Overview of the current management and status of the Namibian horse mackerel stock

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The Namibian adult horse mackerel stock (*Trachurus capensis*) is mainly harvested north of 24°00'S by the midwater trawl fishery for whole round production. Until 2014, juvenile horse mackerel were also targeted by the purse seine fishery for fish meal production but this was discontinued because catches were too low, probably because of low availability of the species to this type of gear. The stock is managed primarily through a total allowable catch (TAC), most of which is allocated to the midwater trawl fishery but a small proportion is also made available for value-added products, mainly through canning, in factories owned by purse seine operators. Currently, the stock is assessed using an age-structured production model (ASPM), which incorporates the age distribution and biomass estimates from research surveys together with commercial data to assess the current state of the stock (MFMR 2015).

Research surveys

Hydro-acoustic surveys, run in conjunction with targeted trawling, have been conducted by the Ministry of Fisheries and Marine Resources (MFMR) since 1999 (Figure 1). Results from these surveys form the basis of the information for the ASPM, which is used to provide advice for management of the Namibian horse mackerel resource. The same survey methodology was used from 1999 until 2015 when the recently acquired research vessel, the *R.V. Mirabilis*, was used for the first time. The diurnal vertical distribution of horse mackerel throughout the water column can vary considerably and the results of hydro-acoustic surveys therefore do not always provide accurate absolute estimates of abundance but the results are used as a reliable indicator of trends. The biomass has shown considerable variability between 1999 and 2015, with peaks in 1999, 2005 and 2013 and lows in 2002, 2006, 2007 and, to a lesser extent, in 2011 and 2015. The most recent estimates showed a decline in total biomass from 1 451 000 in tonnes in 2014 to 1 184 000 tonnes in 2015. Estimated biomass of juvenile horse mackerel (i.e. fish less than 17 cm in length) continues to be low (Figure 1) but this is probably a result of changes in the environment that lead to changes in the behaviour of the juvenile fish. These, in turn, reduce the effectiveness of the surveys in obtaining representative estimates of juvenile fish biomass. The 2015 survey encountered a high abundance of very small fish (modal length of 6 cm), which could indicate successful spawning or be a result of higher availability than usual of these small fish to the sampling gear.

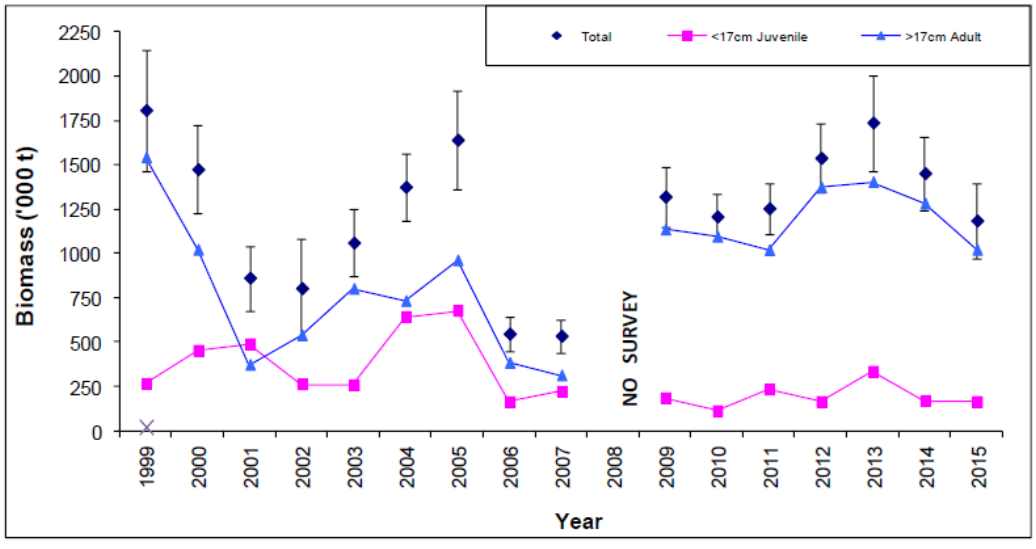

Figure 1. Abundance estimates of adult (>17cm), juvenile (<17cm) and total horse mackerel stock from acoustic surveys. Error bars are also shown (MFMR 2015).

Commercial fisheries

In general, the distribution of fishing effort for the midwater trawl fleet covers the offshore area (i.e. water depths greater than 200 m) between Conception Bay (24°00'S) and the Kunene River (17°00'S) with the bulk of the catches made north of 21°00'S. Catches and catch per trawl time (CPUE) in 2015 were higher than the previous year (Figure 2). It is interesting to note that prior to 2007 the CPUE remained low and more or less constant from year to year and therefore the average catch followed a similar trend to the trawl duration (effort) i.e. catch sizes increased with increasing effort, and *vice versa*. Since then, however, the CPUE has increased more than three-fold and it has therefore been possible to maintain relatively high catches with considerably less fishing effort (Figure 2). Furthermore, inter-annual variations in CPUE have not closely matched variations in biomass, particularly during the period 1990 to 2008, when biomass varied considerably while the CPUE remained relatively unchanged. There is therefore doubt about whether the CPUE provides a suitable index of horse mackerel abundance as the species' aggregating behaviour can vary both spatially and temporally, independently of abundance (MFMR 2015).

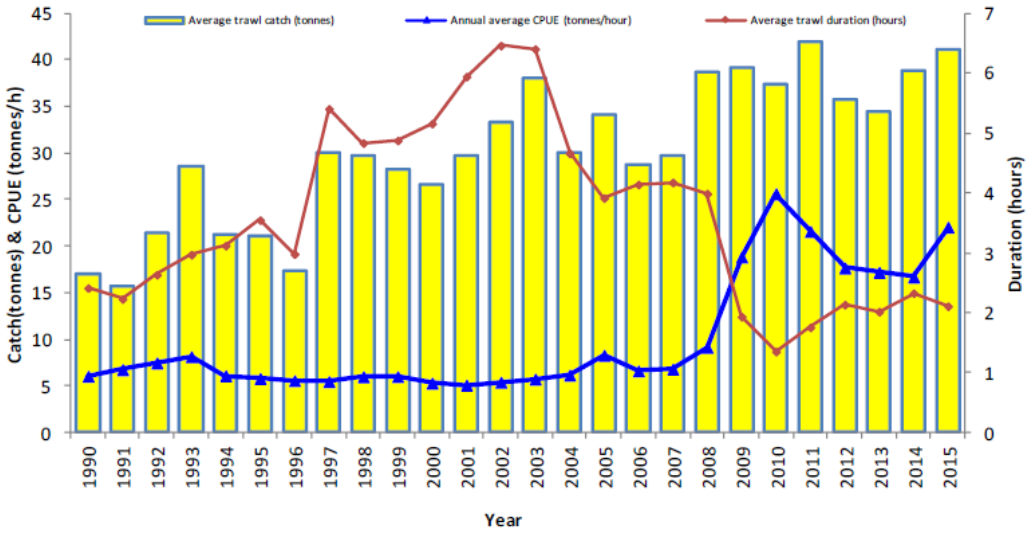

Figure 2. Annual average trawl catch, average trawl duration and average CPUE (tonnes/hour) values for the period 1990 to 2015

The commercial catch-at-length data are an important source of information for the stock assessments. These data showed that the recent midwater trawl catches were still made up of relatively small fish, which has remained unchanged since 1995 (Figure 3). In the last two decades (1995-2014) bigger horse mackerel (>28cm) have been virtually absent in the catches and the majority of the fish were approximately 21 cm during the first and 23 cm during the second of these two recent decades (MFMR 2015). Similarly the length at which the fish were maturing has also decreased from approximately 26 cm in the late 1970s to approximately 19 cm for the period since 1999. This change is believed to be a consequence of continuous exploitation, environmental pressure or possibly both. A reduction in age-at-maturity, as has occurred here, has important implications for the production and resilience of a stock because smaller fish produce fewer eggs and those eggs are generally in a poorer condition and therefore have a lower chance of survival than eggs from larger females. Nevertheless, the 2015 assessment indicated that the stock was

above the maximum sustainable yield (MSY) level and that recruitment for 2015 was estimated to be above the long term average.

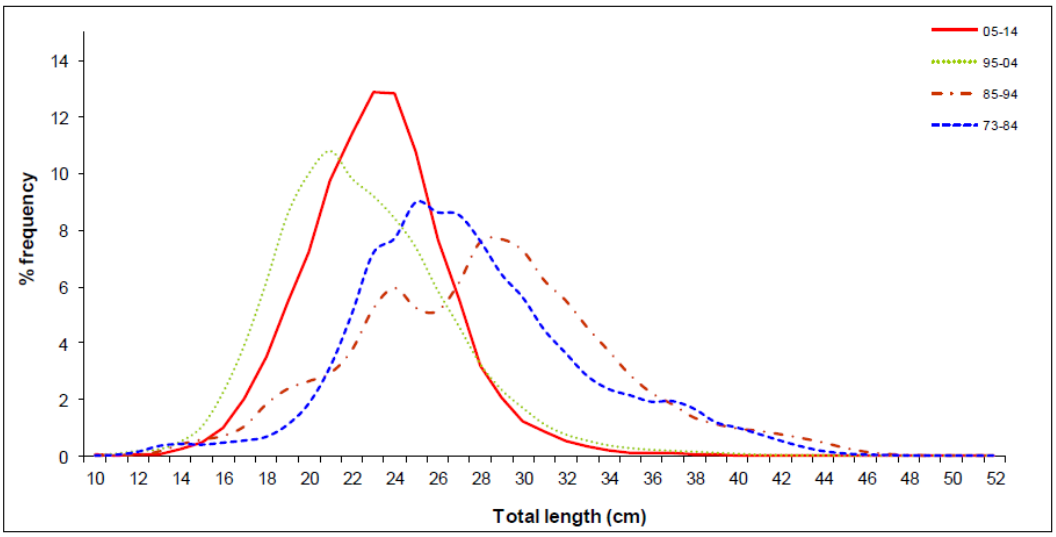

Figure 3. Length-frequency distributions of horse mackerel in midwater catches made during the last four decades (MFMR 2015).

How are resource management decisions made?

The "management monitor graph" (Figure 4) describes how management advice and decisions are made for the Namibian horse mackerel stock. The left graph in Figure 4 is divided into four quadrants each coupled to a specific stock status category and management decision. For example, if the status of the stock is estimated to be in the "down-fishing" quarter (upper right quadrant), the stock is above MSY but the catches at the time of decision-making or assessment were higher than the replacement yield (RY). Under these circumstances, the management decision would be to decrease the TAC conservatively. In the under-exploited quarter (lower right hand quadrant), the stock is estimated to be above MSY and the catches are lower than RY. If those catch levels were continued the stock would continue to grow slowly and therefore the management advice would be to increase the TAC conservatively but not to the extent that the stock would fall below MSY. The remaining two quadrants reflect the decisions that need to be made on changes to effort if the stock is considered to be over-exploited (upper left quadrant) or when the resource is below the MSY level (overfished), and catches are lower than the RY (lower left quadrant). The area, which indicates whether the stock is managed sustainably (labelled 'Sustainable') is clearly identifiable on the graph and shows that the stock is just above MSY and catches are just below the estimated RY. Management decisions and advice are essentially aimed at achieving and maintaining the stock in this area.

The right graph in Figure 4 shows the assessment results, starting from 1990 (when the resource was assessed as being at MSY). From then the catches increased and in 1993 were much higher than the RY causing a severe decrease in the resource biomass (i.e. overfishing). Catches from 1995 to 2006 were maintained close to the RY, but from 2007 to 2013 were below the RY, resulting in the growth of the resource to above MSY. For the 2014 and 2015 fishing season, the stock was experiencing a higher removal; hence the catches were higher than the replacement yield.

Applying the indicators described above and the set of harvest rules currently in place, it was recommended that the TAC for 2016 should be set at 317 000 tonnes, which was 9% lower than 2015. It was also recommended that the minimum size restriction of 17 cm for the midwater trawl fishery should remain in place (MFMR 2015).

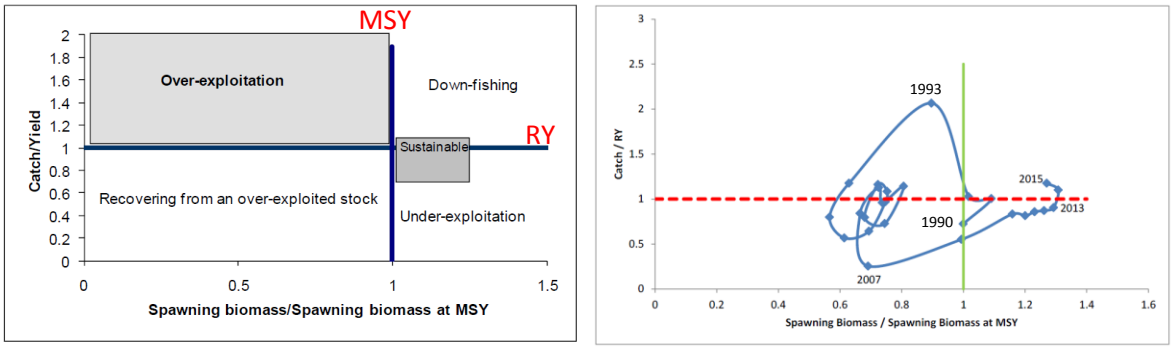

Figure 4. The management monitor graph showing the various stock status and management zones (left graph). The results from the base-case model showing the status and management of the resource from 1990 – 2015 (right graph).

Reference

MFMR 2015. Republic of Namibia Ministry of Fisheries and Marine Resources, 2015, Horse Mackerel State of the Stock Report.