

# **A Comprehensive Study on a Reasonable Exploitation of the Ocean Fishing Grounds in Extra-Shelf Regions around the Ryukyu Island Arc — Preliminary Report**

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## **Abstract**

The fishing grounds in extra-shelf regions around the Ryukyu Island Arc are investigated comprehensively by many scientists in co-operation as a University Project during three years. The research cruise of Kagoshima-maru in 1978 is described and preliminary results are reviewed. Hydrological differences between both sides of the Ryukyu Ridge, insular shelf, current over a bank, stepwise profile of temperature, bacteriophage, larva, taking by three kinds of fishing gear, some special features of bottom fauna, and fish market problem are discussed.

## **1. Introduction**

We have had many excellent fishing grounds for many years on the continental shelves, composed of only eight percents of the all waters on the earth including high seas and foreign waters. In the meantime, however, it has become urgently necessary to seek for another fishing ground outside of shelf areas, i.e. extra-shelf regions, since population forces us into getting further products. Thus, it is attempted as one of the University Projects on the ocean science, supported by a special project research fund from the Education Ministry, to research the overall situation of fishing grounds in extra-shelf regions around the Ryukyu Island Arc. Many investigators of different specialities belonging to different Departments and Universities participate in this comprehensive project with their specialized knowledge in co-operation. Items are geological and hydrological researches concerning hopeful extra-shelf fishing grounds, ecological research concerning various stages of life, i.e. adult, juvenile, larva, and micro-organisms, effective extra-shelf fishing gear and technique, food processing technique of unused species, and market system problem. The research vessel is appropriately used for this project, aiming at successful expedition. This project is expected to continue at least during three years beginning at 1978.

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## 2. Planning and the First Cruise

The Ryukyu Island Arc is the outer boundary of the East China Sea and extends about 1200 km northeast-southwest direction, approximately parallel to the edge of the continental shelf, along which a long trough exists between the shelf edge and the Ryukyu Ridge. Bottom topography around the Arc is rather irregular, with banks, basins, valleys, insular shelves, etc. Furthermore, a strong current of the Kuroshio flowing northeastward along the continental slope, weak and variable counter-current, and travelling vortices work together to determine the instantaneous distribution of the water movements and characteristics. All of these factors affect the ecosystem of life in the sea. Therefore, available materials are examined exhaustively in order to decide the research procedure, aiming primarily at taking the bottom faunae.

There is no such a comprehensive study as this project, though so many investigations relating with these problems has been carried out by many scientists so far. Of course Okinawa Prefecture Fisheries Institute carries on fishing experiments in these regions (*e.g.* OPFI, 1976) and Kagoshima Prefecture Fisheries Institute does also (*e.g.* KPFI, 1975, 1977). Many results of hydrological research are published (*e.g.* Takahashi *et al*, 1971; Takahashi, 1978; Nitani, 1972) and geological problems are discussed also (*e.g.* Uji-ie *et al*, 1974). Fish larvae and juvenile around the Arc are discussed by Ozawa (1976) and micro-organisms by Hidaka (1976). A relation between oceanic conditions and fisheries in the East China Sea is discussed by Nakao (1977). So many literatures are reviewed in order to decide our present research procedure, though these are not cited here.

Oceanic regions expected to cruise are shown in Fig. 1. In the first year of the project period an area around the southern Ryukyu Arc is chosen because of a low speed of water movement. In the second year an area around the Amami Islands will be investigated and finally an area above continental slope in the third year because of the strong current there.

Thus, the first expedition has been carried out with the Kagoshima-maru during a period from 27th of October to 15th of November in 1978, 23 scientists on board (19 belonging to the Faculty of Fisheries, 1 the Faculty of Engineering, Kagoshima University, and 2 the Faculty of Science and Technology, Ryukyu University) and 13 students (7 graduate students, 3 students, Kagoshima University, and 3 students of Ryukyu University). The cruise track is given in Fig. 2.

## 3. Preliminary Discussion on the Results obtained during the First Year

General outline of the results obtained during the first fiscal year of 1978 is described here briefly, though a booklet, which contains fifteen short articles

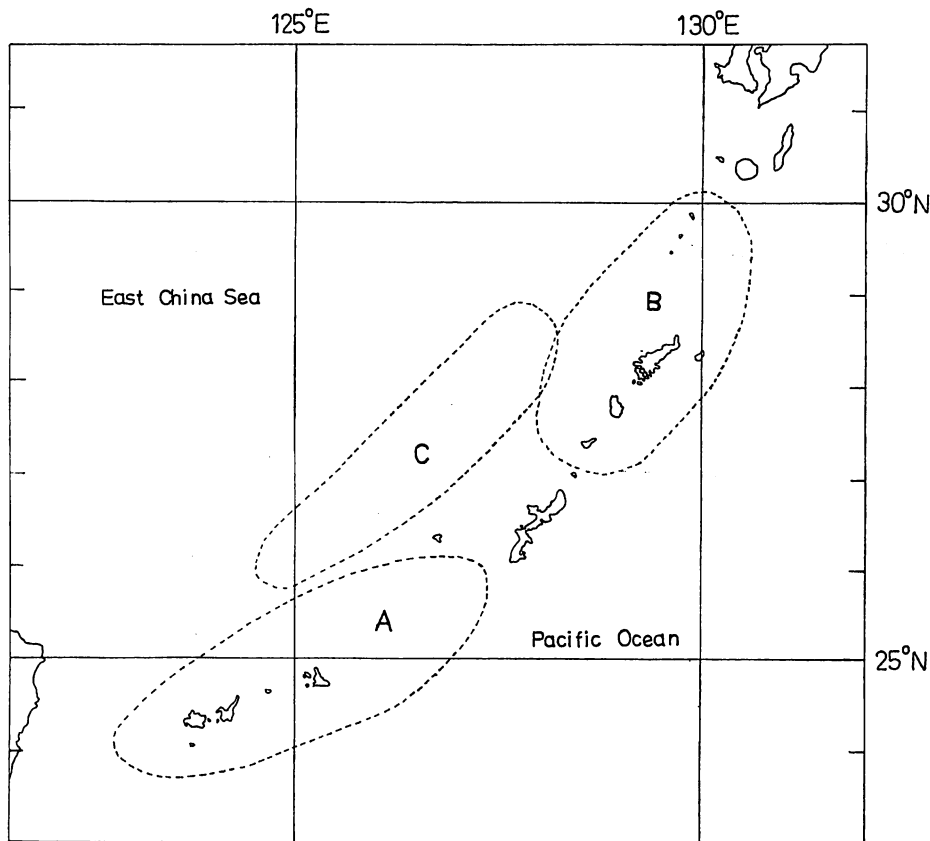


Fig. 1 Oceanic regions expected to cruise. A, 1978; B, 1979; C, 1980

based on preliminary analyses, has been prepared in Japanese for more or less a financial need by the Faculty of Fisheries, Kagoshima University in March of 1979 (KUFF, 1979). Lots of discussions and conclusions derived from relevant analyses will be presented by individual participants before or after a fiscal year of 1980.

Chaen *et al* (KUFF, 1979) point out that Ryukyu Ridge prevents the water exchange between the East China Sea and the Pacific not only in the deep layer but also in the surface layer, showing in the East China Sea a existence of high saline subsurface water of higher than 35‰ at ca 100 m moving within the Kuroshio and disappearance of low saline North Pacific intermediate water of lower than 34.3‰ below 600 m and at the boundary over the ridge a existence of a water of lower temperature and lower salinity than those of both sides of the ridge, suggesting an upwelling process.

Takahashi *et al* (KUFF, 1979) describe the results of current measurements above a bank on the Ryukyu Ridge, Hozan-son, for four days about the neap tide and show that the diurnal tidal current exceeds the semi-diurnal one and



than in the East China Sea in general, and that the plenty of bacteriophage systems seem to exist on a level of ca 50 m especially.

Ozawa (KUFF, 1979) describes that this region seems to be abundant in larvae of *Stolephorus buccaneri*, *Vinciguerria nimbaria*, and Bothidae spp. and that a larva of *Lethrinus* sp. is found for the first time.

Higo *et al* (KUFF, 1979) discuss the distribution of bottom fauna, based on the taking by three kinds of fishing gear, i.e. 149 fishes of 29 species caught by the vertical long line, 48 fishes of 11 species caught by the pot, and 9 fishes of 6 species caught by the small beam trawl dragged a little off the sea floor, and summarize as follows: the fish fauna around the southern Ryukyu Arc consists mainly of osteichthyes (*Gymnocraninus* sp., *Etelis* sp., etc.) above a depth of 300 m and mainly of sharks (*Galeus* sp., *Squalus* sp., *Etmopterus* sp., etc.) below the depth.

Yonemori *et al* (KUFF, 1979) present some test experiments of new devices recording continuously both the water temperature and each catch of a fish, detected by a sudden increase of the tension acting on a trolling line under way.

Kawamura (KUFF, 1979) examines the fish retinae, classified into three groups according to the depth, 0–200 m, 200–400 m, more than 400 m, and recognizes that the retinae of deep fishes appear to be more advantageous for the movement perception than those of shallow fishes having higher visual acuity.

Yoshino *et al* (KUFF, 1979) describe that the taking contains 5 families, 1 species of shark including *Mustelus manazo* caught at shallower floor and *Squalus megalops* caught at deeper floor.

Nishimoto *et al* (KUFF, 1979) examine the qualities of muscles of several fish species and find that the freshness lowering-rate of *Tropidnius amoenus* is remarkable and the actomyosin is much more stable for *Lutjanus caeruleovittatus* and *Taius tumifrons* than *Tropidnius amoenus* and *Etelis carbunculus* from a viewpoint of thermal inactivation and that the shark muscle may be made to a high grade fish cake in spite of a inferiority of its gel-forming capacity.

Kataoka (KUFF, 1979) discusses the historical progress of the fisheries forms in the Okinawa Prefecture and suggests the increase of sea bream taking by the vertical long line technique in future.

Matsu-ura (KUFF, 1979) discusses the fish market system and points out that the major part of the taking has been used to be dealt directly with consumers at a temporary street market or by peddling and that fish prices are subject to wide fluctuations, since the market system is not properly prepared, even though the regular wholesale fish market.

#### 4. Concluding Remarks

All the results together are itemized in the preceding section, which is a step

toward the objective, since individual specialists present their results separately. A situation or a reality of nature must be fixed under the mutual interaction between many factors. Therefore, we should do debate how a factor influences another factor and what is a decisive factor in order to synthesize the itemized results presented separately. This will be attempted during the further expeditions.

All participants wish to express their hearty thanks for the performance of this comprehensive research to the staff of Ministry of Education, of the Administration Offices of Kagoshima University and Ryukyu University, of the Okinawa Prefectural Authorities, of the Maritime Safety Board, and of the research vessel.

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