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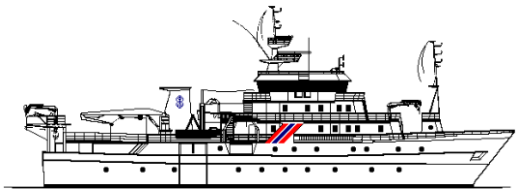

Countries: Angola, Namibia

Research vessel: R/V DR. FRIDTJOF NANSEN

Survey number: 2012405

Number of days: 14

General objectives: A transboundary study of the pelagic fish stocks of Southern Angola and Northern Namibia

	Port	Date	Coverage	Specific objectives
Departure	-	22 September	Angola Namibia	• To map the distribution and estimate the abundance of the most commercially important pelagic species in the Namibia-Angola transboundary area (15°50-19°00'), following the survey design utilized in Angolan waters (6 n.mi spacing between transect lines), with special emphasis on the two horse mackerel Cunene horse mackerel (*Trachurus trecae)* and Cape horse mackerel (*Trachurus capensis)*, sardine "Pilchard" (*Sardinops sagax)* and other small pelagic species, including anchovy (*Engraulis capensis)* and round herring (*Etrumeus whiteheadi)*. • To map the distributions and estimate the abundance of the same species in central Namibia south to Dune Point (20°15' S), following the established survey design with 10 n.mi spacing between the transect lines. • To study and analyse the biological state of the main species, including length frequencies, length-weight relationships, reproductive stages and length-at-maturity. • To map the meteorological and hydrographical conditions in the survey area by means of continuous recordings of weather data such as Sea-surface temperature (SST), Sea-surface salinity (SSS), wind speed and direction, using CTD-casts (Temperature, Salinity and Oxygen).
Arrival	Walvis Bay	6 October		

Cruise leader: Jens Otto Krakstad, Vaino Shigwedha (Namibian team leader), Aristoteles P. Da S. Amaro (Angolan team leader)

Participants:

From INIP, Angola: Aristoteles P. Da S. Amaro (Angolan team leader), Bomba Basíca Nsangolay, João Morais Domingos, Antonio Buco, Eridson Saquenha, Marisa F. De N. Macueria, Fátima Delicado, Geraldina Salvador and Eusébio Dos Santos.

From NatMIRC, Namibia: Vaino Shigwedha (Namibian team leader) and Justine Kakuuai.

From IMR, Norway: Jens Otto Krakstad (cruise leader), Diana Zaera, Tore Mørk and Jarle Kristiansen.

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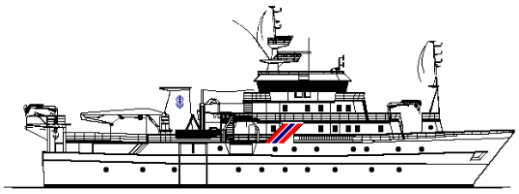


Summary of the results:

The results from this year's survey show the transboundary nature of the fish resources under study. The results still portray a more positive picture in terms of biomass for *T. capensis* and *T. trecae* although the same cannot be said about *S. sagax.* But caution should be taken when interpreting the data, as changes from year to year may well reflect migration in and out of the transboundary area rather than increases/decreases in the biomass levels. It should also be noted that the estimates are relative indices, not absolute estimates of abundance, and that all estimates, in particular for the densely and patchily aggregated sardine, are prone to acoustical survey errors (Anon. 2003, 2004).

As for previous years, the results also show that the *T. capensis* population is in comparatively much better condition than the *T. trecae* in terms of estimated biomass within the transboundary areas. It was also noted that *T. capensis* was not undergoing a vertical migration during the night. It should, however, be emphasized that the time series of the transboundary region cannot be interpreted as time series of the stock units, as many of the populations have distribution areas that go far beyond the transboundary area and are characterized by migrations in and out of the transboundary area due to environmental factors and, in particular, the positioning of the Angola-Benguela Front (ABF). Fluctuations in the abundance estimates within the transboundary area do thus not necessarily reflect fluctuations in the stock units.

Sardinella aurita has so far not been considered a transboundary species, but was in 2010 for the first time in the transboundary time series encountered in sizeable aggregations within the transboundary area (in Angola).

The main findings from the survey can be summarized as:

1) The biomass estimate of Cape horse mackerel was lower (290 700) than last year's (516 000 tonnes) but higher than in previous years (2008: 205 000 tonnes and 2009: 202 300 tonnes).

2) Approximately 46 % (by weight) of the Cape horse mackerel in the transboundary area was found in Angolan waters, which is far different to what has been found in recent years (2008: 10 %; 2009: 11 %; 2011: 13 %), but it still contrast the comparatively higher proportion found in Angola during the first transboundary survey in 2005 (64 %).

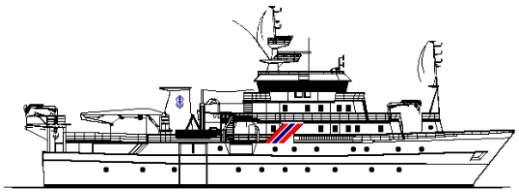
3) The variation in abundance of Cape horse mackerel in the transboundary area and the relative distribution of the biomass in Angolan and Namibian waters between years, show that the aggregation dynamics is highly dynamic within the transboundary area at this time of the year, and that both the total biomass and the relative distribution in the countries may fluctuate considerably over time, largely reflecting the impacts of a changing positioning of the Angola-Benguela Front (ABF).

4) An unusual behaviour for the Namibian *T. capensis* was observed during this survey whereby there was no vertical migration (diurnal) during the night to the upper part of the water column. Therefore, many bottom trawls done during the night contained significant amounts of *T. capensis*. This is more typical of *T. trecae* in Angolan waters and *T. capensis* in South African waters and probably caused by more oxygenated water masses during the period of this survey, or possibly a lack of diurnal migration by the horse mackerel prey.

5) The estimate of Cunene horse mackerel was 59 800 tonnes which is relatively similar to those found in previous years (2005: 44 000 tonnes, 2009: 50 700 tonnes and 2011: 45 500 tonnes).

6) The distribution pattern of Cunene horse mackerel was strikingly similar to that of last year (2011) and 2009, with the majority of the biomass (66 %) found in Angolan waters, compared to 75 % in 2011, 78 % in 2009, 80 % in 2008 and 100 % in 2005.

7) Given yearly fluctuations due to oceanographic conditions (the position of the ABF), it seems that the main bulk of the Cunene horse mackerel biomass within the transboundary region is



presently found predominantly in Angolan waters (>99 %), while the bulk of the Cape horse mackerel biomass (>64 %) is found in Namibian waters.
8) The biomass of Sardine (*Sardinops sagax*, "pilchard") decreased (87 100 tonnes) compared to 2011 (132 000) and (399 000 tonnes) in 2010 but it is higher compared to previous years (2005: 0; 2008: 0; 2009: 35 700 tonnes). It should however be noted that these estimates are relative indices, not absolute estimates of abundance and so the population estimate should not be interpreted in absolute terms. Similarly, this was not a dedicated sardine survey and both acoustic and net sampling was limited, thus warranting some uncertainty associated to this estimate, as discussed above.
9) In 2012, the sardine biomass was not found in a single, fairly homogenous aggregation like 2010 but there were aggregations in Namibian water as well. Nevertheless, the biggest aggregation was located in Angolan waters. As for Cape horse mackerel, both the aggregation pattern and the relative distribution between Angolan and Namibian zones within the transboundary area appear to fluctuate dramatically with environmental conditions between years. However, the more inshore-bound and short-lived life-history of the sardine compared to the carangid horse mackerels, combined with the fact that the sardine is still in a recovery phase from heavy fishing over the past decades, may add further to the dynamic picture for sardine compared to horse mackerel, rendering a yet more volatile and less predictable scenario in terms of abundance and distribution pattern for sardine compared to horse mackerel within the transboundary area.
10) This year, no *Sardinella aurita* was found in the transboundary area unlike in 2011 when 57 500 tonnes were found in the Angolan transboundary area.
11) The other clupeid species (round herring and anchovy) were found in extended, homogenous aggregation just like last year (2011), contrasting with the situation in 2009 where scattered, high-density aggregations were found.

The main recommendations are:

1) The time series should be continue, at the same time of the year, in order to monitor changes within the transboundary area over time and to establish whether the observed patterns are persistent over time.
2) Additional surveys should be conducted also in the warm season, as the distribution patterns of all the targeted species are likely to be quite different in the alternate season. Horse mackerel distributions over the transboundary area generally follow the position of the Angola-Benguela front (ABF), *i.e*. both species have a more southern distribution in the warm season, leading expectations of more Cunene horse mackerel in Namibian waters and less Cape horse mackerel in Angolan waters during summer.
3) Angola and Namibia should, through the BCC, put in place mechanisms for continuing the monitoring of the transboundary area and expand on the established collaboration in the management of the transboundary pelagic fish resources there; all populations studied are to some extent transboundary, and most are in low abundance.
4) Collaborative monitoring should focus on joint training and harmonization of survey techniques, irrespective of the future of the transboundary surveys.
5) The quality and use of transboundary surveys will improve if participants are trained in biological sampling, mostly on maturity and stomach fullness staging. Such information is subjective and requires consistency. That combined with retention of participants could help in data precision.

Report status final References:

NORAD - FAO PROJECT: CCP/INT/003/NOR, Cruise reports "Dr. Fridtjof Nansen". BCC Prject: LMR/NANSEN/1/10. Krakstad, J.-O. , A. P. da S. Amaro and V. Shigwedha. **A**

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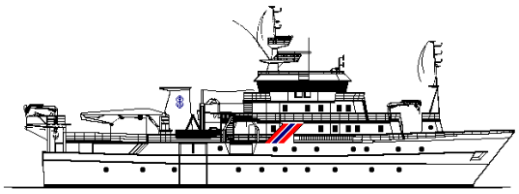

transboundary study of the pelagic fish stocks of Southern Angola and Northern Namibia. BCC Cruise Report N. 2/2012. 22 September – 6 October 2012. Institute of Marine Research, Norway, Instituto Nacional de Investigaçào Pesqueira, Luanda, Angola and National Marine Information and Research Centre, Swakopmund, Namibia. 2012

Constraints/Comments: