Economic and other impacts of proposed changes to hake sectoral allocations

by

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1 Executive Summary

This document evaluates some of the key implications of DFFE following through with its September 2021 proposal to increase the sectoral allocation to hake longline from 6.551% to 10%, an increase for the longline sector of 52.6%, and potentially a matching reduction in the allocation to the offshore trawl sector. Although this proposal has been removed from the final November 2021 policy document, it can be enacted at any time and therefore deserves closer examination.

For some of the impacts discussed here, quantitative results are now available, for others, further analyses are required to provide quantitative estimates. The main impacts are the net loss of economic contribution by the South African hake fishery and associated losses of employment, negative impacts on offshore trawl CPUE due to avoidance of conflict and/or interactions with longline gear with resultant negative impacts on the TAC, and potentially negative impacts on the MSC certification of South African hake trawl, which is of great value to the South African fishing industry. There are also complexities that would need to be resolved with respect to the apportionment of the kingklip PUCL. Subsumed within these main impacts is a concern about the apparent low utilisation of TAC allocations to longline in the last two years of 50-60% based on data used in scientific deliberations, and the implications for the hake OMP which has through numerical analysis been shown to be robust to the possibility of stock sharing of hake between South African and Namibia. The strong conclusion that comes out of the work presented here is that

(a) there will be substantial loss of employment and economic contribution from South African hake across all sectors,

(b) that the hake OMP will need urgent revision before it might be possible to establish a similarly favourable position with the MSC w.r.t. the conditions and action plans that have been imposed and committed to, failing which this certification could be put at risk, and that rectification of this situation would not be feasible in time for any decision on reapportionment of the TAC for 2022,

and

(c) that good faith adherence to the SADSTIA/SAHLLA code of conduct requiring trawlers to avoid longline gear could already have caused a reduction in the offshore trawl CPUE – this may already also have resulted in reduced TACs – these impacts will increase with increasing allocations to the longline sector – it may be feasible to estimate the scale of these impacts but this would require access to all historical trawl and longline catch logs, positions and data-time stamps. Such analyses would take time and cannot be completed by the beginning of 2022.

The economic analysis presented here is based on a comparison of the economic and employment creation performance of three representative vertically integrated fresh fish vessel operations, with a single well developed vertically integrated longlining vessel and operation. The comparison is a worst-case scenario because the longline operation is well developed in relation to the hake longline sector overall, and its value addition and associated employment creation potential has been largely realized. The reason for the comparison with fresh fish trawl operations is that any cuts to fishing activity and employment as a result of DFFE's draft policy proposal (circa September 2021) will have to take place in fresh fish operations, and the fresh fish operations included here cover more than 75% of fresh fish catches made in the offshore sector.

The key economic estimates and comparisons are as follows:

	Fresh Fish Offshore Trawl	Hake Longlining
Direct + Indirect employment created per 1000 ton catch processed	**136.9**	**52.7**
Investment in assets per 1000t quota tons	**R105,310,000**	**R15,543,000**
Revenue generation per kg whole weight hake caught and processed	**R55.76**	**R41.51**

The draft policy on sectoral allocations implies the transfer of 4553 MT of hake quota previously assigned to the offshore trawl sector, and the fresh fish component of that sector, to the hake longline sector, using the 2022 TAC of 132 154 MT. Assuming that the 4553 MT will lead to reductions in fresh fish operations, the net implications are:

- Jobs lost from offshore trawl sector: 623 (a 10% reduction in jobs in the offshore trawl sector)
- Jobs gained by hake longline sector: 240
- Net loss of jobs in the South African hake fishery as a whole: 383.

For total revenue:

- Revenue lost from the offshore trawl sector: R253,857,000
- Revenue gained by the hake longline sector: R188,979,000
- Net loss of revenue in the South African hake fishery: R64,878,000

In addition, assigning investment to 4553 MT pro rata to total investment against quota tons, R479,476,000 worth of assets in the offshore trawl sector would be unutilised, or stranded, or sold, whereas additional investments required in the longline sector will be, on the same basis, R70,760,000[1]. The net loss of investment is 408,709,000, which is a very substantial investment value.

Data available for scientific analysis suggest that the utilisation of longline quota has been very low in the last two years, in the region of 50 - 60%. If this is correct and it persists in the future at, say, 70% (using a conservative figure somewhat larger than the recent values on the range 50 – 60%), then the net impact of the exchange of 4553 MT from the offshore trawl sector to the longline sector would instead be:

- Jobs lost from offshore trawl sector: 623
- Jobs gained by hake longline sector: 240 x 0.7 = 168
- Net loss of jobs in the South African hake fishery as a whole: 455

For total revenue:

[1] These estimates and consequences are based on an economic analysis that has excluded multiplier effects on revenue generation and supplier activity with regard to employment creation other than the employment created in sales and merchandising. These multiplier effects in the economy and induced supplier and other jobs are substantial (for example a typical multiplier for total economic contribution by the fishing sector is 1.6), and this qualification should be considered in assessing the overall impacts. It is likely therefore that the net impact given here is a conservative estimate.

- Revenue lost from the offshore trawl sector: R253,857,000
- Revenue gained by the hake longline sector: R188,979,000 x 0.7 = R132,285,000
- Net loss of revenue in the South African hake fishery: R121,572,000.

SAHLLA and SADSTIA have signed a code of conduct to reduce conflict at sea between longline and offshore trawl vessels with the important provision that "If another vessel is already about to deploy its gear or already fishing the later vessel must immediately select another area and repeat the process". It must follow that this will cause the offshore trawl CPUE to be less (on average) than it would be in the absence of longline gear sets on traditional trawl grounds. This has two negative short-term impacts on the offshore trawl sector, (a) increased fishing costs and (b) reduced TACs. The scale of these impacts should be quantified since they will increase if there is a 52.6 % increase in the TAC allocation to the longline sector.

There is good reason to obtain a full picture of the scale of longline effort and activity at sea for hake. The values given here are based on Japp and Droste (2021):

- 45 active vessels[2] – the 2021 draft policy document on hake longlining (Government Gazette, 2021b) notes that "… 64% of the vessels in the longline fleet are forced to operate in other sectors as well (primarily tuna pole and pelagic longline)".
- Average number of seadays per vessel per year of 142
- 36 million hooks deployed per year, some 10% of which are lost annually, i.e. perhaps 3.6 million hooks lost annually, between 8% and 18% of hooks that are retrieved contain hake. About 40% of the hooks come up clean. 0.8% show clear evidence of depredation of hake on the hook.
- 56438 km of line set each year, and 155 km of line set per calendar day.

Overall, when considering the scale of longline effort, there are implications for the scale of wastage of hake either lost off the longline gear during hauling operations, or depredated from hooks between the start of setting and the end of hauling. Some attempt should be made to determine whether these impacts need further consideration or are material before enacting a 52.6% increase in longline allocations.

Modeling studies reported on here based on the reference case hake stock assessment model suggest that the impact on the resource of a shift in TAC allocation away from offshore trawl towards hake longline is relatively small. Over the period 2022 – 2036 the spawning biomass is reduced by ~ 4% for ***M. paradoxus***, and by 1-2% for ***M. capensis*** relative to if there is no additional re-allocation to hake longline. These results need to be viewed with a degree of caution because the hake reference case model does not include any hake longline CPUE data, and the most recent catch-at-length data for longlining used by the stock assessment model is from 2010. A further reason for some caution is that in the hake reference case stock assessment model fits, trends in model calculated CPUE are in conflict with the available longline CPUE data (the assessment model is more optimistic). Ideally some resolution of these issues should be achieved before considering increases in longline sector allocations.

The % of kingklip landed in the hake longline fishery as reported by Weston and Atwood (2017) is 3.1%. The % of kingklip in the offshore trawl fishery is 3905/132000 (kingklip PUCL/ Hake TAC) = 2.95%. On the face of it offshore trawl would lose, roughly, 2.95% of 4553 MT = 138 MT of kingklip, and longline hake would gain roughly 3.1% of 4553 MT = 141 MT. However, given the historical performance on kingklip that is recognized in the SADSTIA system for apportioning the kingklip PUCL, there are likely to be claims against the 141 MT of kingklip PUCL gained by the hake longline sector. This issue needs to be resolved prior to

[2] There is no easily accessible list of active or registered hake longline fishing vessels

making any sectoral allocation changes. Also different authors report different kingklip percentages in hake longline catches and some work is needed to determine which estimates can be used confidently.

Maintenance of MSC certification is of paramount importance for the South African fishing sector. The loss of this certification will have a profound impact on prices and access to markets, not only for hake trawl sectors, but for other sectors of the South African fishing industry as well. As it stands now, SECIFA/SADSTIA, the certified parties, could potential close out all P1 and P3 conditions much earlier than the 4 years permitted, which would provide some much-needed assurance to the industry. The proposed sectoral allocation changes are however a new development which was not included in the hake stock assessment model and the consequent projections underpinning the OMP, which was finalized in 2018. Given the MSC's procedures, SADSTIA and SECIFA would have to inform the MSC about a change to these sectoral allocations at the next audit of the industry scheduled for February 2022, should those have been enacted. At that time, in order to avoid revisiting a very complex and finely balanced set of P1 and P3 conditions and associated action plans, at minimum, it would be necessary to also provide a demonstration that under these new circumstances, the stock assessment model and OMP remain robust in general, and in particular with regard to the possibility of stock sharing. Logically, since the hake OMP will be revised during 2022, this work needs to be conducted as part of that revision process. It is suggested here that it is not practicable to attempt such in time for the MSC CAB's audit in February 2022, since it is likely that demonstration of the robustness referred to would require that the development process of the existing OMP in 2018 would have to be revisited. This is not feasible by February 2022.

It is also necessary to revisit the P2 conditions and action plans to see what, if any, knock-on effects may arise for MSC terms of certification for SADSTIA and SECIFA. Such effects could go beyond ETP species since there is the possibility that new conditions are raised for 'primary' and 'secondary' species for which no conditions were raised at the recertification of the fishery (see Appendices D-G and Lloyd's Register, 2021). Analysis of the ETP impacts made by the longline sector should be tempered by the fact that hake longline is not an MSC certified fishery, and impacts on ETP species made by that sector are not required to be accounted for by South African trawl. The available scientific information (Weston and Atwood, 2017) suggests that there is no overlap between the non-seabird species that are ETP and impacted by hake longline, and those for offshore and inshore trawl. Furthermore, there is no evidence available that suggests that any impact on seabird species by longline is a concern. There is also no reason to expect that additional concerns or conditions might be raised for primary and secondary species stemming from the proposed sectoral re-allocation of hake TAC.

In making any decision regarding the allocation of TAC to the hake longline sector fishery the Minister must adhere to the objectives and principles in section 2 of the MLRA, which require, inter alia, that consideration be given to the need "to achieve optimum utilisation and ecologically sustainable development" and the need to "achieve economic growth and human resource development". The economic information provided here shows that an increase in the allocation to the hake longline sector by reducing the apportionment to the offshore trawl sector will result in a net reduction in the revenue and employment contribution achieved from the exploitation of the South African hake resource and would therefore not be a rational course of action.

This study highlights a number of important steps that must be taken to ensure that adequate information is available about the impact of a sectoral allocation to hake longlining at the expense of the offshore trawl sector. These are

- An evaluation of the impact on the MSC certification of South African hake trawl, and the cost of associated modified conditions and action plans
- A consideration of the scale of longline effort and whether the scale of any wastage due to depredation and fish lost off hooks dead is a material issue that should become part of scientific calculations and management decision.

- To analyze the present spatial overlap between longline and offshore trawl fishing activity and to quantify the resultant impact on the offshore trawl CPUE.
- Quantification of the level of utilization in the hake longline sector, and the extent to which apparently poor utilization in that sector would exacerbate the losses of employment, revenue generation and investment that this study shows will follow the sectoral reallocation proposed in the draft policy of September 2021
- The inclusion of recent hake longline catch-at-length and CPUE data in the stock assessment models used for the revision of the hake OMP.

2 Background and Rationale

In September 2021, DFFE published a draft policy for comment which proposed a change in the sectoral allocations in the hake fishing industry (Government Gazette, 2021a,b). This proposed sectoral allocation change was removed from the final policy document for the offshore sector (Government Gazette, 2021c). The reasons for this have not been clarified[3], but it remains the case that the Minister DFFE retains the power and discretion to change sectoral allocations. Given that this change was being contemplated and may yet be raised again, the impact study reported here remains in SADSTIA's view of great relevance to the management of the resource. It should be noted that there has been no prior socio-economic study to assess the likely costs associated with the allocations to hake longlining contemplated by the draft policy of September 2021. There has also been no assessment as to whether the anticipated socio-economic benefits of the contemplated decision outweigh the socio-economic costs. There has also to date not been any contemporary scientific study to support the contemplated reapportionment of the TAC[4].

Regarding the proposal in September 2021 to change sectoral allocations in the South African hake fishery, the relevant excerpt is on page 53 of Government Gazette (2021a):

"The Department manages the hake Deep-Sea Trawl fishery as part of a "hake collective", with the primary management measure being an annual TAC. In terms of the MLRA the "global" TAC for hakes (both species combined and applied to all hake-directed sectors as a collective) is set annually by the Minister of Forestry, Fisheries and the Environment. A reserve to allow for incidental hake by-catch in the horse mackerel directed midwater trawl fishery is deducted from the global hake TAC before the remainder of the TAC is distributed among the hake-directed fishing sectors; hake Deep-Sea Trawl, hake inshore trawl (hake & sole), hake longline and hake handline. In terms of that arrangement, 83.9268% of the global hake TAC is allocated to Deep-Sea Trawl, 6.179% to inshore trawl, 6.551% to hake long line, 1.8433% to hake handline and 1.5% to small scale fishing. Other management measures include a capacity management system to restrict operational effort (vessels and sea days) to what is required to catch the TAC, spatial and gear restrictions, catch limits on various by-catch species as well as the implementation of measures to reduce seabird mortalities. Management measures to be considered/implemented during the next Rights cycle (2022 –2037):

a) The department is considering implementing changes in the hake TAC sectoral apportionment:
   - <u>Longline apportionment increased from 6.551 to 10% of the hake TAC, subject to further investigation on possible impacts on the resource dynamics</u>
   - Handline apportionment set aside in its entirety for the allocation to small scale

b)

c) Roll overs will be discouraged

d) Transfer of hake quota between hake-directed sectors (e.g. from inshore trawl to deepsea trawl) will be discouraged

e) Change in the fishing season from the 1 January – 31 December to 1 March – 28/29 February. The intension is to implement this change in alignment with the new hake OMP that will be developed during 2022 and implemented in 2023.

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[3] It may be that the intention is to institute this change for 2023, to synchronize this change with the finalization of a new OMP for the South African hake resource.

[4] A decision on the apportionment of the hake TAC is <u>not</u> a section 18 rights allocation decision, it is a section 14 TAC decision. Any section 14 TAC allocation decision that might be considered cannot take place until such time as there has been (1) a proper evidence-based socio-economic impact assessment and (2) there has been a rigorous scientific study to support the contemplated measure and a new OMP has been developed

f) Efforts will be directed at removing vessels smaller than 30m from the fishery for safety considerations."

The draft policy proposed reserving the entire handline allocation for the small-scale sector, and discourages any transfer from the inshore trawling sector to the offshore trawling sector. It also proposed an increase in the allocation for the longline sector from 6.551% to 10%, an increase in the apportionment to the longline sector of 52.6%. Given the constraints proposed in the draft policy for small scale, handline set aside in its entirety for small scale and inshore to offshore trawling sector quota transfers, the only option for giving effect to the proposed increased allocation to the longline sector is, in terms of a strict interpretation of these policy proposals, a reduction in the apportionment to offshore trawling from 83.9268% to 80.4778%, a reduction of 4.11% in the offshore trawling apportionment. However, it can be argued that serious considerations needs to be given to this apportionment, **because both the small-scale and handline allocations have not been caught for longer than a decade.** This is wasted TAC that could have resulted in economic benefits elsewhere if better utilized. There are serious doubts and concerns whether this can be utilised by the small-scale sector in future, and therefore this would be a much more logical sector to assess and investigate further, as opposed to a fully utilised sector such as the offshore trawl sector where employment, investment and harvesting is optimised.

The offshore trawl sector has substantial investments in trawling and processing assets, makes a large contribution to the South African economy and to employment, both directly and indirectly, and therefore makes a significant contribution to livelihoods in general. A reduction in the share of the TAC to offshore trawling by 4.11% will have a number of direct and indirect effects, the quantitative scale of which should be assessed before making this change. These changes, if enacted, represent a significant negative socio-economic impact on the Hake Deep-Sea Trawl sector of the fishery. The impacts are compounded by a simultaneous 5% reduction in the TAC for 2022, which follows an earlier 5% reduction in the TAC for 2021.

The purpose of this document is to highlight the impact on the offshore trawl sector of a reduction in allocation to that sector, and where possible to compare these to the benefits that might accrue to the longlining sector and its economic contribution, in order to inform the policy development process, viz.

1. **Socio-economic impacts:** There will be a negative economic and socio-economic impact on the offshore trawl sector, since the proposal implies shrinking the size of this sector. This will reduce the contribution to revenue and employment relative to what would otherwise be achieved. The implication of the draft proposal, which must be consistent with the South African Marine Living Resource Act of 1998[5] is that the drafters are of the view that the socio-economic impact of the proposed shrinkage of the offshore trawl sector is at least offset by the socio-economic benefits that will flow from the proposed expansion of the longline sector.
2. **Utilisation of the TAC:** Although this is related to the broad socio-economic pros and cons, dealt with in the previous section, it deserves its own section. This issue must consider the extent to which allocations to different hake sectors are utilised and hence to comment on the prospects that socio-economic benefits that may exist at the level of per MT of catch will actually be realized, when expressed per MT of quota.

There are other impacts which, although they may overlap with the above, are worthy of being addressed in their own right. Many of these arise because of the need to manage the hake resource on a biologically sustainable basis. These include:

[5] In particular the Objectives and Principles in the section Introductory Provisions. Two noteworthy provisions are 2(a) and 2(b):
2(a) The need to achieve optimal utilisation and ecologically sustainable development of marine living resources
2(d) The need to utilise marine living resources to achieve economic growth, human resource development, capacity building within fisheries and mariculture branches, employment creation and a sound ecological balance consistent with the development objectives of the national government

3. Resource sustainability considerations, specifically:
   a) Impacts on the offshore trawling CPUE
   b) Impacts on the size structure of offshore trawling catches
   c) Spawning biomass and recruitment considerations
   d) Impacts on commercially valuable bycatch species
   e) Impacts on ETP species
4. Implications for the MSC certification of the inshore and offshore sectors.
5. Implications for the OMP
6. Conflict between trawling and longlining on shared fishing grounds.

3 Consideration of the socio-economic and biological impacts of the proposed new sectoral allocations

3.1 An economic case study – the socio-economic impacts of decreasing the offshore allocation and increasing the longline allocation

The draft reallocation of TAC away from the offshore sector to the longline sector has potentially important socio-economic impacts. For this study:

A. **Offshore trawl:** It is taken as given that any reduction in allocations to the offshore sector will be absorbed internally by offshore operating companies by reducing their fresh fleet operations (and not by a reduction in internal freezer vessel allocations). Fresh fish operations are less profitable, more capital and labour intensive. The losses to HDST (Hake Deep Sea Trawl) rights holders will be suffered on a pro-rata basis, and the larger players would therefore contribute the majority of this loss. These operators would need to re-engineer their businesses, and the only viable option would be to right-size the less profitable and more labour-intensive parts of their businesses, being their fresh fish operations. It is therefore only necessary to calculate the revenue generation and employment creation performance of a representative set of case studies of vertically integrated fresh fish vessel operations.

B. **Longline:** It is assumed that the longlining operations carried out by **company 'Unnamed'**, a vertically integrated longline fishing and processing and marketing operator, with value addition activities, provides the ideal representation of a fully developed longline operation, and will therefore reflect the maximum potential per catch or quota ton for revenue generation and employment (the latter both direct and indirect) by a longline operator.

Given the above, the comparison of revenue generation or employment creation per catch and quota ton of A to B should be seen as a worst case, from an offshore trawling perspective, of the relative benefits of allocating TAC to either the offshore trawling sector or the longline trawling sector. Inclusion of other longline operations which are not vertically integrated into B will reduce the revenue contribution and employment figure attributable to the longline sector, to the benefit of an argument in favour of trawling. The three fresh-fish fleet operators mentioned in A represent more than 75% of the catch by fresh fish vessels and do not therefore need to be expanded to include other examples.

The economic metrics that are considered here for both the fresh fish operations and the long line operations are grouped under 'Jobs', 'Investment' and 'Revenue', and the following details within those categories are considered, with comments added to aid an understanding of the various quantities:

Jobs

This section looks at the employment which is created for a given tonnage of fish caught, processed and sold. Item 1 is the total tonnage in whole weight units which the remaining items are related to.

1. Total Fish Allocated for fresh fish catching and processing (tons whole weight)
2. Sea-going employees working on vessels delivering fish for processing (direct)
3. Land-based employees involved in primary and value-adding processing (direct)
4. Land-based employees involved in selling, merchandising and distribution (these comprise both direct and indirect employment created)
5. Total Jobs Created in vertically integrated industrial operations, i.e. the sum 2 + 3 + 4
6. Jobs per 1000t nominal quota (direct jobs only)
7. Jobs per 1000t (including Sales and Merchandising)

Investment

Investment relates to long term commitments which are made with a certain quota tonnage in mind and therefore these amounts are linked to quota tonnage rather than actual tons caught and processed, although the two are likely to be very similar to each other. The investments considered here are specific to vertically integrated **fresh fish operations only**, consistent with the logic of the three representative case studies selected here. What is most relevant therefore for this study is the final amount (item 12 below), the investment per 1000t of nominal quota. Investment is linked to insured value as the most reliable indication of asset value:

8. Quota tons allocated **to fresh fish operations**
9. Insured value of vessels related to landing catch
10. Insured value of processing operations (Primary and Value-added)
11. Total Investment created in vertically integrated industrial operations
12. Investment per 1000t of nominal quota

Revenue

The amounts recorded in this section are straightforward and present the total fresh fish catch in whole weight terms, the final sales values from the sale of all products derived from this catch, and the ratio of the two, giving the revenue per kilogram whole weight.

13. Total fish allocated for fresh fish processing
14. Sales value of total catch sold from Fresh Fish and related Value-Added operations
15. Revenue per nominal kilo

3.1.1 Fresh-fish vessel with vertical integration - value chain

The value chain along which vertically integrated fresh-fish vessel operations generate revenue and employment consists of three main sequential processes (Felet at al, 2020): (i) harvesting, (ii) processing and (iii) sales and marketing, as follows:

1.1. *Harvesting.* The fresh-fish vessel may land whole hake or headed and gutted hake (H&G). H&G or whole hake may either be transferred directly to sales and distribution process or to the processing level of the value chain.

1.2. *Processing.* Fish landed by fresh fish vessels is transferred and processed at a more sophisticated on-shore facility. On-shore processing facilities produce a wide variety of hake products, ranging from basic fillets to crumbed, sauced or battered products. These processed hake products then move on to the sales and distribution level of the value chain.

1.3. *Sales and marketing.* Fish sold in raw commodity form (whole or H&G) is sold into both domestic and export wholesale and foodservice markets. Fish that is processed, on the other hand, is predominantly sold into export or domestic retail and food service markets.

At each of these steps employment is generated by direct employment with the fishing company, or by employment with supplier companies, or more generally by multiplier effects into the economic as a whole. Value creation takes place at each level, either directly or by supplier spend, or by revenue generation stimulate in the broader South African economy.

The scale of employment and revenue contribution within each of the three levels in the value chain has been described for offshore trawl as a whole by Felet et al (2020) and it has also been collated by companies as part of their FRAP applications. Hence the value generation and employment creation along the value chain are known quantities, and the disaggregation of these amounts to fresh fish vessels are also known quantities.

3.1.2 Results of socio-economic data; fresh fish trawl vs hake longline

The summarised results of the socio-economic study are given in Table 1.

Table 1. A table comparing relevant socio-economic quantities, between three representative fresh fish trawl operations and companies, and one representative longline company and operation. It is common in such comparisons to apply a multiplier to scale up to the complete contribution to economic activity, and further to apply additional factors and considerations to reflect all indirect employment that is created (for example as a result of spending on suppliers, of which there are many such entities in trawling operations). Both of these aspects are omitted here, except for the specific inclusion of jobs created and classified as 'indirect' in the category 'sales and merchandising' which are created in retail operations – these operations are a significant outlet for hake products from vertically integrated fresh fish trawling operations.

	Combined Fresh Fish Offshore Trawling Operation	Representative Longline Operation
Jobs		
Total Fish Allocated for fresh fish processing (tons)	**43293**	**683**
Sea-going employees working on vessels delivering fish for processing (direct employment)	762	23
Land-based employees involved in primary and value-adding processing (direct)	2796	10
Land-based employees involved in selling, merchandising and distribution (direct)	146	0
Land-based employees involved in selling, merchandising and distribution (indirect)	2223	3
Total Jobs Created in vertically integrated industrial operations directly	3704	33
Total Direct + Indirect Jobs	5927	36
Jobs per 1000t nominal quota (direct jobs only)	85.6	48.4
Jobs per 1000t (Direct + Indirect Jobs, the latter being Sales and Merchandising employment)	**136.9**	**52.7**
Investment		
Quota tons allocated	**43293**	**682**
Insured value of vessels related to landing catch	R1,337,636,000	R8,200,000
Insured value of processing operations (primary and Value-added)	R2,971,553,980	
Insured value of processing operations (apportioned to catch)		R2,000,000
Insured value of distribution assets (trucks)		R400,000
Distribution assets insured value	R250,000,000	
Total Investement created in vertically inregrated fresh fish operations	R4,559,189,980	R10,600,000
Investment per 1000t of nominal quota	**R105,310,000**	**R15,543,000**
Revenue		
Total fish allocated for fresh fish processing	**45070**	**530**
Sales value of total catch sold from Fresh Fish and Value-Added operations	R2,513,127,000	R22,000,000
Revenue per nominal kilo	**R55.76**	**R41.51**

The main conclusions from Table 1 are the comparative direct + indirect employment figures of, for fresh fish trawl versus hake longlining of 136.9 vs 52.7 jobs per 1000 ton of whole weight hake caught and processed, the much higher investment in assets underpinning the vertically integrated fresh fish operation compared to the longline operation (R105 310 000 vs R 15 543 000 per 1000 quota tons), and the higher revenue generation per kg of hake caught and processed, again trawling versus longlining, of R 55.76 vs R 41.51 per kg caught and processed.

Taking the companies polled to construct Table 1 as representative of the fresh fish component of the offshore hake trawl sector, the simple socio-economic consequence of moving 4553 MT of TAC away from offshore trawl and to hake longline (based on the 2022 TAC of 132 000 MT) will be the following:

- Jobs lost from offshore trawl sector: 623
- Jobs gained by hake longline sector: 240

- Net loss of jobs in the South African hake fishery as a whole (direct and indirect as defined in Table 1): 383[6].

For total revenue generated, the impact is as follows:

- Revenue lost from the offshore trawl sector: R253,857,000
- Revenue gained by the hake longline sector: R188,979,000
- Net loss of revenue in the South African hake fishery: R64,878,000.

In addition, on a pro rata indicative basis, R479,476,000 worth of assets in the offshore trawl sector may be unutilised, or stranded, or sold, whereas additional investments required in the longline sector will be, on the same basis, R70,760,000.

3.2 Competition for space to fish: trawling vs longlining

3.2.1 Longline gear and longline effort

The South African hake longline fishery uses the double line "Spanish" system. The gear consists of a buoyant top line and a weighted bottom line – pods/pots of hooks are attached to the bottom line by drop lines (Nyengera and Angel, 2019). Greenstone et al (2016) reports that there were (circa 2015/2016) 25 vessels active in the fishery. The SAHLLA (South African Hake Longline Association) website reports that 40 vessels are active in the fishery[7], presumably currently. Many of these vessels are understood to be involved in other longline fishing activity in addition to hake. Government Gazette (2021b), pp 69, notes "It is notable in this context that a recent socio-economic study of the sector showed that 64% of the vessels in the longline fleet are forced to operate in other sectors as well (primarily tuna pole and pelagic longline)".

A typical hake fishing trip involves 4 or 5 sets, and each set involves a single line (Japp, 2007). The fishing permit limits the maximum number of hooks per line to 20 000. Line lengths of up to 30 km are possible. Hooks and connecting lines are deployed from pots. Fishing trips take place on a weekly cycle of 4 or 5 fishing days with the remaining days of the week used for steaming and/or to reset the vessel and crew for the next trip. On a typical fishing day the line is set at between 2 and 3 am (to minimise seabird mortalities), and hauling commences at between 8 and 9 am of each fishing day and lasts until about[8] 17h00.

Figure 1 is a schematic of the double line "Spanish" system. Each dropper line connects to a "pod" or "pot" of hooks, and the typical spacing between dropper lines measured along the top-line is 92 metres.

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[6] Since 96% of the employees in the HDST fishery are HDI's, this loss of employment would be a regressive step for transformation in the fishing industry – see Figure 7, p23 of Felet et al (2020)

[7] Nyengera, and Angel (2019) notes in addition that "The fishery is restricted to 20 000 hooks per set (Permit Conditions, DAFF 2018). In 2018 there were 134 rights holders and 40 registered vessels, of which 25 were active (Clyde Bodenham pers. Comm.). The vessels operating in this fishery are small and range from 15m to 30m in length, catching primarily for export to the wetfish market. The fleet targets two hake species, *Merluccius paradoxus* (deep-water hake) and *Merluccius capensis* (shallow-water hake) (Greenstone et al., 2015)".

[8] Japp (2007): "Vessels sailing from the West Coast (Saldanha, Cape Town, Hout Bay) and targeting grounds off Cape Town and Cape Point. This is the most heavily targeted longline area and extends from west of Cape Town to due south of Cape Agulhas. Steaming time is relatively short for the 1st line set with boats mostly sailing from port in the afternoon and preparing and setting lines from late evening to early morning the next day. Lines are set between 2-3 am and hauling commences between 8 and 9 am and ends on average at 17h00 in the afternoon. Returning vessels from the same grounds haul during the day and return to port in the evening, so both fishing and steaming to or from grounds may occur on the same day or overlap into the following day. As mostly FOUR line sets are completed, four fishing days are accumulated with a combination of 3 days for steaming to and from grounds, discharge, re-provisioning and return to grounds (Note: this assumes vessels fish optimally)".

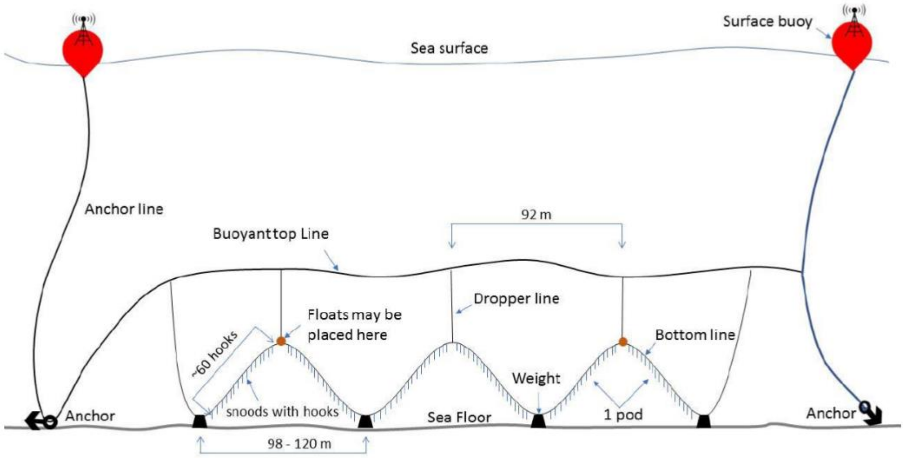

Figure 1. As extracted directly from Nyengera and Angel (2019) whose caption reads "Schematic diagram of the double line demersal longline gear in South Africa".

Various calculations can be carried out to estimate the number of sets and hooks deployed annually in the fishery. Appendix B carries out such calculations based largely on Greenstone et al (2016) and Japp (2007) -it suggests that between 20 million and 60 million hooks and between 3600 and 5882 lines are deployed each year. The most recent available estimates are however those given by Japp and Droste (2021) – see Table 2. These suggests that 36 million hooks were deployed on average per annum between 2011 and 2017, and that 56438 km of line is set per annum, equivalent to 56438/364 = 155 km of line per calendar day. On the assumption that the average weight of a hake caught by longline gear is 2.4 kg, 8.3% of hooks that were set contain hake. There are some important differences between quota allocations for the hake longline sector and catches recorded between Japp and Droste (2021) and Ross-Gillespie and Butterworth (2021) which are relevant to estimates of utilisation in the longline sector – this is considered in a later section.

Table 2. Longline effort measures based on information provided in Japp and Droste (2021). Also shown are some contrasting quantities, mainly catches, as given in Ross-Gillespie and Butterworth (2021).

Quantity	Value	Source	Value	Source
2016 Catch	9027	Japp & Droste, 2021	7169	Ross-Gillespie and Butterworth, 2021
Number of Rights Holders	123	Japp & Droste, 2021		
2017 # vessels	45	Japp & Droste, 2021		
2017 average seadays / vessel	142	Japp & Droste, 2021		
Hooks set 2011 to 2017	252000000	Japp & Droste, 2021		
Hooks average p.a. 2011 to 2017	36000000			
Catch total 2011 to 2007	50000	Japp & Droste, 2021	59367	
Number of hake caught	20833333			
% hooks containing hake	0.083			
2018 TAC	133119	Japp & Droste, 2021	133119	Ross-Gillespie and Butterworth, 2021
Quota allocated to longline	7987	Japp & Droste, 2021	8721	Bergh, 2021, this study
# hooks per line, Min	6900			
# hooks per line, Max	15600			
Line length (km), Min	10			
Line length (km), Max	20			
# sets/year, Min	2308			
# sets/year, Max	5217			
Total line length set per year (km) Average	56438			
Total line length set per day (km) Average	155			

3.2.2 Overlap between longline and trawl fishing locations

The hake longline fishery developed initially by fishing on rocky untrawlable grounds where good catch rates of larger hake available to longline gear were achievable[9] and where there was a spatial separation between hake longline fishing operation and trawl fishing operations.

In the first 10 years of the hake longline fishery the good catch rates that were initially achieved on 'rocky untrawlable grounds' declined sharply, forcing longline vessels to find other fishing areas with economically viable catch rates. The most recent information available to this document is a density map of longline fishing effort measured by the number of sets (see Figure 3). These are data for the period 2002 to 2012. It is clear that there is direct overlap of the hot spots of longline fishing activity and effort in Figure 3 with the trawl footprint in Figure 4.

Figure 2 is a snapshot of vessel activity on the trawl grounds south of Cape Point based on AIS signals on the morning of 29 November 2021 received by one of the trawl fishing companies who provided socio-economic information for this study. The following are known trawl fishing vessels: Bluebell, Avro Warrior, Boronia, Harvest Selina, Harvest Gavina and Harvest Georgina. The other vessels range from tuna pole to hake longline to other non-trawl vessels. This map illustrates how congested the fishing grounds are under current circumstances.

3.2.3 Potential for conflict and costs

Given the comparison in Figure 3 and Figure 4 there is clearly potential for conflict between the trawl and longline sectors. Trawling across a longline will damage the line, and longline gear can and does foul trawl vessel props and rudders. These interactions incur costs for both parties. There are however other potential costs that must be considered, as follows. In order to reduce conflict, the South African Longline Hake Association (SAHLLA) and the South African Deep Sea Trawling Association (SADSTIA) signed a code of conduct (in February 2017) containing a set of measures aimed at reducing conflict. The provisions in this agreement include the following:

- Vessels intending to fish, shall contact all vessels in the vicinity on VHF Channel 16. They shall then immediately switch to VHF Channel 8 and indicate their intention to conduct fishing operations, giving starting point, heading and any other relevant information which could prevent interference between vessel activities.
- If there are no responses from other vessels within 15 minutes, the vessel intending to fish may proceed with gear deployment.
- If other vessels are in the way, they shall immediately respond and, either give way within 30 minutes, or respond that they have already, or are about to deploy their gear and give their starting position and heading, or describe their approximate fishing track if it is not linear. If feasible it should also give the approximate end position.

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[9] Japp (2007) notes that: "Longlining was first introduced to South Africa in 1983 as a hake longline fishery, but very quickly shifted to a kingklip-directed fishery between 1983 – 1989 (Japp, 1995). With the decline in the kingklip catch rates effort shifted back to hake in 1989 and at the same time the boats in the kingklip fishery began targeting hake. The subsequent closure of the kingklip-directed longline fishery resulted in fishers lobbying for a hake-directed longline fishery. This resulted in an experimental hake-longline fishery between 1994-1995 aimed at evaluating the scientific and socio-economic feasibility of hake longlining in South Africa. A hake-directed fishery was subsequently introduced amidst much controversy and litigation over rights allocations. Stability in the sector was finally accomplished with the introduction of medium-term fishing rights from 2002 and long-term rights in 2006. The introduction of hake longlining increased the effective number of operators targeting hake significantly with 65 rights issued in 2006 and between 50-70 boats operating each with allocations varying from 40 – 100 t per rights holder. From an effort management point of view this is the most challenging characteristic of the fishery as many boats operate with relatively small allocations, the boats carry multiple permits, fish for shorter periods than trawlers and also have specific market requirements."

- ***If another vessel is already about to deploy its gear or already fishing the later vessel must immediately select another area and repeat the process***.

The implication of this agreement, particularly the last provision in italics, is that fishing must be managed by the parties to avoid overlap of fishing activity, and trawlers **must select another area** if a line is set in the path of an intended tow[10]. This arrangement will impose costs on the offshore trawl sector **because by moving to an alternative fishing area, the trawl CPUE will become sub-optimal (there was an economic preference for an intended trawl path)**. A suboptimal CPUE implies the following costs:

i. **More fishing effort** required to land quota; If the CPUE is reduced, then more sea-time will be needed to land a certain catch. Felet et al (2020) estimate that these fishing effort costs comprise about 60% of total fishing costs, implying that a, say, 5% reduction in CPUE will increase sea-time requirements by about 5% and will increase overall fishing costs by 0.6 x 5% = 3%.
ii. **Lower TACs** awarded by the OMP formula; The OMP formula uses offshore trawl CPUE levels as the most important resource index. These lower TACs are not necessarily 'biologically rational' since higher CPUEs may remain feasible in the absence of longline fishing activity.

Relevant to the above is that CPUE hotspots do not exist at a particular location at all times during the year. These hotspots may exist only while conditions are right, and knowledge about these hotspots are often driven by recent fishing performance, where recent is a matter of days or hours. Some trawl vessel skippers communicate with each other about hotspots, and this information is used in combination with other information by skippers and fleet managers to direct their fishing activities on a daily basis.

The question of course is "What is the scale of the costs imposed on the trawl sector when conforming with the terms of the code of conduct described above?". We don't know, but we know that other situations where fishing has been excluded from areas have been very costly, as demonstrated through modelling and analysis for the South African small pelagic fishery (see Bergh et al, 2016). Some aspects of the use in Bergh et al (2016) of an opportunity-based model to describe the small pelagic fishery are applicable to the offshore trawl fishery, and the costs incurred by the advent of longline fishing within the trawl footprint. Note the following from Bergh et al (2016) in relation to the small pelagic fishery:

"*… the fishery needs to be understood as an opportunity based fishery, where fishing opportunities are available at particular points in space and time.*"

As in the small pelagic fishery, trawling opportunities forfeited to avoid conflict or interaction with longline gear may not be replaceable with alternative opportunities of a similar economic value. Similar analyses to those presented in Bergh et al (2016) may therefore be relevant to evaluating the scale of the costs being incurred by the offshore trawling sector as a result of the advent of longlining. In their analysis, Bergh et al (2016) reviewed every pelagic set made in the fishery since 1985 and developed an opportunity selection model to estimate the catch which could not be replaced by making using of alternative opportunities, when fishing exclusion zones are imposed. A similar review of all tows made in the trawl fishery, combined with all sets made in the longline fishery (assuming these data are available, **with** catch positions and date time stamps) could be carried out to estimate the scale of the impacts of past and additional sectoral

[10] Longline vessels have a distinct advantage because they physically occupy the entire length of their preferred fishing track with static gear ('the fishing line'), whereas trawlers pass through their preferred fishing track. It is therefore much easier for a longline vessel to claim 'ownership or occupancy of a fishing ground' once their gear is set, and more difficult for a trawler to prove that their intention was to fish along a particular trawl track. In addition, trawling occurs parallel to isobaths, i.e. at roughly a constant depth, whereas longline vessels are able to deploy their static gear perpendicular to the isobaths. When this happens multiple potential trawl tracks are blocked. Although there is a gentleman's agreement between longline and trawl skippers that the longline gear must be deployed parallel to the isobaths, this is not always the case (R. Landman, pers. comm.). An additional advantage for longline vessels is that they set their gear between 2 and 3 am (see Japp, 2007) to minimize seabird mortalities. They are therefore always 'first in the queue', and can establish control of the fishing track before trawling commences.

allocations to the hake longline sector. This would be an ambitious study, but some attempt should be made to quantify the impacts. This needs to be done before any sectoral allocation changes are considered.

In addition to the larger fishing effort costs referred to above, there are also impacts on the TAC as a result of lower CPUE levels in the offshore trawl fishery. The current OMP formula, OMP18, assigns the following weights to CPUE and survey data, to produce a combined index of resource abundance, separately for ***M. paradoxus*** and ***M. capensis***.

Table 3. Weightings applied to difference resource abundance indices in the OMP calculations.

M. paradoxus	**WC CPUE**	1.00
M. paradoxus	**SC CPUE**	0.75
M. paradoxus	**WC Summer**	0.50
M. paradoxus	**SC Autumn**	0.25
M. capensis	**WC CPUE**	1.00
M. capensis	**SC CPUE**	0.75
M. capensis	**WC Summer**	0.50
M. capensis	**SC Autumn**	1.00

All CPUE indices in Table 3 are **offshore trawl** CPUE indices, and these have the largest weights. Application of the OMP18 formula shows that:

- A sustained 3% reduction in the offshore CPUE could[11] cause a reduction in the TAC of as much as 2%.
- If the reduction in the CPUE is 5%, the reduction in the TAC could be as much as 3.5%.

There are therefore two compounding short term negative impacts which stem from good faith adherence to the code of conduct in Appendix H. If each is 2-3%, then the net loss of revenue from the offshore sector would be roughly 5-6%[12] of current levels.

The circumstances described here indicate that the re-allocation of quota from offshore trawl to hake longline would have negative impacts on the offshore trawl sector in terms of the code of conduct agreed between SAHLLA and SADSTIA. The scale of this impact needs to be evaluated before embarking on the proposed hake sectoral allocation policy change.

[11] The OMP limits the TAC reduction to 5% - this reduction may be applicable regardless of smaller differences in CPUE which would only come into play when the 5% constraint is not active.

[12] Note that these quantities are purely illustrative, there are no estimates available at present of the scale of these impacts.

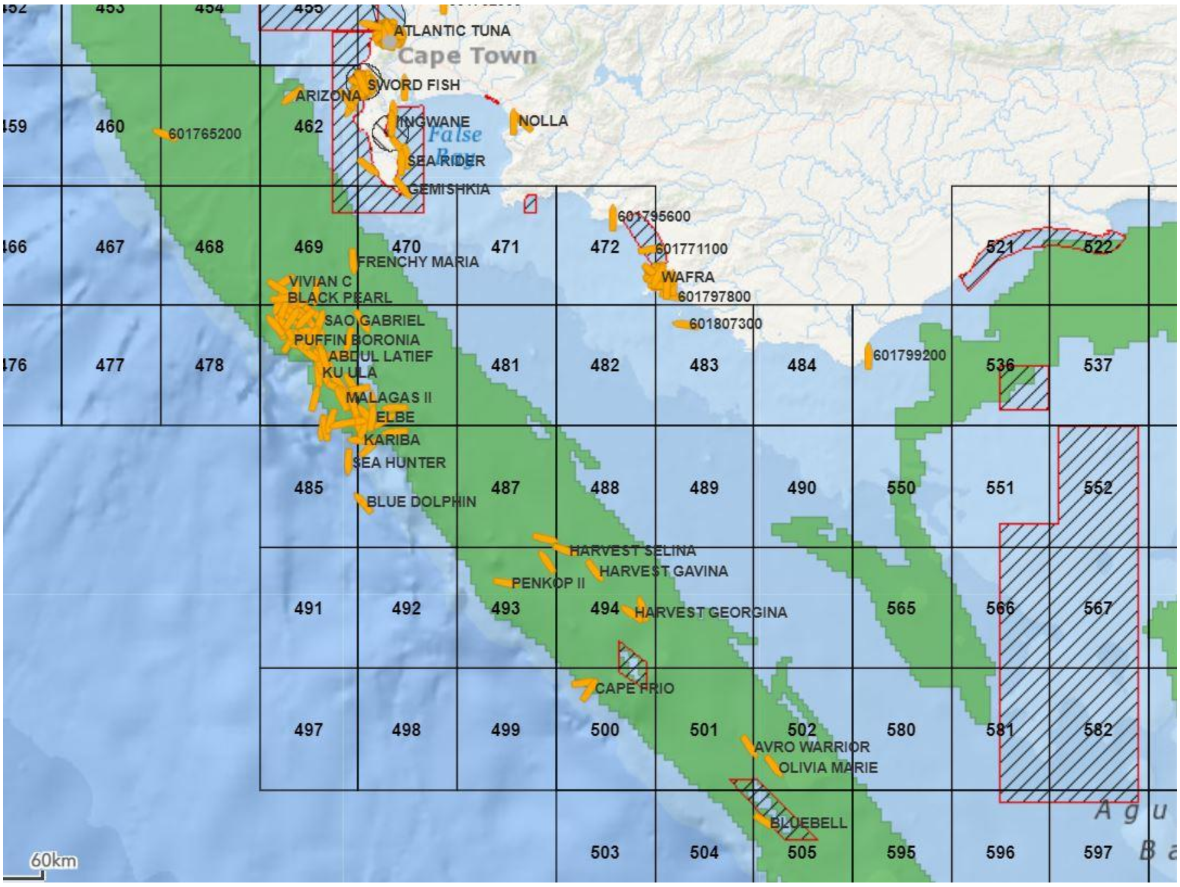

Figure 2. A map of vessel activity on the trawl grounds south of Cape Point based on AIS signals on the morning of 29 November 2021 received by one of the trawl fishing companies who provided socio-economic information for this study. The following are known trawl fishing vessels: Bluebell, Avro Warrior, Boronia, Harvest Selina, Harvest Gavina and Harvest Georgina. The other vessels range from tuna pole to hake longline to other non-trawl vessels

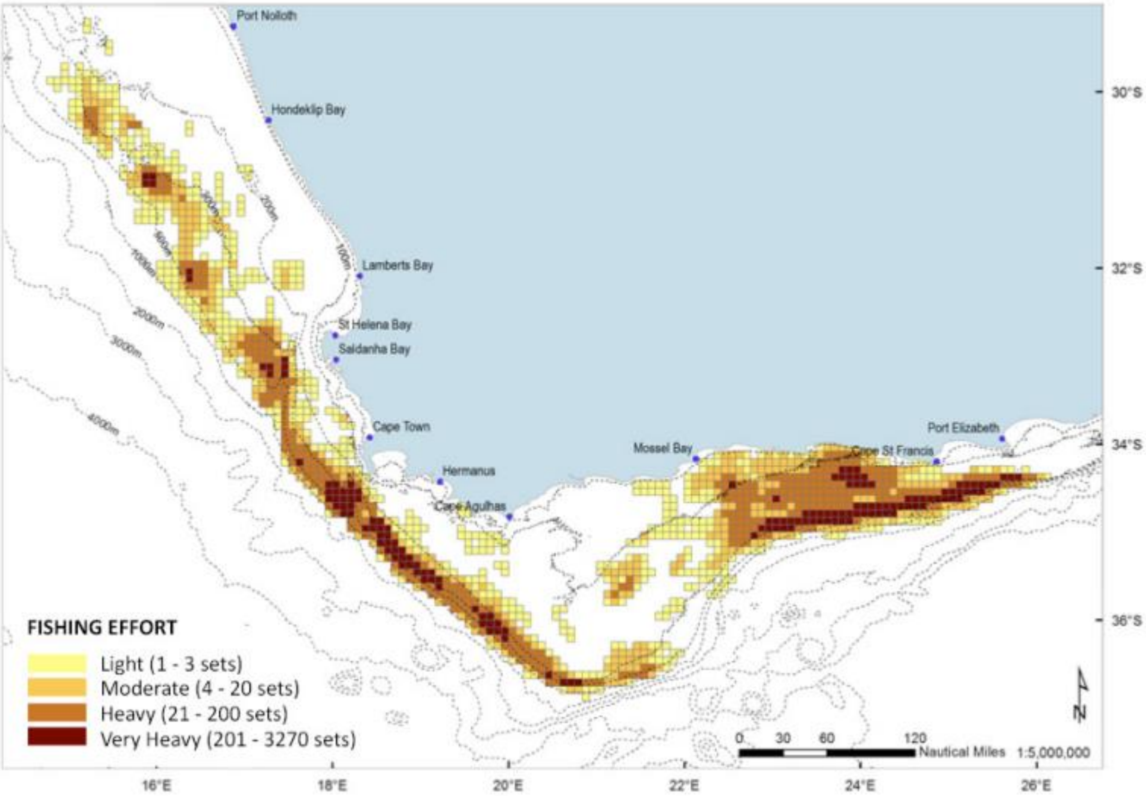

Figure 3. National overview of the spatial footprint and fishing effort of the demersal longline sector for the period 2002 to 2012 displayed at a 5' x 5' grid resolution (source: Massie, Wilkinson & Japp 2015).

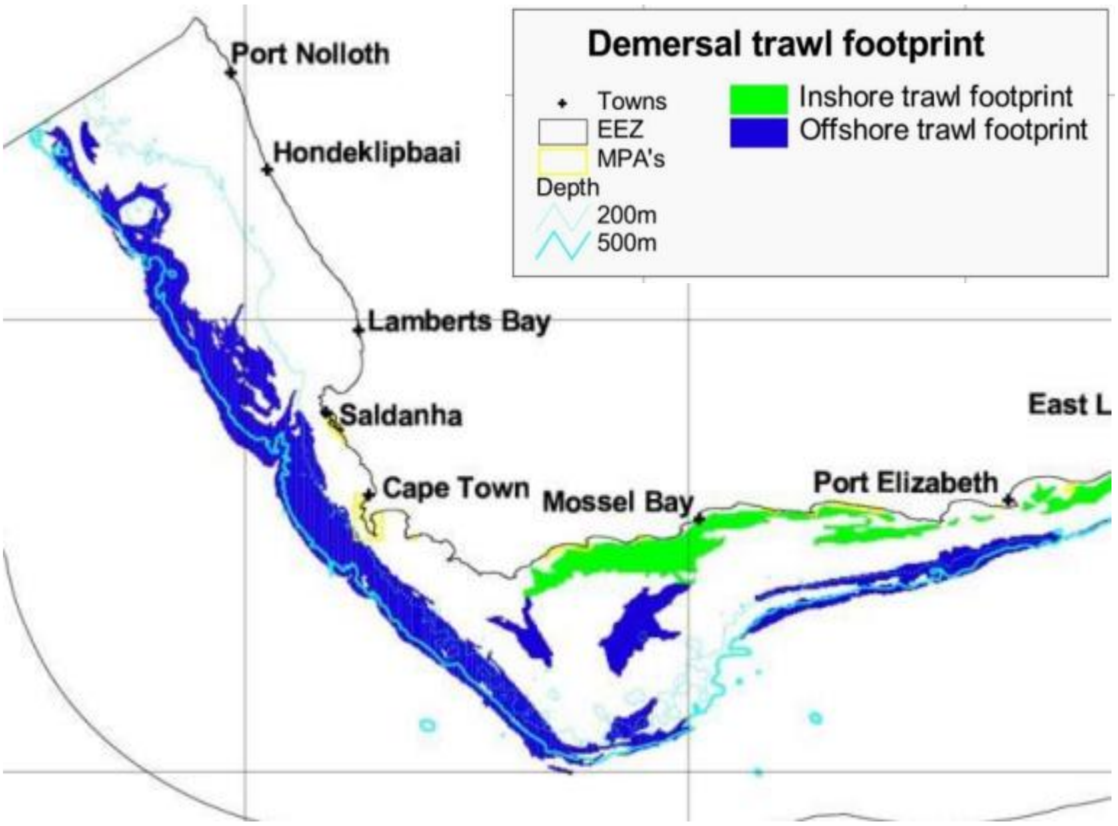

Figure 4. Map illustrating the hake "trawl footprint", first incorporated into permit conditions for the two trawl sectors in 2015. (Source: MARAM/IWS/2019/Hake/BG2 An overview of the SA hake fishery M.D. Durholtz).

3.3 Utilisation of the TAC

The annual hake TAC and the catch per sector are given in Table 4.

Table 4. Hake TACs and sectoral catch as used in stock assessment calculations (source: Ross-Gillespie and Butterworth, 2021).

South African hake: TACs and catches (MT) 2016 - 2020							
Year	**TAC**	**Small scale**	**Handline**	**Longline**	**Offshore trawl**	**Inshore trawl**	**Trawl (Offshore + Inshore)**
2016	148000	0	1.3	7169.1	129694.0	3972.8	133666.8
2017	140125	0	3.5	8244.7	123026.0	2812.0	125838.0
2018	133119	0	24.3	8341.7	119022.0	3983.0	123005.0
2019	146431	0	9.0	5536.0	116456.0	4149.0	120605.0
2020	146431	0	4.1	4692.8	128769.0	4536.0	133305.0

The split of the catch between inshore trawl and offshore trawl reflected in Table 4 is not regarded as reliable since some of the inshore allocation caught by larger trawlers further offshore has been recorded by DFFE as offshore catch (see Appendix K for further on this). Some care must therefore be exercised when interpreting the offshore/inshore utilisation figures.

Based on the historical levels of TAC and catches by sector given in Table 4, and using the sectoral allocation percentages since 2005 of:

- Small scale: 1.500%
- Handline: 1.8433%
- Longline: 6.551%
- Inshore trawl: 6.179%
- Offshore trawl: 83.9268%,

the sectoral allocations can be calculated and are as given in Table 5[13].

Table 5. Hake sectoral allocations in MT.

South African hake: TACs and sectoral allocations (MT) 2016 - 2021							
Year	**TAC**	**Small scale**	**Handline**	**Longline**	**Offshore trawl**	**Inshore trawl**	**Trawl (Offshore + Inshore)**
2016	148000	2220.0	2728.1	9695.5	124211.7	9144.9	133356.6
2017	140125	2101.9	2582.9	9179.6	117602.4	8658.3	126260.8
2018	133119	1996.8	2453.8	8720.6	111722.5	8225.4	119947.9
2019	146431	2196.5	2699.2	9592.7	122894.9	9048.0	131942.8
2020	146431	2196.5	2699.2	9592.7	122894.9	9048.0	131942.8
2021	139109	2086.6	2564.2	9113.0	116749.7	8595.5	125345.3

With the values in Table 4 and Table 5, it is possible to calculate the utilisation of the quota as catch divided by the allocation. This is given in Table 6 for the period 2016 to 2020. The values for the full period 2006 to 2020 are given in Appendix L.

[13] On the assumption that the allocations were based rigorously on the percentages shown immediately above.

Table 6. % utilisation of allocations for South African hake based on the historical catches given in Table 4 and the sectoral allocations given in Table 5. The low values for Inshore trawling are underestimates, for reasons given in the text. Averages for the periods 2005 – 2020 and 2016 – 2020 are given.

South African hake: Utilised Amount (Catch) as % of Allocations 2016 - 2020							
Year	**TAC**	**Small scale**	**Handline**	**Longline**	**Offshore trawl**	**Inshore trawl**	**Trawl (Offshore + Inshore)**
2016	148000	0.0%	0.0%	73.9%	104.4%	43.4%	100.2%
2017	140125	0.0%	0.1%	89.8%	104.6%	32.5%	99.7%
2018	133119	0.0%	1.0%	95.7%	106.5%	48.4%	102.5%
2019	146431	0.0%	0.3%	57.7%	94.8%	45.9%	91.4%
2020	146431	0.0%	0.2%	48.9%	104.8%	50.1%	101.0%
Average (2016 - 2020)	142821.2	0.0%	0.3%	73.2%	103.0%	44.1%	99.0%

The reasons for the underutilisation by the inshore trawl sector have been investigated here and are discussed in more detail in Appendix K. It seems that a considerable portion of the inshore catch which is recorded in the dataset used here, viz. data inputted for purposes of hake stock assessment models, may be recorded as offshore catch. Other issues also play a role, as outlined in Appendix K. This is a longstanding problem and further investigations into this by DFFE are underway. Consequently, it is more reliable to view utilisation by trawl combined, i.e. inshore + offshore trawl sectors, rather than by each sector separately.

The average utilisation of 73.2% by the longline sector, and the low %'s in 2019 and 2020 are notable. The reasons for this should be investigated, since any reallocation to longlining would presumably be accompanied by the assumption that the socio-economic benefits of the reallocation is tied to the allocation, and not to 73% of the allocation, or even less. There are some important differences in the hake longline sectors catches and allocation reflected in these tables and those reported by Japp and Droste (2021). Resolution of these discrepancies are outside the scope of this document. Some of these discrepancies are evidence in Table 2. Steps should be taken to resolve these discrepancies.

There could be various reasons for the underutilisation by the hake longline sector shown in Table 6. Four that should be considered are:

1. Data recording issues, as for inshore hake
2. Reduced catch rates are making hake longlining economically unviable
3. Market conditions are making hake longlining economically unviable
4. Other operational considerations are causing reduced utilisation, e.g. the COVID-19 pandemic.

It would be a concern if the low utilisation level in the longline sector is due to poor catch rates. If these are part of a long-term trend then any socio-economic benefits associated with a reallocation to the longline sector would be vulnerable to ongoing underutilisation.

We know that in South Africa, hake longline gear catches much larger hake than does trawl gear, whereas the latter harvests across a broad size spectrum. The biomass of large sizes of hake is more limited than the entire size spectrum of hake, hence longline catches and catch rates are perhaps more susceptible to catch rate declines or fluctuations than trawl catch rate.

Japp (2007) reports sharp declines in longline CPUE "The hake longline CPUE has declined by more than 50% since 1995 from about 460 kg per 1000 hooks to less than 198.5 kg per 1000 hooks up to the end of 2006 (note 2007 data not complete)", and presents the graph in Figure 5 which indicates severe catch rate declines between 2002 and 2007; which is approximately 60% between 2002 and 2007.

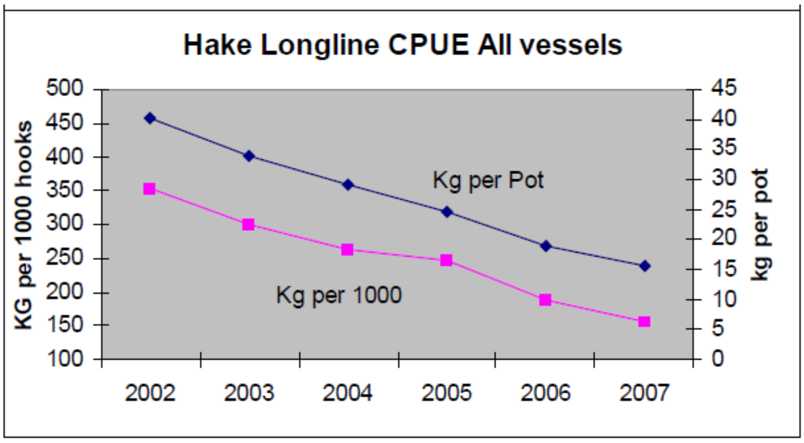

Figure 5. Hake longline catch rate trends from selected vessels. Note that data extending into 2007 has been used and that the CPUE index with respect to pots is shown - this is compared to the index kg per 1000 hooks (bottom right graph). Source: Japp (2007).

These CPUE trends suggest that there is a problem with the sustainability of the hake longline catch rate, and this may be a clue to the reason for the underutilisation presented here.

However, more recent CPUE trend information for hake longline, detailed in Appendix C, present a longer time series and offers information on splits in CPUE trends by species and coast. These suggest that the nominal CPUE has stabilised in some cases (i.e. some species, some coasts), following the decline noted in Figure 5. However, the standardized CPUE generally shows much sharper declines over time than does the nominal CPUE. This is an indication that the hake longline fishery is having to make changes to its operation to remain economically viable, despite sharp declines in the exploitable biomass of hake available to it. We don't know what all these changes are, although some have clearly been a move away from rocky untrawlable grounds directly into the main trawling grounds. This may also have been accompanied by upscaling the number of hooks, and line lengths, and other changes presently unknown to this study.

Certainly, CPUE trends such as are presented in Appendix C, combined with limitations on the available fishing capacity, have the potential to drive some of the underutilisation documented in Table 6. This and other possible causes of the underutilisation of longline allocations should be explored to ascertain whether the situation is likely to persist in the future, and hence perhaps compromise the socio-economic benefits that longlining may offer.

3.4 Depredation and loss of hake from longlines

It is known anecdotally that a cottage industry based on the collection of hake floating on the surface in the vicinity of longline hauling operations existed for a short period, but was banned because of marine safety considerations. This suggests that there is some loss of hake from longlines and wastage of catch. There is also the possibility that some hake are lost to depredation.

Greenstone et al (2016) consider the possible extent of depredation by classifying hooks and gear hauled up into 6 categories and assigning a percentage based on observations of 96 276 hooks (the number of hooks for 15.7 % of the sets hauled during the observation period). The results of this classification are given in Table 7.

Table 7. Classification of hooks and hook lines during gear hauling, based on observations of 96 276 hooks (source: Greenstone et al (201)).

Category	% of Hooks
Fish	20.84%%
Benthos	0.17%
Clean	41.28%
With Bait	26.04%
Lost Fish	0.80 %
No Hook	10.85%

Based on these results, Greenstone et al (2016) conclude that

"This information can be interpreted in the following way: It is unlikely that depredation events occurred on approximately 47.1% of hooks – those observed with fish (excluding the mauled fish), with benthos, or with bait; it is unknown whether depredation occurred on 52.1% (clean hooks or no hooks), and depredation events did occur on 0.8% of hooks". This conclusion places an upper bound on depredation of the frequency of occurrents of 'clean hooks' + 'no hooks' + 'lost fish' = 41.28 + 10.85 + 0.8 = 52.9% of the hooks, which is potentially a very high ????depredation rate.

Greenstone et al (2016) did not consider what the information in Table 7 might imply for 'lost' fish. Here 'lost' fish are assumed to be fish that fall off or escape the hook, and/or break free with an imbedded hook and then die as a result – some of these as a result of barotrauma. Hence the earlier cottage industry involved in collecting floating fish behind longline vessels. An upper bound for lost hake is perhaps 'clean hooks' + 'no hooks' = 41.28 + 10.85 = 52.1% of the hooks.

These upper bounds are of course speculative. Their relevance is to suggest that the impacts could be large and should be researched if possible. There are some precedents for this kind of work, for toothfish and not hake. For example, estimates of toothfish depredation from longlines by killer whales and sperm whales in the South African EEZ of the Southern Ocean is in the order of 5% of the recorded catch (FISHERIES/2019/OCT/SWG-DEM/34). However, other studies, also for toothfish, suggest a much higher figure of 27.3% to 29.1% (see Gasco et al, 2015).

Note as well that the lost hook rate of 10.85% suggests that of the 36 million hooks deployed annually, 3.6 million are being lost annually.

3.5 Resource sustainability considerations - hake

Resource sustainability is multifaceted. The question is whether the proposed reallocation from the offshore to the longline sectors will result in one or more of the following four outcomes:

1. Lower TACs in the short, medium and long term than would otherwise have been the case
2. Lower offshore trawling CPUE (than would otherwise have been the case).
3. Reductions in spawning biomass and/or recruitment considerations.
4. An undesirable change in the size structure of offshore trawling catches – particularly a reduction in the % of medium and large sized hake in catches

It is also relevant to this determination whether the available stock assessment models provide an adequate basis for exploring factors 1-4, and whether adequate data on long lining are available to the scientific process to support such determinations.

3.5.1 Adequacy of longline data used in the stock assessment model, and whether important features of longline dynamics are captured

The following longline data are used in the hake stock assessment model:

- Total catch 1983-2020, by species, coast and in some cases by gender

- Sex-aggregated catch-at-length data for the years 1994-1997
- Sex-disaggregated catch-at-length data for the years 2001-2010

Noting that the selectivity of longline gear is, from a stock assessment point of view (see Figure 6), a key feature that needs to be reflected in the stock assessment model, that this selectivity has changed over time and that catch-at-length data are needed to update and monitor how selectivity is changing, it is important that sex disaggregated catch-at-length data be made available for incorporation into the stock assessment for 2011 – 2020.

CPUE is a key indicator of longline exploitable biomass. Some of the available data (e.g. Japp, 2007) shows a 60% decline in the catch rate for the period 2002 to 2007, whereas the hake reference case model shows at most a 28% decline in the longline exploitable biomass over the same period, but an average across both coasts of 13% and 4% for ***M. paradoxus*** and ***M. capensis*** respectively (see Table 8).

Table 8. An extract from Table 14, focussing on the 2007/2002 exploitable biomass ratios.

		M. paradoxus biomass ratios									
		Option 1 (Status quo)					Option 2 (Transfer to Longline)				
		Bexp: Exploitable biomass					Bexp: Exploitable biomass				
		WC Offshore	SC Offshore	WC Longline	SC Longline	Average Longline	WC Offshore	SC Offshore	WC Longline	SC Longline	Average Longline
Fixed Catch P	2007/2002	1.35	1.05	0.72	1.02	0.87	1.35	1.05	0.72	1.02	0.87
Fixed F Ratio	2007/2002	1.35	1.05	0.72	1.02	0.87	1.35	1.05	0.72	1.02	0.87

		M. capensis biomass ratios									
		Option 1 (Status quo)					Option 2 (Transfer to Longline)				
		Bexp: Exploitable biomass					Bexp: Exploitable biomass				
		WC Offshore	SC Offshore	WC Longline	SC Longline	Average Longline	WC Offshore	SC Offshore	WC Longline	SC Longline	Average Longline
Fixed Catch P	2007/2002	0.88	0.88	0.95	0.98	0.96	0.88	0.88	0.95	0.98	0.96
Fixed F Ratio	2007/2002	0.88	0.88	0.95	0.98	0.96	0.88	0.88	0.95	0.98	0.96

This suggests that the assessment model is not able to adequately reflect key dynamic features in the longline fishery. The longline CPUE data therefore should be worked up for incorporation in the stock assessment model to see whether this leads to improved agreement with longline exploitable biomass trends from the model. Clearly there is the potential for complex dynamic features induced by spatial shifts in longline fishing effort that would need to be considered as part of such an extension of the hake stock assessment model.

3.5.2 TACs, CPUE, spawning biomass and population size structure

The extent to which the proposed change in sectoral allocations causes lower TACs and/or offshore trawl CPUE has been raised in an earlier section in relation to spatial competition between longline and trawl operations. Another mechanism which may lead to a reduction in TACs and/or offshore trawl CPUE levels is in the basic population dynamics of the two species of hake, under the different selectivity characteristics of offshore trawl versus longlining. This is shown by the comparison of longline and offshore trawl selectivity curves for the reference case assessment model in Figure 6. Longline gear selects a much larger size of hake.

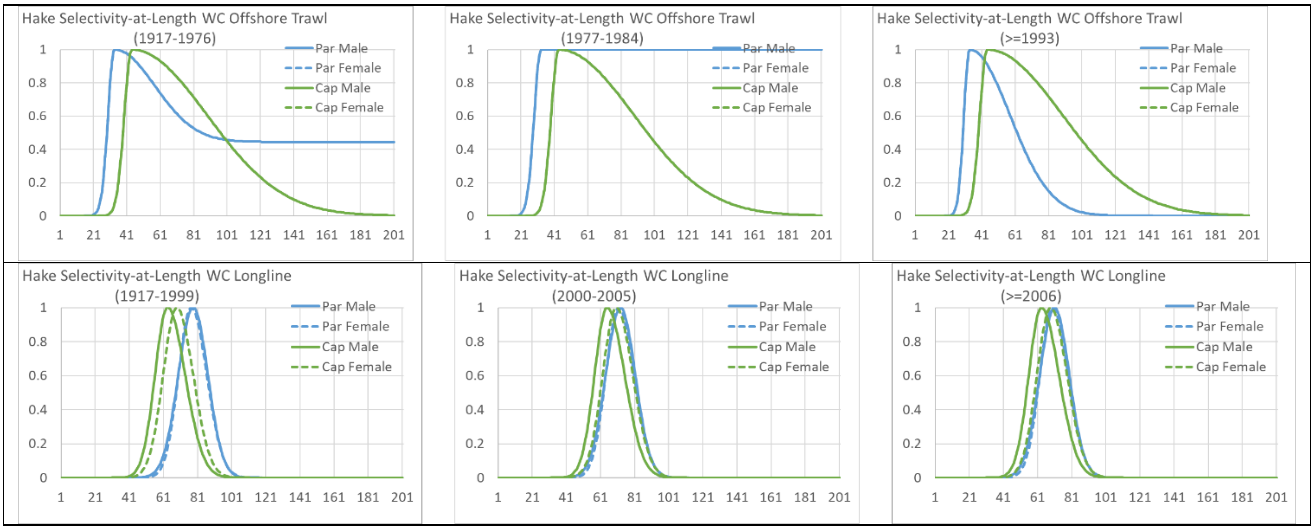

Figure 6. West Coast fishing selectivity curves comparing in the top panels the offshore trawl selectivity curves and below the longline selectivity curves (source: hake reference case stock assessment model, OLSPS Marine internal modelling work, 2021).

These different selectivity curves logically imply that hake population dynamics will respond to different amounts of longline fishing. Here the reference case hake stock assessment model was used to compare the long-range outcomes of spawning biomass and exploitable biomass available to different gear types and sectors, in response to two different options regarding future sectoral breakdowns of the annual catch. Projections of various quantities under a constant catch of 140 000 MT and for the following two allocation options effective from 2022 onwards are presented (Table 9):

Table 9. Two sectoral allocation options for hake. Option 1 is the status quo and Option 2 reflects the changes implied by the draft policy document.

Sector	**Option 1**	**Option 2**
Small Scale	1.5000%	1.5000%
Handline	1.8433%	1.8433%
Longline	6.5510%	10.0000%
Inshore Trawl	6.1790%	6.1790%
Offshore Trawl	83.9268%	80.4778%

It is proposed that in implementing Options 1 and 2 above, the reality of the underutilisation of allocation to the Small Scale and Handline sectors needs to be addressed. To do so, the assumption is made that there is no utilisation of these allocations in the future as well, hence Options 1 and 2 have been modified to (Table 10):

Table 10. The manner in which the two sectoral allocation options for hake set out in Table 9 are implemented in the resource projection calculations presented here. These preserve, in the projections, the absence of utilisation by the Small Scale and Handline sectors seen over the last 5 years.

Sector	**Option 1**	**Option 2**
Small Scale	0%	0%
Handline	0%	0%
Longline	6.5510%	10.0000%
Inshore Trawl	6.1790%	6.1790%
Offshore Trawl	83.9268%	80.4778%

The methods that were used to carry out the projections are described in Appendix A. The projection results are also shown in Appendix A, in Table 14 (Options 1 and 2) and in Figure 7 (Option 1) and Figure 8 (Option 2).

Figure 7 (Option 1) and Figure 8 (Option 2) provide graphs which show how the size structure of the population might change under the two different projection options.

The worst outcome from these analyses is that the spawning biomass under Option 2 is somewhat lower by 2036 than it would be under the status quo Option 1, relative to the 2021 spawning biomass level, by about 4% for ***M. paradoxus*** and 1-2 % for ***M. capensis***. This is a relatively small impact. Also, the impact on population size structure is small.

3.6 Resource sustainability considerations – other non-ETP species

3.6.1 Impacts on commercially valuable bycatch species

Weston and Atwood (2017) report the species breakdown of catches in the offshore, inshore and hake longline fisheries. This is summarised here in Table 11. These data suggest that hake longline catches a higher % of its hake catch as ***M. paradoxus*** than does the offshore trawl fishery. Monkfish does not feature in hake longline catches. The % of kingklip caught by hake longline gear reported by Weston and Atwood (2017) is 3.1 %[14]. SADSTIA manages the allowance for kingklip catches by members on the assumption that the incidental catch of kingklip is 1.5%, and then distributes additional allowances to operators based on their historical kingklip performance, such that the sum of all allowances is equal to the kingklip PUCL. The results in Weston and Atwood (2017) indicate that kingklip is 3.5% of the hake catch. On the other hand, the kingklip PUCL has been set at 3905 MT for 2022, which is 2.95 % of the 2022 hake TAC of 132 000 MT. Thus, superficially, under the proposed reallocation of the TAC, 141 MT of kingklip catch could be gained by the hake longline sector. 2.95% of 4553 is 135 MT which could be lost by the offshore trawl sector, but the incidental catch amount linked to this is 68 MT (0.015 x 4553), so the balance of 135 – 68 = 67 MT could be potentially claimed by offshore trawl rights holders who have a historical claim to this amount based on historically provable performance and on the precedent that has been established for many years by SADSTIA's recognition of these rights. These matters need resolution in the event of a reallocation of hake from the offshore sector to the hake longline sector.

[14] Japp and Droste (2021) report, citing SANBI (2017 – reference not given) that non-hake bycatch comprises about 3.63% of the hake catch in the hake longline fishery, and of this 68.02% is kingklip. This suggests therefore a lower figure of 0.6802 x 3.63 = 2.47% of the hake catch is kingklip, although an interpretation of Table 15 of Japp and Droste (2021) suggests a higher figure of 3.4%. Clearly some work is required to clear up these discrepancies and explain the differences in different sources w.r.t. the kingklip bycatch %.

Table 11. Catch breakdown based on observer samples before discarding in the offshore, inshore trawl and hake longline fisheries (source: Weston and Atwood, 2017).

Offshore Trawl (observer data: 2002 - 2006)			Inshore Trawl (observer data: 2002 - 2006)			Hake Longline (observer data: 2013 - 2014)		
Species or species group	**sample kg**	**% by wt**	**Species or species group**	**sample kg**	**% by wt**	**Species or species group**	**sample kg**	**% by wt**
Merluccius paradoxus	71553354	65.0%	Merluccius paradoxus	427844	2.5%	Merluccius paradoxus	176727	75.8%
Merluccius capensis	14623479	13.3%	Merluccius capensis	9653757	55.4%	Merluccius capensis	30182	12.9%
Lophius vomerinus	4308904	3.9%	Lophius vomerinus	86891	0.5%	Lophius vomerinus	26	0.0%
Genypterus capensis	3904502	3.5%	Genypterus capensis	216156	1.2%	Genypterus capensis	7154.8	3.1%
Lepidopus caudatus	3449888	3.1%	Lepidopus caudatus	44138	0.3%	Lepidopus caudatus	8	0.0%
Thyrsites atun	2695564	2.4%	Thyrsites atun	56909	0.3%	Thyrsites atun	400	0.2%
Merluccius spp.	2261651	2.1%			0.0%	Merlucciidae	5100	2.2%
Helicolenus dactylopterus	1710662	1.6%	Helicolenus dactylopterus	16796	0.1%	Helicolenus dactylopterus	2504	1.1%
Trachurus trachurus	1272562	1.2%	Trachurus trachurus	1345028	7.7%			
Zeus capensis	1071336	1.0%	Zeus capensis	41551	0.2%	Zeus capensis	12	0.0%
Squalus spp.	755777	0.7%	Squalus spp	409203	2.3%	Family Squalidae	660	0.3%
Brama brama	743366	0.7%	Brama brama	900	0.0%	Brama brama	3774	1.6%
Coelorinchus simorhynchu	741650	0.7%			0.0%			0.0%
Malacocephalus laevis	573414	0.5%			0.0%			0.0%
Toderopsis spp.	393252	0.4%			0.0%			0.0%
Sub Total %		**100.0%**			**70.5%**			**97.2%**
Holohalaelurus regani			Pterogymnus laniarius	1050173		Conger spp.	2077	
Coelorinchus braueri			Raja spp	833321		Superorder Selachimorpha	1063	
Zeus faber			Chelidonichthys spp	824164		Chelidonichthys capensis	839	
Scyliorhinus capensis			Austroglossus pectoralis	504049		Lepidion spp.	829.5	
Squid (general)			Callorhinchus capensis	503551		Pterogymnus laniarius	594	
Octopus (general)			Argyrosomus inodorus	294264		Argyrozona argyrozona	562	
Raja straeleni			Loligo vulgaris	283206		Raja spp.	299	
Loligo vulgaris			Rhabdosargus globiceps	230517		Prionace glauca	118	
Rat Tail (general)			Argyrozona argyrozona	107176		Thunnus albacares	74	
Scomber japonicus			Atractoscion aequidens	83984		Alopias spp.	60	
Lepidion spp.			Mustelus spp	82249		Pomatomus saltatrix	25	
Cruriraja parcomaculata			Galeorhinus galeus	37770		Holohalaelurus regani	18	
Beryx splendens			Scomber japonicus	35718		Ruvettus pretiosus	13	
Psychrolutes macrocephalus			Myliobatis aquila	26634		Raja caudaspinosa	12	
Emmelichthys nitidus nitidus			Order Torpediniformes	25674		Family Macrouridae	5	
Conger wilsoni			Galeichthys feliceps	24990		Coryphaena hippurus	3	
Raja pullopunctata			Congiopodus spp	21343		Polyprion americanus	3	
Callorhincus capensis			Rhinobatos annulatus	18313		Beryx spp.	1	
Total %		**100.0%**			**99.1%**			**100.0%**

3.7 Implications for the hake OMP

The prevailing hake OMP, designated OMP18, was developed on the basis of the following assumptions about sectoral allocations and levels of utilisation (see page 3 of Ross-Gillespie and Butterworth, 2018):

"**6. Allocation of future TAC by fleet**

Future TAC is split into fleets using the legal allocations, rather than the ratios derived from recent catches as had been the case in the past. The legal allocations provide a split between offshore trawl, inshore trawl, longline and handline catches. The projections further split the trawl catches by coast using the ratios of these catches for recent years. For the results reported in this document, the proportional split between the fleets was thus:

WC offshore	0.62269
SC offshore	0.21658
SC inshore	0.06179
WC longline	0.05979
SC longline	0.00572
SC handline	0.03343

Note is made here of the fact that catches resulting from surveys have not been included in the projections, as these catches have historically also not been included in the OMs. These catches are

> not substantial and unlikely to make any difference of note. Hake by-catch from the midwater trawl fishery (targeted at horse mackerel) has, however, been accounted for in the projections by adding a value of 260 tons to the total catch after the TAC is calculated".

The development of an OMP is a lengthy process and the revision of the prevailing OMP, OMP18, has been scheduled for completion in late 2022, in time for the 2023 TAC recommendation. Given the new sectoral allocation draft policy, it is necessary to include in the development process the possibility of an alternative sectoral allocation. This cannot be done in time for a new sectoral allocation by the beginning of 2022. Logically this investigation should take place as part of the revision of OMP18 during 2022, which will be finalised in Q4 of 2022.

Any short-term decision which departs from the sectoral allocation implicit in OMP18 without accompanying scientific analyses to prove that OMP18 is not being compromised would risk the MSC certification of the inshore and offshore sectors of the hake fishery, which is of considerable value, as noted by Lallemand et al (2016):

> "A succession of four scenarios was proposed to simulate possible economic outcomes resulting from shifting to a non-certified fishery. The method then compared the current economic worth of the fishery to the progressive loss of value following these scenarios; the difference representing the net worth of MSC certification to the fishery. The analysis showed that the fishery's Net Present Value (NPV) of combining these scenarios over a 5-year period corresponds to a <u>37.6% reduction vis-à-vis the status quo</u>. This study showed that retaining MSC-certification is critical for the fishery to maintain its market position"

and by Felet et al (2020):

> "The value of MSC certification has been quantified in a number of economic studies, indicating a "MSC price premium" of c.10 to 15% <u>and contributing c.30% of the current HDST fishery value</u> as a result of improved market access".

OMP18 is the basis of the current scoring by the MSC for issues which fall under P1. As part of this, OMP18 has been tested to determine whether it is robust to uncertainty about the extent to which the ***M. paradoxus*** component of the South African hake resource is shared with the Namibian ***M. paradoxus*** resource (Butterworth and Ross-Gillespie, 2020a,b). This is a critical condition for the continuation of the MSC certification of the hake trawl fishery which is so important to the contribution made to the South African economy by the trawl sector.

The MSC would need to be notified about any material changes in the basis for the management of the hake TAC and this would include any change in sectoral allocations, given that these involve an important change to the amount of the TAC which may be caught with a method that is different to the trawl method. It is therefore very important that any sectoral allocation changes are not made before the implications of this change are fully tested and properly addressed within a revised OMP. Any ad hoc decisions could have negative consequences for the MSC certification for the trawl fishery, and the loss of that certification would have far-reaching and substantial negative socio-economic impacts, as outlined more fully in Lallemand et al (2016).

3.8 Implications for MSC certification

The CAB assesses the certifiability of a fishery against the MSC standard. The version of the standard most recently used to assess South African hake trawl is v2.01, set out in Marine Stewardship Council (2014a,b). The assessment is conducted according to three principles P1, P2 and P3, which are:

Principle 1 (P1): Sustainable target fish stocks: A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and, for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery.

Principle 2 (P2): Environmental impact of fishing: Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.

Principle 3 (P3): Effective management: The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.

Appendices D, E, F and G outline the MSC's conditions for the certification of the South African hake trawl sector, as well as the certified parties action plans; Appendix D covers P1 conditions and actions, Appendix E deals with Endangered, Threatened or Protected species which falls under P2, and Appendix G addresses P3 issues. Habitat issues fall under P2 but are not detailed here – they are not considered to be relevant to an increase in the sectoral allocation of hake TAC to the longline sector (Appendix F is just a placeholder to remind the reader that these exist).

3.8.1 Potential for new conditions – Primary and secondary species, ecosystem

Appendix J presents a diagram and the classification criteria which are used by the CAB in accordance with the MSC standard to classify species other than the species which are the subject of the MSC certification (i.e. ***Merluccius paradoxus*** and ***Merluccius capensis***) as either Primary, Secondary or ETP species. Briefly, "primary species" are species other than hake for which there are already management tools and procedures in place reflected in either limit or target reference points, such as kingklip, monk, sole and horse mackerel. "Secondary species" are species that are caught in the fishery but are neither "Primary species" nor "ETP species". Jacopever, angel fish and grenadier are examples of secondary species. ETP species are defined by the MSC Standard (SA3.1.5) as species that are recognised by national ETP legislation, species that are listed in binding international agreements as outlined in Appendix J, or species classified as 'out-of scope' (amphibians, reptiles, birds and mammals) that are listed in the IUCN Redlist as vulnerable (VU), endangered (EN) or critically endangered (CE). (Note as well: Where threshold catch limits have been established for an ETP species then the fishery will be scored against PI2.3.1 scoring issue a AND the cumulative impacts of overlapping MSC fisheries must be taken into account. Where there are no limits set or non-retention bans only, then cumulative impacts are not considered and the fishery is scored against PI2.3.1 scoring issue b).

At present the CAB has raised no conditions in regard to primary or secondary species. P2 conditions at present are restricted to ETP species and Habitat. Also no Ecosystem conditions (which also fall under P2) have been raised. However changed circumstance, such as the draft policy on sectoral allocation changes in the hake fishery under consideration here, do raise the possibility that new conditions could be raised w.r.t. primary and secondary species, or in the category 'ecosystem'. Considering the catch mix reported by Weston and Atwood (2017), and assuming that this is a fair reflection of the situation in the hake longline fishery at present, there do not seem to be grounds to be concerned about such new conditions being raised. The only possibility is perhaps kingklip. The kingklip resource is managed by a PUCL. Should the economic viability of the hake longline deteriorate and result in an escalation of pressure on kingklip by the hake longline sector, then that might lead to catches which in aggregate across all sectors exceed the PUCL substantially, perhaps leading to an additional condition on kingklip as a primary species.

3.8.2 Principles 1 and 3 (P1 and P3)

The latest certification of the South African hake trawl sector faced a number of new challenges under P1 and P3. For P1, the possibility that the ***Merluccius paradoxus*** stock is shared in some sense with the Namibian stock of ***Merluccius paradoxus*** placed a burden on SADSTIA/SECIFA/DFFE to demonstrate that the stock assessment model, and the associated OMP both either accommodated this possibility or were robust to this possibility. Additional stock assessment analyses and simulation tests were carried out and were able to demonstrate that this was the case. This demonstration was critical to establishing the nature of conditions required for P3, which set out how the certified parties in South Africa need to engage with the certified parties in Namibia to ensure that both P1 and P3 conditions can be satisfied, and that the action plans proposed were acceptable to the CAB in relation to the MSC standard. The deliberations on the conditions and the action plans were very lengthy and ***finely balanced***.

As it stands now the final outcome has been very positive and there is the potential to close out the existing P1 and P3 conditions much sooner than the four-year duration of the certification period.

However, the MSC would have to be notified in the event that there is a change in the sectoral allocation of hake.

It will be necessary to revisit all simulation studies which formed part of the previous deliberations on P1 and P3 to assess whether the fine balance referred to is compromised by this sectoral allocation change, and to demonstrate again that the stock assessment model, and the associated OMP both allow for the possibility of stock sharing of ***M. paradoxus*** between South Africa and Namibia, and remain robust to this possibility. This will take considerable time and resources and cannot be completed to support a sectoral allocation change by the beginning of 2022. Logically this work should be done during 2022 as part of the planned review of the hake OMP.

And it may emerge that changes need to be made to the P1 and P3 conditions, with the potential for knock on costs to the certified parties SECIFA and SADSTIA. All of this has yet to be determined.

3.8.3 Principle 2 (P2)

For P2 a number of new features in the MSC standard has led to a large number of new conditions for ETP species and habitats with significant new cost implications for the certified parties SECIFA and SADSTIA. As a result, the proposed change in the sectoral allocation raises the following questions for P2 conditions and actions

1. Will the additional catch of longline hake increase the **catch of**/**impact on** ETP species compared to the status quo?
2. If yes to the above, will this impose a greater onus on SECIFA/SADSTIA to satisfy revised and more onerous MSC conditions w.r.t. to their **catch of**/**impact on** ETP species?
3. If the answer to (2) above is no at the present time, considering the ongoing revision of the MSC standard under pressure from 'conservation lobby groups', is (2) likely to be yes for the next certification cycle for South African hake trawl or a successive certification cycle.
4. Could any of the above impact negatively on the outcome of forthcoming audits,

Appendix I summarises the list of ETP species drawn up by Weston and Atwood (2017) for the inshore and offshore trawl sectors and for the longline sector using a definition of ETP considered to be relevant to the South African hake trawl certification at that time. Their work did not address seabird species and considered only teleost, chondrichthyan, mammal or turtle species. For longline catches, they identified three thresher shark species and elf as ETP species which are impacted by the gear. None of these four species are at risk from either inshore or offshore trawl gear. With respect to teleost, chondrichthyan, mammal or turtle species, the answer to (1) above would appear to be yes for the four species listed. However, since these species are not at risk to trawl gear, the answer to question (2) is apparently no.

The definition of an ETP species that the MSC requires SECIFA/SADSTIA to consider as relevant to the ETP P2 conditions and action plans has been analysed in more detail following the work by Weston and Atwood (2017). Appendix I provides the latest short list of all ETP species that must now be considered. This list includes seabird species.

3.8.4 Seabird ETP species

Existing P2 ETP conditions have been determined to be relevant to the list of seabird species contained in Table 12.

Table 12. A list of ETP seabird species that have been assessed as ETP species from the point of view of the MSC certification of South African hake trawl and to which the conditions and actions in Appendix E apply.

Species name	Common name
Thalassarche carteri	Indian Yellow-nosed albatross
Thalassarche chlororhynchos	Atlantic Yellow-nosed Albatross
Thalassarche steadi	White-capped albatross
Morus capensis	Cape gannet
Calonectris borealis	Cory's shearwater
Diomedea exulans	Wandering albatross
Diomedea dabbenena	Tristan albatross
Diomedea epomophora	Southern royal albatross
Spheniscus demersus	African penguin
Diomedea epomophora	Northern royal albatross

The question then is whether impacts in the hake longline fishery, and increased impacts as a result of additional hake longline catch, could have an effect which leads to new and/or more burdensome conditions being raised for SECIFA and SADSTIA w.r.t. seabirds.

At present the seabird ETP issue is settled for offshore trawl (not an issue of concern nor one that the MSC requires further assurances about), but further work is required for the species listed in Table 12 for the inshore trawl sector.

As regards the impact of the hake longline sector on seabirds, a number of operational modifications appear to have eliminated the once considerable threat of hake longlining in South Africa to seabirds. These include the use of bird scaring devices, faster sinking rates due to heavier sinkers, line setting at night and the installation of offal management devices on all vessels (Nyengera and Angel, 2019). The best estimate available to this study is Ngcongo (2015), cited in Nyengera and Angel (2019), who reports a death rate of 0.0017 per 1000 hooks, - these deaths were for white-chinned petrels only which are not included in Table 12. Appendix B estimates the total annual mortality from this to be in the order of 60 birds per annum which is not a concern for the white chinned petrel population.

4 Observer coverage in hake longline vs offshore trawl Compliance and

4.1 Observers, bycatch and ETP species

Much of the available information that reflects favourably on the longline sector with respect to low impacts on seabirds and the implementation of measures which have brought this about assume, as for all other hake sectors, that these practices are verified by observers. SAHLLA have made commitments to an observer programme[15]. The available information from observer trips should be reviewed to get an updated picture of the situation. It would also be prudent to update the work of Weston and Atwood (2017) to verify what the situation is in the contemporary hake longline fishery, to seek assurance that there have not been any changes which might raise red flags such as an increase in the kingklip content of hake longline catches, or whether the situation regarding ETP species impacts has changed.

[15] "The at-sea observer program is an integral component of SAHLLA's pursuit to validate itself as a commercially viable sustainable fishing sector in South Africa. Challenges were experienced during 2020 as a result of COVID and further aggravated by a Nation-Wide strike which took place towards the end of 2020 and continued through to March of 2021. The program's objectives were to provide information on the length-frequency of hake catches, the catch composition (including non-target species and discards), interactions with ETP species (emphasis on marine mammals), monitoring the use of bird-bycatch mitigation measures, support for scientific determination of updated bycatch species conversion factors, and possible comparison of current and historical observer data" Japp and Droste (2021).

4.2 Compliance

There are a large number of rights holders in the hake longline fishery, in the order of three times more than in the offshore trawl sector. Compliance operates at the level of rights holders, and so depending on what DFFE's intentions are, whether to introduce new rights holders or whether to increase the allocations to existing rights holder there might be an increase compliance costs for hake in general.

5 Discussion

The economic analysis presented here is based on a comparison of the economic and employment creation performance of three representative vertically integrated fresh fish vessel operations, with a single well developed longlining vessel and operation. The comparison is a worst-case scenario because the longline operation is well developed in relation to the hake longline sector overall, and its value addition and associated employment creation potential has been realized to a greater extent than the rest of the hake longline sector[16]. The reason the comparison has been made with three fresh fish vessel operations is that

(a) Two of these operations are part of larger fishing companies which also operate freezer vessels. It is clear to these operators that should the proposed change to the sector allocation (from offshore trawl to longline) take place, that the cuts to fishing activity and employment will have to take place in their fresh fish divisions, and not for freezer vessels.
(b) These three operations represent more than 75% of fresh fish catches made in the offshore sector.

The most important comparisons summarised in Table 1 are the employment creation realized per 1000 quota tons whole weight, the investment in assets per quota 1000 quota tons whole weight, and the revenue generated per kg whole weight of hake caught. The final quantities expressed on this basis are given in (Table 13).

Table 13. Summary of the economic comparison between fresh fish offshore trawl operations and hake longlining operations

	Fresh Fish Offshore Trawl	Hake Longlining
Direct + Indirect employment created per 1000 ton catch processed	**136.9**	**52.7**
Investment in assets per 1000t quota tons	**R105,310,000**	**R15,543,000**
Revenue generation per kg whole weight hake caught and processed	**R55.76**	**R41.51**

These numbers reflect the larger employment creation capability of fresh fish offshore trawl operations, and their larger revenue generation performance, compared to hake longlining. The investment backing up these key performance indicators (per 1000 quota tons) is roughly seven times larger for fresh fish operations than for hake longlining operations.

[16] And represents the ideal that the sector is moving towards.

The draft policy on sectoral allocations (Government Gazette, 2021a) implies the transfer of 4553 MT of hake quota previously assigned to the offshore trawl sector, and the fresh fish component of that sector, to the hake longline sector, using the 2022 TAC of 132 154 MT. Given the numbers in Table 13, the implications for employment can be calculated, applying these economic factors to this quantum of 4553 MT. These are the following:

- Jobs lost from offshore trawl sector: 623
- Jobs gained by hake longline sector: 240
- Net loss of jobs in the South African hake fishery as a whole (direct and indirect as defined in Table 1): 383.

For total revenue generated, the impact is estimated to be:

- Revenue lost from the offshore trawl sector: R253,857,000
- Revenue gained by the hake longline sector: R188,979,000
- Net loss of revenue in the South African hake fishery: R64,878,000.

In addition, assigning investment to 4553 MT pro rata to total investment against quota tons, R479,476,000 worth of assets in the offshore trawl sector would be unutilised, or stranded, or sold, whereas additional investments required in the longline sector will be, on the same basis, R70,760,000. The offshore trawl sector's investment of roughly R479 million which would be placed at risk by the contemplated shift of TAC to the hake longline fishery dwarfs the total value of investments in the hake longline sector, given as R 200 million in the Draft Policy on the Allocation and Management of Commercial Fishing Rights in the Hake Longline Fishery of September 2021 (see page 74 of Government Gazette, 2021b).

These estimates and consequences are based on an economic analysis that has excluded multiplier effects on revenue generation and supplier activity with regard to employment creation other than sales and merchandising. Both of these are substantial (a typical multiplier for total economic contribution by the fishing sector is 1.6), and this qualification should be considered in assessing the overall impacts. It is likely therefore that the net impact given above is a conservative estimate.

The history of demersal longlining is that it was initially targeted at kingklip, then shifted to targeting hake on rocky untrawlable fishing grounds. Within the first decade of the transition to focussing on hake, catch rates had declined dramatically. The most recent information about the fishery available publicly is that hake longline operations are competing directly with trawlers in the hake trawl footprint. Given the potential for conflict that this creates, SAHLLA and SADSTIA have signed a code of conduct which contains the following provision, viz. "If another vessel is already about to deploy its gear or already fishing the later vessel must immediately select another area and repeat the process". The implications are that trawlers will at times have to choose an alternative fishing location and forfeit the opportunity to fish along their preferred path. This must lead to instances in which the trawl CPUE is suboptimal. The consequence of this is that the trawl CPUE in its entirety will be less than it would have been in the absence of longline gear set in traditional trawl grounds. In the short term this has two negative impacts on the offshore trawl sector, viz. that lower offshore trawl CPUE levels (a) increase fishing costs and (b) reduce the TAC calculated from the OMP formula[17]. It may be possible to develop mathematical models of the interactions between longline and trawl gear, using all available historical data about the time and positions of longline and trawl gear to provide some insight into the likely scale of the impact. These analyses are ambitious and would take some time. But such investigations and objective analyses are really the only option for estimating the costs that are being incurred by the offshore trawl sector. Similar analyses have been conducted to estimate the costs of the exclusion of small pelagic fishing close to penguin breeding colonies, and the methods deployed there could provide an initial framework for these analyses.

The socio-economic comparisons, expressed as they are in terms of quota tons, assume that the benefit of 1 quota ton will be fully realized. This cannot be correct if all allocated quota tons are not fully utilised. In considering the merits of the proposed reallocation from longline to offshore trawl, the levels of utilisation in each sector must be calculated. Estimates of the socio-economic benefits per quota ton should be scaled down by the actual % of quota tons landed. The data easily available for this are the data used in the scientific process for hake stock assessments. Examination of these data shows some anomalies. For example, we know that the data used in scientific deliberations and for hake stock assessments has not correctly assigned trawl catches to the inshore trawl sector, and has therefore produced a very skewed and negative impression of utilisation in the inshore sector in the last two years. It seems that a large part of this discrepancy is caused by catches that are the result of inshore quota allocations being assigned to the offshore trawl sector. There are other complicating factors. But overall this means that utilisation at the level of inshore + offshore trawl is a more reliable measure of utilisation in the trawl sector, than viewing inshore and offshore separately. The utilisation of longline allocation has, using the same 'stock assessment' data, been very low in the last two years, in the region of 50-60%. The reasons for this need to be investigated – there are important discrepancies between the estimates cited here and some of the catch and allocation values reported by Japp and Droste (2021). This suggests that as with the inshore trawl sector, there may be data recording issues with hake longline as well[18] If not, what are the reasons, and is the situation temporary or likely to continue in the future. If persistent then one cannot expect to realize the full benefits of a quota ton allocated to longline. If the utilisation is, say 70% instead of 100%, but trawl utilisation is 100%, then the exchange of 4553 MT from the offshore trawl sector to the longline sector would have the following impacts (refer again to Table 13):

- Jobs lost from offshore trawl sector: 623
- Jobs gained by hake longline sector: 240 x 0.7 = 168
- Net loss of jobs in the South African hake fishery as a whole (direct and indirect as defined in Table 1): 455 (was 383 assume 100% longline utilisation).

For total revenue generated, the impact is estimated to be:

- Revenue lost from the offshore trawl sector: R253,857,000
- Revenue gained by the hake longline sector: R188,979,000 x 0.7 = R132,285,000
- Net loss of revenue in the South African hake fishery: R121,572,000 (was R64,878,000 assuming 100% longline utilisation).

[17] As a result of the lower TACs, the CPUE is expected to increase in the long terms – but in the short term both costs (a) and (b) are incurred by the offshore trawl sector.
[18] There are discrepancies between the utilization %s calculated here and those that are obtained used catches recorded in Japp and Droste (2021) which need to be resolved

For various reasons it is important to get a picture of the scale of hake longline effort. It is a concern that effort levels may recently have escalated to compensate for possible continued declines in CPUE[19]. With the available data (based on Japp and Droste, 2021) the following picture emerges of the scale of the hake longline fishing operation:

- 45 vessels – Government Gazette (2021b), pp 69,notes "It is notable in this context that a recent socio-economic study of the sector showed that 64% of the vessels in the longline fleet are forced to operate in other sectors as well (primarily tuna pole and pelagic longline),
- 36 million hooks deployed per year, some 10% of which are lost annually, i.e. perhaps 3.6 million hooks lost annually, between 8% and 18% of hooks that are retrieved contain hake. About 40% of the hooks come up clean. 0.8% show clear evidence of depredation of hake on the hook.
- 56438 km of line set each year, and between 155 km of line set per calendar day.

The effort figures just mentioned have a bearing on estimates of the scale of wastage of hake either lost off the longline gear during hauling operations, or depredated from hooks between the start of setting and the end of hauling. Some attempt to estimate these amounts should be made to determine whether they are material and of concern, or can continue to be regarded as insignificant as at present.

The issue of resource sustainability and how this might be impacted by a larger proportion of longline catch depends on whether the rate of natural mortality is faster than the compensatory effects of hake growth. In recent years the natural mortality of hakes has been re-estimated using stock assessment models which describe inter and intra-species predation in the hake population complex. These revised estimates of natural mortality have been incorporated into the hake reference case assessment model. Here we used the reference case stock assessment model to run some projections under the same constant catch levels, comparing the status quo policy on sectoral allocation (Option 1) with the draft policy which shifts some allocation towards the longline sector (Option 2). We find that over time the spawning biomass for Option 2 is somewhat reduced compared to Option 1 by ~ 4% for ***M. paradox***us, and by 1-2% for ***M. capensis***. These results do not on their own indicate a serious resource sustainability concern, but they do need to be viewed with a degree of caution because the hake reference case model does not include any hake longline CPUE data, and the most recent catch-at-length data for longlining used by the stock assessment model is from 2010. The DSWG is working to rectify this situation but this cannot be done in time to provide quantitative input on the implication of a change in sectoral allocations for January 2022, and would more sensibly form part of work during 2022 to revise the hake OMP. Furthermore, there are features in the hake reference case model, viz. trends in model calculated CPUE, which are in conflict with the available longline CPUE data (the assessment model is more optimistic), which further adds to the need to proceed cautiously.

Weston and Atwood (2017) report the species breakdown of catches in the offshore, inshore and hake longline fisheries. This is summarised here in Table 11. These data suggest that hake longline catches a higher % of its hake catch as ***M. paradoxus*** than does the offshore trawl fishery. Monkfish does not feature in hake longline catches. The % of kingklip caught by hake longline gear reported by Weston and Atwood (2017) is 3.1 %[20]. SADSTIA manages the allowance for kingklip catches by members on the assumption that the incidental catch of kingklip is 1.5%, and then distributes additional allowances to operators based on

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[19] We can't be sure because recent hake longline CPUE data have not been tabled at Demersal Scientific Working Group meetings

[20] Japp and Droste (2021) report, citing SANBI (2017 – reference not given) that non-hake bycatch comprises about 3.63% of the hake catch in the hake longline fishery, and of this 68.02% is kingklip. This suggests therefore a lower figure of 0.6802 x 3.63 = 2.47% of the hake catch is kingklip, although an interpretation of Table 15 of Japp and Droste (2021) suggests a higher figure of 3.4%. Clearly some work is required to clear up these discrepancies and explain the differences in different sources w.r.t. the kingklip bycatch %.

their historical kingklip performance, such that the sum of all allowances is equal to the kingklip PUCL. The results in Weston and Atwood (2017) indicate that kingklip is 3.5% of the hake catch. Calculations in this document suggest that under the proposed reallocation of hake TAC 141 MT of kingklip catch could be gained by the hake longline sector and 135 MT which could be lost by the offshore trawl sector, but that there is a portion of the 135 MT that could be potentially claimed by offshore trawl rights holders who have a historical claim to this amount. These matters need resolution in the event of a reallocation of hake from the offshore sector to the hake longline sector.

The draft sectoral allocation change has implications for the MSC certification of South African hake trawl. The value of this certification was estimated by Lallemand et al (2016) to be in the order of 35% of the revenue generated in the hake trawl sector – this value is well in excess of R 1 billion given the total sales value of the offshore trawl sector in excess of R 4 billion. Maintenance of MSC certification is therefore paramount for the South African fishing sector. The loss of this certification will have a profound impact on prices and access to markets, not only for hake trawl sectors, but for other sectors of the South African fishing industry as well (again, see Lallemand et al, 2016). The attainment and maintenance of MSC certification is a complex process involving a plethora of rules and regulations, and significant costs. Experience has shown that over the years the MSC requirements have become increasingly challenging and costly. In particular, the most recent round of evaluations and recertification were more complex than usual because a new MSC standard was applied (v2.01), containing new requirements regarding shared stocks, ETP species and Habitats. Deliberations were very complex and arrived at a finely balanced but successful result. This was due in large part to the demonstrated robustness of the hake stock assessment model[21] and OMP to the possibility[22] that the ***M. paradoxus*** resource is shared between South Africa and Namibia (Butterworth and Ross-Gillespie, 2020a,b). As things stand now, SECIFA/SADSTIA, the certified parties, could potential close out all P1 and P3 conditions much earlier than the 4 years permitted, which would provide some much-needed assurance to the industry. The proposed sectoral allocation changes are however a new development which was not included in the hake stock assessment model and the consequent projections underpinning the OMP, which was finalized in 2018. Given the MSC's procedures, SADSTIA and SECIFA would have to inform the MSC about a change to these sectoral allocations at the next audit of the industry schedules for February 2022, should those have been enacted. At that time, in order to avoid revisiting a very complex and finely balanced set of P1 and P3 conditions and associated action plans, at minimum, it would be necessary to also provide a demonstration that under these new circumstances, the stock assessment model/OMP remain robust in general, and in particular with regard to the possibility of stock sharing. Logically, since the hake OMP will be revised during 2022, this work needs to be conducted as part of that revision process. It is suggested here that it is not practicable to attempt such in time for the MSC CAB's audit in February 2022, since it is likely that demonstration of the robustness referred to would require that the development process of the existing OMP in 2018 would have to be revisited. This is not feasible by February 2022.

It is also necessary to revisit the P2 conditions and action plans to see what, if any, knock-on effects may arise for MSC terms of certification for SADSTIA and SECIFA. Although superficially these may appear to only involve ETP species, there is the possibility that conditions are raised for 'primary' and 'secondary' species for which no conditions were raised at the recertification of the fishery (see Appendices D-G and Lloyd's Register, 2021). Analysis of the ETP impacts made by the longline sector should be tempered by the fact that hake longline is not an MSC certified fishery, and impacts on ETP species made by that sector are not required to be accounted for by South African trawl. Having said that, the available scientific information (Weston and Atwood, 2017) suggests that there is no overlap between the non-seabird species

[21] After some modification to account for biomass indices and catches in Namibia.
[22] The genetic data indicate that this is a possibility, but that demographic separation between the two remain also a possibility

that are ETP and impacted by hake longline, and those for offshore and inshore trawl. Furthermore, there is no evidence available that suggests that any impact on seabird species by longline is a concern nor that these species overlap with those impacted by the inshore and offshore trawl sectors. Finally, there is little reason to expect that additional concerns or conditions might be raised for primary and secondary species stemming from the proposed sectoral re-allocation of hake TAC.

6 Conclusions

In making any decision regarding the allocation of TAC to the hake longline sector fishery the Minister must adhere to the objectives and principles in section 2 of the MLRA, which require, inter alia, that consideration be given to the need "to achieve optimum utilisation and ecologically sustainable development" and the need to "achieve economic growth and human resource development". The economic information provided here shows that an increase in the allocation to the hake longline sector by reducing the apportionment to offshore trawl will result in a net reduction in the revenue and employment contribution by the South African hake resource and its fisheries and would therefore not be a rational course of action.

In addition, this study has highlighted a number of important steps that must be taken to further inform an appreciation of an impact of such a sectoral allocation change. These are

- Impact on the MSC certification of South African hake trawl, and the cost of associated modified conditions and actions plans
- Consideration of the scale of longline effort and the likely scale of the induced wastage due to depredation and fish lost off hooks dead.
- The present spatial overlap between longline and offshore trawl fishing activity and the consequential impact on the offshore trawl CPUE as a result of avoidance of longline gear
- To quantify the level of utilization in the hake longline sector, and the extent to which poor utilization in that sector would exacerbate the losses of employment, revenue generation and investment that would follow the sectoral reallocation proposed in the draft policy of September 2021
- The reliability of stock assessments and OMP trials given that crucial data on hake longline catch-at-lengths and CPUE levels have not been taken into consideration.

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8 Appendix A. Constant catch projections with two different sectoral allocation options

The reference case stock assessment model described in Rademeyer et al (2019) and Ross-Gillespie and Butterworth (2021) was used as the basis of the forecasts. The forecasting equations that were used are a simple forward application of the dynamic equations that are used in the stock assessment model for recreating the historical dynamics. With this approach it is necessary to disaggregate the catch to the level of fleet, coast and species or in the case of longline, gender as well. The fleet level breakdown of the constant catch is specified in Table 10. Two different methods were used for the further coast, species and gender aspects. These were a “fixed catch proportion method” and a ‘fixed fishing mortality ratio method”.

With the “fixed catch proportion method” all catch splits within each fleet for 2021 were used for the % splits within the fleet by coast, species and gender for the forecasts. The splits between fleet catch totals were however governed by the sectoral breakdowns as given in Table 10.

For the “fixed fishing mortality ratio method”, the catch splits within each fleet were determined such that the ratio of the fishing mortality scaling parameters between species and genders was held constant at the their 2021 values. Again, the splits between fleet catch totals were governed by the sectoral % breakdowns given in Table 10.

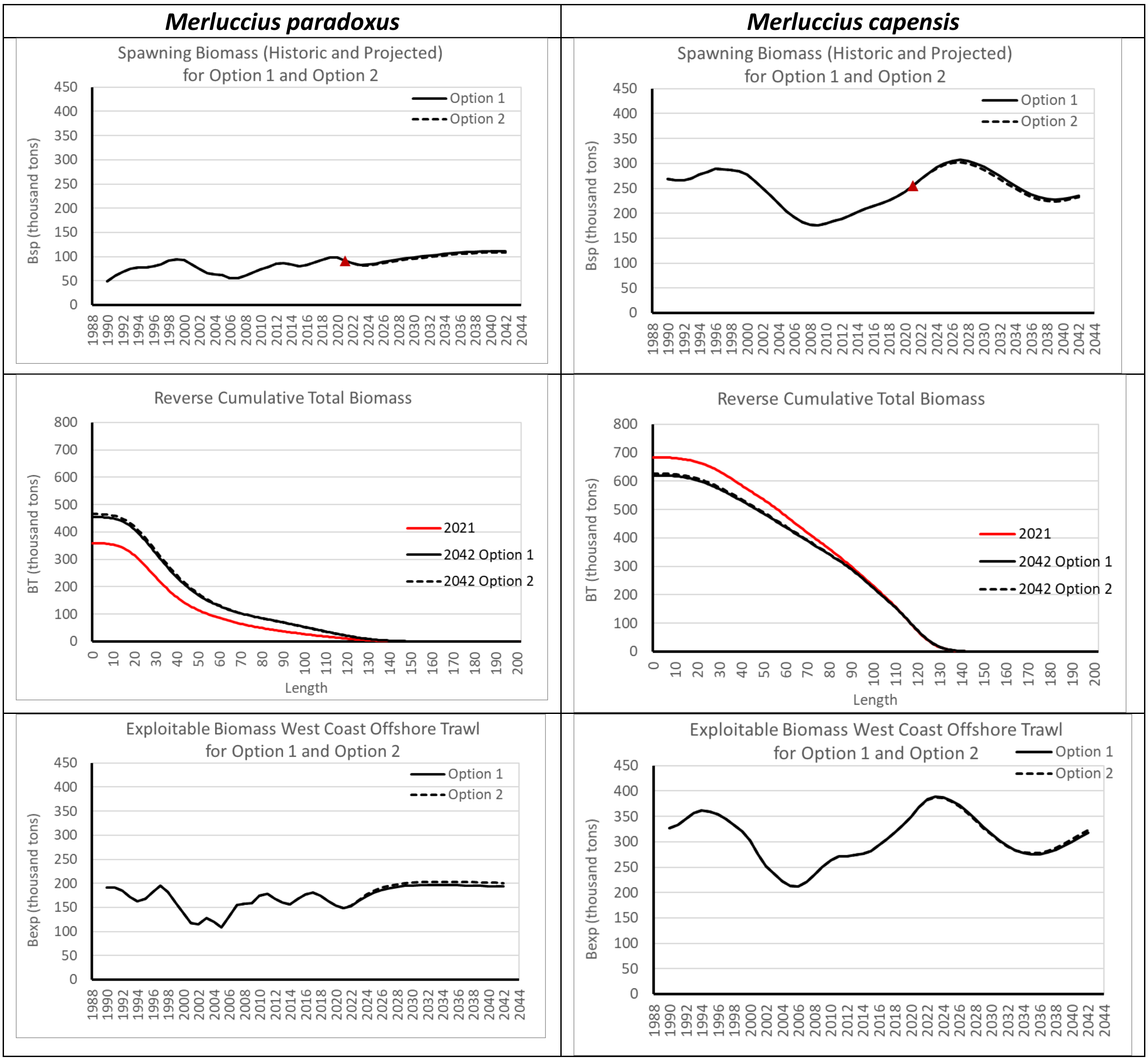


Figure 7. Projections under a constant catch of 140 000 MT, using the Option 1 and Option 2 sectoral allocations given in Table 10, and applying the 'fixed catch proportion method". The top two panels provide spawning biomass projections, the middle two panels give the cumulative biomass over hake lengths, in reverse order, and the last two panels plots the exploitable biomass on the West Coast for the offshore trawling fleet

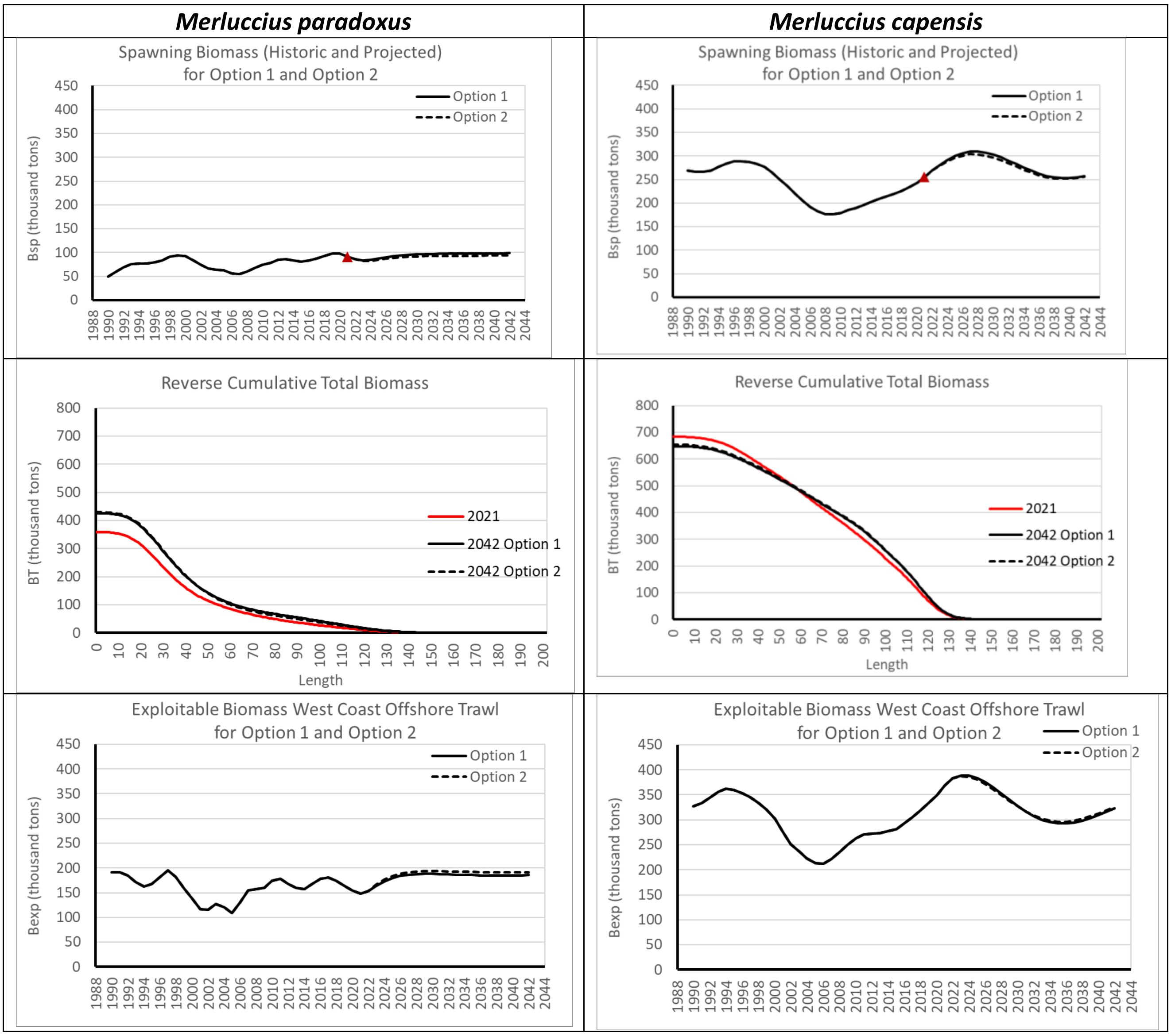


Figure 8. Projections under a constant catch of 140 000 MT, using the Option 1 and Option 2 sectoral allocations given in Table 10, and applying the 'fixed fishing mortality ratio method". The top two panels provide spawning biomass projections, the middle two panels give the cumulative biomass over hake lengths, in reverse order, and the last two panels plot the exploitable biomass on the West Coast for the offshore trawling fleet

Table 14. Ratios of spawning biomass and exploitable biomass, 2007/2002 and 2036/2021, for M. paradoxus and M. capensis, sectoral allocation Options 1 vs Option 2, and using either the "fixed catch proportion method" or the fixed fishing mortality ratio method". The projections are based on the Reference Case stock assessment model for hake.

		M. paradoxus biomass ratios									
		Option 1 (Status quo)					Option 2 (Transfer to Longline)				
		Spawning biomass	Bexp: Exploitable biomass				Spawning biomass	Bexp: Exploitable biomass			
		Bsp	WC Offshore	SC Offshore	WC Longline	SC Longline	Bsp	WC Offshore	SC Offshore	WC Longline	SC Longline
Fixed Catch P	2007/2002	0.74	1.35	1.05	0.72	1.02	0.74	1.35	1.05	0.72	1.02
Fixed F Ratio	2007/2002	0.74	1.35	1.05	0.72	1.02	0.74	1.35	1.05	0.72	1.02
Fixed Catch P	2036/2021	1.19	1.32	1.51	1.34	1.44	1.15	1.37	1.58	1.41	1.53
Fixed F Ratio	2036/2021	1.07	1.25	1.35	1.14	1.25	1.02	1.29	1.39	1.18	1.32

		M. capensis biomass ratios									
		Option 1 (Status quo)					Option 2 (Transfer to Longline)				
		Spawning biomass	Bexp: Exploitable biomass				Spawning biomass	Bexp: Exploitable biomass			
		Bsp	WC Offshore	SC Offshore	WC Longline	SC Longline	Bsp	WC Offshore	SC Offshore	WC Longline	SC Longline
Fixed Catch P	2007/2002	0.73	0.88	0.88	0.95	0.98	0.73	0.88	0.88	0.95	0.98
Fixed F Ratio	2007/2002	0.73	0.88	0.88	0.95	0.98	0.73	0.88	0.88	0.95	0.98
Fixed Catch P	2036/2021	0.93	0.75	0.75	0.62	0.63	0.91	0.76	0.76	0.64	0.64
Fixed F Ratio	2036/2021	1.03	0.79	0.79	0.65	0.65	1.02	0.80	0.80	0.67	0.66

9 Appendix B. Longline effort levels: Hooks, pots, sets and vessels. Implied seabird deaths and # full time hake longline vessels.

Table 15. Calculation of the mortality of white chinned petrels and full time operational hake longline vessels in the hake longline fishery based on input values provided by either Greenstone et al (2016) or Japp (2007).

	Greenstone et al(2016)		Japp (2007)			
	Quantities	Formula	Quantities	Formula	Quantities	Formula
			Effort based calculation		CPUE based calculation	
Illustrative hake catch MT	8310.6	W	8310.6	Z		
# hooks / pot	n/a		114	A		
kg hake/pot (Japp)	n/a		15.70	B		
#hake / pot	n/a		6.54	B/C		
average fish whole wt (kg)	2.40	C	2.40	C		
# hake caught	3462750	1000W/C	3462750	1000Z/C		
proportion of hooks with fish	0.208	U	n/a			
proportion of fish caught that are hake	0.900	V	n/a			
proportion of hooks with hake	0.188	U x V	0.057	B/C/A		
# hooks used per annum	18462092	UV1000W/C	36936000	12F x A x G	60344484	H = (1000Z/C) / (B/C/A)
White chinned petrels killed / 1000 hooks	0.0017	Y	0.0017	D		
White chinned petrels killed / year	31.39	YUV1000W/C	62.79	12 FAGD		
kg / 1000 hooks	n/a		225	E		
# pots / vessel / set	n/a		90	F		
# hooks / set	n/a		10260	F x A		
# sets / month	n/a		300	G	490	H/(F x A)/12
# sets / year	n/a		3600	12G	5882	H/(F x A)
# fishing days per year	n/a		197	H		
# full time vessels / year	n/a		18	12G/H	30	
# full time vessels / year	25	J	25	J		

Table 16. The source of the various input quantities which are used (as shown in red) in Table 15. The linking letters used in Table 15 are also shown here.

Linking letter	Input Quantity Description	Input Quantity Value	Source of Value
A	# hooks / pot	114	As recommended in the middle of page 9 of Japp (2007)
B	kg hake/pot (Japp)	15.70	Top panel of Figure 8 of Japp (2007)
C	average fish whole wt (kg)	2.40	Rough estimate by the author based on the hake reference case stock assessment model
U	proportion of hooks with fish	0.208	Figure 5 of Greenstone et al (2016)
V	proportion of fish caught that are hake	0.900	Assumption by author roughly based on the % of longline catch that comprises hakes
Y	White chinned petrels killed/hook	0.0017	Mentioned at the bottom of page 11 of Greenstone et al (2016)
E	kg / 1000 hooks	225	Rough inference of value for 2006 from the top RH panel of Figure 9 of Japp (2007)
F	# pots / vessel / set	90	Rough inference of value for the main cluster of vessels in Figure 6 of Japp (2007)
G	# sets / month	300	Roughly inferred from the middle panel of Figure 4 of Japp (2007)
H	# fishing days per year	197	Given in Table 3 of Japp (2007)
J	# vessels	25	Nyengera and Angel, 2019. Page 2: "In 2018 there were 134 rights holders and 40 registered vessels, of which 25 were active (Clyde Bodenham pers. Comm.)".

10 Appendix C. Longline CPUE trends circa 2016

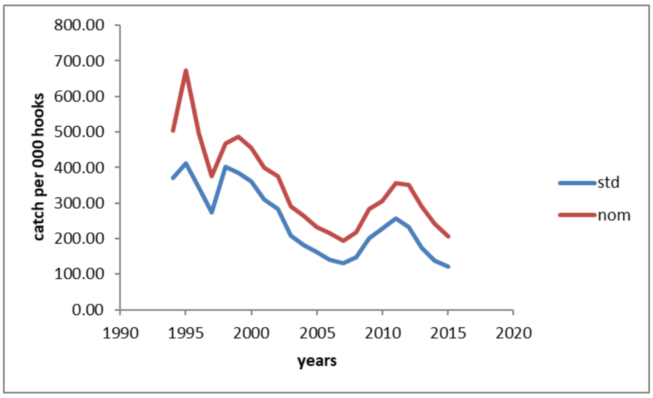


Figure 9. Nominal and standardised CPUE for hake all coasts and for both species combined (source: Somhlaba et al, 2016).

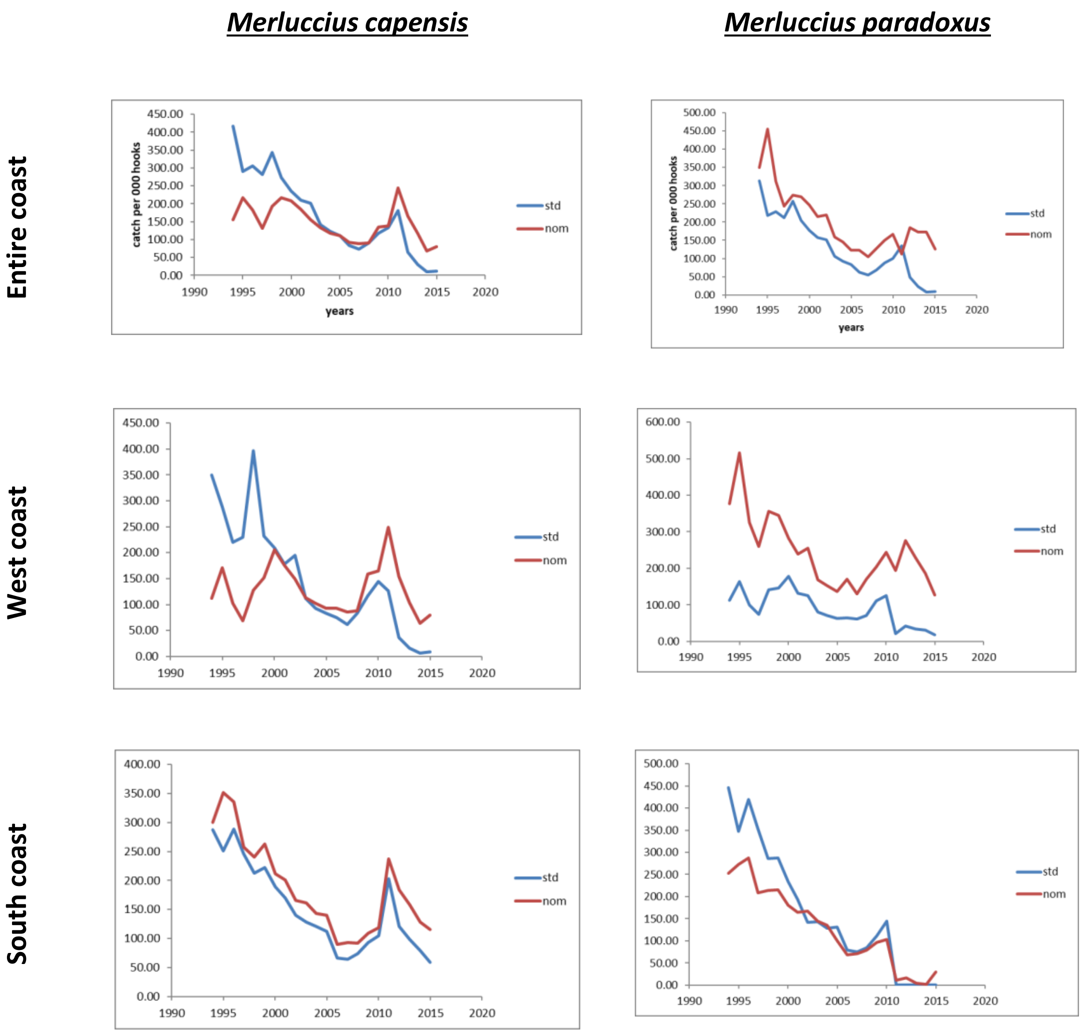


Figure 10. CPUE trends in the hake longline fishery based on Somhlaba et al (2016). Units: kg / '000 Hooks ((source: Somhlaba et al, 2016)).

11 Appendix D. P1: MSC Condition 1 and associated Client Action Plans ("Assessment of Stock Status - M. paradoxus")

11.1 Condition

Evidence shall be presented to show that here is an adequate assessment of the stock status that:

a) Is appropriate for both the stock assessment and for the harvest control rule;

b) Estimates stock status relative to reference points that are appropriate to the stock; and can be estimated

11.2 Milestones

Year 1 (2021): A proposal shall be presented for reviewing and if necessary, updating the current national assessments of the *M. paradoxus* stock carried out by South Africa and Namibia in the context of points (a) and (b) of the condition.

Year 2 (2022): Results of the review of the stock assessments shall be presented. This should:

a) Consider whether the existing national stock assessments are able to meet the requirements of parts (a)-(b) of this condition;

b) Whether a revised stock assessment (or stock assessments) are needed in order to meet the requirements of parts (a)-(b) of the condition; and

c) Propose new stock assessment(s) that will meet parts (a)-(b) of the condition if these are considered necessary.

Year 3 (2023): Evidence shall be presented to show that, if necessary, revised stock assessment(s) are being carried out for the *M. paradoxus* stock.

Year 4 (2024): Evidence shall be presented to show that the stock assessment(s) meet the requirements of parts (a)-(b) of the condition.

(Note that if the Year 4 milestone is achieved earlier in the certification cycle it may be possible to re-score this PI and close this condition sooner than anticipated).

11.3 Client Action Plan

Summary of action plan: Following the advice given by the 2019 IWS Panel, Butterworth and Ross-Gillespie (2020a) include estimated historical catches of *M. paradoxus* off Namibia in the South African hake Reference Case model to provide an assessment of this species for the extreme scenario of demographic panmixia of *M. paradoxus* throughout the SA and Namibian regions. Results in Butterworth and Ross-Gillespie (2020b) imply that performance of SA hake OMP2018 will not be jeopardised in terms of resource conservation under this scenario, so that these results remain compatible with the reference points implicit in OMP2018. These two documents have been internationally reviewed and endorsed by Punt (2020) and Wilberg (2020).

However, in reviewing Butterworth and Ross-Gillespie (2020a), Punt (2020) included the comments: "The results should be interpreted with caution because it includes no abundance index data for a large portion of the range. Nevertheless, the conclusion that stock status is more optimistic [than for *M. paradoxus* as assessed for South Africa alone] follows from the assumptions made and the differences in the time-trajectories of historical catch." The CAB has indicated that the absence of such abundance index data from the analyses of Butterworth and Ross-Gillespie (2020a) is the reason for the score under this Indicator being less than 80.

The only hake abundance indices available for the region off Namibia (the "portion of the range" referenced by Punt, 2020) which is disaggregated by species so as to be able to provide the information on *M. paradoxus* indicated to be required to be included is that from surveys (see e.g. Kathena *et al*., 2016) and CPUE (Kathena *et al*., 2018). However, the latter will be included only as a sensitivity, given the comments by (Kathena *et al*., 2018) that: "such CPUE data should not be used for stock-size assessments and fisheries advice concerning northern Benguela hakes until this [problem of spatial coverage issues] is solved". The analyses of Butterworth and Ross-Gillespie (2020a) will be extended to include this information to address the concern raised by Punt (2020) and subsequently the CAB.

Action: Extend the assessment of *M. paradoxus* of Butterworth and Ross-Gillespie (2020a) for the scenario of a demographically panmictic stock off both South Africa and Namibia to meet the remaining requirement for inclusion abundance index data for this species off Namibia

Expected results: Assessment for scenario of a demographically panmictic stock off South Africa and Namibia

12 Appendix E. P2: MSC Conditions 2-7 and associated Client Action Plans ("ETP species")

This section provides a summary of the applicable conditions for ETP species, and the client actions plans.

12.1 Conditions

12.1.1 Conditions numbers 2&3

By the fourth surveillance audit, information shall be gathered such that the direct effects of the UoA are shown to be highly unlikely to hinder recovery of ETP species, by quantitatively estimating the nature and extent of interactions and/or captures, or by reducing the susceptibility of the ETP species currently assessed as "Medium" risk in the Risk Based Framework such that "Low" risk is attained. Note that for the following species, addressing susceptibility will not reduce the assessed risk to Low in the Risk Based Framework: Loggerhead turtle, Sixgill sawshark.

Year 1 (2021): A plan has been developed that is reasonably expected to be effective in collecting the information needed to address the condition.

Years 2-3 (2022-2023): Information collection takes place in accordance with the plan developed in Year 1, and the plan is still reasonably expected to be effective in collecting the information needed to address the condition. If newly available information has shown that the plan can no longer reasonably be expected to be effective in collecting the information needed to address the condition, the plan has been reviewed as appropriate to address the condition.

Year 4 (2024): Information collection and analysis concluded, and findings confirm that direct effects of the UoA are highly likely to not hinder recovery of ETP species.

12.1.2 Conditions numbers 4&5

By the fourth surveillance audit, management strategies shall be developed and implemented to ensure the UoA does not hinder the recovery of ETP species.

Year 1 (2021): A plan has been formulated for the development of a strategy/strategies to ensure the UoA does not hinder the recovery of ETP species. Among other appropriate content relating to the development of the strategy/strategies, the plan will: set out how the strategy will address ETP impacts resulting from the activities of UoA vessels, including smaller vessels (i.e., those characterised as "inshore"), identify mechanisms by which fishing practices may be modified in light of unacceptable impacts on ETP subcomponents.

Year 2 (2022): The plan developed in Year 1 is in place.

Year 3 (2023): Strategies are completed and being implemented.

Year 4 (2024): Strategies are in place, to ensure the UoA does not hinder the recovery of ETP species.

12.1.3 Conditions numbers 6&7

By the fourth surveillance audit: quantitative information is available on the UoA related mortality and impact on Cape fur seals, and it can be determined whether the UoA may be a threat to protection and recovery of this species; and adequate information on ETP species shall be available such that trends can be measured and strategies supported, to manage impacts of the fishery on ETP species.

Year 1 (2021): A plan shall be developed: to collect quantitative information on the UoA related mortality and impact on Cape fur seals (including in relation to impacts on protection and recovery); and, for the collection of information on ETP which will enable trends to be measured and strategies to be supported, in due course.

Year 2-3 (2022-2023): Information collection is undertaken in accordance with the plan developed in Year 1, and the plan is still reasonably expected to be effective in collecting the information needed to address the condition. If newly available information has shown that the plan can no longer reasonably be expected to be effective in collecting the information needed to address the condition, the plan has been reviewed as appropriate to address the condition.

Year 4 (2024): The adequacy of information is demonstrated: with quantitative information characterising the UoA related mortality and impact on Cape fur seals and enabling a determination of whether the UoA may be a threat to protection and recovery of this species, to measure trends and support strategies to manage impacts on ETP species.

12.2 Client Action Plans and Client Actions

SADSTIA and **SECIFA** have drafted client action plans to respond to Conditions 3-8. The following highlights the salient actions in the CAPs and identifies which of these are impacted by the work reported in this document (in blue and red in the following sections).

12.2.1 Actions in response to Conditions 2&3

1. Determine observer coverage required to enhance collection of information to levels sufficient to confirm with reasonable probability that unsustainable thresholds are not breached for ETP species as a result of interactions with the fishery.
2. Initiate such information collection.

1. Initiate modelling study to quantitatively estimate 'acceptable mortality' and status (where possible) of ETP species. (This document, seabirds in inshore trawl fishery only)

3. Set up a SADSTIA ETP Management Committee that operates alongside the existing VME MC
4. Affirm BLSA-MSC bycatch mitigation project and encourage participation by inshore fleet vessels.
5. Continue information collection.

2. Estimate of 'acceptable mortality' of ETP species calculated and review of results undertaken. (This document, seabirds in inshore trawl fishery only)

6. Management Committee annual meeting to review information collection.

7. BLSA-MSC project initiated.
8. Continue information collection at adequate levels.
9. ***Initiate quantitative evaluation of fishery impact on ETP species based on determined thresholds. (This document, seabirds in inshore trawl fishery only)***
10. Management Committee annual meeting to review progress of all actions.
11. BLSA-MSC project progress report
12. Continue information collection at adequate levels.
13. ***Results of quantitative evaluation of fishery impact on ETP species. (This document, seabirds in inshore trawl fishery only)***
14. Management Committee annual meeting to review progress of all projects and confirm implementation of necessary actions arising therefrom.
15. BLSA-MSC project final report

12.2.2 Actions in response to Conditions 4&5

3. Determine observer coverage required to enhance collection of information to levels sufficient to confirm with reasonable probability that unsustainable thresholds are not breached for ETP species as a result of interactions with the fishery.
4. Initiate such information collection.
5. ***Initiate modelling study to quantitatively estimate 'acceptable mortality' of ETP species. (This document, seabirds in inshore trawl fishery only)***
6. Set up a Management Committee that operates alongside the existing VME MC
7. Affirm BLSA-MSC bycatch mitigation project and encourage participation by inshore fleet vessels.
8. Conduct a literature review to identify mechanisms by which fishing practices may be modified in light of unacceptable impacts on ETP subcomponents.
9. Continue information collection at adequate levels.
10. ***Estimate of 'acceptable mortality' of ETP species determined. (This document, seabirds in inshore trawl fishery only)***
11. Management Committee annual meeting to review information collection.
12. BLSA-MSC project initiated.
13. ETP species bycatch mitigation mechanisms have been identified.
14. Continue data collection at adequate levels.
15. ***Initiate quantitative evaluation of fishery impact on ETP species based on determined thresholds. (This document, seabirds in inshore trawl fishery only)***
16. Management Committee annual meeting to review progress of all actions.
17. BLSA-MSC project progress report.
18. Bycatch mitigation mechanisms identified are trialed at sea (where necessary).
19. Continue data collection at adequate levels.
20. ***Results of quantitative evaluation of fishery impact on ETP species. (This document, seabirds in inshore trawl fishery only)***
21. Management Committee annual meeting to review progress of all actions.
22. BLSA-MSC project final report

23. Bycatch mitigation mechanisms are available or in place (where necessary).

12.2.3 Actions in response to Conditions 6&7

1. Determine observer coverage required to continue information collection at adequate levels sufficient to confirm with reasonable probability that unsustainable thresholds are not breached for ETP species as a result of interactions with the fishery.
2. Initiate such information collection.
3. ***Initiate modelling study to quantitatively estimate 'acceptable mortality' and status (where possible) of ETP species. The modelling work referred to here will be carried out using the methods in FISHERIES/2018/AUG/SWG-DEM/39 ("Proposed by-catch limits for selected iconic species in the directed mid-water trawl fishery" by OLSPS Marine) and subsequent versions and revisions of this work. (This document, seabirds in inshore trawl fishery only).*** The same is applicable to the determination of stock status.
4. Set up a SADSTIA ETP Management Committee that operates alongside the existing VME MC
5. Affirm BLSA-MSC bycatch mitigation project and encourage participation by inshore fleet vessels.
6. Continue information collection.
7. ***Estimate of 'acceptable mortality' of ETP species calculated. (This document, seabirds in inshore trawl fishery only)***
8. Management Committee annual meeting to review information collection.
9. BLSA-MSC project initiated.
10. Continue information collection at adequate levels.
11. ***Initiate quantitative evaluation of fishery impact on ETP species based on determined thresholds. (This document, seabirds in inshore trawl fishery only)***
12. Management Committee annual meeting to review progress of all actions.
13. BLSA-MSC project progress report.
14. Continue information collection at adequate levels.
15. ***Results of quantitative evaluation of fishery impact on ETP species. (This document, seabirds in inshore trawl fishery only)***
16. Management Committee annual meeting to review progress of all projects and confirm implementation of necessary actions arising therefrom.
17. BLSA-MSC project final report.

13 Appendix F. P2: MSC Conditions 8-13 and associated Client Action Plans ("Habitat")

Not detailed here

14 Appendix G. P3: MSC Condition 14 and associated Client Action Plans ("Legal and/or customary framework")

This section is relevant to UoA1 only, meaning ***Merluccius paradoxus***.

14.1 Condition

A system for organised and effective cooperation shall be established between the respective clients which delivers management outcomes consistent with MSC Principles 1 and 2 in accordance with the normative requirements set out in MSC Standard v2.01 SA4.3.3.2 which are necessary to achieve that.

14.1.1 Milestones

Year 1 (2021): A proposal shall be presented for developing a system for organised and effective cooperation between the clients that will meet the requirements of the condition of certification

Year 2 (2022): Evidence shall be presented of discussions between the clients to develop a system for organised and effective cooperation that will meet the requirements of the condition of certification.

Year 3 (2023): Evidence shall be presented of discussions between the clients to develop a system for organised and effective cooperation that will meet the requirements of the condition of certification.

Year 4 (2024): Evidence shall be presented to show that a system for organised and effective cooperation between parties that will meet the requirements of the condition of certification has been developed.

(Note that if the Year 4 milestone is achieved earlier in the certification cycle it may be possible to re-score this PI and close this condition sooner than anticipated).

14.1.2 Client Action Plans

Summary of action plan: It should be noted that issues of effective monitoring, control, surveillance and enforcement do not arise in this context, as the vessels from the two countries concerned fish only within their own country's waters, there have been no recorded instances of any cross-boundary violations in that regard, and each country separately has effective legislation and mechanisms to deal with such matters internally.

The only outstanding issue arising from the analysis of the robustness of OMP2018 (Butterworth and Ross-Gillespie 2020) to ensure management outcomes consistent with MSC Principle 1 (Principle 2 is not relevant here) is that interactions with Namibia may be required to ensure that the MSC objective of sustainable utilisation of the *M. paradoxus* resource by the South African fishery is achieved in circumstances where Exceptional Circumstances are triggered under OMP2018 because of excessive catches of *M. paradoxus* by Namibia.

The action plan required to achieve this needs to be formulated in a way that is appropriate given that such a level of catch by Namibia is in any case a low probability event: MSC certification of the Namibian hake fishery should ensure scientifically based sustainable TACs are set and observed by Namibia, and furthermore the scale of such additional catch is some 50% more than is being taken at present – this would necessitate a large increase in Namibian fishing effort capacity together with the economic ability to tolerate appreciably reduced CPUEs. Hence this scenario reflects a situation that is hardly likely to arise in the very near future (the next two years, at least), so that there is no need for extreme urgency in bringing this action plan to completion.

The action plan must accordingly provide an effective, simple mechanism focussed on this "excessive catch of *M paradox*us by Namibia" issue only, this being the one that could result in non-sustainable use. This mechanism needs to be one agreed by the clients for the South African and Namibian hake fishery certifications by the MSC, so as to allow for rapid implementation by and through them if this is required (and hence to also provide a direct incentive – the clients are the ones with most at stake, being liable to lose certification if they fail to implement this mechanism effectively should the need to do so arise).

While this mechanism might allow for possible referral to the Benguela Current Commission and the SA-Namibia MoU, it is clear for many reasons that such a mechanism should not be entirely dependent on such instruments. It is important to stress that the fact that there may be demographic sharing to some extent of the *M. paradoxus* resource between South Africa and Namibia does NOT necessitate a formal joint management structure between these two countries. Note the 2006 BCLME meeting with its agreement on that point by both the SA and Namibia representatives present, plus the advice given by the Norwegian economist Gunnstein Bakke at the South Africa National Consultation Meeting on Shared Stocks organised by FAO in Cape Town in June 2019 to the effect that reliance on such structures should be avoided if at all possible. Such formal structures between countries require regular meetings, which are very expensive to run and heavy on time requirements for key individuals who are already over-committed. Such difficulties are evident from the fact that nothing further has materialised from the SA-Namibian MoU subsequent to its signing early in 2019, as well as the very slow progress made on fishery-related matters in the BCC, which in any case is a body with membership extending beyond South Africa and Namibia, and is not an RFMO. The possible use of either of these instruments as the primary basis to resolve possible problems arising in relation to the possible demographic sharing to some extent of the *M. paradoxus* resource has to be evaluated in the light of their considerable associated cost (both monetary and in terms of time, as indicated above) - burdens which developing countries such as South Africa and Namibia will struggle to meet. Again, this points to "formal joint management" NOT needing to be an automatic requirement in the current circumstances of the hake fisheries in this region – rather arrangements must be tailored to what are the key requirements only, and must take costs into account in choosing amongst options.

Hence, to avoid these problems and the normal delays associated with international diplomatic exchanges, this action plan envisages the agreement of a protocol between the South African and Namibian clients for (re-)certification of their hake fisheries by the MSC. Its single purpose would be to ensure appropriate consultation between these clients in the event of South Africa having to declare Exceptional Circumstances under OMP2018 because of excessive catches of *M. paradoxus* by Namibia, with a view towards these clients then reaching agreement to move to remedy the situation. Naturally excessive catches of *M. paradoxus* by South Africa could in principle also give rise to a declaration of such Exceptional Circumstances. However, this situation could not arise in circumstances where South African TACs are being approved in line of outputs from OMP2018, as would also be a requirement for continuation of MSC certification of the South African hake trawl fishery. Nevertheless, in the interests of inter-country balance in the wording envisaged for the protocol, it is anticipated that reference would also be made to addressing the situation in the event of the excessive catch being made by the South African fishery.

<u>Action</u>

Timeframe	**Action**	**Expected result**
Year 1	Initiate interactions with Namibian client towards the development of the requisite protocol	Written exchanges with Namibian client
Year 2	Continued interactions with Namibian client towards the development of the requisite protocol	Written exchanges with Namibian client, with possibly a physical meeting to facilitate progress
Year 3	Continued interactions with Namibian client towards the development of the requisite protocol	Written exchanges with Namibian client, including at least one physical meeting to facilitate progress and to develop an initial draft of the protocol
Year 4	Meeting to agree final protocol	Protocol finalized and agreed by both clients

15 Appendix H. Code of Conduct Agreed between SADSTIA and SAHLLA, February 2017 regarding conflict between hake longline vessels and hake trawlers

Resolving conflict between hake longline vessels and hake trawlers

Code of Conduct

The current scenario and problem

The basic problem arises from time to time when both trawlers and longliners wish to fish the same grounds. This has resulted in longline gear losses when trawlers have trawled over longlines that have been set where they intend to trawl and to claims against trawling companies. It should be emphasised that such conflict is not a common occurrence, and usually only a small number of trawlers, longliners and vessel masters are involved. The problem usually arises from a lack of effective communications between the vessels.

Background and history

The hake trawl fishery has a 120 year history – vessels began to fish in the 1890s. Initially, vessels were able to trawl close inshore and satisfy local demand for fish. However after World War II and the rise of export markets, the grounds expanded rapidly until most trawlable grounds were covered, up to a depth of approximately 700 m. These grounds are characterised by sandy, gravel or mud substrates. More recently, hard (rocky) bottoms have also been fished as bobbins, rollers and “rockhopper” gear have been developed.

The hake longline fishery developed out of the discontinued kingklip fishery in the 1990s. Initially, mostly hard grounds, less favoured for trawling, was used, and large fish were targeted. This changed over time as large fish became scarcer, and grounds used by trawlers also began to be used. At the same time, trawlers also began to move away from small fish and target larger fish demanded by the market. In general, both fleets now fish where hake abundance of the targeted sizes occurs.

Current accepted protocol

When intending to fish in an area, trawlers and longliners determine whether there are any other vessels in the area, using visual contact, radar or AIS identification. They then send out a VHF Channel 16 announcement to all vessels in the vicinity that they intend to conduct fishing operations, switch to Channel 8 and give further information, usually including their approximate starting position and heading. If there are no responses, they proceed with their gear deployment. If other vessels are in the way, they respond and, either give way, or respond that they have already deployed their gear or intend to deploy their gear and give their starting position and heading. If another vessel is already fishing or is about to fish the later vessel must select another area and repeat the process.

CODE OF CONDUCT

On behalf of their members, the South African Deep-Sea Trawling Industry Association (SADSTIA) and the South African Hake Longline Industry Association (SAHLLIA) therefore agree to follow the protocol as set out below:

- When intending to fish in an area, trawlers and longliners shall determine whether there are any other vessels in the area, using all means of recognition, including visual, radar, or AIS identification, bearing in mind that most longliners are smaller and have a lower profile superstructure than trawlers and do not usually carry radar reflectors. In most cases, however, vessels within 30 n.m. can be detected.
- Vessels intending to fish, shall contact all vessels in the vicinity on VHF Channel 16. They shall then immediately switch to VHF Channel 8 and indicate their intention to conduct fishing operations,

giving starting point, heading and any other relevant information which could prevent interference between vessel activities.

- All communications shall be responded to immediately by affected vessels and will be conducted with due courtesy and consideration by both parties.
- If there are no responses from other vessels within 15 minutes, the vessel intending to fish may proceed with gear deployment.
- If other vessels are in the way, they shall immediately respond and, either give way within 30 minutes, or respond that they have already, or are about to deploy their gear and give their starting position and heading, or describe their approximate fishing track if it is not linear. If feasible it should also give the approximate end position.
- If another vessel is already about to deploy its gear or already fishing the later vessel must immediately select another area and repeat the process.
- If any vessel is observed to be transgressing the above Code of Conduct, SADSTIA and SAHLLA (the Associations) must be informed via a formal report in the prescribed template (attached) sent by the Captain via his company to the respective Secretaries of the Associations within 5 working days of the incident occurring. This can be submitted by any vessel affected by the activity or by another vessel in a position to observe or by other means witness the activity.
- SADSTIA or SAHLLA shall then request that the reported vessel give a written response within 5 working days, via its counterpart Association.
- The parties shall attempt to resolve the matter and agree on responsibility for the incident within 15 working days.
- If the parties cannot resolve the matter, SADSTIA and/or SAHLLA shall within 7 working days submit the complaint and response to an arbitration lawyer, agreed on and jointly appointed by both Associations, who will assess the case, determine who is the transgressing party, report to the Associations and issue an arbitration cost apportionment. This must be done within a calendar month of the case being assessed.
- There shall be no appeal.
- The arbitration report shall be published on the SADSTIA and SAHLLA websites within 5 working days after arbitration.
- The Secretaries of the Associations shall maintain a log of all reported incidents, noting the outcomes.

Note that the most important factor that determines whether or not an incident occurs is almost always the level of communication conducted between vessels. If adequate notifications are given and adequate responses received, incidents will seldom take place.

Signed on this day, 21 February 2017, at Harbour Place, Foreshore, Cape Town.

16 Appendix I. Impacts on ETP species

The following species list are the species that have been earmarked, in coordination with the MSC, as those that the client (SADSTIA and SECIFA) need to monitor and whose mortality due to interactions with trawl gear must be monitored and where necessary, mitigated.

Table 17. List of ETP species of concern for the MSC certification of the South African inshore and the offshore trawl sectors.

Species name	Common name
Thalassarche carteri	Indian Yellow-nosed albatross
Thalassarche chlororhynchos	Atlantic Yellow-nosed Albatross
Thalassarche steadi	White-capped albatross
Morus capensis	Cape gannet
Calonectris borealis	Cory's shearwater
Diomedea exulans	Wandering albatross
Diomedea dabbenena	Tristan albatross
Diomedea epomophora	Southern royal albatross
Spheniscus demersus	African penguin
Diomedea epomophora	Northern royal albatross
Pliotrema warreni	Sixgill sawshark
Poroderma pantherinum	Leopard catshark
Caretta caretta	Loggerhead turtle

16.1 Teleost, chondrichthyan, mammal and turtle ETP species

Weston and Atwood (2017) drew up a list of teleost, chondrichthyan, mammal or turtle species which they classify as ETP species which have been recorded in the catch of offshore, inshore and hake longline fishing operationsTable 18 is a consolidated list, where the definition of an ETP species by Weston and Atwood (2017) is a species which falls into one or more of the following categories:

i. IUCN: Listed as threatened by the IUCN Red List of Threatened Species, viz. Vulnerable, Endangered or Critically Endangered.
ii. CITES: Species listed as being protected under CITES Appendices I, II and III.
iii. TOPS: Threatened or Protected species (TOPS), as defined in Section 97 of the South African Biodiversity Act No. 10 of 2004.

Sector by sector comments drawn almost verbatim from Weston and Atwood (2017), bearing in mind that the MSC rules regarding ETP species has changed since Marine Stewardship Council (2014a), and hence the list of ETP species of relevance to the certification has also changed.

Offshore trawl: The white skate, *Rostroraja alba*, is the only ETP species caught as bycatch in the South African offshore hake fishery, and so, on this basis, can be considered to be a significant bycatch species with high potential vulnerability to overfishing (Table 18). The relative productivity and susceptibility scores show that this is mainly because of the intrinsic biological traits of the species. The high productivity risk score of R. alba (18 out of a possible 21) suggests a lower productivity, with slower growth, and longer life span. This results in a lower resilience, and thus higher vulnerability to fishing."

Inshore trawl: Within the inshore hake trawl fishery, of the 12 ETP species caught as bycatch, chondrichthyans, in general, indicate higher potential vulnerability to overfishing, than their teleost counterparts (Table 18). The top six species with highest potential risk within this fishery are all sharks. The top three highest risk species (***G. cuvier, P. warreni*** and ***P. africanum***) are not listed as being threatened by the IUCN Red List, however, they are protected by South African legislation. Red steenbras, ***Petrus rupestris***, is the most vulnerable teleost species, and is ranked fourth in relative risk to overfishing. This is on account of the species having a relatively low productivity. This species is listed as being endangered by the IUCN Red List and so a high risk ranking is validated.

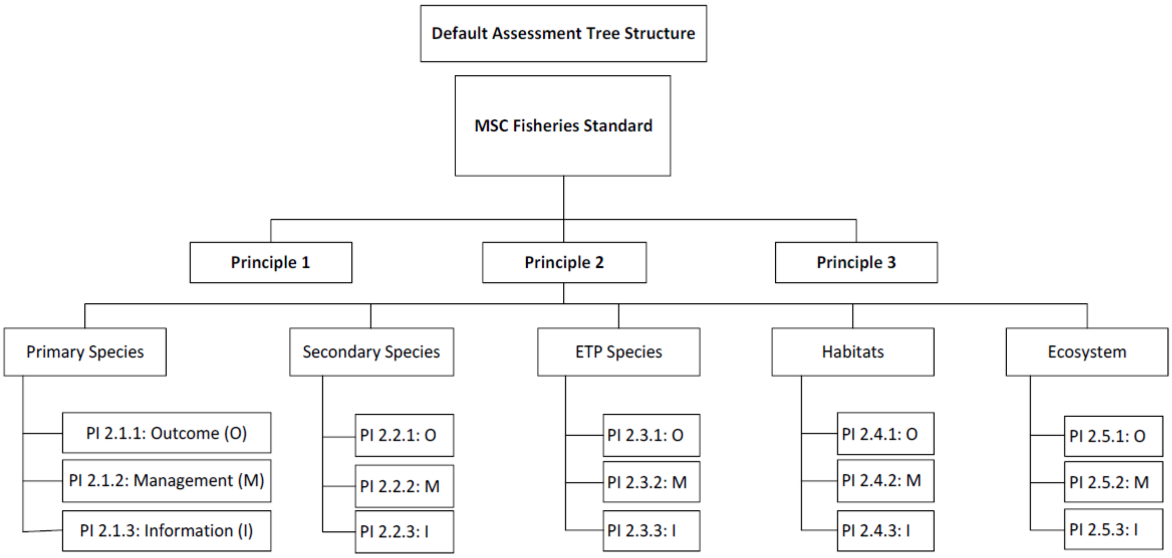
Hake Longline: Of the four potential ETP species caught as bycatch in the South African hake longline fishery, the three Alopias species indicate the highest vulnerability to overfishing, with A***. superciliosus*** and ***A. vulpinus*** presenting the highest risk scores (Table 18). The Alopias specimens caught in the fishery were only classified to genus level, and so all three species that may occur in South African waters were assessed in the PSA. Again, the high risk scores scored by the three Alopias species can mainly be attributed to their low productivity and resulting high productivity risk scores. The susceptibility of all four species to capture by the fishery is more similar. In order to focus management interventions, future research and monitoring should focus on identifying the Alopias species caught in the South African hake longline fishery.

Table 18. A list of teleost, chondrichthyan, mammal or turtle species classified as ETP species which have been recorded in the catch of offshore, inshore and hake longline fishing operations (Weston and Atwood, 2017). Weston and Atwood (2017) define ETP species as those which are either (i) IUCN: Listed as threatened by the IUCN Red List of Threatened Species, viz. Vulnerable, Endangered or Critically Endangered, or (ii) CITES: Species listed as being protected under CITES Appendices I, II and III, or (iii) TOPS: Threatened or Protected species (TOPS), as defined in Section 97 of the South African Biodiversity Act No. 10 of 2004. The total risk based on a Productivity and Susceptibility Analysis following the methodology recommended in Marine Stewardship Council (2014a).

Sector	Common Name	Species	IUCN Status	CITES Status	TOPS Status	P	S	Tot. Risk	Rank
Inshore trawl	White stumpnose	*Rhabdosargus globiceps*	Vulnerable	Not evaluated	Not listed	9	10	19	6
	Geelbek	*Atractoscion aequidens*	Vulnerable	Not evaluated	Not listed	13	10	23	5
	Houndshark	*Mustelus spp. M. mustelus*	Listed as vulnerable	Not evaluated	Not listed	17	9	26	3
	Soupfin shark	*Galeorhinus galeus*	Vulnerable	Not evaluated	Not listed	18	8	26	3
	Striped catshark	*Poraderma africanum*	Near Threatened	Not evaluated	Protected	17	10	27	2
	Stingray	*Family Dasyatidae: Himantura uarnak*	listed as vulnerable	Not evaluated	Not listed	18	7	25	4
	Hammerhead	*Sphyrna zygaena*	Vulnerable	Appendix II: International Trade Monitored	Not listed	19	7	26	3
	Tiger shark	*Galeocerdo cuvier*	Near Threatened	Not evaluated	Protected	20	8	28	1
	Sawshark	*Pliotrema warreni*	Near Threatened	Not evaluated	Protected	19	9	28	1
	Elf	*Pomatomus saltatrix*	Vulnerable	Not evaluated	Not listed	12	7	19	6
	Red steenbras	*Petrus rupestris*	Endangered	Not evaluated	Not listed	15	10	25	4
	Leopard catshark	*Poroderma pantherinum*	Data Deficient	Not evaluated	Protected	16	10	26	3
Offshore trawl	White skate	*Rostroraja alba*	Endangered	Not evaluated	Not listed	18	9	27	N/A
	Thresher shark	*Alopias spp.: Alopias pelagicus*				20	6	26	2
	Thresher shark	*Alopias spp.: A. superciliosus*				19	8	27	1
Hake Longline	Thresher shark	*Alopias spp.: A. vulpinus*	Listed as vulnerable	Not evaluated	Not listed	20	7	27	1
	Elf	*Pomatomus saltatrix*	Vulnerable	Not evaluated	Not listed	12	7	19	3

17 Appendix J. Categorisation of species for purposes of MSC assessment under Principle 2 (P2)

Figure SA2: Principle 2 Assessment Tree Structure



Primary species

The team shall assign primary species in P2 where all the following criteria are met:

- Species in the catch that are not covered under P1 because they are not included in the UoA;
- Species that are within scope of the MSC program as defined in FCP Section 7.4; and
- Species where management tools and measures are in place, intended to achieve stock management objectives reflected in either limit or target reference points.

In cases where a species would be classified as primary due to the management measures of one jurisdiction but not another that overlaps with the UoA, that species shall still be considered as primary.

Secondary species

The team shall assign secondary species in P2 as species in the catch that are within scope of the MSC program but are not covered under P1 because they are not included in the Unit of Assessment and:

- Are not considered 'primary' as defined above; or
- Species that are out of scope of the program, but where the definition of ETP species is not applicable.

ETP species

The team shall assign ETP (endangered, threatened or protected) species as follows:

- Species that are recognised by national ETP legislation;
- Species listed in the binding international agreements given below:

  a. Appendix 1 of the Convention on International Trade in Endangered Species (CITES), unless it can be shown that the particular stock of the CITES listed species impacted by the UoA under assessment is not endangered.

  b. Binding agreements concluded under the Convention on Migratory Species (CMS), including:

     ii. Annex 1 of the Agreement on Conservation of Albatross and Petrels (ACAP);
     iii. Table 1 Column A of the African-Eurasian Migratory Waterbird Agreement (AEWA);
     iv. Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS);

v. Annex 1, Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS);
vi. Wadden Sea Seals Agreement;
vii. Any other binding agreements that list relevant ETP species concluded under this Convention.

Species classified as 'out-of scope' (amphibians, reptiles, birds and mammals) that are listed in the IUCN Redlist as vulnerable (VU), endangered (EN) or critically endangered (CE).

18 Appendix K. Catch reporting and recording in the inshore trawl fishery

There is a difference between the catches recorded against the inshore trawl sector by SECIFA's "inshore by-catch monitoring program", here 'SECIFA' data, and the quantities that are used in the hake stock assessment models, referred to here as 'DFFE' data. Figure 11, which is based on the 'DFFE' data, suggests a substantial underutilization by the inshore sector. This is at odds with the 'SECIFA' estimates, as reflected in the following inshore trawl sector utilization %'s

2016: DFFE 45 % and SECIFA: 84%

2018: DFFE 50% and SECIFA 101%

2019: DFFE 50% and SECIFA 94%

(source: Peter Sims, pers. comm., 2021)

With respect to 2019 it is noted that the 94% underutilization value was due in part to legal intervention and allocation of an unused "reserve". In addition, for 2017, the inshore sector only commenced fishing in July owing to 'FRAP confusion' which resulted in only a few active months of fishing (Peter Sims, pers. comm., 2021)

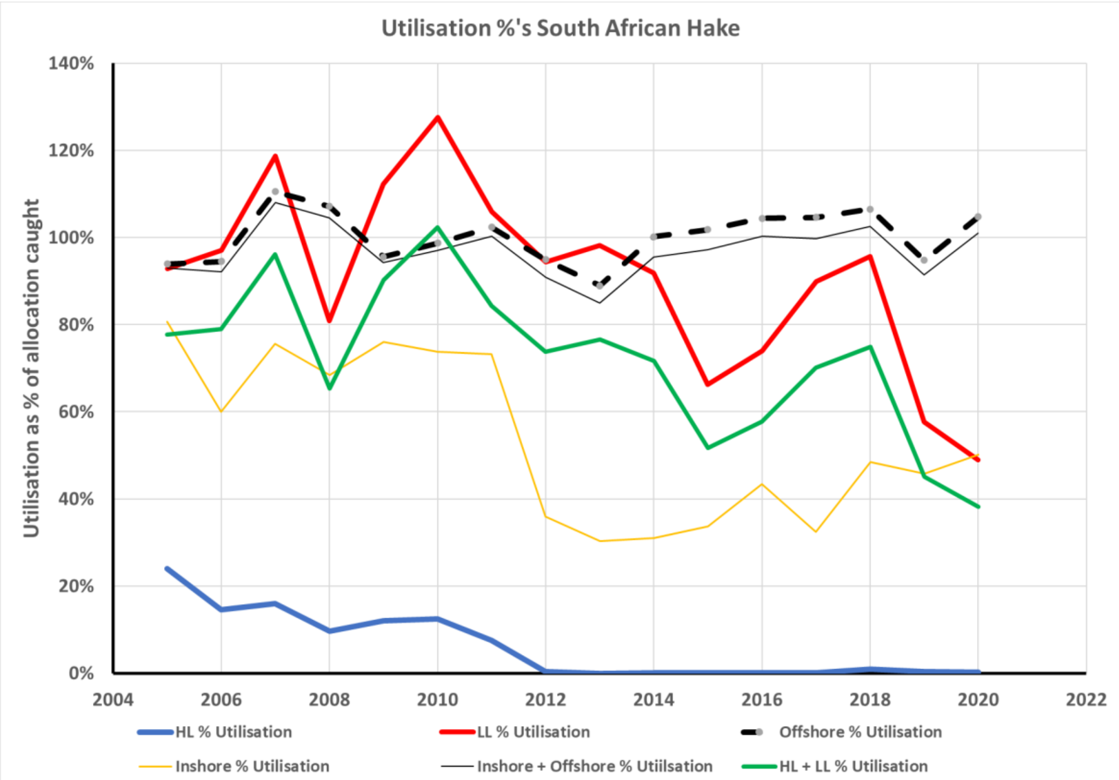


Figure 11, Utilization %'s as presented in Table 6 based on historical catch information used in stock assessment analyses.

Furthermore, it is noted that the interpretation, methodology, reconciliation and presentation of inshore catch data has been an issue since 1979. The data priorities of Resource Management versus that of Resource Research and the emphasis on scientific "catch and effort data" requirements versus the regulatory accounting and reconciliation of R/H performance against the sector allocation has/had an influence on the difference between the 'DFFE" and the 'SECIFA' utilization calculations.

But one of the possible reasons for the discrepancy between the two data sources is recording vessel catches which are based on quotas awarded in the inshore trawl sector against the offshore trawl sector.

There are numerous other factors that could be contributing to the discrepancy between 'DFFE' and 'SECIFA' data and there is ongoing work on improving data capture and data reconciliation.

19 Appendix L. Utilization percentages for hake sectors, 2006 - 2020

Table 19. Utilisation of hake allocations by sector 2006 – 2020, assuming that the allocations each year were consistent with the sectoral allocation %'s given in the original policy for South African hake of 2005.

South African hake: Utilisation %s							
Year	**TAC**	**Small scale**	**Handline**	**Longline**	**Offshore trawl**	**Inshore trawl**	**Trawl (Offshore + Inshore)**
2005	158000	0%	24%	93%	94%	81%	93%
2006	149000	0%	15%	97%	94%	60%	92%
2007	136000	0%	16%	119%	110%	76%	108%
2008	130000	0%	10%	81%	107%	68%	104%
2009	120000	0%	12%	112%	96%	76%	94%
2010	120000	0%	12%	128%	99%	74%	97%
2011	133000	0%	8%	106%	102%	73%	100%
2012	145000	0%	0%	94%	95%	36%	91%
2013	156000	0%	0%	98%	89%	30%	85%
2014	155000	0%	0%	92%	100%	31%	95%
2015	147500	0%	0%	66%	102%	34%	97%
2016	148000	0%	0%	74%	104%	43%	100%
2017	140125	0%	0%	90%	105%	32%	100%
2018	133119	0%	1%	96%	107%	48%	103%
2019	146431	0%	0%	58%	95%	46%	91%
2020	146431	0%	0%	49%	105%	50%	101%