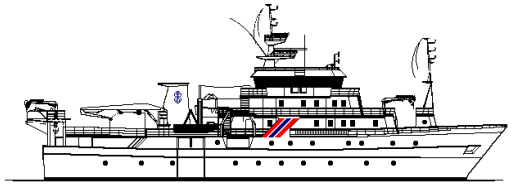
NANSEN PROJECT



Countries: Namibia

Research vessel: R/V DR. FRIDTJOF NANSEN

Survey number: 2011409

Number of days: 13

General objectives: Survey to determine spawning of the deep water hake M. Paradoxus in the Northern Benguela Region off Namibia

	Port	Date	Coverage	Specific objectives
Departure	Cape Town	26 September	Namibia	• to conduct bottom trawling between 400 and 1000 m depth, largely based on positions trawled on during the annual hake survey • to sample the adult population of *M. paradoxus* and inspect maturity stages in order to identify spawning fish and locate potential spawning locations geographically • to conduct multisampler stations at < 500 m bottom depth in order to collect hake eggs and larvae and identify potential spawning areas geographically • to collect gonad samples of *M. paradoxus* for later histological analysis • to collect environmental and hydroacoustic data to improve our understanding of the link between the environment and the distribution of the hakes, and the fish community structure in the distribution areas of the hake.
Arrival	Walvis Bay	8 October		

Cruise leader:

Participants:
Lauren Abels, Samantha Ockhuis (*BCRE, South Africa*)
Sarah Paulus, Suama Kashava, Malakia Shimanda, Johnny Gamatham, Ernestus Kangombe, Heniritha Sibanda (*NatMIRC, Namibia*)
Oddgeir Alvheim, Arved Staby, Jan Frode Wilhelmsen, (*IMR, Norway*)
Britta Grote (*ZMT Bremen, Germany*)

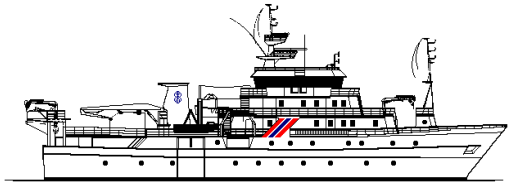
Summary of the results:

Hydrography

Sea surface temperature was between 12-15.9 0C and decreased to 10.4-11.3 at 250 m depth. Dissolved oxygen (DO) and density decreased from 5.5 at the surface to1.1-3.1 ml/l, and from 26-25.3 to 26.74-26.86 at 250 m depth respectively. Deeper than 400 m temperature was generally below 9 0C and measured 4.8 at 740 m depth. Oxygen minimum was between 200 and 450 m depth, and on the northern transect (23 0S) DO levels were as low as 0.8 ml/l.

Length distributions

Females measured 20 – 78 cm, and males 23 – 58 cm. The average length of both male and female deep sea hake increased with increasing depth. No apparent difference between male and female length was visible within a depth range, although all larger fish caught (> 60 cm), regardless of depth, were females. Average length did not seem to vary greatly with latitude,



although a trend of decreasing average length with decreasing latitude is visible.

Gonad maturity

Neither ripe-running females nor ripe-running males were found, and only one probably spent female and male were identified during the course of the survey. Ripe males were practically absent, with a majority of inactive males (stage 1) and a smaller proportion of maturing fish (stage2). The relative proportion of ripe females in biological samples (n=20 per station) was higher south of 260S and north of 240S.

Based on the limited biological data collected, the proportion of females with ripe gonads seems to increase with depth. Few ripe females were caught inshore of 600 m, but their contribution was generally above 20% in catches deeper than 700 m. Between 240S and 260S just one trawl station was deeper than 600 m and two ripe females were caught. The lack of geographical coverage and biological samples from deeper waters makes it thus difficult to draw any conclusions about the absence or presence of ripe females in this area. The smallest female with maturing (stage 2) gonads was 34 cm and with ripe gonads 45 cm long. Average length of stage 3 females was 55 cm. The data suggests that females only start maturing once > 30 cm and possibly spawn when > 40 cm.

Average stage 3 gonad weight of a female weighing on average 1345 g was 21 g, less than 2% of its total weight. Less than 6% of stage 3 gonads sampled weighed more than 50, corresponding to a GSI of 1.9 to 3.7. The GSI for females staged as ripe ranged between 0.5 and 4. In a study of the spawning cycle of the European hake, Recasens et al. (2008) found that stage 2 GSI ranged between 2 and 6, stage 3 GSI between 4 and 8 and stage 4 females between 8 and 18. Considering that fully developed and close to spawning (ripe and running) female gonads can contribute at least 8 % to the total body weight, the current data suggests that only few females had started investing resources in the development of eggs, and that with all certainty spawning was not taking place. It is more likely that spawning occurs later towards the end of the year.

The GSI data and gonad weight data further suggests that the staging of hake maturity stages is somewhat inconsistent, and that resultantly the macroscopic staging of maturity stages would need to be looked at in more detail.

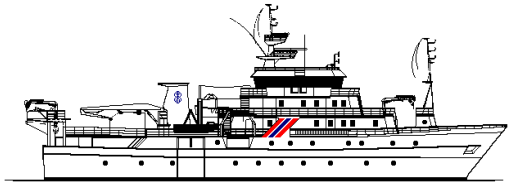
Eggs and larvae

Due to the patchy distribution of the multinet stations, owing bad weather, limited conclusions regarding the distribution of eggs can be drawn. The abundance of hake eggs (eggs m-2) increased at the inshore stations. Some hake eggs (7) were found at 25030 at app. 400 m bottom depths, while at 23020, at 200 and 300 m bottom depth, a total of 306 eggs (station 14) were counted. Highest egg abundance (mean eggs m-3) was found in the 100 – 150 m depth strata, where oxygen ranged from 0.7 – 2.1 ml l-1, and temperature from 11.4 – 13 0C. Based on this distribution pattern it is most likely that the majority of inshore eggs caught were *M. capensis* and those found deeper *M. paradoxus* eggs, although this would need to be verified by genetic analyses. Only two hake larvae (early stage) were found during the entire survey. The low abundance of eggs and the low number of larvae found may be indicative of very limited spawning activity taking place.

Conclusions:

The survey covered only a fraction of the northern Benguela region, approximately half of the Namibian slop area. Since higher proportions of ripe females were found in the southern part of the surveyed area (260S-270S), it would be advisable that future surveys also covered the area south of 270S up to at least 290S.

The data shows that most ripe females were found deeper than 600 m depth, suggesting that spawning most likely would take place in deeper waters, perhaps even beyond 700 m. By



restricting survey effort to a depth range of 550 to 800 m bottom depth, valuable survey time can be saved by omitting shallower stations that contribute little to the overall understanding of the distribution and presence of spawning fish.
The fact that no ripe and running nor spent males or females were found during the survey, in addition to only few possibly deep sea hake eggs and larvae, suggest that spawning was not taking place nor had taken place. Furthermore, average stage 3 gonad weight was comparatively low (low GSI), meaning that even females with stage 3 gonads were most likely not going to spawn within the next following weeks or perhaps month. As such shifting the timing of a future survey to November / December may increase the probability of finding spawning deep sea hake.
The question of whether *M. paradoxus* spawn in the northern Benguela region (200S to 290S) has not been resolved with this survey. Additional surveys would need to be conducted, covering a wider latitudinal range and deeper habitat, as well as taking place in late summer.

Report: status: final References:

FAO PROJECT: CCP/INT/003/NOR. Cruise reports “Dr. Fridtjof Nansen”EAF-N2011/1. **2011 BCC Survey. Survey to determine spawning of the deep water hake M. Paradoxus in the Northern Benguela Region off Namibia. Cruise report No 9/2011. 23 September – 8 October 2011.** Bergen, October 2011

Constraints/Comments: