SOCIO-ECONOMIC ASSESSMENT FOR THE HAKE LONGLINE FISHERY

SOUTH AFRICAN HAKE LONGLINE ASSOCIAITON

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Cover Photo Credit : D.W. Japp - Hake Longline fleet in Cape Town Harbour

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Acronyms

BBBEE	Broad-Based Black Economic Empowerment
DFFE	Department of Environment Forestry and Fisheries
EE	Employment Equity
FC	Fixed Cost (i.e., annual costs for vessel maintenance)
H&G	Head-off and gutted (Hake/Kingklip with head removed and guts removed from abdominal cavity)
HLSR	Hake Longline Sector Report (2008)
MSC	Marine Stewardship Council
PQ	Prime Quality (Hake with head on and guts extracted through small slit in abdomen)
Q1	Questionnaire 1 (Extensive questionnaire that was distributed to respondents in February 2019)
Q2	Questionnaire 2 (Simplified questionnaire that was distributed to respondents in August 2019)
SAHLLA	South African Hake Longline Association
SANBI	South African national Biodiversity Institute
TAC	Total Allowable Catch
ToC	Theory of Change
VC	Variable Costs (i.e., costs per trip)

Executive Summary

The hake longline (demersal) fishery has been through a difficult process since it was first mooted as a viable alternative fishery to catching hake. The allocation of fishing rights to the hake longline has however been undertaken without any substantive socio-economic understanding of the fishery including its operations and general logistics that determine its economic viability.

From a strictly economic perspective, the fishery has challenges associated with cost of labor, unstable currency and high cost of fuel. Operators of longline vessels therefore carry enormous risks, not least of all is to maintain markets in a competitive export and domestic market (white fish).

For most fisheries catch volume determines stability of operation. This guarantees employment of sea and land-based crews, supports market demand for a unique product ("longline") and importantly allows for year-round maintenance of assets, and can also lead to development of onshore infrastructure. All of these have benefits to the National agenda of optimizing South Africa's natural resources to sustain the economy and associated livelihoods, in particular of previously disadvantaged persons.

In this socio-economic assessment it is shown that the fishery has largely had to adapt to the many challenges to sustain itself. It is clear that while the fishery has many rights holders, few have viable allocations to sustain fishery operation. The outcome of this is that the fishery is effectively "serviced" by few boats (no more than 45). This demonstrates that based on the TAC portion allocated to the sector, the effort capacity is limited with many quota / rights being consolidated onto single vessels. This "model" results in the creation of "Economic Units" to optimize quota and also the impracticability of a "fishing right" being able to achieve the policy objectives (DFFE, 2021) of supporting livelihoods and generally contributing to the economy through employment and infrastructure development.

Operationally the fishery is labor intensive and has a significant employment to catch ratio. Assuming economically viable amounts of hake sufficient to maintain year-round operation are available to an operator, a relatively high employment base can be sustained. This benefit is however compromised as allocations as low as 30 t or even 100 t allows for irregular operation and destabilizes the fishery. Data available in this survey suggest that at a minimum, a hake longline vessel, in order to achieve breakeven point and achieve a profit, would need to cover annualized fixed costs and trip by trip operational costs. Further, operators of hake longline vessels would also need to absorb a multitude of risks that include market and exchange rates variability as well as the cost of labor and fuel. The data provided suggest that before any profit can be made on an exclusively hake-directed operation a vessel operator would require between 300-350 t of hake per annum.

In regard to land-based investments and employment, the hake longline sector directly supports employment and is distributed across the cape provinces. While the processing facilities are established, their viability and maintenance of employment is dependent on both hake longline as well as other processing lines that include squid, trawl products, sardine and a variety of other seasonal species.

Regarding Transformation, the fishery remains one the most transformed fishery sectors in South Africa. It would be difficult to reconcile that even further intervention in this regard is needed simply because the fishery with marginal quanta is already compromised in being able to sustain operations is needed.

The hake longline fishery has maintained green status of it's products (hake and kingklip) on the WWF - SA SASSI listing and is currently engaged in a Marine Stewardship Council (MSC) improvement program. The hake longline fishery in its relatively short existence has also demonstrated that it is a

viable ecologically sustainable alternative fishing method. Marine Stewardship Council (MSC) certification can therefore further strengthen the fishery, not only for their own product, but also sends out a clear message that the hake resource, along with trawl products, is under effective and progressive management.

The longline fishery also provides an excellent platform for research and understanding the dynamics of South Africa's demersal resources contributing positively to the stock assessment if better use is made of the information available.

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Socio-Economic Evaluation of the Hake Longline Fishery Sector in South Africa

Introduction

Rationale for this Study

The demersal hake-directed longline fishery is a relatively new fisheries sector in South Africa and targets both shallow and deep-water hakes *Merluccius capensis* and *Merluccius paradoxus.* While the hake trawl sector first started in the early 1900s, directed demersal longlining was only first proposed in 1983[1]. Since it was first trialed from 1992, it has evolved into a well-established fishery that is an integral part of the hake Total Allowable Catch (TAC). The trawl component of the TAC includes a small inshore trawl fishery operating on the South African south coast. The demersal longline which also targets hake, has a similar proportion of the hake TAC to the inshore trawl, which currently comprises about 6%. There are some 123 rights holders all with relatively small allocations, mostly under 100 t with only a few larger allocations to groups that have formed clusters. Longline hake allocations may be exploited by single boat operators or fished as a group, a phenomenon known as clustering, where a single vessel or a group of vessels may use several such allocations (known also as "rights", normally to maintain operational viability as the current allocation sizes do not support fishing throughout the year[2].

While the operational characteristics of the fishery have previously been well described, the socioeconomics of the fishery is not well understood. Fisheries are generally high risk in an economic sense, and because of this, decisions that may affect the stability of the fishery such as the proportion of the allowable catch, environmental impacts, markets and political intervention, can, amongst many other factors, significantly affect the economic viability of the fishery. In turn, poor understanding of the fishery is likely to also have social implications i.e., an indirect result of the risks. Unrealistic expectations by decision-makers as a result of this poor understanding, when allocating fishing rights, can also have long-term consequences. We therefore aim to contextualize the fishery with respect to its operational characteristics, markets and socioeconomics and in so doing provided a strong basis to support information needed for the pending Fishery Allocation Process (FRAP).

[1] Application to trial demersal longlining for hake was first made in late 1982, started as an experiment in 1983 and thereafter was directed at kingklip and not hake, until 1992 some 3 years after the kingklip experiment was closed.

[2] This is not the case for the trawl sector which generally has allocations that support year-round operations for vessels as "economic units".

Theory of Change (ToC)

The South African Hake Longline Association is encouraged by the approach adopted by DFFE related to the Socio-Economic Impact Assessment System, in particular that it is underpinned by the Theory of Change (ToC). The application of this concept has in recent years been applied globally. SAHLLA wishes to stress however that the ToC in the context of the socio-economic assessment of fisheries should consider the complexity of fisheries in general and as such its application will have specific and different interpretations for each fisheries sector involved in the FRAP. In its simplest form the ToC is a "*dialogue-based process intended to generate a 'description of a sequence of events that is expected to lead to a particular desired outcome*". ToC is therefore a process of ongoing analysis and reflection and is not a "once-off exercise to design (or evaluate) an initiative but implies an ongoing learning and adaptive management cycle". SAHLLA has preempted this process and contributed to the SEIAS[3] process through the provision of both quantifiable and other useful information and is of the hope that this unbiased and objective approach is supported in the ToC process and that the information available is used to good effect to achieve the best outcome for the fishery.

Theory of Change as a process emphasizes the importance of dialogue with stakeholders, acknowledging multiple viewpoints and recognition of power relations, as well as political, social and environmental realities in the context.

An economic assessment can also formally be defined as "a process of identifying, calculating and comparing the costs and benefits of a revenue generating activity in order to evaluate its merit, either absolutely or in comparison with alternatives." In simpler terms, an economic assessment focuses on gathering monetary values that are associated with certain value creation processes. The economic viability of a process, sector or industry may be represented using different measures, one of which is known as a break-even analysis.

In the case of a fishery, economic inputs and outputs take on a more complex nature. This is in part due the fact that the fishing performance of vessels cannot be identical but also because of the dependence on uncontrollable environmental variables that determine fishing success as well as varying levels of access to allocations. Additionally, not all outputs (e.g., different hake and other fish products) and inputs (e.g., the vessel's fishing capacity) are created equally. Here, certain differences exist in how monetary inputs translate into outputs since variations in hake selling prices, buying of fishing gear and remuneration of staff, exist.

[3] SEIAS = Socio-Economic Impact Assessment System proposed by DFFE to support the FRAP. SAHLLA submitted a detailed response to the SEIAS on 11 June 2021

Background to SAHLLA

The *South African Hake Longline Association* or as we shall refer to it in this report, SAHLLA, is a recognized industrial body in terms of Section 8(1) of the Marine Living Resources Act (No 18 of 1998). The aims of SAHLLA are:

- To be recognized as an industrial body.
- To interact, advocate and protect the interest of the hake longline Fishery and rights holders, and to liaise with the fishing sector on matters of mutual interest.
- To participate in fisheries management committees of the Department of Environment, Forestry & Fisheries (DFFE), and to contribute to the effective management of the hake resource and associated species.
- To assist DFFE with the ongoing research, forwarding data on a regular basis to its research institute, and engaging proactively to support the decision-making processes related to the fishery and stock exploited.
- To assist DFFE with Monitoring, Compliance and Surveillance, including vessel monitoring, observer deployments and land-based controls of landings at designated discharge points.
- To promote sustainable resource management activities, taking into account the evidence of the scientific impact of various user groups on the resource, economy and environment.
- To practice and promote conservation of our hake resources, with the objective of long-term optimal utilization.
- To form a database, and create interaction between fisheries and processors, to create a high level of quality control, and to maintain a strong market base, both locally and internationally.

Context of the Fishery and History

The hake longline fishery receives around 6% of the total allowable catch allocated to the hake fishery. In 2016 a total of 9 027 t of hake was landed with a wholesale value of R338.6 million, or 3% of the total value of all fisheries combined (Japp, 2010). Non-targeted commercial bycatch includes Kingklip. Approximately 252 million hooks were set in the period from 2011 to 2017 in which around 50 000 t of hake were caught (Source: DFFE). The most valuable fishery in South Africa is the demersal trawl fishery targeting Cape Hake. This fishery is primarily a trawl fishery that includes both and inshore and offshore sectors. The Total Allowable Catch or TAC peaked at 165 000 t and was set at 133 119 t in 2018 of which 7 987 t was available to the hake longline fishery. The catches of cape hake by fishing sector from 1960 to 2013 are described in Appendix 3. In terms of overall contribution to the main fisheries in South Africa, the hake longline sector approximates 3% as shown in Figure 1) (based on the most recent available data from DFFE).

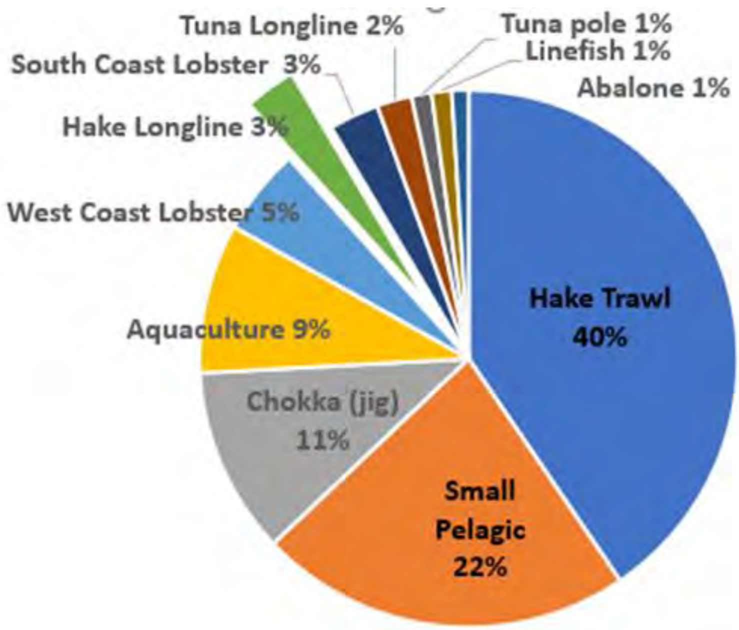

Figure 1. Comparative values of the main commercial fisheries in South Africa based on the most recent data made available from DFFE (2016).

Some key facts about the fishery include:

- The hake-directed trawl fishery developed at the start of the century and grew rapidly after World War II to peak in the early 1970's at more than 300,000 tons.
- The hake longline fishery itself is small, taking around 6% of the hake allowable catch (TAC).
- Since the late 1970's the hake fishery has been controlled largely by means of company-allocated quotas within a Total Allowable Catch (TAC), limitations on the number of vessels, and closed areas.
- The longline sector has only been active since 1983. The exclusion of foreign vessels and a conservative management strategy with effect from 1983 led to a gradual recovery in hake (trawl) catch rates.
- The first motivations to start longlining for hake was made in 1982 – but this led to an experimental fishery for kingklip (*Genypterus capensis*) between 1983 and 1989 (when it was halted, and rights holders were compensated with trawl hake).
- A turbulent period that included illegal longlining between 1990 and 1992 was followed by an experimental demersal hake-directed longline fishery from 1994 to 1996.
- Thereafter it was decided to permit hake-directed longlining amidst recurring legal actions and delays associated with the granting of rights. In fact, it was only from the granting of medium-term fishing rights in 2002 and then long-term rights from 2006 that it can be said stability was achieved in the demersal longline fishery. In 2018, there were 123 rights holders with allocations that ranged from 10 t to 584 t.

Economic Assessment of the Hake Longline

Global and Domestic Economic Information on the Hake Fishery

The fishing industry in South Africa contributes less than 0.5% to the national GDP. Even though it is not the largest contributor to national earnings, the sector has a great impact on the livelihoods of coastal communities. Especially in the Western Cape, fisheries are more important in relative terms and are a significant contributor to the social and economic well-being of the region. Globally, South African hake products compete on the international "white fish" markets where they compete with Namibia and other hake-producing nations. (Japp, 2010).

According to Lallemand *et al.* (2016) both species of South African hake are mostly exported to Southern European countries. These include Italy, Spain and Portugal. These countries imported around 75% of the total South African hake exports up until 2011. However, by 2012 the above listed countries imported only 65% of South Africa's total exports. This was a result of imports arriving in new markets where northern Europe (15.7%), Australia (7.5%) and the USA (2.2%) constituted the remainder. Following 2012, global exports originating from South Africa, attained an export price of around USD 3,678/NWt. This figure is markedly higher than averages obtained globally, which only amounted to USD 2,900/NWt.

A summary of exports is displayed in Table 1 where hake exports originating from South Africa and their associated export markets are displayed. Product types used in local markets and those exported to international markets differ. 62.9% of hake exported arrives at its destination as fillets and the remainder is processed. (Lallemand *et al.*, 2016).

Table 1:: Summary of exports markets, volume and market shares of South African hake in markets in 2012 based on UN COMTRADE data (Lallemand *et al.*, 2016).

Exporter	Export Markets						
		Australia	Northern Europe	Southern Europe	USA	Rest of World	Total Exports
South Africa	Volume exported	2 773 t	5 827 t	24 217 t	806 t	3 379 t	37 002 t
	% Of export market	70.1%	13.5%	17.3%	3.6%	1.6%	8.7%
	% Of country's export	7.5%	15.7%	65.4%	2.2%	9.1%	100%

Lallemand *et al.* (2016) further estimates that that the hake fishery generates R2.871 billion in turnover and that around 70% of the catches are exported. The whole sector thereby provides roughly 35% of all fishing sector jobs. Of this total turnover figure, it was estimated that the hake handline and longline sectors contributed about ZAR 192.4 million for the 2012 period. This fishery is not only a mainstay of domestic fisheries employment, but it also rewards its workers comparatively well with skilled workers earning between ZAR 130, 000 and ZAR 150, 000 per annum. Lallemand *et al.* (2016) contends that without the MSC certification, access to more profitable Northern European markets would not have been achievable. Consequently, in the worst-case scenario predicted in the study, where all exports were re-directed to the domestic markets, total turnover would have more than halved to R1.312 billion. **Figure 2** provides a trend of South African hake exports from 2000 to 2016 and a rise in export values for this product is apparent.

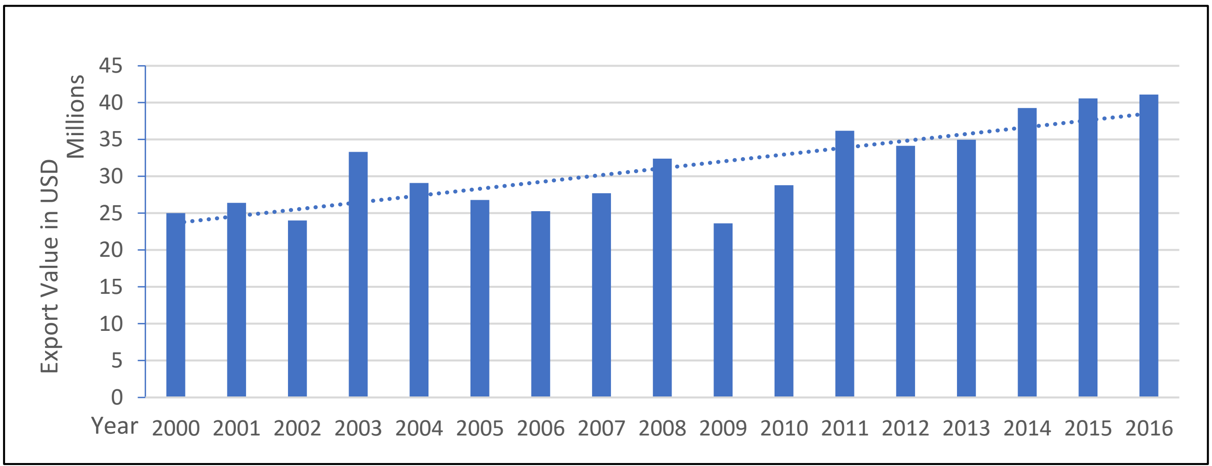

Figure 2: Total value of South African hake exports from 2000 to 2016 recorded in USD. Source: Factfish, United Nations (2018).

With Europe and Southern Europe being the biggest export markets for hake products, it is clear that the Euro-Rand exchange rate has an effect on profit margins. Within this context it is important to note that the rand has weakened significantly relative to the Euro is recent years (Figure 3)

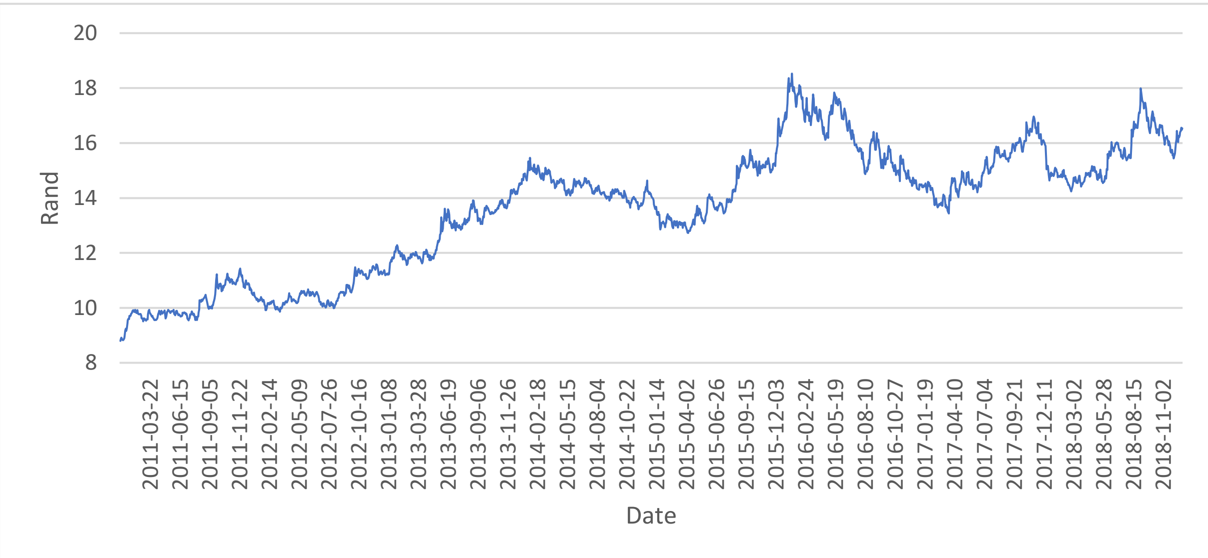

Figure 3: Example of Rand to Euro exchange rate variability (South African Reserve Bank, 2019).

Past Economic Assessments

An Economic and Sectoral Study of the South African Fishing Industry conducted in 2002 by Rhodes University, measured economic variables relating to the Hake Longline Fishery. Here, an average of 48.8 t of hake was harvested for every million (ZAR) of capital invested, which includes the vessel's capital value, with each fisher catching 6.3 tons. This study showed that on average, and taking all crew into account, 15.2 t of hake nominal mass were caught per crew member. Total employment amounted to 683 of which 66.6% worked part-time. The average yearly income for Africans was ZAR 37 274 whereas that for Whites was 69 318. Lastly, the average vessel age was listed at 30 years old. The results from the ESS were compared to those of the current study and these results are displayed in **Table 2**.

Table 2: Hake Longline Economic Assessment (ESS, 2002) and SAHLLA 2019 Economic Assessment data

No. of vessels		**Total Employment (crew)**		**% African Employed**		**% Non-Africa Employed**	
2002	**2017**	**2002**	**2017**	**2002**	**2017**	**2002**	**2017**
45	45	683	1080	87.6	80%	12.4%	20%
Market value of vessel		**Average age of vessel in years**		**Average days at sea**		**Average performance catches per vessel sampled**	
2002	**2017**	**2002**	**2017**	**2002**	**2017**	**2002**	**2017**
R88.7 mil*	R6.8mil	30	50	68	142	95.4 t	305.3 t

- Interpret data from ESS study cautiously. This number reflects est. value for all hale LL vessels and not individual vessels

Changing Dynamics

Due to the large variations in allocations, which translate into relatively small allocations for singular fishing vessels, not all fishing operations are able to solely focus on hake as their primary income generation (pers. comm. Clyde Bodenham). A survey[4] consisting of information provided by 28 vessels of members belonging to SAHLLA, revealed that the majority of them do not only engage in hake longlining activities but also in tuna pole and large pelagic (Figure 4).

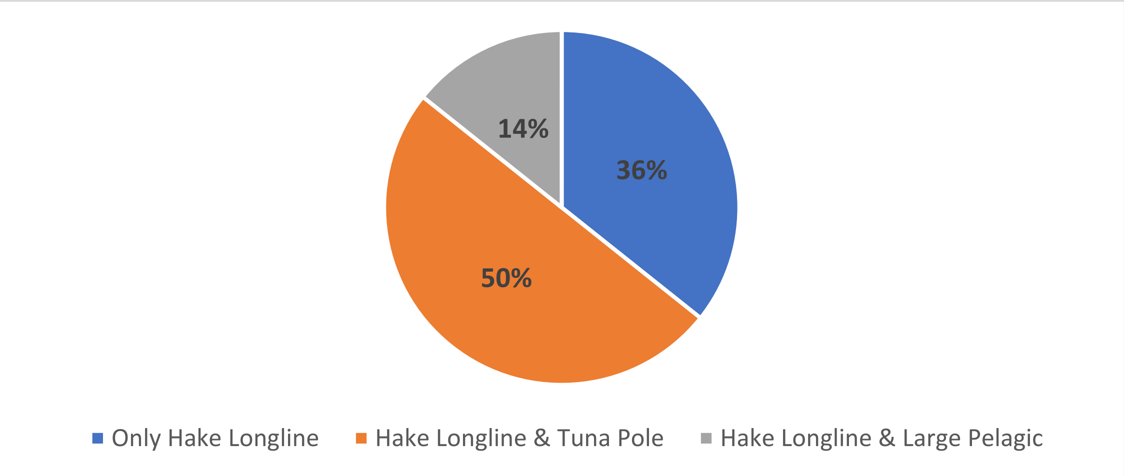

Figure 4: Fishing activity engagement by hake longline vessels (n=28)[5]

[4] Survey B refers to SAHLLA member collected data that specified the particulars of vessels and catches of different members

[5] Information provided independently by SAHLLA

Additionally, various economic factors, such as the 2008 economic crisis, which affected fresh hake prices on the European markets, have led to substantial decreases in the market value of hake products in parts of those markets. These markets may however remain profitable when the Euro-Rand exchange rate is considered as discussed above. The combination of these factors has consequently driven operators to diversify fishing operations, where vessels need to exploit other marine resources in order to remain economically viable.

Results of the Surveys

Employment, Benefits and Demographics

The data collection consisted of two rounds of questionnaires. During the first-round detailed information relating to operating costs, expenses, employment and demographics was provided (Q1). A second questionnaire, which was simplified and included basic expenses, catches and demographics, was also used (Q2) and contained information from the 8 vessels, which submitted prior to this and received a total of 14 submissions.

Employment – Sea-based Crews

Hake longline operations are labor intensive, and vessels employ a complement of 17 to 30 crew, with an average of 24 crew (Q2). The majority of the wage bill used to get the vessel to sea, is spent on labor. Labor costs constitute 43% of the total costs per trip, followed by fuel, lubricants and oil (16%) and bait (11%). The majority of employment consists of low-skilled labor, where mainly deckhands are employed (Figure 5)

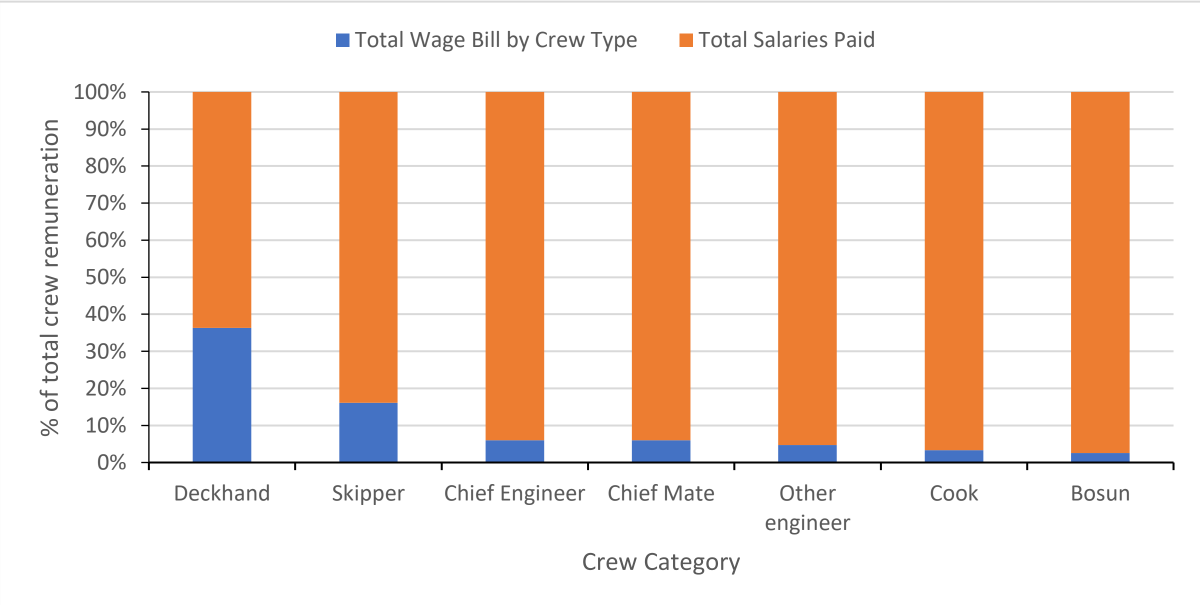

Figure 5: Cumulative wage bill by crew category on hake Longline boats

Deckhands are paid a daily rate plus a commission by tonnage of hake caught. Other positions including skipper, chief mate, chief engineer and other engineer are occasionally fully salaried positions, depending on the company. More commonly, a combination of a basic wage and commission is used.

The remainder of the crew, in particular the deckhands, receive a performance-based wage, which is commensurate to the tonnage of hake caught.

Average monthly income per month fished and average monthly income for the entire year by crew categories are displayed in Figure 6. Although incomes received on a monthly basis may appear high for Skippers, Chief Mates and Other Engineers, when the actual monthly average incomes for the entire year are calculated, they are reduced by a significant margin across all crew categories, apart from Bosons. Hence, high monthly salaries do not translate into high annual salaries as these are commission-based and dependent on fishing productivity.

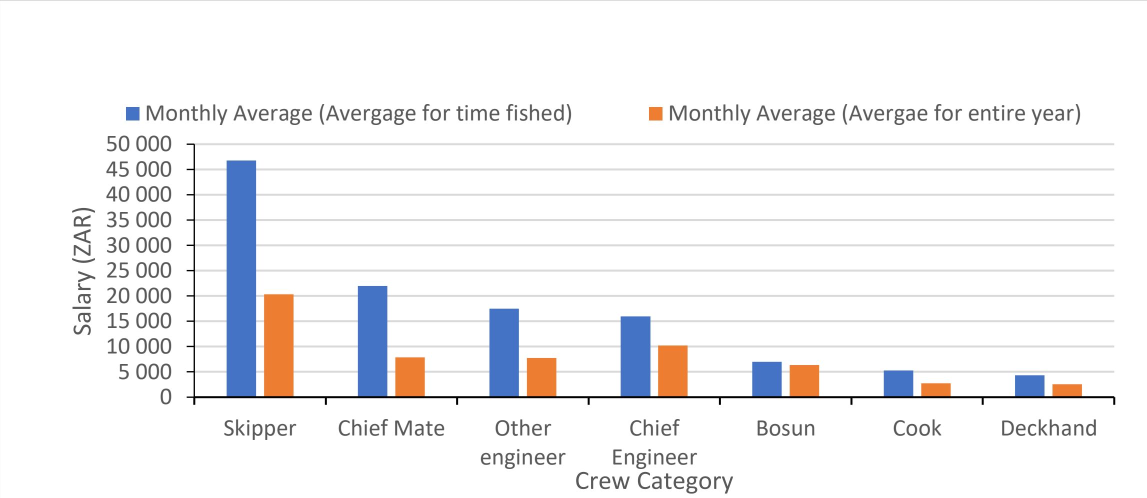

Figure 6: Crew average monthly commissions by ton (2017) displayed for both annual monthly averages as well as for average for fishing months (Q1)

Earning potential therefore relies on catch rates, total time spent fishing and access to allocation. When extrapolated to the total vessels in the sector, an estimated 1 080 crew occupy hake longline vessels and another estimated 500 occupy factory and office positions. The latter figure assumes 0.5 staff per crew and workers in factories may also process a variety of other products, making an accurate assessment of workers employed solely by hake longline challenging. The average annual salary per crew member from Q1 was calculated and extrapolated to the total sector (45 vessels) and according to these results, a total of ZAR 44,700,120 was paid as wages to crew members in 2017.

Vessels that have access to large clusters of allocation and primarily concentrate on hake fishing, may employ the staff full-time. The majority of crew is contracted on a seasonal basis. On average, in 2017 deckhands earned R 2191 per month although this figure does not account for income earned through other occupation and fishing activities. To increase income hake longline vessels may make use of other fishing rights, such as Tuna Pole and Large Pelagic. Note also this average is low primarily because hake allocations do not allow for fishing year-round. Income earned on a trip-by-trip basis is therefore significantly higher and annual average income generated for hake is proportional to hake allocation.

Benefits - Crew

In addition to commission-based salaries, crew members also received additional financial contributions. These contributions included Skills Development, Medical, Unemployment Fund (UIF), Other Training, and Transport and Education Training Authority Contributions (**Figure 7**).

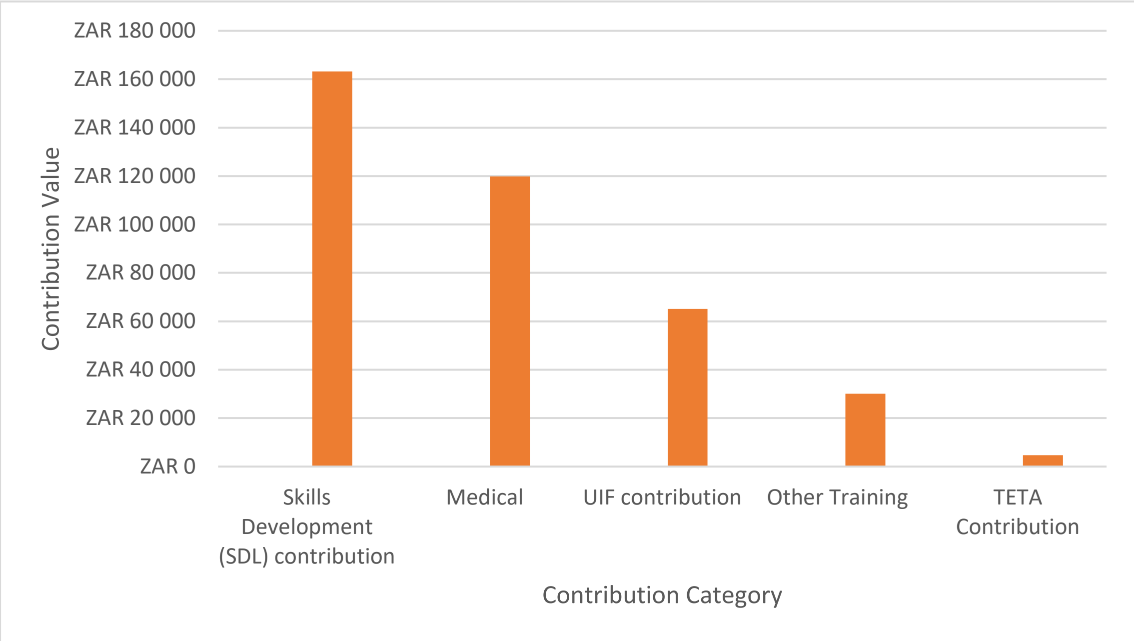

Figure 7: Value of other financial contributions made to crew with number of respondents represented by n for each category (Q1)

Demographics - Crew

With regard to ethnic distribution, African crew made up the majority of sea-going staff **(**Figure 8**).**

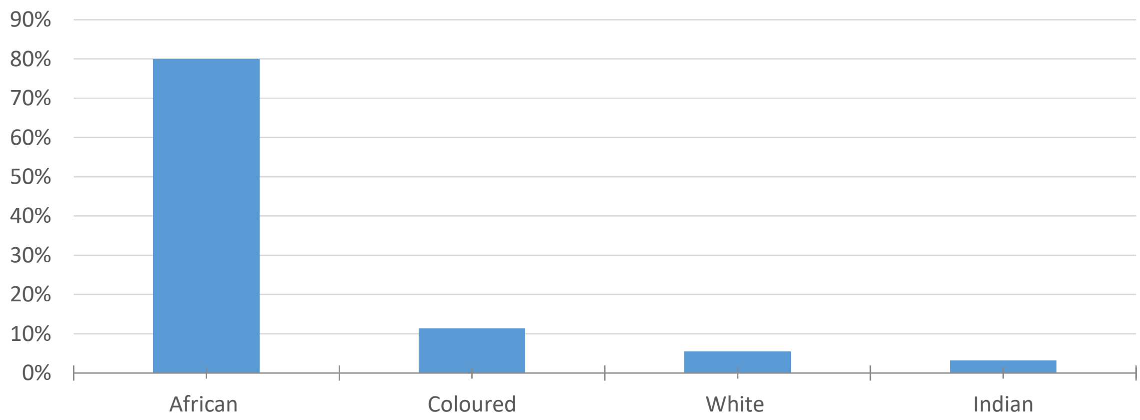

Figure 8: Ethnicity distribution by crew (Q2)

Ethnicity was also reported by crew category by some respondents and these results are displayed in Figure 9. The majority of crew members consist of African males that perform deckhand duties and are on average 49 years old. Colored crew members were also numerous and found in low-skilled and skilled positions, such as Skipper and Chief Engineer. They occupied most crew categories apart from Bosun, Shooter Galley Hand and Greaser and their average age was reported at 43 years old. Lastly, White Males made up the minority of crew members and only filled skilled positions, such as Skipper, Chief Mate and Chief Engineer and their average age was 57 years old.

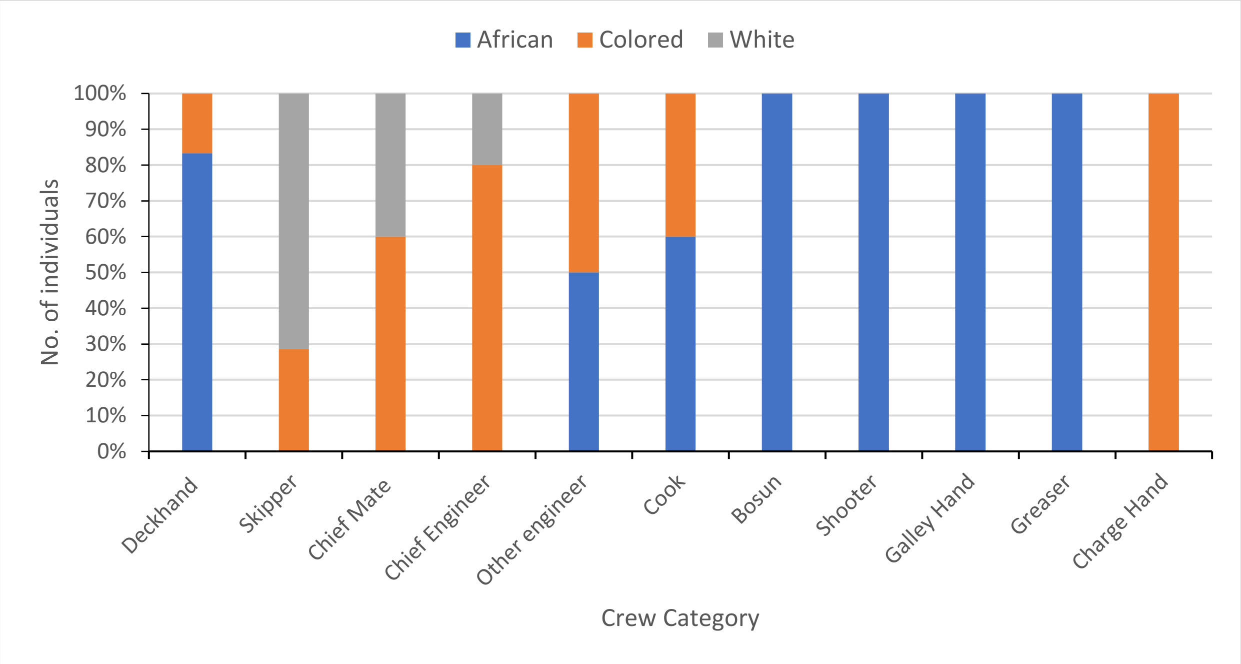

Figure 9. Ethnicity by Crew Category (Q1).

Respondents also reported on education levels of crew **(Figure 10).** White males were the only group with tertiary education and African males constituted the only group without matric. However, the latter had the highest rates of vocational training with over 45% of all individuals falling within this category. Thus, vocational training was received by all ethnic groups and appears to be an integral component of securing employment in the hake longline sector.

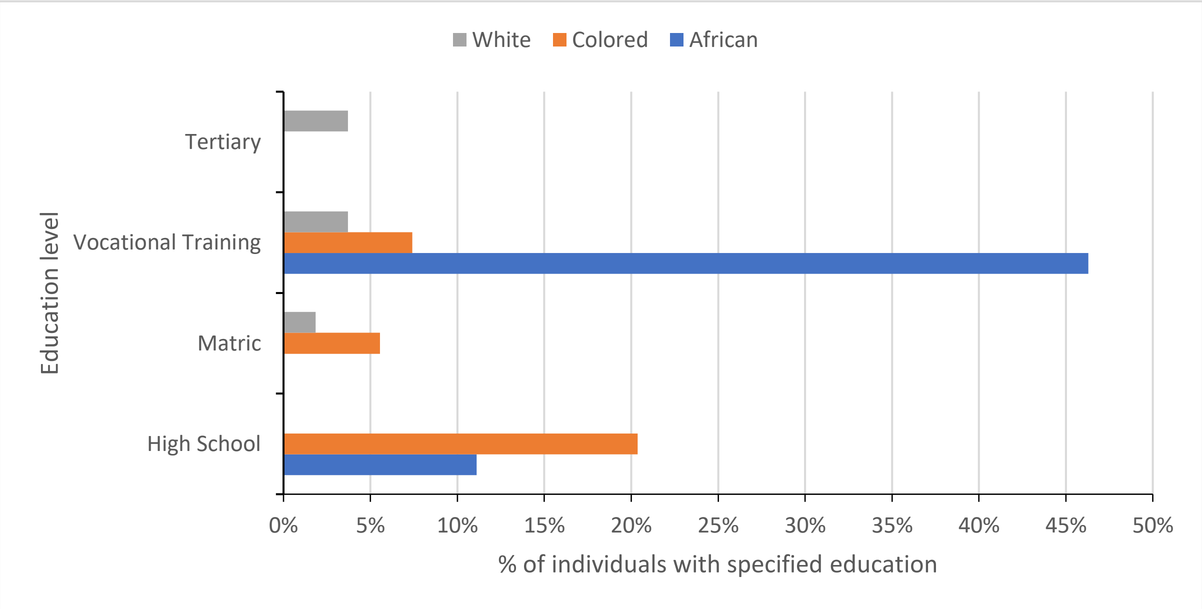

Figure 10: Reported education by ethnicity (Q1) (N= A (31), C (18), W (5))

Capital Investment as a Proportion of Number of Employees

The average investment per crew and all staff was assessed by dividing the total investments of the company by the number of crew or crew and all land-based staff (
Table 3). Total investments were the vessel value (book value), non-current assets and land & buildings. This translates into a total investment per employee as a proportion of the total investment (only based on the sample size and not extrapolated). The average annual hake allocation proportion per fisher in 2017 was 15 t and the effective average annual catch per fisher is shown in **(**Table 4**).**

Table 3: Investment in crew and land-based staff (Q2)

Crew Only	Crew & Land-based staff
R281,280	R258,236

Table 4: Average catch by fisher for hake nominal mass (Q2)

2016	2017	2018
12 t	13 t	12 t

Employment Creation – Land Based

Due primarily to the small hake allocations, investments in land-based infrastructure, such as processing is limited. Only operators that are able to consolidate several hake allocations or combine a processing facility with other fishery sectors can in economic terms, invest in infrastructure. Only one company was able to provide detailed factory salary figures and the occupation titles and specific salaries of a total of employees at the time of the survey 2018/2019 **(**Figure 11**).** The highest cumulative wage bill was paid to fish filleters, as these are the most numerous low-skilled workers in factories and the highest remunerated individual was the manager in the "receive and dispatch" department. Fish processing activities move through four distinct departments of a factory, namely production, quality control, receive and dispatch and cold store and ice plant.

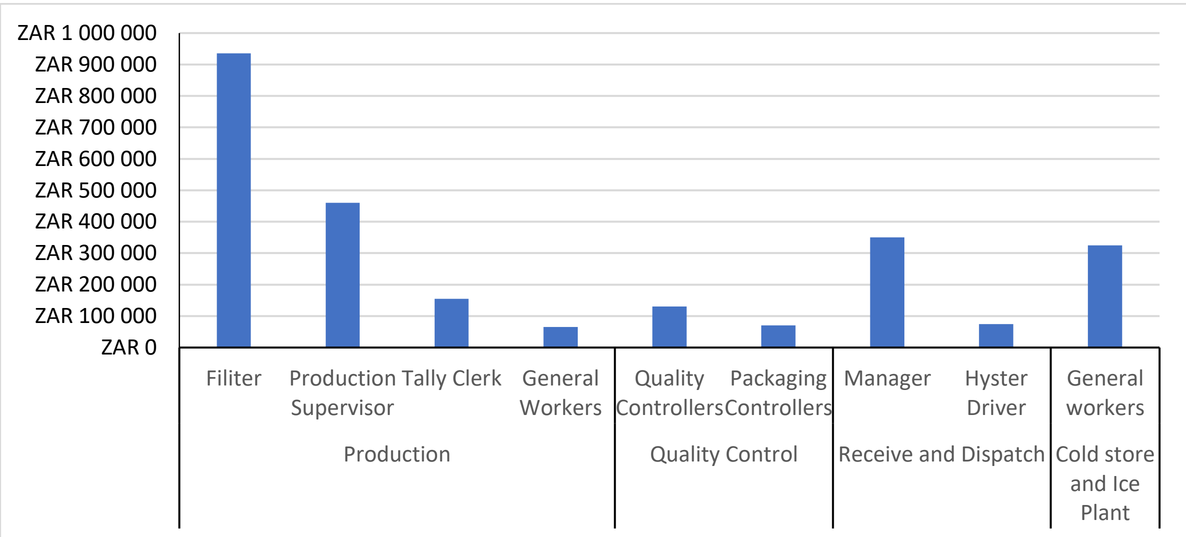

Figure 11: Factory salaries paid by occupation and department (Q1)

Further review of information available on land-based processing facilities was provided for 2020. While this does not cover land-based processing fully, there are numerous hake-directed longline processors in the Western, Southern and Eastern Cape provinces. These facilities focus on processing of both wetfish in the Headed and Gutted (H&G) form (as well as some frozen and reprocessed) as well as a portion of Prime Quality (PQ) hake for direct export. The employment created in these areas is significant and is approximated in Table 5 below.

Table 5. Current employment in processing facilities associated with hake-longline (selected only not all facilities)

Land-Based Processing Employment : Hake Longline (2020)					
		Employment	Hake LL	Province	Comment
Pescaluna	Hout Bay	110	2273 t	Western	Hake longline (H&G and PQ) & 20% other sp.
Komicx	Kommetjie	70	1225 t	Western	Hake Longline (H&G and PQ) % trawl /mixed spp.
Sentinel	Hout Bay	68	388 t	Western	Hake Longline, some trawl and mixed sp.
Balobi	St Francis	50	600 t	Eastern	Hake longline (H&G), squid, sardine mostly
Viking -Sea Harv.	Mossel B.	Not specified		Southern	Hake Longline, Trawl, Mixed

NOTE: These numbers are for current estimates and were provided post the formal surveys

Demographics – Land-Based

Ethnic distribution for land-based staff was provided by respondents **(**Figure 12**)**. Land-based positions were classified into factory positions and office positions. The latter was composed of accountants and shore support. Individuals belonging to this category were all female and colored or black. However, too few respondents included information for this category for meaningful analysis.

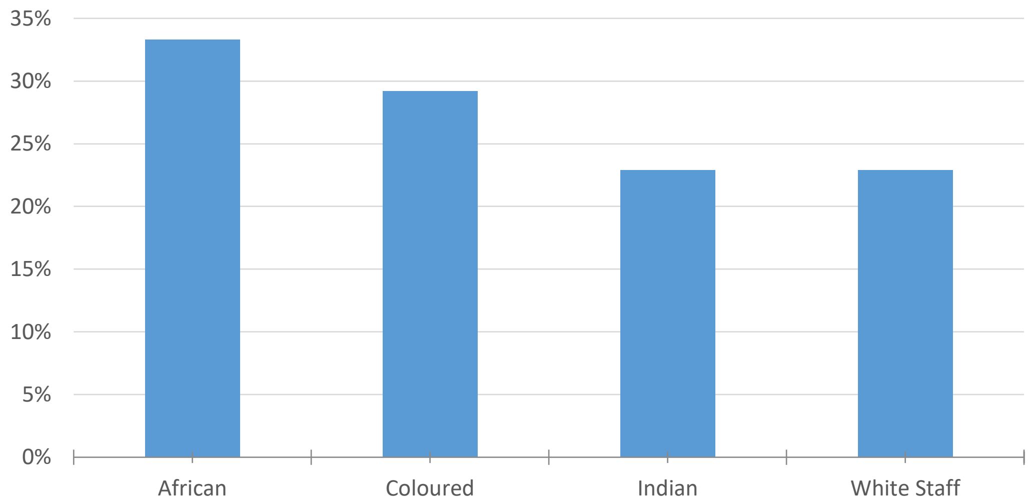

Figure 12. Ethnic distribution of land-based staff

Investments

Survey respondents were asked to provided asset values for vessel, fishing gear and other infrastructure such as land, buildings, vehicles, equipment etc. These were further divided into current and non-current assets, with only the gear value being listed as a non-current asset **(**Table 6**)**. These numbers represent 31% of the sector's total fleet. For values of the total fleet of 45 vessels a simple extrapolation of the value of all assets that can be attributed to the fishery is provided in (Table 7).

Table 6: Asset types and their respective value (Q2)

Total Assets	Non-Current Assets	Current Assets
R101,860,202	R83,290,876	R3,358,570

Table 7: Asset types and their respective values extrapolated to total sector (Q2)

Total Assets	Non-Current Assets	Current Assets
327,989,850	268,196,620	10,814,595

For most respondents, the most valuable assets category is the vessel, and the average book value of each asset type is displayed below **(**Table 8**).** All respondents provided vessel values, but only three were reported land and building information. Vessels ages ranged from 62 to 2 years, with the average age around 39 years.

Table 8: Average value per asset type (Q2)

Vessel	Land & Buildings	Vehicles	Equipment	Other (non-sea going)
6,725,946	813,333	333,725	210,258	2,204,189

Vessel Catch-Per-Trip

The nominal catches of hake varied seasonally with higher catches observed in November, December, March and April. These catches are displayed and compared to total catches on a month-by-month basis. The information collected also provided bycatch information and these results are shown in **Figure 13**. As can be seen, Kingklip always accounted for the highest bycatch with highest levels in April. The other bycatch included Jacopever, Shark and Monk which formed a less prominent portion of the bycatch profile. Out of these species caught in smaller volumes, Angel fish constituted the most common species in April, May and June.

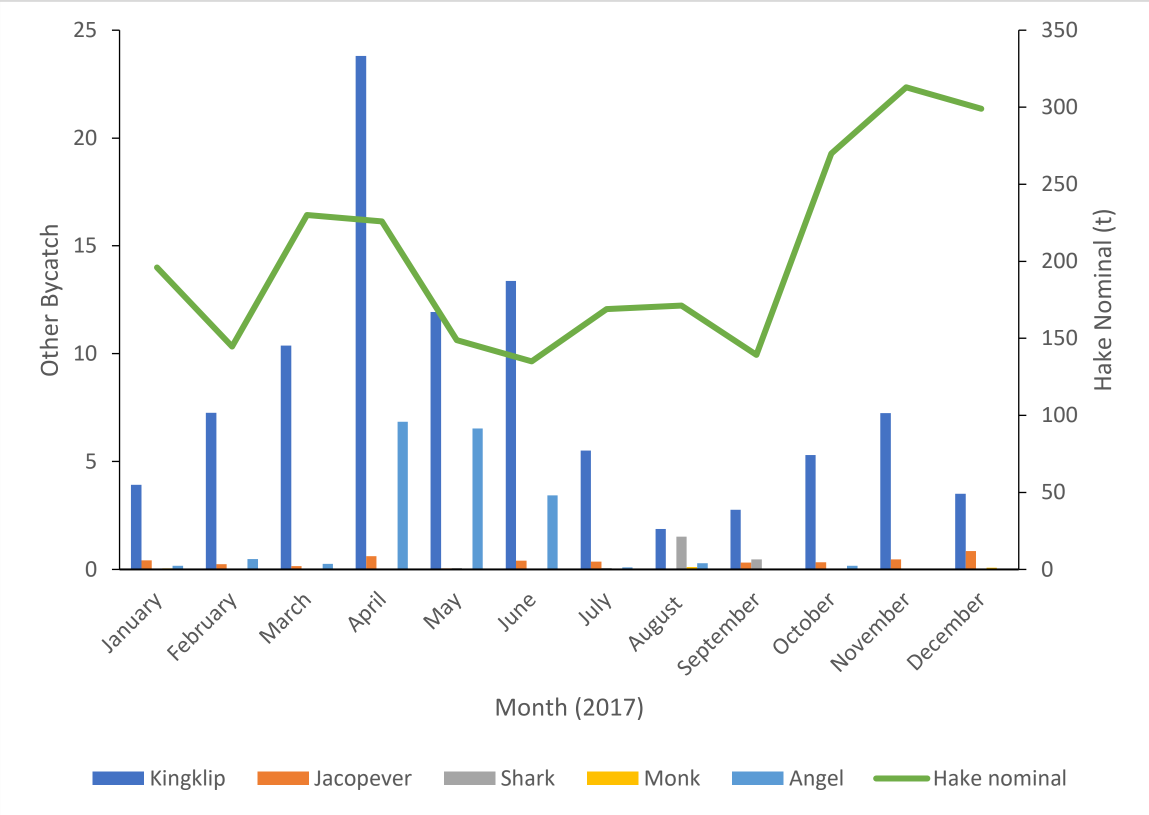

Figure 13: Total bycatch caught by month by 9 vessels in 2017 (Source CapMarine)

Fishing Costs

Annual Costs

Companies paid for a variety of costs to keep their vessels operational. The average of these expenses is shown in (Table 9) and proportionately in Figure 14. Loans (debt) outweighed proportionately all other operational costs.

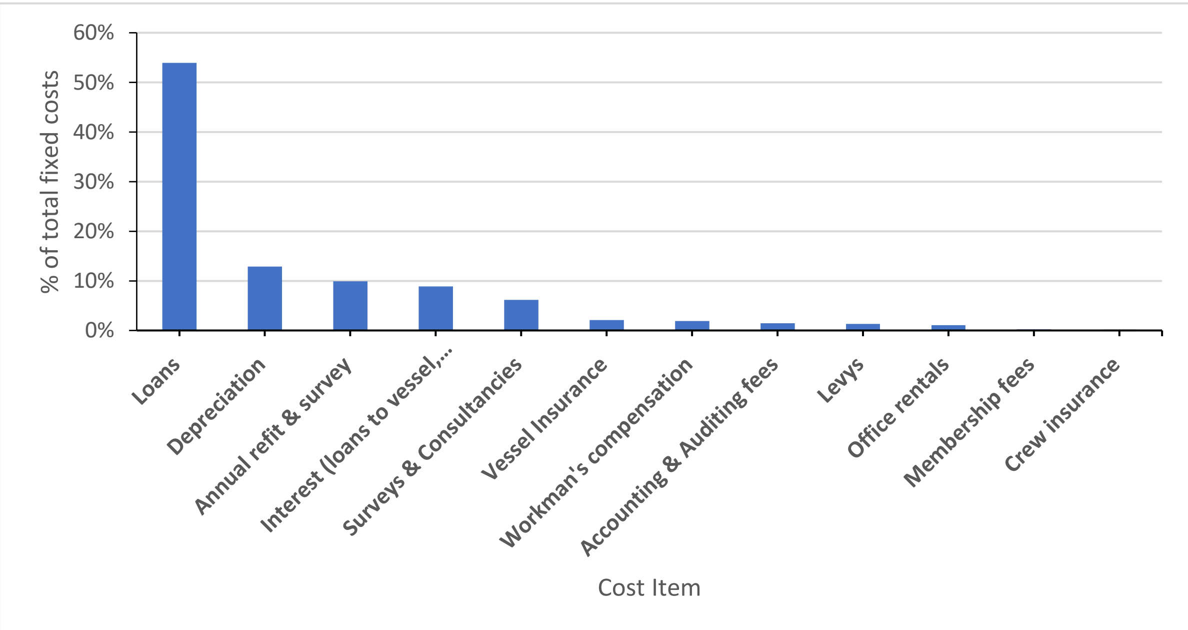

Figure 14: Expenditure: Annual Fixed Costs (Q1)

Table 9: Average ZAR values for all fixed cost items (Q1) for the hake longline sector

Cost item	**ZAR value (average)**	**% Of total wage bill**
Loans (n=4)	2,419,123	53.93%
Depreciation (n=4)	578,921	12.91%
Annual refit & survey (n=5)	443,277	9.88%
Interest (loans to vessel, operations, etc.) (n=4)	397,518	8.86%
Surveys & Consultancies (n=7)	277,702	6.19%
Vessel Insurance (n=6)	93,911	2.09%
Workman's compensation (n=7)	85,649.47	1.91%
Accounting & Auditing fees (n=8)	66,254.34	1.48%
Levies (n=5)	59,839	1.33%
Office rentals (n=3)	48,064	1.07%
Membership fees (n=6)	8,809	0.20%
Crew insurance (n=6)	6,801	0.15%
Total average fixed vessel costs (2017)	4,479,068	-

Per trip Operational Costs

Similarly, the average vessel costs per trip (variable costs or VC) are shown in listed in (**Table 10**). Of these, the labor costs (crew costs) were by far the highest at 43% of the total wage bill.

Table 10: Average ZAR values for variable cost items

Cost item	ZAR value (average)	% Of total wage bill
Labor cost (n=6)	159,187	43.22%
Fuel, oil and lubricants (n=8)	58,492	15.88%
Bait (n=8)	40,510	11.00%
Safety gear and related equipment (n=8)	38,648	10.49%
Ice (n=8)	11,082	3.01%
Provisions (n=8)	9,628	2.61%
Consumables (n=8)	8,651	2.35%
Gear replacement – Hooks (n=8)	6,647	1.80%
Packing Materials (n=9)	6,292	1.71%
Gear replacement per trip – Lines (n=8)	4,724	1.28%
Stevedoring costs (n=6)	4,638	1.26%
Communications (monthly) (n=8)	3,745	1.02%
Other fishing gear replacement etc. (n=5)	3,521	0.96%
Misc. Transport costs (n=6)	3,274	0.89%
Training and Development (n=5)	3,240	0.88%
Port Fees (monthly) (n=8)	3,010	0.82%
Levies (monthly) (n=5)	1,869	0.51%
Gear replacement – Pots (n=7)	1,174	0.32%
TOTAL average operational Costs per month (2017)	368,332	

The second round of questionnaires confirmed the four most common expenditure types for 2017 and 2019 were labor, fuel, bait and gear replacement (Figure 15)

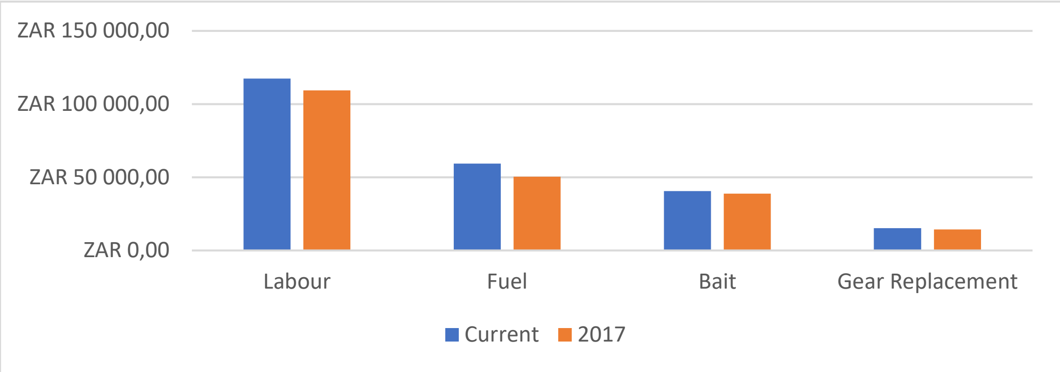

Figure 15: 2017 Average Per Trip Expenses (Q2)

Cost per Ton of Hake

The cost per ton of hake was assessed by combining the fixed costs and variable costs on a trip-by-trip basis and dividing these by the nominal ton of hake caught per vessel. Financial costs, including interest payable and loans amounts were removed from these totals and only 5 of the 8 vessels provided enough information to be included in the sample. An average of ZAR 18,155 of expenditure is required to catch 1 t of hake nominal mass.

Variable costs by vessel category were more challenging to derive as only. Respondents completed about 18 trips on average for 2016, 2017 and 2018. Over these years, respondents caught an average of 322 t of hake (nominal mass) per annum. Vessel sizes and respective catches differed, however. Therefore, vessels have been categorized into vessel displacement categories (Table 11).

Table 11: Vessel hake catches and trips by year (Q2)

GRT	2016		2017		2018	
	Catch (t)	**Trips**	**Catch (t)**	**Trips**	**Catch (t)**	**Trips**
60 t – 90 t (n=5)	191 t	12 trips	275 t	22 trips	683 t	31 trips
100 t–140 t (n=5)	198 t	12 trips	290 t	21 trips	397 t	19 trips
185 t–320 t (n=4)	190 t	11 trips	225 t	18 trips	697 t	27 trips

The total averages for fixed costs and per trip costs for 2017 and 2019 (current) were provided by respondents and are tabulated below (Table 12) for Variable (VC) and Fixed (FC) costs

Table 12: Total average Variable cost (VC) and Fixed cost for 2017 and current by vessel category (Q2)

GRT	2017 (ZAR)		2019 (ZAR)	
	VC	**FC**	**VC**	**FC**
60 t – 90 t	204,985	650,327	202,910	528,515
100 t–140 t	257,845	467,720	305,625	567,207
185 t–320 t	407,489	2,950,897	341,524	1,434,936

Using the information provided by respondents, catching costs per ton of hake can be calculated by vessel category. Larger GRT vessels pay higher catching VC and annual FC, due to the amount of labor needed and the high maintenance costs. The average catch per trip for vessels in 2017 was 12.5 t, 14 t and 12.5 t for small medium and large vessels respectively. For 2018, this average catch was 22 t, 20 t and 25 t for the above-mentioned vessel categories respectively. Since the average trips per year and their catches have been calculated by vessel category, an approximation on the cost per ton may also be made (Table 13**).**

Table 13: Catching costs (VC x trips + FC) per ton for different vessel categories (Q2)

GRT	Cost per ton 2017	Cost per ton 2019
60 t – 90 t	R16,283	R9,983
100 t–140 t	R17,989	R16,055
185 t–320 t	R39,112	R15,288

The annual refit and survey fixed costs in 2017 for the large vessel category were the highest ranging between R 1.2 million and R2.3 million. The questionnaire (Q2) only assessed basic operational expenses per trip which included three other categories and basic annual expenses that also only included three other categories. Not all respondents submitted expenses for the other categories. In Q1, financing costs, including loans and interest, made up the largest proportion of annual costs but these were not included here. Per trip costs for medium and small vessels were reported to be around R16,000 to R20,000. As expected, operational costs for larger vessels are usually higher, but so are their catches. On average, vessel profits may be boosted by approximately 8% when all other bycatch species are taken into account (Q1).

Selling Prices

Selling price were provided by questionnaire respondents for 2017 and 2019, which saw a large increase for both Kingklip products between these years (Table 14)

Table 14: Selling price per ton in ZAR (Q2)

Product	2017	2019
Kingklip H&G	68,000	81,000
Kingklip Whole	50,000	75,000
Hake H&G	34,000	39,000
Hake PQ	27,000	30,000
Hake Other	18,000	21,000

Average selling prices for different species were analyzed and these results are shown in **Table 15**. Hake PQ fetched the highest revenue by mass sold but was only the third highest earner by kg of product. Conversion factors are used for both Hake Prime Quality (PQ) and Hake Headed & Gutted (H&G) and these were 1.46 and 1.1 respectively. These conversion factors are an important part of the calculations as in the case of Hake H&G, 1.46 t is equivalent to 1 t of nominal mass hake caught. The same goes for Hake PQ, where 1.1 t of this product type is equivalent to 1 t nominal mass hake caught.

Table 15: Average selling prices by product type

Product Type	Total Average Revenue Per Vessel (ZAR)	Average Selling Price per KG (ZAR)
Hake PQ	4,851,420	30.96
Hake H&G	1,412,532	35.09
Kingklip Whole	603,935	62.70
Hake Other	25,785	15.15
Shark	13,824	11.00
Angel	12,781	10.18
Jacopever	8,093	10.71
Gurnards	1,686	7.50
Monk	1,007	30.40
Mackerel	727	7.50

From these conversion factors it is evident that greater volumes of PQ Hake product may be achieved from nominal mass hake caught than those from H&G Hake. Moreover, the sales price difference of per/kg Hake PQ from Hake H&G is only 11.8%, whereas the conversion factor difference is 24.7%, thereby making Hake PQ a better economic performer than Hake H&G and providing reason for it being the preferred product type in the sample by revenue.

The average annual revenue generated per vessel in 2017 for hake and kingklip is shown in **Figure 16** and the average selling price for all catch in **Figure 17**.

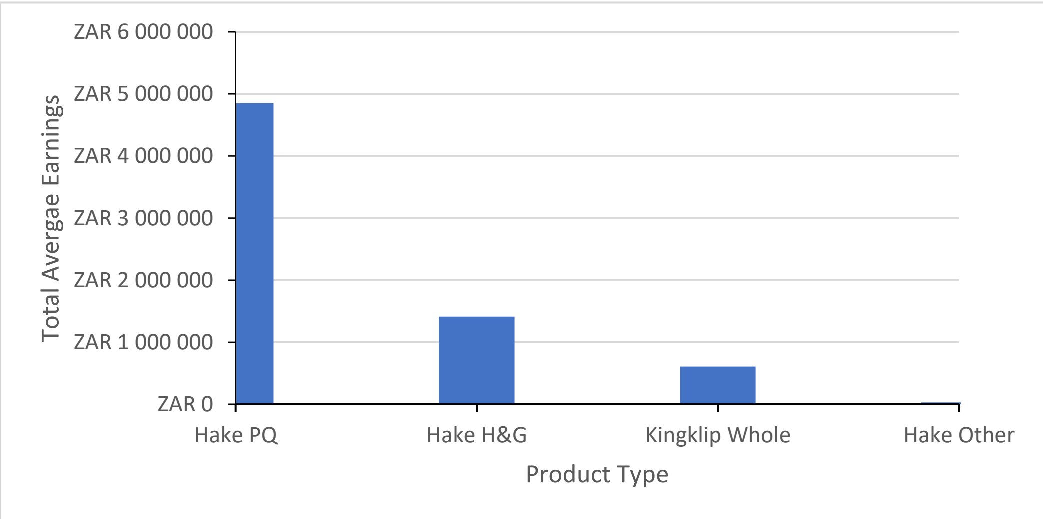

Figure 16: Total Average annual revenue Per Vessel for Hake and Kingklip Products

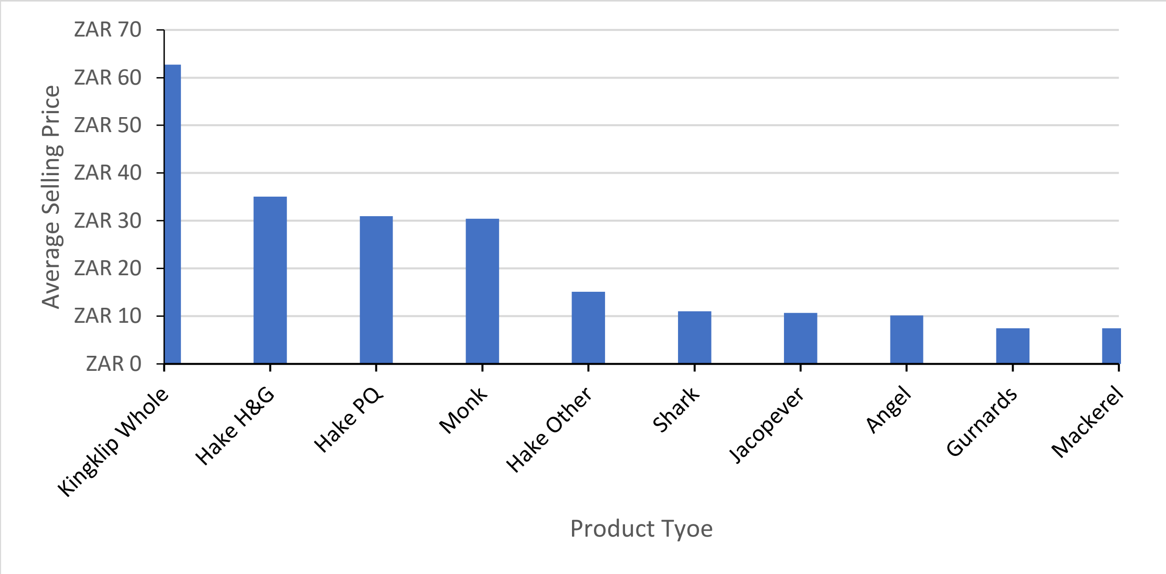

Figure 17: Average KG Selling Price Per Species landed in the hake longline fishery

Revenues and Allocations by vessel size

The average revenue per size class including all species was calculated from respondent information, only taking the respondent supplied information into account **(**Table 16**).** This was calculated by multiplying all product types with their associated value and obtaining an average for the specified vessel categories. This illustrates that medium and larger GRT vessels achieve significantly higher revenues than small vessels.

Table 16: Average revenue for all product types by year and vessel category (Q2)

GRT	**Revenue all product (2017 prices)**			**Revenue all product (2019)**		
	2016	**2017**	**2018**	**2016**	**2017**	**2018**
60 t – 90 t	2,190,940	2,143,180	2,885,787	2,191,521	2,149,955	2,900,387
100 t–140 t	13,839,690	12,937,730	7,912,850	13,993,690	13,015,130	7,943,600
185 t–320 t	16,268,329	11,984,315	15,242,086	16,691,649	12,436,968	15,471,503

Fishery Transformation

Black Ownership by Rights Holder and Geographic Spread

According to the hake longline sector report (HSLR, 2008) the demographic spread of shareholding (2008) was some of the highest in the surveyed fishing sectors, where 87% of rights holders had a greater than 50% shareholding. In 2008, 87% of allocations in the hake longline sector went to Rights Holders with more than 50% Black shareholding. Rights holders were also separated by gender, where 23% were female and 77% male. With regard to the former, even though the sample is quite small, the results from Q2, suggest that this proportion may have risen somewhat.

The largest obstacle to further transformation as identified by hake longline rights holders was access to capital followed by business development skills. In the HLSR an average of 53% of the top salary earners were black and 23% of the top salary earners were female. Obstacles identified to transformation are summarized in Table 17. The hake longline sector also reported that 60% of rights holders were concerned with sustainability of the resource and that rights holders formed a proportionally large part of industry associations, which is relatively high in comparison to all other fishing sectors.

Table 17: Transformation obstacles from HLL Sector Report (2018)

Potential obstacles to Black Success	Overall Response	Overall Rank	HLL Response	HLL Rank
Fishing experience	100	3	13	4
Business Management skills	191	2	27	2
Access to vessels	433	5	18	3
Access to capital	64	1	71	1
Unfair commercial arrangements		4	13	4

During this survey, similar information was collected, which showed that the demographic make-up of the hake longline sector was of similar distribution to the 2008 HSLR. Right's holder information with regard to BBBEE was collected and an average of 79.5% of the 46 rights holders sampled were of black descent **Figure 18**. No information pertaining to other ethnic groups was provided in the survey, but all rights holders had a black ownership component with the lowest Black Ownership levels recorded at 40%. Information pertaining to locations of hake longline rights holders also shows concentrations in Cape Town and Port Elizabeth. Rights Holder in this survey also provided Female Ownership information as well as on black ownership **(**Table 18**).**

Table 18: Black ownership and female ownership of individual rights holders (Q2)

Black Ownership	Female Ownership
79.4%	46.2%

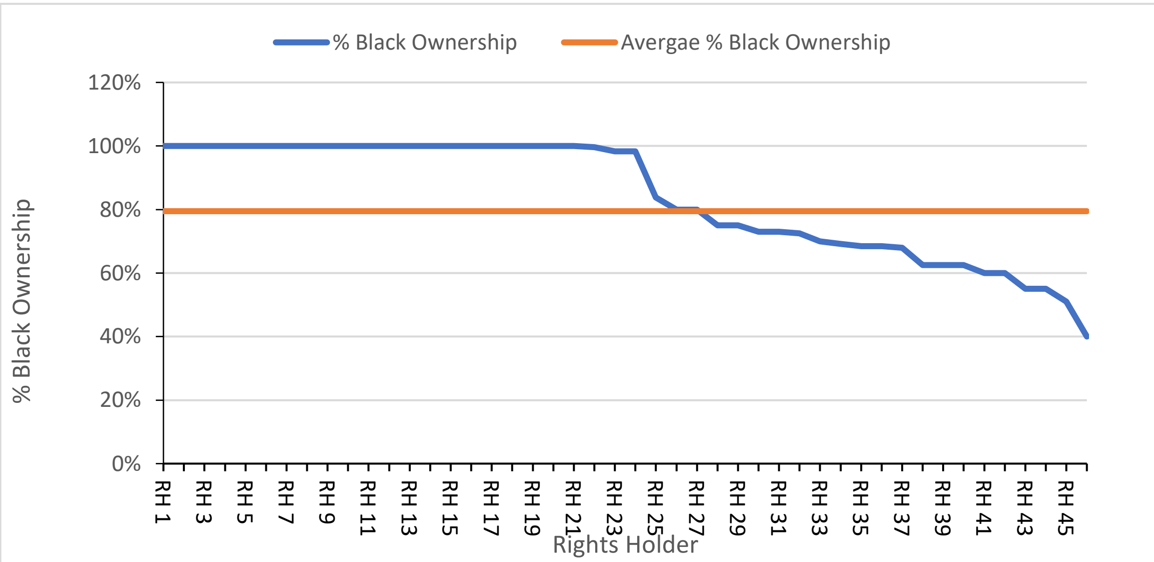

Figure 18: % Black Ownership by Right's Holder in then Hake Longline sector(N=46)

Comparative Transformation Levels

Comparative transformation levels for the South African fisheries sectors are shown in Table 19 for the period 2001 to 2017 (Mthembu, 2018). As can be seen the hake longline historically has one of the highest transformation levels even though a decrease was observed in the 16-year time period. It closely follows the hake trawl in 2017, which received only a slightly better transformation score. In contrast many other sectors received a much lower score[6].

Table 19: Racial Transformation Across South Africa's Various Commercial Fisheries (Reference: Mthembu, 2018 (Author based figures on DAFF's previous figures and his own calculations for 2017)

Sector	2001	2005	2009	2017
Hake Longline	90	91	92	80
Small Pelagics	75	61	51	60
West Coast Rock Lobster	60	62	73	70
Demersal Shark	50	73	86	69
Seaweed	43	55	6	14
Tuna Pole	43	55	50	42
Hake Inshore Trawl	42	48	75	82
Horse Mackerel	41	43	38	41
Patagonian Toothfish	40	58	47	60
Chokka Squid	33	48	45	49
Hake Deep Sea Trawl	25	27	59	56
South Coast Rock Lobster	25	27	59	56
KZN Prawn Trawl	17	63	40	59

Company BBBEE

Company information regarding BBBEE was collected from company BBBEE certificates and is shown in Figure 19).

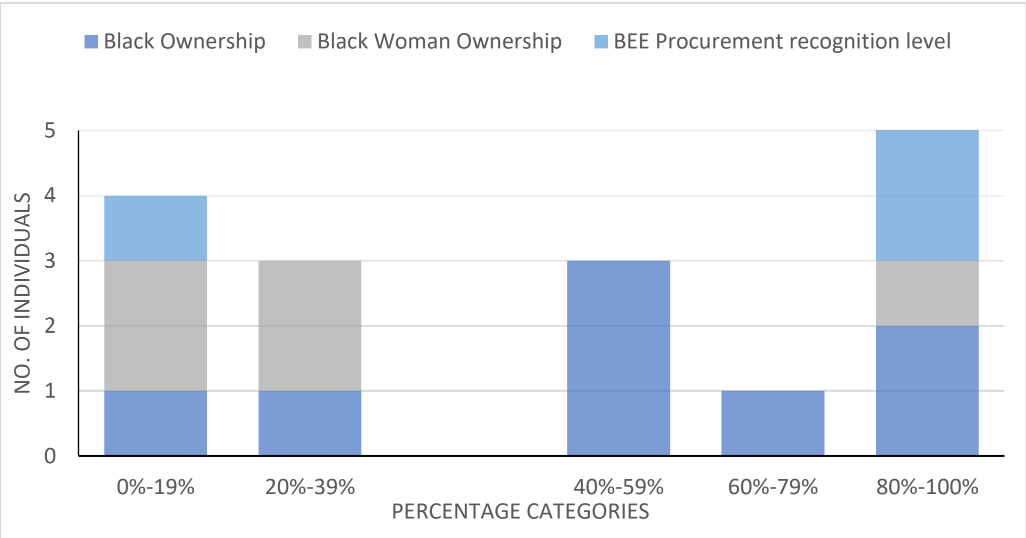

Figure 19: Black Ownership, Black Woman Ownership and BEE Procurement Level in the Hake Longline

[6] Mthembu, S. P. 2018. The socio-economic impact of the squid stock volatility in the Eastern Cape province of South Africa. Masters Thesis. University of Cape Town.

As Black Ownership, Black Woman Ownership and BEE procurement recognition levels are expressed in a percentage on such certificates, categories, consisting of 20% each were created and are displayed below.

Employment Equity Gender and Ethnicity

Employment equity information relating to company's structures was gathered from Employment Equity certificates, which specified the number of female and male individuals falling into specific employment and/or position types. These were further categorized by ethnicity. This breakdown for males and females respectively is provided in Figure 20 and Figure 21.

Males occupied all positions provided in the Employment Equity certificate, whereas females occupied a smaller range of positions and were less numerous than males overall. Furthermore, African individuals for both genders were the most numerous, with whites only constituting a relatively small proportion of positions occupied. The category "total permanent" consisted of the highest number of individuals which were made up of both genders and all ethnicities. African, Colored and White males were found across all position types apart from "Professionally qualified and experienced specialists and mid-management" where no African males were present. Females on the other hand were mainly represented by African individuals, where only "top management", "senior management" and "total permanent" was composed of non-African individuals as well as African individuals.

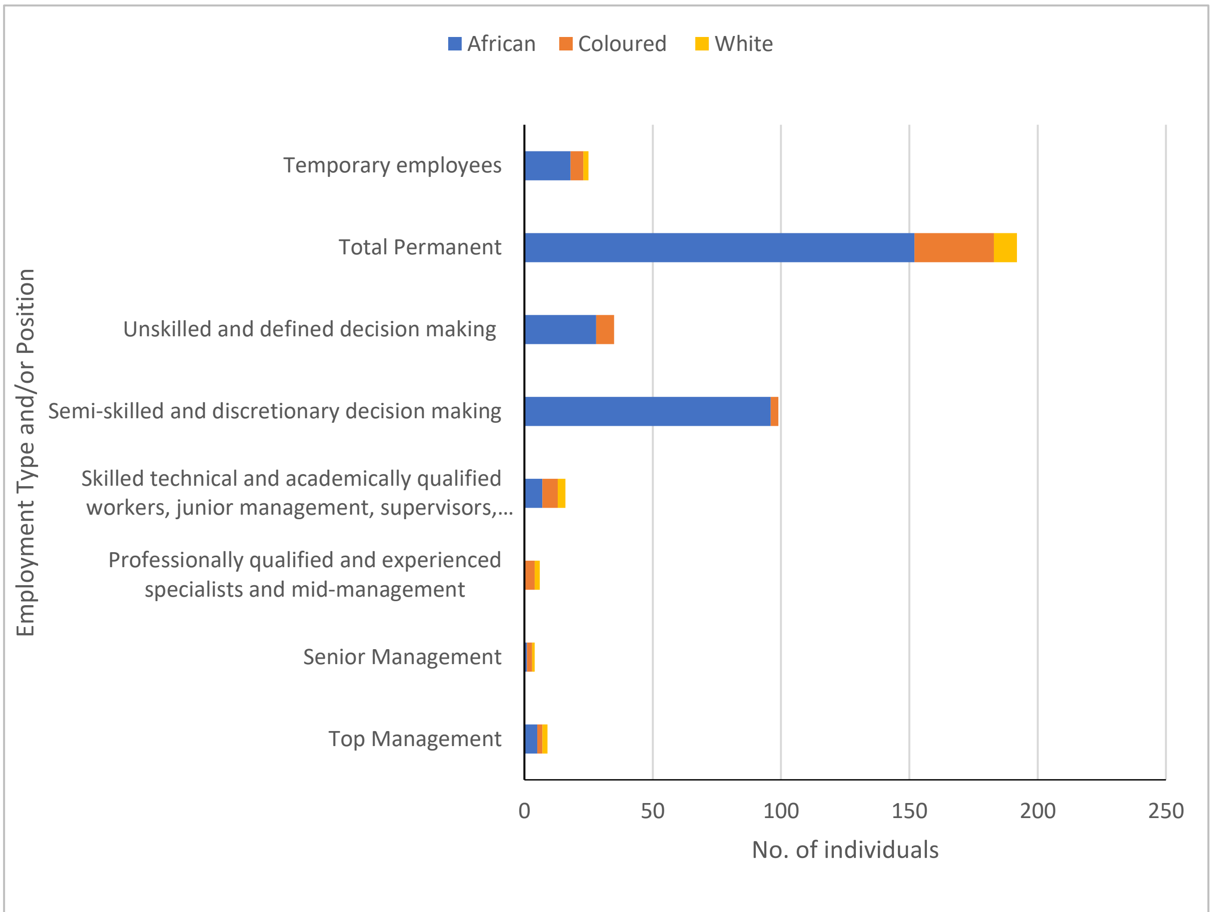

Figure 20: Employment Equity for males by Position and Ethnicity for Totals as gathered from Employment Equity Certificate

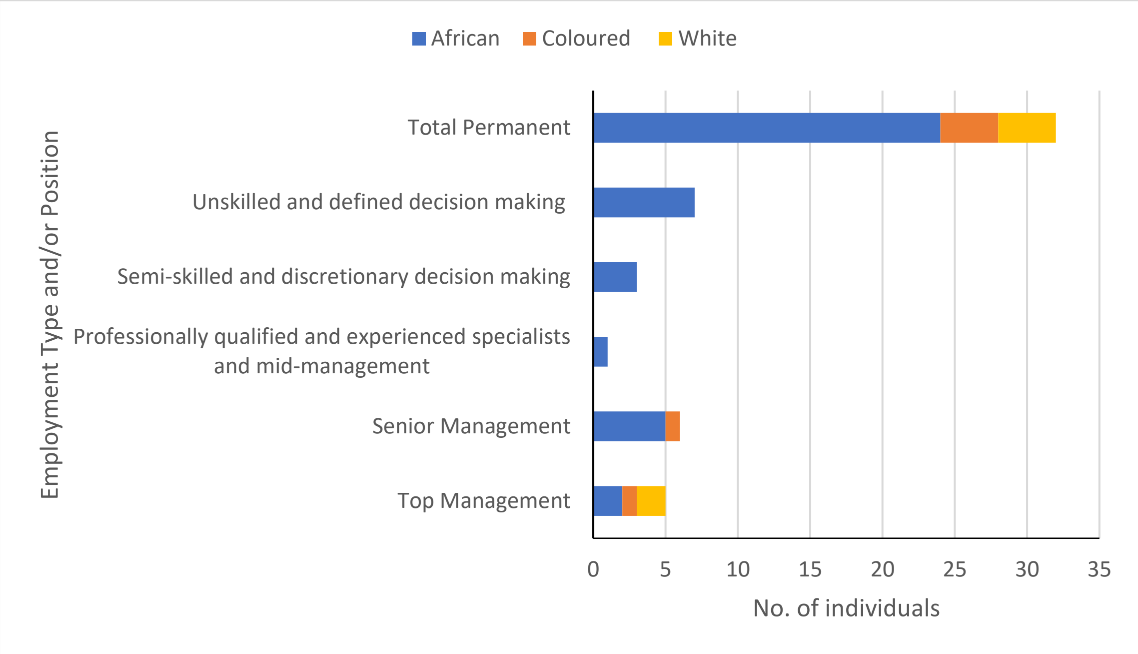

Figure 21: Employment Equity for females by Position and Ethnicity for Totals as gathered from Employment Equity Certificate

Viability of Hake Longline Allocations

A minimum allocation can be calculated for vessels, by examining at which allocation levels they would break even. This can be done by apportioning the total Fixed Cost of the average trips per year and multiplying the average Variable Cost by the average number of trips per vessel category. These expenses may then be compared to product selling prices using an average catch profile for hake only. On average, about 66% of all hake being sold is PQ product, with the remaining 34% being H&G[7]. No other hake products were reported by respondents.

It is challenging to estimate a minimum allocation due the high variability, but different sized vessels do theoretically need different allocations sizes to turn a profit due to the increase in variable and fixed costs. The average allocation size per category supports this notion, as larger vessels "cluster" allocation and fish under several rights holders as demonstrated in the survey samples (Table 20). Additionally, some vessels from the larger size category with freezing capabilities, spend up to 16 days at sea per trip. Smaller vessels generally do not exceed the 8-day threshold.

Table 20: The average allocation and number of rights held by vessels of different size categories in 2017 (Q2)

Vessel Size Class					
60 t – 90 t		**100 t–140 t**		**185 t–320 t**	
Allocation (t)	**No. of rights**	**Allocation (t)**	**No. of rights**	**Allocation (t)**	**No. of rights**
337	4	388	3	498	7

[7] This number has changed since 2019 to increasingly more H&G. There are several reasons for this, contributed to by market preference, logistic costs to export fresh product and not least of all Covid-19.

The catching ability of vessels across these size categories, measured in catch per 1000 hooks, exhibit marginal differences (Figure 22). While smaller vessels are less cost output, the catch rates across vessels classes are similar.

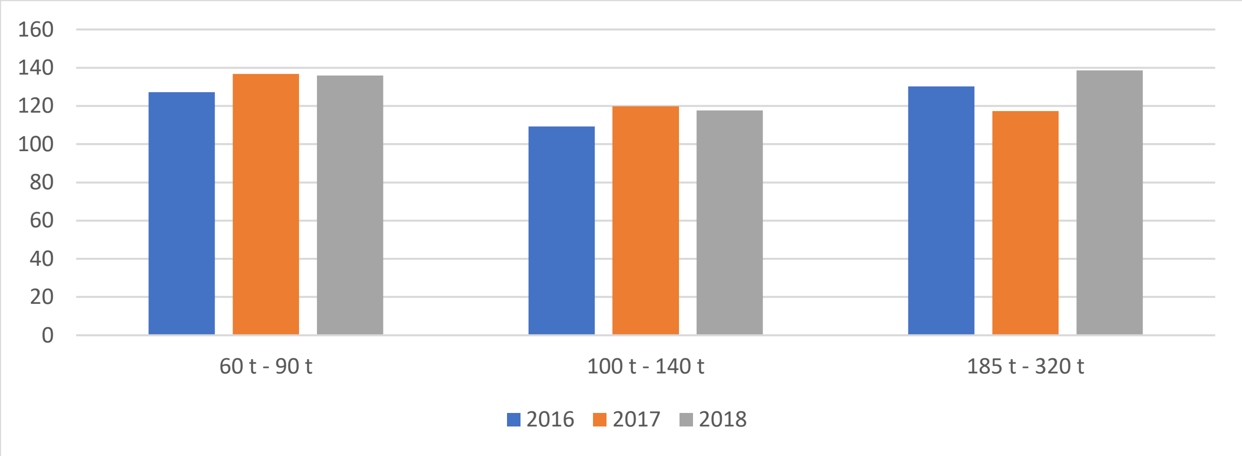

Figure 22: Catch per 1000 hooks for 2016, 2017 and 2018 by vessel category (Q2)

Break-even Points

An average for both variable and fixed costs was used to analyze tons of hake needed in order to sustain operations. This average was compared to the "Average kg selling price per product type". Due to the small sample size, the lack of information for certain cost items and the size discrepancy between vessels, deriving a meaningful average was challenging. Data received from the questionnaire should, however, be able to provide some general information relating to catches required in order to sustain both fixed and variable vessel costs. Some companies provided figures that skewed this average considerably and these were consequently omitted. For example, one vessel reported very high "safety equipment expenses per trip", namely ZAR 300,000. These and others were omitted from the calculations. Furthermore, annual fixed costs, like loans and depreciation were also omitted, as these in some cases added several millions to the total expense bill.

This is not to say that these expenses should not be taken into account, as they do form part of the operating expenses in the long-term. This study however, focused on 2017 break-even costs only and therefore, the information provided should be seen as a snapshot in time as it gives insight into a broader range of possibilities instead of a fixed and definitive set of analysis describing the economic workings of the hake longline sector.

The received data showed that variable costs per trip were set at ZAR 308, 165 and the average fixed costs at ZAR 1, 481, 023. Using this method, for H&G hake, longline vessels need to catch approximately 13 t nominal mass in order to cover operating costs per trip and for PQ hake, vessels need to catch approximately 11 t nominal mass to achieve this. However, with regard to covering fixed expenses, which were provided as an annual figure, hake longline vessels needed to attain catches of over 61 t nominal mass for H&G hake and catches of over 52 t nominal mass for PQ hake.

Vessels averaged 18 trips in 2017 and since costs accumulated as more trips were conducted, the data can only provide a broad understanding of the catches needed for a vessel to break even after one trip. **Figure 23** illustrates the value of catches for both H&G and PQ hake product types necessary to reach recover the total costs per trip. These costs also account for the fixed costs and are based on the fixed costs plus the variable cost for each trip. Companies incur a loss for the first few trips that are executed and only thereafter start to turn a profit. For example, from **Figure 23** below, were vessels to only process PQ hake, then approximately 10 trips would be required to start breaking-even or if they do an average of 18 trips per year with a mix of both H&G and PQ hake, then there is a different breakeven point.

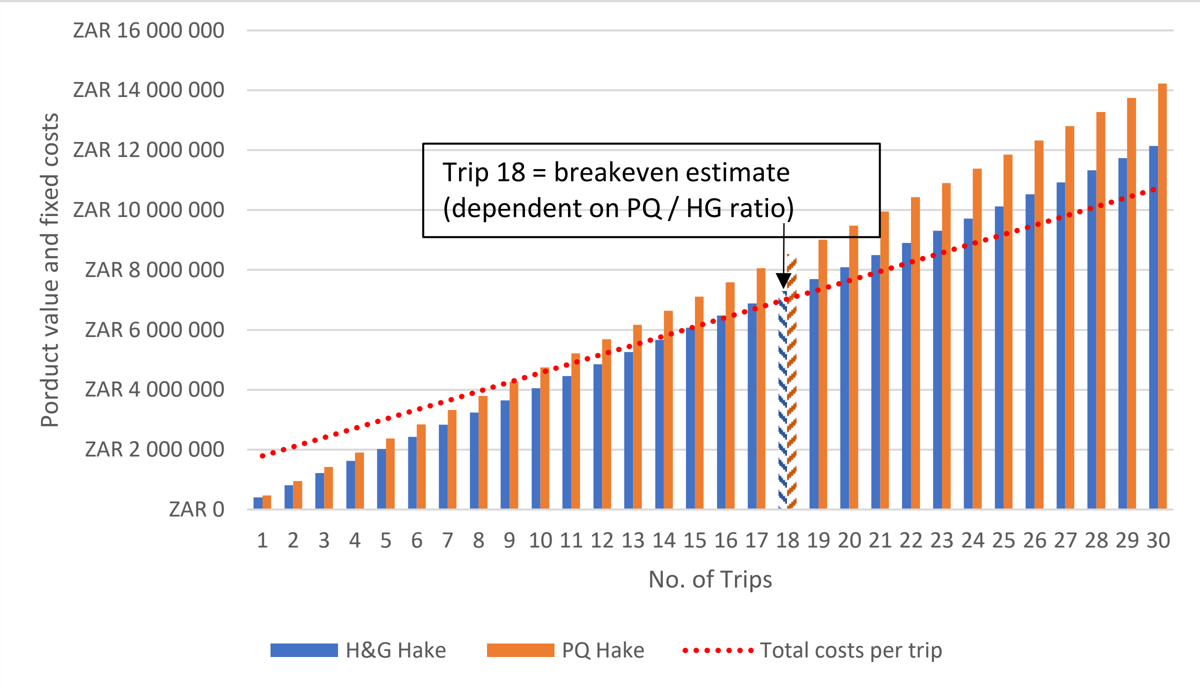

Figure 23: Profits derived from H&G, PQ Hake in comparison to total operating costs without bycatch species.

However, in reality vessels do not solely rely on profits from these product types and bycatch species further enhance earning ability. The average cumulative bycatch per year amounted to 4.67% of the total catches and apart from Kingklip did not include species more valuable than hake. On average, 3.68% of total catches were comprised of Kingklip and due to the value of this species, which fetched ZAR 62.7 per kilogram, catches of this species have the potential to significantly enhance profits. As this is roughly twice the value of PQ Hake, one may expect the total value of catches to increase by 7. 2% if all species are also taken into consideration. The average earnings per species per trip for the most lucrative species is shown in **Figure 24**. Here the average sales price for both PQ and H&G hake were multiplied by the nominal mass of hake caught on average, which was 16.84 t.

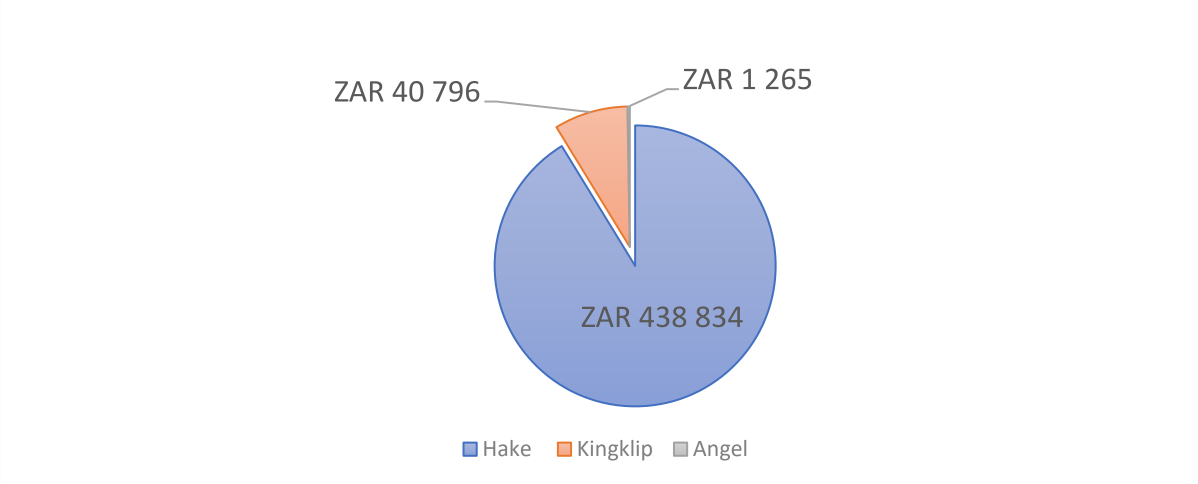

Figure 24: The average earnings by top 3 most profitable species per trip in hake longline in 2017.

The survey data revealed that 57% of vessels providing selling price information processed the majority of their hake catches into PQ products and the remainder only processed their products into H&G hake. Since it is not feasible to identify at which ratio vessels convert hake into H&G and PQ, the average nominal hake catches per vessel were divided by two and then divided by their respective conversion factors to attain their actual weight. These weights were multiplied by their respective selling prices to derive the revenue (ZAR 438,834) were vessels to sell half their hake catches as H&G products and the other half as PQ products. The average revenue for the three most profitable species is shown in **Figure 25** and also expected catch volume was added the average value of bycatch species per trip (ZAR 42,429).

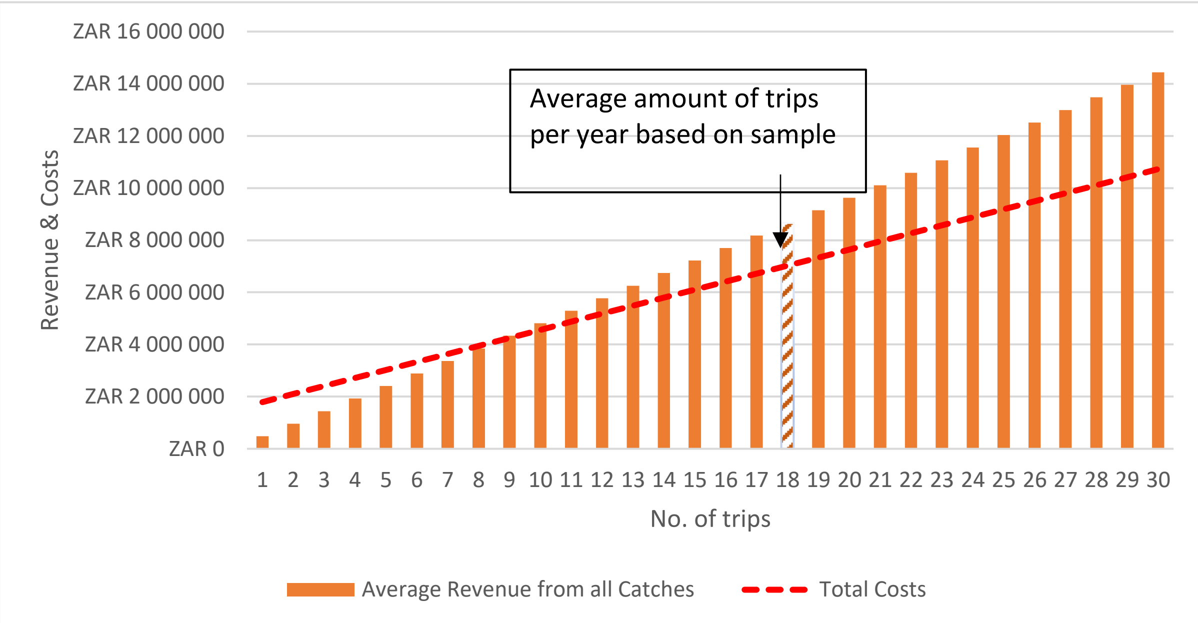

Figure 25: Total average costs and total average revenue from all catches, assuming hake catches are equally processed into both H&G and PQ product types

The differences between the average revenue of hake H&G and PQ as in **Figure 23** compared to the approximations shown in **Figure 25** demonstrate the expected discrepancies of added value through bycatch. Here, vessels break even between 8 and 9 trips, as the total revenue for trip 9 amounts to ZAR 4, 331, 371 and the total costs to ZAR 4, 254, 508. At trip 18, the average amount of trips conducted in 2017 per vessel, revenues from fish sales equaled ZAR 8,662,742 and the cumulative costs amounted to ZAR 7,027,993. That leaves the hake longline operation with an average gross profit of ZAR 1,634,748. Noting also that as mentioned previously, loans, depreciation and some variable vessel costs were not accounted for in the total costs. These also need to be taken into consideration as these are substantial ongoing costs.

Moreover, according to these averages, vessels need to conduct the first 8 trips whilst running at a loss. High operational costs cannot be covered at this stage which means that poor fishing productivity and/or lack of access to allocation, can introduce considerable financial risk to hake longline operations.

Equivalence Point

In order to form a better picture of the opportunity cost incurred by hake longline operations, an equivalence point needs to be derived. The equivalence point is the measured point of production and gives a **Return on Investment** (ROI) that would be received in the market in general. Financial service providers offered a prime interest rate of circa 10.25% in 2017. The average profit per year by vessel was ZAR 1, 634, 784 for 18 trips. Including the fixed costs, the variable costs for 8 trips, before break-even is reached, may be included in the total investable amount. Therefore, the total investable amount would be ZAR 3, 946, 343. Were the amount invested, annual interest would have amounted to ZAR 493, 292, a mere third of the annual profits earned by active vessels.

A secondary approach to estimate the equivalence point would be to use the repo rate in combination with the inflation rate, which amounts to 12.02%. If the above listed operational resources were to be invested at these ideal rates, only ZAR 474, 350 per annum could be earned, still far less than the profits generated from likely fishing activities (Table 21).

Table 21: Repo and Inflation rate for 2017

Repo Rate 2017	Inflation Rate 2017	Total
6.75%	5.27%	12.02%

A crude predictive model using current revenue and expense levels was constructed in Figure 26. Here, four scenarios were provided, where expense levels increase by 2%, 5%, 10% and 15% respectively. The first two scenarios are highly likely to occur since current wage expenses constitute 43.2% of all expenses and should increase over time. Other external shocks include the oil price which will fluctuate over time. The latter two scenarios, namely the 5% and 10% increase scenarios, may take place during extreme fluctuations of labour costs and oil prices.

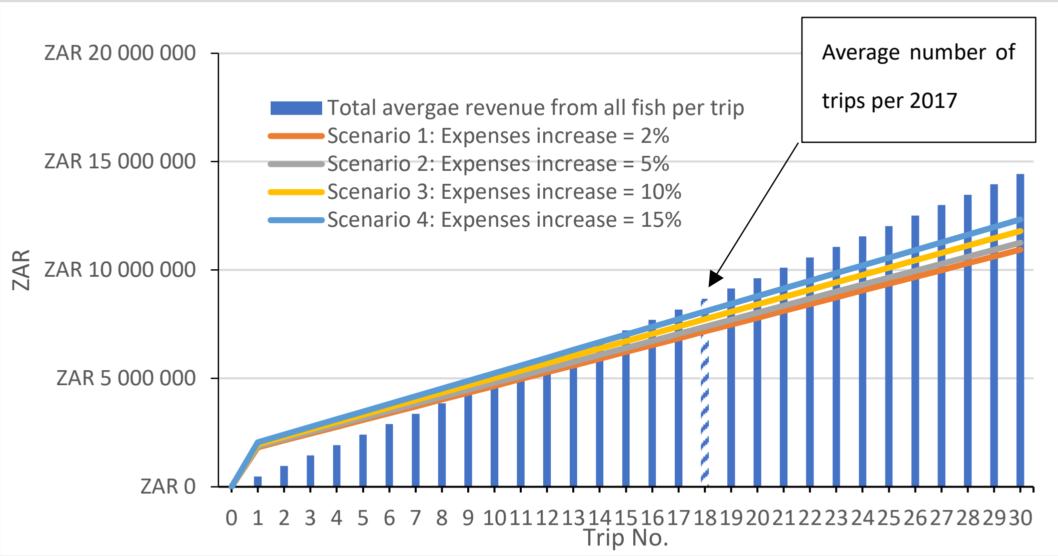

Figure 26: Break-even predictions at different expense increase levels

Table 22 illustrates at which trip number a profit would be obtained given the different scenarios. Positive returns are delayed as expenses inevitably increase and more catch is needed to maintain profitability. This also assumes hake prices remain stable. Further variables that increase the complexity of the matrix if other expenses increase between 5% and 10%, i.e., not only the labor cost increases to inflation levels, but also other cost items similarly increase at this rate.

Since profits are delayed, and currently approximately 16 t of hake nominal mass are caught per trip, either more hake will have to be caught per trip or more trips will have to be conducted to maintain profitability above the breakeven point. Assuming that in 2017 an average of 18 trips were conducted one could argue that a minimum of 21 trips would be needed if price variability was to result in a decline of between 5% and 10%, in which case a top up allocation of 50 t would be required to make up for these high-risk variables. i.e., the 2017 average of 16.8 t x 18 tips = 302.4 compared to a likely average of 16.8 t x 21 trips = 352.8 t.

It is therefore not possible to accurately predict at which levels hake prices and other cost items will increase and the resulting increase in quota that will be needed to compensate for these changes but that breakeven for an annual operation would at a minimum be between 300 and 350 t of hake.

Table 22: Trip at which first profits are earned, and at which point further catch is needed

Scenario	**Current**	**1: 2%**	**2: 5%**	**3: 10%**	**4: 15%**
First profit trip	9	10	10	12	14
Trips per year	18	19	19	21	23
Additional allocation required	NA	16.8 t	16.8 t	50.4 t	84 t
Additional allocation needed	NA	756 t	756 t	2268 t	3780 t

Discussion and Recommendations

The hake longline (demersal) fishery has been through a difficult process since it was first mooted as a viable alternative fishery to catching hake. The eventual recognition of the fishery through the medium-term fishing rights allocation and subsequent issuing of long-term right through to 2021 (current FRAP extension) was a significant development in the context of the transformation process that has been ongoing in the fisheries sector. The allocation of fishing rights to the hake longline has been without any substantive socio-economic understanding of the fishery including its operations and general logistics that determine its economic viability.

This has led in part to the allocation of many rights with variable “quota” allocations.

While the allocation of these rights has served the fishery well it has resulted in many challenges, the consequences of which are undeniably not well understood. Fishing is a high-risk business and in South Africa, a largely developing country, many socio-economic risks prevail. From a strictly economic perspective, the fishery has challenges associated with cost of labor, unstable currency and high cost of fuel. To mitigate these risks, operators of longline vessels carry enormous risks, not least of all is to maintain markets in a competitive export and domestic market (white fish). The fishery also competes with the dominant trawl sector and in many respects, longline operations are similar to the trawl wetfish component. Longliners rely mostly on delivering fresh hake either for export as Prime Quality, or to onshore processors. No matter the product type, most fisheries depend on a scale factor in that volume determines stability of operation. This guarantees employment of sea and land-based crews, supports market demand for a unique product (“longline”) and importantly allows for year-round maintenance of assets, and can also lead to development of onshore infrastructure.

All of these have benefits to the National agenda of optimizing South Africa’s natural resources to sustain the economy and associated livelihoods, in particular of previously disadvantaged persons.

In this socio-economic assessment, it is shown that the fishery has largely had to adapt to the many challenges to sustain itself. It is clear that while the fishery has many rights holders, few have viable allocations to sustain fishery operation. The outcome of this is that the fishery is effectively “serviced” by few boats (no more than 45). This in itself demonstrates that based on the TAC portion allocated to the sector, the effort capacity is limited with many quota / rights being consolidated onto single vessels. This “model” which has been indirectly forced on the fishery, results in “economic units” and the impracticability of a “fishing right” being able to achieve the policy objectives (DFFE, 2021) of supporting livelihoods and generally contributing to the economy through employment and infrastructure development.

It is significant that in this socio-economic assessment, there is only one dedicated onshore processing facility for longline hake. There are numerous other processing plants that process longline hake, but these are established only because they service other sectors of the fishing industry. In this assessment, which was protracted due to many confounding factors, not least of which was the intervention of COVID-19 and the extension of the FRAP process, the information provided was predominantly from the vessel operators and few factory processors, as many rights holders understandably so for the reasons given above, could not provide operational and economic information with which to determine a more comprehensive data set. The information used is nevertheless adequate for determining the principle economic factors. The survey was however able to determine transformation levels, employment equity and other socio-economic facts based on company declarations as required by law.

Operationally the fishery is labor intensive and has a significant employment to catch ratio. Assuming economically viable amounts of hake sufficient to maintain year-round operation are available to an operator, a relatively high employment base can be sustained. This benefit is however compromised as allocations as low as 30 t or even 100 t allows for irregular operation and destabilizes the fishery. Data available in this survey and assessment suggest that at a minimum, a hake longline vessel, in order to achieve breakeven point and achieve a profit, would need to cover annualized fixed costs and trip by trip operational costs. Further, operators of hake longline vessels would also need to absorb a multitude of risks that include market and exchange rates variability as well as the cost of labor and fuel. The data provided suggest that before any profit can be made on an exclusively hake-directed operation a vessel operator would require between 300-350 t of hake per annum. There is also a small margin associated with bycatch, mainly kingklip, but this is not a significant determining factor as bycatch in the fishery is extremely low.

In regard to land-based investments and employment, the hake longline sector directly supports employment and is distributed across the cape provinces. While the processing facilities are established, their viability and maintenance of employment is dependent on both hake longline as well as other processing lines that include squid, trawl products, sardine and a variety of other seasonal species.

Regarding Transformation, the fishery remains one the most transformed fishery sectors in South Africa. It would be difficult to reconcile that even further intervention in this regard is needed simply because the fishery with marginal quanta is already compromised in being able to sustain operations. This in no way implies that the political imperatives of BBBEE should be rejected in the fisheries context, but with a sector already economically stressed, the existing requirements of procurement, employment and management criteria should ensure momentum in transformation is maintained, allowing the fishery to build on its core focus of providing a valued international and domestic product which has been emulated by the established trawl sector is needed.

The hake longline fishery has maintained green status of it's products (hake and kingklip) on the WWF - SA SASSI listing and is currently engaged in a Marine Stewardship Council (MSC) improvement program. The hake longline fishery in its relatively short existence has also demonstrated that it is a viable ecologically sustainable alternative fishing method. Marine Stewardship Council (MSC) certification can therefore further strengthen the fishery, not only for their own product, but also sends out a clear message that the hake resource, along with trawl products, is under effective and progressive management.

The hake longline fishery also provides an excellent platform for research and understanding the dynamics of South Africa’s demersal resources and, importantly, contributing positively to the stock assessment with better use of the information available.

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Bibliography

CapMarine (2009). Review of the Offshore Resources Observer Programme and the observer data: 2002-2009. CapMarine (unpub).

CapMarine (2018). A Review and Strengthening of the Spatial Management of South Africa's Offshore Fisheries, S.J. Norman[1], S.J. Wilkinson[1], D.W. Japp[1], J. Reed[2] and K.J Sink[2.] Capricorn Marine Environmental (Pty) Ltd. South African National Biodiversity Institute

Capfish cc (2003). The hake longline fishery. Heinecken C (unpub).

DFFE (2008). Hake Longline sector report (2008). Department of Forestry, Fisheries and the Environment

DFFE, (2021). Draft sector specific policies for the fishing rights allocation process and the draft policy on the transfer of commercial fishing rights. Gov Gazette 20 September 2021 No. 45180

Intertek. (2015). South African Hake Trawl Fishery MSC Full Assessment Report. Intertek Fisheries Certification United Kingdom.

Japp, D.W. and J. Wissema. (1997). Brief overview of the hake-directed longline experiment from 1994-1996. Unpub report.

Japp, D.W. and J. Wissema. (1999). The development of hake-directed longlining in South Africa and a summary of results of the hake-directed longline experiment from 1994 to 1997. Marine and Coastal Management: Document presented at the Consultative Advisory Forum meeting on 10th March 1999. 22 pp.

Japp, D.W. (2007). Management of Hake Longline Effort in South Africa.

Japp, D.W. (2010). Pre-Assessment Report for the South African longline fishery for hake, unpublished document, compiled by Capricorn Fisheries Monitoring cc for WWF-SA and Ocean Fresh, 30pp.

Lallemand, Philippe, Mike Bergh, Margaret Hansen, and Martin Purves. (2016). Estimating the economic benefits of MSC certification for the South African hake trawl fishery. *Fisheries Research* 182 (2016): 98-115.

Mthembu, S. P. (2018). The socio-economic impact of the squid stock volatility in the Eastern Cape province of South Africa. Master's Thesis. University of Cape Town.

Sauer WHH, Hecht T, Britz PJ, Mather D (ed by) (2003). An Economic and Sectoral Study of the South African Fishing Industry. Volume 2. Fishery Profiles. Rhodes University, Grahamstown, pp 101–114

Annexure 1. Methodology Applied

Two questionnaires were sent to SAHLLA members in late 2019 and through to 2020. A questionnaire was designed containing eight unique sections (Table 23), which required mainly quantitative data. Although responses through the drop-down tab selections included written statements, these could be assigned a numeric value and thus form part of the quantitative component.

Table 23: Sections of Hake Longline Economic Assessment

Part	Title
A	Vessel & Catch Information
B	Vessel Operating Costs
C	Staff Expenses
C2	Staff Expenses (Factory)
D	Selling Prices
E	EE, BBBEE & Financial benefits
F	Demographic
F2	Demographic (Factory)

Since only quantitative data was used in this assessment, the questionnaire was developed in excel. Each of the above sections was assigned an excel sheet on which individual fields with either a pre-assigned dropdown tabs or empty cells were provided. Information was only requested from January 2017 to December 2017 as more recent information may not have been completed on the records of respondents. Furthermore, the questionnaire aimed to achieve a higher response rate by facilitating easy and swift completion of questions, without compromising accuracy. As a result, dated and historical information was not required by each respondent. The option of supplying historical information dating back to 2015 was provided to respondents but no such information was received.

Section A aimed to inquire only about rights holder, vessel, catch and ownership information whereas specific financial information, was required in sections two to five.

Only section E to F2 required information pertaining to EE, BBBEEE and financial benefits paid to stakeholders.

The questionnaire was designed to not only capture economic information relating to inputs and outputs of this fishery, but to also capture the details of its participants. Participants were defined as any person that directly received financial benefits from the said fishing operations.

These details focused on transformative elements, which could be compared to a similar but older economic assessment by Sauer *et al.* (2003). Information on equity, shares or any other financial benefits held and/or received by black stakeholders was requested.

- SITE & TIME: The questionnaire was distributed to SAHLLA members via e-mail on the 14/02/19. Respondents were expected to complete the questionnaire in their own time with assistance from CapMarine being offered. The submission deadline for completed questionnaires was the 31/03/2019 but was extended to 19/04/2019.
- STUDY POPULATION: The questionnaire was distributed by SAHLLA to about 170 members and vessel owners of which 8 responded. The data provided in 8 of the completed questionnaires was selected for use. The data provided was of varying quality with some respondents returning incomplete responses and others providing erroneous information which was omitted.

- MEASUREMENTS AND INSTRUMENTS: The main instrument for managing, storing and processing the data was Microsoft excel 2013. Data was analyzed using Microsoft excel functions that are described in the next sections.
- VARIABLES IN ANALYSIS: Quantitative data gathered could be grouped into two categories; numeric and selector data. Numeric variables included data relating to financial variables expressed in 2017 ZAR currency, weights expressed in tones and time expressed in days at sea or other. Selector data referred to fields where a pre-supplied answer through a drop-down tab was provided. There were several variants of this data, but it mainly related to Yes/No answers and an ethnicity section (African/Colored/White/Indian) for the demographic analysis.
- ANALYSIS: Break-even points were of major interest to this study. This measure was straightforward to calculate and involved dividing the selling price per ton of hake caught by the sum of fixed and variable costs per trip.
- BREAK –EVEN POINT: The arithmetic component of the measurements consisted of analyzing inputs and outputs in sections two to five. The aim was to calculate break-even points for individual operators by using the simple formula of "Fixed Costs / (Price of Product - Variable Costs)". Different iterations of the formula were used, which were always clearly specified in text (e.g., Fixed Costs less fixed investment vessel: vessel value).
- BREAK-EVEN ALLOCATION: Break-even costs were further used to calculate break-even allocation. This merely refers to the amount of hake longline allocation (measured in tons) required by operators to break even and make no loss or profit.
- GENERAL COSTS & MARKET-ENTRY BARRIERS (RISKS): New entrants are faced with financial entry barriers that range from fixed investment costs to levy fees paid for tone of quota. Given the raw data from the questionnaire, the study was able to shed some light on some of the commercial costs affiliated with running a hake longline operation.
- ETHICS: A non-disclosure agreement was signed between CapMarine, SAHLLA and each respondent, which guaranteed that information provided by respondents would only be used for the purpose of the study. The response by members served as consent and anonymity was also extended to each member via the NDA. Furthermore, the right to withdraw from the study was made available to respondents.

Data Quality and Response Levels

Two rounds of questionnaires were submitted to SAHLLA members (for more details please see Annexure 1). During Q1, information on 7 vessels was submitted by respondents, which represents 15% of the total fleet. Q2 results consisted of 14 vessels, which included all 7 vessels from Q1 and represented 30% of the total fleet. Respondents were generally larger GRT vessels with some companies operating several vessels. Smaller companies, only operating one vessel also did participate. Data quality was inconsistent in both rounds of questionnaires with data absent from a several fields, where vessels did either not fish or respondents did not complete the questionnaire adequately. Averages were obtained by omitting non-response fields. Furthermore, some operators supplied figures that were substantially different from those of others. Figures were excluded, where this difference greatly exceeded supplied figures by other operators.

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Appendix 2. Hake Longline Fleet Characteristics and Spatial Effort

A demersal longline vessel may deploy either a double or single line which is weighted along its length to keep it close to the seafloor. Steel anchors, of 40 kg to 60 kg, are placed at the ends of each line to anchor it and are marked with an array of floats. If a double line system is used, top and bottom lines are connected by means of dropper lines. Since the top-line (polyethylene, 10 – 16 mm diameter) is more buoyant than the bottom line, it is raised off the seafloor and minimizes the risk of snagging or fouling. The purpose of the top-line is to aid in gear retrieval if the bottom-line breaks at any point along the length of the line. Lines are typically between 10 km and 20 km in length, carrying between 6 900 and 15 600 hooks (**Figure 28**). Baited hooks are attached to the bottom line at regular intervals (1 to 1.5 m) by means of a snood. Gear is usually set at night at a speed of between five and nine knots. Once deployed the line is left to soak for up to eight hours before it is retrieved. A line hauler is used to retrieve gear (at a speed of approximately one knot) and can take six to ten hours to complete. See **Figure 27** below for a schematic of the gear and its configuration used by the demersal longline fleet.

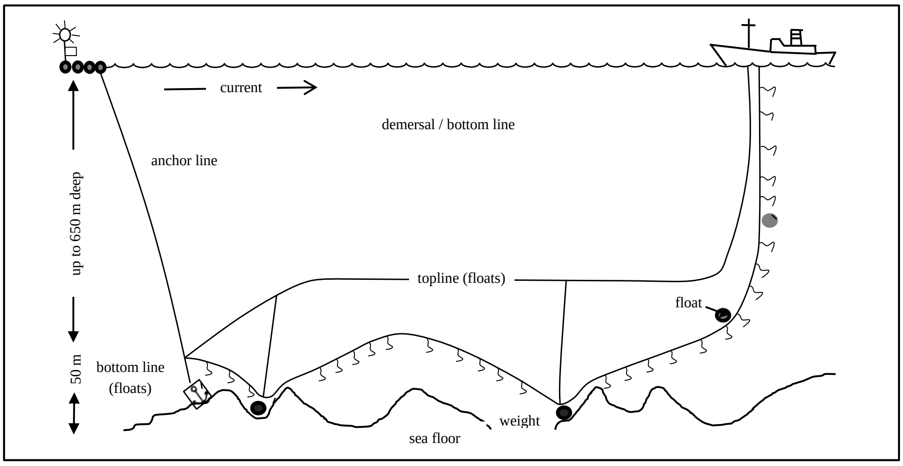

Figure 27: Typical configuration of demersal longline gear used in the South African hake-directed fishery (after Japp, 1989).

Figure 28: Bottom line with hooks as used by demersal longline vessels (credit V. Ngcongo, CapMarine) and line hauling operations on board a South African longline vessel (credit T. Rasehlomi, BirdLife South Africa).

According to Japp (2007), hake longline vessels spend an average of 4 days at sea with another 3 days offloading, re-fueling and other routine maintenance activities, which add up to circa 1 week per trip. Currently 45 hake-directed vessels are active within the fishery, most of which operate from the harbors of Cape Town and Hout Bay. Fishing grounds are similar to those targeted by the hake-directed trawl fleet. The hake longline footprint extends down the west coast from approximately 150 km offshore of Port Nolloth (15°E, 29°S). It lies inshore to the south of St Helena Bay moving offshore once again as it skirts the Agulhas Bank to the south of the country (21°E, 37°S).

Vessel Categories and Catch performance

A variety of vessels sizes may be found in the hake longline fishery which differ in length, Gross Registered Tonnage (GRT) and crew complement. For comparative purposes, vessel GRT will be used to express fishing capacity, since larger vessels are able to hold more fishing gear, bait, crew and provisions and hence stay at sea for longer. The South African hake longline fleet can be described by grouping vessels into GRT categories. This categorisation system can identify 5 distinct vessel categories, namely those in the 40 t to 60 t, 60 t to 80 t, 80 t to 100 t, 100 t to 120 t and over 120 t classes (Figure 29). From the available information, vessels between 80 to 120 t are most numerous with the smaller categories constituting half of the larger vessels.

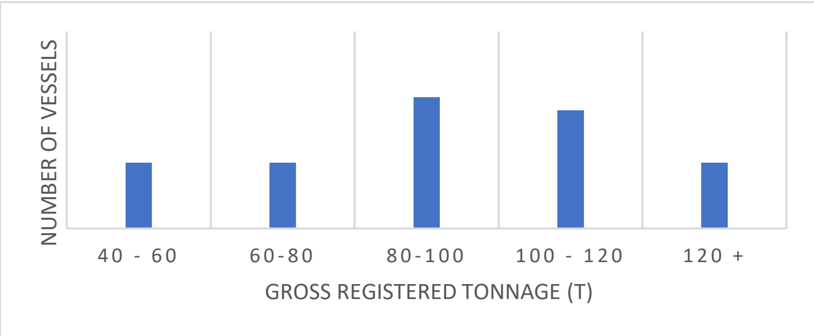

Figure 29: Hake Longline Vessel size classes by GRT (SAHLLA, 2018).

Median length across these GRT categories only show slight variation with a difference of approximately 4m between the smallest and largest vessel category. Although vessel specifications measured in GRT differ considerably, only slight differences in the associated crew complement for each vessel category were observed. The crew complement ranged from 18-25 members over all categories, with the smallest differences observable in the 80 t to 120 t categories. The relationship between the average hake catch per vessel and the average allocation per vessel is illustrated in **Figure 30**. These findings do not provide any definitive evidence about catch efficiency, but large amounts of unexploited allocation for the 75 t – 95 t class vessels were observed, which receive the highest average amount of allocation per vessel.

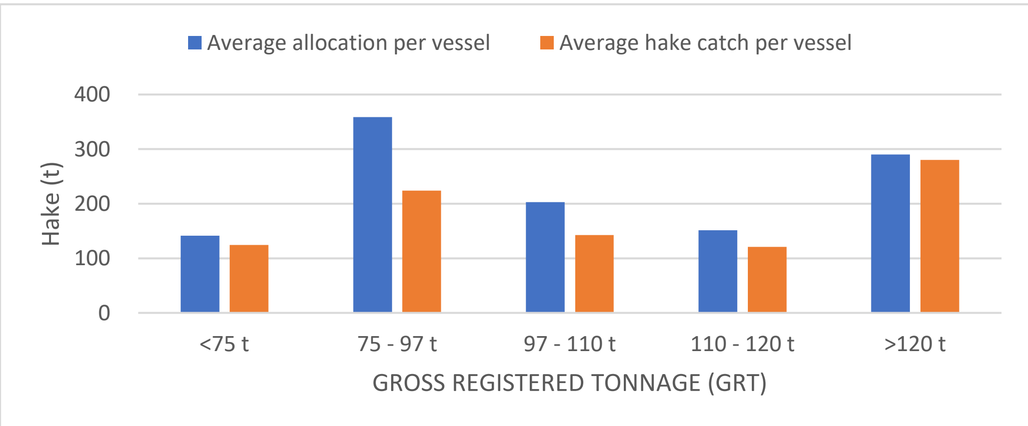

Figure 30: Average hake catch by vessel category and average allocation alloted in 2017 (SAHLLA, 2018)

A multitude of factors limiting these vessels, such as unfavourable weather, may be responsible for this phenomenon. Contrastingly, larger vessel categories progressively use more of their available allocations and hake allocations appear to be a primary focus of their fishing operation.

Table 24: Number of allocations used per vessel (SAHLLA, 2018).

No. of vessels	No. of allocations	Total sum of allocation size (t)
2	9	1215
1	8	761
1	7	720
1	6	591
1	4	469
2	3	607
5	2	318
9	1	383

Table 24 demonstrates the “clustering” phenomenon, where one vessel may make use of several allocations. Vessels belonging to the larger size categories (from 90 t onward) seem to adopt the “clustering” strategy. Vessels making the effort to obtain several allocations appear to also achieve higher catch rates. Here, the top 3 highest landings per vessel made use of 9, 6 and 8 TAC allocations respectively. This indicates that “clusterers” actively focus on exploiting allotted allocations to their fullest extent. Two vessels, which will remain anonymous, were only granted one allocation, but however managed to land the highest hake catches. According to SAHLLA-provided data, in 2017, the average allocation per vessel amounted to 72.3 t and the average hake landings per vessel was recorded at 60.9 t. This translates into an average of 81.8% of allocations being entirely exploited, with the remaining 18.2% of allocation going unexploited. Furthermore, these averages may be a poor indicator of overall performance of the sector since poor catch rested of some vessel may severely affect it. An average of 4% Kingklip bycatch was recorded over all hake catches.

Time at Sea, Gear Configuration and Relationship with Vessel Size

According to information gathered from 2002 to 2007, the average time at sea amounts to 7 days, including discharge, provisioning and steaming, but actual days fished amount to around 4 days per trip. Here, the expected longline fishing days per annum amounted to 197 days. Based on historical effort in the hake longline sector, the average number of hooks per pot is 114 with a maximum of 143 hooks per pot and a minimum of 91 hooks per pot. The average number of hooks per line vary, with an average of 10 191 hooks per line and a minimum of 2 496 hooks. The maximum number of hooks was recorded at 21 090.

Hake Longline Spatial Catch and Effort

The South African hake longline footprint (**Figure 31**) extends down the West Coast from approximately 150 km offshore of Port Nolloth (15°E, 29°S). It lies inshore to the south of St Helena Bay moving offshore once again as it skirts the Agulhas Bank to the south of the country (21°E, 37°S). Along the South Coast of South Africa, the footprint moves inshore again towards Mossel Bay. Its eastern extent lies at approximately 26°E, 34.5°S. Figure 31 displays a 10-year footprint and fishing intensity of the fishery with detailing hake landings from 2000 – 2017.

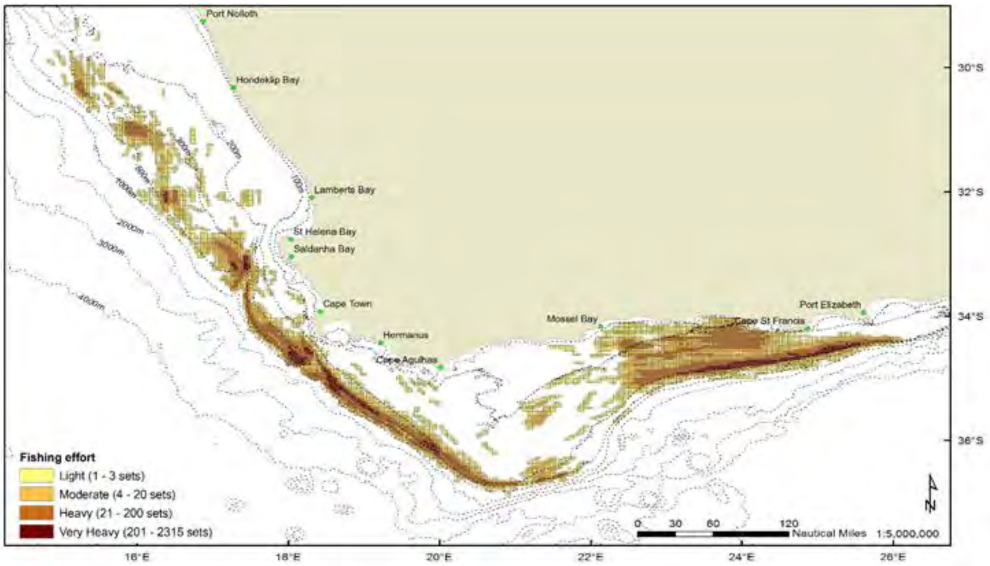

Figure 31: National overview of the spatial footprint and fishing effort of the demersal longline sector for the period 2002 to 2012 displayed at a 2'x2' grid resolution.

The deep-water hake (*M. paradoxus*) is found from about 250m to about 800m and the shallow-water hake (*M. capensis*) from 30m to about 400m. The two species overlap in their distribution in the depth range 250-400m and both species are found around the entire South African coast, extending northwards into Namibian waters. Large *M. capensis* are found seasonally on the central Agulhas Bank and inshore (shallower than 100m), particularly in autumn. *M. paradoxus* is the mainstay of the offshore (or deep-water) trawl fishery, whilst *M. capensis* is targeted by the inshore trawl and longline fisheries (Intertek, 2015).

Bycatch Composition

Data for this bycatch analysis was used from both DAFF and SANBI records and relate to the period of 2002 to 2017 but excludes the period from 2007 to 2010. Bycatch of Shark (*Carcharinus spp.*), Jacopever/Reds (*Helicolenus dactylopterus*) Silvers/Carpenters (*Argyrozona argyrozona*), Angelfish (*Brama brama*), Mackerel (*Scomber spp.*), Panga (*Pterogymnus laniarius*), Monk (*Lophius vomerinus*), Ribbonfish (*Lepidopus caudatus*) and Kingklip (*Genypterus capensis*) were recorded over the time series. Their proportions are represented in **Figure 32**. A total of 29 teleost and elasmobranch species have been recorded in this fishery. Total bycatch amounted to 3.63 % of all hake catches over the period from 2002 to 2017

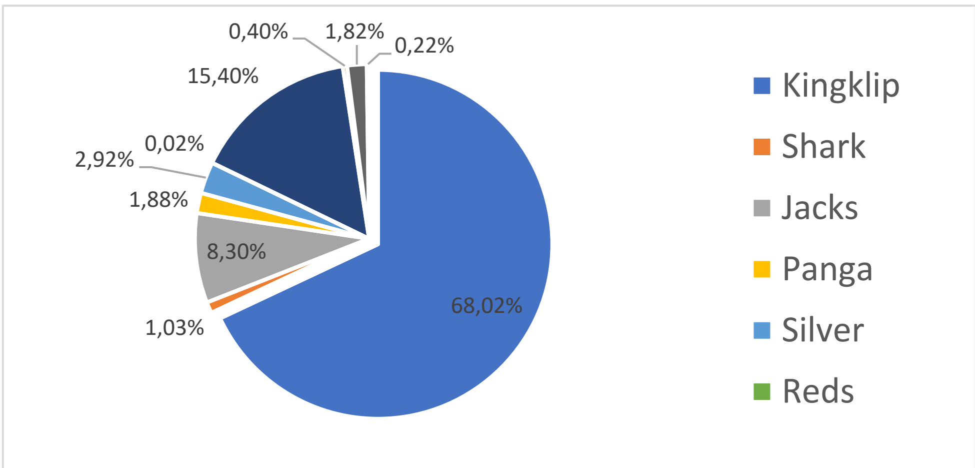

Figure 32: Proportion of bycatch species in hake longline fishery from 2002 – 2017 (SANBI, 2017)

Of all bycatch species recorded, *G. capensis, B. brama* and *H. dactylopterus* constituted the highest bycatch biomass over the time series. None of the above listed bycatch teleost species are of conservation concern.

However, no distinction was made between *Carcharinus spp.* individuals, and it is unclear if vulnerable *Alopia species* were included in these records. *G. capensis* numbers, exhibiting the highest bycatch biomass, declined by over 50% from around 41 t in 2002 to approximately 20 t in 2017. This is also the most economically profitable species in the fishery, fetching and average of ZAR 60 per kg. The species that constitute the lesser bycatch species in the series, i.e., those with a cumulative mass under 20 include 6 species of which *Scomber spp*, *A. argyrozona* and *P. laniarius* form the highest proportions. It is noteworthy that Kingklip does not only form the primary bycatch species, but also constitutes the most valuable bycatch species in the fishery. Its bycatch trends from 2011 to 2017 indicate that its average weight caught on a year-by-year basis remained relatively stable and it also may form an economically significant part of the fishery.

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Appendix 3. Hake Stock Status and Resource Assessments

The following broad description of the hake fishery and current management is provided by:

Ref: MARAM/IWS/2018/HAKE/BG3

An overview of the SA hake fishery

Dr M.D. Durholtz
Department of Environment Forestry and Fisheries

Background

The South African hake resource comprises two species, the shallow-water Cape hake *Merluccius capensis* and the deep-water hake *M. paradoxus*. *Merluccius capensis* is found from southern Angola to northern KwaZulu–Natal on the east coast of South Africa. *Merluccius paradoxus*, on the other hand, is distributed from northern Namibia to southern Moçambique (see Figure 1). As the common names imply, the two species differ in terms of distribution by depth. Off South Africa, the shallow-water species has been recorded at depths of between 30 and 500 m, with most of the population between 100 and 300 m. Deep-water hake are found between 110 and about 1000 m, with most of the population located between 200 and 800 m. Both species display a pattern of increasing size with increasing depth and distance offshore. The distributions of both species are virtually continuous around the South African coast, and they are currently treated as single stocks of each species within South African waters. Recent genetic analyses have suggested that there is one stock of shallow-water hake in South African waters, another stock in central/northern Namibia, and a third stock that extends from southern Namibia into the northern areas of the SA West Coast (although the extent of the southward extension is currently unknown). These analyses have also suggested that *M. paradoxus* is probably a single stock that extends into Namibia.

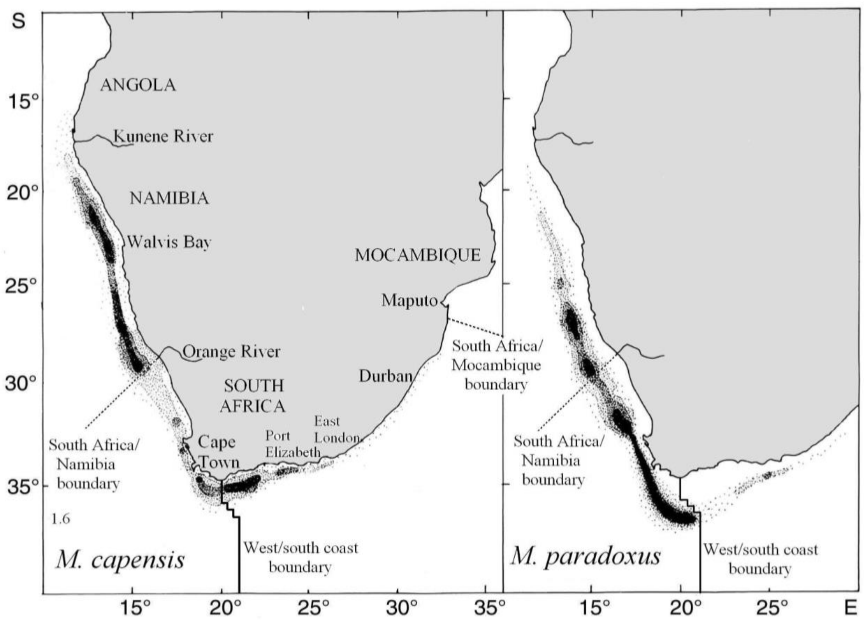

Figure 1: Species distribution for southern African hake (adapted from Payne 1989).

The resources are currently targeted by four fishing sectors:

- Deep-sea trawl: Operates around the entire SA coast in waters deeper than 110 m. Currently restricted to the “trawl footprint” (Figure 2)
- Inshore trawl: Restricted to the SA South Coast east of the 20°E line of longitude. Currently restricted to the “trawl footprint” (Figure 2).
- Hake longline: Operates around the entire SA coast.
- Hake handline: Restricted to the SA South Coast east of the 20°E line of longitude
- Hake are also caught as incidental by-catch in the traditional linefish and horse mackerel-directed midwater trawl fisheries.

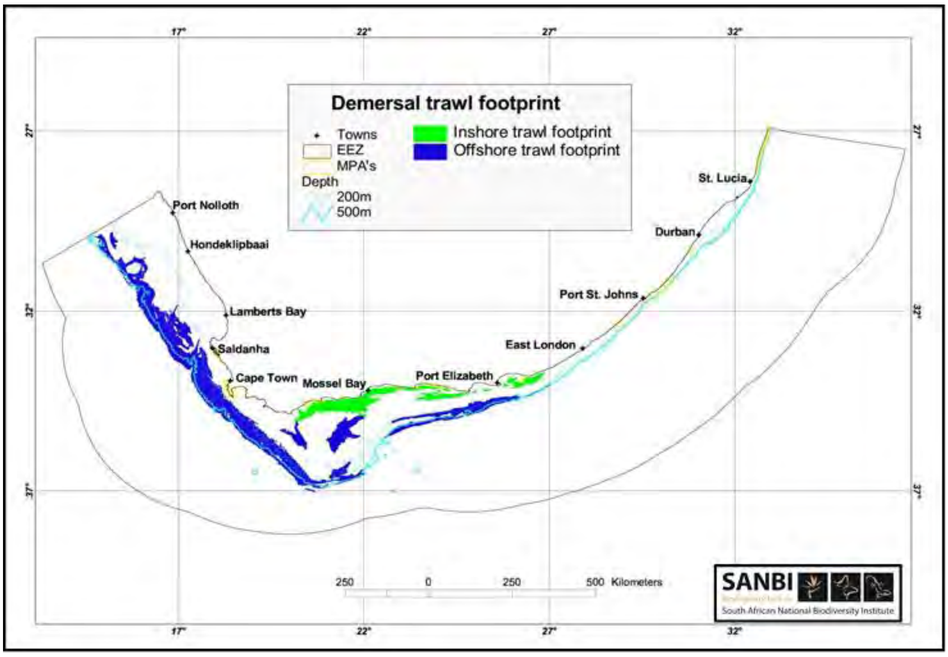

Figure 2: Map illustrating the hake "trawl footprint", first incorporated into permit conditions for the two trawl sectors in 2015

Historical development of the fishery

The demersal trawl fishery dates back to the late 1890s, when small side trawlers targeted primarily Agulhas sole (*Austroglossus pectoralis*) and West Coast sole (*A. microlepis*) on soft grounds in bays and close to the coast, with hake (likely to be almost entirely *M. capensis*) being caught as an incidental by-catch. Directed fishing for hake only began towards the end of the First World War and escalated rapidly after the Second World War with about 40 local trawlers operating in South African waters by 1948. Knowledge of the large southern African hake resource spread, leading to the incursion of foreign fleets into the Southeast Atlantic in 1962. Vessels (mostly large factory trawlers) from Japan, Spain and several Eastern European countries began fishing in South African and then in Namibian waters, leading to a dramatic increase in fishing effort and catches of hake. Simultaneously new local entrants were introduced into the domestic fleet. In 1972, the annual hake catch in South African waters peaked at almost 300 000 t and >1.1 million t of hake was taken from Southeast Atlantic waters in that year alone. Decreases in catch rates showed that the resource could not sustain that level of exploitation, and in 1972, the International Commission for the Southeast Atlantic Fisheries (ICSEAF) was established in an attempt to control what had then become an international fishery. By 1977, the number of local trawlers operating in South African waters had expanded to about 85 and the smaller vessels based along the south coast had increased in numbers to 49. At least 20 (with reports of as many as 50) foreign vessels operated in South African waters between 1962 and 1978. South Africa's declaration of a 200-mile Exclusive Fishing Zone (EFZ) in 1977 marked the onset of direct management of the South African hake resource by the national government. Foreign vessels were largely excluded from South African waters, resulting in a reduction in the total catch of hake to about 50% of that recorded in 1972.

A major source of uncertainty in the development of the hake fishery is the period over which exploitation shifted from almost entirely *M. capensis* (when the fishery commenced in inshore waters) to catches being dominated by *M. paradoxus* (which has been the case since about 1978). Catches of hake over recent decades have typically fluctuated about 150 000 t per annum (Figure 3), with most of the catch being landed by the deep-sea trawl sector and comprising mainly *M. paradoxus*.

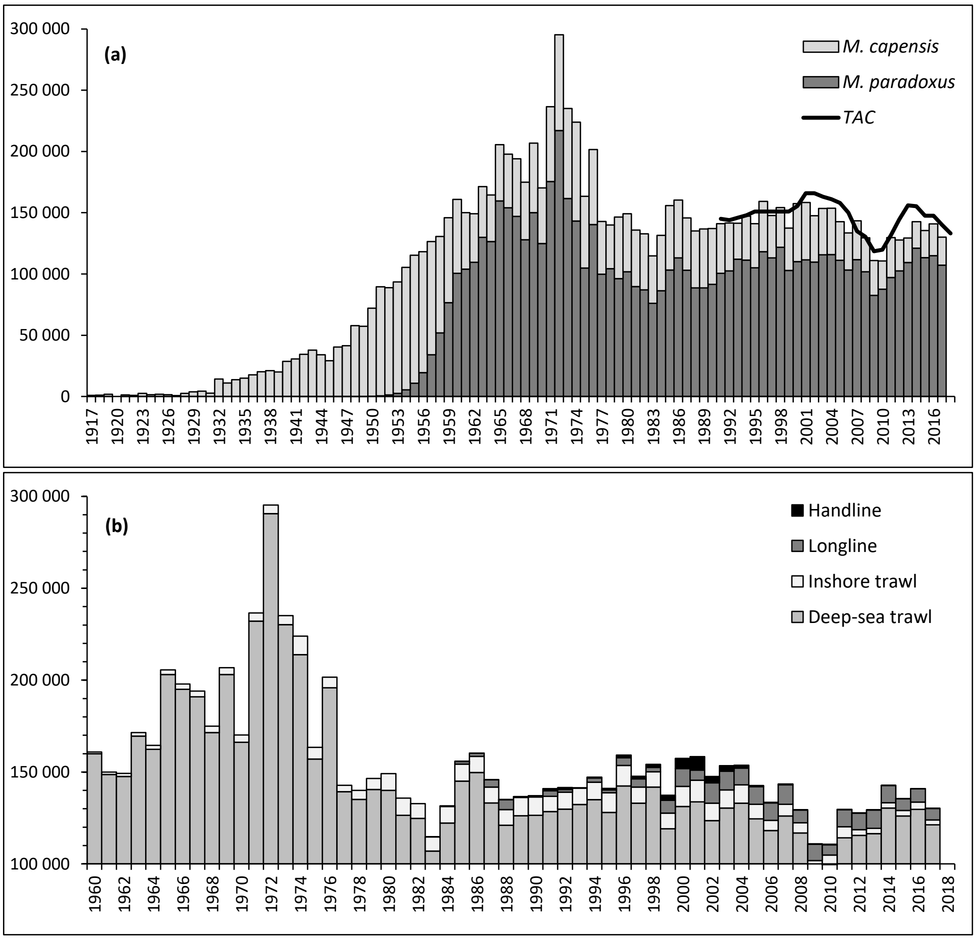

Figure 3: (a)Top: Total catches (tons) of Cape hakes split by species over the period 1917 – 2017 and the TAC set each year since the implementation of the OMP approach in 1991.

Prior to 1978, where the data required to split the catch by species are not available, the split is calculated using an algorithm that assumes 1958 as the centre year for the shift from a primarily *M. capensis* to a primarily *M. paradoxus* offshore trawl catch. B: (bottom) Catches of Cape hakes per fishing sector for the period 1960 – 2016. Prior to 1960, all catches are attributed to the deep-sea trawl sector.

Current assessment and management

Assessment of the South African hake resource is complicated by the fact that the two hake species are morphologically similar, so the commercially landed (processed) product cannot be identified easily to species. Catch-and-effort statistics collected from the fishery are therefore not species-disaggregated and splitting of the catches to species level has required the use of various algorithms (described below). The South African hake resource is currently assessed using a suite of gender-disaggregated Statistical Catch-at-Length models (termed the "Reference Set"), which are fitted directly to age-length keys and length frequencies, as well as to abundance indices provided by both commercial trawl CPUE information (Figure 4) and fishery-independent trawl surveys (Figure 5). The models assess the two hake species as two independent stocks and are fitted to species-disaggregated data as well as species-combined data.

Exploitation of the SA hake resources are managed primarily with a species-combined Total Allowable Catch (TAC) regulation, the magnitude of which has been computed since 1991 using an Operational Management Procedure (OMP). An OMP is essentially a combination of pre-specified methods of data collection and analysis, coupled with a set of simulation-tested decision rules (effectively a Management Strategy Evaluation approach) that specify exactly how the regulatory mechanism is to be computed each year. In the case of South African hake, the regulatory mechanism is a species-aggregated TAC, the value of which is calculated from stock-specific monitoring data (commercial CPUE indices and indices of abundance derived from demersal research surveys); the ratio of the two species in the catch is monitored to check that it remains within the range evident in the OMP simulation trials. Implicit in this OMP approach is a schedule for OMP revision (every 4 years) to account for updated data sets and possible changes in resource and/or fishery dynamics (or their understanding) and management objectives. The development and revision of recent OMPs has had to take certification of the SA hake trawl fishery by the Marine Stewardship Council (MSC) into consideration. The fishery was first certified in 2004, and re-certified on two occasions (2010 and 2015). The fishery will undergo assessment towards a third re-certification under the new MSC fishery Standard during 2019.

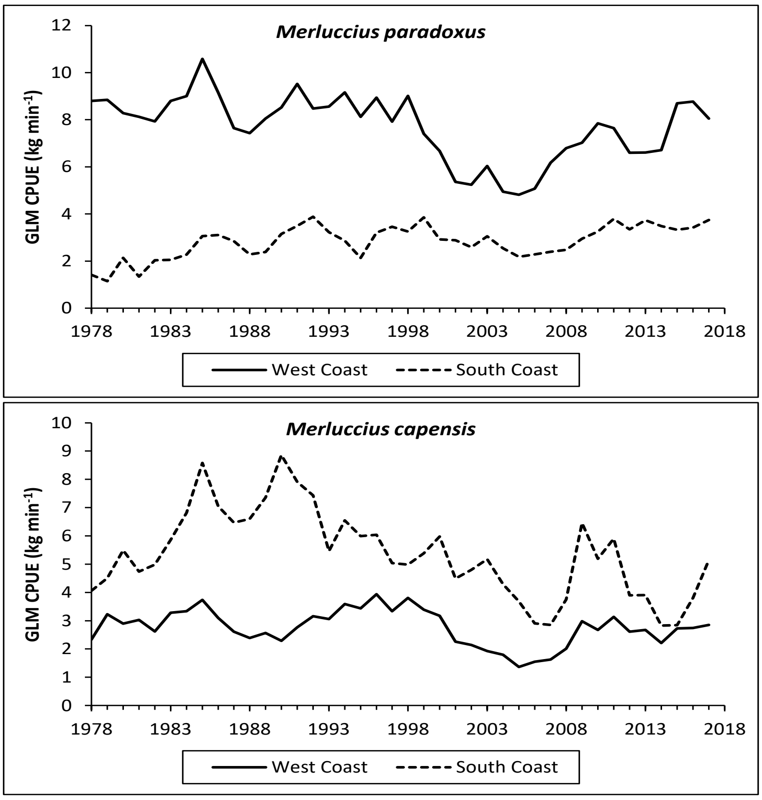

Figure 4: GLM-standardised deep-sea trawl CPUE (kg.min^{-1}) indices of hake abundance shown by species and coast

Once the TAC has been determined, a by-catch allowance for the mid-water trawl fishery is deducted (equivalent to 2% of the horse mackerel TAC), following which the remainder is allocated among the four hake-directed sectors in the following proportions:

– Deep-sea trawl: 0.8393
– Inshore trawl: 0.0618
– Hake longline: 0.0655
– Hake handline: 0.0334

Within each sector, the TAC is then apportioned among Right Holders according to their proportional allocations set during the Fishing Rights Allocation Process. The demersal trawl components (inshore and deep-sea) of the fishery are restricted to fishing within the "trawl footprint" (see Figure 2). This measure was initially a voluntary measure by the industry to facilitate MSC certification but was incorporated into permit conditions as a formal management measure in 2015.

Data available for assessments (see MARAM/IWS/2017/Hake/P2 for more details)

1. Total annual catch (Figure 3) per: Species; Gender; Coast & Sector

Note: catches from 1978 onwards are split into species using the species-splitting algorithm that uses spatially explicit species composition information derived from research surveys. Species splitting of catches prior to 1978 assumes a logistic decrease in the percentage of *M. capensis* from 100% in 1917 to a level corresponding to the 1978-1982 average by 1977. Three variants of operating models use a "centre year" for the shift from predominantly *M. capensis* to predominantly *M. paradoxus* of 1950, 1958 and 1965 respectively.

2. Commercial (hake deep-sea trawl) CPUE by species (Figure 4). Estimates are available from 1978, when spatially explicit catch and effort data first became available. There is information for earlier years from ICSEAF.

a. Commercial proportions at length per: Species; Gender; Coast & Sector

Estimates are available for:

– Deepsea trawl: 1981 – present (West coast species and sex combined), 1975 – present (South Coast species and sex combined)

– Inshore trawl: 1981 – present (*M. capensis*, sex combined)

– Longline: 1994 – 1997 (species and sex combined) and 2000 – 2010 (species and sex disaggregated)

b. Survey abundance indices (Figure 5) per: Species & Coast

Note: Surveys are conducted separately on the West and South Coasts. The West Coast is surveyed in summer (January-February), with six winter (June-July) surveys having been conducted in the late 1980s. The South Coast is generally surveyed in autumn (April-May), although a few spring (September-October) surveys have been conducted in the late 1980s and during the 2000s.

Abundance estimates are available for 1985 - present.

c. Survey proportions at length per: Species; Gender; Coast (Estimates are available from 1985 – present, although sex-disaggregated data are available only for 1993 – present)

d. Age at length per: Species; Gender; Coast (Age length keys are available for the period 1988 – 2008).

e. Female maturity at length ogives per: Species & Coast

f. Weight at length per: Species; Gender & Coast

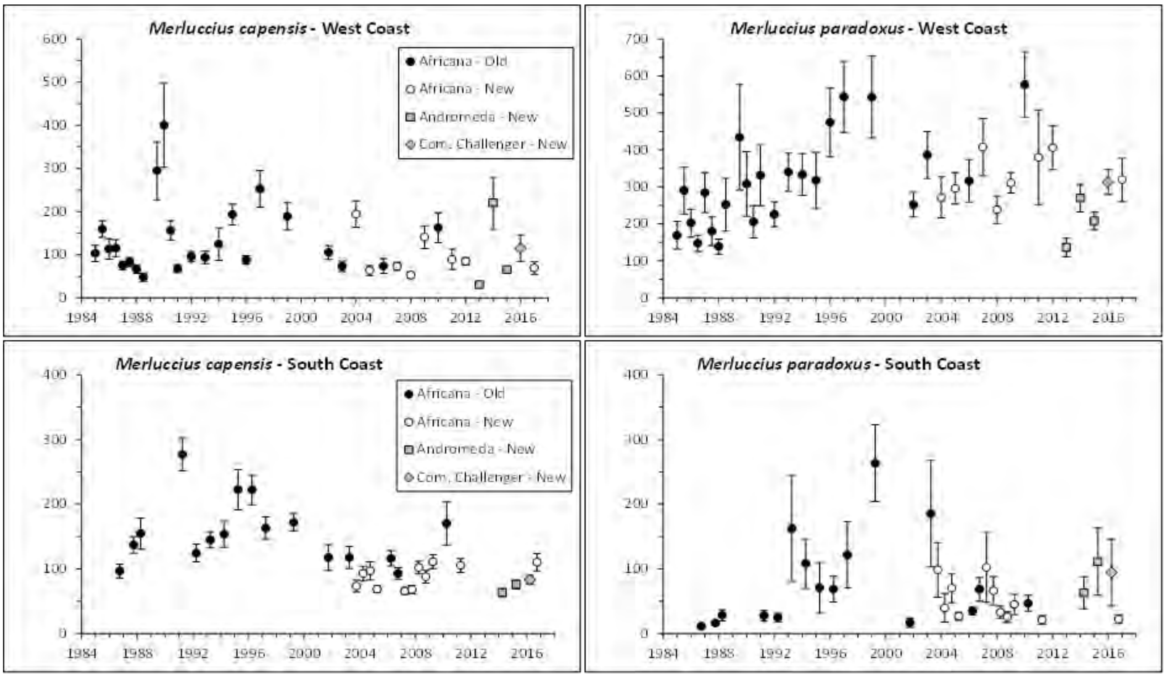

Figure 5: Survey-derived hake abundance estimates ('000 t ± 1 SE) shown by species and coast. The various vessel – gear combinations are indicated. Note that only surveys that extended to the 500 m isobath are shown.

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Appendix 4. SAHLLA Observer Programme and Ecosystem Considerations

SAHLLA Observer Programme

Report for the period April 2019 - December 2020 (abbreviated)

CAPRICORN MARINE ENVIRONMENTAL PTY LTD

Stewart Norman, Jodie Reed, Zonke Gumede

Annual reports are submitted to SAHLLA for the purpose of discussion and communication between CapMarine (Pty) Ltd and the Recognized Industrial Body Secretary and Executive Committee. These reports also provide an opportunity for the industry to query, comment and contribute to any aspect of the observer program and provide a summary report for external scientific assessment bodies to reference an independent source of information about fishery operations and ecosystem impacts.

History of the Fishery

The hake fishery is the most valuable of all fisheries in South Africa and second only to the small pelagic fishery (for sardine and anchovy) in terms of volume. The sector is highly structured, primarily because of the bottom trawl fishery the history of which extends back to the late 1890s. Hake-directed longlining was first proposed in 1982 and was to be based on similar "bottom longline" fisheries in European waters. Existing hake-trawl quota holders were issued experimental permits in 1983 but quickly discovered a valuable and unregulated resource kingklip (*Genypterus capensis*). An additional 6 permits were issued to non-hake quota holders in 1985 but catches declined rapidly and after the regulating the fishery with a TAC failed to recover the resource the fishery was closed by the end of 1990. Subsequently, after much pressure for access to hake and to compensate for loss of opportunity to participants in the kingklip-directed experimental fishery, an experimental hake-directed longline fishery was re-established in 1994[8]. Permanent hake longline fishing rights were formally introduced in 1997 with medium-term rights granted in 2002. This evolution towards long-term rights engendered trust and investment in the sector. Long term (15 years) rights were issued in 2006 and came to term in 2020. The South African Fishing Rights Allocation Process of 2020 has been delayed, with Exemptions being issued until 31 December 2021.

Hake longline had 123 rights holders in 2018 with relatively small allocations ranging between 10 to 584 t. In 2021 that number has reduced to 110 RHs, mainly due to the consolidation of Rights. SAHLLA represents the interests of over 90% of the Rights Holder's in the fishery and has gained the support of their membership as they continue to advocate for sustainable fisheries conducted in a fair and equitable manner with as little adverse impacts to the environment on which the fishery and livelihoods depends (www.sahlla.co.za). Quota allocations may be exploited by single boat operators or fished as a group, an economic practice known as clustering, where a single vessel or a group of vessels may utilize several such allocations. The demersal hake-directed longline fishery targets both shallow and deep-water hakes; *Merluccius capensis* and *Merluccius paradoxus*. It is now a well-established fishery that is apportioned 6.5510% of the hake Total Allowable Catch (TAC). There are certain operators that have access to large enough quota to target hake year-round whilst others are dual rights holders in the large pelagic tuna pole and line fishery and will only fish demersal longline seasonally.

Summary of Sustainability Projects

The hake longline sector is seeking to validate the economic and social value of the fishery by retaining its positive rating with WWF SASSI and by, in the medium-term, achieving MSC certification. SAHLLA have been proactive in maintaining relationships with their sustainability partners and NGOs and continue to build on the conservation projects that have been fundamental to the success story of the hake longline fishery in South Africa. Some highlights of the work achieved thus far:

- ✓ A preliminary evaluation of the fishery against the Marine Stewardship Council (MSC) Standard to guide fishery improvements.
- ✓ Completion of the three year, 2013-2015, Fishery Conservation Project (FCP) and the majority of associated workplan actions[9,10];
- ✓ Implementation of an at-sea scientific fishery observer program.
- ✓ Association with BirdLife South Africa (BLSA) and the Albatross Task Force (ATF) to investigate the level of seabird mortality and develop vessel specific bird-scaring lines.
- ✓ Fishery training in the ecosystem and the ecosystem approach to fisheries in association with the Responsible Fisheries Alliance (RFA).
- ✓ Development of an Association Code of Conduct; and culminating in the
- ✓ Upward transition from a SASSI rating of 'orange' to a 'green' as a result of the success of the FCP.

8 Durholtz et al 2015. Fisheries, ecology and markets of South African hake.

9 Greenstone J., V. Ngcongo, C. Bodenham. 2016. The South African Hake Longline Fishery Conservation Project Final Report. Unpublished report, WWF-SA. Cape Town.

10 Betts, M. 2017. Improving the WWF-SASSI Sustainability Rating from The Hake Demersal Longline Sector. Unpublished report, WWF-SA. Cape Town.

SAHLLA previously embarked on a Fishery Certification Program (FCP) in collaboration with WWF-SA and CapMarine from 2013-2015. The FCP used the MSC pre-assessment approach to identify gaps in the fishery sustainability profile and developed a key set of priority actions to for targeted improvement. The MSC Standard assesses a fishery against Principle 1 Stock status; Principle 2 – Ecosystem impacts; & Principle 3 -Management. The workplan actions (P1 - 5; P2 - 8; P3 - 3) were largely completed, however, there were six actions that were incomplete by the end of the FCP. A summary of the FCP was published9 and some progress has been made towards completing the outstanding actions in the post-FCP years. Some highlights include SAHLLA and BLSA having successfully completed the redesign of the tori line, the specifications of which has been included in the Permit conditions by Birdlife SA. In the pursuit this achievement BLSA carried out their own independent research program that included deployment of the same personnel at sea. A summary of the objectives and coverage of that program is provided in Annex 3. CapMarine are working with DFFE to obtain historical commercial catch data for the fishery and also to analyze and compare the observer data collected during the Offshore Resources Observer Program (OROP). Fishery observer deployments decreased post-FCP and a number of resignations at WWF SA11 led to an interruption in coordinated progress.

Discussions in 2019 with WWF South Africa have initiated the development of the "next-phase" of improvements in order that the fishery maintains it's green-listing on the South African Sustainable Seafood Initiative (SASSI) list. The remaining workplan actions from the 2016 FCP Report along with recommendations made to the National fishery department (then DAFF) are being evaluated and re-worked for implementation in the fishery. At the same time the fishery is in the beginnings of a *bona fide* Fishery Improvement Project (FIP), the first step of which is to complete an updated pre-assessment against the criteria defined in the MSC Fishery Standard V2.01 that will be undertaken by CapMarine. Separately the fishery has appointed Dave Japp as an independent advisor to SAHLLA both in respect to MSC and Scientific & Management Working Groups.

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.

Commercial Fishing Effort

Currently 45-50 hake-directed vessels are active within the fishery, most of which operate from the harbors of Cape Town and Hout Bay, with a small group operating out of Port Elizabeth and Saldanha Bay. A summary of vessels currently active in the fishery is provided in **Annexure 5.** The fishery targets deep and shallow-water cape hake species and also has a bycatch limit for kingklip. The deep-water hake (*M. paradoxus*) is found from about 250m to about 800m and the shallow-water hake (*M. capensis*) from 30m to about 400m. The two species overlap in their distribution in the depth range 250-400m and both species are found around the entire South African coast, extending northwards into Namibian waters. Large *M. capensis* are found seasonally on the central Agulhas Bank and inshore (shallower than 100m), particularly in autumn. Fishing grounds are similar to those targeted by the hake-directed trawl fleet and have expanded since the experimental start of the fishery (Figure). The hake longline footprint extends down the west coast from approximately 150 km offshore of Port Nolloth (15°E, 29°S). It lies inshore to the south of St Helena Bay moving offshore once again as it skirts the Agulhas Bank to the south of the country (21°E, 37°S). The eastern extent of the footprint lies at approximately (26°E, 34.5°S).

11 John Duncan and Jessica Greenstone

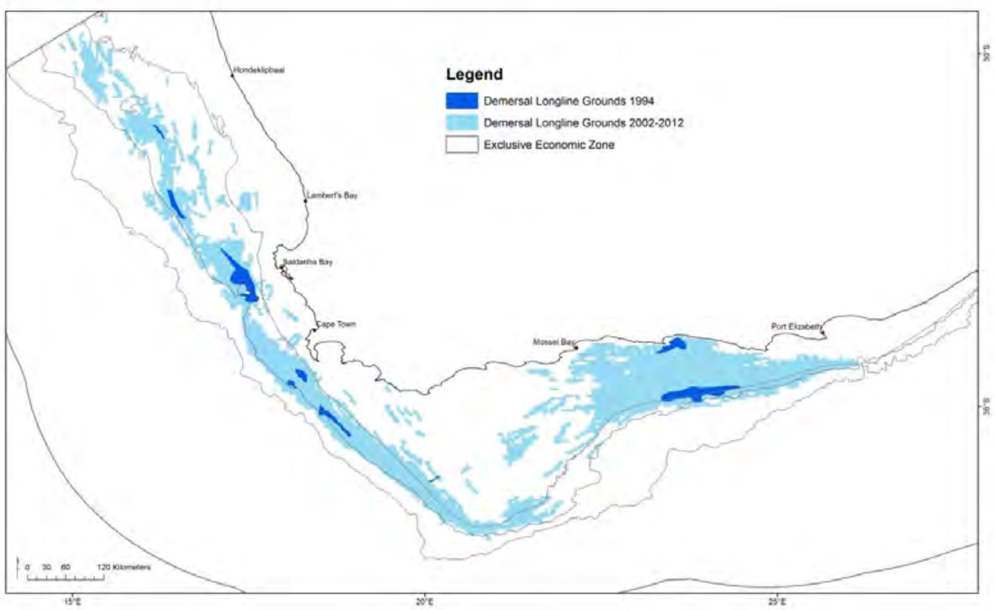

Figure 1: Consolidation of longline areas showing the expansion of effort from the 1994 experimental period to the total area as exploited between 2002 and 2012 (Wilkinson, CapMarine).

According to SAHLLA a total of 283 separate commercial fishing trips took place between January and November 2020 (Table 1). The notable decrease in effort over November and December is generally expected as right holders may have used up their quota for the year, however in the case of 2020 it is attributed to a nation-wide strike by vessel crew. A breakdown of reported number of trips per vessel that submitted data is provided in Table 2.

Table 1: Recorded number of commercial trips Jan-Dec 2020 according to data submitted by its members to SAHLLA.

Month	Unique vessels	Number of trips
Jan	12	22
Feb	12	28
March	16	45
April	12	28
May	15	36
June	11	17
July	15	30
August	11	21
September	15	25
October	12	29
November	1	2
December		
Total		**283**

Table 2: Reported number of commercial trips by vessel Jan-Dec 2020 (Source SAHLLA).

	Vessel name	Number of trips Jan-Dec 2020
1	Boloko 1	34
2	Augusta 1	30
3	Olivia marie	29
4	Shivon	28
5	Cape Frio	16
6	Karen 1	15
7	Abe Shapiro	13
8	Highland Queen	13
9	Staalkop	13
10	Penkop II	12
11	Aquilla	11
12	Intini	11
13	Tina	10
14	Arizona	9
15	Oceana Amethyst	9
16	Capt. De Sousa	8
17	Emerald	6
18	Southwest Lapwing	3
19	Valhalla	3
20	Armando	2
21	I Do	2
22	Abraham T	1
23	Hai Lim No. 38	1
24	Kentucky	1
25	Nicolette	1

Fishing Gear and Method

Longline fishing is one of the oldest fishing techniques known and is practiced in many parts of the world (Japp, 1994). The hake longline fishing technique was introduced in South Africa in the early 1980's, prior to which the only longline and line fisheries in South Africa waters were the pelagic (tuna) longline and hand line methods. There are typically two hake longline fishing methods used, namely the single line and the double line systems. The South African fleet uses the double line system first introduced in South African waters by fishers of Spanish and Portuguese descent. This demersal longline technique with weighted lines and baited hooks is regarded as a selective fishing technique in terms of both sizes of fish caught and low catches of non-target species.

The Double Line Demersal Longline

The double line gear consists of two lines, a top and bottom line, running parallel to one another and connected to a 14-18 mm thick polypropylene twisted rope (anchor line) on each end. The anchor line has an anchor at one end and a surface float at the other (Figure 2). The topline is a 12-16 mm thick rope that floats above the bottom line. The top line is connected to the bottom line at intervals by droppers and both lines are hauled simultaneously from different winches. The topline is also used to retrieve the bottom line when fouled and broken.

The bottom line is a rope with a diameter of 5-6 mm with fixed swivels at an average of 1 fathom spacing. Between 35 and 40 snoods with hooks are attached to the swivels on each line. The bottom lines are stored in baskets or 'pots and each basket hold four lines. At intervals of two lines 5-7 kg concrete weights are attached to keep the line closer to the sea floor (making it "demersal" gear). Rigid plastic buoys (floats) are attached on the bottom line to control the position of the baited hooks above the sea bottom.

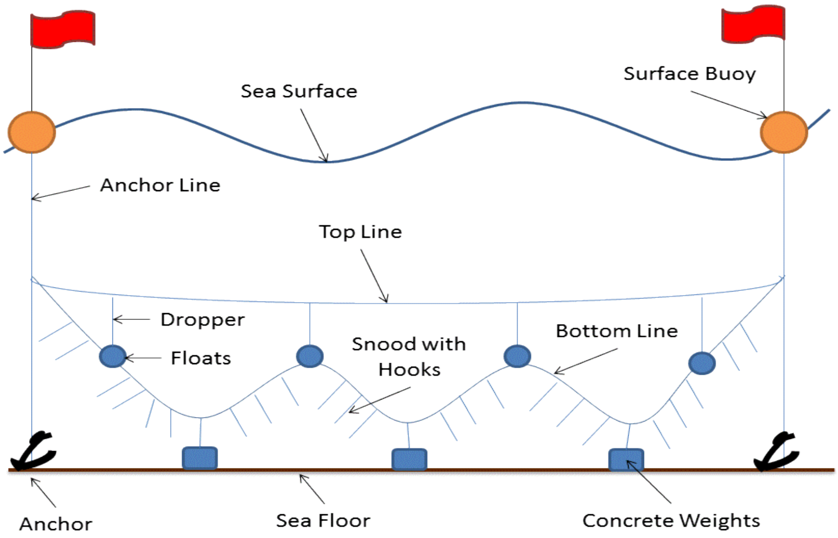

Figure 2: Schematic diagram of the double line demersal longline gear used by the industry.

Figure 33 : Standard hake longline pot as prepared prior to shooting of the line. Pots comprise normally of four lines of 25-30 hooks per line (Source CapMarine).

CapMarine Scientific Fishery Observer Programme

Schedule of Observer deployments 2019/2020

The observer program set an ambitious target to monitor 10-15% of the fishing effort of the fleet annually. Due to financial constraints SAHLLA and CapMarine negotiated to target at least one observer trip per month. Instances of vessel mechanical failure or else severe weather led to a number of deployments being cut short, therefore the number of days deployed, and the number of sea days observed can reflect differently. The SAHLLA on-board observer deployment coverage matches the historical catch data locations relatively well with most deployments taking place from Hout Bay harbour and covering the full range of the fishing grounds extending from the Agulhas Bank northwards to Port Nolloth (Figure 4). Two deployments from Port Elizabeth were achieved both on the same vessel providing coverage of important fishing grounds on the south-east coast and around the kingklip grounds.

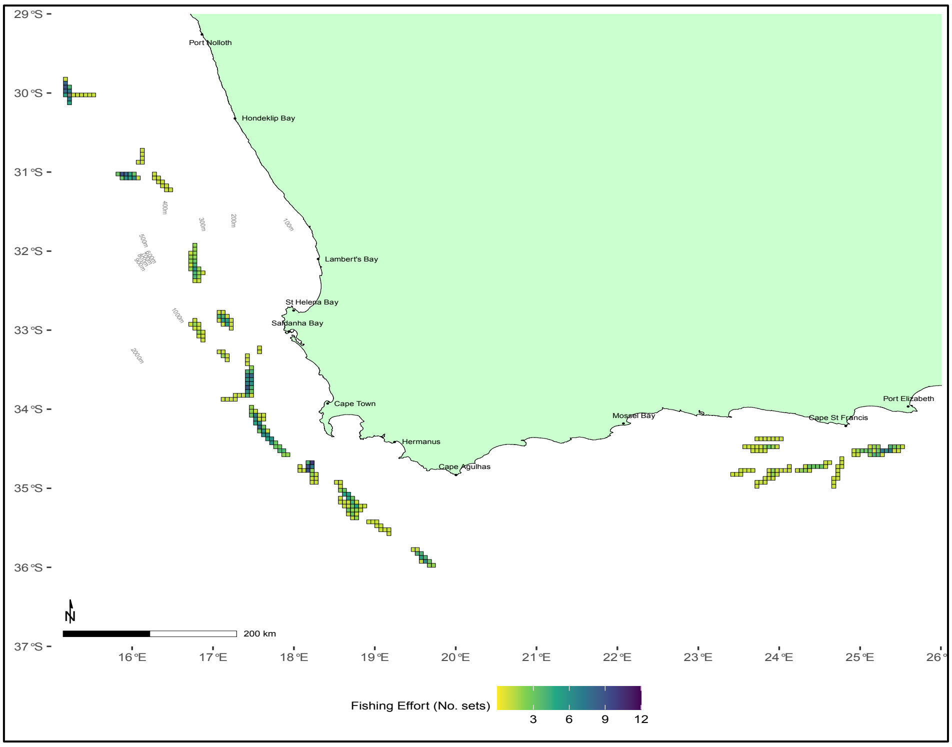

Figure 4: Location of observed sets indicating the number of sets observed from April 2019 - December 2020 (Source CapMarine).

Operational coverage

Figure 5 and Table and Table shows the number of observed sea days per month from April 2019. During this period, 16 trips, 131 observer days, 160 sets and 12 vessels were observed).

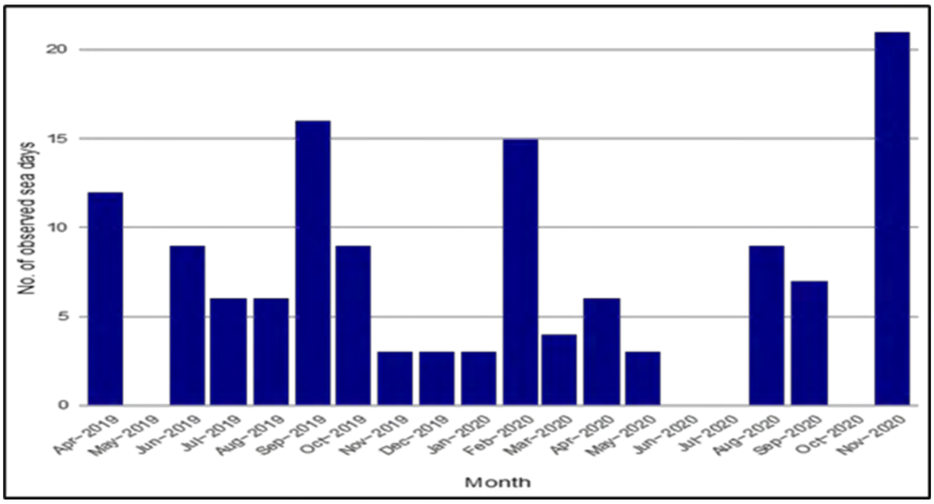

Figure 5: Number of sea days observed from April 2019 to December 2020. Note May-July 2020 the fishery was not able to accommodate observers due to COVID 19 restrictions.

Table 3: Summary of operational observer coverage statistics during the 2019/20 observer program.

Number of vessels unique vessels covered	12
Number of trips covered	16
Number of observers deployed during this period	8
Number of observer days	131
Number of fishing sets monitored	155
Total number of hooks set	1 259 313
Total number of hooks observed during line count period	562 558
Average percentage of the line observed during line count period	45%

Biological coverage

Observers are instructed to monitor exhaustively 40% of the line during hauling. During this period, they record the catch to species level on every single hook that is hauled as well as the fate (retained/discarded) and also record if the hook is clean (no catch), if the hook has been bitten off, if the catch is depredated, if they observe fish dropping off the hook (lost) or if catch is lost to seals. The observers record the number of pots (and by simple arithmetic the number of hooks) they observed during this period. Data can therefore be reasonably extrapolated up to the remainder of the hauling period.

Biological - During the biological sampling period observers are instructed to join the processing line and sample a representative sub-sample of the catch that comes on board for another 40% of hauling period. They are set a limit of 50 hake of each species which they also sex and stage for maturity. For all sampled fish the observers record the fate of the fish against a likelihood of survival scale, the commercial processing code, the length type they have measured (Fork length, standard length, total length), the sex and maturity for hake and jacopever. It is not possible for observers to measure every fish or record all bycatch that is brought on board and retained or discarded during this period.

A total of 10 376 fish were measured by observers to determine the length frequencies of catches. A total of 7699 hake, identified to species level, were measured. All *M. paradoxus* were sampled on the west coast (n = 3931), while *M. capensis* were sampled from both the west (n = 1811) and south coasts (n = 1967) (Figure 6). The proportions of *M. capensis* and *M. paradoxus* sampled were relatively similar, owing to similar proportions of sampling occurring in shallow and deep waters - 56% of sampling effort occurred in waters shallower than 350m, while the remaining 44% of sampling effort occurred in waters deeper than 350m. Length frequency distribution for hake, split by coast, is shown in Figure . *M. capensis* caught by longlines on the south coast had a mean size of 63.7cm total length (TL), while the mean size of those caught on the west coast was 61.4cm TL. The maximum size of *M. capensis* from the west coast (98cm) was larger than the maximum size from the south coast (91cm). The minimum size of *M. capensis* from the west coast was smaller (29cm) than the minimum size from the south coast (33cm). *M. paradoxus* had a mean size of 57.2cm TL. The maximum size of *M. paradoxus* was 100cm while the minimum size was 20cm.

The proportion of juvenile hake landed was approximately 12.4% of the total hake landed (both *Merluccius* species combined). This estimation was based on *M. paradoxus* reaching 50% maturity at the length of 42cm and *M. capensis* reaching 50% maturity at 54cm[12].

[12] Durholtz et al 2015. Fisheries, ecology and markets of South African hake.

A total of 735 jacopever (*Helicolenus dactylopterus*) were measured, with samples from the west coast dominating (n = 666). The length frequency distribution for jacopever is shown in Figure 7. The mean length (and standard deviations) of hake and bycatch species are listed in Table 4.

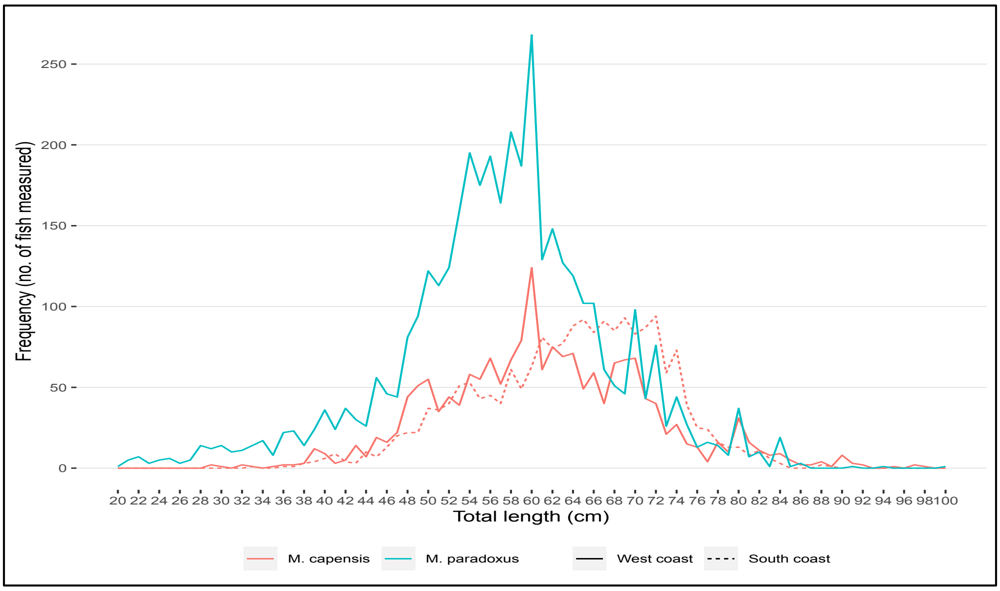

Figure 6. Shallow water hake (*M. capensis*) and deep-water hake (*M. paradoxus*) length frequency for the south coast and west coast of South Africa as recorded by observers from April 2019 to November 2020.

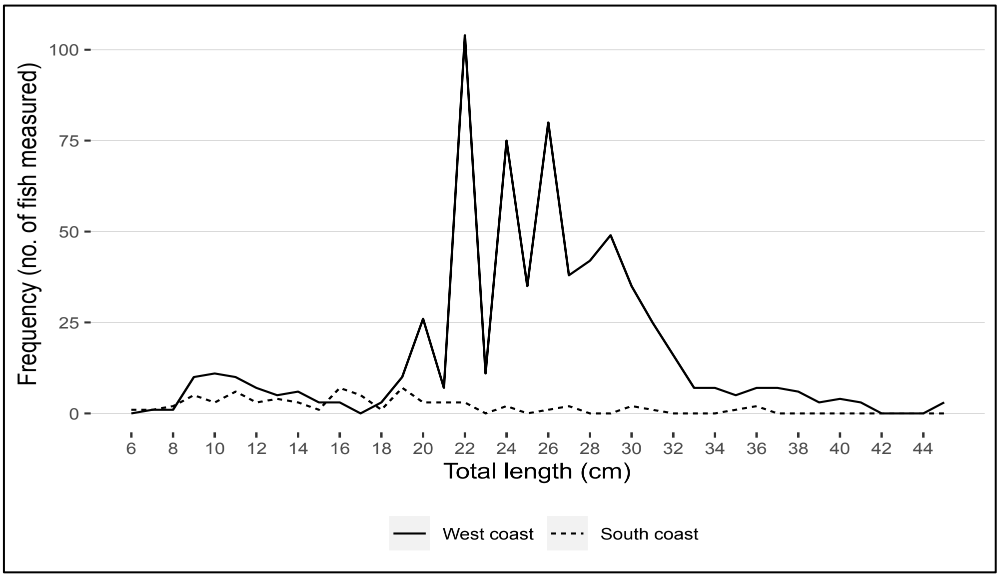

Figure 7. Jacopever (*Helicolenus dactylopterus*) length frequency for the south coast and west coast of South Africa as recorded by observers from April 2019 to November 2020.

Table 4. The number of individuals measured, mean length (and standard deviation) of sampled catch.

Common Name	**Species**	**Number of individuals measured**	**Mean length (cm)**	**Standard deviation (cm)**
Deep-water hake	*Merluccius paradoxus*	3931	57.20	10.30
Shallow-water hake	*Merluccius capensis*	3778	62.62	9.57
Jacopever	*Helicolenus dactylopterus*	735	24.71	10.65
Conger eels	*Conger spp*	476	65.29	17.06
Kingklip	*Genypterus capensis*	394	74.91	16.34
Dogfish sharks	*Squalidae spp*	378	56.08	25.86
Izak catshark	*Holohalaelurus regani*	120	42.22	15.30
Angelfish	*Brama*	77	32.58	5.82
Grenadiers and rattails	*Macrouridae*	62	37.29	19.66
Rays and skates	*Rajidae*	55	50.02	11.14
Cape hakes	*Merluccius spp*	52	63.62	9.07
Lanternsharks	*Etmopterus spp*	48	26.58	10.02
Yellowspotted catshark	*Scyliorhinus capensis*	40	56.55	15.42
Cape gurnard	*Chelidonichthys capensis*	38	43.84	5.18
Cape horse mackerel	*Trachurus capensis*	36	24.25	4.03
Blue shark	*Prionace glauca*	34	84.21	29.64
Carpenter	*Argyrozona*	25	28.84	5.38
Panga	*Pterogymnus laniarius*	22	15.82	3.26
Monkfish	*Lophius vomerinus*	18	69.50	8.54
Cape Cod	*Lepidion spp*	15	41.53	2.26
Sharks (unidentified)	*Selachimorpha*	9	48.78	15.75
Snoek	*Thyrsites atun*	8	92.88	22.30
Chub mackerel	*Scomber japonicus*	5	44.80	17.80
Silver scabbardfish	*Lepidopus caudatus*	5	76.40	8.76
Sharks, rays, skates, etc.	*Elasmobranchii*	4	31.50	2.38
Common squids	*Loligo spp*	4	18.50	9.33
Deep-water arrowtooth	*Histiobranchus bathybius*	3	61.33	0.58
Starfishes	*Asteroidea*	2	37.50	2.12
Bluenose	*Hyperoglyphe antarctica*	1	53.00	NA
Shortfin mako	*Isurus oxyrinchus*	1	79.00	NA

Catches of both species of hake are dominated by females (Figure 8). Females account for 92.4% of *M. paradoxus* sampled, while females account for 72.1% of *M. capensis* sampled. The vast majority of *M. paradoxus* sampled were at maturity stage 2, while the majority of *M. capensis* sampled were at maturity stage 2 or 3. The maturity stages of a large proportion of *M. capensis* males were either not recorded or undetermined. Samples of *H. dactylopterus* were made up of slightly more males (58.3%) than females. The vast majority of male *H. dactylopterus* sampled were at maturity stage 1, while the majority of females sampled were at maturity stages 1 or 4.

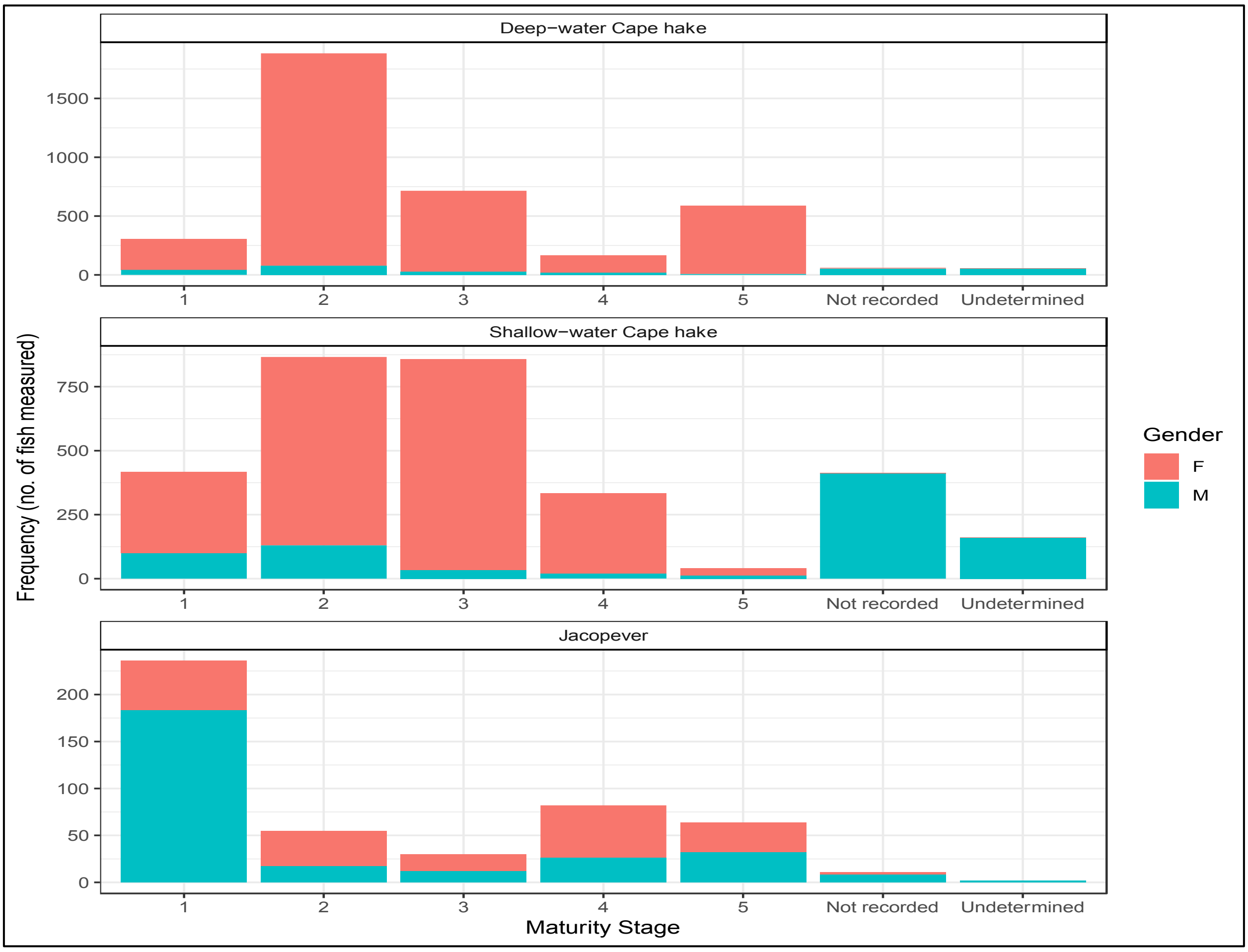

Figure 8. Gender and maturity stage of deep-water hake (*M. paradoxus*), shallow water hake (*M. capensis*), and jacopever (*Helicolenus dactylopterus*) as recorded by observers from April 2019 to November 2020.

Catch composition

The observed retained catch was estimated at 287 385 kg, of which hake catches dominated, at 280 533 kg (97.62%) (Table 5 and Figure 9). Kingklip was the primary bycatch species retained (1.36%) while the remainder of the retained bycatch species amounted to 1.02% of the retained catch. Where catch weight values were missing, weight values were estimated from mean length values.

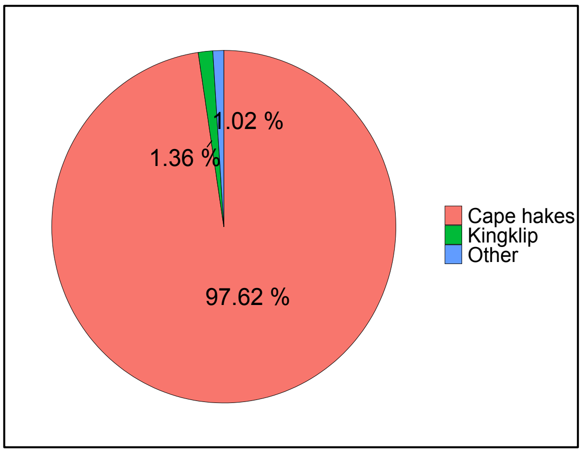

Figure 9. The composition of the total observed retained catch (287 385 kg) from the hake longline fishery during the period April 2019 to November 2020.

Table 5. The composition of the total observed retained catch from the hake longline fishery during the period April 2019 to November 2020.

Common name	Species	Total Weight (kg)
Deep-water Cape hake	*Merluccius paradoxus*	138229
Shallow-water Cape hake	*Merluccius capensis*	120019
Cape hakes	*Merluccius spp*	22285
Kingklip	*Genypterus capensis*	3914
Angelfish	*Brama*	1137
Carpenter	*Argyrozona*	1070
Smooth-hound shark	*Mustelus mustelus*	380
Jacopever	*Helicolenus dactylopterus*	171
Cape stumpnose	*Rhabdosargus holubi*	90
Monkfish	*Lophius vomerinus*	42
Snoek	*Thyrsites atun*	39
Chub mackerel	*Scomber japonicus*	6
Bluenose	*Hyperoglyphe antarctica*	3
	TOTAL	**287385**

Discards composition

The discarded catch was estimated at 8 071 kg, with hake accounting for the greatest discards, by weight (Table 6). The discarded catch accounts for 2.73% of the total catch and is slightly lower than reported in the hake longline FCP report from 2016.

Table 6. The composition of discarded catch from the hake longline fishery during the period April 2019 to November 2020.

Common Name	Species Name	Number of	Weight (kg)	Percentage of
Cape hakes	*Merluccius spp*	671	1892	0.64%
Dogfish sharks	*Squalidae*	888	1556	0.53%
Conger eels	*Conger spp*	494	1246	0.42%
Jacopever	*Helicolenus dactylopterus*	1375	1201	0.41%
Chub mackerel	*Scomber japonicus*	3206	692	0.23%
Blue shark	*Prionace glauca*	43	512	0.17%
Rays and skates	*Rajidae*	78	213	0.07%
Thresher sharks	*Alopias spp*	1	150	0.05%
Izak catshark	*Holohalaelurus regani*	169	127	0.04%
Sharks (unidentified)	*Selachimorpha (Pleurotremata)*	11	85	0.03%
Yellowspotted catshark	*Scyliorhinus capensis*	65	84	0.03%
Cape horse mackerel	*Trachurus capensis*	40	75	0.03%
Kingklip	*Genypterus capensis*	16	35	0.01%
Grenadiers and rattails	*Macrouridae*	81	32	0.01%
Cape gurnard	*Chelidonichthys capensis*	32	30	0.01%
Lanternsharks	*Etmopterus spp*	158	30	0.01%
Cape cod	*Lepidion capensis*	15	28	0.01%
Carpenter	*Argyrozona*	25	26	0.01%
Monkfish	*Lophius vomerinus*	4	17	0.01%
Panga	*Pterogymnus laniarius*	21	15	0.01%
Snoek	*Thyrsites atun*	2	11	0.00%
Shortfin mako	*Isurus oxyrinchus*	2	8	0.00%
Deep-water arrowtooth eel	*Histiobranchus bathybius*	3	6	0.00%
	TOTAL	**7400**	**8071**	**2.73%**
Total Chondrichthyans	*Squalidae spp; Prionace glauca;*	1415	2765	0.94%

The majority of the Cape hakes that were discarded were depredated, with a very small proportion being discarded because they were undersized (Figure 10). The majority of the remainder of the discards (apart from rays and skates and thresher sharks) were discarded dead. The majority of rays and skates and all thresher sharks were observed to be discarded alive. Line count observations were also made (Figure 10).

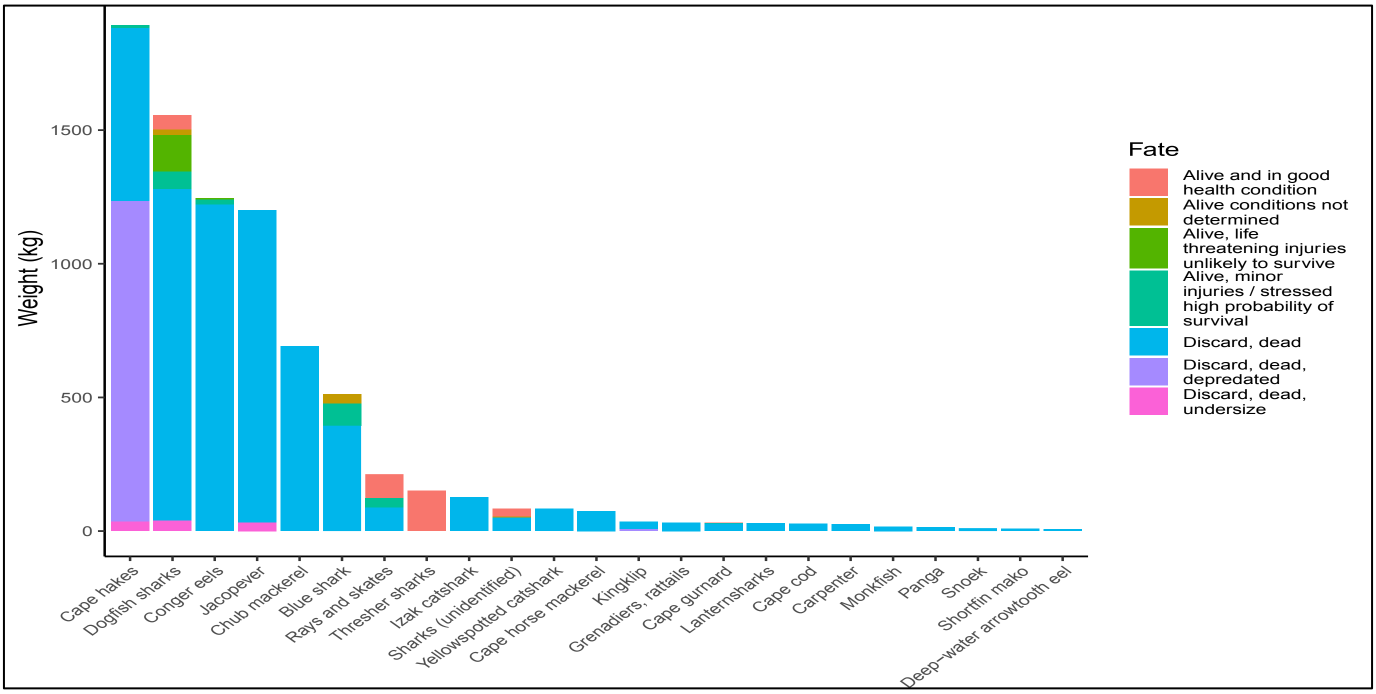

Figure 10. Fate of discarded catch recorded by observers during the period April 2019 to November 2020.

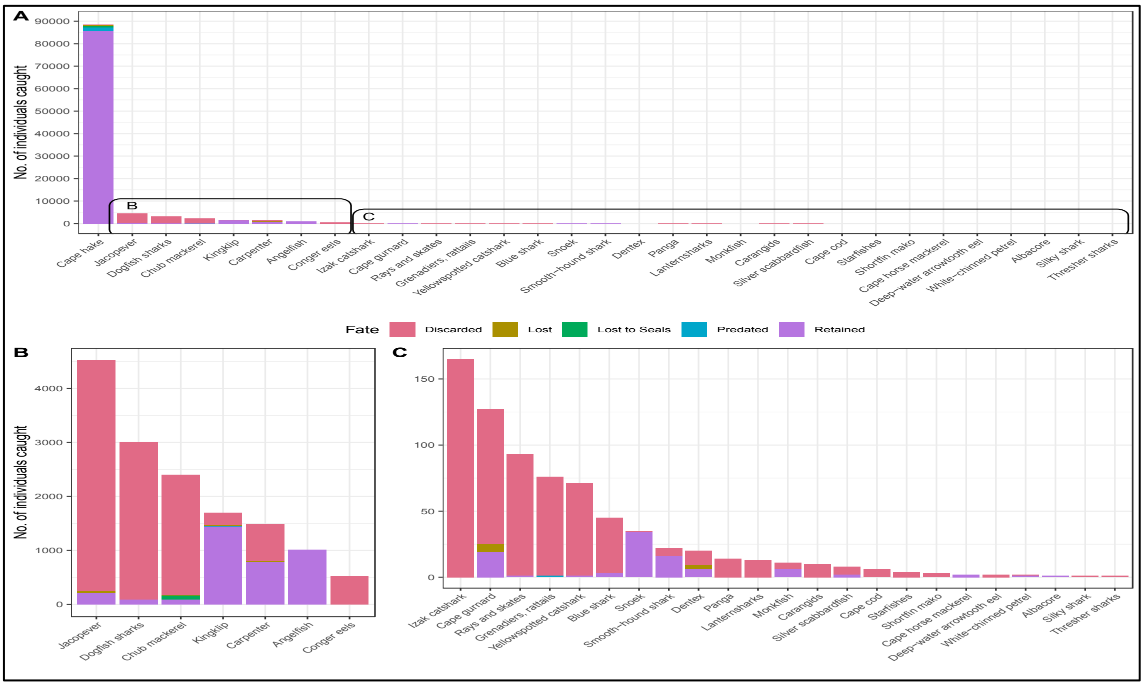

Figure 11. Fate of target and bycatch species recorded by observers during direct line observation period (~40% of the hooks hauled). Take note of the different scales in figures A, B and C.

Marine mammal and seabird observations

Seabirds eating from vessel discards account for the vast majority of interactions that occur, with white-chinned petrels being the most prevalent species (Figure 12). Of the marine mammal interactions, the fur seals were the most prevalent, with seals eating from the haul accounting for the majority of the interactions.

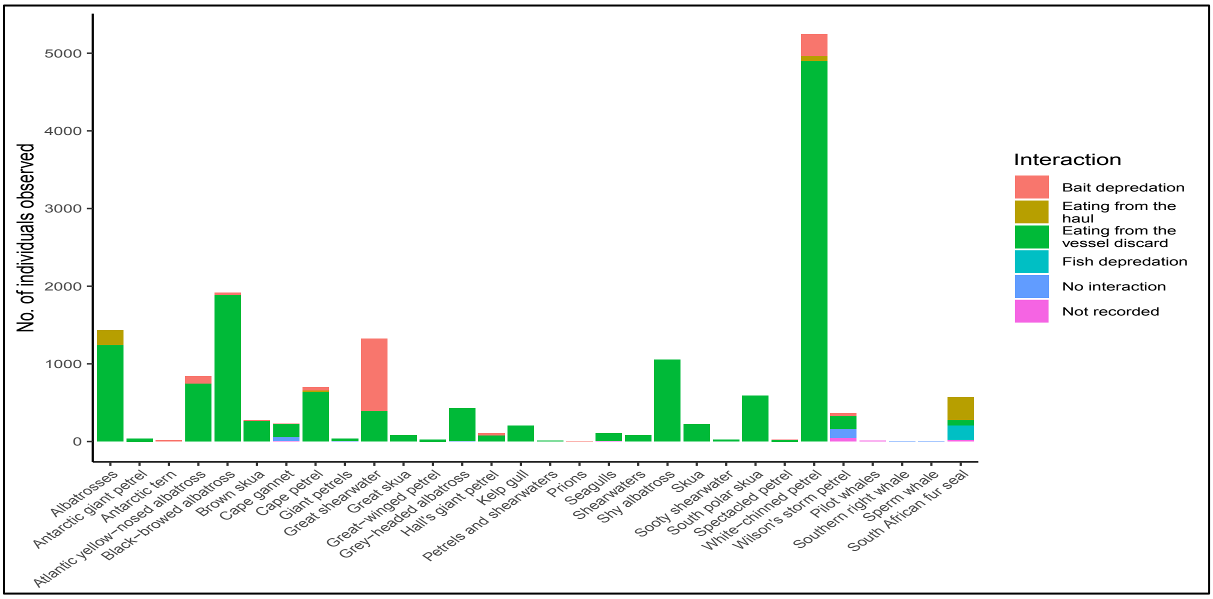

Figure 12. Observed seabird and marine mammal interactions with the hake longline fishery.

ETP interactions and mitigation measures

The majority of observed ETP species incidentally caught by the hake longline fishery are seabirds, with great shearwaters (*Puffinus gravis*) and white-chinned petrels (*Procellaria aequinoctialis*) dominating (Figure 13).

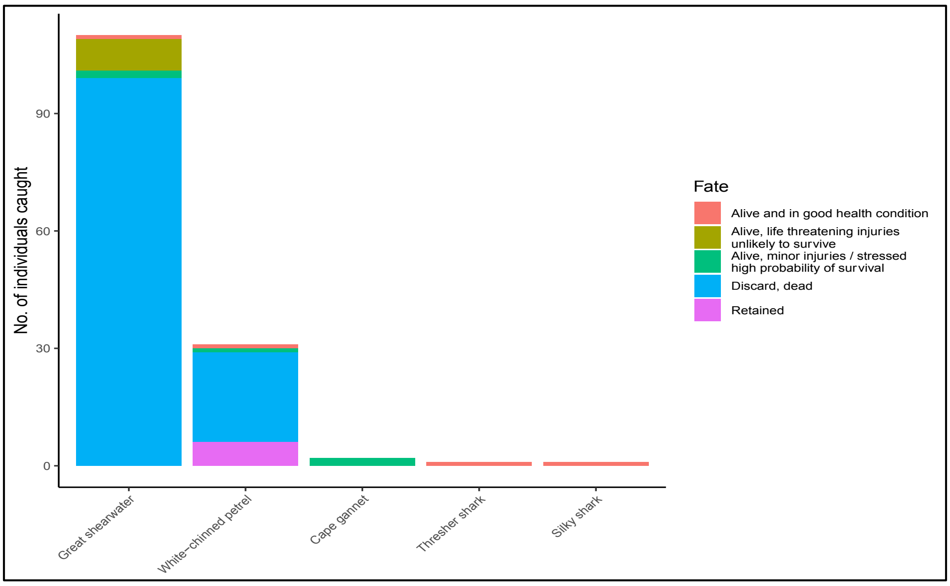

Figure 13. ETP species observed caught by the hake longline fishery.

The majority of individuals of these two species caught did not survive or were deemed unlikely to survive. 18 white-chinned petrels and 103 great shearwater were observed to have been killed during a single voyage that took place over full moon. In that bird bycatch mitigation measures (tori line, offal dumping protocol) were not employed, and floats were used by the vessel during setting. Although this is an anomalous result (most observed trips recording zero seabird mortalities) this single voyage included 10 sets, and seabirds were caught in every single set. These two species of seabirds are also the two species most likely to engage in bait depredation behaviour.

A small number of cape gannets (Morus capensis), thresher sharks (Alopias spp) and silky sharks (*Carcharhinus falciformis*) were also caught, however these were released alive.

Compliance

Although not the primary function of a scientific observer program observers are in a position to report on issues of compliance. The Department of Environment, Forestry and Fisheries issues annual permits and associated permit conditions separately for vessels fishing on the west and south coasts. These inter alia include measures relating to fishing and restricted areas, effort limitations and gear restrictions, bycatch mitigation, pollution, retained bycatch species limits and submission of information. Observers, through their routine data collection, are in a position to report on issues of compliance.

All sets took place between the hours of nautical dusk and nautical dawn. Despite low light at night, tori lines (bird-scaring lines) should be deployed during setting. It was recorded during the 2019/20 program that compliance ranged between 0% to 100% depending on the vessel. On average tori lines were deployed on 41.3% of sets observed (Figure 14). Other mitigation measures used by the fleet include night setting and discarding of offal either only after hauling or on the other side of hauling (some vessels have a discard chute installed to carry offal to the other side of the vessel).

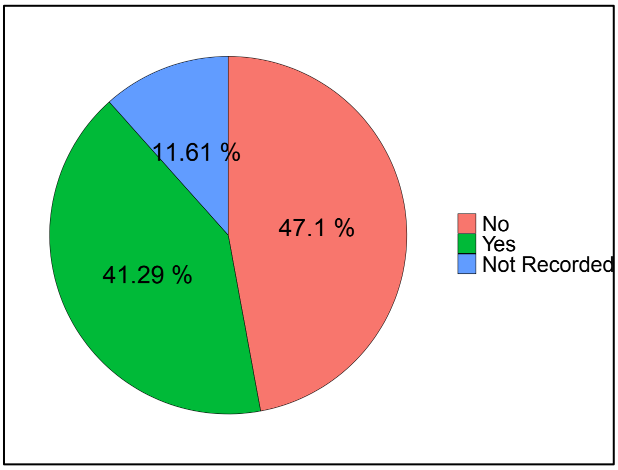

Figure 14. Observed tori line compliance in the hake longline fishery.

There were no reported incidences of waste disposal in contravention of the permit conditions. This means that only kitchen waste and cardboard/paper were ever observed disposed of at sea. Non-biodegradable fishing gear, metal and glass, plastic, oil or fuel were retained onboard the vessel for disposal in port on land.

According to permit conditions if the catch of kingklip taken in any one set is greater than 10% by weight of the hake catch then the vessel shall not set further lines within 5 nautical miles of that position. In 13 of the 155 observed sets (8.4%), the kingklip catch amounted to more than 10% of the hake catch by weight. Of these 13 sets, five of the following lines were set within 5 nm. Every effort shall be made to ensure that sharks captured during longlining are released alive and that where possible hooks are removed without jeopardising the life of the animal concerned. Observers record the fate of the released/discarded catch.

The vast majority of sharks captured during hake longlining are discarded dead (Figure 15). The most prevalent shark species caught are dogfish sharks (*Squalidae*). While a small proportion of these sharks are released alive, many are deemed to have life threatening injuries and were unlikely to survive.

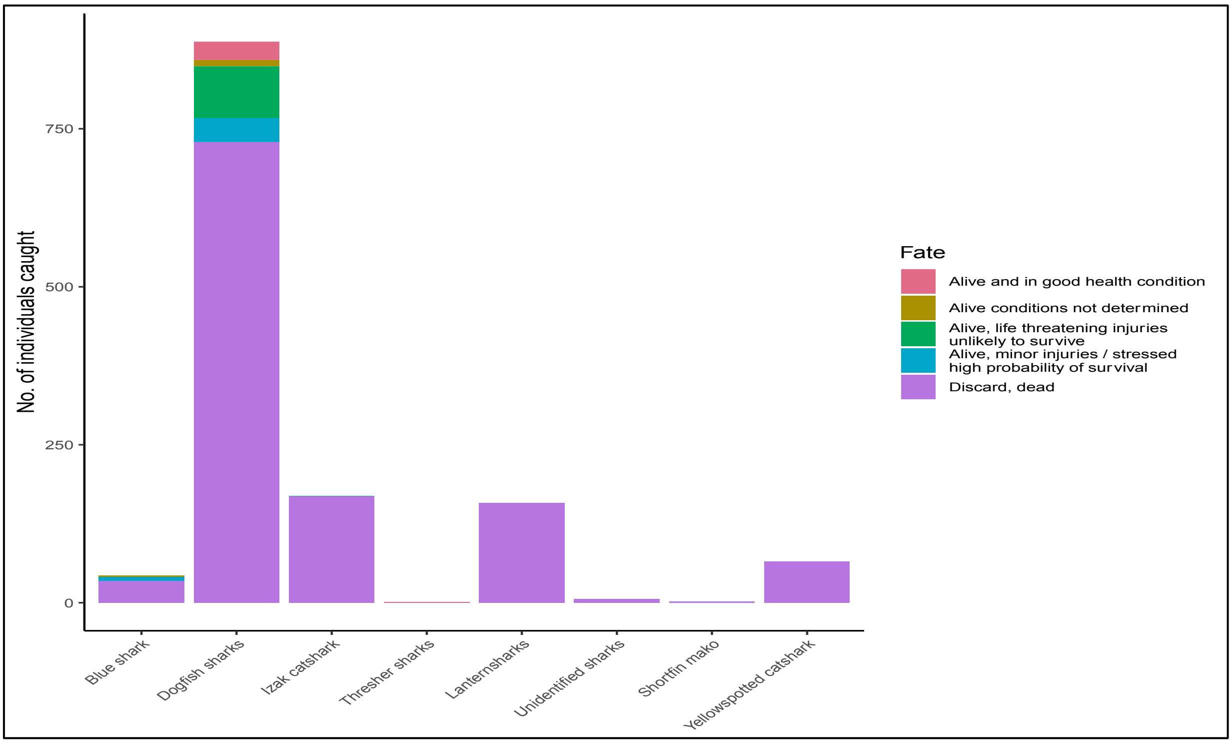

Figure 15. Fate of sharks captured in the hake longline fishery.

Conclusions

The SAHLLA observer programme continues to be useful in providing important scientific data (much of which would otherwise be unavailable) on fishing operations, stock distribution, catch rates for both hake and bycatch (retained and non-retained), bird interactions and the environment. Although coverage is only around 1-5%, comparative work can be done within the observer data (between observers, between vessels, between seasons) and between observer data and research data and historical data to show the observer data to be of good quality with respect to catch composition.

Annexure 5. Demersal Hake longline vessels currently active in the fishery

(with status in respect of SAHLLA membership (source SAHLLA)

	Vessel Name	SAHLLA Member	Vessel length (m)	GT	Construction year	Crew
1	Abe Shapiro	Yes	19.05	64.71	1958	18
2	Abraham T	Yes	22.2	109	1963	20
3	Alpha	No	21.98	99.98	2000	22
4	Amoria	Yes	28.7	177	1972	25
5	Aquilla	Yes	20.09	136.32	2011	23
6	Arizona	Yes	19.51	75.39	1950	24
7	Armando	Yes	16.59	60.99	1990	21
8	Augusta 1	Yes	26.3	240.58	1974	26
9	Boloko 1	Yes	27.14	184.5	Not provided	25
10	Cape Frio	Yes	20.93	114.15	1964	25
11	Cape Padrone	Yes	22.0	73.78	1963	
12	Capt. De Sousa	Yes	17.22	63.43	1947	20
13	Christie Sue	No	18.56	73.13	1963	18
14	Christo Rei	No	22.62	116.2	1991	25
15	Emerald	Yes	No given	-	Not provided	-
16	Estrella Do Mar	Yes	21.8	139.12	1975	24
17	Hai Lim No. 38	Yes	27.46	113.82	1995	29
18	Herman S	Yes	27.46	113.82	1995	29
19	Highland Queen	Yes	20.64	99.95	1968	22
20	I Do	Yes	23.94	231.69	2014	28
21	Intini	Yes	20.58	113.39	1973	24
22	Karin 1	Yes	25.3	110	2017	28
23	Kentucky	Yes	18.89	80.24	1991	20
24	Monnickendam	Yes	20.43	90.83	1962	23
25	Nicolette	Yes	19.39	86.87	1979	24
26	Oceana Amethyst	Yes	20.2	96.99	1990	20
27	Olivia Marie	Yes	30.77	315.63	Not provided	25
28	Ouma	Yes	16.43	50.8	1959	15
29	Pakamani	Yes	21	117.03	2000	25
30	Penkop II	Yes	20.16	110.04	1965	23
31	Perle Du Atlantic	No	15.38	51.1	1985	20
32	RRR	Yes	17.39	41.31	1980	17
33	Scomber	Yes	18.27	95.96	1997	10
34	Sea Pride II	Yes	24.23	99.22	1967	22
35	Shivon	Yes	18.1	88.85	1999	25
36	Silver Hunter	Yes	20.0	-	Not provided	-
37	Southwest Condor	Yes	22.76	188	1970	20
38	Southwest Lapwing	Yes	18.34	69.88	1963	18
39	Southern Tiger	Yes	21.87	72.31	1960	20
40	Staalkop	Yes	18.9	96	1961	22
41	Tiger Fish	Yes	18.07	60.84	1958	18
42	Tina	Yes	19.03	137.8	Not provided	25
43	Valhalla	Yes	17.7	57.42	1955	17