incurred as a result of these MPAs.

178. The proclamation dates of these MPAs is relevant to whether they should be part of the benefits to penguins estimated by the ICE.

179. These proclamation dates were:

- Robben Island: The Robben Island Inner Controlled Zone, the Robben Island Middle Controlled Zone, and the Robben Island Restricted Zone, proclaimed 23 May 2019.
- Stony Point: The Betty's Bay Controlled Zone, proclaimed in 1981

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[126] Dr Bergh, paragraphs 161 – 170.

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- St Croix Island: The St Croix Island Offshore Restricted Zone, proclaimed 23 May 2019
- Bird Island: The Bird Island Offshore Restricted Zone, proclaimed 23 May 2019.

180. Apart from the Betty's Bay Controlled Zone, proclaimed in 1981, the other MPAs were proclaimed on 23 May 2019. The ICE experiment started in 2008 and ran up to 2021, and so the benefits of closures estimated by the ICE include, in the main, the benefits that are conferred by these MPAs, since they were proclaimed close to the end of the ICE experimental period.

The rationality of the Minister's decision

181. On 23 July 2023, the Minister took the impugned decision, after having received the Panel's report.

182. At the time that the Minister made the decision, the Interim Closures that had been in place were about to expire. They had been put in place only until the end of July 2023.

183. For all the reasons extensively canvassed in these answering papers, the Panel report did not place the Minister in a position to finally determine new closure areas by determining penguins' core foraging areas and taking a trade-off decision. As the Panel found, further data collection and research must first be done.

184. The Minister therefore extended the Interim Closures, preserving the status *quo ante*. If she hadn't done so, whilst waiting for further data collection and research to be done, there would have been no protection in place at all from island closures for penguins in their foraging areas around the six islands.

185. The Interim Closures were not put in place for an indefinite period They were to be implemented for the six islands for a minimum of ten (10) years, with a mandatory review after six (6) years of implementation and data collection.

186. The Minister then left open the possibility that the conservation and fishing sectors may be able to reach agreement on the delineation of closure areas different to the Interim Closure areas. She gave a period of time (six months) within which the two interest-groups could endeavour to find each other. But if they did not, she recorded that the Interim Closures would continue while the further data collection and research was done.

187. The Minister's decision allowed for consensus not in abdication of her responsibility, but in recognition that the Panel's report did not equip her to finally determine new closure areas. So, she provided a further opportunity for the two main interest groups to find consensus about new delineations of the closure areas. If that could be achieved, then those agreed closures could be implemented. But if there was no agreement, then the Panel's proposals for further data to be collected and further research to be done, including on other causes of penguin decline, would have to take place, to enable a further review to be done in six years' time.

188. The Minister's decision also does not preclude a further decision in respect of island closures being taken sooner than the six-year review period, once further research has been done.

189. The Interim Closures are therefore not "meaningless" as a measure to conserve penguins. The Applicants contend that they are, because they do not correspond with the Applicants' proposed closures. But Dr Bergh has undertaken an analysis of a comparison between the Interim Closures and the Applicants' proposed closures based on areal extents of the areas, which must bear some relation to the relative scale of the benefit to penguins. In Dr Bergh's analysis (i) the sum of the areas of the Interim Closures is 70% of the sum of the Applicants' proposed closures, and (ii) the <u>overlap</u> between the Applicants' proposed closures and the Interim Closures is between 55% and 65%. Within the limitation of using area as a proxy for benefit to penguins, Dr

Bergh concludes that the Interim Closures already confer 65% of the benefit to penguins that would be conferred by the Applicants' proposed closures.

190. Against all these facts, and a proper interpretation of the Panel report, it is simply incorrect for the Applicants to claim that the Minister's decision was irrational.

Second ground of review: unconstitutionality and unlawfulness

191. The Applicants' second ground of review appears to contend that the Minister is currently in breach of a number of legal provisions that range from section 24 of the Constitution (the environmental right) and section 3:1 of NEM:BA, as well as the MLRA and the relevant international conventions. The upshot of this challenge appears to be that the Minister is obliged to do more than she is currently doing to preserve the African penguin.

192. The Applicants also criticise the Minister and the DFFE for having somehow "subordinated" their obligations and the preservation of the African penguin to "healthy relationships with the industry."

193. There are a number of flaws with this challenge.

194. The first is that none of the legal provisions to which the Applicants' refer entitles the African penguin to be conserved *at all costs*. The fraught reality of the decision-making that faces the Minister is that there is a constant need to balance various, legitimate, competing interests. There are the salutary and important interests of conservation groups seeking to protect the African penguin, on the one hand, **and** the legitimate and important concerns of the small pelagic fishing industry and the local communities that they serve of the impact on their livelihoods of a substantially diminished catch, on the other.

195. Thus the Applicants' reference to these legal provisions does not expose the unlawfulness of the Minister's decision. On the contrary, it explains how difficult, poly-centric and complex her decision-making was in this case.

196. Second, the Applicants' own papers reveal an inconsistency about the Minister's legal obligations. On the one hand, they refer to a range of legal provisions, which they appear to claim, mean that the Minister needs to do more than impose the Interim Closures, but then on the other hand, their founding papers regularly question the source of the Minister's power to impose closures at all. For example, at paragraph 31.4 they say "the legal basis on which the Minister has imposed the Interim Closures and taken the decision is entirely unclear". But the Applicants cannot ground their review on contradictory claims. Either the Minister has the power to impose the Interim Closures and has not done enough in imposing them, or she lacked any power at all to implement the closures. But if it is the latter, then the Applicants' review cannot even get out of the starting blocks because the absence of power would mean the Minister could not have imposed even the Interim Closures

197. To the extent, therefore, that the Applicants question the Minister's power to impose the Interim Closures at all, they undermine their own case.

198. In so far as their review is actually directed at the notion that the Minister has not done enough, the response is twofold:

198.1 First, there is no legal obligation on the Minister to do more than to rationally and reasonably strike a balance between the competing interests at stake here.

198.2 Second, what she has done was an entirely rational exercise of her powers.

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INDUSTRY RESPONDENTS' OPPOSITION TO THE RELIEF SOUGHT

199. In the light of what I have set out above, the Industry Respondents oppose the relief sought by the Applicants. I deal with each aspect of it in the sections that follow.

Review relief

200. The Applicants' whole case rests on the premise that the Applicants are simply mechanically applying the recommendations of the Panel, and that the Minister is obliged to follow suit. The relief they seek is based on that premise. But the premise is simply wrong.

201. In the first place, the Applicants misconstrue what the Panel actually found. The Panel did not make recommendations that could simply be plugged into a map drawing programme and produce the proposed closures that the Applicants would have this Court implement. On the contrary, the Panel recognised that the benefits to penguins of closures was small and recognised that the other causes of their declining population need to be investigated further. More data, such as dive data, need to be collected in order to update the accuracy of the foraging areas. And further research needs to be done to have the necessary input information for a proper trade-off analysis to be done. All of that work is still awaited. And it will be done in the next six years, according to the Minister's decision.

202. In the second place, the Applicants' misreading of the Panel's Report then infects their claims of irrationality on the part of the Minister. Contrary to the Applicants' claims, the Minister's decision was not irrational. It was sensibly taken on the basis of the work that the Panel had managed to do and said still needed to be done. It extended the Interim Closures that were about to expire and it created the pathway for the further research and data collection to be done that the Panel had recommended.

203. There is, accordingly, no basis for the impugned decision to be set aside.

Substitution

204. There is also no basis for a substitution remedy from this Court.

205. In their substitution case, the Applicants ask this Court to impose their proposed closures, allegedly "in accordance with the Panel's recommended trade-off mechanism". The Applicants contend that this remedy is appropriate because it is a foregone conclusion (paragraph 218.1 of the founding affidavit) and the Court is as well placed as the Minister to impose the proposed closures (paragraph 218.4 of the founding affidavit). But neither of these contentions is correct.

206. The Applicants' proposed closures are not a foregone conclusion. As the evidence of Dr Bergh makes plain, there are on-going hotly contested aspects of the Applicants' approach. There are also inconsistencies in their approach and unexplained premises. The scientists do not agree and they are the experts.

207. Furthermore, contrary to the Applicants' claims, the Panel did not specify the details of trade-off analysis approaches that should be used. Methodologies still have to be developed, for example, in respect of the trade-off curve.

208. There are numerous flaws in the way that Weideman has carried out her trade-off analyses. The Applicants' proposed closures are themselves inconsistent with the methodology which they propose for carrying out the trade-off analyses.

209. There is further work that needs to be done to investigate and improve the OBM to calculate the costs to industry and the economy of island closures before a trade-off decision as contemplated by the Panel can be made.

210. The Court is certainly not as well placed as the Minister to make a determination of the appropriate closures. The Minister has the expertise and ability to call for more research, more data and further representations form the stakeholders about the delineation of further closures. The Court is functionally ill-equipped to assume that role of expert decision-maker and investigator.

211. The decision on island closures is also a policy decision. I am advised that our law has repeatedly emphasised that courts are not equipped to make such determinations. Policy design, under our constitutional scheme, is left to the administrators whom Parliament empowers to carry forward the policy objectives of the day. Resolving the polycentric balance required of decisions of this nature is not within the courts' competencies.

212. The Applicants' claim that substitution relief is also required because the penguin population has been severely prejudiced by the Minister's "dithering and delay" also does not withstand scrutiny.[127]

213. The Minister's decision has to be considered against a proper account of the Panel's findings. The Panel found that:-

213.1 Island closures will provide only a part of the measures required to slow or reverse the population decline of the penguins [128] and found that island closures alone "would be unlikely to reverse the current decline in population numbers."[129]

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[127] FA para 218.2 record p.121.

[128] Panel report, "AM 14" record p.323 bullet 4.

[129] Panel report, "AM 14" record p.359, section 7.1, last bullet.

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213.2 Further research is needed to address each of the possible drivers impacting the penguin population which could be explores by developing an integrated ecosystem model such as MICE.

214. Rather than evidence of dithering, the Minister's decision properly took into account these keys aspects of the Panel's report.

215. Finally, the Applicants allege that the Minister's decision was "so patently irrational and unlawful that it would be entirely unfair to remit the decision to the Minister." [130] For all the reasons already traversed, that is simply not correct. The Minister has not revealed herself to be incapable of making these difficult decisions. On the contrary, the impugned decision was a rational result of a complex process. The Minister can make one again, in the event that the decision is set aside.

216. There is also a further consideration weighing against the appropriateness of substitution relief in this case. The economic impact of the substitution remedy on the pelagic fishing industry would be staggeringly high. As Dr Bergh shows in his expert report, based on currently available data, the estimated direct cost to the pelagic fishing industry of the Applicants' proposed closures is R114% greater than those of the Interim Closures. This is because the direct costs of the Interim Closures to the Industry are around R88,859,113 per annum: whereas the cost of the Applicants' proposed closures is as much as and R189,877,010 per annum. Based on Dr Bergh's affidavit the loss of jobs is 4.18 jobs for every R 1 million of direct loss to the fishing industry. Using this value, the number of jobs lost varies, depending on the closure option. For the Interim Closures, the estimated number of jobs lost is 371. For the Applicants' proposed closures it is 794 jobs lost, 114% greater.

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[130] FA para 218.3 record p.122.

217. The pelagic fishing industry will be crippled by the Applicant's proposed closures. It could therefore never be just and equitable to impose a remedy in this case that would have such a serious negative impact on the industry.

Remittal relief coupled with an interim interdict

218. In the event that the Applicants do not succeed in obtaining their substitution relief they claim, in the alternative, that the impugned decision be remitted to the Minister and that their proposed closures operate in the interim.

219. But for all the reasons that the Applicants' case for substitution relief is fatally flawed, their case for the interim imposition of their proposed closures, pending a remittal of the impugned decision to the Minister, is also flawed. There simply is no basis on which this Court can impose the Applicants' proposed closures around the six islands even on a temporary basis because the proposed closures are scientifically contentious, disputed and incomplete. The Court is therefore not in a position to impose such a remedy. And its impact (even for a shorter period) on the small pelagic fishing industry will be significant.

PARAGRAPH-BY-PARAGRAPH RESPONSE

Founding affidavit

Ad paragraph 7.2

220. The Industry Respondents deny that this application gives effect to BLSA's vision. The Applicants lose sight of the need for sustainable and equitable use of natural resources.

Ad paragraph 7.3

221. It is notable that three of the members of the CSG namely, EWT, WWFSA and NMU are not co-applicants. The Industry Respondents deny that Nelson Mandela University as an institute is a member of the CSG (as opposed to Ms Pichegru who is an adjunct professor in the Institute of Coastal and Marine Research at Nelson Mandela University and who has deposed to a confirmatory affidavit). The EWT was not one of the original members of CSG.

Ad paragraph 18

222. The Industry Respondents deny that Dr Sherley's expert affidavit states that extinction of the African Penguin in the wild is "*anticipated to occur as early as 2035*". The affidavit of Dr Sherley states that *"the uplisting submission concludes that the African Penguin faces an extremely high risk of extinction in the wild by 2035"* (paragraph 6, record p 14) and *"at these rates of decline, there is a real threat that the global African Penguin population could be extinct in the wild by 2034"* (paragraph 15, record p 143).

Ad paragraph 19

223. The Industry Respondents deny that the resulting scientific studies have demonstrated that a precautionary approach requires fishing closures in the vicinity of African Penguin breeding colonies and that the studies demonstrate the immediate need for long term closures of African Penguin preferred foraging areas. As dealt with above, the Panel found that population declines may be partly arrested by optimising availability of African Penguins preferred prey, but not by much. The precautionary approach does not *"require closures"* just because there may be some benefit – appropriate trade-offs need to be demonstrated first.

Ad paragraph 20

224. Save to admit that there have been at least four rounds of scientific review, the contents of this paragraph are denied. The Minister delayed implementation of conservation actions because the scientific evidence (for example, of Dr Sherley et al 2018) that the closures would be beneficial was unclear and contested, as were the costs to industry that would eventuate.

225. In any event, the ICE provided *"50% protection"* to four of the islands.

226. ICE was initiated in 2008. It involved four important breeding sites, namely Dassen Island and Robben Island on the west coast, and St Croix and Bird Island in Algoa Bay. It involved an opening and closing regime of two paired islands (Dassen/Robben and St Croix/Bird) designed to optimise the outcome of the experiment. The conclusion at the end of the Feasibility Study was that a statistically significant effect could be detected from the analyses of the impacts of purse seine fishing in the vicinities of breeding islands, and thus it was recommended that this experiment can be continued as identified response variables will be able to determine the extent of the effect within a reasonable time frame. The alternating opening and closing regimes around the islands effectively closed the islands to purse seine fishing for 50% of the time within a 20km radius around the islands.

Ad paragraph 21

227. In the light of the contents of the Panel report, before the launch of the application the DFFE was in the process of establishing a scientific penguin working group.

Ad paragraph 22

228. The contents of this paragraph are denied. The terms of reference included advising on whether "*any*" fishing closures were appropriate. The Applicants imply that the Panel's report would make certain recommendations before they had even considered the evidence. The Panel's primary responsibility was to advise on the implications of the ICE results.

Ad paragraph 24

229. For the reasons given above, the contents of this paragraph are denied.

Ad paragraph 25

230. The Industry Respondents deny that this is an accurate reflection of the Minister's decision.

Ad paragraph 27

231. The Industry Respondents deny that the delineations in black constitute the applicable delineations should the Panel's recommendations be applied. It is also denied that these results follow from the *"Panel's recommended trade-off mechanism"*.

Ad paragraph 28

232. It is correct that no agreement on alternative island closures was reached by the deadline. It is however denied that the failure to reach such agreement was predictable in the pejorative sense implied by the Applicants.

233. The Industry Respondents deny that absent this Honourable Court's intervention, the Interim Closures will now remain in place until 31 December 2033. There is a review after six years, agreements between the Conservation Sector Group and the Industry

Respondents are not precluded, nor that the Minister can take a further decision on island closures.

Ad paragraph 30

234. The Industry Respondents deny that the Applicants have established the grounds of review which they rely upon. I refer to what I have stated above in respect of the Minister's decision.

Ad paragraph 31 (opening sentence)

235. The contents of this paragraph are denied.

Ad paragraph 31.1

236. For the reasons given above, it is denied that the Minister's decision was unconstitutional and unlawful.

Ad paragraph 31.2

237. The Minister has been taking steps to address the decline of the penguin population by, amongst other aspects, establishing the Panel to ensure that any decisions made are scientifically justified and demonstrate an appropriate cost benefit trade-off. The Industry Respondents deny that the Minister has acknowledged that island closures are a necessary conservation measure.

Ad paragraph 31.3

238. The contents of this paragraph are denied.

Ad paragraph 31.4

239. The Minister took a policy decision.

Ad paragraph 31.5

240. The contents of this paragraph are denied. The Applicants have opted to launch court proceedings rather than to continue to participate in further steps, such as establishing a Penguin Scientific Working Group to take forward the Panel's report and the Minister's decision.

Ad paragraph 32

241. The Industry Respondents deny that the maps apply the Panel's recommendations regarding the methods for determining preferred foraging areas and appropriate trade-offs to determine closure delineations.

Ad paragraph 33

242. The Industry Respondents deny that the contents of this paragraph accurately reflect the relief sought in prayer 4 of the notice of motion.

Ad paragraph 35

243. Legal protection requires identification of the main factors causing the penguin decline and efforts to ameliorate those factors. It is denied that the populations have dwindled to the "*precipice of extinction*".

Ad paragraph 38

244. The Applicants have not attached the extracts of the policy that they rely upon. In any event, there have been a number of more quantitative analyses since 2007 which have overtaken the qualitative analyses available in 2007. In particular, this includes the MICE analyses recommended by the Panel.

Ad paragraph 42

245. CITES pertains only to control of international trade. It is not of relevance because penguins are not in trade.

Ad paragraph 43

246. The comment in the 2013 BMP about one of the most important current threats to African Penguins, being considered to be the abundance and availability of prey was heavily contested by the Penguin Working Group, together with Ocean and Coasts' comments at the time about the proportionate role of fisheries in the penguin decline. The ICE was subsequently established, and the Panel interpreted the results of the ICE.

Ad paragraph 53

247. The Industry Respondents deny that the penguin population has nearly halved in the time the Minister has had the scientific input needed to help arrest these declines. As already dealt with above, the scientific inputs available to the Minister were contested and had differing implications. That appears clearly from the terms of reference for the Panel report. In particular, the key scientific input by Dr Sherley et al was argued to be invalid, as was later confirmed by the Panel.

Ad paragraph 54

248. The Applicants' sole focus appears to be island closures as opposed to other conservation measures and analyses attempting to identify other major causes of the penguin decline, as recommended by the Panel - such as MICE analyses. The Namibian situation is not comparable – the proportional sardine reduction in Namibia was likely at least an order of magnitude greater than in South Africa.

Ad paragraph 55

249. The Industry Respondents deny that the Minister has failed to implement adequate fishing closures.

Ad paragraph 56

250. The Industry Respondents deny that any delays in the grant and implementation of the relief sought in the proceedings will result in further population decline of the African Penguin at the material risk of it soon becoming extinct in the wild. Even if the relief sought by the Applicants is granted (which the Industry Respondents deny should be), such island closures would only bring a small alleviation of the decline in the African Penguin population. The priority is to identify and address the other causes of the penguin decline.

Ad paragraph 57

251. The ICE results were dealt with in the Panel report, as dealt with above.

Ad paragraph 59

252. The non-alignment of the periods of the ICE with African Penguin lifecycles was not of relevance due to the interpretation of the ICE results. There was no "*Panel's recommended trade-off mechanism*".

Ad paragraph 59.2

253. The tracking data available at the time of the commencement of the ICE suggested that the 20km radius covered most of the foraging. The Industry Respondents deny that the Interim Closures are irrational and that the Panel made recommendations pertaining to closures on the bases alleged by the Applicants.

Ad paragraph 59.3

254. The contents of this paragraph are denied. The interpretation of the findings of the ICE published in 2018 were contested, and the Panel interpreted the results of the ICE.

Ad paragraph 62

255. The contents of this paragraph are denied. In respect of the allegation that sardine and anchovy biomass continues to decline, sardine is now on a marked upswing and anchovy, though with a recent downward fluctuation, is on average well above the levels in the 1990's.

Ad paragraph 65

256. The Industry Respondents note the contents of the correspondence but disagree with the allegations in respect of lack of prey as the most significant threat to African Penguins, and the interpretation and application of the precautionary principle.

Ad paragraph 68.2

257. The findings of the Panel confirm that the fisheries scientists' view was correct. The impact of fishing around penguin colonies on the decline of the African Penguin is small relative to the rates of penguin decline.

Ad paragraph 72

258. The Applicants conclusions in "AM26" in respect of meaningful biological impacts appear to be based primarily on their mIBA computations, which are flawed.

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Ad paragraph 73

259. As recognised in the terms of reference for the Panel, there was contestation about the science and methodologies, which is why the Panel was ultimately appointed.

Ad paragraph 77

260. The CAF attempted to broker an amenable compromise between the Conservation Sector and the industry sector, which was ultimately not successful. The outcome of this process was placed before the Panel.

Ad paragraph 78

261. The characterisation of the industry's stance is denied. The industry advocated sound science as the basis for any decisions to be made and questioned the Conservation Sector Group's interpretation of the ICE results. The Panel subsequently interpreted the ICE results, and the outcome thereof justified the industry concerns with the prior interpretations of the ICE relied upon by the Conservation Sector Group.

Ad paragraph 79

262. The Industry Respondents deny that the negotiations were led by the Conservation Sector. The Industry became frustrated by there not being a definitive conclusion on the analyses of the ICE, and also by the CAF not reaching any conclusion on this either, and thus proposed that an International Panel be convened to evaluate the analyses.

263. It is denied that the Interim Closures are "*woefully inadequate*". Even if the Panel had made a firm set of clear and consolidated recommendations (which it did not), the Minister would still have had to make an independent decision taking into account any

such recommendations. She would never have been obliged to simply follow any such recommendations.

Ad paragraph 82

264. The Industry Respondents deny that this paragraph constitutes an accurate summary of the email "AM30".

Ad paragraph 83

265. Industry questioned the need for island closures if the science showed that a trade-off would result in a small benefit to the penguins on the one hand and significant negative economic and social consequences, such as the loss of many jobs, on the other hand.

Ad paragraph 84

266. Again the Conservation Sector, even at that stage, was under the misapprehension that a panel could be appointed which would reach an outcome in respect of island closures which everyone, including the Minister, would simply abide by. In any event, the Panel ultimately did not reach any such conclusions.

Ad paragraphs 86 to 88

267. The Industry Respondents deny the allegations under the heading "*industry refuses to compromise*" based on the meetings and correspondence referred to in these paragraphs. The email from Mark Anderson ("AM33") records that the representatives of the Conservation Sector (Mr Anderson and Mr du Plessis) found the meeting constructive. Both the conservation and fishery sectors were not supportive of the CAF's recommendations. SAPFIA, together with the ESCPA, had by that stage already addressed correspondence to the Minister. A copy of the 17 March 2022 letter is annexed marked "**MC 10**."

268. It was broadly agreed at the meeting on 25 May 2022 that an independent expert panel / process be put in place as soon as possible by the Minister, the details of which were yet to be determined. The email records that the representatives of SAPFIA would still have to explore the level of support from other members of SAPFIA. At that stage, the discussion was in respect of interim closures pending the outcome of the contemplated independent expert panel.

269. The Industry Respondents deny that paragraph 87 is an accurate summary of the email dated 30 May 2022 ("AM34"). The email does, however, reflect the complex polycentric nature of the issues and the difficulties of a trade-off decision.

270. As appears from Mr Anderson's email of 4 July 2022 to the Minister, there was further important email correspondence between SAPFIA / ESCPA that is not dealt with in the founding affidavit. It is annexed as appendix 2 to the Conservation Sector's report to the Minister which accompanied Mark Anderson's email of 4 July 2022 and appears at record pp 602 to 607. In broad terms that email correspondence reflects that there was negotiation that took place in respect of various island closure options (p 603). The backwards and forwards engagement between the sectors is further evidence of why it was important for the Panel to be appointed and that it is inaccurate to characterise these engagements as *"industry refuses to compromise"*. Industry made proposals but they were not acceptable to the Conservation Sector.

Ad paragraph 89

271. The correspondence of 29 June 2022 was addressed to Mr Naidoo on behalf of SAPFIA and ESCPA. The letter followed on from correspondence of 17 March 2022, and 25 March 2022 and a further letter dated 20 June 2022, a copy of which is annexed marked "**MC 11**".

272. The letter of 29 June 2022 ("AM36" record p 589) expressed the view that the need for a Panel had become all the more necessary given that the CAF did not evaluate the quantitative scientific analyses of the ICE relating to the key aspect of the need, if any, to implement closures to pelagic fishing around some penguin breeding colonies.

273. SAPFIA made suggestions concerning the issues of Panel membership, chair and procedures and terms of reference. The point was made that international scientists had emphasised to industry that it is important for terms of reference to clearly distinguish issues related to science and those related to policy choices.

274. In respect of the terms of reference (III) the following is stated (record p 592):

> "*Ultimately decisions in this matter come down to trade-off selections, which involve policy matters, and the Minister must select amongst the trade-off options available. This requires that the pros and cons for each option are quantified, based on the best scientific evidence. Thus, for example, island closure proposals involve a trade-off between the benefits in terms of the likely change to the penguin population growth rate, against the cost in terms of loss of revenue and jobs to the pelagic fishing industry. The Panel is responsible for scientifically evaluating the various estimates of such quantities, and to then recommend which are best, and their reliability. Comments on policy choices, if any, should focus on clarification aspects only.*"

275. In that context, proposals were made in respect of six specific questions that industry suggested the Panel be given the task of answering (record p 593).

Ad paragraph 90

276. The Industry Respondents deny that the report again implored the Minister to appoint an international review panel and to implement closures based on the precautionary principle. The conclusion to the report was that the Conservation Sector urges the Honourable Minister to urgently implement the island closures as per the governance

forum's recommendations (appendix 3) and establish the international review panel so that longer term measures can be implemented to benefit the endangered African Penguin.

Ad paragraphs 93 to 101

277. We refer to what we have said above in respect of Minister's decision and the Interim Closures, and the Applicants' proposed closures.

278. The Industry Respondents deny that post-CAF negotiations the industry had indicated that it was not prepared to compromise on closure delineations and that this refusal to compromise extended to temporary closures. It is further denied that the Interim Closures were arbitrary.

279. The Interim Closures had good area closures at the extremes of the range of African Penguins (namely Bird and Dassen islands), which was a "win" for the CSG, with some compromises in-between. At the time, the Industry was not happy with the increased areas at Dassen and St Croix Islands (and the year round closures) and the restrictions at Dyer Island.

Ad paragraph 103

280. The Industry Respondents deny that the TOR made it clear that the Panel was being convened to present consolidated recommendations to enable the Minister to make a decision about closures in the sense relied upon by the Applicants. As set out above, ultimately the Panel did not make such consolidated recommendations.

Ad paragraph 104

281. The Applicants' quotation of specific objectives is selective.

Ad paragraph 105

282. The contents of this paragraph are denied. Section 5 of the terms of reference details the outcomes and recommendations from paragraphs (a) to (g) (record pp 310 and 311).

Ad paragraph 106.1

283. Importantly, the Panel determined that the benefit to African Penguins would be small.

Ad paragraph 106.2

284. The Panel endorsed this method in principle, but not the Applicants' flawed implementation thereof.

Ad paragraph 106.3

285. The contents of this paragraph are denied. The Panel did not provide a complete or clear trade-off mechanism.

Ad paragraph 107

286. I refer to what I have stated above in respect of using mIBAs in determining African Penguin foraging areas and the Applicants' application thereof. The Industry Respondents deny that the Panel made the recommendations contended for by the Applicants, and consequently that there was a failure by the Minister to follow the alleged trade-off mechanism recommendation. In this context of island closures the reference to "fight for food" is inflammatory and unsubstantiated.

Ad paragraph 108

287. The allegations of the Minister's irrationality: the expectation of agreement, are denied.

Ad paragraph 110

288. It is denied that the events in respect of the attempted Eastern Cape Agreement initiated a course of events which would highlight the futility of the Minister's continued emphasis on agreement but also cast into the relief the DFFE and the Minister's apparent refusal to take decisive action to benefit African Penguins.

Ad paragraph 112

289. I deny that the contents of this paragraph are accurate and that the Eastern Cape Agreement discussions demonstrate the inherent unworkability of the Minister's contemplation of any agreement being reached between the Conservation Sector and industry.

Ad paragraph 113.1

290. The key findings did include that the ICE showed that excluding the effect of sardine and anchovy fishing from waters around the breeding colonies is likely contributing to reducing the rate of decline of the African Penguin population. However, it also found that the likely effect is small. The Industry Respondents deny that the Panel answered the question posed at paragraph 2 (a) of the terms of reference.

Ad paragraph 113.2

291. The Industry Respondents deny that the recommendation in respect of year-round closures answered the question at paragraph 2(c)(a) of the TOR. That paragraph refers to delineation of fishery no take areas around six African penguin colonies and the duration of the closures.

292. The Panel recommended that, if designated, closed areas to protect penguins during breeding should be year-round, unless reasons demonstrate otherwise.[131]

293. In the Industry Respondents' view (i) the distribution of breeding throughout the year at each colony should be considered and (ii) this recommendation should be read subject to it still being necessary to consider a trade-off. What about the extra cost to industry? If, for example, only 5 % of the penguin breeding occurs in the summer months, but most of the catch is in that period, a year-round closure may not be justifiable.

Ad paragraph 113.3

294. The Industry Respondents deny that the Panel responds to para 5 (c) of the TOR by stating that the most appropriate method for delineating important penguin foraging habitat was the mIBA – ARS method which remained conservative in terms of African penguins year-round foraging behaviors.

295. The mIBA-ARS method is not fully defined, and key data required to implement the Panel's findings in respect of the mIBA - ARS method is not yet available. I refer to what I have stated above in respect of further validation of mIBAs, in particular using dive data that provide objective identification of foraging locations, rather than commuting or travelling locations.

Ad paragraph 113.4

[131] Section 4.1 record p.348.

296. The Industry Respondents deny that the point at which the change in African penguin benefits matches the change in costs based on the OBM was recommended by the Panel as a reference point to guide selection of optimal closures and that a trade-off mechanism was provided as contemplated by paragraphs 2(c) and (d) of the TOR.

297. The suggestion (amongst a range of others in respect of trade off space)[132] was that, if such curves can be created, one approach would be to find the point at which the change in penguin benefits (by increasing closures) matches the changes in cost to society. [133]

Ad para 113.5 (introductory para)

298. The contents of this paragraph are denied.

Ad para 113.5.1

299. The Panel found that the OBM likely overestimates the loss in catches due to closures to an unquantified extent.

300. Save as aforesaid, the contents of this paragraph are denied.

301. The Panel stated in the Report that "The OBM and SAM are appropriate methods for estimating costs to the fishery but their results should be considered primarily in a relative sense (section 4.4) and as measures of short run impacts." [134] The Panel report does not state that existing OBM outputs could be used to assess and rank closure options in a relative sense.

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[132] Section 4.4 bullet points 1 – 8 record pp.351 – 352.

[133] Section 4.4 left hand column, second last bullet record p.351.

[134] Section 7.2 bullet point 2 record p.359.

302. For the reasons given above, it was not possible to use the existing OBM data in determining an appropriate trade-off so that island closures could be immediately delineated and implemented.

Ad paragraph 113.5.2

303. The Industry Respondents deny that the Panel recommended that closure areas should be selected based on the suitability of these delineations to evaluate the effectiveness of alleviating resource competition on African penguins.

Ad paragraph 113.5.3

304. The Industry Respondents deny that the Panel recommended what is stated in this paragraph. The method for, and data required for, determining "valuable African foraging areas" still requires further work.

Ad paragraph 114 (introductory portion)

305. The contents of this paragraph are denied.

Ad paragraph 114.1

306. For the reasons given in paragraphs 110 to 113 the contents of this paragraph are denied.

Ad paragraph 114.2

307. For the reasons given in paragraphs 114 to 116 the contents of this paragraph are denied.

308. Although the Panel recommended that the mIBA-ARS method represents the appropriate method for delineating important penguin foraging habitat, they also recommended that (a) the methods should first be validated by the use of dive data and (b) that the final closure decision should be based on a trade-off.

Ad paragraph 114.3

309. For the reasons given in paragraphs 117 to 121 the contents of this paragraph are denied.

Ad paragraph 115

310. For the reasons dealt with above, in respect of the Panel's findings and the Applicants' mischaracterization thereof, the contents of this paragraph are denied. Furthermore, there is no "support" for "immediate imposition of biologically meaningful closures" stated anywhere in the Panel's report and these allegations are at odds with the findings that the Panel did make.

Ad paragraph 116.1

311. The Industry Respondents deny that the fact that the Minister made her decision "in the light of the report" suggests approval of the report.

Ad paragraph 116.2

312. The Industry Respondents deny that the 6 (six) year period is the monitoring period as relied upon by the Applicants. The Minister's decision refers to a review after 6 years.

Ad paragraph 116.3

313. The contents of this paragraph are denied.

Ad paragraph 118

314. The Industry Respondents deny that the effect of the Minister's decision was those alleged in this paragraph.

Ad paragraph 119

315. The contents of this paragraph are denied. The Panel did not make clear recommendations regarding closure delineations. The Industry Respondents deny the Applicants allegations in respect of the Minister's decision.

Ad paragraph 120

316. The contents of this paragraph are denied.

317. No agreement was reached between Industry and the conservation sector by 15 January 2024.

318. We have been awaiting the establishment of the penguin SWG to take forward the Panel's report and the Minister's decision.

Ad paragraph 121

319. Save for the first sentence, which is noted, the contents of this paragraph are denied.

Ad paragraphs 122 – 125

SCF

320. These events are irrelevant. It is denied that the DFFE had bowed to resistance from Industry at the expense of Africa penguins.

Ad paragraph 126

321. The contents of this paragraph are denied.

Ad paragraph 127

322. For the reasons given above, the mIBAs-ARS method is not yet implementable.

323. The Industry Respondents deny that paragraphs 127.2 and 127.3 accurately reflect what is stated in the email.

324. The Minister was not obliged to "align" her decision with the findings of the Panel. The decision was made by the Minister, not the DFFE.

Ad paragraph 128.3

325. Before the application was launched the DFFE was establishing a Penguin SWG to discuss and take forward the scientific investigations arising from the Panel's report.

Ad paragraph 128.4

326. The Industry Respondents deny that the next six-years is the monitoring period.

Ad paragraph 128.5

327. This is not an accurate reflection of the contents of the email. The decision to use fishing closures may require revision once the further research has been done and a trade-off decision is then made.

Ad paragraph 129

328. For the reasons traversed, the contents of this paragraph are denied.

Ad paragraph 130

329. The Industry Respondents deny that there was a decision by the DFFE to retain the Interim Closures. I refer to what I have stated in respect of the Minister's decision.

Ad paragraph 132

330. The notion of agreement was a component of Mr Naidoo's approach. The Panel itself encouraged consensus closure options in its key findings.

331. The remainder of the contents of this paragraph are denied. The Industry Respondents deny that Mr Naidoo misinterpreted the Panel's "recommendation", that he had not fully appreciated the DFFE's and the Minister's obligations to intervene to protect threatened species and that there was any subordination as alleged.

Ad paragraph 133

332. Clearly, further engagement was required in respect of the Panel's report. The Minister's decision does not render the Panel process an exercise in futility.

Ad paragraphs 134 – 136

333. The Industry Respondents deny that there was a need to "mitigate the impact of the Minister's decision".

334. The "conservation sector" had not even attempted to engage with SAPFIA about the Panel's report. Instead, it was attempting to negotiate directly with Oceana - a member of SAPFIA – through the "back-door'.

335. The Minister's decision did not contemplate agreements between the conservation sector and only one industry player. That would in any event give rise to a number of difficulties in respect of the fishing rights allocations and permit conditions.

Ad paragraph 137

336. Once again, the Industry Respondents deny that there was a need to "mitigate the effect of the Minister's decision" and point out that the "conservation sector" had not even attempted to engage with SAPFIA and ESCPA about the Panel's report and the Minister's decision. It is not an excuse for the conservation sector not to engage with SAPFIA and the ESCPA on the basis of assumptions and pre-judgments such as "We also knew that the leadership of SAPFIA was unlikely to move from old positions."

337. SAPFIA and ECPA are the recognized industry bodies under the MLRA.

338. Not all rights holders belong to SAPFIA and the ECPA, but all rights holders are in one way or another linked to these associations. Details pertaining to rights holders could be obtained from information that is tabled at the SWG-PEL and/or from the recent fishing rights allocation process.

Ad paragraph 141

339. The contents of this paragraph are denied.

340. How could it be said that SAPFIA had been intransigent when the conservation sector had simply tried to bypass SAPFIA and had not engaged with SAPFIA?

Ad paragraph 142

341. The contents of this paragraph are denied.

Ad paragraph 143

342. The Industry Respondents deny that there was a need to "mitigate the effect of the Minister's decision" and that the CSG assessment demonstrated the Panel's recommendations regarding the application of the mIBA-ARS method and trade-off mechanism.

Ad paragraph 144

343. It is noteworthy that the Applicants did not send the CSG Assessment to the Industry Respondents. It was ultimately received by the Industry. Our impression was that the CSG was deliberately avoiding meeting with us.

Ad paragraph 145

344. For the reasons given above, the Industry Respondents deny that the Panel made recommendations which could immediately and readily be implemented and deny the allegations in respect of the Interim Closures.

Ad paragraph 146

345. I refer to what I have stated above in respect of the CSG Assessment and deny that the CSG Assessment presented a trade-off analysis as recommended by the Panel. On SAPFIA's assessment as reflected in the SAPFIA comments, the mIBA-ARS (as calculated without the further data and validation specified by the Panel) results in significant losses to the fishery and the economy.

Ad paragraph 148

346. The Minister's decision reflects that the Panel's report was considered and that it was acknowledged that the Panel's findings included that further research needs to be done to implement the key findings.

Ad paragraph 149

347. Mr Naidoo arranged a meeting with the Industry for 31 October 2023 (having had a meeting with the conservation sector on 24 October 2023).

348. We confirmed that we would be submitting a formal response to the Panel report, and advised that we supported the formation of a penguin taskteam / working group.

Ad paragraph 150

349. The Industry Respondents deny that the email states that Mr Naidoo had not understood that the DFFE was responsible for facilitating agreement.

Ad paragraphs 151 – 157

350. The Industry Respondents deny that in November 2023 SAPFIA rejected the need for island closures.

Ad paragraph 151

351. The Industry Respondents deny that this is an accurate reflection of the chain of email correspondence.

352. Mr Naidoo's email of 3 November 2023 (record p.789) states that "This is a first attempt at setting a date for the planned joint meeting where each sector will provide some thoughts on the Panel Report and possibly offer some recommendations on future work and policy considerations."

353. For the reasons given above, Mr Naidoo's correspondence indicates that there was no agreement on the way forward reached on 24 November 2023. In any event, Industry was not at that meeting.

354. The Industry Respondents deny that they were preparing an "equivalent to the Assessment".

Ad paragraph 154

355. The SAPFIA comment must be read together with the rest of the document which supported the Minister's decision as being the most definitive policy position by government under circumstances of the current state of knowledge about the trade-offs.

Ad paragraph 155

356. The Industry Respondents deny that "this" was contrary to the Panel's recommendation, including because the measurement of costs of closure to the fishery and economy was not finally determined by the Panel.

357. The Industry Respondents also deny that the SAPFIA document was entirely destructive of a viable solution or "agreement" being found.

Ad paragraph 156

358. The Industry Respondents deny that "AM70" reflects that the conservation sector had grave concerns about the merits of further meetings.

Ad paragraph 157

359. Mr Naidoo cancelled the meeting because of the conservation sector group's stance that it was premature to meet to present respective analyses as SAPFIA's document indicated that a more detailed response would follow.

360. The Industry Respondents deny that the Panel had made recommendations regarding closure delineations on the bases contended for by the Applicants.

Ad paragraph 162

361. In the founding affidavit, the Applicants have not dealt with any of the material issues raised by SAPFIA in the SAPFIA comments.

Ad paragraph 163

362. The contents of this paragraph are denied.

363. The Island Closures are in place, which are subject to a review after 6 years. There is - as the Panel found – a high priority need to investigate and address other factors

causing the decline of the African penguin population to avoid further deterioration in penguin numbers.

Ad paragraphs 164 - 183

364. We refer to what we have stated above in paragraphs 147 to 176 above in respect of the Applicants' allegations pertaining to the alleged shortcomings of each island closure.

Ad paragraphs 204 – 209

365. For the reasons given in paragraphs 181 to 189 above, the Industry Respondents deny that the Applicants have established that the Minister's decision was irrational.

Ad paragraphs 217 – 219

366. For the reasons given in the section above dealing with the Industry Respondent's opposition to the relief sought, the Industry Respondents deny that the Applicants are entitled to any of the relief that they seek.

The affidavit of Weideman

367. We refer to what we have stated above in respect of Weideman's evidence, in particular in the accompanying expert affidavit of Dr Bergh.

The supplementary founding affidavit

Ad paragraph 7

368. Even if the relief sought is granted, the Industry Respondents deny that the extinction of the African penguin would be prevented.

Ad paragraph 9

369. The publication of the early results of the ICE did not confirm that island closures had a positive impact. The ICE results were ultimately interpreted by the Panel. The Industry Respondents did not refuse to accept the benefits of fishing closures.

Ad paragraph 11

370. It is denied that once the Panel determined that island closures are a valid conservation measure the key substantive issue for purposes of the decision-making related to how these closures are to be determined. A trade-off decision of a policy nature is still required.

Ad paragraph 12

371. It is denied that there was a recommended trade-off mechanism and that the Minister ignored "the conclusion". The Panel did not provide any proposed delineations. The Panel ultimately did not fulfill all the purposes for which it was appointed.

Ad paragraph 13

372. There is no "Panel's recommended trade-off mechanism". The Panel itself encouraged consensus seeking between stakeholders in taking forward the Panel's findings and work. The Minister's reasons are contained in the Naidoo memo. It is denied that impugned decision is irrational on the basis alleged.

Ad paragraph 14

373. For the reasons given, there was no recommended trade-off mechanism. The Minister was not in a position to apply a trade-off without further work research work being done, including the research and tasks identified by the Panel.

Ad paragraph 15

374. The Panel did not provide a trade-off mechanism. In the absence of consensus reached between stakeholders by negotiation, the Minister was unable to take a trade-off decision. In the absence of finality on any trade-off mechanism, the Panel's report - including suggestions about aspects of a trade-off framework - could be used for as part of a consensus negotiated outcome.

Ad paragraph 17

375. The contents of this paragraph are denied. The Applicants steadfastly fail to acknowledge that there are competing interests at stake that must be take into account and that the Minister imposed the Interim Closures (which does not amount to "placating industry interests").

Ad paragraph 18

376. We refer to what we have stated above in respect of the Interim Closures, and the comparison between the Interim Closures and the Applicants' proposed closures (which are flawed and disputed).

Ad paragraph 19

377. It is denied that the Minister disregarded the recommendations of the Panel regarding the appropriate approach for delineating fishing closures. We refer to what we have stated above in respect of the Interim Closures, and the comparison between the Interim Closures and the Applicants' proposed closures (which are flawed and disputed).

Ad paragraph 20

378. The contents of this paragraph are denied.

Ad paragraph 21

379. The contents of this paragraph are denied.

380. There is a review of the Interim Closures after six years. Once more research work is done - as contemplated by the Panel - the Minister may take a further decision in respect of island closures before the expiry of the six years.

Ad paragraph 22

381. The contents of this paragraph are denied.

Ad paragraph 41

382. The contents of this paragraph are denied.

Ad paragraph 42

383. The Panel did not deliver on all the objectives and terms of reference. It did not reach the conclusion contended for by the Applicants.

Ad paragraphs 43 - 44

384. For the reasons already given, the contents of these paragraph are denied.

Ad paragraph 47

385. The contents of this paragraph are denied.

386. The summary of aspects of the Panel's report in paragraph 2.8 of the Naidoo memo must be read in the context of the contents of the Panel report. The Panel did not provide a trade-off mechanism which could be applied by the Minister.

387. The Industry Respondents contend that for a trade-off decision to be made by the Minister further data needs to be obtained in respect of available catch data for purposes of the OBM.

Ad paragraph 49

388. The contents of this paragraph are denied.

389. The Panel did not make the recommendations contended for by the Applicants. It did not meet all the objectives of the terms of reference.

Ad paragraph 50

390. The allegation of irrationality is denied.

391. The Interim Closures retain the status *quo ante* which had been in place since September 2022 pending the further research that needs to be done before a trade-off decision can be made.

Ad paragraph 51

392. It is denied that those paragraphs of the Naidoo memo purport to flow from the Panel's recommendations.

Ad paragraph 52

393. It is denied that paragraph 2.9 of the Naidoo memo correctly reflects the Panel's recommendations regarding the need for island closures and that the Naidoo memo, "flowing from these" recommends fishing limitations around the breeding colonies.

Ad paragraph 53

394. It is denied that paragraphs 2.10 and 2.11 of the Naidoo memo contain a number of inexplicable inconsistencies with the Panel's recommendations, for the reasons alleged in the sub-paragraphs.

Ad paragraphs 54.3.2 and 55

395. It is denied that Dr Fikizolo's email "AM42" acknowledged that the Interim Closures are not fit for conservation purposes. It is simply not what the email states, nor what it reflects.

396. For all the reasons already traversed, the contents of paragraph 55 are denied. I refer to what I have stated in respect of the Interim Closures, and the comparison between the Interim Closures and the Applicants' proposed closures.

Ad paragraph 56

397. It is denied that the reliance on consensus was a flaw and that there was clear evidence of none being likely when the Minister took the decision.

Ad paragraphs 58 – 65

398. These references all predate the release of the Panel report which encouraged further efforts to seek consensus. Negotiations post the Panel report would have had the benefit of the Panel report.

Ad paragraphs 66 - 70

399. It is denied that it is inconceivable that the Minister would have come to the decision that she did had she properly applied her mind to the Panel report. On the contrary.

400. It is further denied that the Minister "rubber-stamped" what had been prepared by Naidoo and failed to properly apply her mind to what the Applicants refer to as the Panel's "recommendations" and "the trade-off mechanism".

Ad paragraph 71

401. The contents of this paragraph are denied. The Panel did not recommend the "necessity of implementing closures". The Panel did not make a recommendation which would resolve the impasse.

Ad paragraph 72

402. The contents of this paragraph are denied.

403. The Industry Respondents deny that there is a clear reference in paragraph 2.8 of the Naidoo memo to the Panel's trade-off mechanism and that a trade-off mechanism was recommended.

Ad paragraph 73

404. The contents of this paragraph are denied.

Ad paragraph 76

405. For the reasons given, the Industry Respondents deny that the Minister's decision bears no relationship to the purpose for which it was taken or the power to order fishing no-take zones on the bases alleged in sub-paragraphs 76.1 – 76.7.

406. The Industry Respondents deny that the Interim Closures are incapable of achieving the objective of science-based conservation measures and that they fail to reduce competition between Industry and African penguins and accordingly fail to serve as a mitigation measure.

Ad paragraph 77

407. For the reasons already traversed, the Industry Respondents deny that the impugned decision is not supported by the evidence and information specifically procured by the Minister, that it is based on material factual errors regarding the scope, content and import of the Panel's recommendations and that key considerations were not considered, on the bases alleged in sub-paragraphs 77.1 – 77.6.

Ad paragraph 78

408. The Industry Respondents deny that the impugned decision is not capable of advancing the purpose for which it was taken, on the bases alleged.

Ad paragraph 79

409. It is denied that the record contains no reasons for the Minister decision and that the Minister's decision is hence irrational.

Ad paragraph 80

410. It is denied that the Minister's decision is both substantively and procedurally irrational. The Panel did not deliver on all the terms of reference and did not make the recommendations the Applicants say the Panel made.

Ad paragraph 81

411. The contents of this paragraph are denied.

Ad paragraph 82

412. It is denied that "this irrationality" is highlighted on the basis alleged in this paragraph.

Ad paragraph 83

413. The Applicants have not established the review grounds that they rely upon and have not made any factual or other allegations in the support of the review grounds that the decision was unreasonable or was not taken in a manner that was procedurally fair and rational on the ground in section 6(2)(c) of PAJA.

Ad paragraphs 85 - 90

414. The Applicants have not established the review grounds that they rely upon.

415. The Minister's legal obligations under these laws and instruments and the precautionary principle will be dealt with in legal argument.

416. The Minister has imposed island closures as one of the measures to prevent the extinction of the African penguin.

417. The Naidoo memo does not subordinate government's obligations to the notion of agreement between the conservation and industry sectors.

418. It is denied that "Industry" has consistently held the line that closures are not necessary.

CONCLUSION

419. In the circumstances of all of the above, the application should be dismissed.

MICHAEL COPELAND

S.C.T

I certify that the above signature is the true signature of the deponent and that he has acknowledged that he knows and understands the contents of this affidavit which affidavit was signed and sworn to before me in my presence at Hout Bay on this 22 day of August **2024**, in accordance with Government Notice No. R1258 dated 21 July 1972, as amended by Government Notice No R1648 dated 19 August 1977, as further amended by Government Notice No. R1428 dated 11 July 1980, and by Government Notice No R774 of 23 April 1982.

SUID-AFRIKAANSE POLISIEDIENS
HOUT BAY
22 AUG 2024
COMMUNITY SERVICE
SOUTH AFRICAN POLICE SERVICE

7214158-1
S. TSHAMBU

COMMISSIONER OF OATHS

FULL NAME: Sigabonga Tshambu

S.T

Subject: FW: Updates on penguin MICE analyses
Date: Friday, 31 May 2024 at 19:17:27 South Africa Standard Time
From: Doug Butterworth
To: marius.diemont@gmail.com, Coriaan de Villiers, mike, Michael Copeland, matt@olsps.com
Attachments: FISHERIES_2023_NOV_SWG-PEL_25rev2_final.docx

Shows that the most recent MICE document was forwarded to Birdlife and other ENGO scientists in mid-Feb. – Cheers - Doug

Emeritus Professor Doug S Butterworth
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University of Cape Town
Rondebosch 7701 South Africa
Ph: +27-21-650-2343/2340

"MC1"

From: Doug Butterworth
Sent: Friday, February 16, 2024 3:39 PM
To: Fannie Welcome Shabangu <FShabangu@dffe.gov.za>; 'Janet Coetzee' <janetccoetzee@gmail.com>; Kim Prochazka <KProchazka@dffe.gov.za>; Carryn de Moor <carryn.demoor@uct.ac.za>; kevern.cochrane@gmail.com; copeland.fishconsult <copeland.fishconsult@gmail.com>; Riedau <redah@rialfishing.co.za>; Alistair McInnes <alistair.mcinnes@birdlife.org.za>; christina.hagen <christina.hagen@birdlife.org.za>; Mike <mike@olsps.com>; johann@sadstia.co.za; Lauren Waller <laurenw@ewt.org.za>; Cloverley Lawrence <cloverley.lawrence@sanparks.org>; Azwianewi Makhado <AMakhado@dffe.gov.za>; Smith, Craig <csmith@wwf.org.za>
Cc: Andrea Ross-Gillespie <andrea.ross-gillespie@uct.ac.za>
Subject: RE: Updates on penguin MICE analyses

Hi Colleagues

Herewith a further update of PEL/25 in response to further suggestions received. We look forward to collaborative discussions on this in the penguin SWG whose formation by DFEE we understand to be imminent.

Cheers

Doug and Andrea

Emeritus Professor Doug S Butterworth
Department of Mathematics and Applied Mathematics
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Rondebosch 7701 South Africa
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From: Doug Butterworth
Sent: Saturday, January 20, 2024 12:39 PM
To: Fannie Welcome Shabangu <FShabangu@dffe.gov.za>; 'Janet Coetzee' <janetccoetzee@gmail.com>; Kim Prochazka <KProchazka@dffe.gov.za>; Carryn de Moor <carryn.demoor@uct.ac.za>; kevern.cochrane@gmail.com; copeland.fishconsult <copeland.fishconsult@gmail.com>; Riedau <redah@rialfishing.co.za>; Alistair McInnes <alistair.mcinnes@birdlife.org.za>; christina.hagen

<christina.hagen@birdlife.org.za>; Mike <mike@olsps.com>; johann@sadstia.co.za; Lauren Waller <laurenw@ewt.org.za>; Cloverley Lawrence <cloverley.lawrence@sanparks.org>; Azwianewi Makhado <AMakhado@dffe.gov.za>; Smith, Craig <csmith@wwf.org.za>
Cc: Andrea Ross-Gillespie <andrea.ross-gillespie@uct.ac.za>
Subject: Updates on penguin MICE analyses

PS: Apologies for some double postings following a premature accidental send

Hi colleagues

Many of you will recall the November PWG meeting where we tabled document PEL/25 on penguin MICE, requesting initial feedback. Attached please find a revised version of that document which both extends some of the work presented at that time, and also takes account of feedback received at and after that PWG meeting. Furthermore, that meeting requested provision of a document providing a broad summary of the fundamentals (basic explanation of motivation and framework) of MICE approaches to examine possible reasons for the penguin decline, for which initial results have previously been reported. That document is attached, labelled for now as PEL/02.

At this time we await DFFE to finalise (we anticipate probably shortly) what may be a new joint DFFE Fisheries/Oceans-and-Coasts SWG on penguin matters, at which such documents would likely be discussed and taken forward. To enable such discussions to be initiated as efficiently and effectively as possible when such a SWG first meets, we are circulating these documents now, but at this stage only to those who have previously offered comments on these matters. The purpose is to allow receipt of possible requests for clarification and other comments, and suggestions for limited further model runs if considered needed. This would then allow PEL/25rev to be revised further before a meeting of this new joint SWG, so as to further facilitate that discussion.

Given that that meeting may well be scheduled for sometime in February, we request (pending possible further advice being provided by DFFE) that any such responses be returned to us by email by Monday 5 February, to allow sufficient time for us to complete further possible calculations and document amendments before such a meeting takes place.

Cheers

Doug and Andrea

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Subject: FW: First batch of SWG-PEL documents for 2024 - MICE docs were circulated to PWG
Date: Saturday, 01 June 2024 at 10:42:07 South Africa Standard Time
From: Doug Butterworth
To: marius.diemont@gmail.com, Coriaan de Villiers, mike, Michael Copeland, matt@olsps.com
Attachments: SAPFIA Biological Data Collection_January_2024.pdf, FISHERIES_2023_NOV_SWG-PEL_25rev2_final.pdf, FISHERIES_2024_JAN_SWG-PEL_02_2024_01_19.pdf, FISHERIES_2023_DEC_SWG-PEL_28 Small pelagic 2024 interim recommendations_FINAL.pdf

Hi all

Apologies – I missed this yesterday. The two MICE related documents (which include the one originally tabled in November and now updated in response to comments from some) WERE circulated to the full PWG on 19 Feb, as per below.

Cheers

Doug

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"MC2"

From: Fannie Welcome Shabangu <FShabangu@dffe.gov.za>
Sent: Monday, February 19, 2024 11:17 AM
To: Janet Claire Coetzee <JCoetzee@dffe.gov.za>; Doug Butterworth <doug.butterworth@uct.ac.za>; Carryn de Moor <carryn.demoor@uct.ac.za>; Dagmar Merkle <DMerkle@dffe.gov.za>; Nandipha Monica Mhlongo <NMhlongo@dffe.gov.za>; Mzwamadoda Phillips <MzPhillips@dffe.gov.za>; ssomhlaba@dffe.gov.za; Yonela Geja <YGeja@dffe.gov.za>
Cc: kevern.cochrane@gmail.com; copeland.fishconsult <copeland.fishconsult@gmail.com>; mvdh <mvdh@pioneerfishing.co.za>; Riedau <redah@rialfishing.co.za>; Alistair McInnes <alistair.mcinnes@birdlife.org.za>; christina.hagen <christina.hagen@birdlife.org.za>; Deon Van Zyl <Deon@afrofishing.co.za>; Lynne Shannon <lynne.shannon@uct.ac.za>; Azwianewi Makhado <AMakhado@dffe.gov.za>; mike <mike@olsps.com>; Makhudu J. Masotla <MMasotla@dffe.gov.za>; Johannes De Goede <JDeGoede@dffe.gov.za>; Andrea Ross-Gillespie <andrea.ross-gillespie@uct.ac.za>; dan <dan@inshore.co.za>; johann@sadstia.co.za; k.cochrane <k.cochrane@ru.ac.za>; Kelly Ortega Cisneros <kelly.ortegacisneros@uct.ac.za>; marthin@saldanha.co.za; Lauren Waller <laurenw@ewt.org.za>; Ashok Bali <ABali@dffe.gov.za>; Jonathan <Jonathan@africantuna.com>; Lungelwa Nomxego <LNomxego@dffe.gov.za>; Mmonwa, Kolobe <kmmonwa@wwf.org.za>; nsafe <nsafe@worldonline.co.za>; Grant Sauls <SLSGRA001@myuct.ac.za>; sdbconsultingsa@gmail.com; Pierre de Villiers <estuaries@capenature.co.za>; Cloverley Lawrence <cloverley.lawrence@sanparks.org>; Zimasa Jika <ZJika@dffe.gov.za>; carl.vanderlingen@gmail.com; Redah De Maine <redah@oceangrow.co.za>; Dawit Yemane Ghebrehiwet <DGhebrehiwet@dffe.gov.za>; Mathebula, Surprise <smathebula@wwf.org.za>
Subject: First batch of SWG-PEL documents for 2024

Good morning all,

I hope you are all having a good to start to 2024.

This serves as the first communication of the SWG-PEL for 2024, and attached are the following documents to get us going this year:

1. 2023 PEL/28 contains the approved interim SWG-PEL recommendations for 2024,
2. 2023 PEL/25Rev that details further progress on the MICE work given that information on that front remains awaited. Initial collaborative discussion of this work is anticipated to take place in the Penguin SWG currently under formation,
3. 2024 PEL/02 that provides an explanation for the need and use of MICE approaches to investigate African penguin decline, and
4. January 2024 SAPFIA Observer Report for your records.

More SWG-PEL documents will follow in due time.

Kind regards,
Fannie

"MC3"

FISHERIES/2023/NOV/SWG-PEL/25rev

Note: *Though initiated as a PWG contribution, this now revised document is understood to likely first come under discussion in a Penguin SWG currently under formation by DFFE*

Exploration of a MICE approach to evaluate the impact of fish abundance on penguin survival[1]

D.S. Butterworth and A Ross-Gillespie[2]

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Summary

A MICE approach is used to investigate the possible relationship between penguin annual survival proportions and sardine biomass. The approach is applied for the West and South coasts separately, as well as for the two coasts combined. Logistic relationships are fit for the coasts combined and West coast models, both of which indicate an increase in survival proportion with higher biomass. The survival proportions estimated are compatible with those obtained from independent analyses of other (primarily tag-re-sightings) data. However, the MICE results do also indicate an additional marked reduction in survival proportions over the first decade of this century, which cannot be attributed to changes in sardine abundance. Had it not been for this additional reduction, it is estimated that current penguin abundance would be more than what it was forty years ago, which serves to emphasise the importance of a better understanding of what could have caused such a reduction. A possibility is negative effects, over an extended period, of the *Treasure* oil spill in 2000. However, the number of these cumulative additional mortalities is substantial, and discussion is needed as to whether this *Treasure* hypothesis on its own provides a plausible explanation, or other reasons for this additional mortality also need to be sought. (One possibility is a reduction is reproduction over this period, which could be a consequence of oiling, but that would need to have been substantial – by about 80% over almost a decade.) After allowing for these effects, the estimated annual survival proportions during the beginning and end of the period analysed (mid-1980s to the present) are only some 3% less than is needed for the penguin population to stabilise. One possible reason that has been put forward to explain this non-sustainability is predation by seals that have expanded beyond their "natural" pristine abundance, given that some earlier space-limitation constraints no longer apply. The numbers of additional penguin deaths leading to population decreases over these initial and final time intervals are shown to be compatible with such a hypothesis, in that the requisite extent of such seal predation would need to be of the order of an average of only 0.01 penguins per seal per year.

A recently added Appendix C (responding to some further suggestions received) finds that adding anchovy to sardine as a component of the effective biomass impacting penguin survival generally does not seem to provide models with notably better explanatory power. The management implications of the Holling Type III (logistic) functional response form adopted for the Base Case MICE are important. This is consistent with the penguin abundance data from the mid 1980s to mid-1990s, but the situation is not as clear cut for the most recent decade. Further consideration of this should, however, first await discussion

[1] This paper is a revision of the PEL/25 originally presented to the PWG, taking into account feedback at and after the PWG meeting held in early November 2023. Notable differences include the revision of Appendix A for greater clarity, and the addition of Figure 7 on the impact on penguin population trends of marked reduction of survival proportions during the first decade of this century. Further, a glitch was found in the manner in which that ΔS reduction for the 2002-2010+ period in the $S(B)$ relationship was implemented, which has been corrected here. The impact of this error is mostly on the magnitude of the ΔS reduction, which is bigger now than in the original PEL/25 document; consequent qualitative implications are unchanged.

[2] Marine Resource Assessment and Management Group, Department of Mathematics and Applied Mathematics, University of Cape Town, Rondebosch.

(and possible inclusion in this MICE approach) of other recent effects including (but not necessarily limited to) the impact of shipping noise on penguins in the Eastern Cape and reports of perhaps large numbers of penguin mortalities in illegal gill nets set close to some of the penguin breeding colonies. **Further inputs on such other factors possibly making a relatively large contribution to the penguin decline do also need to be considered in moving forward with this MICE approach, and are to be welcomed, so that alternative models and assumptions can also be progressed.**

Keywords: African penguin, MICE, survival proportion, sardine, anchovy, biomass

Note: Penguin numbers provided in this document are expressed in terms of adult pairs, but when estimated numbers of deaths (or "recruits to the adult population) are reported, these refer to adult individuals

Introduction

Fishing around the breeding colony islands of African penguins at best accounts for only a small fraction of the decline in penguin numbers[3] (DFFE, 2023). Appendix F of that report, which arose from the 2023 penguin review, provides details of suggestions for how to develop a Model of intermediate Complexity (MICE) in order to attempt to explain the trends in the penguin population numbers. The Panel suggested that the key species that need to be represented in the MICE included African penguins, sardine, anchovy and Cape fur seals. For the results presented in this paper, a MICE incorporating the penguin population count and forage fish abundance is developed. These data are listed in Table 1.

Note that Butterworth and Ross-Gillespie (2023) consider the impact of guano harvesting on the penguin population. Even though guano harvesting ended some decades ago, this harvesting reduced the available breeding habitat for the penguins, so that they now nest in sites where they are more exposed to predators, nest flooding or overheating (DFFE, 2023). However, as can be seen in Butterworth and Ross-Gillespie (2023), the transient impact of the guano harvesting should have ended about 1-2 decades previously, and hence is unlikely to be a contributory cause to the decline in the penguin numbers in more recent years.

Random walk approach to estimating survival proportions

Please note that the random walk approach described below was a temporary approach implemented to explore what form the relationship between survival and fish biomass might take. The approach and its model results therefore do not carry any importance in and of themselves, but have been included here only for the purposes of explaining the process by which the Base Case (BC) model was developed.

Details of the MICE developed are given in Appendix A. One of the core assumptions of this food limitation model is that penguin survival proportion (S) is some function of fish biomass (B). In order initially to get an impression of what form of relationship between S and B might result in a reasonable fit to the penguin count data, survival proportion estimates S were estimated using a random walk method (independent of fish biomass, see Appendix A), where these S values essentially represent the "ideal" annual survival proportions which would result in a good match between the model and the penguin count data.

In Figure 1, the resulting inferred survival proportions S are plotted against the sardine biomass to see whether there is evidence for an underlying functional form for an $S(B)$ relationship. Results in Figure 1 use sardine only for the fish biomass[4] and plot results for both West and South coasts combined, as well as for when the model is applied to the two coasts separately. The following indications from these plots shaped the approach going forward.

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[3] The Panel report states "Overall, the results of the ICE for Dassen and Robben islands indicate that fishing closures around the breeding colonies are likely to have a positive impact on population growth rates, but that the impacts may be small, in the range 0.71–1.51 % (expressed in units of annual population growth rate). These impacts are small relative to the estimated rates of reduction in penguin abundance for these two colonies over recent years." (DFFE, 2023).

[4] Sardine was considered initially for the model explorations, and anchovy included later in sensitivity runs.

- In general, the inferred survival proportion starts declining in 1999/2000, when the overall forage fish biomass was still increasing, which is indicative of potential problems for finding a simple functional form for the $S(B)$ relationship.
- In principle, the most promising candidate for a functional form for the $S(B)$ relationship is the West Coast (WC) only model. Inspection of the WC estimates of survival against sardine biomass therefore seemed a good starting place.
- The WC model shows some unexpected features in the plot of inferred survival proportion against sardine biomass (middle bottom plot of Figure 1). In particular, at low biomass there are two distinct groupings, with the estimated survival proportions for the 2005-2010 period lying markedly below those from earlier and later years. Furthermore at high biomass, the 2002-2003 survival estimates are lower than would have been expected given the high fish biomass. Thus the 2002-2010 survival estimates in general appear to be lower than would have been expected given the fish biomass.
- Ignoring these years, the remaining survival estimates appear to lie roughly on a logistic curve relative to the sardine biomass (i.e., survival proportion flattens and does not continue to decline for very low fish biomass). Therefore, the most likely candidate for an $S(B)$ relationship for the West Coast is a logistic curve, with a forced additional reduction for the 2002-2010+ period. This relationship is presented in this paper as the Base Case (BC).
- These indications of a reduced survival for the 2002-2010+ period are interesting in the light of the Treasure Oil Spill which occurred in June 2000. Further discussion with relevant scientists regarding the biological plausibility of a connection between the two will be important. However, survival also appears to be lower than expected for that time period for the SC, which would not immediately seem relatable to occurrences on the WC, but could arise from penguin movements.

Results

As mentioned above, the BC $S(B)$ relationship assumed is a logistic curve with a forced reduction ΔS_y for year y in the 2002 to 2010+ period. The magnitude of the reduction is estimated in the model, with the greatest reduction occurring in 2002 and a gradual (logistic) decline in this reduction[5]. Appendix B presents more detailed results, including results for other functional forms tested and various alternative assumptions for the 2002-2010+ reduction.

Figure 2 plots the fits of the model for this BC $S(B)$ relationship for the coast combined data, as well as for the coast-disaggregated data. Fits for the coast-combined and WC only models are reasonable, though those for the SC model are not good. Figure 3 repeats the fits of Figure 2, but also shows the standardised residuals.

Figure 4 converts the ΔS_y reduction function into the number of additional associated deaths for the 2002 to 2010+ period. Note that while the penguin count and the modelled numbers are in terms of adult penguin pairs, the number of deaths has been converted to number of adult individuals dying by multiplying the modelled number of pairs by 2, i.e. assuming a 50:50 male:female ratio. This was done because individual deaths, rather than number of pairs dying, seems to be a more intuitive measure for reality checks.

Figure 5a and b superimpose independent survival estimates for the African penguins (primarily determined from tag re-sightings data) onto the inferred survival proportions estimated by the BC model.

Figure 6 plots the difference between the model-estimated survival and the equilibrium survival proportion calculated for $H = 0.70$ (see Appendix A). This difference is expressed in terms of the difference in the number of deaths of individual adult penguins each year.

Figure 7 shows the results for a repeat of the coast-combined BC run, fixing the estimable parameters at their BC MLE values, but with the ΔS_y reduction set to zero. This run shows what situation is estimated to have

[5] The form of the reduction is $\Delta S_y = \Delta S_{max}/\left(1 + e^{k(y-y_0)}\right)$, with ΔS_{max}, k and y_0 estimable parameters. Depending on the value estimated for y_0, ΔS_y may be zero in 2010, or it may decrease to zero in the few years following 2010.

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resulted had penguin survival proportions tracked the sardine biomass only, instead of experiencing the reduction in survival from 2002-2010+ needed to match the observed penguin population trend.

Appendix B has some further model output to consider, including some alternative options considered for the forms of the ΔS_y reduction function and the $S(B)$ relationship, a further attempt at achieving a better fit for the SC only model, the inclusion of the anchovy biomass in the $S(B)$ relationship, the possibility that the sharp decline in abundance after 2002 was related to a drop in reproduction as a result of oiling and sensitivity to the choice of the H value of 0.70 assumed for the BC.

Discussion

Some discussion points are listed below.

- The number of additional deaths (over 80 000 adult individuals) corresponding to the 2002 to 2010 + period from the ΔS_y reduction function (Figure 4) is substantially larger than the deaths reported from the Treasure oil spill (approaching 2000 oiled birds, and an estimated 4000 chicks dying before they could be rescued – Crawford et al, 2000). However, the last reflects only observed mortalities, plus there could be later additional deaths arising from longer-term effects of the oiling. This matter merits further discussion, together with what other mechanisms might explain the clear evidence in the data of excess penguin mortality in the first decade of this century that cannot be attributed to (lower) forage fish biomass,

- At face value the third row of Figure 2 indicates that sardine abundance from the commencement of surveys in the mid-1980s until the mid-1990s was too low to sustain the penguin population (i.e., prevent it declining). This does however raise questions, given that marked fluctuations in sardine abundance are to be expected naturally (even in the absence of fishing) – wouldn't penguins be expected to have evolved to be able to accommodate those? Could the failure of the annual penguin survival proportion over that period (and also over the last decade) be large enough to prevent decline[6] therefore arise from some other cause? One possibility that has been suggested is predation by seals.

  Seals in South Africa were near extirpated at the turn of the 19th century as a result of over-harvesting, but have since increased substantially (Butterworth *et al.*, 1995) before levelling off over the last two-three decades (Kirkman *et al.*, 2007). This new level may be above that before harvesting started, given that seal colonies on the mainland have now become viable following eradication of most of their land-based predators (lions and hyenas), and now generally constitute the majority of a seal population that is likely not space-limited at present to the extent it was in the past. Gough island in South Atlantic reflects a similar situation with a reduction in rockhopper penguin numbers co- incident with a sub-Antarctic fur seal population recovering from previous over-harvesting (and there in the absence of any fishery), with evidence also of penguin mortalities caused by those seals (Ryan and Kerr, 2012).

  Could then the current "unusual" land-breeding seals in South Africa account for this additional penguin mortality, which Figure 6 indicates to correspond to some 2500 additional penguin deaths annually around 1990, and some 1000 in the last decade? Total seal pup counts at colonies in South Africa over the last four decades have been in the region of 80000 (data provided by F. Shabangu, *pers. comm.*) with the land-based colony at Kleinsee approaching 100 thousand in some years (though this has dropped by about 50% recently). Conversion of pup numbers to the total number of seals requires a multiplier somewhat in excess of 4 (Butterworth *et al.*, 1995), so that these Kleinsee numbers indicate that there have been in the vicinity of some 200 to 400 thousand of these "unusual" (or "excess") seals off South Africa in recent decades. It would seem that these could then plausibly explain these additional penguin deaths, as this would require a consumption rate of penguins by these seals in the

[6] The survival proportion over these periods is estimated to be about 3% too low for the penguin population to sustain itself. This difference is insensitive to the value assumed for H – varying H up or down by 0.1 from the 0.7 assumed sees this percentage range over 3.2-3.3% (see Table 2).

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vicinity of only 0.01 penguins killed per seal per annum. This conclusion is hardly sensitive to alternative assumptions for the value of *H* (see Figure B.6).

- Figure B.3 of Appendix B provides results for a further attempt at achieving a better fit to the SC data. These initial explorations suggest that increasing the survival proportion prior to 1990 allows for a better fit to the data. However, the plausibility of such an increase (higher than what would be expected given the sardine biomass at the time) would need to be discussed.

  Possible movement of penguins between the WC and SC is an additional complicating factor here. Though a priori one might prefer a MICE approach to separate west and south coasts, that brings with it the complication of in principle needing to estimate such movement in fitting the data. The Coasts combined approach, in contrast, avoids that because it is modelling a closed penguin population.

- Figure B.2 of Appendix B shows some results for alternative forms for to the ΔS_y function and the $S(B)$ relationship which were explored Of the alternative forms for the former, the logistic decline for the ΔS_y function assumed in the BC seems preferable to a constant reduction or a linear decline. While the alternative von-Bertalanffy-type shape tested for the $S(B)$ relationship (also with a 2002-2010+ reduction) results in a similarly good overall model fit, the linear shape for the VBL function which is estimated does not seem particularly defensible.

- Figure B.5 of Appendix B shows that the fit to the penguin count data deteriorates if anchovy in addition to sardine biomass is included as a determinant of the relationship between penguin survival and forage fish abundance. This extension provides some benefits but also leads to some negatives.

- Figure B.5 of Appendix B plots the results for different values of *H*. Adjusting *H* by 0.10 either way has minimal impact on the results, so that the choice of a specific value for *H* for the Base Case model does not seem particularly critical.

- Results shown in Figure 5a and b and in Appendix B indicate broad compatibility between the MICE estimates of survival proportions with those provided by approaches using independent data, both in terms of trends and absolute values.

- Figure 7 shows that if the penguin survival had been dependent solely on the sardine biomass, with no reduction in the 2002-2010+ period, the penguin population could have continued to increase to over 80000 breeding pairs by 2006 before starting to decline following the drop in sardine biomass (these values are for the $S(B)$ function estimated for the coast-combined BC). Under this scenario, the 2020 penguin count should have been over 50000 instead of the model-estimate of just over 13500 from the coast-combined BC model, i.e. higher now than in the mid-1980s.

Further work possibilities

- Incorporate a more explicit model of seal predation into this MICE.
- Link this MICE with that developed earlier (Butterworth and Ross-Gillespie, 2023) for the impact of guano harvests on primary penguin breeding habitat.

Acknowledgements

We thank those scientists who originally collected the penguin, pelagic fish and seal data used in these analyses.

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Table 1: Data used for the analyses presented in this document. The numbers of penguin pairs are derived from the data provided by N. Makhado (F. Shabangu, *pers. comm.*). The data are available by penguin colony; where there are years with missing data, these gaps have been filled by linear interpolation between previous and successive years (Appendix B of Butterworth and Ross-Gillespie, 2023 provides more details on this process). The sardine and anchovy biomass values are the November survey estimates (J. Coetzee, *pers. comm.*). The West/South coast boundary is Cape Agulhas.

	No. penguin pairs			Sardine biomass (tons)			Anchovy biomass (tons)		
Year	Total	WC	SC	Total	WC	SC	Total	WC	SC
1984	46075	29424	16650	48378	48009	369	1336482	611049	725432
1985	45144	27795	17348	45013	25457	19556	1327710	967004	360706
1986	44490	26385	18105	299797	238230	61566	2568625	1978652	589973
1987	41367	22438	18928	111285	94165	17120	2108771	1866430	242341
1988	41396	21565	19831	134362	128043	6319	1607060	1289624	317436
1989	42208	21382	20825	256655	198328	58327	751529	517293	234236
1990	42225	20297	21928	289876	248855	41020	651711	342812	308899
1991	41500	18971	22529	597858	517180	80678	2327834	1254359	1073476
1992	42796	19164	23632	494157	247756	246401	2088025	1036580	1051445
1993	35998	13250	22748	560019	480822	79198	916359	439121	477238
1994	38022	19225	18798	518354	389730	128624	617276	309981	307294
1995	34271	18218	16053	843944	363542	480402	601271	468678	132593
1996	29852	17714	12138	529456	257763	271693	162048	29748	132300
1997	26277	17028	9249	1224632	964835	259797	1482633	377663	1104969
1998	26810	18385	8425	1607328	1082547	524781	1229132	206586	1022547
1999	42743	24252	18491	1635410	708029	927381	2052156	741961	1310195
2000	46528	26196	20332	2292380	726230	1566150	4653779	1960122	2693657
2001	56679	33606	23072	2309600	669617	1639983	6720287	2301999	4418288
2002	52735	35242	17493	4206250	1184713	3021538	3867649	2018570	1849079
2003	41930	31372	10558	3564171	1343118	2221053	3563232	1181111	2382121
2004	52545	38679	13866	2619301	296108	2323193	2037011	729369	1307642
2005	42890	34836	8054	1048991	75604	973386	3077001	670730	2406272
2006	32971	21681	11290	712557	177889	534667	2106273	1027009	1079264
2007	27965	21961	6004	252199	53138	199061	2505655	887831	1617824
2008	22784	12109	10675	384080	211871	172209	3598790	1314490	2284300
2009	20574	10789	9785	501575	262175	239400	3792547	2098253	1694294
2010	15397	11068	4329	508363	309465	198897	2058185	335298	1722887
2011	20022	8726	11297	1037060	182825	854235	754124	173390	580734
2012	18683	8871	9812	345054	186109	158945	3187964	1022472	2165493
2013	18835	8332	10503	611763	467613	144150	3819666	1161192	2658474
2014	19514	7667	11847	444500	195786	248715	2970760	1298929	1671831
2015	19338	8432	10906	363230	98467	264763	1944258	654540	1289718
2016	17304	8175	9129	258575	183356	75219	1733040	1337305	395736
2017	16079	7229	8850	334804	107173	227631	1568398	820377	748022
2018	15174	6732	8442	90768	34845	55922	1559546	356113	1203433
2019	13284	7108	6176	193630	43619	150010	843745	481291	362454
2020	10844	7097	3747	248942	51678	197263	2556598	1526611	1029987
2021	10216	6682	3534						

Table 2: Values for equilibrium survival proportion (calculated by solving equation A.5 of Appendix A for S for a given value of H) are listed for three different H values. The estimate for 2020 survival proportion for the coasts-combined model is also listed for these three different H values. The last column provides the difference before the first two.

H	S^{equilm}	S_{2020}	$S_{2020} - S^{equilm}$
0.6	0.779	0.746	-0.033
0.7	0.763	0.730	-0.032
0.8	0.749	0.717	-0.032

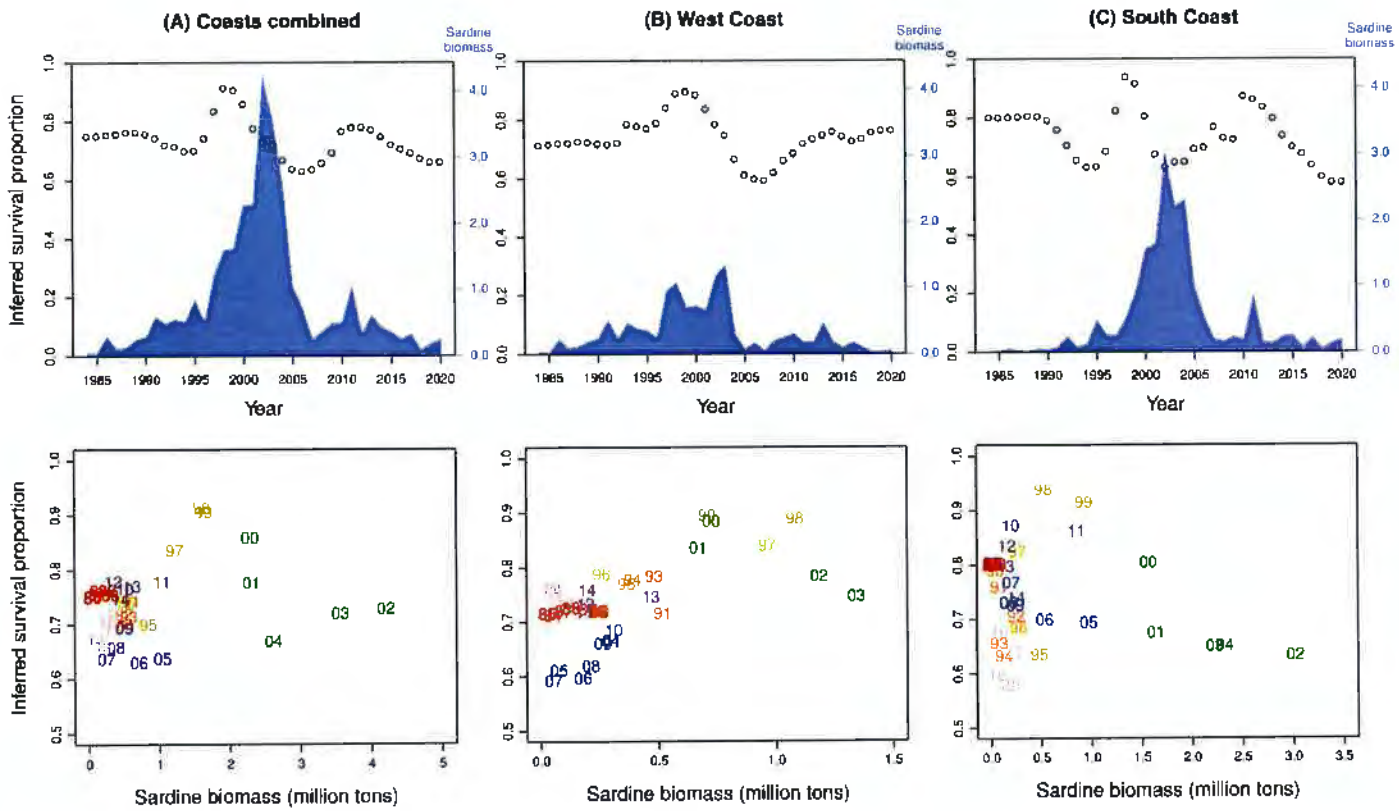

Figure 1: The top row plots the annual survival proportions inferred by the random walk model (open circles), showing what survival proportions are needed to provide a good fit to the penguin count data. The purple shaded areas in the top plots show the sardine biomasses (in million mt) for each coast and for the two coasts combined. The bottom row plots the survival proportions inferred from the random walk model against sardine biomass to see what indications there are regarding an appropriate functional form for the S(B) relationships.

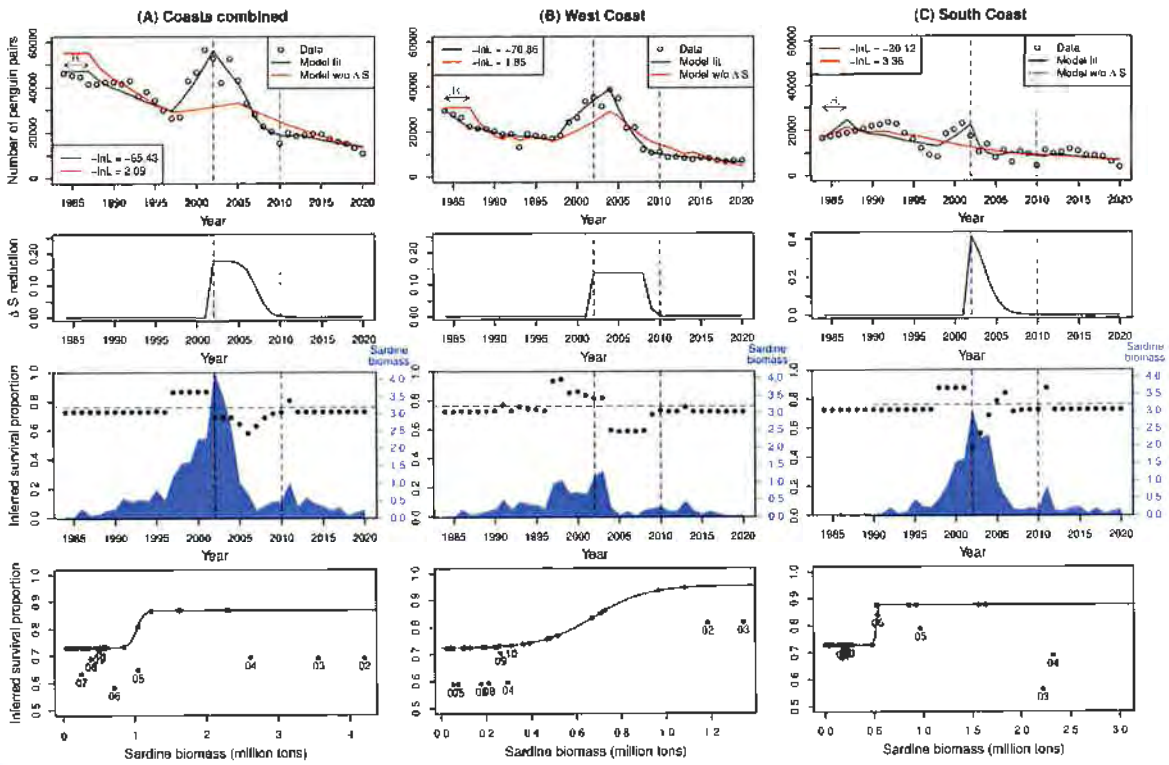

Figure 2: This plot shows fits to the penguin count data (top row) for coasts combined and coast-disaggregated data. Note that a fixed population growth rate is estimated for the first three years of the model in order to specify initial conditions – this has been marked by the grey horizontal arrows under the "R_i" symbol. The red lines in the top row show the model fit when there is no ΔS_y reduction. The second row shows the extent to which the survival proportions need to be decreased over the 2002-2010 (and possibly beyond) period in order to produce a reasonable fit to the penguin count data. The third rows plots those resulting inferred annual survival proportions against the sardine biomass. The green horizontal dashed line in these plots shows the survival proportion that would keep the population at equilibrium for the value of $H = 0.70$ assumed for this BC model (see Appendix A). The final row shows the S(B) relationship which the model estimates and includes estimates for the years for which a further reduction is added. Note -lnL values for the fits given within the plots in the first row.

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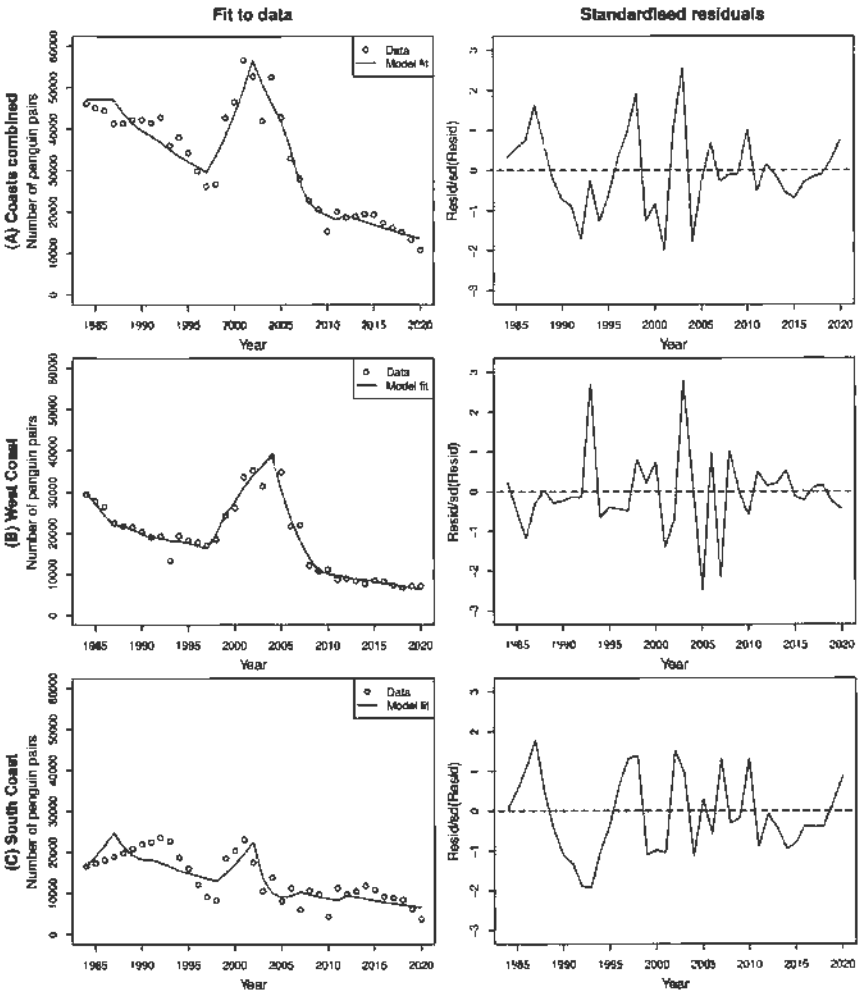

Figure 3: The left column repeats of the top row of Figure 2, while the right column plots the standardised residuals.

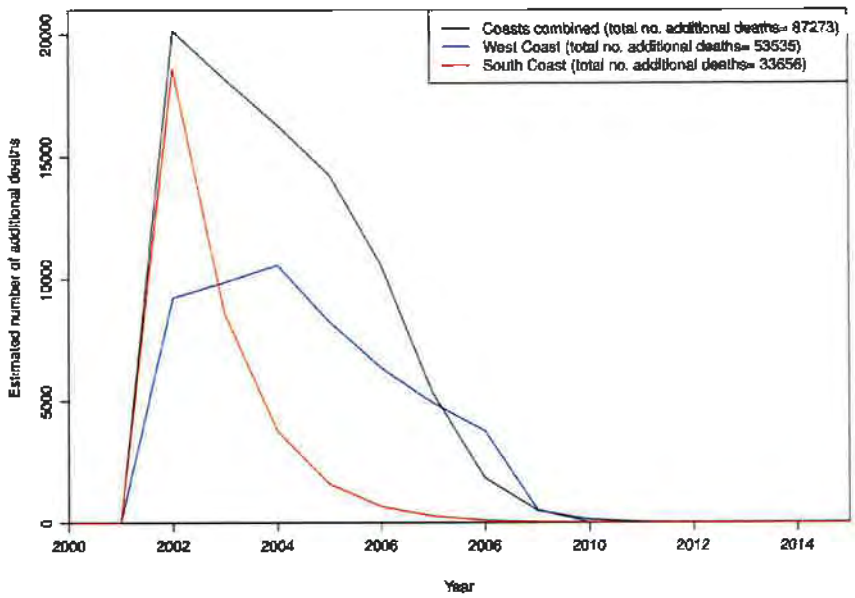

Figure 4: The estimated number of additional deaths of individual adult penguins for the 2002 onwards period required to produce a reasonable fit to the penguin count data. The values here were calculated as $D_y = 2 * \Delta S_y . \hat{N}_y$, where ΔS_y is the reduction in the survival rate estimated for the 2002 to 2010 + period and $\hat{N}_y$ is the model-estimated number of penguin pairs, i.e. a 50:50 male:female ratio was assumed. The legend lists the total number of additional deaths for this period.

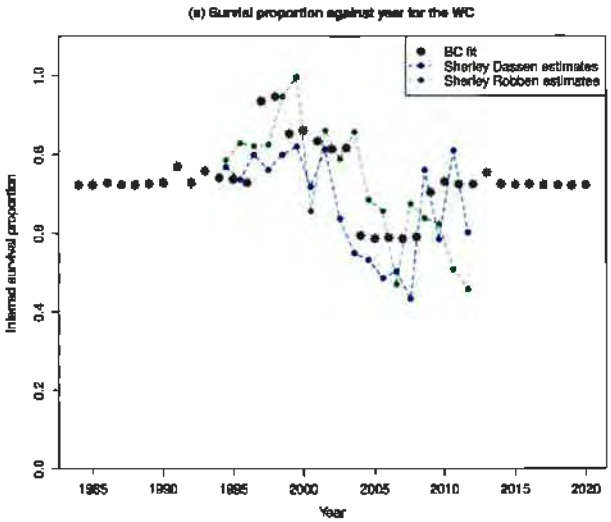

Figure 5a: Estimates of survival proportions from tagging data (extracted from the PowerPoint presentation Sherley made to the 2023 review panel). superimposed onto the inferred survival proportions from the BC WC fit and the WC random walk fit.

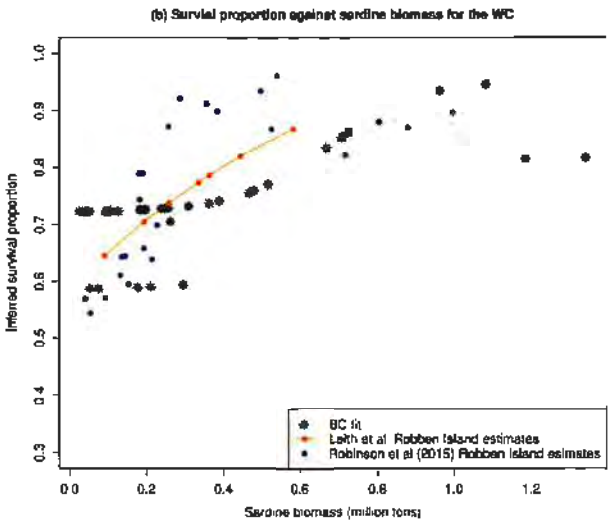

Figure 5b: Estimates of survival proportions from Leith et al. (2022) and Robinson *et al.* (2015) superimposed onto the inferred survival proportions for the BC WC fit and the WC random walk fit. Note that there was a glitch in the Robinson et al. (2015) values plotted in the original PEL/25, which has been corrected here.

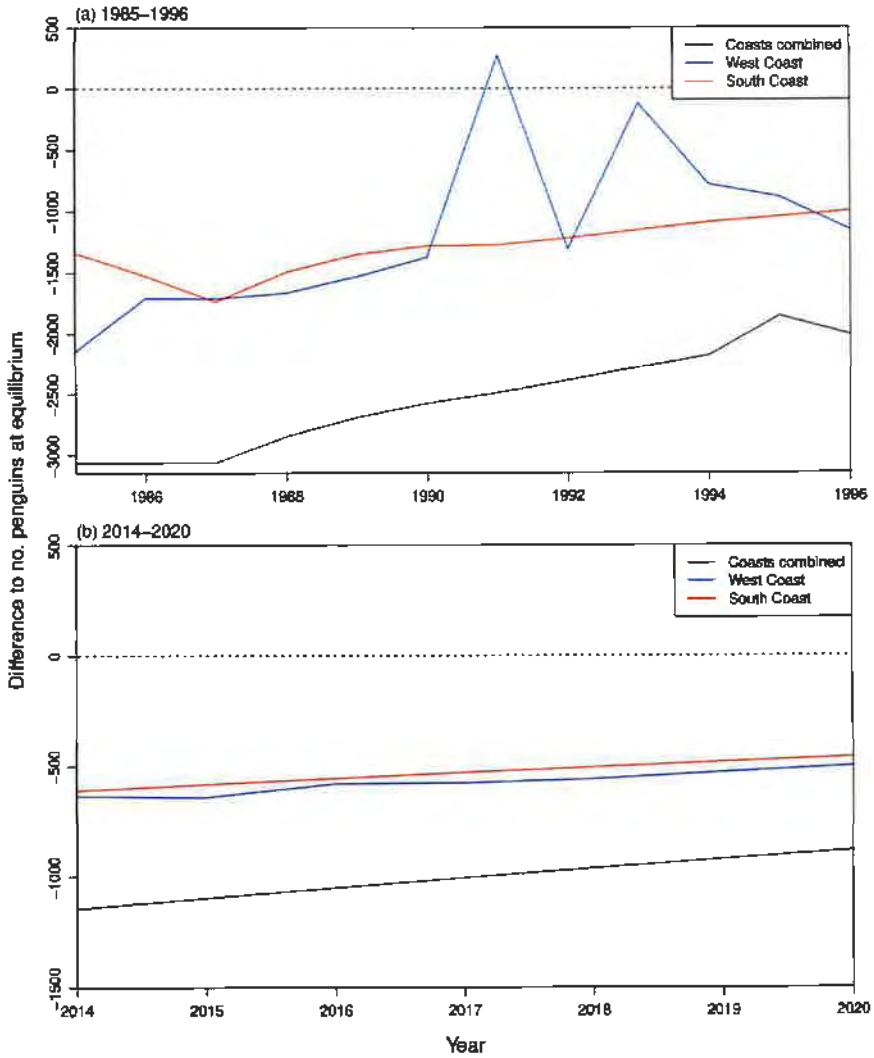

Figure 6: The difference between the inferred survival proportion from the BC model and the equilibrium survival proportion for $H = 0.70$, expressed in terms of the associated number of individual adult penguins, i.e. $2 * (S_y - S_y^{eq})\hat{N}_y$ where $\hat{N}_y$ is the model-estimated number of penguin pairs. Values are shown for the (a) 1985-1996 period and (b) 2014-2020 period. Figure (b) suggests that prevention of about an additional annual number of 1000 penguin deaths (caused perhaps by predation by seals, for example) would be sufficient to prevent further population decline, while (a) suggests that about 2500 fewer deaths before the sardine boom in the late 1990s would have been sufficient to prevent a decline then.

Soa

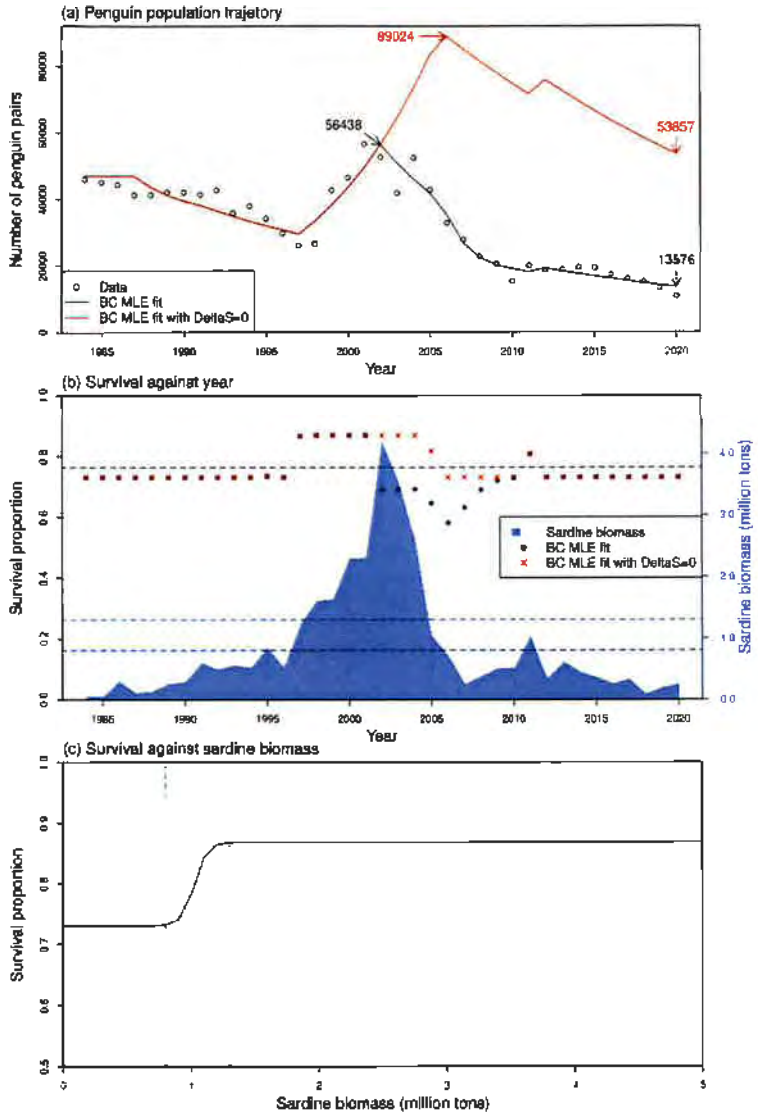

Figure 7: Results for the coast combined BC, re-run with the estimable parameters fixed at their BC maximum likelihood estimates, but with ΔS set to zero. These give an indication for what could have happened if the survival proportion had continued to track the sardine biomass in the 2002-2010+ period. The black dashed horizontal line in (b) indicates the survival proportion at which the penguin population equilibrates. The purple dashed lines (horizontal in (b) and vertical in (c)) mark the sardine biomasses between which the survival proportion increases, and outside which it is constant.

Appendix A – Model equations

Basic model equations

The basic model for the penguin dynamics is:

$$N_{y+1} = N_y S_y^{mat} + N_{y-3} H_{y-3}^{\#} \left(S_{y-3}^{a=0}\right)\left(S_{y-2}^{a=1}\right)\left(S_{y-1}^{a=2}\right)\left(S_y^{a=3}\right) \quad \text{(A.1)}$$

where

- N_y is the number of mature penguin pairs in the middle of year y (corresponding roughly to the mid-point of the breeding season which is also when the annual penguin counts take place),
- S_y^{mat} is the proportion of mature penguins that survive in "year y" (i.e., from July in (calendar) year y to June in year y+1), where maturity is assumed to take place at age 4,
- $S_{y-3}^{a=0}$ is the proportion penguins that survive in "year y-3", subsequent to fledging, for the balance of their first year of life,
- $S_{y-2}^{a=1}$ is the proportion of one-year-old penguins that survive in "year y-2",
- $S_{y-1}^{a=2}$ is the proportion of two-year-old penguins that survive in "year y-1",
- $S_y^{a=3}$ is the proportion of three-year-old penguins that survive in "year y", and
- $H_{y-3}^{\#}$ is the number of fledged chicks per pair in year "y-3".

The initial approach for taking food limitation into account assumes that the main effect of the forage fish abundance is on the survival proportion S, which is taken to be age-independent, so that the equation for the penguin dynamics becomes:

$$N_{y+1} = N_y S(B_y) + N_{y-3} H S(B_{y-3}) S(B_{y-2}) S(B_{y-1}) S(B_y) \quad \text{(A.2)}$$

where

- $S(B_y)$ is the post first year annual survival proportion for year y, corresponding to the survival from the middle of year y to the middle of year y+1, and B_y is the November survey biomass in year y (see Figure A.1), and
- H is the number of fledged chicks per pair adjusted by the ratio of their survival proportion for the rest of their first year of life to the adult survival proportion (Butterworth and Ross-Gillespie, 2024), assumed for the Base Case (BC) model here to be 0.70.

Note that in the interests of simplicity, the survival proportions for second, third and fourth year of life are assumed to be the same as the survival proportion for mature penguins. This is also assumed for the first year of life insofar as a further assumption is made that if the mother dies, then her offspring that year also dies. This may not be exactly true, which is why $H^{\#}$ in equation (A.1) is modified to H in equation (A.2) to account for any difference, i.e. $H^{\#}S_0 = HS$. This is not of consequence to the model results as these are in terms of mature penguins, with parameter values fit to the observed numbers of mature penguin pairs, so results are independent of how reproduction and survival in partitioned amongst $H^{\#}$, S_0, S_1, S_2, S_3 and S_4 as results depend only on their product.

Biomass for this initial approach is assumed to be a weighted sum of the November sardine and anchovy biomasses, with the weighting parameter α taking a (fixed) value between 0 and 1 to allow for the exploration of sensitivities to the relative importance of anchovy in the diet[7].

$$B_y = B_y^{sardine} + \alpha B_y^{anchovy} \quad \text{(A.3)}$$

[7] Note that there was a typo in the equivalent of equation (3) in Appendix A of Butterworth and Ross-Gillespie (2023), where the relationship $B_y = B_{y-1}^{sardine} + \alpha B_y^{anchovy}$ was given.

For the BC, $\alpha = 0$.

The choice of the survey biomass for November to use for sardine is fairly clear, as the survival proportion S corresponds to the period from July to the following June (see Figure A.1), so that this survey (for a comparatively long-lived forage species) takes place close to the mid-point of this period. This choice is less obvious for the shorter-lived anchovy, given especially the key role played by anchovy recruits in penguin feeding on the west coast over the April-June period. The assumption as to exactly which biomass index should best be used for anchovy might be explored more fully.

Sensitivities to differences in the pre- to post-mature survival proportion in their dependence on biomass are explored by modifying the functional form of pertinent $S(B)$ terms in the second term on the RHS of equation (2).

Extensions to include dependence of H on forage fish biomass B in addition can be explored later. At this stage, only S dependence on B is considered for initial simplicity.

The model predicted numbers are fit to the annual gap-filled[8] penguin numbers:

$$-lnL = \sum_y \left(\ln\sigma + \epsilon_y^2/(2\sigma^2)\right) \qquad \text{(A.4)}$$

where $\epsilon_y = \left(lnN_y^{obs} - ln\widehat{N}_y\right)$ and σ is an estimable parameter. Note that strictly speaking the observed numbers penguin breeding pairs, N_y^{obs}, are not independent as missing values were interpolated from values in preceding and successive years, so that care should be taken in drawing statistical inferences from differences in $-lnL$ values.

Note that for penguin numbers to equilibrate, equation (2) provides the relationship:

$$1 = S + HS^4 \qquad \text{(A.5)}$$

So that, for example, if H = 0.70, penguin numbers will decrease unless the penguin annual survival proportion S exceeds 0.76.

Random walk fit

For the initial exploration, survival proportions were estimated using a random walk approach:

$$S_{y+1} = S_y e^{\eta_y} \qquad \text{(A.6)}$$

with a penalty added to the negative log-likelihood to prevent very big jumps in the survival proportions from one year to the next (i.e., to smooth the time series):

$$penalty = \omega \sum_y \eta_y^2 \qquad \text{(A.7)}$$

where ω is a weight, which has been fixed at 0.1 for the random walk results presented in this document (this choice seemed to provide a reasonable trade-off between under- and over-smoothing).

The resulting survival proportion estimates essentially give the "ideal" survival proportions which would explain the trends in the penguin count data under the model assumptions made here.

[8] In order to obtain a continuous series of total population counts to fit to models, the gaps in the data were filled by assuming an exponential trend between the nearest years with data (see Appendix B of Butterworth and Ross-Gillespie, 2023, for details).

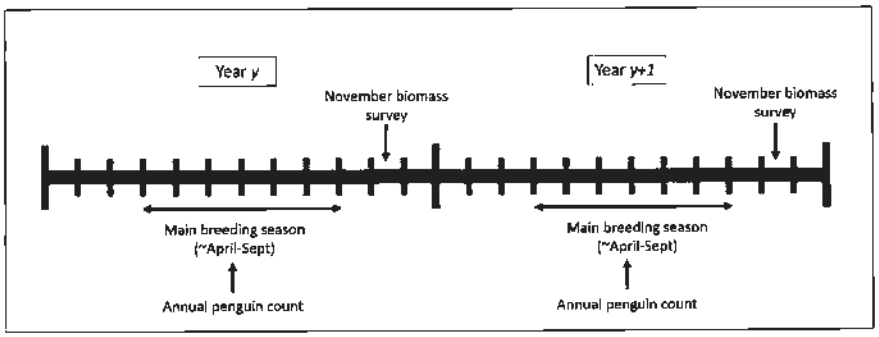

Figure A.1: Diagram showing when the annual penguin count occurs relative to the November biomass survey.

Appendix B – More detailed results

This Appendix provides some additional results to those presented in the main text.

Figure B.1 shows the full random walk fits to the observed number of penguin pairs.

Figure B.2 shows results for some sensitivity runs using different forms for the 2000 to 2010+ reduction in the survival proportion, as well as a von Bertalanffy-type functional form for the $S(B)$ relationship itself. Note that the linear ΔS_y form shown here is one of many which was tested. The logistic form adopted for the BC was the best fitting of all the forms explored. While the fit von-Bertalnffy-type $S(B)$ relationship is not bad, the linear shape for the associated VBL $S(B)$ relationship estimated is hardly realistic.

Figure B.3 shows a further attempt at achieving a better fit for the SC only model. The inferred survival proportions from the random walk model suggest an increased survival proportion prior to 1990 (the red clump of points in Figure 1 of the main text) in addition to the reduced survival proportion for the 2002 to 2010+ period. An additional ΔS was estimated for the pre-1990 period, and this addition greatly improved the overall fit of the model to the SC data. However, this possibility begs a proposal for a plausible biological mechanism that might lead to a higher-than-anticipated survival proportion prior to 1990.

Figure B.4 plots the results for the coasts-combined model for a range of α values for Equation A.3. These results test sensitivity to the inclusion of anchovy biomass in addition to sardine as a determinant of survival. In general, the negative log-likelihood is worse the higher the value of α, i.e. the fit to the penguin count data is better when survival is considered as a function of sardine biomass alone. For α above 0.5, the deterioration in the negative log-likelihood value suggests a statistically unacceptable fit compared to the BC. The inclusion of the anchovy biomass does results in a better fit to the downward trend in the last five years of the model, as well as to the decrease in the population in the late 1990s. Further for α=0.5, the combined sardine-anchovy biomass becomes sufficient by 2020 to arrest the penguin decline. However, these possible positives need to be weighed against the plausibility of the additional negative contribution to survival having to be extended well beyond 2010.

Figure B.5 shows the impact of varying the H parameter (fixed at 0.70 for the BC) by $\pm$0.10 on the WC mdoel. The impact of this change is near-negligible (note the very small changes in -lnL); this is because the effects of a changed H value is near-compensated by the consequent change in S needed to fit to the penguin count data. Table B.1a and b compare the independent survival proportions, averaged over some different time periods, with those estimated for the different values of H. Comparison of the model estimates with the Sherley values suggest a marginal preference for a higher H value than those investigated for the model, while such comparisons with the Robinson *et al.* (2015) values (though note that these apply to Robben island only) suggest lower H values than investigated are to be preferred.

Figure B.6a and b plot the difference between the estimated survival proportion and the equilibrium proportion in terms of number of penguin deaths for the three H values for the West Coast only and coasts combined models respectively. These Figures suggests that increasing (or decreasing) H by 0.10 would increase (or decrease) the number of penguin deaths which would need to be prevented to stop the current penguin decline by about 200 (West Coast only) or 500 (coasts combined) birds.

Wolfvaardt (2007) reports lower reproductive success for oiled penguins, even following rehabilitation. This prompts the question of the extent to which reproductive success (rather than the survival proportion) after 2002 would need to be reduced to account for the sharp reduction in penguin abundance after that time. Figure B.7 shows the results for a re-run of the BC with the H parameter instead of the survival proportion reduced in the 2002-2010+ period. These results indicate that a reduction in H could account for this reduction, but it would need to be very large: a decrease of 0.57 (i.e. taking H down from 0.70 to 0.13) to achieve a similarly good fit to the data as a reduction in S of 0.18.

S, σ μ

Table B.1a: The two Sherley series of survival proportions for Robben and Dassen islands extracted from the PowerPoint presentation made by Sherley to the 2023 Review panel, have been averaged over the two islands (as in Figure B.5(ii)), and then averaged again over different time periods. Equivalent estimates are reported for the WC model for the three different *H* values.

Time period	Sherley presentation	WC model		
		H=0.60	*H*=0.70	*H*=0.80
1995-2012	0.70	0.76	0.74	0.73
1995-2004	0.79	0.84	0.82	0.81
2005-2012	0.59	0.66	0.64	0.63

Table B.1b: Repeat of Table B.1a, but for the Robinson *et al.* (2015) estimates for Robben island (i.e. Figure B.5(iii)).

Time period	Robinson *et al.* (2015)	WC model		
		H=0.60	*H*=0.70	*H*=0.80
1988-2011	0.77	0.76	0.74	0.73
1988-2004	0.83	0.80	0.79	0.78
2005-2011	0.62	0.64	0.63	0.62

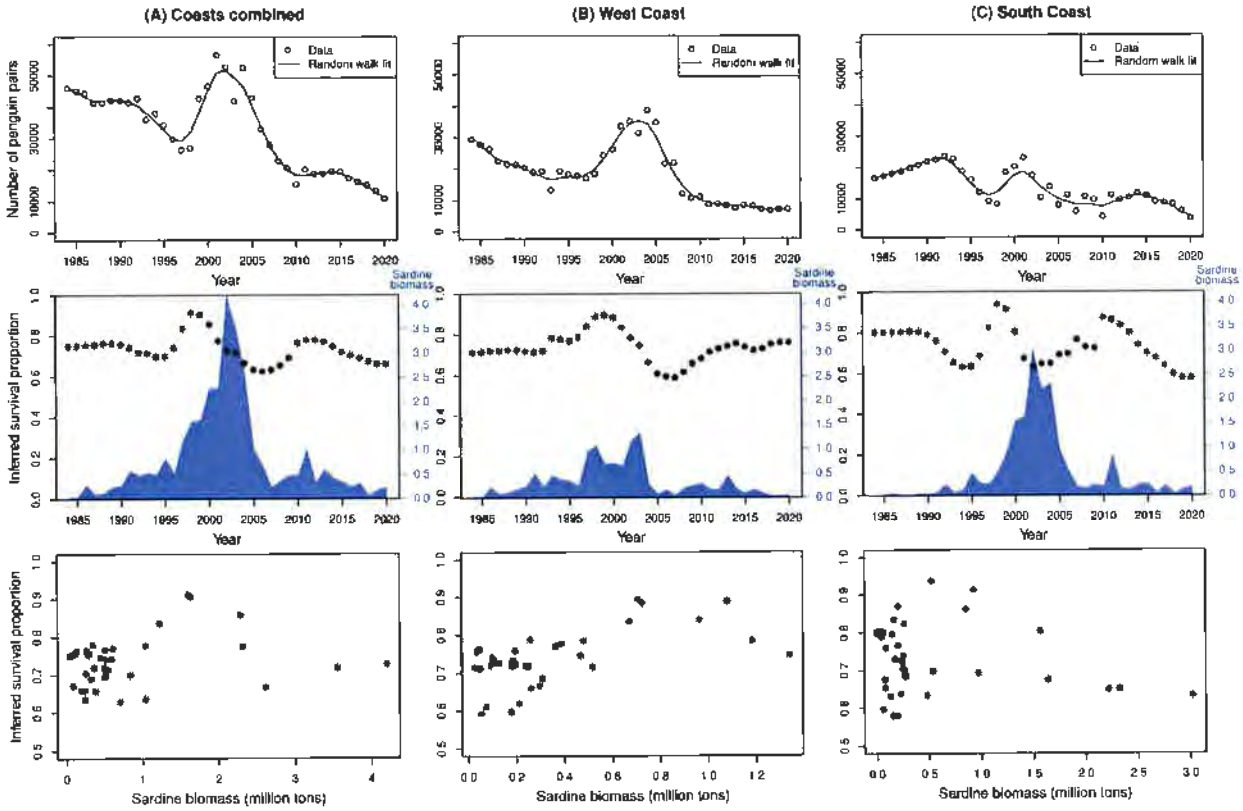

Figure B.1: Repeat of Figure 1 of the main text, but with the BC model fit to the number of adult penguin pairs included.

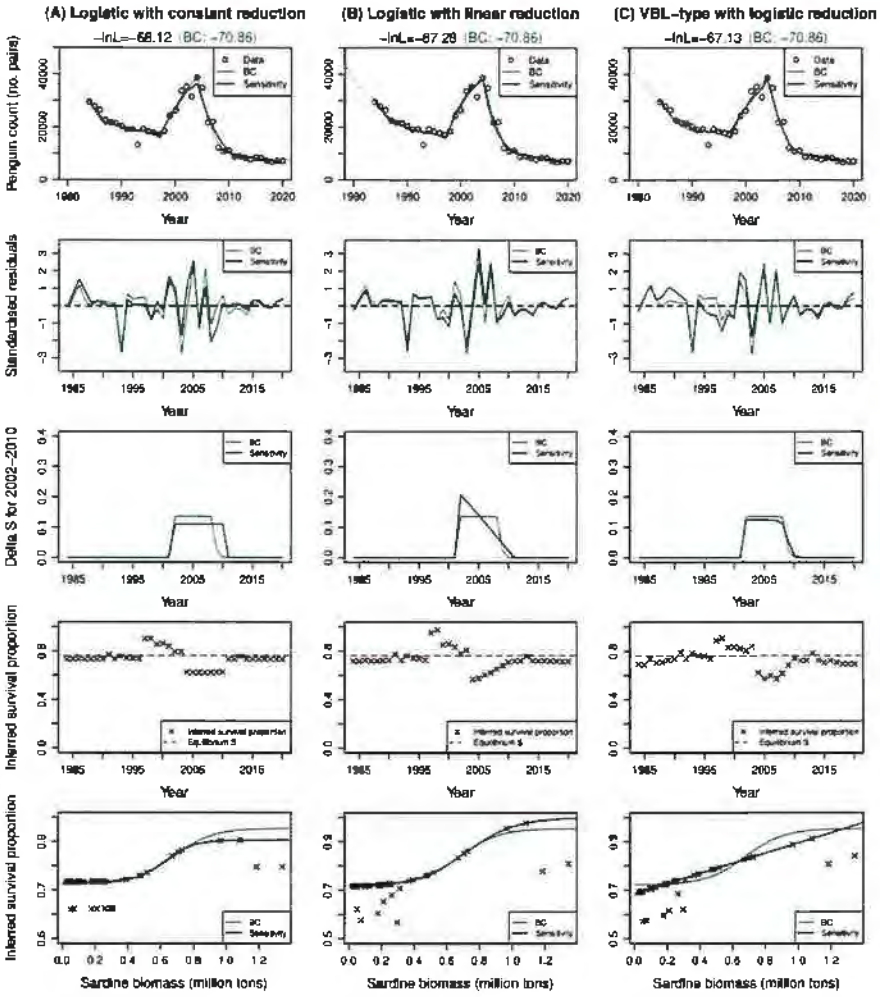

Figure B.2: Some sensitivities explored for the WC only model. The first column shows the BC results. The second column uses a linear decline for the ΔS_y function for the reduction in the 2002 to 2010+ the survival proportion. The third column implements a von-Bertalnffy-type function for the $S(B)$ relationship.

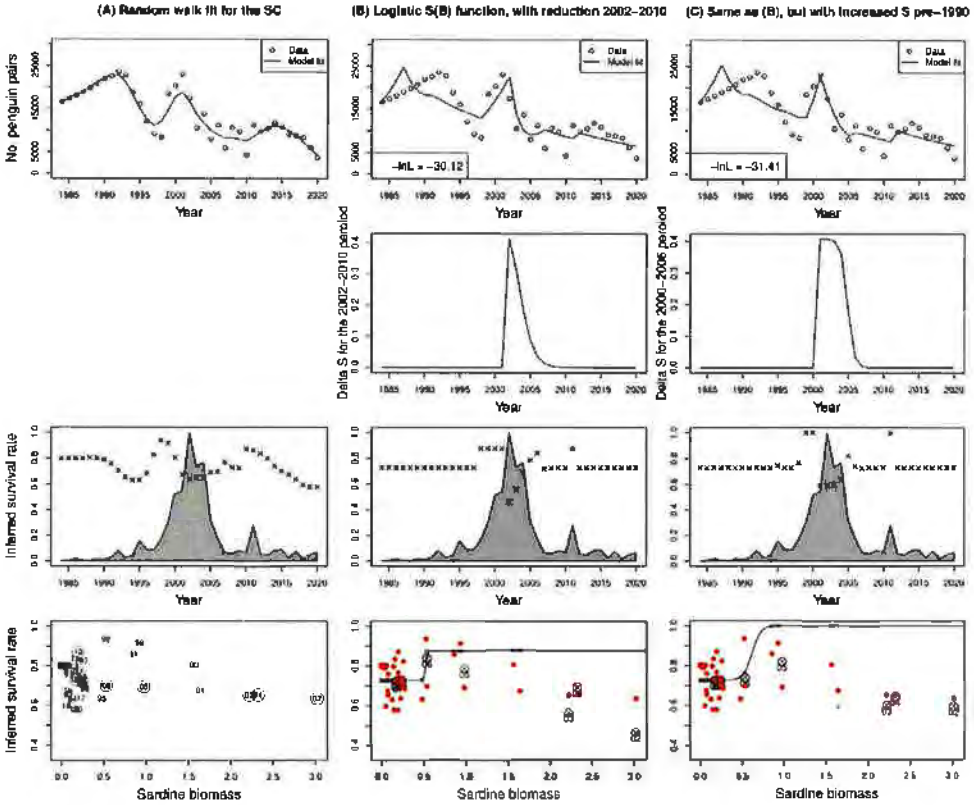

Figure B.3: An attempt at achieving a better fit to the SC data. The first column shows the random walk fit (as in Figure B.1). The second column shows the BC fit (as in Figure 2 of the main text). The third column shows an attempt where the pre-1990 annual survival proportion was increased by an estimable constant; this results in a more reasonable fit to the data for the earliest years.

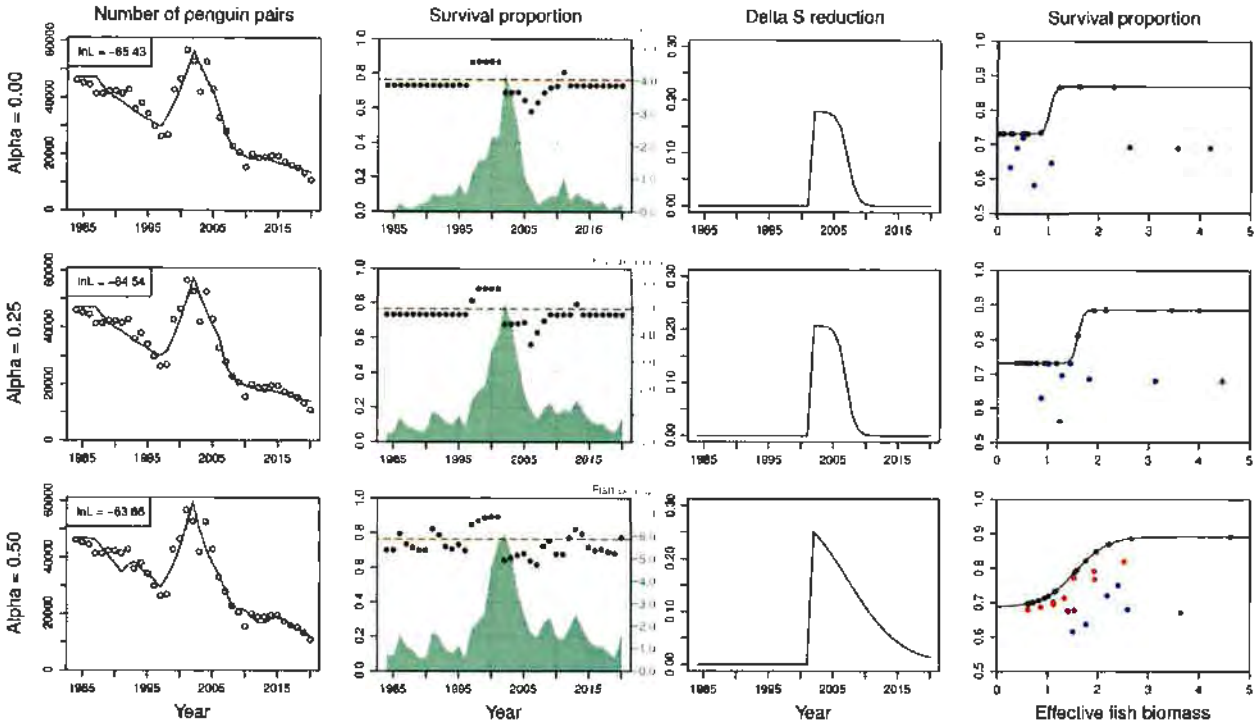

Figure B.4: Results for the coast-combined model run for a range of α values, where the fish biomass is given by $B_y^{sardine} + \alpha B_y^{anchovy}$ (Equation A.3). The BC assumes $\alpha = 0$. The first column shows the fit to the penguin count data. The second shows the survival proportion (black dots), equilibrium survival proportion (horizontal dashed red line) and the fish biomass given by equation A.3 (green shaded area). The third shows the reduction in S estimated for the 2002-2010+ period. The fourth shows the $S(B)$ function estimated by the model. The blue dots in this last column show the points which have been reduced by the ΔS function in the third column (red dots when this reduction applies for years after 2010). The negative log-likelihoods for the three runs are given in the top left corner of the first column plots.

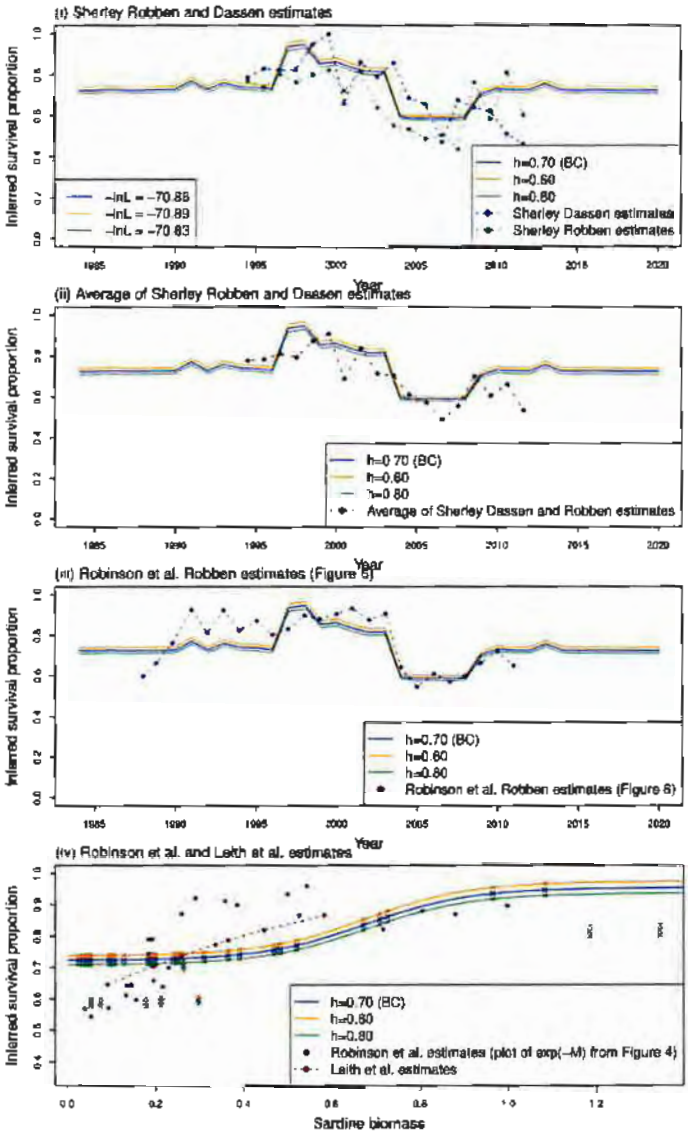

Figure B.5: The WC BC model (with $H = 0.70$) shown alongside to sensitivities for which $H = 0.60$ and $H = 0.80$, The independently estimated survival proportions (from data including tag re-sightings) from Figure 5a and b of the main text have been superimposed here as well.

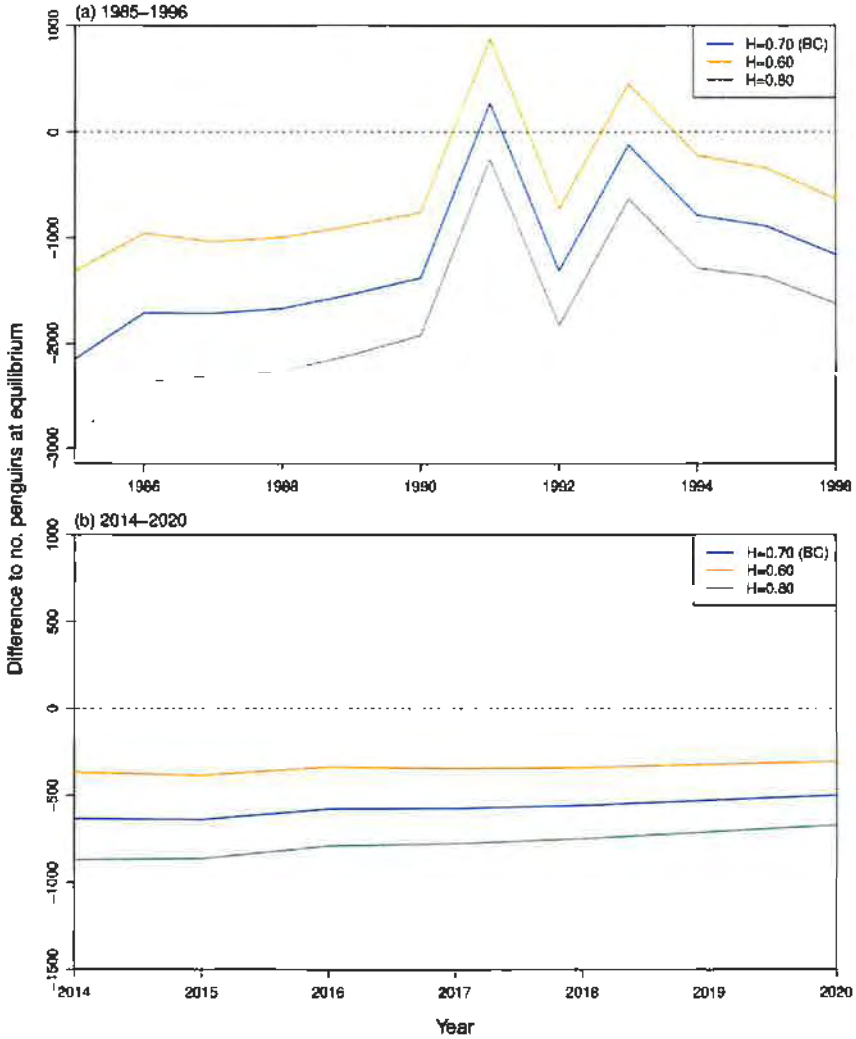

Figure B.6a: The difference between the inferred survival proportion for the **West Coast** model and the equilibrium survival proportion, plotted as number of individual adult penguin deaths, for the BC assumption of $H = 0.70$ and for two alternative values for H, namely 0.60 and 0.80. The difference between the BC blue line in (b) and the other two lines is roughly 200 penguins, and for (a) varies between about 500 and 1000 penguins. Note that the blue line here corresponds to the blue line in Figure 6a and b.

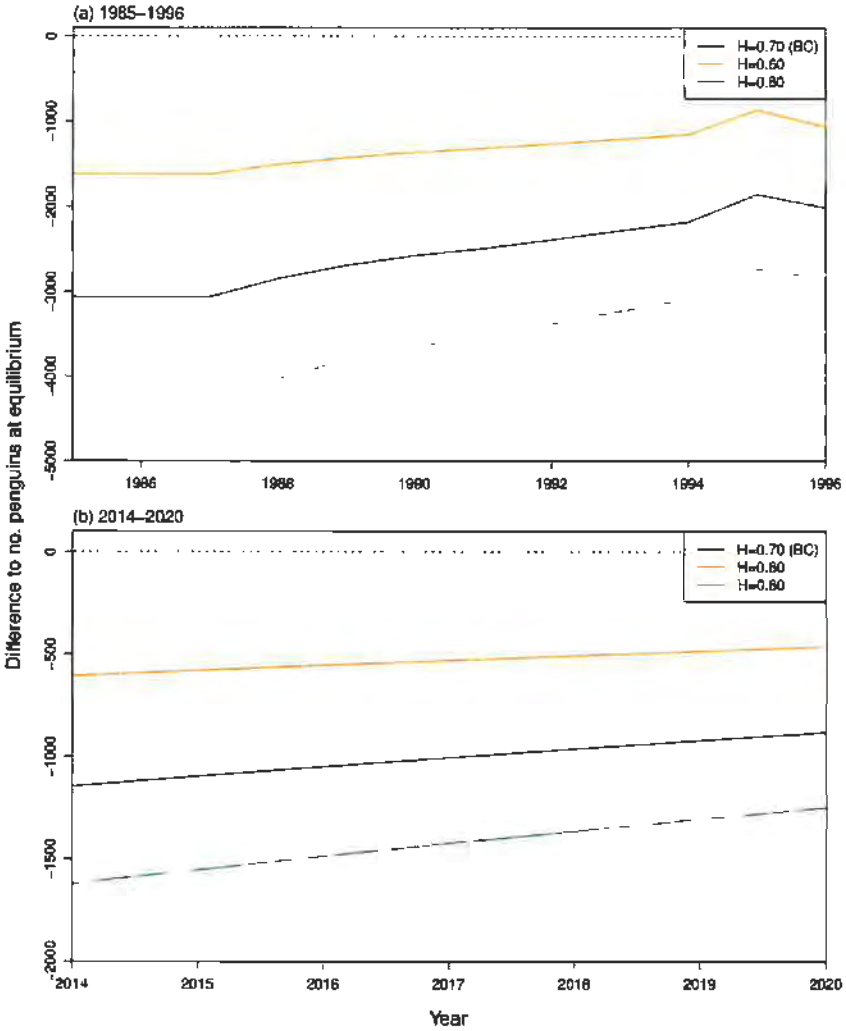

Figure B.6b: The difference between the inferred survival proportion for the **coasts-combined** model and the equilibrium survival proportion, plotted as number of individual adult penguin deaths, for the BC assumption of $H = 0.70$ and for two alternative values for H, namely 0.60 and 0.80. The difference between the BC black line in (b) and the other two lines is roughly 400 penguins, and for (a) varies between about 800 and 1500 penguins. Note that the black line here corresponds to the back line in Figure 6a and b.

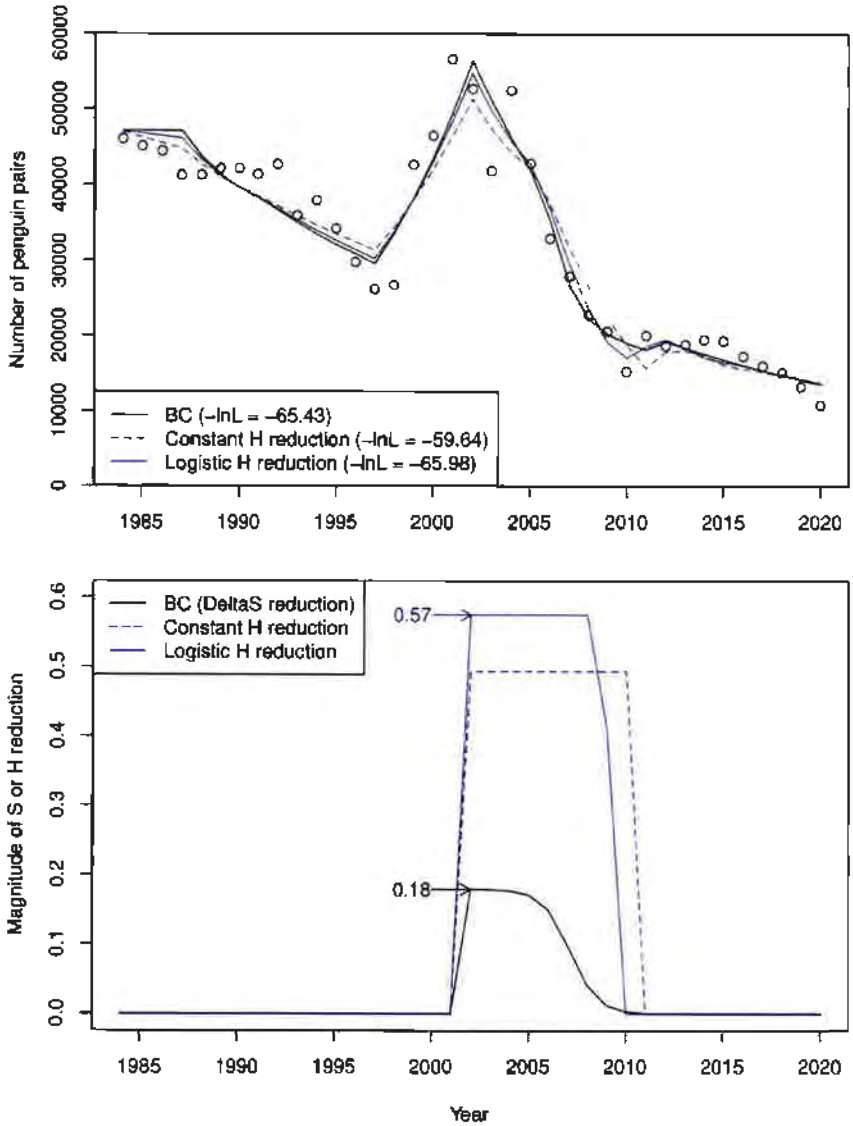

Figure B.7: Re-run of the coasts-combined BC but reducing the H parameter of Equation A.2 instead of the $S(\theta_y)$ value for the years 2002 to 2010+. Two such sensitivities were run: one with a constant H reduction and another where the reduction is a logistic function as for the ΔS_y function of the BC. The top plot shows the fit to the penguin count data and the bottom plot the reduction in S (for the BC) and H (for the sensitivities).

Appendix C – Results for additional runs

Introduction

This Appendix reports on results for 12 additional runs conducted based on further feedback from participants in the PWG. These runs relate to different assumptions about the biomass used in the survival-biomass, $S(B)$, function.

First, runs 1-10 explore different ratios for the contributions of the WC and SC sardine and anchovy biomasses to the effective November biomass measure (see equation A.2). This biomass is now defined as:

$$B = a_1 B^{WC}_{sardine} + a_2 B^{SC}_{sardine} + a_3 B^{WC}_{anchovy} + a_4 B^{SC}_{anchovy} \qquad \text{(C.1)}$$

Table C.1 lists the different values for a_i assumed for runs 1-10.

Secondly, the runs until now have assumed that survival in year y is linked to fish biomass in November of year y, remembering that the model year runs from July of calendar year y to June of calendar year $y+1$ (see Appendix A for more details, in particular Figure A.1). Runs 11-12 assume that the survival in year y is linked to biomass in November of year $y-1$, with run 11 introducing the ΔS reduction from year 2002 as for the BC and run 12 starting the ΔS reduction a year earlier. The motivation for such an approach is that survival might be more influenced by the condition of the penguins resulting from earlier feeding conditions, than from feeding conditions in the year to which the survival value applies.

Results

Table C.1 lists the negative log-likelihoods for the 12 additional runs conducted. Based on these negative log-likelihood values, Runs 3 (the current BC), 4, 10 and 12 were selected as the best candidates and more detailed results have been provided for these.

Table C.2 lists various additional statistics for these four runs and Figure C. 1 plots the fit to the penguin count data, the ΔS functions and the survival proportions.

Figure C. 2 plots the total number of deaths (in terms of numbers of adult individuals) estimated for the four best runs and shows which of these are additional deaths from the ΔS function, and also shows how the survival proportions link to the (effective) fish biomass.

Figure C. 3 compares the trajectories for the total deaths and new adults 'recruited' to the penguin count for the four best runs.

Figure C. 4 plots the $S(B)$ functions for the four best runs and shows where the biomass trajectories lie relative to what effective biomass is required to provide a stable (equilibrium) penguin population.

Discussion

Some brief points for discussion are listed below.

- Despite the fact that Runs 4, 10 and 12 have slightly better negative log-likelihoods than the current BC (also Run 8, but that is "on the way" to the better still Run 4), the improvement is marginal (at most 1.36 negative log-likelihood points). Note that the data being fitted are not independent, but almost certainly positively correlated, which would lead to a bigger negative-log likelihood difference than actually applies.
- It is suggested that the current BC remains the BC for this particular model (not precluding possible alternative models or assumptions which might be explored in the future given further feedback from the other scientists). The improvement in the negative log-likelihood for Runs 4 and 10 is seems likely as a result only of the model fitting some small bumps in the population time series data slightly better than the BC. Two major factors arguing against Run 12 (survival depending on biomass the year before)

as the BC are the fact that the survival function $S(B)$ asymptotes close to 1 which is inconsistent with independent survival estimates from tagging data (see Figure 5a) and the very high number of additional deaths needed for the 2001-2010 period in order for the model to fit the population trends.

- There is relatively little difference between the total number of deaths and recruits to the adult population for the four best models (Table C.2 and Figure C. 3).
- However, the split of adult penguin deaths between "regular" deaths related to the $S(B)$ function and those arising from the additional ΔS term, is not robustly determined, varying considerably amongst the four best models (see Table C.2 and Figure C.2). At least part of the reason for this is explained by the second column of Figure C. 2. For Run 4, the effective fish biomass trajectory decreases more rapidly between 2002-2005, so that the $S(B)$ function has to reduce sooner than for the BC. Thus, the extent to which the $S(B)$ needs to be reduced by ΔS is less than for the BC. Conversely, for Run 12 where the biomass from year *y*-1 is used, the biomass trajectory then lags the BC trajectory by a year and starts decreasing later than for the BC. Consequently, a greater ΔS reduction is needed for the 2002-2010 period to reduce the $S(B)$ function to the levels needed to achieve a reasonable fit to the data.
- As regards the choice of which biomass components to include in the $S(B)$ function, the WC sardine biomass series seems to be the most informative for penguin survival, followed by SC sardine and WC anchovy at similar levels. SC anchovy seems to be the least informative.
- Apart from Run 4 where the biomass trajectory goes above equilibrium effective biomass more frequently, these results suggest (given only the explanatory factors included in these models – see further comments below) that other than the 1995-2005 period the fish biomass has been too low to keep the penguin population above the equilibrium survival proportion (Figure C. 4).
- Inclusion of anchovy in some extent (Runs 4 and 10) pushes the (effective) biomass closer to the equilibrium biomass (columns 2 and 3 of Table C.2), but the survival proportions are slightly further below from the equilibrium survival proportion than for the BC for the most recent five years (column 7 of Table C.2).
- The observed penguin numbers over the last five to six years have been declining somewhat faster than predicted by the four best models (see Table C.2 and Figure C.1). See further comments in the next section.

Moving forward

It is first important to remind readers of the primary intention and focus of the work reported in this document: implementation of a MICE approach to consider especially the possible impact of changing abundance of forage fish (primarily sardine but also anchovy) on the penguin annual survival proportion, and how this might relate to the decline in penguin numbers. Furthermore, in line with customary modelling practice, an understanding of the impact of single factors is sought before moving on to consider factors in combination. Here, in addition to this specific focus, only transient effects of guano harvesting and the possible impact of predation by seals have been considered in any depth. Certainly, other factors possibly making a relatively large contribution to the penguin decline also need to be considered in moving forward, and further inputs thereon are desirable and are to be welcomed, so that alternative models and assumptions can also be progressed.

Much of Appendix C has focussed on whether adding anchovy to sardine as a component of the effective biomass impacting penguin survival provides models with notably better explanatory power. Broadly speaking the answer would seem to be not. Perhaps this is not surprising, as on the west coast in particular, one would expect the dominant feature of the autumn "run" of anchovy recruits to have its greatest impact on penguin reproduction rather than on their survival. However, the ICE results suggest (perhaps surprisingly) that this reproductive success is rather insensitive to the strength of the annual anchovy recruitment (Butterworth and Ross-Gillespie, 2021).

Initial analysis above considered alternative forms for the $S(B)$ function, and settled on the logistic, which for the BC suggests a Holling Type III functional response – that at low sardine abundance penguins rely on other sources of food, and start switching to sardine only when (November survey estimated) abundance reaches about 800 thousand tons (Figure C.1). This has important management implications, and is qualitatively well supported by the quite steady annual penguin survival over the ten year period commencing in the mid-1980s as the sardine

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turn-of-the-century boom started developing (see Figure 1). However, this conclusion is not as clear cut for the most recent decade and needs further investigation. Before moving too much further there though, it will be important to consider other factors which may have impacted penguin numbers over that more recent period, such as the suggested impact of increased shipping noise on the penguin colony at St Croix (Pichegru *et al.* 2022), and anecdotal accounts of perhaps large numbers of penguin mortalities in illegal gill nets set close to some of the penguin breeding colonies (on which more detailed reports are awaited).

References

Butterworth, D.S. and Ross-Gillespie, A. 2021. Comparison of the GLMM year effect variance from models of west coast response variables in the island closure experiment with the variance of anchovy recruitment. DEFF Fisheries document: FISHERIES/2021/JUL/SWG-PEL/42: 3pp.

Pichegru, L., Vibert, L., Thiebault, A., Charrier, I., Stander, N., Ludynia, K., Lewis, M., Carpenter-Kling, T., and McInnes, A. 2022. Maritime traffic trends around the southern tip of Africa – did marine noise pollution contribute to the local penguins' collapse? *Science of the Total Environment* 849: 157878.

Table C.1: Negative log-likelihoods for the 12 additional runs are listed in the last column. The values for α_1-α_4 from equation C.1 are also listed. The four best runs in terms of negative log-likelihood values have been indicated using bold text.

Description		Run #	WC sardine	SC Sardine	WC anchovy	SC anchovy	-lnL
Different Biomass assumptions - set 1		Run1	1	0	0	0	-64.69
		Run2	1	0.5	0	0	-64.35
		Run3 (BC)	**1**	**1**	**0**	**0**	**-65.43**
		Run4	**1**	**0**	**0.5**	**0**	**-66.76**
		Run5	1	0	1	0	-53.01
		Run6	1	0	0	0.5	-63.23
		Run7	1	0	0	1	-54.86
Different Biomass assumptions - set 2		Run8	1	0	0.25	0	-66.08
		Run9	1	0	0.75	0	-61.81
		Run10	**1**	**1**	**0.5**	**0**	**-66.79**
$S(B_{y-1})$	ΔS from 2002	Run11	1	1	0	0	-62.49
	ΔS from 2001	**Run12**	**1**	**1**	**0**	**0**	**-65.93**

Table C.2: Additional statistics are reported for the four best runs.

- The first column repeats the negative log-likelihood values from Table C.1.
- The second and third columns report the average fish biomass for 1984-1989 and 2016-2020 as a proportion of the "equilibrium" biomass. This equilibrium biomass is the biomass for which the value of the $S(B)$ function is equal to the equilibrium survival proportion (see Figure C. 4 for more details).
- The fourth and fifth columns list the values for the S-intercept and asymptote of the $S(B)$ functions, i.e. the minimum and maximum of the $S(B)$ function, ignoring the ΔS reduction term.
- The next two columns list the average survival proportion for 1984-1989 and 2016-2020 in the form of its difference from the equilibrium S.
- The eighth column lists the slope (i.e. average annual decrease) of the model-estimated number of penguins pairs for the 2016-2020 period. Note that the slope of the data points for the last five years is -1606 penguin pairs per year.
- The next three columns list the number of deaths (as numbers of individual adult penguin) estimated for the 1984-2020 period for the four runs, in terms of total deaths, which is then split into deaths due to the additional ΔS reduction and "regular" deaths arising from the estimated $S(B)$ function.
- The last column lists the total number of new adult recruits (number of individual adult penguins), given by twice the $N_{y-3}HS(B_{y-3})S(B_{y-2})S(B_{y-1})S(B_y)$ component of Equation A.2 of Appendix A. Note that the sum starts in 1987 as the first three years of the model are a "burn-in" period with an estimated constant growth rate.

		$Av(B)/B_{equilm}$		S(B) function		$Av(S) - S_{equilm}$		Slope of N over 2016-2020. Slope of data points is -1606	Deaths 1984-2020 in thousands			
	-lnL	1984-1989	2016-2020	min(S)	max(S)	1984-1989	2016-2020		Total	ΔS	Regular	Total recruits 1987-2020 in thousands
Run3 (BC)	-65.43	0.13	0.23	0.73	0.87	-0.033	-0.033	-515	627	87	540	483
Run4	-66.76	0.86	0.59	0.71	0.86	0.002	-0.047	-758	617	52	565	496
Run 10	-66.79	0.71	0.60	0.71	0.88	-0.020	-0.052	-857	623	105	517	488
Run 12	-65.93	0.13	0.23	0.73	0.98	-0.037	-0.037	-546	614	170	444	466

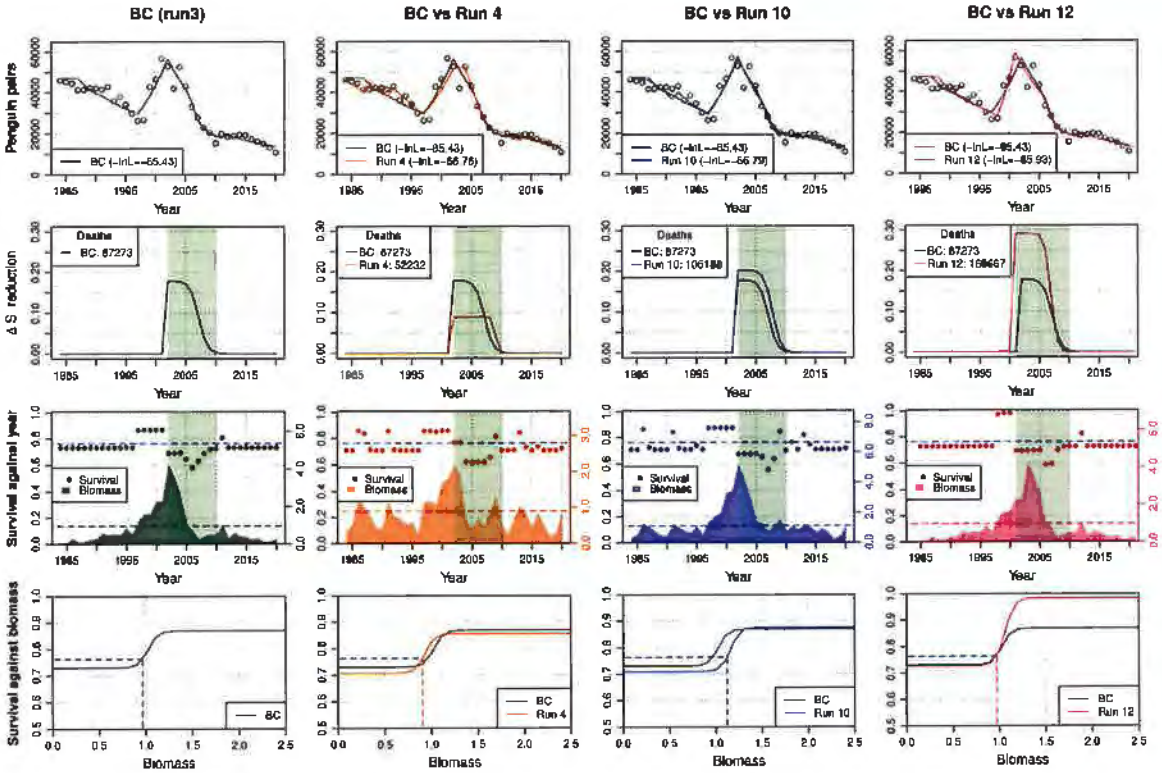

Figure C. 1: Detailed results for the four best runs. The first column plots the BC results and the remaining three the alternative runs, with the BC results included for comparison purposes.

- The top row plots the fit to the penguin count data.
- The second row plots the ΔS reductions. The green shaded area marks the years for which this reduction applies.
- The third row plots the survival proportions, superimposed onto the biomass trajectories. The equilibrium survival proportion has been shown by the blue horizontal dashed line, and the second horizontal dashed line with colour matching that of the biomass series shows the equilibrium biomass for a stable penguin population.
- The fourth row plots the estimated $S(B)$ functions, without the ΔS reduction and again marks the equilibrium survival proportion and corresponding equilibrium fish biomass.

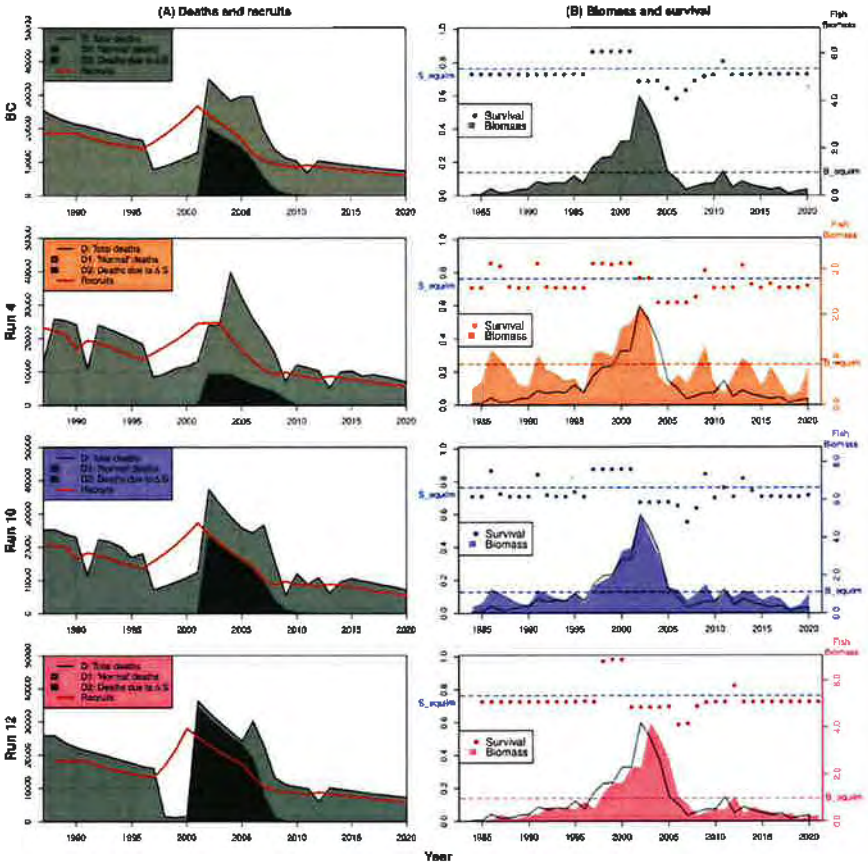

Figure C. 2: The grey shaded areas in the left column show the total number of adult deaths (in numbers, not pairs) estimated by each model. The black shaded area shows what portion of these deaths result from the ΔS reduction to the $S(B)$ function. The number of additional adult "recruits" (the $N_{y-3}HS(B_{y-3})S(B_{y-2})S(B_{y-1})S(B_y)$ component of Equation A.2 of Appendix A, multiplied by 2 to scale from pairs to number of individuals). The second column plots the survival proportions superimposed onto the biomass trajectories; essentially a repeat of row 3 of Figure C. 1.

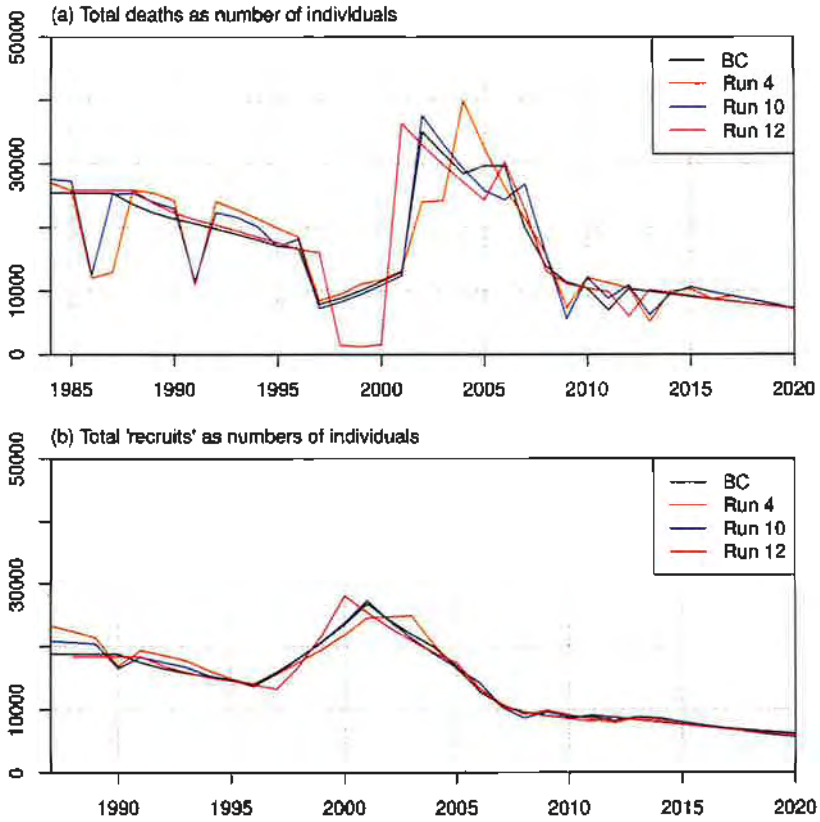

Figure C. 3: Figure (a) plots the trajectories of the total number of deaths of individual adult penguins and Figure (b) the number of recruits to the adult population for the four different runs for comparison purposes.

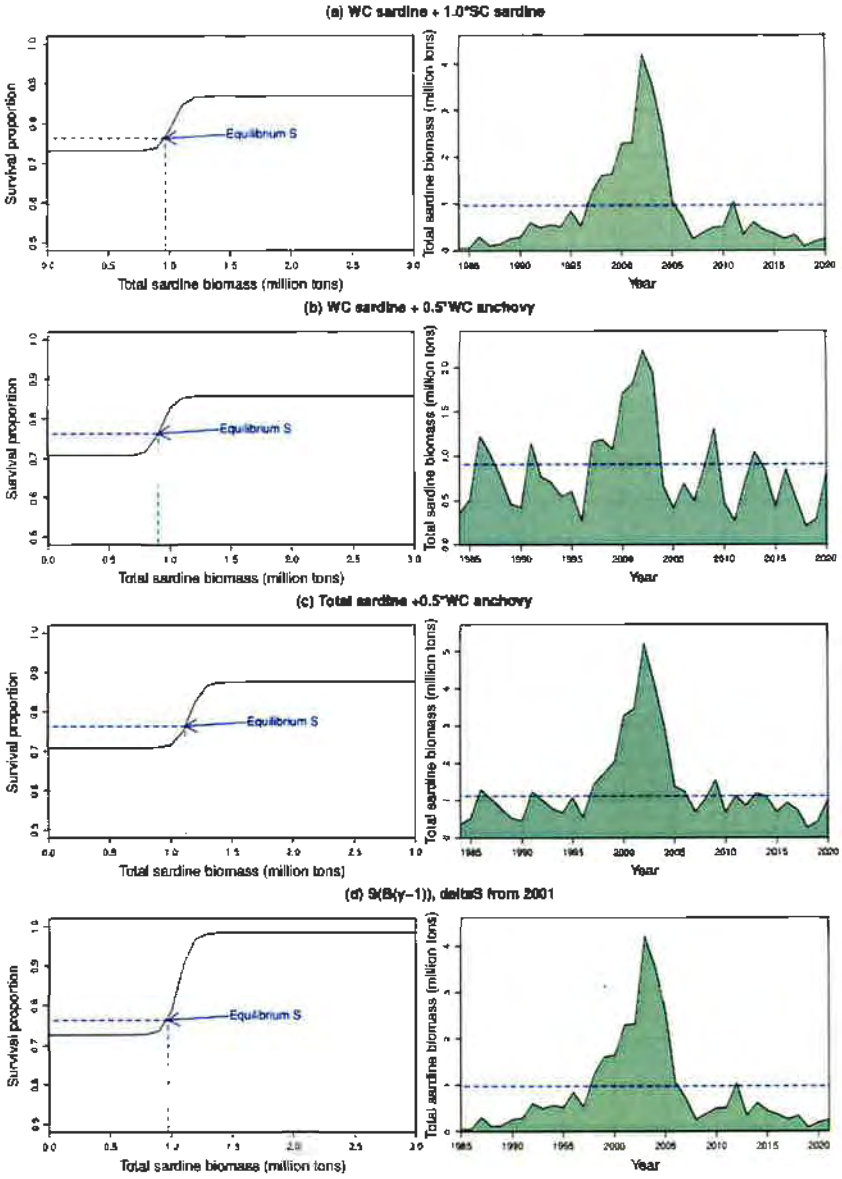

Figure C. 4: Repeat of the $S(B)$ function (left column) and fish biomass (second column) shown in Figure C. 1. Here it can be seen how the equilibrium biomass is read off the $S(B)$ curve given the value of the equilibrium survival proportion. Note that the equilibrium survival proportion is the same for all models (see Equation A.5 of Appendix A) but the corresponding biomass will change across model.

FISHERIES/2024/JAN/SWG-PEL/02

"MC4"

Motivation for and fundamentals of present MICE approaches to investigate possible causes of the decline in penguin abundance[1]

D.S. Butterworth and A Ross-Gillespie[2]

Summary

An explanation is given of the need for more complex modelling of penguin interactions with the wider ecosystem, given that fishing in the neighbourhood of penguin breeding colonies has been shown to be likely to have only a small impact on the concerning decrease in penguin abundance over time. This explanation is extended to why MICE approaches are suggested to be preferred for initial attempts to inform on what the other major causes of this decline might be. First, the fundamental penguin dynamics model that underpins current MICE approaches is explained. Extension of this simple model to MICE involves introducing relationships between either or both of penguin reproduction and survival parameters to other factors. The bases for two MICE approaches already implemented initially is summarised: first, how reduced forage fish availability might impact penguin survival; and secondly, how reduction of guano through harvesting might have adversely impacted the availability of optimum penguin breeding habitat and hence reproductive success.

Keywords: African penguin; breeding habitat; guano; MICE; predators; reproduction; review panel; seals; survival

Motivation

Most analyses over recent years of the concerning decline in penguin numbers have focussed on the impact of pelagic fishing in the neighbourhood of penguin breeding colonies, and have been effectively of the "single-species" type – modelling the impact of human interventions (classically these would be catches in standard fisheries modelling) on the population of interest.

However, as suggested following earlier analyses of the Island Closure Experiment (ICE) (e.g. Butterworth, 2021; Butterworth and Ross-Gillespie,2022), and as confirmed (specifically for the Dassen and Robben island colonies) by the recent International Panel Review (DFFE, 2023), fishing closures around the breeding colonies, while likely to have some positive impact on penguin population growth rates, have only a small impact relative to the estimated relative reductions in penguin abundance. Clearly then: "Fishing limitation around breeding

[1] Note that in due course this document will be tabled at the joint DFFE Fisheries/Oceans-and-Coasts SWG on penguin matters which is currently under formation, and then also given a document number linked to that SWG.

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colonies only addresses one aspect to combat the high rate of penguin decline and it is no miracle intervention" (Creecy, 2023).

This further accentuates the need to try to identify, and if possible ameliorate, the factors responsible for most of the penguin decline. That in turn requires models that attempt to incorporate the impacts of changes to the environment for penguins, and of other predator and prey species on penguins. One approach towards this is the use of "whole ecosystem models" (such as Ecopath with Ecosim – EwE), which have provided insight at a strategic level. However, internationally these have had very little successful implementation at a tactical level (Carruthers and Hilborn, 2021), mainly because of the large data requirements across many species, and the difficulties of obtaining satisfactory fits of such models to what data are available.

In line with common current international practice, the International Panel Review therefore suggested exploration of possible causes of the decline using a MICE (Model of Intermediate Complexity for Ecosystem assessments) approach (Plagányi *et al.*, 2014). The essence of this approach is an extension from a "single-species" to a "multi-species" approach by including only what are considered to be the major interactions and/or species likely to have meaningful impacts on the penguin dynamics. Emphasis is placed on having sufficient data as are required to fit such models, while making only as few model additions as are needed to be able to provide satisfactory fits.

Fundamental penguin dynamics model

MICE approaches typically start from a simple "single-species-like" framework (often already implemented) for the species of primary interest, and then extend that to take other effects into account as well.

For penguins, this framework is the standard Leslie Matrix model often used for predator species dynamics. Its first use for penguins in South Africa was possibly that by Robinson (2013). Thereafter, it was applied to project and thereby estimate the change in penguin population growth rates to be expected from changes to reproductive success resulting from island closures (e.g., Robinson *et al.*, 2014; Ross-Gillespie and Butterworth, 2016).

The equation for the Leslie Matrix model (given below) sets out the details of how the number of mature pairs present next year (N_{y+1}) is made up from the number of such pairs surviving the current year (for which they commence with an abundance of N_y) and the number of chicks hatched three years previously that survive to become mature for the first time in year y+1 (maturity is therefore assumed to take place at age 4). Note that since the annual penguin count is conducted during the breeding season which takes place between April-September, the model year is taken from June in year y to June in year y+1.

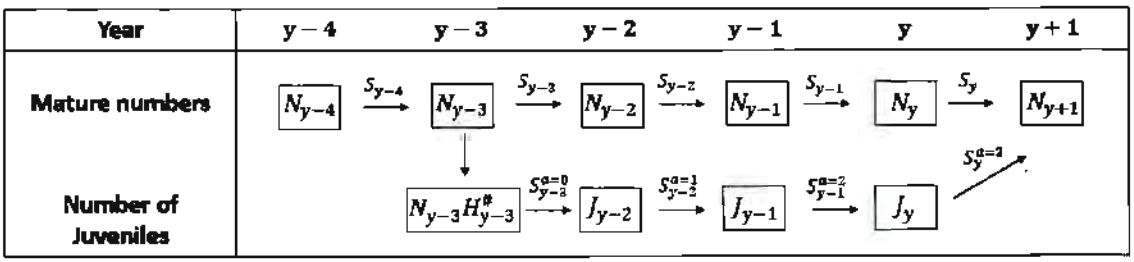
The Leslie Matrix model yields the following core equation for the dynamics of the number of mature penguin pairs[3]:

$$N_{y+1} = N_y S_y^{mat} + N_{y-3} H_{y-3}^{\#} \left(S_{y-3}^{a=0}\right)\left(S_{y-2}^{a=1}\right)\left(S_{y-1}^{a=2}\right)\left(S_y^{a=3}\right) \qquad (1)$$

where

- N_y is the number of mature penguin pairs in the middle of year y (corresponding roughly to the mid-point of the breeding season which is also when the annual penguin counts take place),
- S_y^{mat} is the proportion of mature penguins that survive in "year *y*" (i.e., from June in (calendar) year *y* to June in year *y*+1), where maturity is assumed to take place at age 4,
- $S_{y-3}^{a=0}$ is the proportion penguins that survive in "year *y*-3", subsequent to fledging, for the balance of their first year of life,
- $S_{y-2}^{a=1}$ is the proportion of one-year-old penguins that survive in "year *y*-2",
- $S_{y-1}^{a=2}$ is the proportion of two-year-old penguins that survive in "year *y*-1",
- $S_y^{a=3}$ is the proportion of three-year-old penguins that survive in "year *y*", and
- $H_{y-3}^{\#}$ is the number of fledged chicks per pair in year "*y*-3".

Equation (1) is illustrated in the diagram immediately below:



Note that under the simplifying assumption of reproductive (*H*) parameters which are time-invariant (i.e., $H_y^{\#} = H^{\#}$) and survival proportions (*S*) which are both age-invariant (after the first year of life) and time-invariant (i.e., $S_y^{a\geq 1} = S$), this equation reduces to:

$$N_{y+1} = N_y S + N_{y-3} H S^4 \qquad (2)$$

where *H* is the number of fledged chicks per pair ($H^{\#}$) adjusted by the ratio of their survival proportion for the rest of their first year of life to the annual survival proportion for mature penguins (i.e., $H = H^{\#} \times (S^{a=0}/S)$).

[3] Strictly this equation follows for female penguins under the assumption of a 50:50 male:female ratio at hatching. However, since numbers from observations are reported in terms of penguin pairs, it is convenient to present the model in terms of penguin pairs under the assumption that survival proportions are gender-independent.

Equation (1) assumes that all penguins reach maturity at age 4. Clearly there will be some variation about that in reality. However, this variation has very little effect on projections of abundance.

Extension for MICE approaches

The essence

Extending this fundamental model to a MICE to account for some hypothesis concerning an effect on penguin dynamics requires reflecting that effect by way of its impact on either reproduction (*H*) or survival (*S*).

Some general principles underlying such MICE approaches are:

1) Keep things simple, introducing additional complexity only if needed to reflect key features of the data.
   Hence, for example, one first considers impacts on reproduction or on survival in isolation, before possibly attempting to include both at the same time. Similarly, one considers only a single hypothesis at a time, before attempting fits to data involving more than one type of impact.

2) If extra parameters are introduced, try to ensure that there are sufficient data available to estimate their values when fitting the (extended) penguin model (the MICE). If this is not possible for one or two key parameters, behaviour across plausible ranges of values for those parameters might be examined.

3) Model at a large spatial scale (first) – here treating the whole SA penguin population as a single unit.
   This effective "closed population" assumption means that, overall, immigration and/or emigration do not need to be considered. In contrast, if smaller units within the population are considered (such as single colonies or groups of nearby colonies), movement amongst such units has then to be considered[4]. Possibly it may be defensible to consider that movement to be small enough to be neglected. The problem that generally arises is lack of sufficient data to estimate such movements.

Note that the objective of these modelling exercises is not to "conclusively prove" that some effect is a major cause of the penguin decline. Having a model of that effect which provides a good fit to the data is merely a start to assist by pointing towards where best to look for further corroborative evidence of the effect. Often more will be achieved by way of eliminating some possible hypotheses – this by demonstrating that they are not consistent with the data available.

[4] Thus, for example, the Robinson *et al* (2015) model of the penguins at Robben Island needed to make assumptions concerning penguin immigration to the island before the turn of the century.

Some existing initial applications

Three possibilities for important causes underlying the penguin decline that have been put forward and analysed initially are the following:

1) The effect of fishing on forage food availability for penguins throughout the entirety of their range.
2) A reduction in optimal breeding habitat as a result of the removal over time of guano covering of islands where penguins nest.
3) Competition with seals – both through predation (not all of which might be observed directly) and indirectly through competition for the same sources of food.

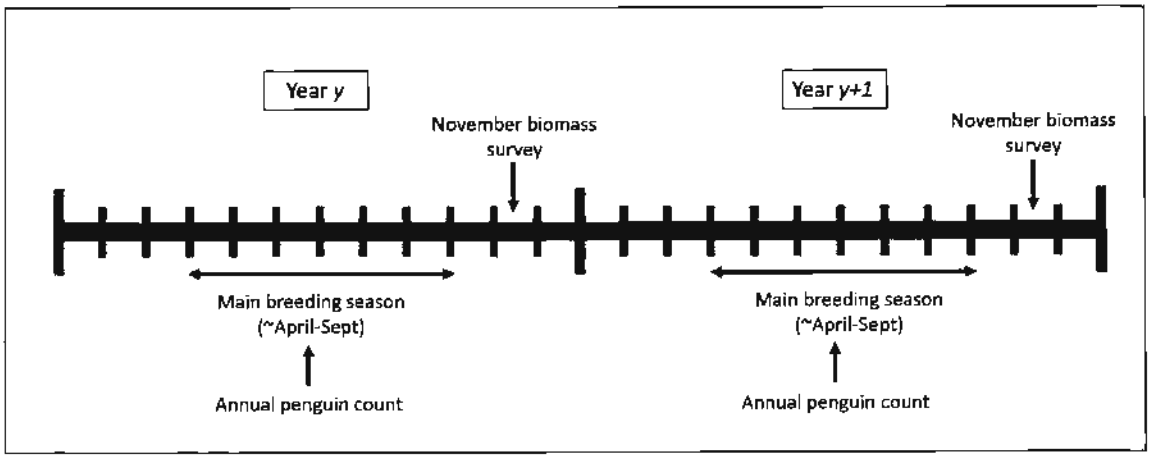
Outlines of the initial MICE approaches that have been implemented for the first two of these three causes are provided below. The reason why more complex implementation for the third is not an immediate priority is explained thereafter.

Food availability

Limitations on forage food availability could impact both reproduction and survival, but the latter seems the better choice for initial analyses, especially because impacts on (especially mature) survival will have a greater impact on population trends than ones on reproductive success. In Butterworth and Ross-Gillespie (2023a), this is achieved by modifying equations (1) and (2) above to make survival proportions functions of some annual forage fish abundance B_y:

$$N_{y+1} = N_y S(B_y) + N_{y-3} H S(B_{y-3}) S(B_{y-2}) S(B_{y-1}) S(B_y) \qquad (3)$$

where the survival proportion S is taken to be age independent, and initial calculations take B to be provided by sardine survey abundance, which is assumed to have the dominant impact (amongst the different forage fish species) on penguin survival. The diagram below shows how the annual penguin counts that inform estimates of penguin abundance relate to the surveys informing on the abundance of forage fish. Based on this diagram, it follows that survival from (the middle of) year y to (the middle of) year y+1 depends then on the sardine biomass in year y (as determined from the November biomass survey). More details are provided in Butterworth and Ross-Gillespie (2023a).



A diagram showing when the annual penguin count occurs relative to the November biomass surveys.

Removal of guano

Removal of guano would clearly have its primary impact on reproductive success through a diminished quality of breeding habitat, and hence on the parameter *H*. This needs to be related in some way to the amount of guano present on islands where penguins can nest, where this amount reduces over time as the guano was harvested. Butterworth and Ross-Gillespie (2023b) model this by amending equations (1) and (2) as follows:

$$N_{y+1} = N_y S + N_{y-3} H \left(1 - \frac{N_{y-3}}{b_{y-3}}\right) S^4 \qquad (4)$$

where b_y is a measure related to (assumed space-limited) penguin carrying capacity. This in turn is assumed to be linearly related to the amount of guano present G_y:

$$b_y = \alpha + \beta G_y \qquad (5)$$ [5]

and G_y is reduced over time by the amount of guano harvested each year. In other words, the parameter b_y (and in turn the reproductive term $H\left(1 - \frac{N_{y-3}}{b_{y-3}}\right)$ from equation 4) decreases in terms of a linear relationship to the total cumulative amount of guano harvested. Butterworth and Ross-Gillespie (2023b) provides more details.

[5] Strictly, given the convention adopted here for the year "beginning" in June, the recorded annual amounts of guano harvested, G_y, should be adjusted to reflect this use of a non-calendar year, but the data are not available at that level of detail, and in any case the effect of such an adjustment to the calculations reported in Butterworth and Ross-Gillespie (2023b) will likely be minimal, and the overall conclusion of that paper would not change.

Seals

Seal competition with penguins for food or predation would occur naturally, so would already contribute to, say, the penguin survival proportion that would apply in a situation where the two species are co-existing. Therefore, for such competition to be a contributor to the penguin decline over recent decades there would need to be a situation where seals are now "unusually abundant. This could indeed be the case at present. Seals in South Africa were near extirpated at the turn of the 19th century as a result of over-harvesting, but have since increased substantially (Butterworth *et al.*, 1995) before levelling off over the last two-three decades (Kirkman *et al.,* 2007). This new level may be above that before harvesting started, given that seal colonies on the mainland have now become viable following eradication of most of their land-based predators (such as lions and hyenas), and at present these colonies generally constitute the majority of a seal population that is likely not as space-limited at present to the extent it was in the past. Hence, these unusually current high numbers of land-breeding seals in South Africa could lead to a decrease in the penguin annual survival proportion that would otherwise pertain, and so could be contributing to the decline in penguin abundance. This impact could be modelled by incorporating some relationship between *S* and seal abundance in a MICE approach. However, this does not seem a high priority immediately, as Butterworth and Ross-Gillespie (2023a) show that the requisite extent of such "additional" seal-related penguin mortality would need to be of the order of an average of only 0.01 penguins per seal per year for a meaningful impact on penguin population trajectories. This seems sufficient to confirm the plausibility that this effect could be making a contribution to the decline in the penguin population, even without immediately conducting more detailed modelling. Nevertheless, the effect could be incorporated in subsequent approaches which attempt to take account of the causes suggested above occurring in combination.

Where next?

Naturally the three possible causes of the penguin decline for which initial MICE applications are outlined above are not exhaustive. Other possibilities, as well as variations of the three presented, need further examination, supplemented by searches for independent corroboration when analyses provide results indicating that hypotheses are consistent with existing data.

But first and as soon as possible, this document, together with its companion papers (Butterworth and Ross-Gillespie, 2023a, b) need further discussion in pertinent DFFE fora to provide feedback, and to identify the most effective and efficient ways forward to address possible major causes of the penguin decline using the MICE approach.

Acknowledgements

We thank those scientists who have collected the various data used in past and to be used in future MICE analyses of this issue.

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"MC5"

Seeking clarification on mIBA computation approaches suggested

D S Butterworth[1]

Summary

Results from a kernel smoothing approach to estimate mIBAs are heavily dependent on the value specified for the smoothing parameter *h*. The choice of 7 km for *h* for mIBA computations for SA penguin colonies by McInnes *et al.* (2023) is taken from a value determined from analyses for colonies in the Scotia Sea. However, it seems that those last analyses did not incorporate any ARS considerations, i.e. did not distinguish between times spent feeding and times spent foraging. This needs further clarification, because if that was indeed the case, the justification for applying the Scotia Sea *h* value for SA analyses would seem to require reconsideration.

Key words: feeding; kernel smoothing; mIBA; penguin

Background

The 2023 International Panel "**recommended** that analyses delineating mIBAs using ARS methods represent the best scientific basis for delineating the preferred foraging habitats during breeding" (Punt *et al.*, 2023, pg 34). ARS is an abbreviation for Area Restricted Search – the intent of related methods is to specify areas that correspond only to where penguins feed, i.e. to exclude regions where they are transiting to, from or between those feeding areas.

Current approach

McInnes *et al.* (2023) describe the method that they have used for mIBA computations for areas around SA penguin colonies on their pg 46. This involves kernel density analysis, which calculates the density of locations by fitting a bivariate normal function with a pre-defined radius (the smoothing parameter *h*) around each location, and then summing these distributions to create a smooth density surface. They use an *h* value of 7 km, "following Dias *et al.* (2018)".

Dias *et al.* (2018) are not entirely clear as how they perform their computations for colonies in the Scotia Sea, but one of their key statements (pg 10522) would seem to be that "PTT-Argos-based location data from penguins are often unsuitable for ARS estimation since trips and, therefore, within-trip behaviors cannot be readily identified". Their eventual choice of a method to choose a value for *h* (pg 10524) seems based only on a form of cross-validation (applying their method to a subset of the data, and then seeing how well that reflects the distribution of the remainder of the data); this leads them to the choice of a value *h* of 7 km. This would seem a perfectly acceptable approach to specifying the overall area used by the penguins for foraging **and** transit; however, there is no indication (either in the main text or in the Supporting information) that it includes an "ARS component" to restrict the results to foraging areas only.

Consequently, the choice of a value for *h* of 7 km does not seem linked to any explicit consideration of ARS, i.e. of distinguishing foraging and transiting behaviour.

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Concerns

Butterworth and Ross-Gillespie (2023) point out that the kernel smoothing approach can lead to mIBAs inflated to sizes appreciably in excess of the actual foraging ranges for penguins in provisioning their chicks – especially if the value chosen for *h* is too large. Horton and Bergh (2023) show that the extents of mIBAs calculated around SA penguin colonies are heavily dependent on the value specified for *h*.

The reason for the "outward smearing" of the kernel approach is to allow for the fact that a penguin has not necessarily moved only in a straight line between any two successive points where its position was monitored, but may have moved outside that line. The appropriate value of *h* to allow for this will clearly depend on the frequency of position monitoring, and the typical distance between such positions.

The question that then arises is how these position monitoring parameters for the SA penguin data correspond to those for the Scotia Sea data considered by Dias *et al.* (2018). Only if they are very similar would it seem justified to apply the Scotia Sea *h*=7 km value to the SA data. Failing that, the choice of an *h* value for the SA data would seem to require a similar cross-validation exercise to that carried out by Dias *et al.* (2018) for their Scotia Sea foraging data.

Clarification is sought as to whether this document has correctly interpreted the methods applied by Dias *et al.* (2018) and also by McInnes *et al.* (2023), to then inform on whether the value of *h* used for the latter needs revision.

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Punt AE (Chair), Furness RW, Parma AM, Plagányi-Lloyd E, Sanchirico JN and Trathan P. 2023. Report of the international review panel regarding fishing closures adjacent to South Africa's African penguin breeding colonies and declines in the penguin population. Prepared for the Department of Forestry, Fisheries and the Environment (DFFE). Pretoria, South Africa: DFFE. 71 pp.

"MC6"

Kate Rebello

From: Ashley Naidoo <ANaidoo@dffe.gov.za>
Sent: Tuesday, 19 December 2023 09:26
To: Dr Mike Bergh
Cc: Kim Prochazka; copeland.fishconsult; Gerhard Cilliers; Gcobani Popose
Subject: Re: Access to Penguin Foraging data for scientific deliberations on Island Closures

Dear Mike and colleagues, now including Gerhard and Gcobani

I generally agree that all data must be shared with all participants, so that all can undertake their further work towards implementing and improving on the Panel's recommendations.

It is our plan, and Gerhard will take this forward in the new year, that we create a space on our Marine Information Management System (MIMS), where all relevant data can be shared and accessed. There are some data management principles that we will to be followed such as metadata and allocating data owners, but these are fairly standard and we have been implementing the system for the last two to three years, with hundreds of datasets. There are some complications that arise when data collectors / owners place severe restrictions on use or do not wish to share, generally this requires some negotiation. One end point here, albeit undesirable, is that analyses based on data that is not shared cannot be used in management / policy discussions – I am hoping that this will be avoided.

These will be some of the basic points in the ToRs of the combined scientific group work that will be taking this work forward. Gerhard and Kim, I suspect, will be developing these ToRs in the new year. As you may know I am leaving the DFFE at the end of the month, and take this opportunity to thank you and those copied here for all your help and contribution to this process over many years, but especially over the last three years when I was involved.

Thank you
Ashley

Ashley Naidoo. Ph.D. | Chief Director: Ocean & Coasts Research (he/him)
Find Annual Ocean & Coasts Science Report at:
http://dx.doi.org/10.13140/RG.22.19915.77601
+2721 493 7301
+2782 764 7131

From: Dr Mike Bergh <mike@olsps.com>
Date: Monday, 18 December 2023 at 11:41
To: Ashley Naidoo <ANaidoo@dffe.gov.za>
Cc: Kim Prochazka <KProchazka@dffe.gov.za>, copeland.fishconsult <copeland.fishconsult@gmail.com>
Subject: FW: Access to Penguin Foraging data for scientific deliberations on Island Closures

Dear Ashley

As you know, in May of this year, as part of the international panel review process we (OLSPS Marine) were given access to data and software in terms of a data sharing agreement between ourselves (OLSPS Marine) and 'Organisation B' comprising BirdLife South Africa, Dr Lauren Waller, Dr Richard Sherley, Dr Lorien Pichegru and Dr Alistair McInnes. The information that was shared with us was as follows:

African Penguin tracking data from the Dassen Island, Robben Island, Stony Point, Dyer Island, St Croix Island, and Bird Island colonies.

R code to create core foraging areas, otherwise known as marine Important Bird Areas (mIBAs).

The data sharing agreement required us to delete this information on our computers in July of this year (2023). At the time I made the point that the information referred to above should be freely available to participants in the scientific deliberations and should not be limited by said data sharing agreement. Now, given the panel's report, this issue is again on the agenda. The report contains numerous recommendations about how to calculate MIBAs some of which I would like to investigate and report on. I cannot do this at the present time.

I am therefore submitting a request via you that these data be made available to participants in the scientific deliberations including myself and my colleagues at OLSPS Marine on the same basis that other information has been curated and made available for deliberations on penguin island closures (for example the information from ICE). There are certain critical investigations which hinge on having access to these data.

Regards

Mike Bergh

Mike Bergh
CTO

+27 21 702 4111

www.olsps.com

Silvermine House, Steenberg Office Park, Tokai, Cape Town, South Africa, 7945

"MC7"

Kate Rebello

From:	Liesl Jacobs <lijacobs@dffe.gov.za>
Sent:	Thursday, 18 January 2024 12:54
To:	copeland.fishconsult
Cc:	Ashley Naidoo; Nosiseko Mhlahlo; Janine Buitendag; Itebogeng Chiloane
Subject:	EDMS MCE238966 Letter to Mr Copeland
Attachments:	EDMS MCE238966 Letter to Mr Copeland.pdf

Dear Mr Copeland

Please receive the attached letter from Minister Creecy for your attention.
Kindly acknowledge receipt thereof.

Regards

Liesl Jacobs
Assistant Appointment Secretary and Administration
Department of the Forestry, Fisheries and the Environment
Ministry
012 399 8515
066 143 8859

forestry, fisheries and the environment
Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

MINISTER
FORESTRY, FISHERIES AND THE ENVIRONMENT
REPUBLIC OF SOUTH AFRICA

Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Tel: (012) 399 8743
Private Bag X9052, Cape Town, 8000, Tel: (021) 469 1500, Fax: (021) 485 3362

Ref: EDMS MCE238966

Mr Mike Copeland
Chair: South African Pelagic Fishing Association

Email: copeland.fishconsult@gmail.com

Dear Mr Copeland

RE: SOUTH AFRICAN PELAGIC FISHING ASSOCIATION'S INITIAL COMMENTS AND VIEW ON THE INTERNATIONAL REVIEW PANEL REPORT AND THE TRADE-OFF BETWEEN THE COSTS AND BENEFITS OF ISLAND CLOSURES

Your email correspondence, dated 27 November 2023, bears reference.

Further to previously noting your organisation's significant contribution to science and policy development on the co-management of marine ecosystems, I want to acknowledge your letter and initial comments, as well as your view on the International Review Panel Report and the trade-off between the costs and benefits of island closures sent to me in November.

I note your considerations that are detailed in the various subsections and appendices. In particular, I note the specific responses on McInnes et al., where you outline your preference for a more quantitative assessment approach to estimates of benefits to penguins, as well as the improvements needed on the cost to fisheries assessments and updating Marine Important Bird Areas prior to using the trade-off method suggested by the Review Panel.

I appreciate your efforts towards the quantification of the costs to fisheries and numbers of increased breeding pairs with the currently available information. In doing so, I also thank you for accepting my proposal on continuing with the interim closed areas while additional science is being undertaken. I agree that this additional work must include the use of Models of Intermediate Complexity for Ecosystem Assessments (MICEs) to assess the contributing pressures on African penguins, such as previous devastating oil spills and seals predation.

Your conclusions on the preparatory work required before using the trade-off method suggested by the Expert Panel are noted. Our internal team of Fisheries, Oceans and Coasts, and SANParks scientists will continue to engage with your science representatives on this work and future planned work on penguin conservation interventions. Cooperative and inclusive scientific analyses across the Department of Forestry, Fisheries and the Environment (DFFE); Fisheries and Conservation scientists

RE: SOUTH AFRICAN PELAGIC FISHING ASSOCIATION'S INITIAL COMMENTS AND VIEW ON THE INTERNATIONAL REVIEW PANEL REPORT AND THE TRADE-OFF BETWEEN THE COSTS AND BENEFITS OF ISLAND CLOSURES

will allow for more opportunities regarding agreed or at least consolidated methods and policy advice. Finally, the DFFE will share with you all its data and observations that you require, including the penguin breeding pair counts per colony, as per your request. The DFFE does not undertake monthly counts of seabirds on all colonies, but will share the observations.

Finally, I am informed that your request to distribute the document is now covered through your email on 19 December in which you sent this latest version to the relevant stakeholders in response to an ongoing email discussion.

Yours sincerely,

MS B D CREECY, MP
MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT
DATE: 14/1/2024

"MC8"

From: Charlotte Ducommun
To: Charlotte Ducommun
Subject: FW: Data request / Mike Bergh, SAPFIA
Date: Thursday, 22 August 2024 13:26:06

From: Azwianewi Makhado <AMakhado@dffe.gov.za>
Sent: Thursday, 08 February 2024 08:10
To: Dr Mike Bergh <mike@olsps.com>; copeland.fishconsult <copeland.fishconsult@gmail.com>
Subject: FW: Data request / Mike Bergh, SAPFIA

Dear Mike

Please find below the response from data owners. Please liaise with them.

Regards
Newi

From: Alistair McInnes <alistair.mcinnes@birdlife.org.za>
Date: Monday, 05 February 2024 at 13:42
To: Azwianewi Makhado <AMakhado@dffe.gov.za>
Cc: lorien.pichegru@mandela.ac.za <lorien.pichegru@mandela.ac.za>, r.sherley@exeter.ac.uk <r.sherley@exeter.ac.uk>, Lauren Waller <laurenw@ewt.org.za>
Subject: RE: Data request / Mike Bergh, SAPFIA

Dear Newi

I have consulted with the data providers regarding your request. Unfortunately, we are not in a position to provide this data (already made available for the specific purposes of the International Panel Review process and subject to an NDA) outside a formal review process which includes seabird biologists. The purpose of the data-request is not clear to us and we are reluctant to share data which is currently the subject of imminent peer review and publication.

Regards

Alistair

From: Azwianewi Makhado <AMakhado@dffe.gov.za>
Sent: Wednesday, January 31, 2024 9:34 AM
To: Alistair McInnes <alistair.mcinnes@birdlife.org.za>
Subject: FW: Data request / Mike Bergh, SAPFIA

Dear Alistair

I have received a data request from Mike Bergh on the tracking of penguins. Please below his

request and please advise if it is possible to make those data available.

Regards
Newi

From: Dr Mike Bergh <mike@olsps.com>
Date: Monday, 29 January 2024 at 10:21
To: Azwianewi Makhado <AMakhado@dffe.gov.za>
Cc: copeland.fishconsult <copeland.fishconsult@gmail.com>
Subject: RE: Data request / Mike Bergh, SAPFIA

Dear Newi

I am following up my data requests in the email below with some more detail on item 1 in my email of 26 January 2024. I would like to obtain the following information:

1. African Penguin tracking data from the Dassen Island, Robben Island, Stony Point, Dyer Island, St Croix Island, and Bird Island colonies.
2. R code to create core foraging areas, otherwise known as Marine Important Bird Areas (mIBAs), as formed the basis for MIBA shape files proposed as closed areas by Birdlife late last year, or alternatively as were submitted to the international panel on penguins in the first half of 2023.

The information should be sufficient for an independent scientist to understand how these MIBAs are calculated and to repeat them.

Regards

Mike Bergh

From: Dr Mike Bergh
Sent: Friday, January 26, 2024 5:17 PM
To: Azwianewi Makhado <AMakhado@dffe.gov.za>
Cc: Michael Copeland <copeland.fishconsult@gmail.com>
Subject: FW: Data request / Mike Bergh, SAPFIA

Dear Newi

I am responding to your request for any data requests from SAPFIA, your email to Mike Copeland on 20 January 2024 refers. From my side I have two fairly straightforward data requests which I think you would be able to respond to quite quickly. These are as follows

A. The most recent time series of seal pup counts for South Africa, by location and year
B. The most recently updated time series of penguin population size estimates for South Africa, by colony and year.

Then in broad terms I have the following data requests:

1. The penguin foraging data and associated R code used by Birdlife to calculate MIBA shape files. I will need to provide a follow-up request with more detail, but since we previously obtained these directly from Birdlife, they would know what I need. But I will re-clarify that in an email to you early next wee.
2. Detailed information from hydro-acoustic pelagic surveys. I will need to follow-up next week on this via email, but this is just a heads up of a request I will clarify then.

Regards

Mike

Subject: Fw: Formulation of management advise for penguin island closures and related management measures
Date: Saturday, 01 June 2024 at 12:21:34 South Africa Standard Time
From: Mike Copeland
To: Coriaan de Villiers, Marius Diemont
CC: mike, matt@olsps.com, Doug Butterworth, SAPFIA

Good afternoon,

I am going through my mails to try and retrieve those that are relevant and will save them in appropriate folders and send later (Naidoo, Anderson, CAF etc).

In the meantime, I think below was requested and may cover the points raised.

Thanks Mike

Mike Copeland
+27 82 572 1852

From: Mike Copeland <copeland.fishconsult@gmail.com>
Sent: Monday, February 19, 2024 16:13
To: LFikizolo@dffe.gov.za <LFikizolo@dffe.gov.za>; Gcobani Popose <GPopose@dffe.gov.za>
Cc: Kim Prochazka <KProchazka@dffe.gov.za>; AJohnson@dffe.gov.za <AJohnson@dffe.gov.za>; Azwianewi Makhado <AMakhado@dffe.gov.za>; SAPFIA <sapfia@inshore.co.za>
Subject: Re: Formulation of management advise for penguin island closures and related management measures

"MC9"

Good afternoon All,

We have not yet received a response to the mail below. The matter relating to the formation of a Penguin SWG referred to below, is now becoming pressing for an additional reason other than the obvious.

One of the important recommendations from the International Review Panel Report was suggestions for how to develop a Model of Intermediate Complexity for Ecosystem assessment (MICE) in order to attempt to explain the trends in penguin population numbers. The Panel suggested that the key species that need to be represented in the MICE included African penguins, sardine, anchovy and Cape fur seals.

The latest MICE document circulated last week points out that the results have management implications for the pelagic fishery. Specifically, the results indicate that low sardine catches are likely not as important for penguin recovery as previously thought and used to keep sardine TACs low. The sardine TAC is to come under discussion in the PWG this week and in the next few weeks in circumstances where other pressures on the Industry argue for more latitude on possible TAC increases.

It is important that the MICE results already circulated are discussed in the next week or two, especially given their implications for sardine TAC recommendations.

We look forward to a quick response.

BR

Mike

Mike Copeland
+27 82 572 1852

From: Mike Copeland <copeland.fishconsult@gmail.com>
Sent: Tuesday, February 13, 2024 08:29
To: LFikizolo@dffe.gov.za <LFikizolo@dffe.gov.za>; Gcobani Popose <GPopose@dffe.gov.za>
Cc: Kim Prochazka <KProchazka@dffe.gov.za>; AJohnson@dffe.gov.za <AJohnson@dffe.gov.za>; Azwianewi Makhado <AMakhado@dffe.gov.za>; SAPFIA <sapfia@inshore.co.za>
Subject: Formulation of management advise for penguin island closures and related management measures

Dear Sirs and Kim,

We refer to the letter from the Minister, DFFE, dated 14 January 2024 to Mike Copeland, Chair, SAPFIA (attached hereto), in which the following is stated:

"Cooperative and inclusive scientific analyses across the Department of Forestry, Fisheries and Environment (DFFE); Fisheries and Conservation scientists will allow for more opportunities regarding agreed or at least consolidated methods and policy advice."

The intention is that a penguin focussed WG be formed that can deliberate on and agree on action plans to attempt to halt or reverse the concerning and alarming decline in the numbers of penguin breeding pairs. We would be pleased to be informed what progress has been made in forming such a group.

Following on from the above it is stated in the letter that:

"… the DFFE will share with you all its data and observations that you require, including the penguin breeding pair counts per colony, as per your request"

From the Minister's letter there is a clear intent that DFFE will share with SAPFIA all its data and observations related to penguins in order that informed discussions and decisions can be made in the forum formed above.

As you can see from the thread of communications that has followed this letter from the Minister (see details below this letter), SAPFIA is being frustrated in their attempts to access certain data which are critical to management decisions regarding penguin island closures and related management measures. Specifically, the holders of the penguin tracking data underpinning the mIBA calculations are now saying that (email from Alistair McInnes to Dr Makhado dated 5 February 2024):

"Unfortunately, we are not in a position to provide this data (already made available for the specific purposes of the International Panel Review process and subject to an NDA) outside a formal review process which includes seabird biologists. The purpose of the data-request is not clear to us and we are reluctant to share data which is currently the subject of imminent peer review and publication."

Surely as a matter of principle, any data on which analyses leading to management recommendations are based must be made available to accredited stakeholders for investigation and interrogation. This is now a generally accepted requirement in most international marine population management fora such as RFMOs and their scientific committees, and ecolabelling organisations. This data availability requirement must therefore apply to the tracking data upon which ENGOs proposals for the extent of area closures are based.

We note that the attached Code of Conduct for Scientific Working Groups and the associated attached TOR's of those SWG's are consistent with this principle, in particular the following from Section 14 of the TOR:

"14.3: All data/information/documents, used by the SWG in generating scientific advice will be made publically available within four weeks of the meetings at which they are considered (this period is to allow for prior correction of possible errors), except as provided for in the exceptions detailed in section 15 below".
Section 14 of the TOR lists other requirements and principles related to this matter.

Note that McInnes and at least one of the data providers to whom he refers (Waller) have signed the DFFE Code of Conduct (see attached hereto) to allow their participation in the PWG. This states the following:
"In my capacity as Member/ Observer of a Scientific Working Group, I undertake to honour the following Code of Conduct for Scientific Working Groups. I hereby pledge to: ...
ensure that data and information on which scientific recommendations may be based is freely available to the Scientific Working Group"
(4th bullet on second pg of the Code of Conduct).
McInnes' 5 February response indicates that he and Waller (at least) are in contravention of their undertakings.

It is therefore important that these penguin tracking data and indeed any other data used in the formulation of management advice on penguin management matters be made available transparently and freely to the scientific process and deliberations without any other restrictions.

The copies of the attached SWG code of conduct and ToR are from some years ago, but they have not been changed and still apply.

We therefore request that DFFE confirms that these mIBA proposals will not be considered until the associated data have been made available to other stakeholders to allow independent analyses. Note that there have already been documents submitted questioning results from such analyses submitted by ENGOs, to which their authors have not responded (mIBA-related papers submitted to the International Review Panel on penguin island closures, June 2023).

Note that requirements for short term confidentiality for reasons of publication etc. referred to in the McInnes email of 5 February 20224 are already well covered by the SWG ToR (see section 15).

Yours sincerely

Mike Copeland
Chair/SAPFIA

Communications between SAPFIA and DFFE Oceans and Coasts regarding access to data:

Following our receipt of the letter of 14 January 2024 from the Minister, we received an email from Dr Makhado on 20 January 2024 addressed to Mike Copeland in which he offered to provide any data that SAPFIA required.
"I have been requested to provide data to you and would like to find out if there is any data

you require from DFFE? The Minister has sent me a request to consider your data request. Please let me know as soon as possible".

To which Mike Bergh replied on behalf of SAPFIA as follows on 26 January 2024:
"I am responding to your request for any data requests from SAPFIA, your email to Mike Copeland on 20 January 2024 refers. From my side I have two fairly straightforward data requests which I think you would be able to respond to quite quickly. These are as follows
The most recent time series of seal pup counts for South Africa, by location and year
The most recently updated time series of penguin population size estimates for South Africa, by colony and year.
Then in broad terms I have the following data requests:
The penguin foraging data and associated R code used by Birdlife to calculate mIBA shape files. I will need to provide a follow-up request with more detail, but since we previously obtained these directly from Birdlife, they would know what I need. But I will re-clarify that in an email to you early next week.
Detailed information from hydro-acoustic pelagic surveys. I will need to follow-up next week on this via email, but this is just a heads up of a request I will clarify then."

Then on 29 January 2024 Mike Bergh followed up with the following request to Dr Makhado:
"I am following up my data requests in the email below with some more detail on item 1 in my email of 26 January 2024. I would like to obtain the following information:
African Penguin tracking data from the Dassen Island, Robben Island, Stony Point, Dyer Island, St Croix Island, and Bird Island colonies.
R code to create core foraging areas, otherwise known as Marine Important Bird Areas (mIBAs), as formed the basis for mIBA shape files proposed as closed areas by Birdlife late last year, or alternatively as were submitted to the international panel on penguins in the first half of 2023.
The information should be sufficient for an independent scientist to understand how these mIBAs are calculated and to repeat them."

Dr Makhado replied on 29 January as follows:
"The number of penguins and seals would not have changed from the one we sent you last year, unless you still need to have the same file. The tracking data you mentioned is held by Birdlife and Sherley. We can send them a request. Please let me know if you still need the same file we sent last year with the data held within DFFE."

To which Mike Bergh responded, also on 29 January 2024:
"Yes If you could please send through those files. Then, with the tracking data and the R code that Birdlife sent through previously, my view is that these data should be made available to the scientific deliberations regarding penguins without restrictions or special agreements. After all, the Minister has asked that we are provided the data we need for our analyses. Could you prevail on the holders of the data. In general it would be a requirement that any arguments that make management recommendations must back this up by making their data available on the same basis as all other data are available."

In response we received a copy of the following email communication from Dr Makhado to Alistair McInnes:
"I have received a data request from Mike Bergh on the tracking of penguins. Please below his request and please advise if it is possible to make those data available."

On 5 February 2024 the following reply was relayed to Mike Bergh via Dr Makhado from Alistair McInnes:
"I have consulted with the data providers regarding your request. Unfortunately, we are not in a position to provide this data (already made available for the specific purposes of the

International Panel Review process and subject to an NDA) outside a formal review process which includes seabird biologists. The purpose of the data-request is not clear to us and we are reluctant to share data which is currently the subject of imminent peer review and publication".

Mike Copeland
+27 82 572 1852

"MC10"

SAPFIA
South African Pelagic Fishing Industry Association
1st FLOOR, HARBOUR PLACE, 7 MARTIN HAMMERSCHLAG WAY, FORESHORE, CAPE TOWN, 8001
P.O. BOX 2066, CAPE TOWN, 8000
TEL: +27 21 425 2727 • FAX: +27 21 425 4734 EMAIL: sapfia@inshore.co.za

17 March 2022

The Honourable Minister
Department of Forestry, Fisheries and Environment

Dear Minister Creecy,

Re: SAPFIA/ESCPA Comments on the CAFMLR deliberations re Penguin Island Closure with a proposal for an international scientific review of the results of the Island Closure Experiment

CAFMLR has concluded its African penguin deliberations in the presence of observers. Given that we were not able to meet with you to discuss this matter in advance (see our letter of 15 December), we take this opportunity to provide comments on the CAFMLR process (see Annexure to this letter below). Further, given the absence of a consensus at CAFMLR, we present SAPFIA/ESCPA proposals later in this letter.

CAFMLR were, by their own candid admission, not able to evaluate the science surrounding the Island Closure Experiment (ICE), which is fundamental to this matter. Rather they sought a compromise of 50% closure of the marine important bird areas (MIBAs). SAPFIA and ESCPA, despite their reservations because the best scientific evidence (as required to be considered by the MLRA) was clearly that these closures would result in only a negligible benefit for penguins, made proposals to close somewhat more than 50%, for compromise's sake and for the short term only. Maps of SAPFIA and ESCPA proposed closures are available and have been submitted to CAFMLR.

We are concerned that CAFMLR has, in trying to appease the NGO position, produced their own map of closures. These, although also at the 50% compromise MIBA level, have severe negative socio-economic consequences for

the small pelagic fishery, and thus the CAFMLR's proposal (at last viewing) is unacceptable to and not supported by SAPFIA and ESCPA, inter alia as its basis is contrary to the requirements of the MLRA.

SAPFIA/ESCPA therefore proposes the following:

1. The adoption of SAPFIA/ESCPA's closure proposals, for 9 months (i.e., to the end of 2022). This mitigates negative socio-economic impacts, and is a compromise which closes at least 50% of the MIBAs, which was CAFMLR's guideline for a compromise.
2. The appointment of an international scientific panel to review the science surrounding the ICE and related aspects of African penguin conservation, to return its report within 9 months. SAPFIA/ESCPA have some proposals to make about scientists with appropriate expertise to be considered for inclusion in this panel, and about the appropriate terms of references for such a body, which would ensure that useable outputs are produced. We will forward these shortly.
3. Implementation of scientific investigations to identify the reasons for the decline of the African penguin population, including the application of suitable multispecies models – this to return results that can be produced within 9 months.
4. Mitigation of the negative socio-economic impacts on the small pelagic fishery by allowing this fishery to fish inside that part of the 16 Mile Beach MPA seaward of 1 km from the shoreline (presently fishing is barred within 3 km of the shoreline).

We re-iterate our earlier request for a meeting with yourself, as was afforded to the NGOs last year, to be able to elaborate on our position and its rationale.

Yours sincerely

Mike Copeland
Chair / SAPFIA and on behalf of ESCPA

Annexure: Comments on the CAFMLR process for African Penguin Conservation by SAFPIA/ESCPA

1. CAFMLR informed a meeting with observers (on 9th February 2022,) that its members had neither the time nor the expertise to evaluate the scientific arguments related to island closures. SAPFIA/ESCPA are appreciative of CAFMLR's honesty and openness regarding their lack of such expertise. This is of course a very complicated matter, which explains why the fact that South Africa does not possess sufficient skills to carry out an independent evaluation of the science is not surprising.
2. Notwithstanding that fact, the most important shortcoming of the CAFMLR process on penguins has therefore been that their deliberations did not evaluate the scientific evidence, and hence that CAFMLR's final recommendations will not be based on the best scientific evidence.
3. CAFMLR instead followed an alternative approach, placing the burden on parties representing divergent viewpoints to reach a consensus through a process of compromise. Such consensus could not be achieved.
4. This created an unfortunate situation in which claims and counter-claims were made in CAFMLR meetings in the presence of observers, but without any requirement for these claims to be based on clearly specified scientific arguments and methods. That is standard practice in other national and international scientific evaluations in fisheries, rather than engaging in appeasement of different groups.
5. CAFMLR have, based on the last meeting with observers present, developed their own recommendation which is a compromise of sorts between proposals put forward by the NGO and industry groups. This proposal is quite unacceptable to and is not supported by SAPFIA and ESCPA.
6. The process of compromise without evaluating the science sets a dangerous precedent for other future contested situations in the natural resource management arena in South Africa. This precedent would be that CAFMLR attempts to resolve complex scientific questions by seeking a compromise between divergent views, rather than on the basis of the best scientific

evidence. This has potential for wide negative effects for fisheries and fisheries management in South Africa. CAFMLR has to make its recommendations consistent with the provisions of the MLRA – it cannot override these provisions.

7. Very little time was devoted to the numerous material factors other than island closures that may impact negatively on the conservation of the African penguin. This is a very serious omission, as identifying and ameliorating these factors has far better prospects for arresting the worrying penguin decline than is offered by island closures. SAPFIA made specific recommendations for research work to be carried out towards this end. No informed deliberations of this topic took place when observers were present, reflecting a continuation of an imbalance that has plagued penguin conservation efforts for more than the last 12 months.
8. CAFMLR need to acknowledge that the journal article (Sherley et al., 2018) that initiated its penguin deliberations was in error, and the Minister should have been alerted to this as soon as it became known in 2021. This is because this paper was cited in media reports as the basis for a call for island closures by SANCOB, Birdlife and WWF, and hence, we assume, was the primary rationale advanced by them in the Minister's consultation meeting with those groups that they requested last year.
9. CAFMLR recorded (at a meeting of 8 March 2022) that they had specifically not considered the shortcomings in the recently published Sydeman et al (2021) paper in the ICES Journal of Marine Science (which advocates for island closures, and was later adjudged by ICES to have violated their article review policies) in any of their deliberations about island closures. Thus, CAFMLR have deliberately avoided an evaluation of the ICE analyses. The data and analyses from ICE are the only evidence about the impact of island closures on penguins available to CAFMLR. This should surely have been a central issue for CAFMLR to resolve in coming to a recommendation based on the best scientific evidence.
10. The issues surrounding ICE and the possible interactions between fishing and penguin populations trends, the impact of other factors and multispecies interactions are complex, requiring the application of advanced scientific skills. CAFMLR, for its deliberations, had the option to co-opt adequate

expertise related to these skill-sets, but chose not to do so. SAPFIA/ESCPA considers that it was a serious omission on their part to decide not to include persons with these skills in its deliberations. Although such expertise is limited in South Africa, the South African scientists who carried out ICE analyses, most of whom do possess such skills, should have been included in these deliberations. Indeed, in her meeting interacting with stakeholders on 12 August 2021, the Minister gave an undertaking that such consultation would occur, but that has not happened.

Kate Rebello

From: Mike Copeland <copeland.fishconsult@gmail.com>
Sent: Saturday, 01 June 2024 14:26
To: copeland.fishconsult@gmail.com
Subject: Fw: Letter to the Minister
Attachments: Letter to the Minister 20 June 2022.pdf

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"MC11"

From: Mike Copeland <copeland.fishconsult@gmail.com>
Sent: Monday, June 20, 2022 16:05
To: Feroze Shaik <fshaik@environment.gov.za>; FShaik@dffe.gov.za <FShaik@dffe.gov.za>
Cc: Redah De Maine <redah@rialfishing.co.za>; SAPFIA <sapfia@inshore.co.za>
Subject: Letter to the Minister

Dear Mr Shaik,

As mentioned please find attached for the Minister's attention a more detailed account of the area closure deliberations with the Conservation Group.

Thank you

Mike

Mike Copeland (+27 82 572 1852)
Sent from Mail for Windows 10

SAPFIA
South African Pelagic Fishing Industry Association

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20 June 2022

The Honourable Minister
Department of Forestry, Fisheries and Environment.

Dear Minister Creecy,

Re: SAPFIA/ESCPA discussions with WWF/Birdlife/SanParks

As you are aware SAPFIA and the ESCPA have been engaging with Drs Mark Anderson, Morne du Plessis and Luthando Dziba, representing Birdlife South Africa, WWF and SanParks, to try to reach a consensus on island closures. On 25th May these three representatives proposed closure of 87.9%, 75.8% and 75.0% of the MIBA at Dassen Island, Dyer Island and St Croix Island, with no further closure at Robben Island, Stoney Point and Bird Island, Algoa Bay except for the existing MPAs. This has led to further correspondence. I have just forwarded an email sent to Mark Anderson which gives the background to where we are now. We are still far from an agreement and although it seems unlikely that agreement will be reached, we are willing to maintain our communications with this new group to continue to explore the possibility of a compromise.

We note from our correspondence with Dr Mark Anderson (response to SAPFIA, see our email to Mark Anderson of 20 June 2022) that he appears to have knowledge about processes taking place with respect to the International Panel. Given the sensitivity of the matter and the need for complete transparency, it is important that

we are granted the opportunity of an in-person meeting with yourself so that we can clearly articulate, motivate and provide further details for the reasons behind our proposals in our own words.

We are of course concerned that this new group of negotiators are out of touch with the deliberations in the ETT and the CAFMLR over the last about 9 months. Their statement (response to SAPFIA, see our email to Mark Anderson of 20 June 2022) that there were no island closures in 2021 is factually incorrect. Robben Island was closed for the whole of 2021 and Dassen Island and St Croix were both closed for 6 months in 2021. The PWG recommended further closures for 2022 which industry supported, but after island closure management was taken away from the PWG, the 2022 closures were not implemented. There are other factual errors in their email.

SAPFIA/ESCPA understand that the Minister is being lobbied by conservation groups, and we are aware that these groups have and are waging an aggressive social media campaign (as recently as 12 June 2022- a Facebook post by Professor Lorien Pichegru, which prompted numerous press articles). This is unfortunate given our attempts to engage with them in good faith on the basis of the best scientific evidence.

SAPFIA/ESCPA would like to build on the deliberations in the ETT and then the CAFMLR, a process of more than 9 months with involvement by scores of stakeholders. The common ground that was achieved at the end of the CAFMLR process is that there should be an international scientific review of the scientific support for island closures and that island closures for 2023 and beyond should be based on the outcomes of that review. The three representatives of Birdlife/WWF/SanParks engaging with us now agree with this as well. In reality the contention with conservation groups, concerns island closures for the balance of 2022 only. Whatever these interim closures are, SAPFIA/ESCPA proposes that agreement to such closures should be part of a package including agreement to:

- The terms of reference of an international scientific review process which evaluates the results of ICE and makes recommendations for future island closures.
- The make-up of a scientific panel to carry out the scientific review process referred to above and the quantitative competency requirements for such

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reviewers. We will update our recommendations for this and the ToRs referred to in the previous bullet point in a separate letter to be sent to you later this week.

- That the timing of the aforementioned scientific review process for 2022 is agreed to, or failing this, that any island closures fall away after 2022 until such a review is completed.
- Provision of, and agreement to the data required for the MICE analyses.
- To allow different researchers to start work on MICE models as they see fit without prior constraints, and to judge the results on their merits. Progress with these MICE models is urgent, to provide insights into what may be driving the decline in the penguin population. All parties must urgently agree to the central dataset for these analyses
- Socio-economic evaluations of the cost of closures on the fishing industry and the value generated from eco-tourism.
- The trade-off between the socio-economic cost to the fishing industry compared to the likely benefit to the penguins.
- Island closures continue to be managed by means of fishing permits.

CAFMLR has said that the 16 Mile Beach MPA is outside their remit, and so it is appropriate for us to raise this directly with yourself. The extension of the 16 Mile Beach MPA offshore to exclude small pelagic fishing took place with no consultation and has had substantial economic impacts on the industry. The logic of the exclusion of small pelagic fishing from the 16 Mile Beach MPA should be revisited on the basis of the results from the International Scientific Review panel.

SAPFIA/ESCPA have been working hard to try to reach a compromise with seabird biologists and conservationists who attended the CAFMLR process, and the DFFE, Oceans and Coasts, ETT on Penguins process before that by satisfying the CAFMLR's guideline for a compromise position at ~ 300% of the MIBAs. As you can see in Table 1 we have moved our positions substantially during deliberations over the last 6 months, from 224.9% in late 2021 to 312% on 8 March 2022, surpassing the CAFMLR guideline of 300%.

The industry has consistently based their position on the 'best scientific evidence', which is a requirement in terms of the MLRA and South Africa's international commitments (e.g., UNCLOS). However, since

a) SAPFIA has been advised by some of the top quantitative marine and fisheries scientists in the world that the best scientific evidence is that the benefits from closures are negligible,
b) Conservation bodies are committed to promoting island closures as a tool to benefit penguins,

we expect (i) that island closures will not bring benefits and (ii) in response, conservation groups will call for ever larger closures. Our view is that these NGO groups will never be satisfied and the only protection from their continuous demands is to strictly adhere to the best scientific evidence. This fishery makes a very important contribution to food security for the people of South Africa, and for this and other reasons management measures must be based on the best scientific evidence. Furthermore, our estimates based on best scientific evidence and socio-economic impact estimates are that implementation of the island closures at all 6 breeding sites considering ICE parameters (i.e., closure in a 20 km radius around the 6 breeding sites) will preserve at most 12 penguin pairs per annum and that job losses will be conservatively in the order of 50 jobs/penguin pair.

The rationale for SAPFIA and ESCPA putting forward any island closures at all has been in the spirit of compromise, and to avoid an unacceptable economic impact on the industry, particularly at Dyer Island and St Croix. While there are publications claiming that there would be more substantial benefits for penguins as a result of island closures, we have been advised that the paper cited in the media as the basis for the original WWF/Birdlife/SANCCOB call for island closures, and which motivated the initiative by the Minister on 12 August 2021, Sherley et al (2018), was wrong. The correction paper issued in 2021 also contains errors. We are therefore advised that there is no scientific basis for further island closures in terms of predicted benefits for penguins.

As an interim measure for the balance of 2022, we have nevertheless explored with our members the possibility of additional closures in an attempt to compromise with the new group of three representatives from Birdlife/WWF/SanParks. The proposal

we now submit is as given in Table 2, which exceeds the CAFMLRs guideline for a compromise by a full 23%, and exceeds our previous last proposal by 11%. This proposal has been forwarded to Drs Mark Anderson, Morne du Plessis and Luthando Dziba. In its favour this proposal offers a large closure at Dassen Island and preserves the CAFMLR's proposal for St Croix and Bird Island. 100% is recommended for Robben Island since the management of fishing in the 5% which was open in our 8 March proposal is impractical. Dyer Island is a very important fishing area, both for the 7 local fishing vessels but also for vessels coming from the West Coast, and St Croix is a very important fishing area in Algoa Bay. The Minister acknowledged at her meeting with all stakeholders on 12 August 2021 that it would be necessary to mitigate the impacts on the industry which is why our proposal has the specific %s selected at each locality.

We wish to confirm that because of our concern in the alarming decline in numbers of the African penguin that we willingly participated in ICE from 2008, and were willing then and still are willing to accept what the conclusions from the experiment would infer in terms of area closures. We firmly believe that the ground-breaking results from ICE need the closure that the International Panel can provide. We also wish to reiterate the urgent need to initiate MICE models so that insights can be gained into the possible drivers causing the decline.

Yours sincerely

Mike Copeland, Chair, SAPFIA
Riedau De Maine Chair ESCPA

Table 1. Compromise proposals made by the conservation group (CSG), CAFMLR and industry.

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	Dassen	Robben	Stoney	Dyer	St Croix	Bird	CAFMLR Compromise Guideline (300%)
CSG (circa 27 May 2022, Morne du Plessis, Mark Anderson and Luthando Dziba)	87.9	41	5	75.8	75.0	44	329
Industry Original Compromise from ETT on Penguins Dec 2021	64.0	61.3	10.6	20.3	24.7	44.0	224.9
Industry position in CAFMLR 24 February 2022	75.0	75.0	10.6	20.3	44.0	75.0	299.9
Industry at end of CAFMLR (8 March 2022)	54	95	23	20	27	93	312
CAFMLR 1 April 2022	84	41	16	40	27	93	301

Table 2. A further proposal by SAPFIA and ESCPA circa 2 June 2022.

	Dassen	Robben	Stoney	Dyer	St Croix	Bird	CAFMLR Compromise Guideline (300%)
Industry Revised 2 June 2022	60	100	23	20	27	93	323