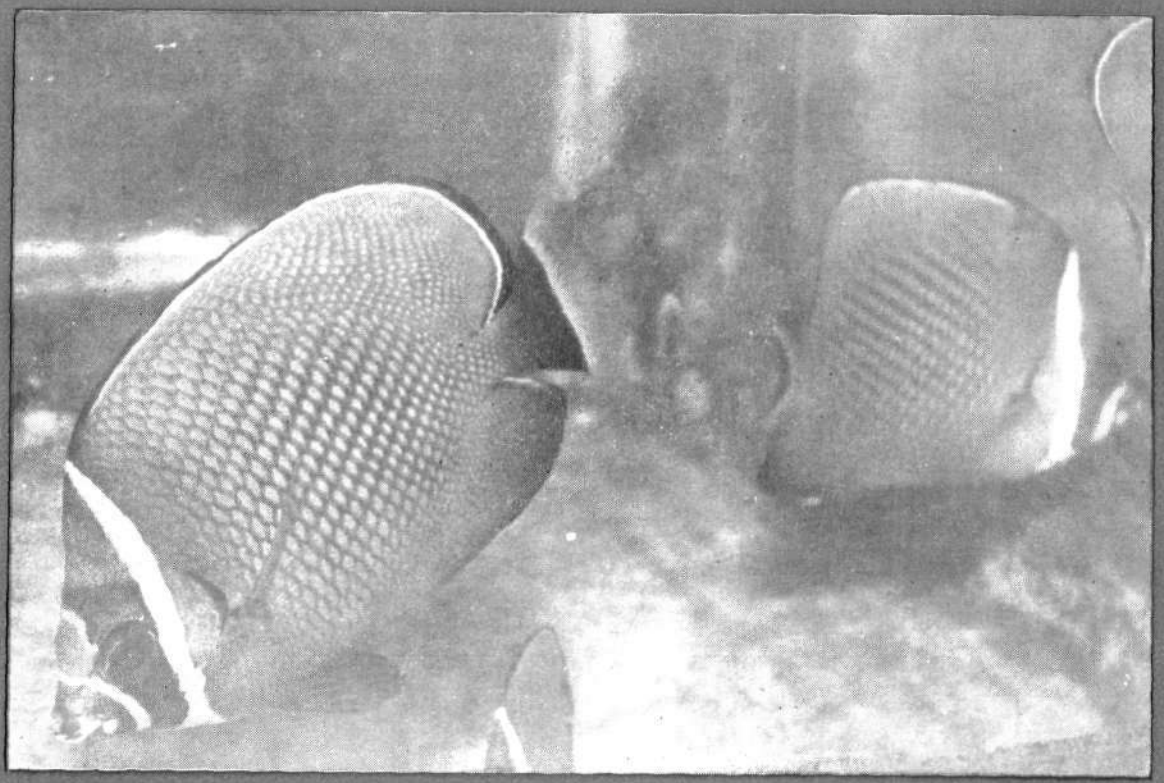
ISSN 0254-380 X

भाकृअनुप
ICAR

समुद्री मात्स्यिकी सूचना सेवा
MARINE FISHERIES INFORMATION SERVICE

No. 93 MARCH 1989



तकनीकी एवं विस्तार अंकावली
TECHNICAL AND EXTENSION SERIES

केन्द्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान कोचिन, भारत
CENTRAL MARINE FISHERIES RESEARCH INSTITUTE COCHIN, INDIA

भारतीय कृषि अनुसंधान परिषद
INDIAN COUNCIL OF AGRICULTURAL RESEARCH

Background paper 4

FISHERY OCEANOGRAPHIC CONDITIONS OFF THE COAST OF MAHARASHTRA*

The fishery of Maharashtra, as elsewhere in the world is influenced by abiotic oceanographic factors such as temperature, salinity, currents, monsoons, storms, light, dissolved oxygen content, inorganic nutrients like phosphates, nitrates, silicates and biotic factors like phytoplankton, zooplankton and benthos.

In the waters off Maharashtra in the summer months of May-June the surface temperature is high, around 30°C and drops by nearly 10°C in the winter months of December-January, when it averages 20°C. The temperature at the depth of 100 m is 20–22°C. Normally within a given season, the variations in temperature are not wide but during the southwest monsoon season (June-August) off Maharashtra the variations are as wide as 7°C at the surface. The variation at 500 m depth during the monsoon season is 6°C whereas during the premonsoon and post monsoon season, it is barely 1°C.

The waters in the upper 50 m are well mixed and nearly isothermal. The temperature starts to fall down sharply below 50 m.

Off Maharashtra, surface salinity varies from 35.4 to 36.6‰. It decreases from north to south. There are no marked variations due to seasons except in the close shore waters due to runoff during south west monsoon. The salinity at 500 m decreases slightly to 35.08–35.54‰.

The northeast monsoon (November-January) off the west coast is generally weak. The precipitation is also negligible. During this season and upto March, the surface currents are weak and flow from north to south. April is a transitory month. By late May, the strong moisture-laden southwest monsoon winds reach Maharashtra and prevail upto September. Heavy precipitation occurs during June-September. The strong Somali current (south equatorial current) which originates from Africa, forms part of the anticyclonic circulation in the Arabian Sea and reaches Maharashtra coast by May. The surface currents flow from south to north along the coast during May-September. October is a transitory month again.

Localized eddies and meanders are quite common affecting the circulation patterns. The tidal currents are stronger along the northern coast than the southern.

Storms and surge-causing tropical cyclones occur predominantly during the premonsoon (March-May) and postmonsoon (October-December) periods, and are rare during the southwest monsoon. During cyclones wave heights of 2 to 4.5 m are not uncommon.

Along the coast of Maharashtra, oxygen often becomes supersaturated in the mixed layer (upto 50 m). The annual average is in the range of 4.0 to 5.2 ml/l. In deeper layers, around 1000 m depth wide seasonal fluctuations are encountered. The oxygen values near the surface show a decrease during the upwelling period of August-September on account of the upward movement of oxygen low waters from deeper layers.

The vertical distribution of oxygen in the water column is not uniform. Two oxygen minima, one between 100 and 400 m and the other between 800 and 1500 m occur, with maxima at the intermediate depths. The shallow minimum is due to limited mixing and near stagnant conditions, high organic production and sinking and decomposition of large amounts of organic matter.

Inorganic nutrients such as phosphates, nitrates and silicates play a very important role in the fertility of any ecosystem. Silicates, by an large, are in abundant supply and are rarely a limiting factor in marine productivity.

Phosphates in the surface waters off Maharashtra are generally low and are in the range of 0.5–0.75 µg at/l at the surface and 1.0-1.25 µg at/l at 100 m. Higher values of 3.0–3.5 µg at/l are recorded at deeper layers of 1000 m. Surface values are higher during the premonsoon than the rest of the year, whereas 100 m values are low during this period.

Nitrates are also generally low. At the surface they are 2.0–2.5, at 100 m 2.5, at 500 m 5–15 and at 1000 m 7.5–15 µg at/l. High concentrations occur at the surface and 100 m during the southwest monsoon.

Sunlight is an important factor for plant production or primary productivity in the sea. It is generally

* Prepared by K. Radhakrishna, Visakhapatnam Research Centre of CMFRI, Visakhapatnam.

agreed that at the depth where 1% of the incident surface sunlight penetrates, production and consumption balance each other with no net gain. The productive zone above this 1% depth is known as the euphotic zone.

In the inshore waters off Maharashtra, the euphotic zone extends to 25–30 m and increases to 40–60 m further offshore. The waters close to the shore are turbid with high suspended matter load (4 mg/l) due to land influence. In the offshore, the turbidity levels are around 2 mg/l.

The fertility of any sea is easily judged by the amount of plants (microscopic algae) produced there. This plant production is also known as primary production and is estimated per unit time and unit volume/area.

Primary production at the surface is high ranging from 50–100 g c/m^3 /day in waters upto 50 m depth. It decreases in the offshore as the depth increases (25–50 mgC in 50–100 m deep waters and 10–25 mgC in waters beyond 100 m depth.)

The production in the water column is also high (876 mgC/m^2/day) upto 50 m depth and 607 mgC in waters beyond. The average works out to 700 mgC/m^2/day for the continental shelf areas.

Primary production is high during the postmonsoon months extending upto March–April, and low in the following southwest monsoon months. Wide fluctuations are encountered in primary production depending on climatic conditions like cloud cover, rain and sea state.

Primary production or synthesis of fresh organic matter in the presence of sunlight occurs primarily through the action of pigments present in the phytoplankton. Among the various pigments, chlorophylls are the most important. The concentration of chlorophylls is, thus a direct index of the primary productivity potential or in other words, the fertility of the sea. Among the chlorophylls, chlorophyll *a*, by and large, is the most important in the marine ecosystem. In the coastal waters off northern Maharashtra, chlorophyll *a* at the surface is in the range of 1.0-2.0 mg/m^3 whereas down south and in the offshore waters the concentrations are low: 0.5–1.0 mg/m^3.

In the euphotic column (upto 50 m) the integrated concentration of chlorophyll *a* is in the range of 10–20 mg/m^2 close to and a little south of Bombay and less than 10 mg/m^2 in the area in general.

Zooplankton, is an important link between the primary producers *viz*, the phytoplankton and the consumers *viz*. fishes, squids, shrimps *etc*. Zooplankton abundance is a direct index of the fishery wealth of the sea.

Zooplankton biomass in the nearshore waters north of Bombay and off Ratnagiri is quite high (over 0.5 ml/m^3). The shelf waters also support biomass of 0.4–0.5 ml/m^3 and the offshore waters support 0.3–0.4 ml/m^3. Ostracods, copepods and salps dominate the zooplankton. Zooplankton, below 200 m, *i.e.* in the mesopelagic region is very low probably because of the oxygen minimum layer.

Benthos, *i.e.* the organisms that live on or near the sea bottom are important as food of bottom living, or, demersal fishes. The larger animals like polychaete worms, shellfish like gastropods and bivalves, and crustaceans like stomaopods and small prawns, compose the macrobenthos. Smaller animals like, amphipods, cumacians, small polychaetes, nematodes and foraminiferans constitute the meiobenthos.

The biomass of macrobenthos varies widely (0.15–153.2 g/m^2) with an average of 6.75 g/m^2 along the Maharashtra coast. The region between 16–20°N is very rich. Meiobenthos average 12.65 in the range of 0.92–14.74 g/m^2. In the offshore waters benthic biomass is low on account of greater depths, low oxygen concentrations and sandy and rocky nature of sea bottom.

The waters of Maharashtra are fertile and support high plankton production. The postmonsoon peak of plankton production (October–December) coincides with the peak fish landings during that period. The secondary peak of plankton in March is associated with good fish landings in May.

During October–November, the shoreward migration of demersal fishes from the deeper layers is a result of shoreward uplift of the oxygen minimum layer.

The processes of upwelling and the shoreward uplift of the oxygen minimum layer generally influence the fisheries of Maharashtra.

The primary productivity of EEZ off Maharashtra amounts to about 60 million tonnes of carbon. The present exploitation of fish from this area is around 0.36 million tonnes only *i.e.* out of every 167 units of phytoplankton, only one unit is being harvested as fish. This clearly is severe under exploitation. The major fishery resources of Maharashtra being constituted by the primary and secondary carnivores such as Bombay duck, prawns, croakers, pomfrets, ribbon fish, catfish *etc.*, it should be possible to realise nearly twice the present fish catch from the sea off Maharashtra.