Oceana Sustainability Report 2023

Status and Management of

Namibian and South African Horse Mackerel

Stock status of the Namibian and South African Horse Mackerel

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The Namibian Horse Mackerel

*Although the Namibian horse mackerel biomass is currently at sustainable levels (above MSY), the stock is in a poor condition due to the high volumes of very small fish (< 20cm). The stock needs to recover to a healthier size and age structure. Therefore, it is recommended that the Total Allowable Catch (TAC) for 2023 is set at **234, 000** tonnes - a 29% reduction from last year (MFMR, 2021).*

Namibia annually establishes a Total Allowable Catch (TAC) for horse mackerel (*Trachurus capensis*), guided by scientific evaluations of the fish stock's health and population trends. The primary objective of a TAC is to prevent overfishing and uphold the sustainability of this resource. The determination of the Namibian horse mackerel TAC relies on an Age Structured Production Model (ASPM), which assesses the dynamics of the horse mackerel stock and offers insights into its long-term viability for sustainable utilization. This stock assessment incorporates a blend of survey (fisheries independent data) and commercial data (from skipper logbooks) as input variables.

Research survey data

Horse mackerel acoustic biomass surveys have been carried out annually since 1999, except for 2008, 2020 and 2021 when no surveys took place due to vessel problems (Figure 1). Biomass estimates derived from these surveys provide a reliable trend, due to consistency in the survey methodology since 1999, and are used as relative indicators of the abundance of the horse mackerel stock (MFMR, 2021). The most recent survey in 2022 indicated that the biomass has decreased by 30%, since 2019, to just under 0.6 million tonnes (Figure 1). Notably, this is not the lowest recorded biomass level. In both 2006 and 2007, the stock plummeted to 0.5 million tonnes without a clear explanation as to why this occurred but subsequently recovered two years later. Such fluctuations in horse mackerel stocks are not unusual; some years exhibit better outcomes than others. Scientists attribute these fluctuations to environmental variability, particularly due to the species' sensitivity to sea surface temperature changes, that can affect its distribution and availability.

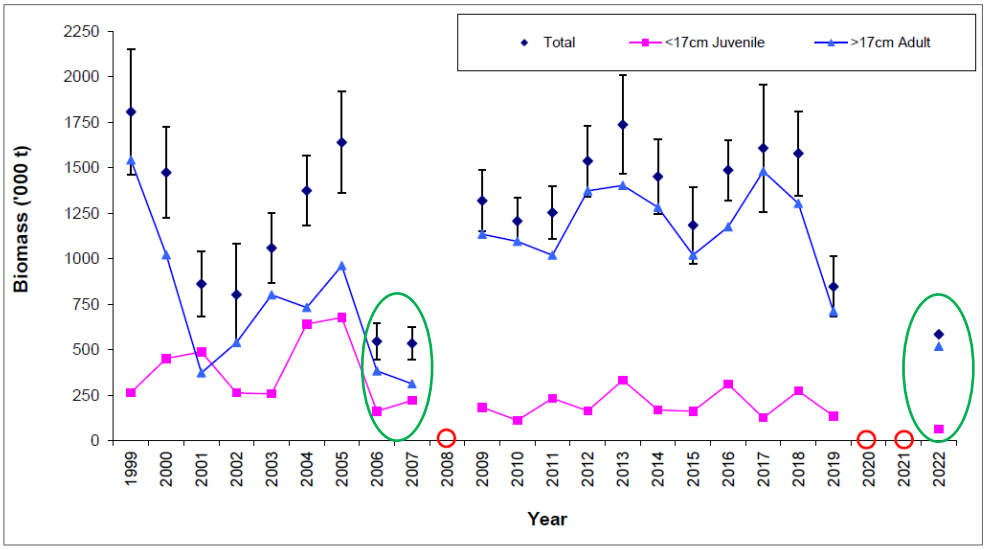

Figure 1. Biomass estimates of adult (≥ 17 cm), juvenile (< 17 cm) and the total horse mackerel stock obtained from acoustic surveys. Error bars represent biomass variation, red circles on the x-axis indicate years when the survey did not take place and the green circles show years of low abundance (MFMR, 2021).

Fluctuations in Sea Surface Temperatures (SST) in Namibia are the result of a complex interplay of natural factors such as ocean currents, upwelling, and weather patterns, as well as human-induced factors like climate change and local environmental changes. Setting aside the human impacts in this report, during the summer and autumn seasons, there is a reduction in upwelling intensity, which allows the Angola Current to extend further southward. This decline in upwelling results in an increase in SST, causing the water column to stratify due to temperature variations. These newly formed thermocline and frontal zones become regions with higher concentrations of food, providing essential nourishment for the survival of horse mackerel larvae in the upper water column. The central Namibian shelf region is recognized as a vital area for the spawning and nurturing of horse mackerel eggs and larvae. The most significant concentrations are typically found within 50-100 km (Figure 2) from the shoreline in the upper 50 m of the water column (MFMR, 2021).

During the pelagic survey conducted in March 2022, the SST ranged from 14°C to 20°C, in contrast to a wider SST range of 14°C to 23°C recorded in 2019. This divergence in SST conditions between the two years likely contributed to the lower quantity of observed eggs in 2022, indicating a less productive spawning season compared to 2019. This decline in egg abundance aligns with the reduced horse mackerel biomass observed during the same period (MFMR, 2021).

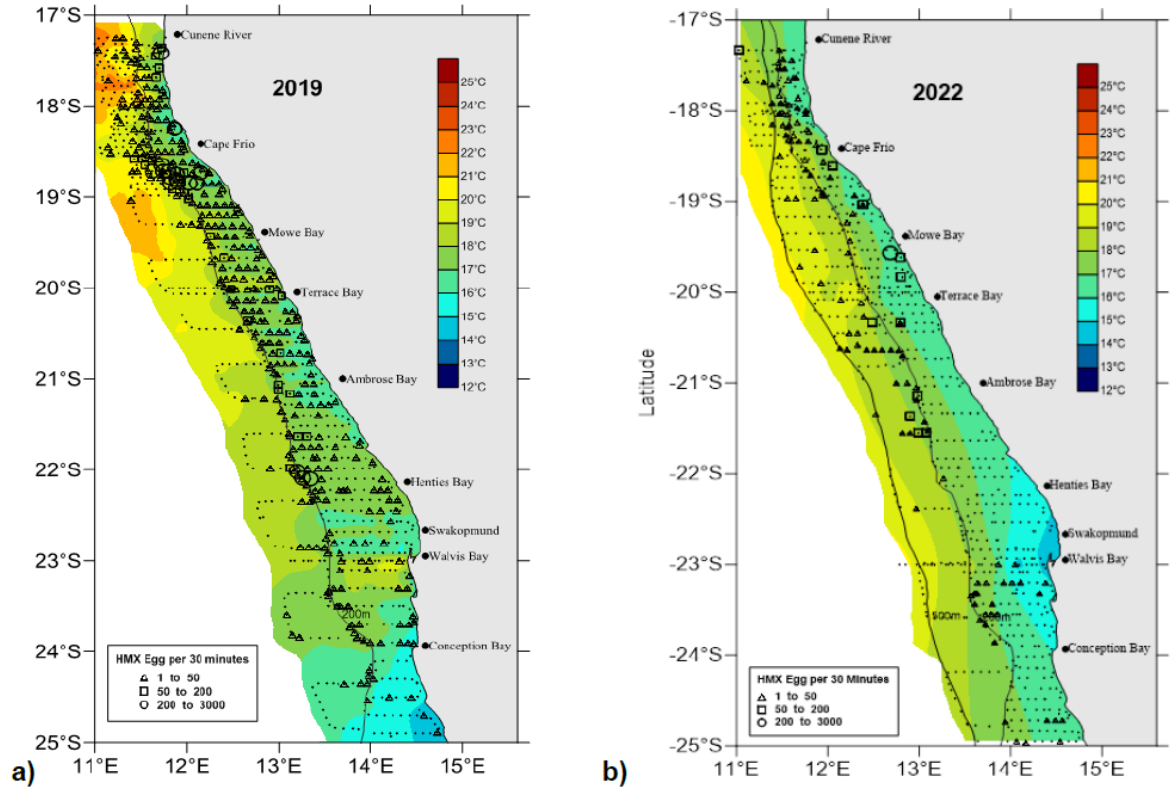

Figure 2. Map showing horse mackerel egg distribution and abundance overlaid on sea surface temperature during a) March 2019 and b) March 2022 (MFMR, 2021).

Commercial fisheries data

Namibian horse mackerel are mainly harvested by the mid-water fishery (targeting adult horse mackerel) within a region north of 21°S. Historically the fishing effort, as measured by average trawling hours, revealed three distinct periods. First, there was a phase of fluctuation with a general increase from 1990 to 2004. Then, from 2004 to 2010, there was a sharp decline, followed by a gradual and consistent increase from 2010 to the present (Figure 3). The longest annual average trawl duration, approximately 6 hours, was recorded in both 2002 and 2003, while the shortest, approximately 1 hour

per trawl, occurred in 2010 (Figure 3). Notably, there has been a recent trend of decreasing average trawl durations over the last two years (2020 and 2021) and into the first half of 2022 (MFMR, 2021).

Prior to 2007, a rise in fishing effort corresponded to an increase in average trawl catches (Figure 3). However, from 2008 to 2010, despite a reduction in fishing effort, there was a significant increase in average trawl catches, which remained consistently high even when fishing effort declined. Nonetheless, in 2021 there is a noticeable decline in average trawl catches, with a slight increase in 2022 (MFMR, 2021).

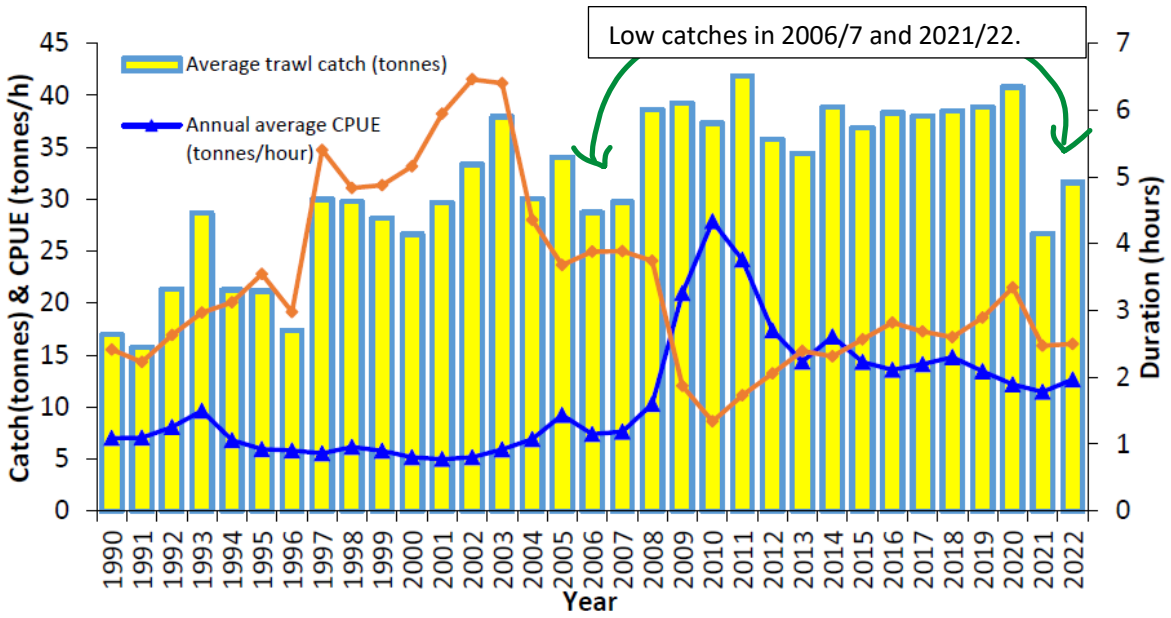

Figure 3. Annual average trawl catch, CPUE and trawl duration of the midwater fishery during the period 1990 to June 2022

While it's noteworthy that the biomass estimates and commercial catches of horse mackerel have shown signs of decrease and then recovery, the reduction in the catch-at-length and age of the fish is of great concern. Between 1993 and 2002 there was a marked reduction in the occurrence of bigger fish and an increase in smaller fish. Additionally, fish measuring 30 cm in length and larger virtually disappeared from the catches. Since then, the bulk of the fish caught have been about 24 cm, and fish smaller than 20 cm have become more prominent. Considering that smaller fish are typically more susceptible to environmental disturbances and predation, it is necessary to adjust the natural mortality rate in the stock assessment to account for the recent shifts in the population structure (MFMR, 2021).

With this in mind, the Namibian scientists tested eight scenarios of different natural mortality rates in the recent 2022 stock assessment model, which were fitted to the available survey and commercial data. Results showed a 67% increase in the abundance of immature fish (0-year-olds) compared to last year, but recruitment was still below the long-term average. The model also estimated the spawning biomass of mature fish (> 2-year-olds) to be similar to that of last year but again, it is still at a level where production of high recruitment is very unlikely. Be that as it may, the collective outcome derived from the management monitor graph, which integrates all the data and generates a management response, suggests that the status of the resource is currently above the Maximum Sustainable Yield (MSY) level but is showing signs of becoming unsustainable.

In conclusion, based on historical and current survey and commercial data, there appears to be potential for the improvement of this stock's health if fisheries management addresses the concerns. The Namibian government, primarily through the Ministry of Fisheries and Marine Resources (MFMR),

plays a central role in the management of the horse mackerel fishery. Their objective is to strike a balance between economic interests and the long-term sustainability of this valuable marine resource. Effective management practices are crucial for ensuring the continued well-being of the horse mackerel population and the overall preservation of Namibia's marine ecosystem. Fortunately, the Namibian fisheries management body, MFMR, has recognized these concerns and has effectively responded by reducing the TAC this year.

The South African horse mackerel

The Operational Management Procedure (OMP) for South African horse mackerel is programmed to provide Total Allowable Catch (TAC) recommendations for three fishing sectors: the midwater trawl fishery, a Precautionary Upper Catch Limit (PUCL) for the small pelagic purse seine fishery, and a fixed bycatch reserve in the demersal trawl fishery. The 2023 TAC (40 067 tonnes) for adult horse mackerel increased by 2.5% since last year and the PUCL for juvenile horse mackerel increased from the 2022 level of 12 000 tonnes to 15 000 tonnes spread over three years (DFFE 2022).

State of the stock

According to the most recent state of the stocks report (DFFE, 2020), the South African horse mackerel (*Trachurus capensis*) is classified as being in an "Optimal" state in terms of both its stock status and fishing pressure. This classification indicates that the current biomass level and fishing pressure are aligned with achieving the maximum sustainable yield (MSY). Additionally, findings from a recent OMP assessment suggest that the horse mackerel resource currently stands at approximately 69% of its pre-exploitation level, which is more than double the level required amount for MSY (Figure 4).

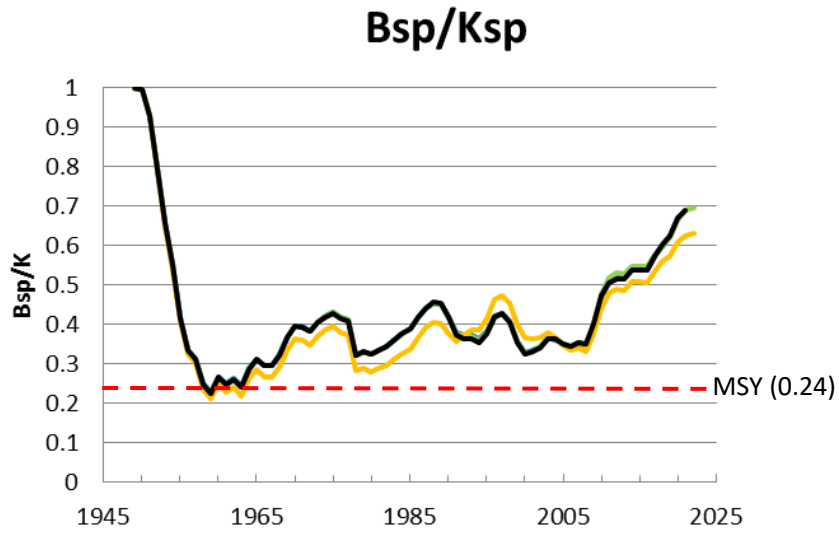

Figure 4. Trajectories of the South African horse mackerel spawning biomass relative to K (carrying capacity). Red dashed line shows the level of MSY at 2.4 (Johnston et al. 2022b).

Horse mackerel catches

The fluctuations in South African horse mackerel catches tend to act in a similar way to that of the Namibian stock, with some years showing better performance than others. In 2014 and 2015, the South African stock experienced a substantial decline, falling considerably lower than what was

expected (Figure 5). However, this trend of declining catches was also observed in 1994/1995, 2001/2002. In all instances, the stock bounced back a few years later, indicating not only the resilience of the horse mackerel species, but also underpins the effectiveness of management measures which are generally aimed at the maintaining an optimum level for sustainable utilisation.

Similar to the Namibian experience, South African management also responded quickly and effectively to the downward trend and confronted the challenge of determining whether the low catch rates were due to decreased catchability or increased natural mortality. As a precautionary measure, the TAC was reduced, and an effort limitation (TAE) was introduced from 2016 - 2018. Since then, stock assessments indicated that the decline was likely due to a catchability effect rather than increased mortality and consequently, in 2022, the effort restriction was relaxed and only the catch control system remained in place.

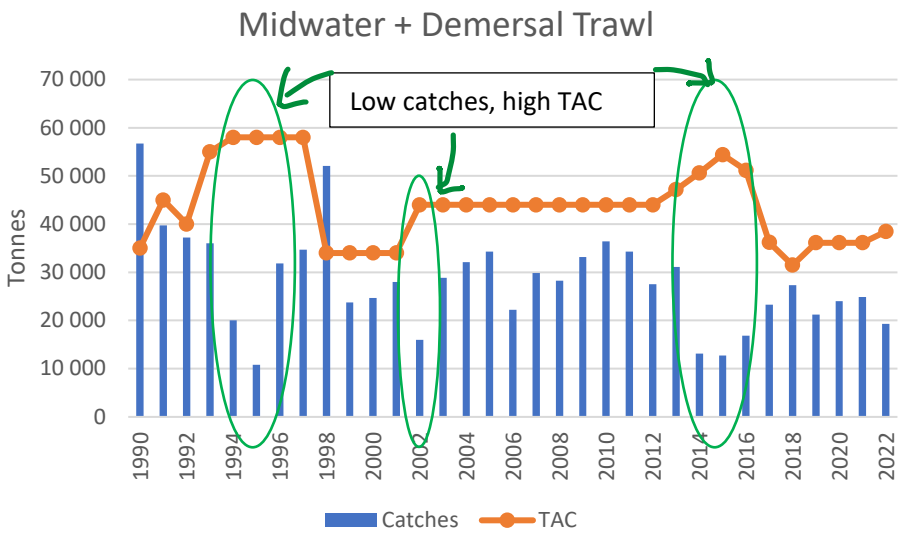

Figure 5. Annual horse mackerel catches for the midwater and demersal trawl fishery and the TAC (tonnes). Green circles indicate years of low catches.

Interestingly, when the horse mackerel catches were low, the stock assessment model predicted an increased TAC. There are several factors that may have influenced this outcome, but the main reasons could be that horse mackerel exhibit significant year-to-year variability due to changes in the environmental conditions, such as changes in sea surface temperature, currents, upwelling or prey availability. Stock assessment models rely on historical data to make predictions, but they may not always account for short-term fluctuations. Also, because of their semi-pelagic behaviour and distribution throughout the water column, the biomass of horse mackerel cannot be reliably estimated using either hydro-acoustic surveys or demersal swept-area surveys in isolation. Fish near the seabed are accessible to demersal swept-area surveys but are not acoustically detectable, whereas fish in the water column can be detected by hydro- acoustic surveys but are not accessible to demersal trawl gear. These factors make it difficult to assess the abundance of the resource.

Be that as it may, variations in sea surface temperature have been observed to influence the distribution of horse mackerel and other semi-pelagic fish. Hence it is reasonable to assume that the

El Niño-Southern Oscillation (ENSO) might affect the horse mackerel fisheries in Namibia and South Africa.

ENSO has two phases: El Niño and La Niña, each with distinct impacts on the environment (Figure 6). El Niño events are when warmer sea surface temperatures in the equatorial Pacific Ocean can disrupt normal weather patterns worldwide. In Namibia and South Africa, El Niño typically brings drier and warmer conditions, leading to reduced upwelling along the west coast. This reduced upwelling could result in a decrease in nutrient-rich cold water reaching the surface, which could affect the primary production of phytoplankton, with cascading effects on zooplankton and small fish populations – an important prey item for horse mackerel and other species. Therefore, during El Niño events, horse mackerel may experience reduced food availability and changes in their distribution as they seek out suitable feeding grounds (Figure 6). It should be noted that ENSO events in the Pacific Ocean may not necessarily equate to strong impacts locally, but we can't rule it out.

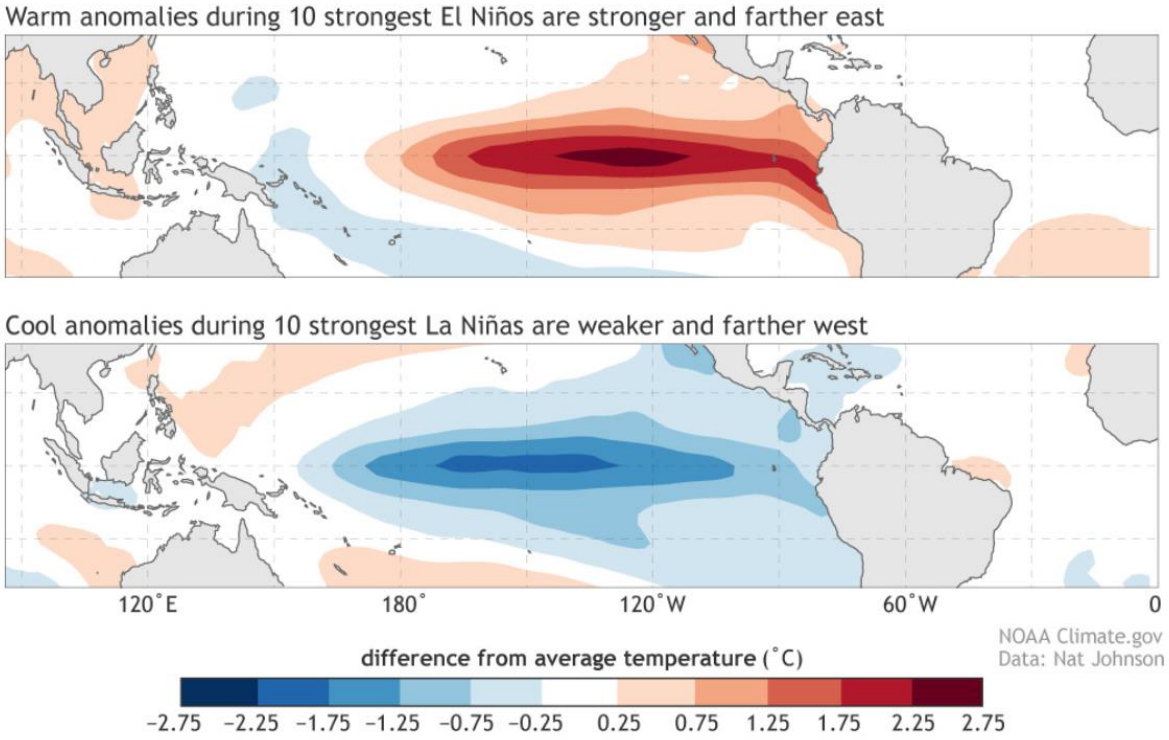

Figure 6. Average November – January sea surface temperature anomalies (°C) for the top 10 strongest (top) El Niño and (bottom) La Niña events since 1950 (NOAA Physical Sciences Laboratory).

During La Niña events the opposite occurs, and cooler sea surface temperatures are found in the equatorial Pacific Ocean. In Namibia and South Africa, La Niña typically brings wetter and cooler conditions, which can enhance upwelling along the west coast, resulting in higher nutrient levels and leading to increased phytoplankton production. This could have a positive impact on the abundance of zooplankton and small fish, providing ample food for horse mackerel and potentially leading to better growth and reproduction rates for the species (Figure 6).

What's interesting to point out in Figure 7, and this may just be a coincidence, but the midwater trawl directed fishery made a connection between low catches and the continuous (3 years) occurrence of intense La Niña events (pers. comm. Pierre Rocher). They observed that following each of the years of

poor catches (in 1994/5, 2001/2 and 2014/15) there was a very strong recovery but then in 2021, a La Niña event hit, and together with abnormally cold sea surface temperatures on the southeast coast, there was an immediate drop in catches. Noting also that 2023 had the lowest catches. Nevertheless, industry is optimistic that the swing back to a strong El Niño in 2024 will have a positive impact on future catches.

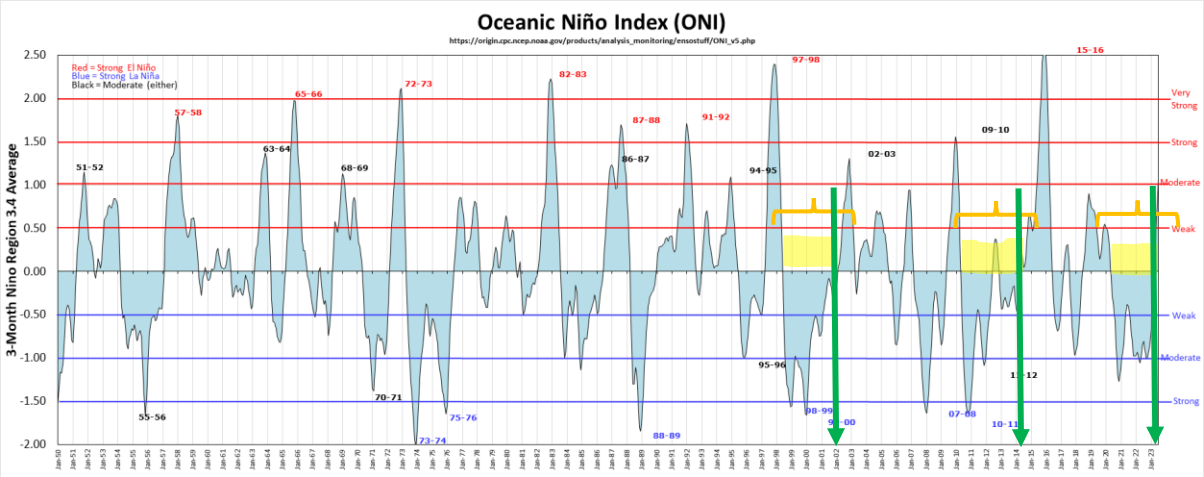

Figure 7. El Niño and La Niña years and intensities. Based on Oceanic Niño Index (ONI) (Null, 2023). Green lines show years of low catches of adult South African horse mackerel. Yellow highlights show long periods (3 consecutive years) of high La Nina.

Many international studies in different parts of the world highlighted the impact of the ENSO cycles on specifically pelagic species. There is a case to understand the impact on specifically the horse mackerel species off the East coast of south Africa. What is more important is to understand the impact of multi-year or prolonged La Nina events, which has occurred three times since 1998 and appears to become more frequent.

While there may or may not be some correlation between the ENSO events and the horse mackerel catches (this needs further investigation), the key takeaway is that for the effective management of horse mackerel fisheries, authorities in both Namibia and South Africa should consider a variety of factors, including ENSO events, when formulating decisions regarding catch limits and other management strategies.

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