

A DECADE OF ECOLOGICAL INVESTIGATIONS ON FOUR IMPORTANT MARINE FOOD FISHES OF CHINA

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ABSTRACT

China is rich in marine food fish resources. Among the fifty species of the marine food fishes, the Ribbonfish, *Trichiurus haumela*, the Small Yellow croaker, *Pseudosciaena polyactis*, and the Large Yellow croaker, *P. crocea*, are of primary importance, as the annual catches of each of these fishes in China exceed 100,000 tons. Annual catches of the other fishes vary greatly from species to species, ranging from several thousand tons to over ten thousand tons. As ichthyological studies were devoted mainly to the taxonomical works in China before 1949, the scientific data regarding the ecology of the marine food fishes in the Chinese waters were extremely scarce.

Since the liberation, a series of active ecological investigations on the three important fishes mentioned above and the Japanese mackerel, *Pneumatophorus japonicus*, have been made for the purpose of studying the stocks and migration of these fishes. The investigations deal with the biology of the fish, and the hydrology as well as the plankton and benthos of the fishing grounds, especially the main spawning grounds.

The purpose of this article is to make a brief review of the results, especially the relationships between the fish and the environmental factors, thus obtained during the last few years.

1. The Small Yellow Croaker

It is believed that there are three different local populations of *P. polyactis* in the Chinese waters. The ecological investigation of this fish has been devoted mainly to the northern population, which spawns in the Pohai and in the northern part of the Yellow Sea.

The wintering grounds of this population is situated in the middle region of the southern part of the Yellow Sea. It has been found that the croaker shoals usually aggregate in the region where is rich in benthos and plankton. The mean water temperature near the bottom of the wintering grounds is about 10°C, and the salinity about 33.00‰. The fish do take food during the winter months, and their diurnal vertical migration is obvious.

The northward spawning migration of the croaker usually takes place in mid- or late March. When they reach the coastal region off Weihai and Yantai, they always aggregate in huge shoals in the deeper places where the temperature near sea bottom is between 5.0 and 5.5°C, and the salinity between 31.20 and 32.40‰. During spawning migration, the larger individuals with well developed gonads usually arrive at this region first, then followed by the smaller ones. The appearing of the croaker shoals of both large and small individuals indicates the close of the fishing season in this region. Based upon these ecological data and the valuable experiences of the fishing experts, the forecasting of the fishing season and fishing centers of this region has been made with success in the spring of this year.

The small croaker spawns in May. The spawning grounds in the Pohai are situated at the Laichow Bay, Liaotung Bay and Pohai Bay. The spawning ground at Laichow Bay has been

better studied. The spawning center at this Bay is located in the region where the flow of the Yellow River is mixing with the offshore water mass of higher salinity. The optimum salinity for the spawning of the fish ranges from 25.30 to 28.55‰, and the optimum bottom temperature from 12—14°C. Therefore it is easy to locate where the spawning shoals aggregate.

The distribution of the young fish and the feeding shoals is related to the temperature and the distribution of food which they take.

2. The Japanese Mackerel

There are three mackerel spawning grounds along the China coast in the Yellow Sea. Off Yentai and Weihai is the main spawning ground. The results of the investigation show that the center of this spawning ground is situated in the region where the coastal water is mixing with the offshore water mass. During the most productive period of the fishing season in May and June, thermocline in the fishing ground always occurs about 10 meters below the sea surface.

The temperature seems to be one of the important factors affecting the spawning and activities of the fish. For example, the fishing season usually begins towards the end of April. The mean surface temperature of the center of the fishing ground, however, is always about 8°C in all these years. When the mean temperature reaches about 12°C, the mackerel aggregate in huge shoals and become active near the surface, and the spawning begins. The relationship between the temperature and the close of the fishing season is not obvious.

The Japanese Mackerel is mainly a plankton feeder, but it also takes small and young fishes. An analysis of the stomach contents indicates that the diurnal and seasonal variations of the food constituents are correlated with the distribution of the zooplankton.

Another important spawning ground of the mackerel is near Haiyang Is., east of the Liaotung Peninsula. This region is also a feeding ground of the fish, as it is rich in plankton. It has been found that the depth of thermocline in this fishing ground has exerted particular influence on the activities of the fish.

3. The Large Yellow Croaker

Along China coast, there are a series of spawning grounds of this fish extending from southern Kiangsu to Naochow, in the west part of Kwangtung.

It has been proved for the first time that this fish spawns twice a year at Taichu Yang, Chekiang and near Naochow, Kwangtung. The main spawning season of *P. Crocea* off Chekiang and Fukien is from April to June, while near Naochow it is in October and November. Although the spawning season is different at different localities, the water temperature (surface temperature) for spawning is quite similar, ranging from 18—23°C at Taichu Yang, Chekiang, from 18—24°C near Naochow, Kwangtung. The optimum temperature for the spawning of this fish is from 19—21°C at Taichu Yang, 19.5—22.5°C at Kuantsing Yang, Fukien, and about 18°C near Naochow.

The other important factor affecting the spawning of the fish is the current, since the spawners aggregate and spawn only during the spring tide.

The result of racial investigation shows that the croaker found at Taichu Yang and that found near Naochow belong to two different local populations, and that the spring spawner and the autumn spawner at Taichu Yang are definitely present.

4. The Ribbonfish

This species is widely distributed in the Chinese waters. There are about seven spawning grounds along the China coast, but only two of them have been surveyed. Results show that

the important factors affecting the spawning of the fish appear to be temperature and salinity, as the bottom temperature during the spawning aggregation and the salinity values of the spawning grounds are very similar at Laichow Bay in the Pohai and off Jushan, Shantung.

During the southward migration in the winter, the fish aggregate in huge shoals near Alacrity Anch., Chekiang. The water temperature during their aggregation ranges from 13—20°C, and the optimum water temperature from 16—16.5°C. The fish is absent in the region where the transparency is less than one meter in depth. When the water temperature is lower than 12°C the fish leaves the fishing ground. The fishing center always coincides with the aggregations of *Pseudoeuphausia laifrons* and *Acetes chinensis*, the main food of the ribbonfish.