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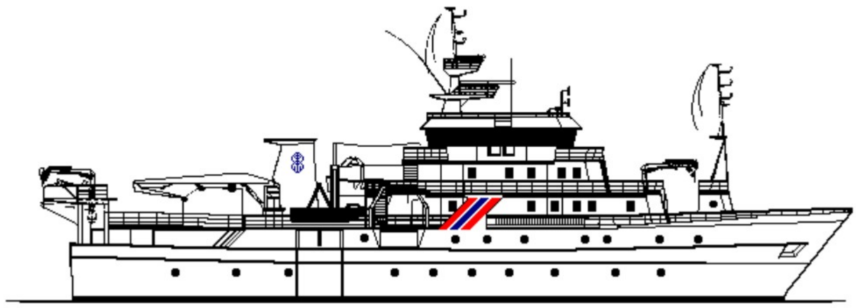
CRUISE REPORTS "DR. FRIDTJOF NANSEN"



SURVEYS OF THE FISH RESOURCES OF NAMIBIA

Abundance estimation and ecology of 0-group hake (*Merluccius capensis*)
30 March - 4 April 1998

Ministry of Fisheries & Marine Resources
Swakopmund
Republic of Namibia

Institute of Marine Research
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Abundance estimation and ecology of 0-group hake (*Merluccius capensis*)
30 March - 4 April 1998

by

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Institute of Marine Research
Bergen, 1998

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CHAPTER 1 INTRODUCTION

1.1 Background and objectives

This survey represents the second stage of a research programme started in May 1996 (Bianchi et al, 1997) aimed at mapping concentrations of juvenile hake in its pelagic phase and the ecological conditions (hydrography, food and predation) dominating in the area where they are located. The more detailed objectives are as follows:

- Study the distribution and abundance of juvenile hake with the acoustic method;
- Carry out target strength measurements;
- Study juvenile hake ecological preferences (environmental conditions, zooplankton abundance and distribution);
- Determine the main predators;
- Carry out biological sampling to determine: length-weight relationship, age (by otholit reading) and stomach content

1.2 Participants

The scientific staff consisted of:

From NatMIRC, Swakopmund (Namibia):
  Heidrun PLARRE
  Anneke V. WESTHAUSEN
  Sean WELLS
  Konrad Thorisson
From , Sea Fisheries Research Station, Lüderitz (Namibia):
  Jean-Paul ROUX.
From IMR, Bergen (Norway):
  Gabriella BIANCHI, Guillermo BURGOS, Tore MØRK, Reidar JOHANNESSEN

1.3 Narrative

The vessel left Walvis Bay on March 30 at around 14.00 hrs and steamed southwards to 23. 20 S, where the survey started. The survey track consisted of transects perpendicular to the coast and about 15 nautical miles (NM) apart. CTD stations were spaced about 20 NM, along the transects, covering a depth range of 70 to 200 m depth. Sampling with pelagic and bottom trawl was performed to identify the echo-traces that might represent juvenile hake. On April 2 the vessel reached the northernmost planned transect. Because no juvenile hake had been found in the central and northern parts of the area, it was decided to steam southwards to 23ºS where a few juvenile hake had been caught at the beginning of the survey.

The vessel returned to Walvis Bay in the early morning of April 4. Figure 1 shows the cruise track and the sampled stations.

Figure 1. Cruise track and position of sampling stations

CHAPTER 2 METHODS

2.1 Hydrographic sampling

A Seabird 911 CTD plus was used to obtain a general overview and standard vertical profiles of temperature, salinity and oxygen. Real time plotting and logging was done using the Seabird Seasave software installed on a PC. The profiles were taken down to a few metres above the bottom. Calibration of the CTD equipment for oxygen and salinity values is usually performed by collecting water samples with Niskin bottles. This calibration was not performed and the parameters obtained from the calibration in the previous survey in Namibian waters were used (intercept = 0.184; slope = 0.998).

Meteorological observations

Wind (direction and speed), air temperature, global radiation and sea surface temperature (5 m depth) were logged automatically every nautical mile using an Aanderaa meteorological station.

2.2 Zooplankton sampling

One zooplankton transect, consisting of 5 stations was taken at 23º50'. The purpose of the sampling was to compare the zooplankton composition from the stomachs of 0-group fish caught at this transect with the available zooplankton in the surrounding water. The object of this sampling programme was originally 0-group hake, but was changed to juvenile horse mackerel in the absence of the former.

Plankton samples were collected using a paired Bongo net, 57 cm in diameter with mesh sizes of 500 µm and a mouth area of 0.25 m^2. One of the nets was fitted with a TSK flowmeter to measure the volume of water filtered. A SCANMAR sensor was attached to the frame to provide information on the fishing depth of the net.

Oblique plankton hauls were made in the 0 - 100 m layer by lowering the net from the surface to a depth of 100 m at a rate of about 1 m/sec. Where the bottom depth was shallower than 100 m the net was lowered to about 5 m above the bottom. Once the required depth was reached, the net was allowed to stabilise for about 30 seconds before being retrieved at a rate of about 0.5 m/sec. Tows were taken during the night while the vessel maintained a speed of about 2 knots. After each haul, the contents of the nets was examined and large jellyfish (>2 cm) were discarded. The remaining plankton was then concentrated and the contents of one net fixed in 5% neutralised formalin for later identification of the most important zooplankton groups. The contents of the other net was conserved in 80% alcohol for later identification of euphausiids.

2.3 Fish sampling

According standard notation, 0-group hake is fish caught in the year they were hatched and an average length of about 8 cm, while 0+ group, is all the fish younger than 12 months corresponding to lengths of about 8 to 20 cm, with a mode of 13-14 cm (Wysokinski,1983). This definition has been adopted in this report.

The pelagic trawl was used for target identification of the echo-traces, while bottom trawl was used to sample the occurrence of juvenile hake near the bottom, on few occasions. The catches were sampled for species composition, by weight and numbers. Length was measured for target or particularly abundant species.Records of fishing stations are presented in Annex I.

A description of the acoustic instruments and their standard settings is given in Annex II. This also includes a description of the fishing gear used.

The mean integrator values in each sampling unit (S_A-values) were divided between the following categories of fish on the basis of trawl catches and characteristics of the echo traces:

- hake (0-group only)
- gobies (*S. bibarbatus*)
- horse mackerel (*T. capensis*)
- round herring (*Etrumeus whiteheadi*)
- pilchard (*Sardinops ocellata*)
- anchovy (*Engraulis japonicus*)
- P2 (non clupeiformes, unidentified pelagic fish other than horse mackerel)
- plankton
- mesopelagic fish (mainly Myctophidae)

2. 4 Seal counting

The aim of this part of the work was to test methods to estimate the density of fur seals at sea and relate the seal distribution and density with that of their potential preys. A *half strip transect* method (similar in principle to strip transect methods used for cetacean observations) has been used: while the ship was cruising at constant speed, all seals detected on one side of the ships route were noted and the perpendicular distance was estimated. The chosen sampling unit was a period of 10 min while the ship was cruising at approximately 10 Kts (18.5 km/h), covering a distance of 3.09 km in 10 min. Using the ships log the true speed and distance covered can then be corrected for each count. All observations were conducted from the bridge deck, which gave a near 360 degrees visibility with a viewing height of about 15 m above sea level.

Two devices were used to measure the perpendicular distances of the seal sighted to the ships route:

- An optical range finder was found to be satisfactory and precise at short range (generally less than 200 m), but extremely difficult to use as soon as the sea was not calm and not accurate enough for long distances;
- A simple measuring device, as illustrated in Figure 2, allowed us to measure distances consistently in a wide range of sea and wind conditions with an acceptable precision up to about 1500 m. Viewing height was measured in harbour as 15.06 m, and the distance from the device was 1.5 m, the readings on the scale of the device were made to the nearest cm. The distance D from the ships side can then be calculated as:

$$D = (d\,H / h) - d$$

D: distance of the seal in m

d: distance from the measuring device = 1.5 m

H: viewing height above sea level = 15.06 m

h: measured distance on the scale between the horizon line and the line of sight to the seal expressed in metres.

Figure 2. Diagram of the device used to measure seal sighting distances from the ships side. The distance is calculated by the following equation: $D = (d H / h) - d$ where: D= distance of the seal in m, d= distance from the measuring device = 1.5 m, H: viewing height above sea level = 15.06 m, and h: reading on the scale of the device.

The frequency distribution of the measured distances can then be modelled to calculate the width of the strip effectively sampled and from that the area. The results will obviously only be an index of density as all seals cannot be expected to be detected since they spend a fair proportion of the time at sea diving. On the other hand this index can be used to compare different areas.

Other information noted was related to the behaviour of the seals which might give indications of the different activities (mainly to try to discern between seals in transit between the colony and the feeding areas and seals involved in feeding). These observations were divided in the following categories:

- resting at the surface or grooming
- slow swimming
- fast swimming or porpoising
- feeding

In addition, the size of the groups was noted.

During trawling operations, the numbers and behaviour of the seals attending was noted separately.

2. 5 Seabird observations

Seabirds are well known as good indicators of fish concentrations and oceanographic features. They are in fact potential predators for a number of fish species. Seabird distribution was therefore included in this study to evaluate the potential impact on fish aggregations as well as their value as biological indicators on the Namibian shelf.

Seabirds were identified and counted from the bridge deck using 10x40 binoculars and a tally counter when necessary. All birds present around the ship per period of 10 min were counted using the following categories:

- flying fast
- sitting on the water
- feeding on the surface
- diving
- following or accompanying the ship

For several species (penguins, albatrosses, Cape gannets and kelp gulls) it was possible to note the age class from plumage features as well as bill coloration. In addition, the number and behaviour of the birds attending the sampling stations (trawling, bongo nets and hydrographic) were noted separately.

Many of the seabird observations could be made concurrently with the seal counts and the general distributions of the □10 min stations is presented in Figure 3.

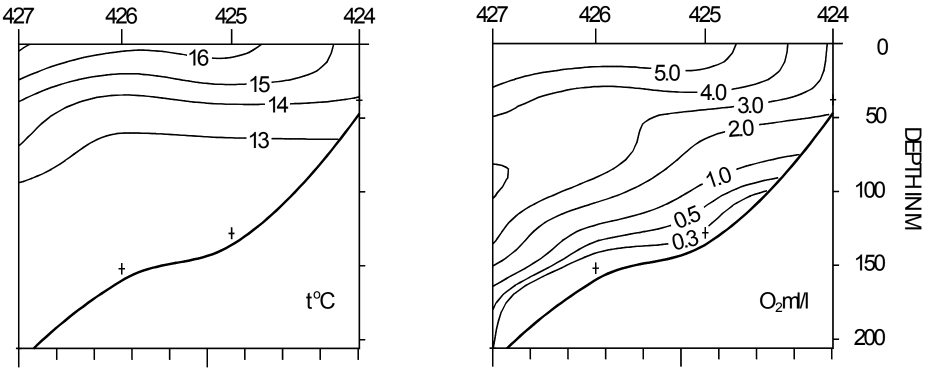
Figure 3. Distribution of the □10 min counts for seal and seabird counts along the ships route. Observations could be made only during daylight hours, from about 06:15 to 17:35.

CHAPTER 3 RESULTS

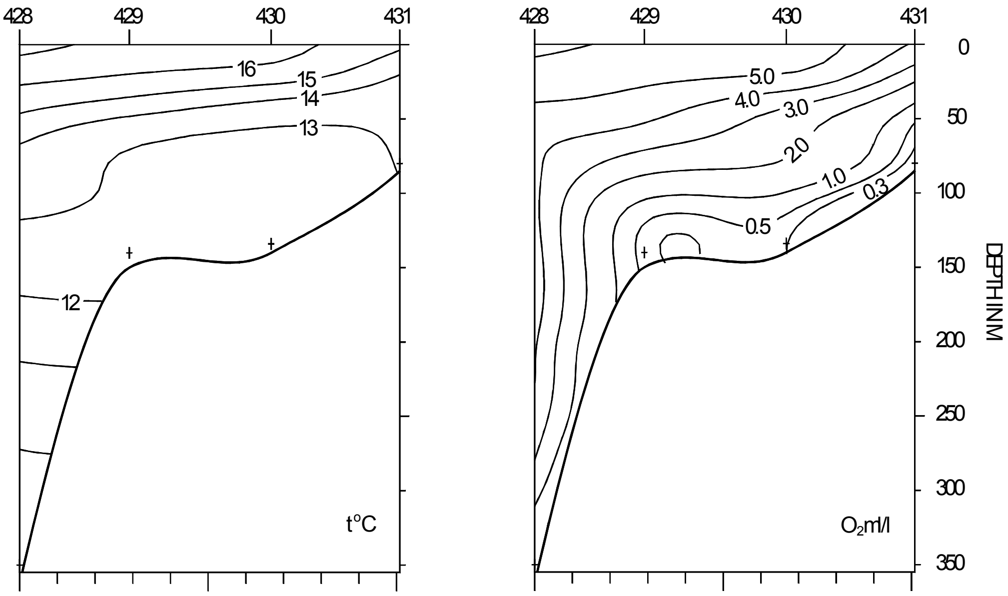
3.1 General environmental conditions

The survey was characterised by generally good whether conditions, with mostly clear sky. Figure 4 shows the wind strength along the course track. Constant, southerly winds dominated, with a strength usually between 20 and 30 knots.

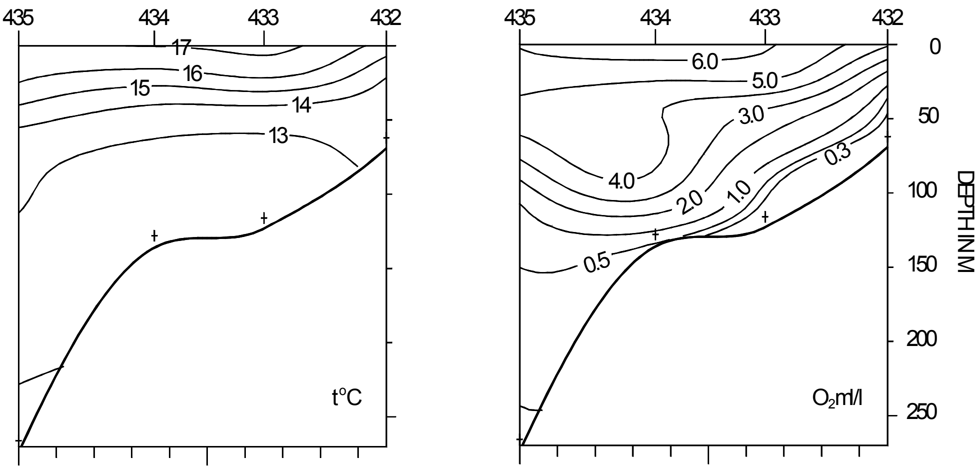
Figure 5 shows the vertical profiles of temperature and oxygen at different latitudes of the survey area. There are signs of up-welling in inshore waters, evidenced by the tilting of both temperature and oxygen isolines in the vertical profiles, near the coast. Figures 6 displays the sea surface temperature as recorded by the thermograph (at 5 m depth). There are pockets of cooler, up-welled waters near the coast both off Walvis Bay and just north of Cape Cross. Figure 7 shows the distribution of oxygen content near the bottom. Most of the surveyed area is characterised by almost anoxyc conditions near the bottom, usually below 0.5 ml/l. The vertical distribution of oxygen shows the presence of a strong oxycline, with values falling from 5 ml/l at the surface to below 0.5 ml/l in the upper 50 m layer.



23º 15 S



23º 00 S



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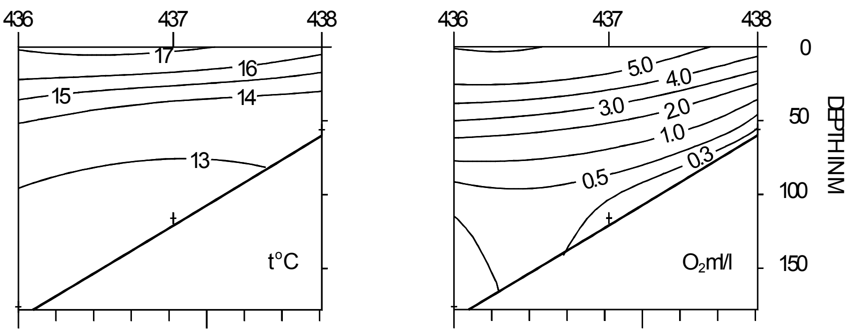
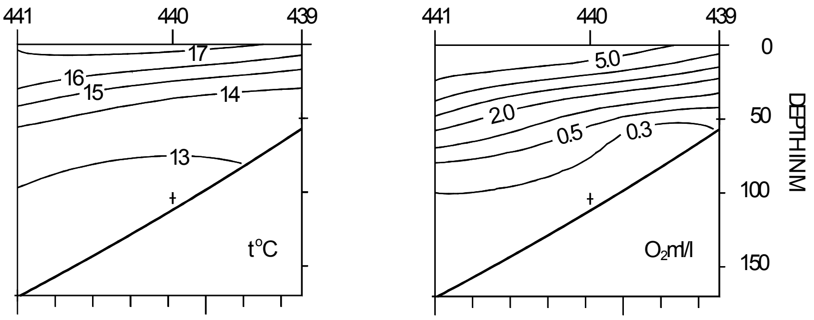
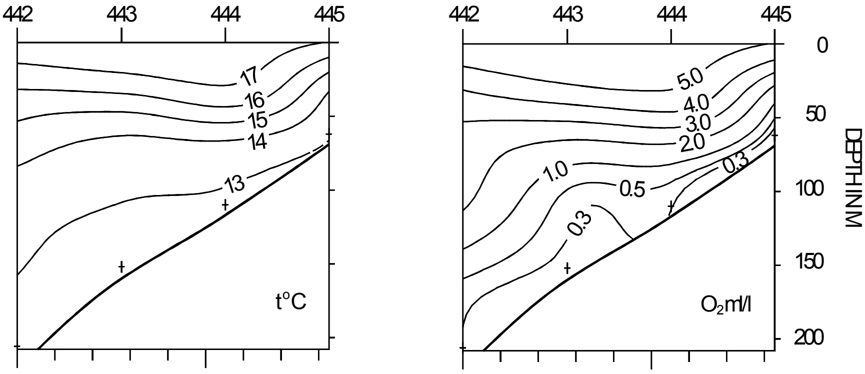


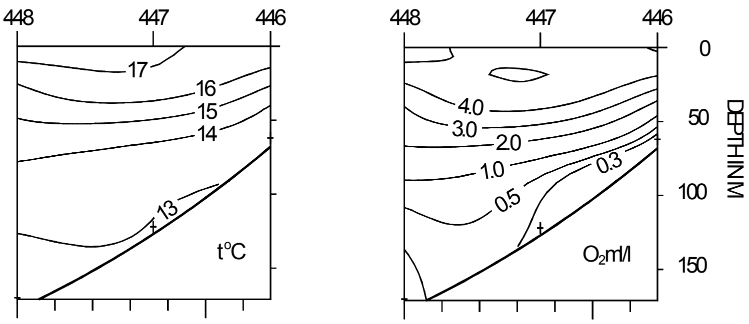
22º 30 S



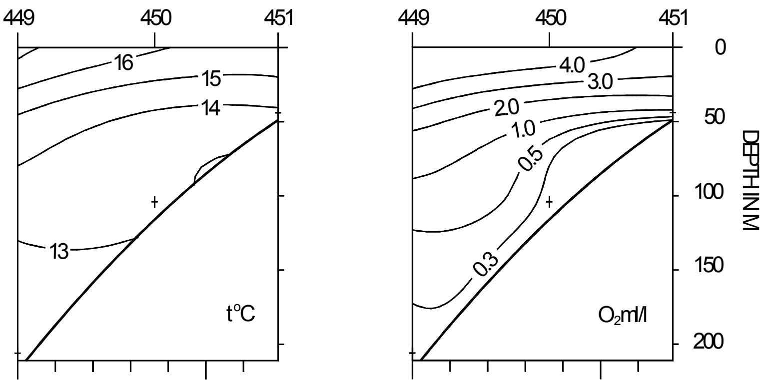
22º 15 S



22º 00 S



21º 45 S



21º 30 S

Figure 4. Wind strength and direction along the survey track

Figure 5. Vertical profiles of temperature (°C) and oxygen (ml/l) in the survey area. Depth in metres.

Figure 5. Cont.

Figure 6. Water temperature at 5 m depth

Figure 7. Oxygen concentrations (ml/l) near the bottom.

The observed conditions are typical of late summer, with extensive areas of oxygen depleted waters near the bottom. During ‘normal’ winters, when the active up-welling creates the conditions for a renewal of the water masses, the extension of the oxygen-depleted waters (with oxygen content < 1 ml/l) is reduced and limited to the area between Walvis Bay and Cape Cross, to about 100 m depth (see for example Strømme and Hamukuaya, 1996).

Figure 8 shows the distribution of the echo integration values for the bottom channel (10 metres from the bottom). Almost the whole shelf appears to be barren, except for the area close to the edge of the shelf where oxygen concentrations increase.

Figure 8. Echo-integration values in the bottom channel (10 metres from the bottom)

3.2 Zooplankton observations

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3.3 Distribution of the main species as observed with the echo-integration system

The main objective of the survey was to map the distribution of juvenile hake and assess the appropriateness of the acoustic method to quantify their abundance. Unfortunately, a few specimens (20 in total, in three trawls, see Annex I) of juvenile hake were caught, and the objective of the survey could therefore not be fulfilled. In May 1996 the 0-group was found in the deeper part of the shelf, after having joined the older part of the population. The present, apparent lack of juvenile hake in the survey area, the reportedly most important nursery area for this species, is difficult to explain. The 1997 year-class may be very weak or there is a displacement of the juvenile hake to outside the survey area.

The pelagic environment is dominated by the presence of two, co-occurring jellyfish (*Chrysaora* sp. and *Aequorea aequorea*), usually caught together with juvenile horse mackerel
(throughout the area) or with the goby (*Sufflogobius bibarbatus*), from about south of 23 ºS.

The dominating species in the pelagic zone was juvenile horse mackerel, caught in 14 out 15 trawls. The distribution and size composition of this species are presented in figures ?? and ?? respectively.

As compared with the results of last horse mackerel survey with the RV Dr. F. Nansen off Namibia in June 1997, there seems to be a larger amount of juveniles this year. However it should be noted that the present survey took place three months earlier than the 1997 survey and only covered the central Namibian shelf . The two surveys might not be totally comparable as the distribution pattern of juveniles might change with season (???? ref??).

Figure ??. Distribution of juvenile horse mackerel

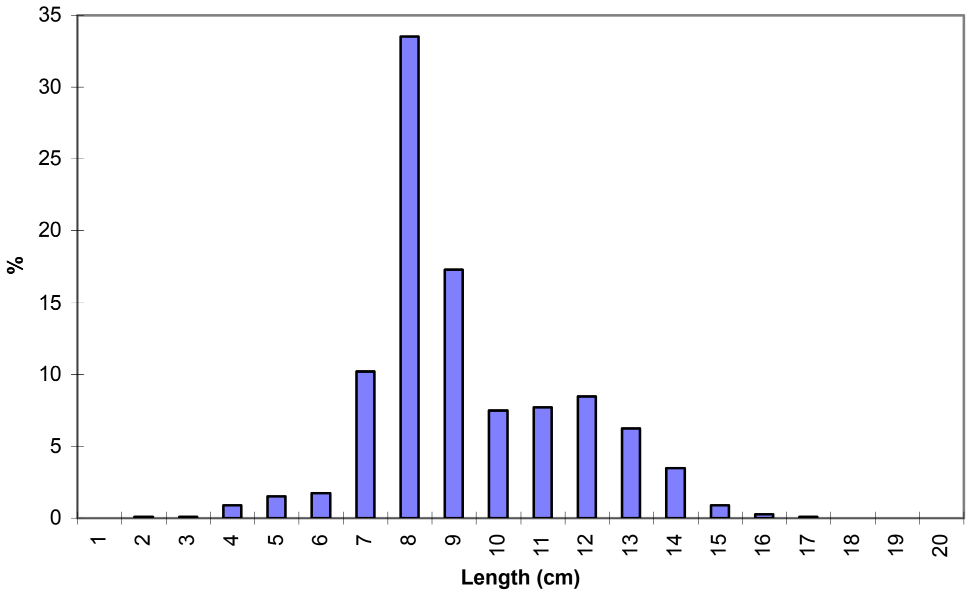

Figure ??. Length frequency distribution of juvenile horse mackerel in the survey area

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3.4 Seal distribution and abundance

3.5 Bird distribution and abundance

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CHAPTER 4

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