Comments on FISHERIES/2020/SEP/SWG-PEL/105REV, "Recommendations for island closures around African Penguin colonies".

by

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1 Main points in response to FISHERIES/2020/OCT/SWG-PEL/105REV

1. **FISHERIES/2020/OCT/SWG-PEL/105REV** refers to documents which report estimates of the economic impact of island closures on the fishing industry. Some of these reports need further analyses and critical review, and it seems unlikely that that can be fully completed by the end of 2020.
2. For reasons described here, the results of analyses of the island closure experiment as reported in **FISHERIES/2020/JUL/SWG-PEL/53REV** and **MARAM/IWS/2019/PENG/P4** should not form part of the deliberations about island closures.
3. Island closure experimental results differ across the four islands included in the experiment and cannot therefore be extrapolated to Stony Point and Dyer Island.
4. The details of other mitigations under consideration to benefit penguins need to be made available to participants in the deliberations about island closures, including their costs and benefits, and the methods and data used to estimate these quantities.
5. Ecosystem considerations are an important part of the management of small pelagic stocks in South Africa; these stocks are being managed conservatively in part as a response to an appreciation of their role in the ecosystem and the needs of predators.
6. The results of the island closure experiment are not sufficiently consistent nor of a scale that such closures are likely to benefit penguin population trends substantially; there is therefore no reason for immediate urgency with regard to action to implement island closures.

2 More detailed comments

2.1 Comments on the Summary of FISHERIES/2020/OCT/SWG-PEL/105REV

2.1.1 "…are scheduled to inform fisheries management recommendations by the end of 2020"

The summary of FISHERIES/2020/OCT/SWG-PEL/105REV states that the results of the island closure experiment for African Penguins "are scheduled to inform fisheries management recommendations by the end of 2020". It is important however to bear in mind that the context within which any further decisions about the island closures are

to be made, including their timing and scope, are defined by the managing authority DEFF. Clarification should therefore be sought from this authority as to the context and scope of any decisions that are required by the end of 2020.

2.1.2 "The most recent set of results that has followed due diligence…"

There are two sets of results on the island closure experiment that are under discussion, those reported in **FISHERIES/2020/JUL/SWG-PEL/53REV** and those reported in **FISHERIES/2020/SEP/SWG-PEL/97REV**. **FISHERIES/2020/AUG/SWG-PEL/84** pointed out that the analytical methods underpinning **FISHERIES/2020/JUL/SWG-PEL/53REV** have not following the full set of analytical recommendations made by the IWS panel dating back to 2014, which included recommendations to carry out simulations to address biases that arise from the application of GLM techniques for the specific situation pertaining to the island closure experiment. Those in **FISHERIES/2020/SEP/SWG-PEL/97REV** have. In addition, the methods in **FISHERIES/2020/JUL/SWG-PEL/53REV** are based on the use of individual bird data which results in standard errors (se's) that are at times considerably smaller than those reported in **FISHERIES/2020/SEP/SWG-PEL/97REV**, the latter being based on the use of year and island aggregated data. A mathematical proof presented in an annex to **FISHERIES/2020/AUG/SWG-PEL/82** shows that unbiased se's of island closure effects cannot be smaller than those produced from analyses based on aggregated data. The se's of island closure effects reported in **FISHERIES/2020/JUL/SWG-PEL/53REV** are in some cases smaller than those that are based on the use of aggregated data, indicating that some biases have arisen in calculating these standard error estimates. The soundness of the mathematical proof in an annex to **FISHERIES/2020/AUG/SWG-PEL/82** has not been questioned or shown to be questionable. **Until such time** that the proof might be refuted, the results based on the work contained in **FISHERIES/2020/JUL/SWG-PEL/53REV** must be disregarded, and conclusions/recommendations can only be based on the results reported in **FISHERIES/2020/SEP/SWG-PEL/97REV**.

2.1.3 "2-3 times more evidence for positive effects of fishing closures on breeding penguins than no effects."

This statement apparently makes use of results in **FISHERIES/2020/JUL/SWG-PEL/53REV**, in particular a composite posterior distribution for which a technical question regarding the possible duplication of information was raised in a previous commentary (see **FISHERIES/2020/SEP/SWG-PEL/93**). This technical question has not been answered, other than to present its negative, which does not deal with the concern underlying the original question.

2.1.4 "Strongly recommend that closures be implemented around the 6 largest colonies which make up approximately 90% of the African Penguin breeding population in South Africa."

The experimental results reported in **FISHERIES/2020/SEP/SWG-PEL/97REV** show that the island closure effect is not generally consistent across different islands and in some cases different response variables show contradictory results. The experimental results cannot therefore be reliably extrapolated to the Dyer Island and Stony Point penguin colonies. Also (see **FISHERIES/2020/SEP/SWG-PEL/97REV**), while there is some evidence of a positive island closure effect at Robben Island and the effect is positive for both chick survival and fledgling success, the positive effect on chick survival at Dassen Island is confused by a negative island closure effect for fledgling success, detracting from the chick survival results there.

There have also been important technical questions raised about the chick survival analyses which have not yet been answered, viz. there is apparently some time dependence of survival which requires urgent clarification and investigation, since the implication may be that there are biases in the chick survival estimates. These technical questions have implications for the results in both **FISHERIES/2020/JUL/SWG-PEL/53REV** and **FISHERIES/2020/SEP/SWG-PEL/97REV.**

The results at St Croix and Bird Islands do not involve any response variables that are directly interpretable in demographic terms and they are also not consistent in their direction.

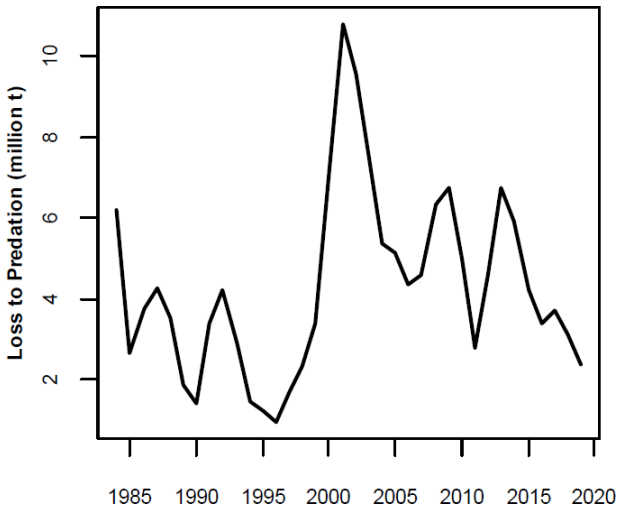
The scale of the island closure effects, viewed across all results, are also not such that island closures could markedly alleviate or avert the rate of decline in penguin numbers, and do not justify the contention that urgent action to close islands to fishing is required. We also have no (or at best very limited) estimates, similarly substantiated by

experimental work and detailed statistical analyses, of what the benefits would be for penguins from other interventions that might be implemented. Examples of such other interventions are concerned with the following processes (from **FISHERIES/2020/OCT/SWG-PEL/105**):

1. Predation,
2. Oiling,
3. Disease,
4. Extreme weather events,
5. Poor breeding habitat and
6. Rehabilitation aspects.

2.1.5 "A failure to implement an effective ecosystem approach to fisheries management within the Benguela Upwelling System"

This comment suggests that there have been no efforts to consider broader ecosystem effects in the management of small pelagic fisheries in South Africa. On the contrary, ecosystem considerations feature prominently in the deliberations of the SPWG (small pelagic working group). The anchovy and sardine resources are being managed at total biomass levels of in the range of 70-80% of the levels they would have been at in the absence of fishing (see later in this document). This is a conservative management approach and this conservatism is to a considerable degree the result of considering the needs of predators. Results have also been produced (see for example **FISHERIES/2020/MAR/SWG-PEL/15)** to estimate the consumption rate of small pelagic resources by predators, in comparison to commercial catches. The estimates of losses to predation for the anchovy resource are as shown in the figure below (taken from **FISHERIES/2020/MAR/SWG-PEL/15)**:



It is instructive to compare the amounts shown in this figure with historical catches. For the period 2015 to 2020, the commercial catches of anchovy, and in parentheses the catch as a % of the losses to predation (as read by eye from the graph above) were:

- 2015: 237 936 MT (5.7%)
- 2016: 261 549 MT (8.1%)
- 2017: 216 755 MT (6.1%)
- 2018: 253 046 MT (8.8%)
- 2019: 165 732 MT (7.4%)
- Average: 227 004 MT (7%)

On average therefore the commercial catch over the last 6 years has been 7% of the amount lost to natural predation. This is a conservative level of catch.

Also relevant to the level of conservativism being adopted in the management of South African small pelagic stocks are the exploitation rates, or TAC/biomass ratios. During 2019 and 2020 South African exploitation rates were compared to the exploitation rates for small pelagic fisheries elsewhere in the world (see **FISHERIES/2020/MAR/SWG-PEL/23** and **FISHERIES/2020/MAY/SWG-PEL/38rev**). Although there was considerable debate about the details of the methods used in these documents, the broad-picture outcome was nevertheless very clear that these South African stocks were being managed conservatively when viewed against general international practice.

2.2 Comments on the Background of FISHERIES/2020/OCT.SWG-PEL/105REV

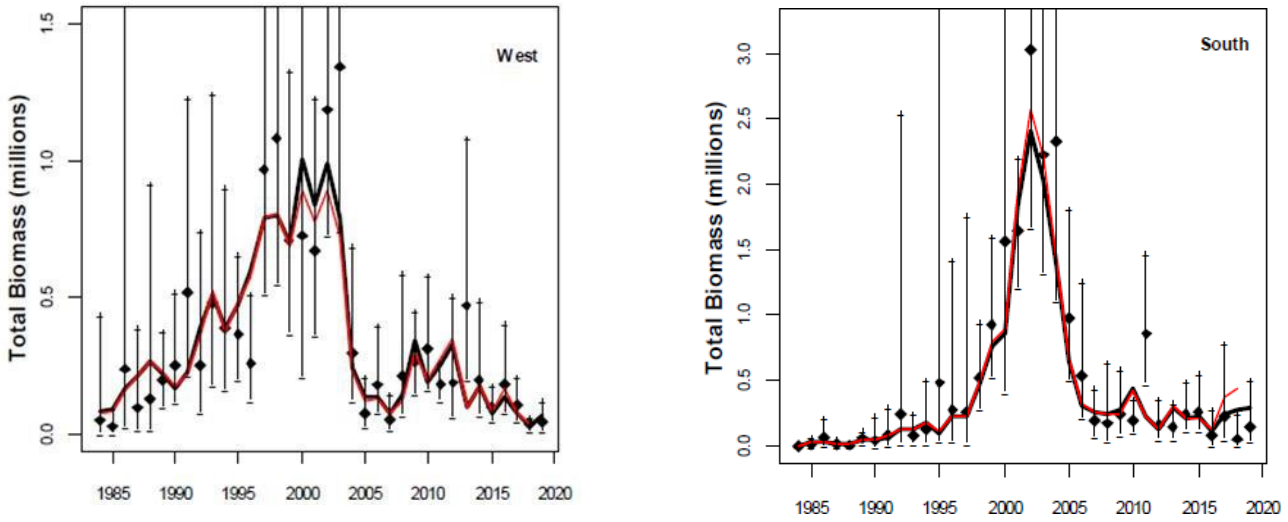
2.2.1 "The implications of inaction will not only have dire ecological impacts to penguins but will also influence the socio-economic benefits that this species provides."

This statement implies that there is great urgency to implement island closures, failing which, dire consequences will follow. The results from the island closure experiment do not indicate that there is a critical role for island closures in the health of the penguin population. The islands in the experiment include about 70% of the breeding population. Only at Robben Island are there some reasonably firm and demographically relatable results which may suggest a positive island closure effect. These translate to a roughly 1% increase in the population growth rate at Robben Island, which in 2019 comprised 1216 breeding birds out of a South African population of 13312 breeding birds. It is of pertinence that the island closure experiment has involved closing Robben Island to fishing 50% of the time, so that only half of the possible benefit from closing Robben Island would be additionally realized by now closing Robben Island every year. This amounts to 0.5 % of the population size of the Robben Island breeding population of 1216 birds. Closure around Robben Island would therefore have a minimal positive effect on the overall South African penguin population for which, since 2008, the average rate of decline has been 6.5% per annum (see **FISHERIES/2020/APR/SWG-PEL/32**).

Another perspective on the island closure experiment is obtained by considering that the experiment has involved island closures since 2008 at four breeding islands comprising some 70% of the breeding population in South Africa, 50% of the time. If island closure had the potential to substantially retard penguin population declines, this would already have been obvious. But the penguin breeding population has continued to decline since 2008 at a concerning 6.5 % per annum. A conclusion from this is that the benefits of island closures for penguins is most likely not very large.

2.2.2 "Sound resource management interventions for this species are likely to benefit the health of the ecosystem for both predators and fishermen"

The implication is that the ecosystem health is presently compromised in some way. As regards sardine, the following plots of total biomass estimates for the South Africa West and South Coasts (from **FISHERIES/2020/APR/SWG-PEL/30**) for the period 1984 to 2019 are relevant to whether this inference is valid:



These suggest that the sardine resource was low in the mid 1980's to early 1990's, then experienced a surge between 1995 and 2005, and has since then been at a low level not dissimilar to levels before the surge. These time trends are not inconsistent with an interpretation that the sardine resource has re-settled back to a level that was typical prior to the surge.

For anchovy the assessment results (from **FISHERIES/2020/MAR/SWG-PEL/15**) contains the following plots of abundance:

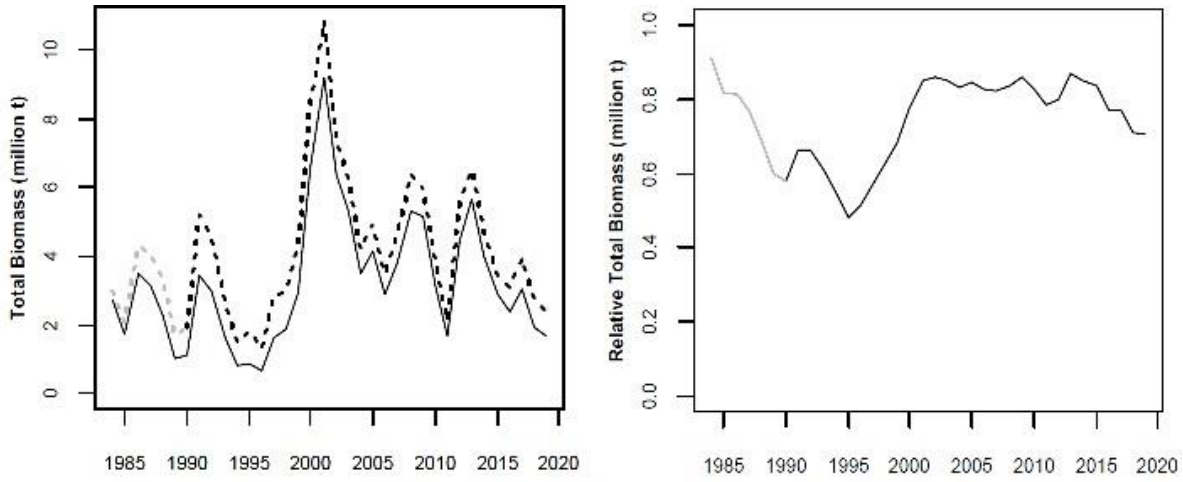


Figure 3. The historical total anchovy biomass under de Moor (2020) (solid) and that calculated for the same model, but assuming no historical catch (Dynamic B_0) (dashed). The historical biomass relative to the Dynamic B_0 time series is also shown. The initial years are less reliable due to transient effects and are plotted in grey.

This suggests that the *anchovy* resource abundance was low in the mid 1980's, experienced a sharp increase in the early 2000's, and has since then been at a somewhat larger level than in the 1980s and early 1990's. This is not inconsistent with a situation where the anchovy resource has been fluctuating about a long term average and recently has generally been above this average; these time plots do not show evidence of a particularly 'unhealthy' situation for the resource in recent years. The figure above, coupled with the following from **FISHERIES/2020/APR/SWG-PEL/30** suggest in addition that over the last 20 years the total anchovy resource biomass has been at a level of 70-80% of the level it would have been

at in the absence of fishing, while for sardine that level for the total biomass has averaged close to 80%. These quantities do not suggest that fishing has caused small pelagic stock abundances to be reduced to unhealthy levels.

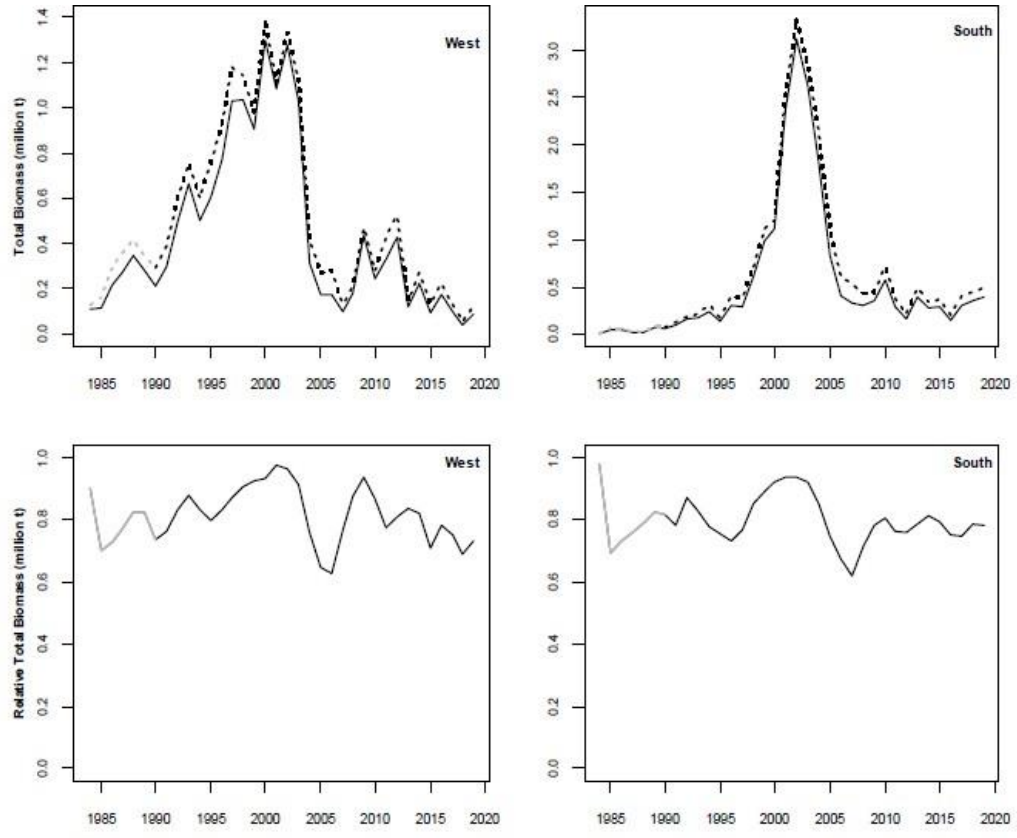


Figure 18a. The historical total sardine biomass under the baseline model (solid) and that calculated assuming no historical catch (Dynamic B_0) (dashed). The historical biomass relative to the Dynamic B_0 time series is also shown. The initial years are less reliable due to transient effects and are plotted in grey.

2.2.3 "It is widely acknowledged that the predominant driver of this species' recent decline is the poor availability of their prey, mostly anchovy and sardine"

The impact of fishing on penguins has been the subject of extensive experimental manipulation of fishing effort around penguin breeding sites (costing the fishing industry an estimated amount in excess of R 300 million[1] since the start of the experiment, when considering the closures at Robben Island and Dassen Island alone), and considerable statistical analyses, coupled with ongoing and multiple international reviews. **In contrast**, the experimental work which has been conducted to estimate the impact of **other f**actors affecting penguin populations is not well documented and has not been introduced to debates at SPWG meetings. These factors include, inter alia, the following (taken from **FISHERIES/2020/OCT/SWG-PEL/105REV**):

1. Predation,
2. Oiling,
3. Disease,
4. Extreme weather events,
5. Poor breeding habitat,

[1] **FISHERIES/2016/MAY/SWG-PEL/01** estimated a loss of roughly R 25 million if either Robben Island or Dassen Island were to be closed. Over the 12 years 2008 – 2019 either one or the other was closed: R 300 million = 12 x R 25 million

6. Rehabilitation aspects.

It is of some considerable importance that the methods used to quantify the impact of these factors on penguin population trends, and the estimates of the scale of these impacts, are made known to all participants involved in the deliberations about the island closure experiment, in order to provide a quantitatively robust basis for the statement made about the primacy of the role of food availability in penguin population dynamics, and to inform participants as to whether there are non-fishing related options to mitigate declines in penguin population size. It is also important to provide an objective alternative to the considerable speculation that exists about the role of some of these factors. This speculation concerns, as an example, the following, which this author has penned to illustrate the problem:

"possible major impacts on penguin population dynamics as a result of the predation of penguin eggs by kelp gulls, predation of eggs and chicks by pelicans, predation of chicks and adults by caracals, feral cats and seals (to name but three out of many possible examples), land and sea based competition between penguins and seals, the long term damage that has followed the removal of guano on islands and the consequent loss of control over parasites and thermo-regulation, historic egg harvesting, the presence of invasive predators on breeding islands, chronic oil pollution of the marine air/water interface, and the occasional major oil spill."

In the absence of the availability of all the information about experimental methods and quantitative estimates of the impacts of these factors, it is not possible to independently verify the statement in the header to this section, that "… the predominant driver of this species' recent decline is the poor availability of their prey, mostly anchovy and sardine".

2.3 Section headed "The value of forage fish resources"

This section contains a variety of estimates of either

(i) the loss of value to the pelagic fishery due to island closures, or
(ii) the value of tourism linked to penguins.

These estimates involve economic arguments and estimation methods whose evaluation cannot be finalised during 2020, but need to be taken to their logical conclusion so that a more satisfactory and reliable appraisal of costs and benefits of different management options can be made. This requires considerably more economic analyses than have been made available in the various references in **FISHERIES/2020/OCT/SWG-PEL/105REV.**

Some comments are made here, but are not comprehensive or an attempt to finalise these estimates:

1. **FISHERIES/2016/MAY/SWG-PEL/01** estimated that closure of either Robben Island or Dassen Island would result in a loss of R 25 million in direct fishing production for the industry. Closure of both therefore translates to a negative economic impact of R 50 million per annum. These estimates were calculated using an exchange rate of 15 Rand to the USD (the present exchange rate is about 10% higher), and they did not use an economic multiplier. An economic multiplier of 3 is not unreasonable. An economic impact of R 150 million per annum is therefore feasible as a result of the closure of both Robben and Dassen Islands. This excludes the possible impact at the other four islands earmarked for closure in the proposal contained in **FISHERIES/2020/OCT/SWG-PEL/105REV.** Although **FISHERIES/2016/MAY/SWG-PEL/01** was restricted to only Dassen and Robben Island, if one were to assume a similar economic impact at Stony Point and Dyer Island then the overall impact of R 150 million would have to be doubled, giving an annual impact of R 300 million per annum if all four West Coast breeding locations under discussion were to be closed.
2. Some of the estimates of ecotourism value use an economic multiplier of 5, a value which could benefit from further interrogation. It is clear that much other economic activity is generated by a 'tourist visit' to South Africa, but not at all clear that penguin tourism is the sole cause of such a unit of economic activity.
3. Appendix A contains comments on the estimates of the economic impact of closure of St Croix Island on the pelagic fishery by Ginsburg (2019). Ginsburg (2019) estimates that the economic impact is not significantly different to zero. The main point in Appendix A is that the methods used by Ginsburg are inferior to other

approaches that could have been used, and that the availability of far more detail about inputs to and outputs from the analyses is necessary in order to allow the SPWG and other stakeholders to the debate to draw their own conclusions about the conclusions of Ginsburg (2019).

2.4 Section headed "Context of at-sea threats"- some general comments

1. In order to inform the deliberations about possible future island closure management, we need to see a comprehensive list of other threats, the mitigations that are presently being taken with respect to these, and the costs and benefits associated with each. This must include details about the methods used, and the estimates themselves of the scale of impact of these mitigations on penguin population trends. It is essential to the deliberative process that the relevant references providing this information are made available.

2. Regarding the results that are cited in this section from **MARAM/IWS/2019/PENG/P4**, comments made earlier about the results reported in **FISHERIES/2020/JUL/SWG-PEL/53REV** are relevant. There is a mathematical proof in an annex to **FISHERIES/2020/AUG/SWG-PEL/82** that shows that unbiased se's of island closure effects cannot be smaller than those produced from analyses based on aggregated data. The se's of island closure effects reported in **FISHERIES/2020/JUL/SWG-PEL/53REV**, which makes use of individual bird data, are in some cases appreciably smaller than those that are based on the use of aggregated data, indicating that some biases have arisen in calculating the standard error estimates. The methods employed in **FISHERIES/2020/JUL/SWG-PEL/53REV** are similar to those used in **MARAM/IWS/2019/PENG/P4** in that both documents report analyses that make use of individual bird data**.** The soundness of the mathematical proof in the annex to **FISHERIES/2020/AUG/SWG-PEL/82** has not been questioned nor shown to be questionable. **Until such time** that this proof might be refuted, the results based on the work contained in **FISHERIES/2020/JUL/SWG-PEL/53REV** and **MARAM/IWS/2019/PENG/P4** must be disregarded, and conclusions and recommendations can only be based on the results reported in **FISHERIES/2020/SEP/SWG-PEL/97REV.**

3. The last sentence in this section suggests that inaction equates with a failure to implement island closures. This ignores the important actions that have already been taken with regard to the management of small pelagic resources. These are being managed conservatively relative to other fish stocks in South Africa (see a description of the rationale for this statement in previous sections, which shows much higher effective target levels for these small pelagic stocks relative to average pristine levels), and conservatively relative to the management of other small pelagic stocks elsewhere in the world. Action is and has been ongoing for many years to manage these stocks considering the importance of their ecosystem service, including the needs of predators. Note further that the island closure experiment has since 2008 equated to closure of the four islands containing about 70% of the breeding population for 50% of the time, itself an important intervention.

4. There is some implication in this section that whatever the scale of the impacts of fishing on penguin populations, these need to be addressed by the closure of the six islands listed in **FISHERIES/2020/OCT/SWG-PEL/105REV**. It is useful to quote the following provisions from the South African constitution:

   Everyone has the right –
   (a) To an environment that is not harmful to their health or well-being; and
   (b) To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –

      (i) prevent pollution and ecological degradation;
      (ii) promote conservation; and
      (iii) secure ecologically sustainable development and use of natural resources **while promoting justifiable economic and social development.** (My emphasis)

Provision (iii) in particular Implies that there should be **a balance between environmental health and socio-economic considerations** in order to achieve the goals of sustainable development. Pursuit of such balance may reasonably be interpreted to mean that a certain scale of impact by fishing on penguin population trends is required to justify island closures. The determination of what such a threshold is has not been investigated, and a blanket closure of six islands does not take account of this provision in the constitution.

2.5 Section headed "Island closure in the context of low pelagic stock estimates"

The argument in this section can be distilled to saying that when pelagic stocks are at a low level, then there is greater urgency to implement island closures to provide benefits to penguin populations. Such conclusions should also acknowledge that small pelagic stocks are extremely variable in their abundance, and penguins, it is consequently reasonable to assume, have evolved to cope with this level of variability.

2.6 Section headed "Recommendation"

1. This section cites results in Sherley (2020) which it is argued elsewhere in this document should be disregarded until and if the mathematical proof in an annex to **FISHERIES/2020/AUG/SWG-PEL/82** might be refuted.
2. The deliberations about further action regarding island closure must be provided with information about how other threats to penguins are being addressed, and in particular the costs and benefits associated with these other mitigations, as well as the scientific underpinnings of the estimates of costs and benefits.
3. The only reputational risk to DEFF is if they proceed with actions that are based on scientifically unsound arguments.

3 References

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Bergh, M.O. 2020. Comments on FISHERIES/2020/SEP/SWG-PEL/87. **FISHERIES/2020/SEP/SWG-PEL/93**.

Bergh, M.O. 2020. Further results for the relationship between anchovy and sardine exploitation rate and biomass from the RAM legacy database. **FISHERIES/2020/MAR/SWG-PEL/23**.

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Sherley, R.B. 2020a. Revisiting the key results in MARAM/IWS/2019/PENG/P4 in light of the 2019 Panel recommendations. **FISHERIES/2020/JUL/SWG-PEL/53REV**.

Sherley, R.B. 2020b. A reply to Bergh: FISHERIES/2020/AUG/SWG-PEL/84. **FISHERIES/2020/SEP/SWG-PEL/87.**

4 Appendix A. Comment on Ginsburg (2019), pp47-50, "Involving fishermen in seabirds' conservation: bridging the gap between socio-economic needs of industry and the needs of seabirds"

FISHERIES/2016/MAY/SWG-PEL/01 *(Bergh et al, 2016 "The economic impact of penguin island closures on the pelagic fishing industry", 91pp*) used data at a grid/set level. The highest resolution considered by Ginsburg (2019) is data at the level of catch per day. Analyses at this level cannot reveal whether the fishery is losing opportunities during closures via a FEZ because vessels can only justify sailing if catches are available at economically viable levels. Thus, catches per day are not a reliable index of economic impacts linked to lost opportunities. A more detailed analysis such as that presented in FISHERIES/2016/MAY/SWG-PEL/01 using an 'opportunity based model' is recommended to determine whether the loss of fishing opportunities has resulted in a loss of potential catch in a particular year. Note that since the sardine catch along the South Coast, including the Eastern Cape, is well below the TAC allocated, lost opportunities could be implicated in a reduction in the final annual catch achieved.

Ginsburg (2019) does not estimate the difference between per set catch 'rates' within the FEZ and those outside the exclusion region. This is an important analysis which is necessary in order to estimate reliably whether catch rates within the FEZ are different to those outside the FEZ. As a result, the analysis in Ginsburg (2019) compares catches during open and closed years and the strength of these results are diminished by the likely presence of strong year effects on catch rates. This consideration was addressed in FISHERIES/2016/MAY/SWG-PEL/01 by the use of set level catch data, and including (i) a flag variable in the log-linear models to indicate whether the set was made within the FEZ area or outside the FEZ area, and (ii) year fixed effects. The coefficient for the flag variable indicates whether fishing inside the FEZ differs from that outside the FEZ.

FISHERIES/2016/MAY/SWG-PEL/01, which formed the basis for estimates of economic impact at Robben and Dassen Islands, was subjected to critique by the SPWG and the international panel on multiple occasions and over a period of almost a year. During these critiques the authors were required to produce extensive additional outputs and variants of their models, as requested by members and observers at SPWG meetings, or by independent international reviewers involved in annual stock assessment reviews. A similar engagement with the SPWG would be appropriate for the work reported in Ginsburg (2019) as a prerequisite for it to perhaps be used as a basis for estimates of the economic impact of the implementation of island closure at St Croix Island.

Ginsburg (2019) states that "*The presence of a fishing exclusion zone could potentially affect average travel time, average fishery catches, and total fishery catch per year. However, none of these three variables were significantly different during closures or not during the fishing exclusion periods (Table 3.2). The average travel time during the fishing exclusion around St Croix was 9.97±0.14 hours while the average travel time with no exclusion was 10.20±0.08 hours. The average purse-seine fishery catch per trip was 21.89±0.41 tonnes when the fishing exclusion*

zone was present, and 21.02±0.22 tonnes when it was absent. Although the average fishery catches during and not during the fishing exclusion periods were not significantly different (p=0.06), there was a slightly higher catch during the fishing exclusion zone." Table 3.2 on page 50 of Ginsburg (2019), shown below

Table 3.2: Results of the Linear model fitted to test the effect of a fishing exclusion zone on fishing vessel travel time and fishery catch. Significance was indicated as: ns (not significant), p<0.05 *, p<0.01 **, p<0.001 ***

Response	Fixed effect	Estimate	Standard error	t-value	p-value	Sig
Average purse-seine vessel travel time (hours) per trip in Algoa Bay	Fishing exclusion zone around St Croix Island	0.2324	0.1642	1.416	0.157	ns
Average purse-seine sardine and anchovy catch (tonnes) per trip in Algoa Bay	Fishing exclusion zone around St Croix Island	-0.8643	0.4607	-1.876	0.060	ns
Total fishery catch per year (tonnes) in Algoa Bay when a fishing exclusion zone around St Croix Island	Fishing exclusion zone around St Croix Island	-2.350	2.228	-1.055	0.319	ns

seems to suggest the reverse of the effect described in the text of Ginsburg (2019), viz. that although not statistically significant:

- vessels have a longer travel time (the 'Fishing exclusion zone around St Croix Island' parameter is positive),
- catch less per trip (the 'Fishing exclusion zone around St Croix Island' parameter is negative), and
- catch less per year in Algoa Bay during FEZ at St Croix (the 'Fishing exclusion zone around St Croix Island' parameter is negative).

It would be helpful to present the actual outputs from ***R:lme4*** so that readers can verify the direction of certain effects, and verify the base level for flag parameters. Also, it is not clear whether the estimation model used a log-link function, or an identity-link function. Far more detail about inputs to and outputs from the analyses is necessary to allow the SPWG and other stakeholders to the debate draw their own conclusions.