

GLOBEC activities in Korean waters

Suam Kim

Korea Ocean Research and Development Institute
Ansan, P.O. Box 29, Seoul 425-600,
REPUBLIC OF KOREA
E-mail: suamkim@sari.kordi.re.kr

Dr. Suam Kim received his B.Sc. (1976) and M.Sc. (1979) in oceanography from the Seoul National University and got his Ph.D. in fisheries oceanography from the University of Washington in 1987. Currently Dr. Kim is Director of the Polar Research Center of the Korea Ocean Research & Development Institute (KORDI) and Chairman of Korea GLOBEC. His fields of interest include (1) the environmental factors causing the recruitment variability of fishery resources in the North Pacific and the Southern Ocean; (2) fisheries ecology, especially early life history of fish in relation to climate change; and (3) fish stock assessment. Dr. Kim represents Korea on committees of international organizations such as: PICES (Co-Chairman for Implementation Panel on CCCC Program and member of the Fishery Science Committee), GLOBEC (SSC member), CCAMLR (Commission for the Conservation of Antarctic Marine Living Resources), and SCAR (Scientific Committee of Antarctic Research).



Introduction

Until a few decades ago, there were many diverse resident and migratory fish species in waters surrounding the Korean Peninsula. As early as the early 1970's, however, under increasing pressure from overfishing and unrestricted access to fisheries, a warning sign of drastic decreases in fish abundance was observed among some of the most commercially important fisheries. Climate and oceanic environmental changes have also exacerbated problems in Korea's fisheries resources by adversely affecting marine ecosystem structures relating to fisheries. A new management practice is urgently required for the new century, one equipped with a predictive technology regarding species replacement and their recoveries, as well as concerning population fluctuations in the marine ecosystem. Under such urgency, the Korean Society for Oceanography and the Korean Society for Fisheries Resources agreed to establish the Korea GLOBEC Committee in 1998. A total of 13 scientists were selected based on their academic specialties. They itemized on-going concerns and strategies for GLOBEC research in Korea. The Committee started its activity by conducting a small and intimate symposium in August 1999. They also plan to invite Japan GLOBEC for the joint Korea-Japan Symposium on GLOBEC in Pusan, in August 2000.

Regional data and information

Three marginal seas semi-encircle the Korean Peninsula, i.e., the East Sea/Japan Sea (referred to as the East Sea hereafter), the Yellow Sea, and the South Sea. The East Sea consists of three deep basins and a steep continental slope with narrow continental shelf whereas, the South and the Yellow Sea mostly possess very shallow continental shelves. The warm

and saline water mass of the Tsushima Current, separated from the Kuroshio, is transported into the East Sea via the South Sea, and converges with the cold waters of the Liman Current in the central East Sea forming a polar front. Thus the distribution of cold and warm water fish species varies depending on the location of the polar front. Consequently, zooplankton production and fish survival might be strongly influenced by the strength of these two water masses. The Yellow Sea and the South Sea are generally influenced and occupied by the warm Tsushima Current, though seasonal cold waters and/or heavy rainfall affect local water properties of these areas. The major fish stock of these areas belongs to warm water species including anchovy and mackerel, hence their productivity may be influenced by the strength of the Kuroshio, and in turn, by El Niño.

Waters encircling the Korean Peninsula have typical regional oceanographic attributes as well as fisheries characteristics. Nevertheless, no clear information is known about meteorological events affecting climatic conditions of the Korean Peninsula including its adjacent seas. By assuming that the climate changes and environmental variability are more important than any other natural factors responsible for the fluctuation of fisheries resources (especially true for the small pelagic fish stock), the Korea GLOBEC is considering its priority focus on conducting GLOBEC research around the Korean Peninsula. Fortunately, plenty of historical data for retrospective analyses are found including temperature, precipitation, and other meteorological observations by the Meteorological Research Institute, lighthouse observations, oceanographic observations and fishery statistics by the National Fisheries Research and Development Institute. However, for the GLOBEC modeling study, a lot of laboratory

work or process-oriented research are required in the future. Most of all, improved and effective political conflict-solving techniques are needed for collecting and standardizing oceanographic, fisheries and meteorological data from neighboring countries such as China, Japan, North Korea, and Russia.

Action Plan for Korea GLOBEC Programme and its structure

The Korea GLOBEC Programme, which was produced in 1999 by Korea GLOBEC Committee members, will last for three years beginning in late December 1999. For short-term results, it aims at collecting all research information that has been carried out in the past, and re-analyzing the historic data sets in relation to climate changes. Ultimately, based on the retrospective analyses, it will provide a long-term science and strategic plan for Korean waters to establish effective and

reasonable conservation and sustainable measures for the fishery and ecosystem management (Fig. 1). With challenges of accomplishing these objectives, Korea GLOBEC Programme incorporated five fields of ecological study area connected interdisciplinarily as follows:

- Climate variability patterns over the Korean Peninsula;
- Climate changes and physical reactions of ocean in Korean waters
- Climate changes and other relevant responses of marine ecosystem in Korean waters
- Climate changes and fluctuation of fisheries resources
- Interaction among ecosystem components affected by changing climate conditions

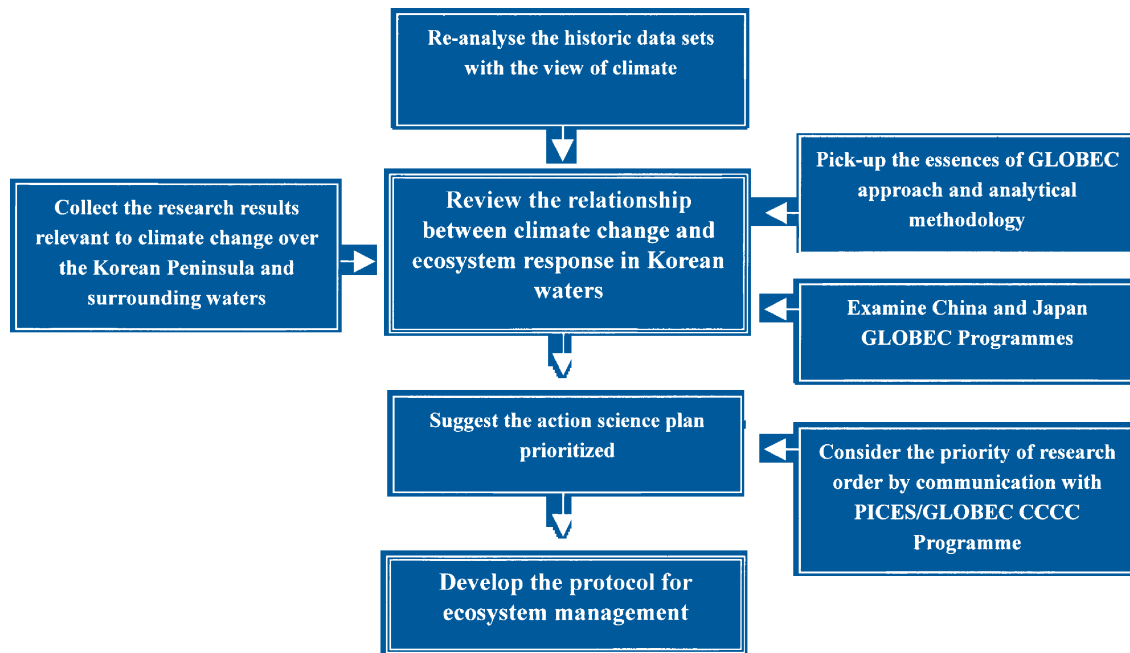


Fig. 1 Flow-chart of long-term activities to be conducted by the Korea GLOBEC Programme.

Connecting marine researches in Korea with the international GLOBEC studies

Four regional programmes, namely, Southern Ocean-GLOBEC (SO-GLOBEC), Small Pelagic Fishes and Climate Change (SPACC), Cod and Climate Change (CCC), and Climate Change and Carrying Capacity (CCCC), of International GLOBEC are strongly interrelated with fishing activities of Korea. Because Korean fishing companies were involved in krill fishing in Antarctica since 1997/98 season, and krill fishing during winter seasons has been on the increase recently, the SO-GLOBEC research which aims for winter processes including overwintering survival strategy of krill,

are pertinent to the Korea Antarctic Research Programme. Moreover, in the South Sea of Korea, two small pelagic fish species (anchovy and mackerel) made up to 44% of the total fish catches in 1995, indicating its importance to the Korean fisheries. Therefore, the South Sea should be one of the study areas in SPACC programme. In addition, Korea’s distant water fishing industries used to explore fisheries resources in the North Pacific and the North Atlantic Oceans. Especially, recruitment processes of demersal fish stocks such as walleye pollock are relevant to the main themes of CCC and CCCC. With emphasis, therefore, any international GLOBEC activities cannot be overlooked.

It is not clear how the El Niño events affect the marine ecosystem of the northwestern Pacific Ocean containing marine areas with the highest annual fish production among the world oceans. Recently, some Korean meteorologists, using the wavelet analysis, revealed that precipitation data in southern areas of Korea exhibit a periodic cycle similar to the El Niño and Southern Oscillation (ENSO) events (Oh and Lee, 1998). Precipitation data near the South Sea are correlated with the Southern Oscillation Index (SOI), which suggested that the occurrence and intensity of El Niño having 3.3 to 5.0 year periodic cycles since 1965.

From the satellite photographs, the SST in the South Sea became a little warmer in winters after El Niño events had occurred in the tropical ocean. The annual SOI showed a high negative correlation with the SST in December, accounting for approximately 25% of the variance in December SST. On the other hand, the SST in December revealed high correlation coefficients with anchovy catch ($r=0.419$, $p<0.05$) and mackerel catch ($r=0.436$, $p<0.05$) in the South Sea of Korea, albeit no statistically significant direct correlation were observed between SOI and fish catches. The relationship between SOI anomaly, SST anomaly in December, and fish catches is depicted in Figure 2 (Kim and Kang, in review).

Regional cooperation

Fishing overcapacity and climate change presumably have changed species composition and abundance of fish stocks in Korean waters during the last few decades. The increases in fishing activities since the 1970s have, in general, depleted fish populations, and in turn, required higher and higher fishing efforts than previous catch. Especially for demersal species, the failure of recruitment and the overall reduction of fish lengths are frequently reported. Fishes are also threatened by coastal development such as land reclamation and the construction of industrial complexes where coastal areas serve as spawning and nursery grounds for resident species. The loss of spawning grounds and the habitat degradation are making previously fertile coastal areas barren. To recover fisheries resources and rebuild stocks to achieve sustainable catch in Korean waters, it is evident that appropriately implemented fisheries research and management strategy should be considered through international cooperation and consideration. A group of Yellow Sea Large Marine Ecosystem (YSLME) scientists has agreed to establish international cooperation. GLOBEC also shares the same understanding as YSLME. YSLME's approaches to the regional co-operation, share ultimately the same purposes with GLOBEC - on how to establish ecosystem management in Korean waters. The thematic center for fisheries research and management should be established as a priority measure, and its final goal is to provide basic information for the ecosystem management including the concept of climate changes. The proposed Task Groups and their activities in new regional organization include:

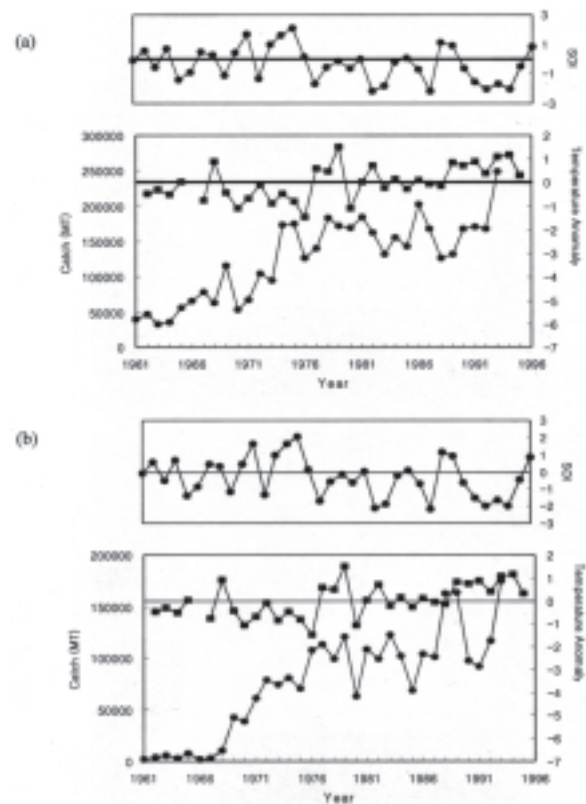


Fig. 2 Physical and biological coupling in the South Sea of Korea shown by the relationship between the annual anomaly of SOI, SST, and the annual catch of (a) anchovy and (b) mackerel from Korean waters.

- Data Management: exchanging fisheries data, creating fine-scale data reporting system, operating observer programme, etc.
- Scientific Investigation: developing cooperative scientific surveys, workshops, etc.
- Capacity Building: training and exchanging of young scientists, etc.
- Fisheries and Ecosystem Management: conducting annual meetings for stock assessment and analyses, making decisions on conservation measures, etc.

Hopefully by addressing the issues in fisheries, and implementing strong measures and newly developed fisheries management practices will rebuild and replenish Korea's fisheries resources for continuing benefit from Korean waters.

References

- Kim, S. and S. Kang. Ecological variations and El Niño effects off the southern coast of the Korean Peninsula during the last three decades. *Fish. Oceanogr.* in review.
- Oh, J.-H. and Lee, Y.H. 1998. Climate jump in precipitation data over Korean Peninsula. In: *Proceedings of the 1st workshop on climate changes and fisheries resources*. Eds. Zhang, C.I., Kim, S. and Oh, J.-H., Pukyong National University. 1-25 pp. (in Korean).