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On the management regime of the *Illex* fisheries in Subareas 3 and 4

by

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Introduction

The various discussions had been made in the late 1970s - early 1980s with the rapid growth of the squid fisheries in ICNAF/NAFO area and the management regime was established in the late 1970s. But the catches of *Illex* had decreased rapidly from 162,000 tons in 1979 to 111 tons in 1986. The research activities on the squid stock also ceased with the depletion of the squid catch. In recent years, there was no advise on squid due to little information on the stock status. After 1986, however, the squid catch in NAFO area has increased gradually to 6,000-7,000 tons in recent three years and periods of high squid abundance can be expected in the near future. In this paper the progress on the management and the biological background of *Illex* are summarized and the management regimes are reviewed for possible choise in present status of the stock and fishery.

Progress on the management

Long and various discussions for the adoption of TAC had been made from 1977 to 1984. The progress of these discussions are briefly summarized below.

Before 1973 Judging from such a catch level and narrow range of fishing grounds in those years, the fishery was not considered to have harmful effect on the stock-recruitment relationship.

1976 Analyses of yield-per-recruit and stock-recruitment considerations indicated that removals could be about 40% of the stock biomass (Redbook 1976, page 112).

1978 From the comparison between catch and effort regulations, there are many potential sources of error in the implementation of fishing effort regulation. However, given the extreme difficulties in setting catch regulations to achieve a particular objective in terms of exploitation rate, effort regulation offers a substantially greater probability of effective management (Redbook 1978, page 29).

STACREC favors, in principle, effort regulation as means of controlling the exploitation rate in the *Illex* fishery. However, it was concluded that effort regulation *per se* would be difficult to design for 1978 because of the practical difficulties of (i) inter-calibration of effort among the different types of vessels and gears, (ii) estimation of effort for *Illex* in mixed fisheries, and (iii) estimation of effort for the relatively large inshore catch (Redbook 1978, page 31).

TAC for 1978 was set based on the target exploitation rate and minimum biomass estimate in 1977 with limitation on the number of fishing days.

1980 TAC of 150,000 tons was set after some considerations on possible historical impact of various TAC levels, because this level is intended to avoid excessive fishing mortality (i.e. >40%) in years of moderate abundance.

The Committee recognized that this regime implies substantial loss of yield in years high squid abundance but that a TAC regulation could result in high fishing mortality in years of low abundance.

The Committee considered that controlled offshore catch allocation in conjunction with effort constraints, as currently practiced, remain the most satisfactory means of preventing biological over-exploitation and a low spawning stock size (Redbook 1980, page 57).

1984 The low abundance in recent years tends to support the rationale for and the maintenance of the current management regime. At the time when the regime was proposed in February 1980, squid abundance levels were anomalously high (Redbook 1984, page 62).

The drastic reduction in fishing effort during 1981-83 supports the concept that the fishery tends to be self-regulation in the years of low abundance. ..... STACFIS continues to support the current management regime and advise the TAC for 1985 be maintained at 150,000 tons (Redbook 1984, page 63).

From 1988 onward The regime established in 1980 is still continued by Fishery commission, although no advise for TAC can be made due to the lack of up-to-date information on abundance and biology.

After the lengthy discussions, it was recognized that the fishing effort regulation is theoretically rational way to keep exploitation rate a target constant level under the variation of the abundance which is not able to predict in advance. However, there are many difficulties which obstacle the enforcement of fishing effort regulation. The major difficulty is to estimate effective fishing effort which is influenced by various factors which may change with time. Under the circumstance, the compromised management regime between catch and fishing effort regulation, namely the TAC regulation with fishing effort constraints, is accepted.

Biological background

In the past two decades the vast amount of researches on the biology of *Illex* have been carried out for an effective management of the stock. The brief summary on the biology of *Illex* is presented below.

The life span of *Illex illecebrosus* is estimated to be about one year, as well as some other ommastrephid species in other regions. Spawning is believed to occur once and most of the squid die after spawning. The spawning ground is suspected to be south of Cape Hatteras over the Blake Plateau (Fig. 1). The major spawning is believed to occur during December through January, though the minor spawning event occurs in spring and summer. The egg masses are transported north by the Gulf Stream. The larvae are hatched after about 9-16 days and continue to drift northward. During late spring-summer the juvenile, grow to 10-

15 cm ML, move onto the Shelf and into the shallow water off northern New England, Nova Scotia and Newfoundland. They grow up to about 25 cm ML rapidly during summer and fall on the Shelf. During the late fall they migrate south with maturation (Black et al., 1987).

The most important characteristic of this stock is that there is only a single age group present at any one time. This means that all individuals are new recruits at the beginning of a fishing season. The residual animals through the year will affect the next year fishing only by the spawning success. Although the relationship between spawner and recruitment is most important point in the annual species as seen from the views of management and utilization, this relationship may be weak or variable and the variability in stock size year by year may be large. Consequently it is hardly possible to estimate the recruitment in the next year based on the information on spawner. Although several larvae-juvenile surveys had been carried out, it is still impossible to estimate the abundance of recruitment directly in advance of the fishery.

Present management regime

The catch of *Illex* in Subareas 3 and 4 has increased gradually since 1987 when the abundance indices obtained in the USA waters was recorded third highest level in time series (US research reports, 1986-1990), and the abundance in US waters has still remained relatively high level. As historically high squid abundance continued for several years in Subareas 3 and 4, good fishing seasons can be expected in the near future.

The research activity also has ceased with the decrease of the *Illex* catch, though STACFIS pointed out the necessity of the research. Then knowledge of squid population dynamics has not been improved since the depression of the squid fishery.

Another *Illex* fishery has been developed rapidly in the southwest Atlantic waters in the last decade. The effort regulation was applied to keep the escapement ratio constant (40%) for the *Illex* stock around the Falkland Islands (Beddington et. al., 1990 and Rosenberg et. al., 1990). The modified Leslie-Delury method is applied to estimate the biomass during the fishing season. The estimates of recruitment and catchabilities of fleets are used for the control of the fishery in the residual fishing season to keep minimum biomass of spawner and evaluate the quantity of efforts licensed in the next fishing season.

There are many valuable suggestions in the regulation applied in the Falkland Island waters, though the situations of fisheries and stock are different between the NAFO area and Falkland Island area. There are some difficulties to apply the same regulation to the NAFO waters; (i) it is difficult to use the Leslie-Delury model, because the offshore squid fishery is restricted in the small area compared with the squid distribution. (ii) It is difficult to collect the data and estimate abundance during the fishing season. There are more complicated fisheries in the NAFO waters including off-shore fishery, inshore fishery and mixed fishery. (iii) the TAC can not be changed in the middle of the fishing season under the present NAFO regulation system.

In conclusion, the most practical way is to continue the present management regime which has been operated well in early 1980s. In the future the management regime will be improved with the better information on the population dynamics of *Illex*.

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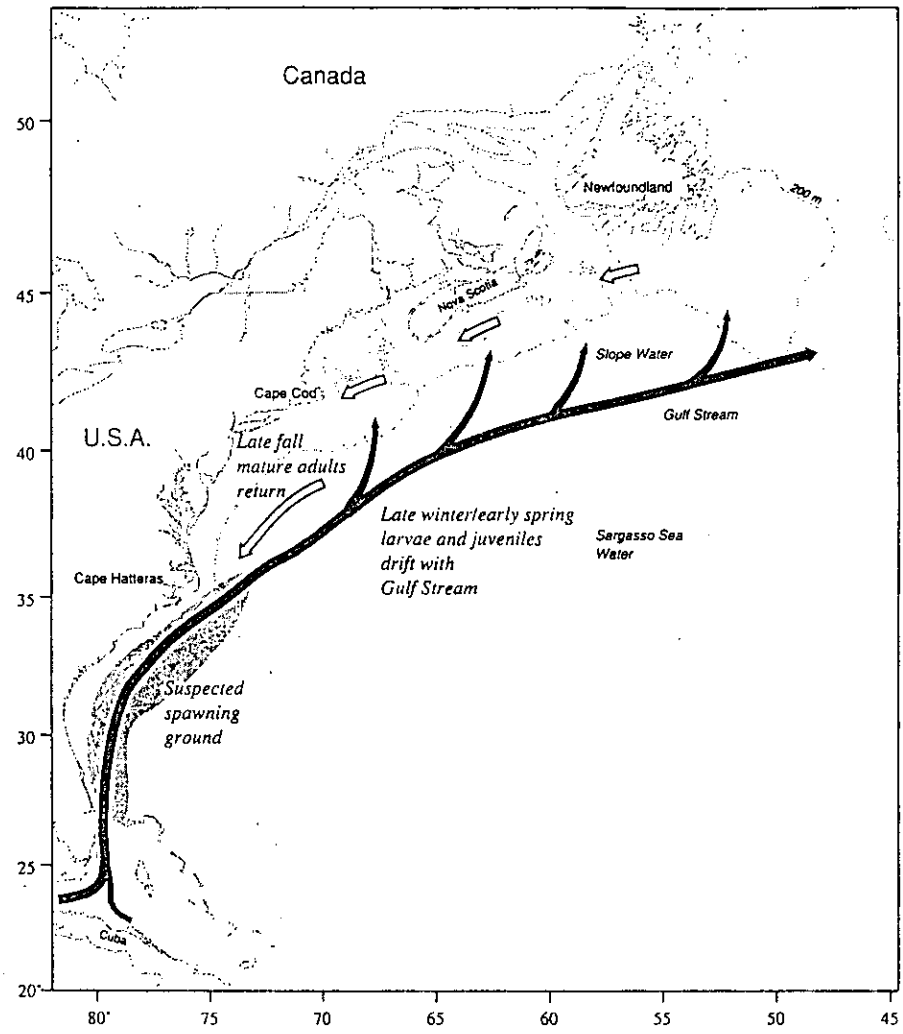

FIG. 1. Hypothetical migration path of *Illex illecebrosus* with passive Gulf Stream transport to the northern feeding grounds and active southward migration to the suspected spawning areas south of Cape Hatteras (cited from Black et. al., 1987).