REMOTE SENSING IN CHINESE FISHERIES

Han Shixing
(Associated Professor, East China Sea Fisheries Institute, Chines Academy of Fisherie Sciences, 300 Jungong Road, Shanghai 200090, P.R. of China, VII)

Abstract

Beginning at the end of the 1960's, remote sensing application in chinese fisheries has been gradually developed. The paper is devoted to narrate important achievements in each developing stage, present the agencies of scientific research and practical service, and describe recent aspects of the field. The practice of Satellite Sea Surface Temperature and Fishing Chart is one of the important points of the paper with emphasis on collecting and processing of information, and making and distributing of the chart.

Key Words: Remote Sensing Application Fishery

Marine fisheries are important industries in China. The annual total aquatic products, in recent year, reached 10 million tons, of which nearly 60 percent came from marine fisheries. Chinese government has been paying great attentions to the new technologies in marine fishing and making every efforts to develop and applicate the advanced scientific achievement in marine fisheries. The application of remote sensing in fisheries is growing rapidly in this circumstances.

THE BEGINNING AND DEVELOPING

At the ends of 1960's, two efforts searching pelagic fish stock from aquatic plane were made in Yellow sea, which were the beginning of application of remote sensing in fishery in China. Without advanced detective equipment these two tests did not get the expected results.

Several years had passed when another experiment was done in the central north part of the Yellow Sea (FRIS 1982). In this experiment Infrared Thermal Radiometer, Aero-camera and Hyperbolitic Positioner were used to locate pelagic fish stock in plane and the fishing vessels collected insute data in the sea. The results were courageable. It is shown that remote sensing can not only find the pelagic fish stock swimming in upper layer but also obtain information of a large area about sea surface temperature and water color which were important for analysing fishing ground.

From the early 1980's, with the development and improvement of remote sensing technology, the application of remote sensing have been extensively developed in various industries. And in fisheries, not only research studies have gotten ultility achievements but also practical service has primarily been taken into operation. It is at the early of the 1980's that sea surface temperature distribution was interpreted from single channel infrared image of AVHRR the detector in NOAA series satellite by using several points of in situ data for calibration (Han & Shen 1985). Then, in the period of 1981 to 1985, through thorough analysis of the fishing ground of Hairtail, Spanish mackerel, Anchovy, Sardine and Black scraper in the East China Sea, Yellow Sea and Tsushima area, it is found that the distribution and variation of fishing ground were correspondent with the change of thermal fronts and convergence refleted in satellite infrared image (Han & Shen 1984, 1987, Wang etal 1990). And then, the efforts for charting the thermal image into sea surface temperature distribution were taken fiercely through research of geometrical correcting and temperature interpreting (Chen 1988). Finally, the first satellite sea surface temperature chart was experimentally send to fishing companies in Nov., 1983. Since 1985, remote sensing fishery application have gained its most significant achievements. Two special image processing systems for fisheries were set up, and some useful image process techniches such as bichannel atomospheric correction, digital geometrical correction and automatic charting were developed. The time of charting was greatly eliminated and made it possible for regular dispatch of Satellite SST Chart. And the convergence, corrent direction, water color and, practical and forecasted location of fishing ground were added into the Satellite SST Chart which then became Satellite SST & Fishing Chart. Meanwhile, the test of monitoring various environment factors by multi-channel AVHRR image has taken its first fruitful step. The research on application of LANDSAT TM products in oceanography were also given out courageable outlet (Ren 1980, Wang 1984, Xiang etal 1985, Zhen 1985). The fishery related subjectes include detecting the primary productivity, water color, photoplankton and oil spill in the sea, measurement and identification of area in shore zone, evaluating the variation of the photoplankton and area in inland water bodies.

THE AGENCIES OF RESEARCH AND SERVICE

As we all know that there are close relations between development of remote sensing application in fishery and that in oceanography. The agencies engaged in remote sensing application in oceanography and thus fishery are following four groups: Institutes sponsored by Chinses Academic Scienca, Institutes of National Oceanic Bureau, Institutes and Universities of Education Ministry and Institutes and University of Agriculture Ministry. Though the main problem of these four groups are the application of remote sensing in oceanography, every one has its own intresting. Some is absorbed in theoretic research, another is entranced by detector making and the others are engaged in comprehensive studies. The Institutes of Chinese Academy of Fisheries Sciences, Agriculture Ministry are the agencies engaged mainly in application of research and service in fishery. This group includes Satellite Image Processing Centre of Chinese Academic of Fishery Science, East China Sea Fisheries Institute, South China Sea Fisheries Institute, Yellow Sea Fisheries Institute, Fishery Machinery & Instrument Institute, and a Fishery Communication Net which connected Information Centre of Fishery Management Bureau with three branches located in Shanghai, Yantai and Gangzhou, respectively. In order to promote the research achievement into operation, in

1990 Fishery Information Service of East China Sea was estibilished in Shanghai, which is an agency for making and transfering satellite SST & Fishing Chart.

PRESENT ASPECTS

Service of SST & Fishery Chart

At the beginning of 1980's, research on the probability of utilizing satellite infrared image in marine fishery was conducted and then studies on extracting sea surface temperature from satellite inferared image and its accurate verification were pursued after then computer image processing and charting were introduced. Later on, in 1986 the service of Satellite SST Chart and SST & Fishery Chart were experimentally put into operation. It has been showned that Satellite SST Chart and SST & Fishing Chart have active guide effacts on fishing operation of pelagic fishes such as Sardine and Anchovy (Wang etal 1990). The distribution of water thermal structure and the location, strength and stability of convergence zone reflected in these charts obviously indicated the formation of fishing ground, beginning of fishing season, stability of the location of fishing ground and the abundance and migration of fish stock. Further more, theses charts were also got successful usage in demersal fishery in that the fishing ground of some important commercial demersal fishes such as Hairtail and Black scraper could be analysed by the location of convergence, area which had the suitable environmental temperature for theses fishes and other environmental factors (Han and Shen 1987). Since the most of chinese marine catches comes from demersal fishery and the main fishing method were bottom trawling, the satellite SST chart gained themselves more important position. In the winter of 1987, the practical service were begun and the charts are dispatched regularly every week. The charts served reflectes the distribution of isotherm, shows the location, strength and variation trends of fronts and convergence zone, and reports the location of the fishing ground and its potential changes. It makes good advice to fishing operation. Now thay are warmly accepted both by fishermen in fleet of national companies and those in cooperative fishing boats.

Measurement of Sea Surface Temperature in Fishing Ground by Airborne Remote Sensing

In December 1984, Du etal(1988) tried an experiment to measure SST in fishing ground by airborne remote sensing in the East China Sea. The equipment used were Airborne Infrared Thermal Radiometer and Floating Thermal Meter droped by plane. The results showed that the accurate of Airborne Infrared Thermal Radiometer is + 0.5 C, its temperature resolving power is o.1 C, and the accurate of Floating Thermal Meter is 0.2 C (Shong etal 1990). They also made quick reports about temperature in fishing ground by their experiment results. After then on, in three consecutive winter from 1986 to 1988, quick reports of SST, derived from airborne remote sensing, were distributed. These reports limited by flight pathes had only covered west area of 124 E and suited only to short scadule, small searching region and small powerred fishing vessels. Because of high cost, these reports will not put into regular service recently.

Application of LANDHSAT Image in Aquaculture

As the natural resources of off shore fishery have severely declined since the early of the 1980's, the aquaculture in shore and in inland water bodies become more and more important in China. The image of LANDSAT has been used to investigate and evaluate the aquacultural potentiality of shore zone and lake. In 1983, there was an attempt to use MSS image in investigation of shore zone of Laozhou Bay, and classification of soil, sediment and flora ,as well as, the area of defferent tidal zone were counted. In the later part of the 1980's, some cooperative investigations in lake were carried out with the help of TM image. For example, in investigation of Ge Lake, the feature and the shape of the lake, and the distribution of aquatic plankton were attracted from TM images. And therefore suggestion about the development of aquaculture and proliferation in the studied lake was proposed. Theses applicaions were promoted greatly, recently, by the rapid development of aquaculture in shore zone and in lake.

Application in Ice Detecting

The Bohai Sea sets in the south edge of icing area of the Northen Hemisphere. The ice in coast disturbes fishery, oil exploration, navigation and coastal construction for nearly half a year. At the early of the 1960's, a net of ice detecting stations was set in the coast of the Bohai Sea and the northen Yellow Sea. Though the detective technich has been improved largely since then, the most important achievements were abtained only after remote sensing was involved. In 1985, first airborne remote sensing experiment of ice detecting was succeeded in Liaodong Bay and Bohai Bay (Du 1991). And then, in the period of 1986 to 1990, the airborne ice detecting system which composed of airborne detective instruments, flight routine determination system and data processing system was estabilished as the result of extensive experiments and studies. The instruments involved include Synthetic Aperture Radar, Multispectral Scanner, Infrared Color Camara, Microwave Radiometer and Infrared Radiometer. Factors detected and analysed are formation, thickness and scale of the ice, density and distributed region of floe, the distribution of ice ridge and the temperature of sea ice. In the meanwhile, some research on ice monitoring by NOAA image were also carried on (Huang 1991). An preliminary system of satellite ice detecting system was formed with capacity of detecting the feature, thickness and density of ice.

CONCLUDING REMARKS

This paper gives out the outline of remote sensing application in chinese fisheries. Up to now, the mostly used information is AVHRR. Other available important images such as Landsat, Spot etc. have not been widely used in fishery. I believe that in near future all these means will be greatly utilized in monitoring pollutants harmful to fishery, in estimating the hydrologic factors and primary productivities important in assessment of ecosystem of marine fishes, and in establishing of GIS essential to the environmental management.

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