

The Influence of Hydrological Conditions on Approaches
of *Sardinella aurita* to the Dakar Area

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Hydrological conditions in the Dakar area are determined by the interaction of the cold Canarian Current and the north-eastern branch of the warm Equatorial Counter-Current. The Canarian Current passes here during almost the whole autumn, winter and spring, while in the summer months (June-September) the waters of the Equatorial Counter-Current, which increases during this period, penetrate here.

Berrit (1952) distinguishes three hydrological seasons for the Dakar area:-

- (1) Cold and salt season (the end of December to the end of May). Mean temperature of the surface waters is 18-19°C and the salinity is about 35.5‰.
- (2) Warm and salt season (the end of May to the end of July). An increase in temperature by 7-8°C and a salinity up to 36.0‰ and even more is observed.
- (3) Warm and freshened season (the end of July to the end of December). The salinity of the surface waters decreases to 35‰ and lower. The layer of the freshened water does not exceed 20-30 m.

The terms of the onset of the above-mentioned seasons may be changed in connection with the intensity of the influence of factors causing the oceanographical regime of the waters in this area.

According to our data *Sardinella aurita* concentrate near the bottom approximately from late June to September, which means that these concentrations are formed from the end of the warm and salt hydrological period to the middle of the warm and freshened period.

In the Takoradi area (Guinea Bay) the formation of near-bottom *Sardinella aurita* concentrations are connected with the dilution of the coastal waters by the continental drainage. The fish are forced to leave the inshore areas for the outer parts of the shelf due to the freshening of the water.

Similar direct relations between the approaches of *Sardinella aurita* and the lower salinity of the inshore waters in the Dakar area do not exist. They appear in this area and form dense concentrations near the bottom during the period when the whole area is covered by waters of salinity between 35.5-36.0‰.

In 1961, in addition to the data available for recent years, the BaltNIRO has carried out special hydrological observations in order to determine the causes affecting the formation of *Sardinella aurita* concentrations in the Dakar area. These investigations were carried out on the shelf from the Kazamans River estuary to Dakar. During the period from 7. June to 3. August five oceanographic surveys were performed. The results of these surveys are as follows:-

In early June, a significant part of the area was covered by water with a salinity of more than 36‰ (Fig. 1). In the southern part of the area one can trace a wedge of the waters carried by the north-eastern branch of the Equatorial Counter-Current which penetrates here. Here temperature and salinity of the surface water were the highest (28°C and 36.38‰). The thickness of this stream was 20-30 m. The heating and salting of the surface water were continued further.

As early as the beginning of July the water with salinity of 36‰ occupied the whole northern part of the area. The temperature of the surface water increased by 2-3°C as compared with that of early June. In the southern part of the area, at the same time, the contrary phenomenon could be observed - the salinity began to decrease.

In mid-July the salinity of the surface waters over the continental shelf adjoining the Kazamans River estuary was less than 35‰ (Fig. 2). This freshening of the water may be explained by the following causes:- In June, in the Konakri area, heavy rainfalls occur due to the wet monsoon. As a result, the continental drainage increases and dilution of the surface water is observed. Therefore, during the period 31. May to 13. June at 8°50'N, 14°25'W the salinity of the surface waters dropped from 35.66‰ to 34.97‰. Afterwards, a more intensive dilution was observed and the salinity decreased to 34.0‰ and even lower over the whole area.

These freshened waters, covering the whole Konakri area are transported by the north-eastern branch of the Equatorial Counter-Current northwards and they penetrate up to the Kazamans River estuary and further. As mentioned above, we can trace a branch of this current in the Kazamans River area in early June. In late June - early July this current is intensified and it penetrates up to Dakar. In the middle of July the velocity of this current in the Dakar area reached 0.56 knots. Here a marked anticyclonic gyre was observed (Fig. 3).

How do the changes in the oceanological structure of the area affect the distribution of the Sardinella aurita concentrations ?

In the first part of July concentrations of Sardinella aurita were found over the shelf from the Kazamans River estuary to the Bissagos Islands. They were distributed at 20-30 miles offshore in the upper layers as well as over depths of 25-35 m. Along with the penetration of the diluted waters from the south, Sardinella aurita shoals moved offshore and migrated northwards with the Equatorial Counter-Current (Fig. 4).

On 6. July Sardinella aurita shoals approached the Dakar area where conditions favourable for their existence were observed. Thus, taking 1961 as an example, the relationship between the formation of Sardinella aurita concentrations and the changes in the hydrological conditions were revealed in the Dakar area.

Unfortunately, few data are available and it is therefore difficult to obtain a clear picture of the situation for the recent years. However, results of some investigations which were carried out earlier, confirmed the above-mentioned relationship. In 1958, the approach of Sardinella aurita to the Dakar area was observed half a month earlier than in 1961. This phenomenon of 1958 was caused by the more rapid freshening of the surface waters.

Summary

Migrations of Sardinella aurita to the Dakar area are caused by freshening of the surface waters which are dispersed from the southern areas northwards. As the diluted waters are transported by the north-eastern branch of the Equatorial Counter-Current from the Konakri area, it is possible, in advance, to forecast the approach of Sardinella aurita to the Dakar area. It is necessary to take into account the influence of the following main factors:-

- (1) The beginning of the rainfall period in the Konakri area.
- (2) The intensity of the precipitations during the first period (15-20 days).
- (3) The velocity of the water stream of the north-eastern branch of the Equatorial Counter-Current which depends on the power and duration of the wet monsoon.

It was established in the summer of 1961 that Sardinella aurita concentrations approach the Dakar area 30-35 days after the beginning of the rain period in the Konakri area.

References

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