

**ALFONSINO (*BERYX SPLENDENS*) BIOLOGY AND FISHERY
ON THE SEAMOUNTS IN THE OPEN NORTH ATLANTIC**

by

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Abstract

Aggregations of Alfonsino on the seamounts in the open North Atlantic were discovered for the first time about two decades ago. In total approximately 25 thou.t of Alfonsino were caught since that time, and virtually all catches have been taken onboard vessels of the USSR/Russia.

Alfonsino was represented in trawl catches by specimens ranging from 15 to 59cm fork length and weight ranging from 0.1 to 3.6 kg. Spawning of Alfonsino is intermittent and is observed during summer. Alfonsino were reported to feed on mesopelagic fish species, crustaceans and squids.

Behavior and distribution of Alfonsino were noted to show considerable variability.

The main factor which appeared to determine a pattern of Alfonsino vertical migrations was the vertical shifting of its food organisms. The latter, in turn, were closely related to variations in light penetration into the sea and hydro-meteorological conditions. Horizontal migrations of Alfonsino have been observed to be limited by the area of seamounts.

Trawl fishery of Alfonsino is rather difficult because of the ragged relief of the seamounts, hard bottom and variability of fish aggregations.

Biomass of Alfonsino appears to be comparatively low, in the period 1976-1995 it constituted about 50-80 thou.t. Heavy fishery in the recent years had a negative impact on Alfonsino stocks. On condition fishery ban is observed, restoration of the stocks shall be expected no sooner than in 4-5 years.

Introduction

By the present time, commercial aggregations of Alfonsino in the open North Atlantic have been found on six seamounts. Three of them ("Perspektivnaya", "Rezervnaya" and "Vybornaya") are located on the Corner Rising 600 miles south of the Flemish Cap Bank and the other three ("Spektr", "Bliznetsy", "Agat") on the Mid-Atlantic Ridge north of the 200-mile zone of the Azores.

Commercial aggregations of Alfonsino on the Corner Rising and in the area of North Azores were discovered for the first time on board the USSR exploratory vessels about two decades ago. Further fisheries expeditions to the seamounts were repeatedly carried out during which a considerable body of research and commercial data has been obtained. In some years a commercial fishery was conducted on the banks based on the results of the research.

The aim of this paper is to sum up the results from research and commercial investigations conducted by the USSR and the Russian Federation as well as to correlate the data obtained and to use them as a basis for the attempt to estimate prospects for Alfonsino fishery.

Material and methods.

This study was based on the analysis of the materials collected between 1976 and 1995 during which 34 research, exploratory and fishing vessel cruises were carried out.

Observations on ichthyology were done according to actual instructions and PINRO-VNIRO methods (Anon., 1980). Biological analysis was performed using pelagic and bottom trawl catches (minimum mesh size 60-90mm) and included measuring of fork length separately for each sex, determination of maturity, stomach fullness and food composition.

Behavior, distribution and vertical migrations of Alfonsino were studied based on results from hydroacoustic observations, oceanological and ichthyological investigations as well as observations of solar and lunar light penetration (Vinnichenko, 1997).

Biomass of Alfonsino aggregations was estimated according to the actual methods (Yudanov et al., 1988) adapted for the seamount conditions.

Historical review of investigations and fishery

Alfonsino aggregations on the Corner Rising were first found by exploratory vessel "Atlant" in 1976. In June-July from 2 to 17 trawlers participated in fishery and their total catch amounted to 10.3 thou.t. In September fishery stopped as a result of reduction in aggregation density and decreasing catches. Research-scouting operations in this area continued into October but no commercial aggregations were found.

In March-July 1977 a scouting-fishing expedition consisting of 8 trawlers operated on the Corner Rising. No stable fish aggregations were observed on the banks. The total catch was about 0.8 thou.t.

In the area of North Azores Alfonsino aggregations were first found on board the exploratory vessel "Andrus Johani" in August 1978. In August-October 1-3 trawlers were fishing in this area, their total catch exceeded 0.7 thou.t.

In March and July 1979 aggregations of Alfonsino on the North Azores seamounts were observed by exploratory vessels "Rzhev" and "Kapitan Demidov". In April-May 1-4 trawlers conducted commercial fishery of Alfonsino in this area. Total catch amounted to about 1.1 thou.t.

During 1980-1986 there was no commercial fishery on Alfonsino on the Corner Rising and the North Azores banks. In that period the area was periodically surveyed by research and scouting vessels. Most of them observed Alfonsino aggregations of different densities and stability on seamounts. In total, in that period about 2 thou.t of Alfonsino were taken by exploratory trawlers on the Corner Rising and about 1 thou.t in the North Azores area.

By the results of research and scouting work conducted on board the exploratory vessel "Sokrat", commercial fishery began on the Corner Rising in March-April 1987. Fishery was conducted by 1-4 trawlers which took a total catch of 2.0 thou.t. In April that year the vessel "Sokrat" took commercial catches of Alfonsino in the North Azores area.

No investigations nor fishery on Alfonsino were carried out in subsequent years. The operations were resumed in September 1993 when a joint Russian-Norwegian expedition on the trawler "Ramoen" was arranged. Aggregations of Alfonsino were observed on three banks. Total catch of the vessel was about 0.3 thou.t.

In 1994-1995 fishery on Alfonsino was resumed by the Russian trawler "Petr Petrov". During June-August 1994 the vessel conducted fishery in the North Azores area, its catch exceeded 0.8 thou.t. In September 1994 "Petr Petrov" caught about 0.4 thou.t of Alfonsino on the Corner Rising. In 1995 the vessel resumed fishery on the Corner Rising and in the period from February to June caught 2 thou.t. In June-August 2-3 Russian and 1 Canadian trawlers operated on the Corner Rising banks the total catch of which amounted to about 3.5 thou.t.

In 1995 North Azores banks were surveyed in different seasons but no stable concentrations were discovered. In 1995 about 0.1 thou.t of Alfonsino were caught in this area.

In 1996 trawlers with Russian crews periodically entered the area on the Corner Rising. Owing to bad fishing conditions they conducted short-term fishery. The total catch taken by them was about 0.6 thou.t.

In 1997 Alfonsino fishery on the Corner Rising and in the area of North Azores was conducted by one trawler. In both areas during the most part of the fishing period the conditions were bad. By the preliminary data, the total catch of the vessel for 8 months of fishery was about 0.9 thou.t.

In 1998 Japanese and Canadian vessels attempted to fish Alfonsino on the Corner Rising but without success.

On the whole, since the time of discovery of Alfonsino commercial aggregations, the total catch in the open North Atlantic has amounted to about 25 thou.t and has been almost exclusively taken by the USSR/Russian vessels.

Biological characteristics

Alfonsino was represented in trawl catches by specimens ranging from 15 to 58 cm fork length and the mean weight ranging from 0.1 to 3.6 kg. On the Corner Rising the bulk of catches was made up by large fish 36-40 cm long, on the North Azores banks both small and large fish with the prevalent 20-40 cm length were caught. The tendency of increasing in fish size with an increase in towing

depth was registered (Pshenichny et al., 1986; Anon., 1993; Vinnichenko et al., 1994; da Silva et al., 1996; Vinnichenko, 1997).

Age of caught fish ranged from 2 to 11 yrs. (Leon, Malkov, 1979). The growth rate during the first years of life was found to be relatively high, mean length-at-age of 1, 2 and 3 yr. olds being 8, 15 and 22 cm, respectively. Sexual maturation was found to begin in the second year of life at a mean length of 18 cm, and by the age of 5-6 yrs. and length 25-30 cm all fish become mature at 25-30 cm length (Anon., 1993).

On the Corner Rising Alfonsino were observed to spawn from May-June to August-September (Alekseeva, Alekseev, 1984). On the North Azores banks specimens with running gonads were not fished but there are reasons to suggest that spawning occurs in this area during summer-fall (da Silva et al., 1996). Spawning of Alfonsino was intermittent and observed as a number of batches at a time of around 10-12. Fecundity was 0.8-2.3 mill. eggs. The duration of individual spawning period was estimated to be up to 2 months (Alekseeva, 1983). Young Alfonsino of 25-98 mm length were caught on the Corner Rising by the fry-sampling trawl in the 0-600m water layers in fall, where water temperatures were 14-26°C (Sherstyukov, Noskov, 1986).

Large Alfonsino were reported to feed mostly on mesopelagic fish (Myctophidae, Sternoptychidae, Chauliodontidae etc.), to a lesser degree on squids, shrimp and euphausiids. Euphausiids were reported to be the main food object for smaller Alfonsino, portion of other food organisms is comparatively small (Vinnichenko, 1996, 1997).

Behavior and distribution

Behavior and distribution of Alfonsino were noted to show variability that, combined with hard bottom, ragged relief and great variability of underwater currents on the seamounts, makes trawl fishery rather difficult. Echo records of Alfonsino schools were registered at a wide depth range from 150 to 950m, both in the near-bottom layers and in the pelagial, and can emerge and disappear for different time periods. However, absence of echo signals does not mean the absence of fish on the bank, as a smaller or greater portion of fish from Alfonsino aggregations is permanently distributed at great depths and near bottom in folds of the microrelief where fish cannot be registered by survey instruments. Alfonsino aggregations were observed at water temperature ranging from 7.5 to 17°C (Pshenichny et al., 1986; Vinnichenko, 1986; 1996; 1997).

The main factor which appeared to determine a pattern of Alfonsino vertical migrations was the vertical shifting of its food organisms. The latter, in turn, were closely related to variations in light penetration in the sea (i.e. sunlight and moonlight conditions) and hydro-meteorological conditions in the area of seamounts. The results of the investigations have revealed several types of Alfonsino

vertical migrations. This served as a basis for recommendations on short-term forecasting of fisheries conditions (Vinnichenko, 1986; 1993; 1997).

The horizontal migrations of Alfonsino have been observed to be limited by the area of seamounts, and their distances did not exceed beyond a few miles (Galaktionov, 1984; Vinnichenko, 1996a).

A highly negative reaction to fishing gears which displayed itself in evading the trawl was noted to be a typical feature of Alfonsino behavior. Fishery on Alfonsino is also complicated by small length and breadth of fish schools (Anon., 1993; Vinnichenko, 1996).

Pelagic trawls were the main fishing gears in both areas. Besides, on some banks there is a possibility to use bottom trawls. Catches vary with fish behavior and distribution from 1-2 to 40-50 t per one tow; however, there is often no catch at all (Vinnichenko et al., 1979; Anon., 1993).

Deepwater fish, in particular, black scabbard fish (*Aphanopus carbo*), cardinal-fish (*Epigonus telescopus*), orange roughy (*Hoplostethus atlanticus*), barrelfish (*Hyperoglyphe perciforma*) and wreckfish (*Polyprion americanicus*) occur as bycatch in Alfonsino fishery (Anon., 1993).

Intraspecies structure

There have been two points of view concerning intraspecies structure of Alfonsino. In the opinion of most investigators this species is believed to form an independent population on each separate seamount of the open North Atlantic, does not migrate to long distances and all stages of its life cycle are developed within the same bank. This approach is proved by the results of genetic investigations (Titova, 1981) as well as by absence of Alfonsino aggregations on the banks for a long time (several years) caused by heavy fishery on these banks (Klimenko, 1983; Melnikov et al., 1993; Vinnichenko, 1995).

The hypothesis of some scientists according to which Alfonsino migrates between the Corner Rising and the Azores banks and there is a single population in that area (Alekseev et al., 1987) appears doubtful not only in view of the above reasons. Analysis indicates that this hypothesis is largely based on non-representative data on length-age composition of Alfonsino on the Corner Rising and in the Azores area suggesting only large mature fish (reproductive part of the distribution area) to inhabit the area of the Corner Rising whereas the Azores area is inhabited mostly by small immature fish (foraging part of the distribution area). However, materials from a number of research-scouting expeditions (evidently unknown to the authors of the hypothesis) suggest that both older and younger age groups of Alfonsino permanently inhabit the Corner Rising and the Azores area (Anon., 1979; Sherstyukov, Noskov, 1986; Vinnichenko et al., 1993; Vinnichenko, 1996). Besides, it should be taken into account that not a single report on mature Alfonsino migrations in the open ocean has been available (Kotlyar, 1996).

Stock status and fishery prospects

No special work at estimation of Alfonsino stocks in the open North Atlantic has been conducted. Nonetheless, results from the analysis of retrospective data from research-scouting and fishing cruises allow to suggest a comparatively low Alfonsino stock level in that area. It was calculated that

biomass of Alfonsino aggregations on the six seamounts in the period between 1976 and 1995 has been about 50-80 thou.t (Vinnichenko, 1995). It should be taken into account that the most of the data used to calculate stock size had been obtained rather long ago. As a result, most of the data were outdated and shall be corrected, at present they can serve only as a reference point for estimation of the possible fishery removal.

The following circumstances were taken into account under analysis of the resources for Alfonsino fishery:

1. Actual fishery removal of Alfonsino considerably exceeds the catch data presented in the official statistics. This discrepancy is caused by considerable discards of fish when catches are too large that often happens in Alfonsino fishery due to the peculiarities of its behavior and distribution. By statistical data, total catch of Alfonsino in the North Atlantic in the period between 1993 and 1997 was about 6 thou.t. However, taking into account discards, actual removal is estimated to be 10-12 thou.t.

2. Heavy fishery during the last years has had a negative impact on the status of Alfonsino stocks in both areas. This has been proved by a gradual decline in fishing efficiency of trawlers in the period from 1993 to 1997 as well as by a reduction in size, density and stability of aggregations.

Thus, the data available allow to presume that the North Atlantic Alfonsino stocks are at present in a state of depression. This is the reason why the efficiency of trawl fishery in the nearest years is expected to be low and will not be sufficient to ensure profitability. Taking into account fishing experience and peculiarities of Alfonsino biology, increase in biomass providing a considerable rise in fishing efficiency is to be expected no sooner than in 4-5 years. However, this is possible on condition the ban on Alfonsino fishery remains in force during the entire period.

Conclusions

1. The former Soviet Union pioneered the exploration and commercial fishing of Alfonsino in the open North Atlantic. The main contribution to the study of the area and its fish resources, and the harvesting of a greater portion of Alfonsino, has been made by the Soviet Union and its successor Russia.

2. By the present time Russian scientists and fishermen have discovered the main peculiarities of Alfonsino biology, obtained data on its behavior, distribution and conditions of aggregations formation, elaborated the tactics and techniques of trawl fishery on this species.

3. Trawl fishery on the Corner Rising and North Azores banks is very difficult owing to complicated physical and oceanographic conditions in those areas and instability of Alfonsino aggregations.

4. At present, Alfonsino stocks are in a state of depression and their restoration is to be expected no sooner than in 4-5 years. Limited biomass and free enterprise fisheries on Alfonsino in the open North Atlantic demonstrate the necessity for the development of an international fishery management plan.

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