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Status and Management of Horse mackerel in South Africa and Namibia, 2019

Capricorn Marine Environmental (Pty) Ltd
David Japp, Daniel Droste and Zonke Gumede

South Africa

Biology and Stock Dynamics

Horse mackerel (*Trachurus capensis)*, better known as 'maasbanker' in the Western Cape, are similar to other *Trachurus* species caught globally in many other parts of the world. They are also classified as carangids which typically are game fish and fast swimmers (such as the kingfish commonly caught in the warmer waters of the South African east coast). Maasbanker, however, differ somewhat in that they are primarily filter feeders, although they do have a fairly broad diet that includes plankton and small swimming crustaceans (such as krill) and small fish and squid. What makes them a good commercial species is their shoaling behaviour, with large aggregations occurring in areas where plankton is abundant. Such is the case with the South African fishery, particularly on the east coast around the Agulhas Bank where adult maasbanker shoal and are targeted by the mid-water trawl fishery.

Maasbanker are difficult to catch, as they are strong swimmers and migrate up and down in the water column and occur from the shallowest waters out to the deep waters of the continental shelf. In South Africa, the fisheries for massbanker can be broadly separated between three fishery sectors – a fishery using midwater trawls, a second using bottom trawls (typically for hake) and a third fishery targeting juvenile maasbanker using purse seine gear such as that used for sardine and anchovy. These variations, combined with the behaviour of maasbanker, require specific management interventions to ensure that the fishery remains sustainable into the future.

Catches

It is important to contextualise the exploitation of horse mackerel in South African waters, in particular noting that there are two main areas targeted – the West Coast where juveniles are caught and the Agulhas Bank area (South East Coast) where predominantly adults are caught. The total catch of maasbanker taken by all fleets is shown in Figure 1.

Historically, maasbanker was caught only by the small pelagic fishery (on the West Coast), up to 1970. Thereafter however, trawling for horse mackerel increased significantly, notably in the 1970s by Japanese trawlers operating on the Agulhas Bank, and then from the 1980's onwards by both the South African bottom and midwater trawls vessels. The current trawl catch (midwater, bottom and dual operators) approximates 50 000 t a year (caught on the Agulhas Bank mostly) whilst the small pelagic fishery catches no more than 10 000 t on the West Coast. For economies of scale, there is presently only one vessel fishing exclusively using midwater trawl, that is the *FV Desert Diamond* which is the largest vessel permitted to fish in South African waters. In addition there are a number of smaller hake trawlers carrying dual hake and horse mackerel rights (the "dual rights vessels").

The *Desert Diamond* lands on average about 70% of the horse mackerel PUCL, fishing in partnership with other rights holders in the midwater trawl sector. As the catch is limited and the resource difficult to catch and process, this arrangement supports the economic exploitation of the allowable catch following the precautionary approach. Applying this international protocol, the use of a single vessel also assists with the monitoring, including tracking of operations using satellite (vessel monitoring systems or VMS) and 100% scientific observer coverage.

We consider this further relating to the spatial management measures for the midwater trawl fishery which is under scientific debate.

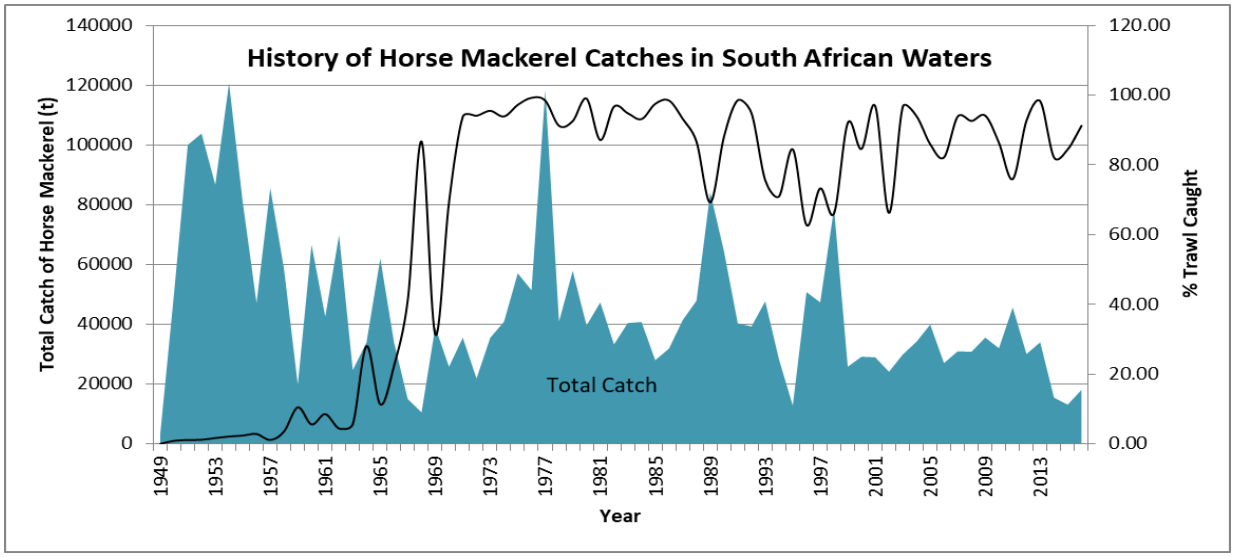

Figure 1: Historical catches of horse mackerel in South African waters (blue) and the relative proportion of the catch taken by the trawl and small pelagic fisheries.

Stock Status and Management

Scientists set a Total Allowable Catch (TAC) for most species in South Africa – this is known as an "output" control. When there is uncertainty in an assessment of a stock (such as maasbanker), management adopts the "precautionary approach" and sets an "Precautionary Upper Catch Limit" or PUCL. A PUCL has been set for maasbanker in the last 10 years or so, primarily because there is no rigorous stock assessment based on data of sufficient quality. In the case of maasbanker caught in South Africa, different sets of information compound the problem, in particular because some of the catch is caught by a directed midwater trawl fishery, some by bottom trawl only and some by bottom trawlers for hake that can switch gear from bottom to midwater gear (dual rights). Finally, adding to the complexity, the small pelagic fishery using purse-seine gear catches only juvenile maasbanker and must also be managed using a PUCL to avoid overexploiting the juvenile stock before they migrate into deeper waters and are caught by the trawl fleets.

Stock assessment scientists must grapple with multiple indices of abundance from these different fisheries and gear types which all give slightly different indices of abundance. Standard indices and reference points as is used for most other fisheries, such as catch per unit of effort (or CPUE) have proven difficult to use as indicators of the status of the horse mackerel stock.

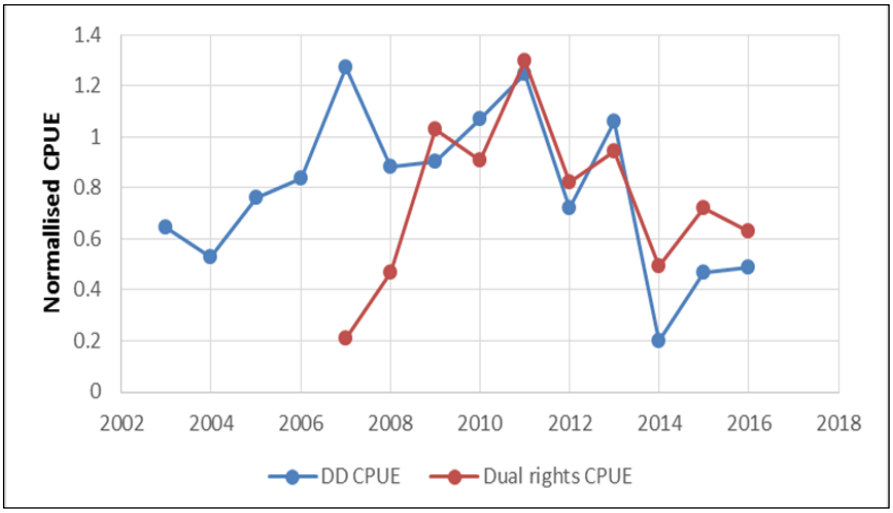

Figure 2: *Normalised CPUE indices of horse mackerel abundance allowing for comparison between the Desert Diamond and other trawl vessels (after Johnson and Butterworth, 2017).*

The considerable fishing record and regular fishing operation of the *Desert Diamond* has allowed for standardisation of fishing effort and has provided a key index of abundance used to assess the stock status of horse mackerel (Figure 3)[1].

The current model on stock status for horse mackerel was developed in 2017 (update of the horse mackerel stock assessment incorporated additional data extending to the end of 2016). Uncertainty regarding the reasons for a continued reduction in availability remains, with the available data being uninformative on this aspect. Nevertheless, the biomass trajectory shown in Figure 3 largely reflects the catch trends shown in Figure 1 with a decline in biomass (as measured by spawning biomass B_{sp} as a proportion of pristine stock size (*K*). However from about 2014 onwards things change with an increase in Natural Mortality reflecting uncertainty in the changing dynamics of the fishery as a likely result of variability in oceanographic conditions on the Agulhas Bank, the main area fished by the mid-water trawl.

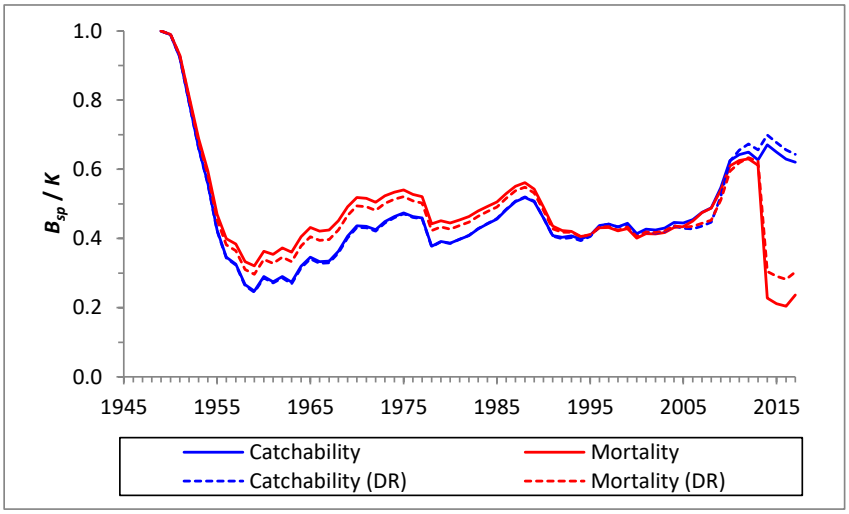

Figure 3: *Spawning biomass trajectories estimated by the 2017 assessment models (Source: DAFF, 2017)*

[1] Johnson, J.S. and D.S. Butterworth (2017). The 2017 Horse Mackerel Updated Assessment Fisheries/2017/Sep/Swg-Dem/31

Given the ongoing uncertainty in the state of the stock and the best efforts to assess the fishery, DEFF has recommended that the precautionary catch approach be maintained and for the near future at least has maintained the management of horse mackerel based on the agreed Operational Management Procedure developed by Furman, (2016) in conjunction with the updated catch rate time series (CPUE) as demonstrated in Figure 3. The Horse Mackerel TAC recommendation for the midwater sector derived from this procedure for 2019 was set at 36 125 t. A portion of this (27 670 t) was allocated to directed mid-water trawling and the balance (8 455 t) set aside as a by-catch reserve in the hake trawl sectors. The Precautionary Upper Catch Limit (PUCL) applied to juvenile horse mackerel catches in the purse-seine fishery for small pelagic species was maintained at the 2017 level of 12 000 t (spread over three years).

Spatial Management Measures

There are numerous measures in place for the management of the fishery. The operations of the vessel are subjected to strict spatial restrictions, most of which originated from the management of the foreign vessels in the past. This included the restrictions of these vessels to east of 20° E, to fishing no deeper than 110 m and no closer than 20 nm from the coast. In combination this spatial management regime was known as the "*Foreign Triangle*". The current spatial measures applied to the midwater fishery have therefore not changed much, although there is now greater emphasis on both the fish bycatch as well as "large bycatch". An extension of this area has been permitted in recent years to allow fishing further west to a line due west of Cape Point (34° 20' S) (Figure 4).

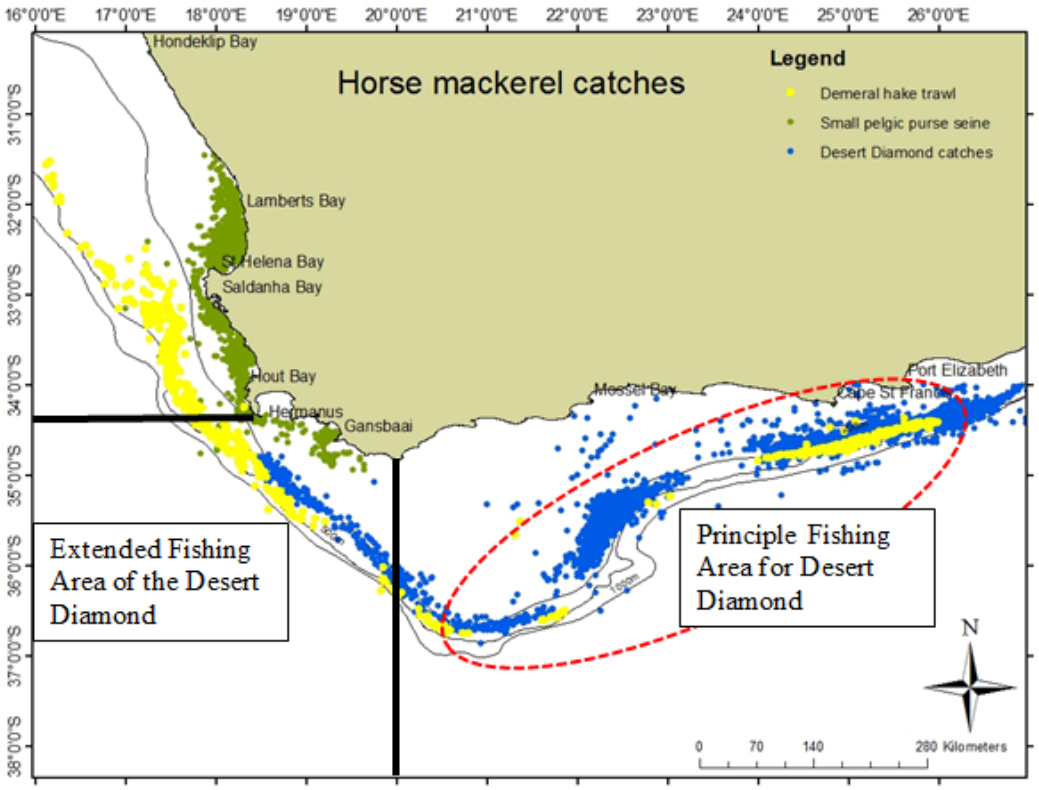

Figure 4: *Distribution of horse mackerel catches taken by the different fishery sectors; directed midwater trawl fishery, demersal trawl fishery and small pelagic purse-seine fishery.*

The semi-pelagic and shoaling nature of the Cape horse mackerel throughout the water column brings this fishery operation into broad contact with three oceanic areas, namely the near surface area, the meso-pelagic (or midwater) and occasionally the demersal or bottom water area. As expected, any fishing gear operated in these extremes is expected to have a variable bycatch (over and above that of the target species, horse mackerel). A consequence of this is that the bycatch in the fishery is closely monitored by employing two scientific observers, who monitor not only the target catch and other fish species caught (especially hake), but also any incidental catches of other species classified as "larger pelagic" species and birds.

While the bycatch species taken in the traditional east coast area of the fishery (Figure 4) is reasonably well understood, the same cannot be said for the areas westwards. In the last three years, fishing by the *Desert Diamond* has been permitted in an extended area onto the west coast (mostly south of Cape Point area towards Cape Agulhas). The information on bycatch in this area has now been analysed and DEFF is in process of deciding if this area can be fished on a more permanent basis by the *Desert Diamond.* Further, an application has been made for exploratory mid-water fishing northwards up the west coast, into areas similar to that exploited in the pre-1970 period as shown in Figure 1.

Namibian Horse Mackerel

Compared to South Africa, the Namibian midwater fishery for horse mackerel is significantly larger. While in South Africa horse mackerel comprises of a single species extending from the southern Benguela ecosystem into the Agulhas ecosystem on the south coast of South Africa, the Namibian fishery is found only in the northern Benguela extending from about Walvis Bay northwards into to Angola (Figure 5). The dominant species caught in Namibian waters is also *T. capensis*, with occasional intrusions of Cunene Horse Mackerel, *Trachurus trecea* from southern Angola (associated with a warm water frontal system knows as the Angola Benguela Front or ABF).

Research

Research on horse mackerel in Namibia is ongoing and is undertake by NatMIRC, the research branch of the Ministry of Fisheries and Marine Resources (MFMR). Annual acoustic surveys are undertaken using internationally scientifically-developed methodology developed for small pelagic species such as sardine and anchovy as well as for horse mackerel. In 2018, the annual survey[2] was undertaken from March to April on the research vessel *FV Mirabilis* with a full team of scientists investigating not only pelagic fish, but also associated oceanography and biology such as size composition, gonad maturity and diet. The results from the survey are compared to previous years such as the distribution and density of horse mackerel as shown in Figure 5. Results show that the main portion of the stock is still found in northern Namibia towards the Angolan border.

[2] MFMR, 2018. Horse mackerel and small pelagic survey of the northern Benguela (10 March to 7 April 2018)

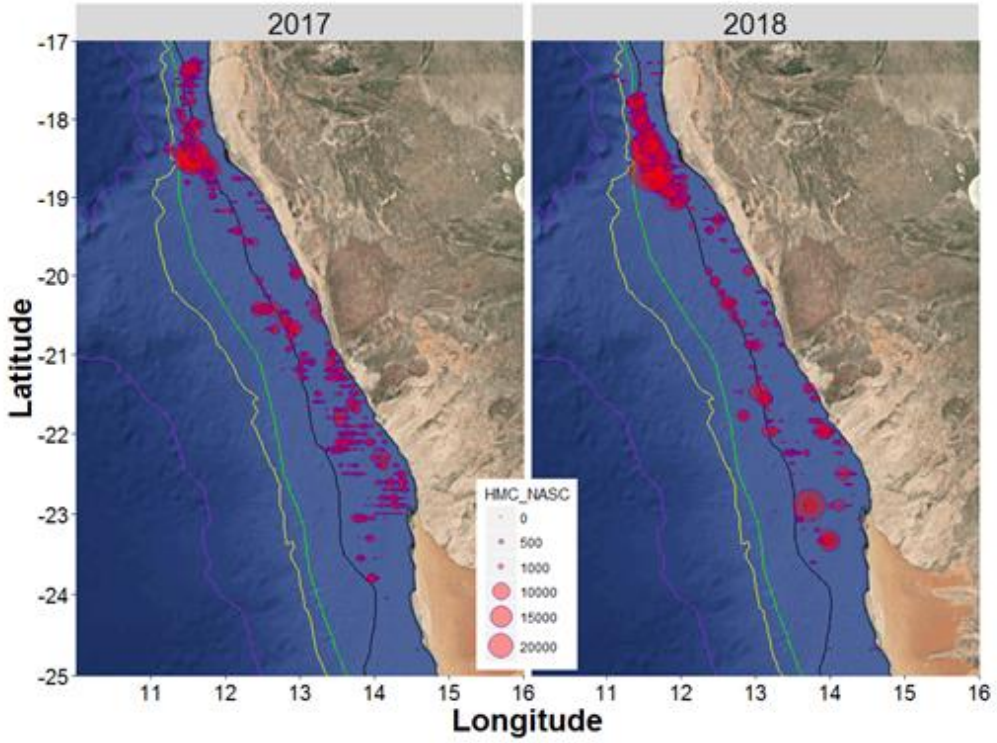

Figure 5: *Spatial distribution and abundance of horse mackerel during the 2017 and 2018 acoustic biomass survey undertaken on the RV Mirabilis (MFMR, 2018).*

The annual state of stocks report prepared by MFMR shows the best-fit model for horse mackerel biomass since 1961 with a gradual improvement in stock biomass since independence (Figure 6)[3]. Overall, the stock biomass is estimated at 1.6 million tons and is above Maximum Sustainable Yield (MSY).

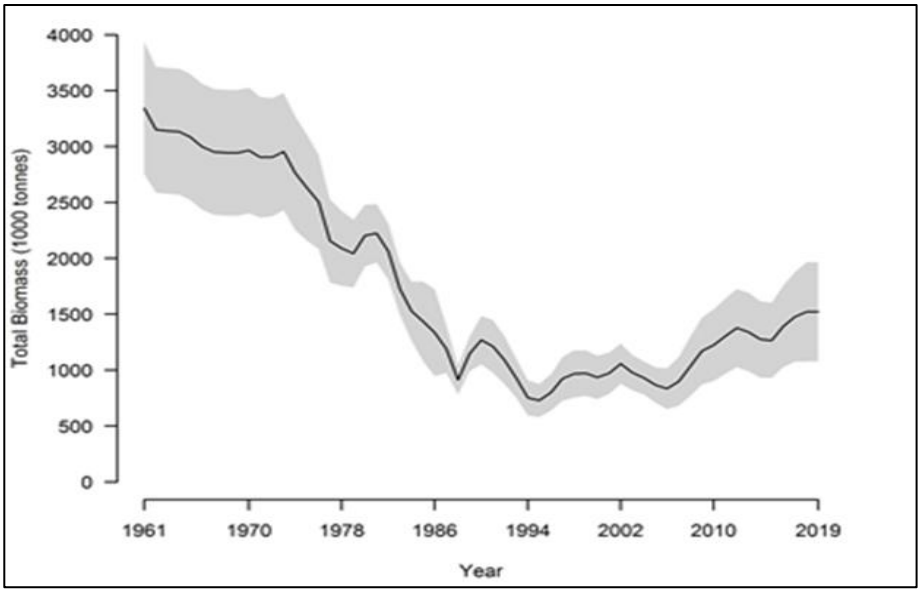

Figure 6: *Total biomass estimated by the best-fit model from 1961 to 2019 for Cape horse mackerel in Namibian waters (MFMR, 2018).*

[3] MFMR, 2018. Annual State of Stocks report for Horse Mackerel for 2018 (information kindly provided by MFMR).

Catches and Management Advice

Catches of horse mackerel are predominantly taken by a fleet of midwater trawlers which are monitored using a satellite Vessel Monitoring System (VMS) as well as having 100 % observer coverage. In recent years the TAC has been stable between 350-400 000 t and with the current biomass estimates this is unlikely to change in the foreseeable future. As shown in Figure 7, trawl duration has decreased in recent years, and catch rates have stabilised, suggesting a healthy balance between fishing effort and the abundance of the stock

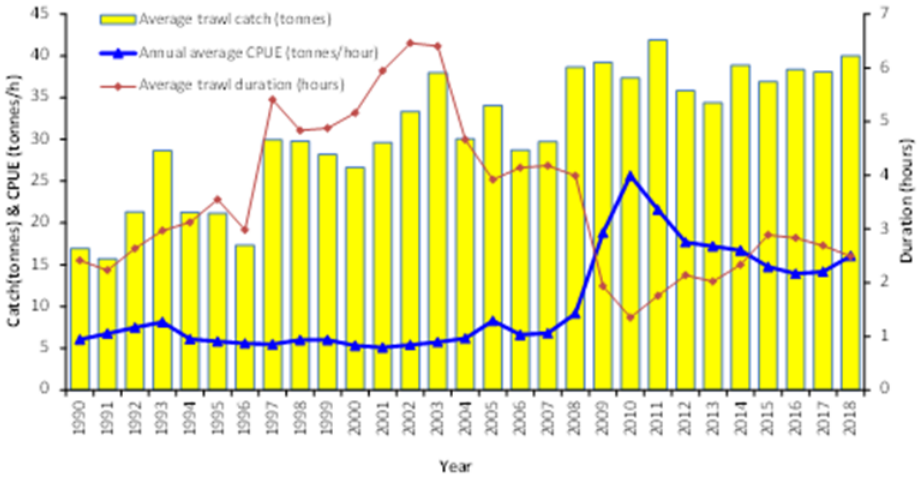

Figure 7: Catch Per Unit of Effort for horse mackerel in the Namibian midwater trawl fishery and catch taken up to 2018 (after MFMR, 2018).

With regard to the management approach for the fishery, this is demonstrated in Figure 8 below (MFMR, 2018). The resource is managed maintaining a careful balance between yield (catch) and the spawning biomass estimates. Critical to this approach are three reference points based on the relative (to "1") status of the spawner stock biomass. The 2018 biomass estimate of 1.6 million tonnes is therefore well above the Target Reference Point (TRP) or Maximum Sustainable Yield (MSY). If biomass falls below 1 (i.e. 0.8) triggering the Precautionary Reference Point (PRP), then catch is reduced accordingly and if at the extreme the Limit Reference Point (LRP) is approached the catch is sharply reduced to zero.

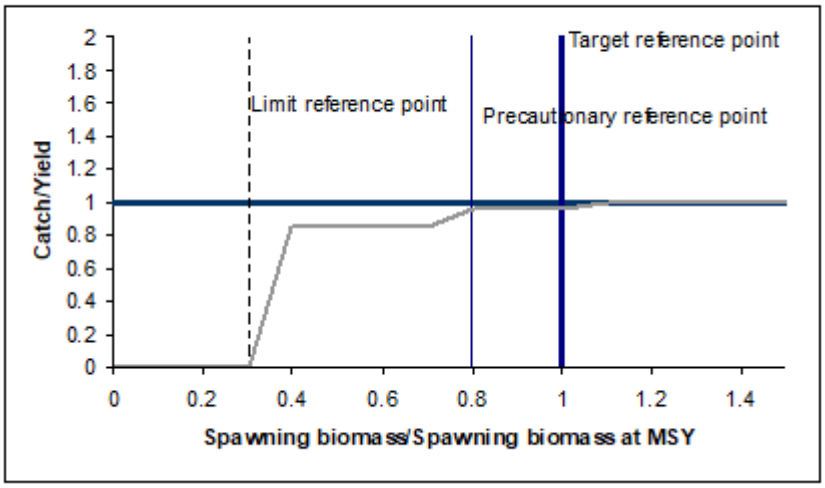

Figure 8: Reference points and catch trajectories used for the management of the Namibian horse mackerel fishery (after MFMR, 2018).

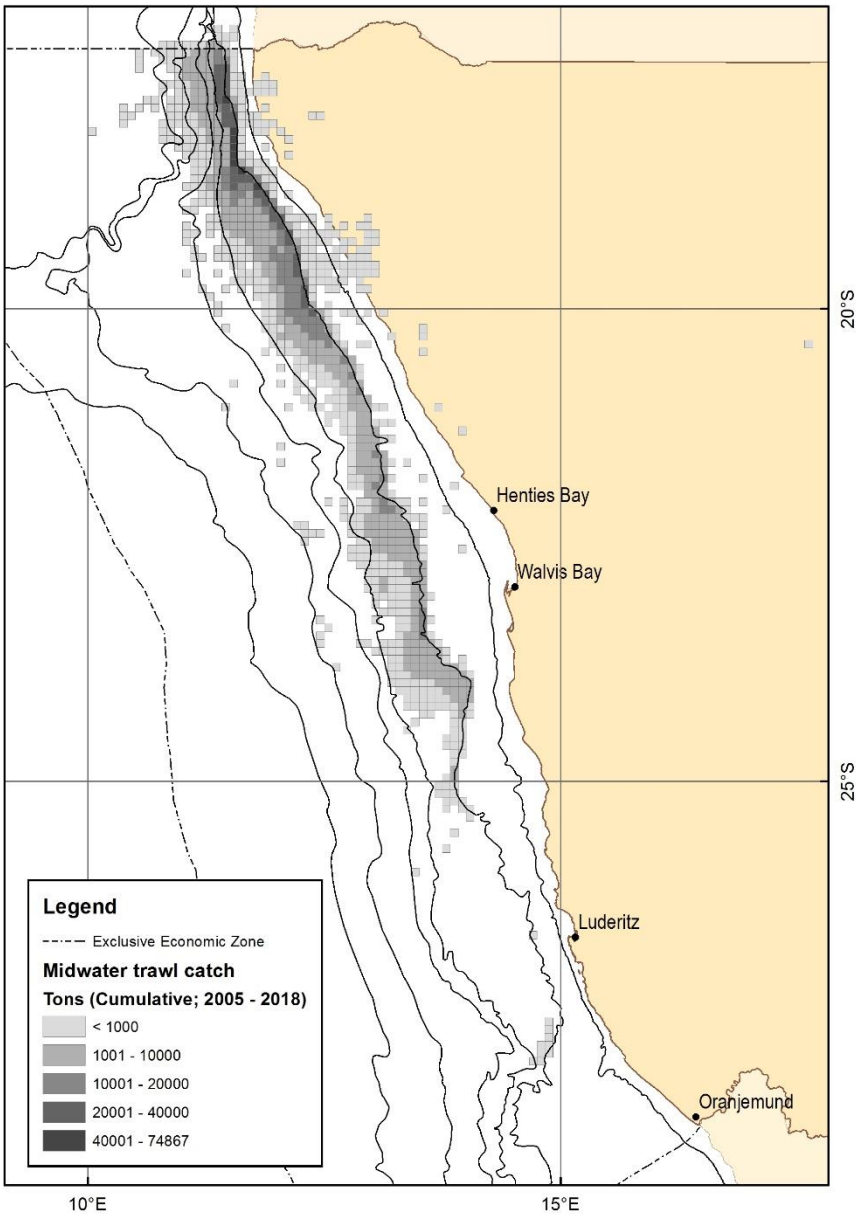

Figure 9: Spatial distribution of commercial catches or horse mackerel taken by the midwater trawl fleet in Namibian waters over the period 2005 to 2018 (after MFMR, 2019).

In summary, current biomass estimates of Namibian horse mackerel indicates that the stock level remains similar to recent years and is therefore stable. The Age Structured Production Model (ASPM) used to assess the status of the horse mackerel resource suggests the current spawning stock biomass is above the spawning stock biomass at maximum sustainable yield level (Bsp_{msy}). Current harvest levels are therefore considered sustainable since the catches are below the estimated Replacement Yield.