STATUS AND MANAGEMENT OF THE SOUTH AFRICAN SMALL PELAGIC FISHERY - AUGUST 2013

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The South African small pelagic fishery

The small pelagic fishery is the largest in South Africa in terms of volume of the landed catch, as well as direct and indirect employment, and after the demersal fishery is the is the second most important in terms of value. This fishery's management procedure is the most complex of all the commercial fisheries.

Small pelagic fish species of importance here are small forage fish that live in the surface and near-surface waters over the continental shelf of most of South Africa's coast. Forage fish are small schooling fish that feed on plankton and occupy a vital place in marine foodwebs. Generally, these species eat herbivorous (phytoplankton) or carnivorous (zooplankton) plankton (primary and secondary producers), and are eaten by larger predators that occur higher up in the foodweb. Forage fish therefore play a fundamental role in marine ecosystems by converting energy from lower trophic levels into food for larger fish, marine mammals, and seabirds–essentially all predators at higher trophic levels in the marine environment.

Two species are the main targets, namely sardine (*Sardinops sagax)* and anchovy (*Engraulis encrasicolus)*, with associated bycatch species being redeye round herring (*Etrumeus whiteheadi*) and Cape horse mackerel (*Trachurus trachurus capensis*). Fishing for these small pelagic fish occurs inshore, primarily along the Western Cape's West and South Coasts (anchovy and sardine) and the Eastern Cape Coast (sardine). Anchovy and sardine are caught using purse-seine nets in the midwater. They, and the other two species, tend to form large shoals, which make them vulnerable to the large purse-seine nets used by the South African purse-seine vessels (a mixture of wooden en steel-hulled purse-seine vessels), which can catch up to 400 tonnes in a single haul. Sardines are canned or frozen for human consumption, pet food and bait, although/whereas anchovy, redeye round herring and horse mackerel

are reduced to fishmeal, fishoil and fish paste in factories situated primarily on the West Coast.

The management system for the South African small pelagic fishery

South Africa's Small Pelagic Fishery is managed through limitations on effort, through access rights and vessel licensing and limitations on catches, through annual total allowable catches (TACs) for anchovy and sardine and precautionary upper catch limits for redeye round herring and juvenile horse mackerel.

The Total Allowable Catches (TACs) for sardine and anchovy are set using a joint Operational Management Procedure (OMP) that consists of formulae that base TAC levels on observed stock sizes. Juvenile sardine and anchovy school together during the first few months of their life and the young sardines are then prone to be taken as an unwanted, but unavoidable bycatch with the recruiting anchovy, which are targeted from April/May onwards as recruiting juvenile fish. This is usually the period when the juveniles of both species begin their southward migration along the west coast, from as far north as the Orange River, then via St Helena Bay and around Cape Point, back to their main spawning grounds on the eastern and western Agulhas Bank. A sardine Total Allowable Bycatch (TAB) is also calculated to allow for reasonably unrestricted anchovy-directed fishing during the five or so months when the two species are quite extensively mixed in the sea. These formulae aim to maximize average sardine and anchovy catches in the medium term, while ensuring that the risk to either population is not above previously agreed levels. The OMP also includes constraints on the extent to which TACS can vary from year-to-year in order to enhance industrial stability.

Input data for the joint OMP are derived from annual hydroacoustic surveys during November to measure the adult biomass of sardine, anchovy, and redeye round herring. Additional input data are also derived from dedicated annual hydroacoustic surveys during May/June the following year, to measure the amount of recruitment stemming from spawning by the adult component measured during the previous November.

The primary challenge for fisheries managers and policymakers

Forage fish worldwide are characterized by highly variable recruitment, which results in large fluctuations in population size. Because these are plankton feeders and are highly fecund, they can respond very rapidly to plankton booms attributable to environmental reasons, they can be highly productive given the right conditions and they are therefore prone to "booms and busts", with large associated impacts on dependent organisms. The abundance of forage fish can be difficult to quantify, because they exhibit such large natural variations in abundance over space and time. The primary challenge for fisheries managers and policymakers is to determine a safe level of catch that also accounts for the important ecological role that forage fish play in the larger marine environment by the implementation of an ecosystems-based approach to fisheries management.

To date, scientific guidance for implementing an ecosystem-based approach to forage fisheries management has mostly focused on broad principles rather than specific goals, targets, or thresholds. In part, the reason is a lack of information about the impact of forage fish removal on marine ecosystems. There has been a global call for research and synthesis to advance scientific understanding of forage fish and to inform management recommendations for these species. The South Africa government is committed to an ecosystems-based approach to fisheries management and over the past five years much progress has been made in attempting to incorporate the needs of at least some of the top predators in the ecosystem that depend on forage fish, for example, penguins, into the management procedures.

Finalization of the revision of the current joint South African pelagic OMP during 2013

The joint South African pelagic OMP was developed specifically to deal with the risks inherent in fishing for short-lived species, such as sardine and anchovy, in the highly dynamic and changeable marine environment that characterizes our temperate waters, where these two species are found in great, but fluctuating abundance. The OMP goes to great length to minimize year-on-year fluctuations in TACs to ensure industry stability; of course within the constraints of the dynamics of the resources themselves. However, the duty cycle of an OMP is usually only four years, whereafter it has to be adapted, as new and updated information about the two main pelagic

species, as well as new insights into the role of these two species as forage fish in the ecosystem; particularly their effect on top predators, such as penguins, become available.

This revision of the then current OMP (OMP–08), which started in 2011 and which had been envisaged to be completed by the end of 2012, was delayed for a number of unforeseen, but critical reasons. Development word, however, continued unabated during 2012, and it is hoped that OMP–13 it will be finalized towards November 2013. The revision of the OMP was in particular plagued problems related finding a comparable definition of the level of risk for anchovy in circumstances where the best choices for both natural mortality and the form of the stock–recruitment relationship curve have changed. In addition, modelling the two-stock hypothesis for sardine further delayed the finalization of the new OMP.

Important issues that have so far been examined and will be finalized during the 2013 revision include:

- A better understanding of the stock–recruitment relationship for anchovy and a more acceptable and plausible value for natural mortality for this species.
- How recruitment and its future variability is best modelled for both sardine and anchovy.
- How best account is taken for implementation of uncertainty in the OMP, particularly regarding likely under catches of anchovy.
- How to best calculate the TAC if abundance estimates from the most recent hydroacoustic survey, upon which computations are highly dependent, are unavailable (e.g. because of a survey vessel breakdown).
- How to best calculate the risks to the resources, which are used to tune the OMP.
- How to address potential spatial management issues, i.e. how to best determine the relative plausibility for alternative sardine stock-structure hypotheses, by testing the hypothesis that two sardine stocks exist in South African waters and whether they should be managed separately or jointly in the new management procedure.

- How to include broader ecosystems objectives in the management procedure, because improved clarity in this area would assist management and decision-making.

The revision has been conducted with full consultation with and cooperation of the small pelagic industry and other role players involved in the management of the pelagic fishery, for implementation in 2013. A number of constraints and control parameters are in place in the OMP to ensure maximum industry stability, without exceeding generally accepted levels of risk for the two main pelagic species. These constraints and control parameters include *inter alia* maximum and minimum TACs for sardine and anchovy, maximum year-on-year deviations in TACs for both species, and the proportions of the total biomass that may be taken of each species. In addition, the revised OMP will also consider the needs of top predators, in this case as a first step, taking into account the interactions between the fishery and penguins. These, and other constraints, have bee tested during exhaustive simulation studies by scientists of the two resources during the course of 2012, and further testing has to be concluded before the final OMP (OMP–13) can be accepted.

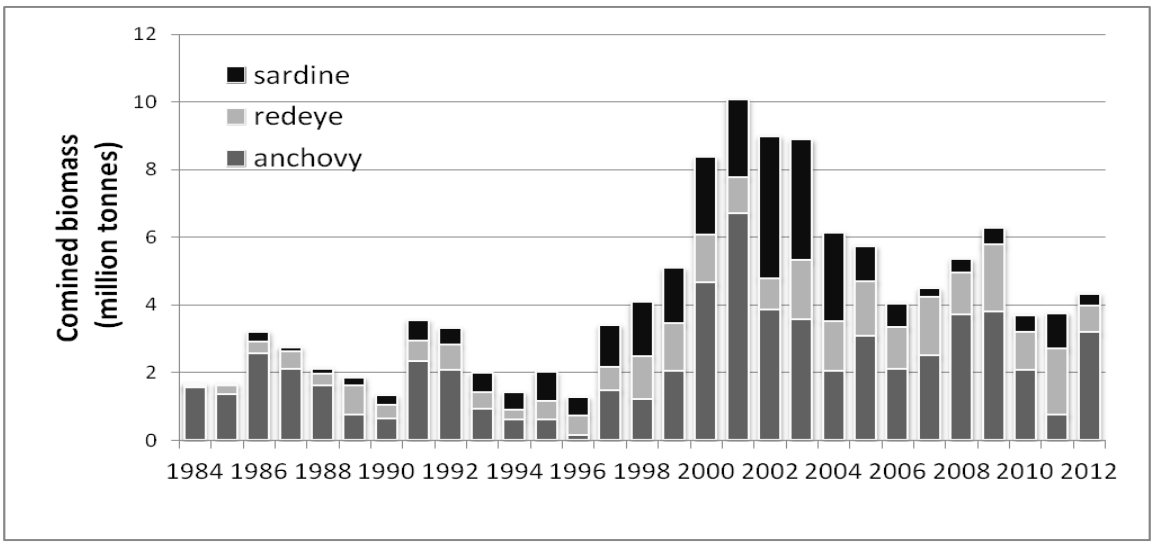
Final sardine and initial anchovy TAC allocations for 2013

The Small Pelagic Working Group of the Branch Fisheries Management of the Department of Agriculture, Forestry and Fisheries met on 21 December 2012 to consider the results of the November 2012 pelagic spawner biomass survey and to recommend the final sardine and initial anchovy TACs for 2012.

The 29th consecutive annual November biomass survey was conducted in two stages by two different vessels; the first leg was between 23 October and 4 November aboard SAS *Africana*, and the second leg was between 24 November and 14 December 2012 aboard MFV *Compass Challenger*. The MFV *Compass Challenger* was chartered to the Department to complete the survey following mechanical failure of the SAS *Africana* off Cape Point.

The anchovy spawner biomass was estimated at approximately 3.2 million tonnes, substantially higher than that estimated in 2011, and well above the long-term (1984–2011) average of 2.2 million tonnes. The sardine biomass of 345 000 tonnes was

considerably lower than the 1.04 million tonnes estimated in 2011 and similarly lower than the long-term (1984–2011) average of 1.02 million tonnes for this stock. The estimate of redeye round herring biomass had decreased by more than half from the previous level of approximately 1.96 million tonnes in 2011 to just 795 000 tonnes in 2012 year. This biomass was also lower than the long-term (1984–2011) average of 961 000 tonnes.



The combined biomass of 4.3 million tonnes for anchovy, sardine, and redeye round herring was slightly higher that that observed in 2011, with the sharp decrease in sardine and redeye biomass being countered by a large increase in the biomass of anchovy.

About 54% (<200 000 tonnes) of the sardine biomass was found in the area to the west of Cape Agulhas and the remaining 46% on the east of Cape Agulhas. This suggests that the recent observed “reversal” of the eastward shift in the distribution of sardine persists in certain years. It also suggests that the large biomass of sardine found to the east of Cape Agulhas and which accounted for 80% of the sardine biomass in 2011 had decreased substantially. For anchovy, the biomass found in the area to the west of Cape Agulhas represents a small proportion of the total biomass (27%) suggesting that the reported eastward shift and mechanisms for maintaining such are still active.

Given the high anchovy recruitment measured earlier in 2012, it was anticipated that the biomass of anchovy would increase. The unexpected decrease in the biomass of sardine appears to suggest that older fish, principally from the good recruitment in

2010, have not survived. The poor recruitment measured in 2011 and 2012, which seems to have successfully recruited to the population, now dominates the population.

Given the generally poor recruitment resulting from spawning to the east of Cape Agulhas in recent years, it was, however, encouraging that some sardine were spawning high up on the west coast too.

Following the results from the biomass survey, the 2013 final directed sardine TAC, the initial normal season TAC (A-season) for anchovy, and initial normal season TAB for sardine were recommended in terms of Interim OMP–13 as follows (with the 2012 values given in brackets):

- Directed sardine TAC: 90 000 tonnes (100 595 tonnes)
- Initial normal season anchovy TAC: 247 500 tonnes (202 718 tonnes)
- Initial normal season sardine TAB for anchovy-directed fishing: 25139 tonnes (21 947 tonnes)

These recommendations were accepted by the Minister and declared as the final TAC (for sardine) and initial TAC (for anchovy) for 2013.