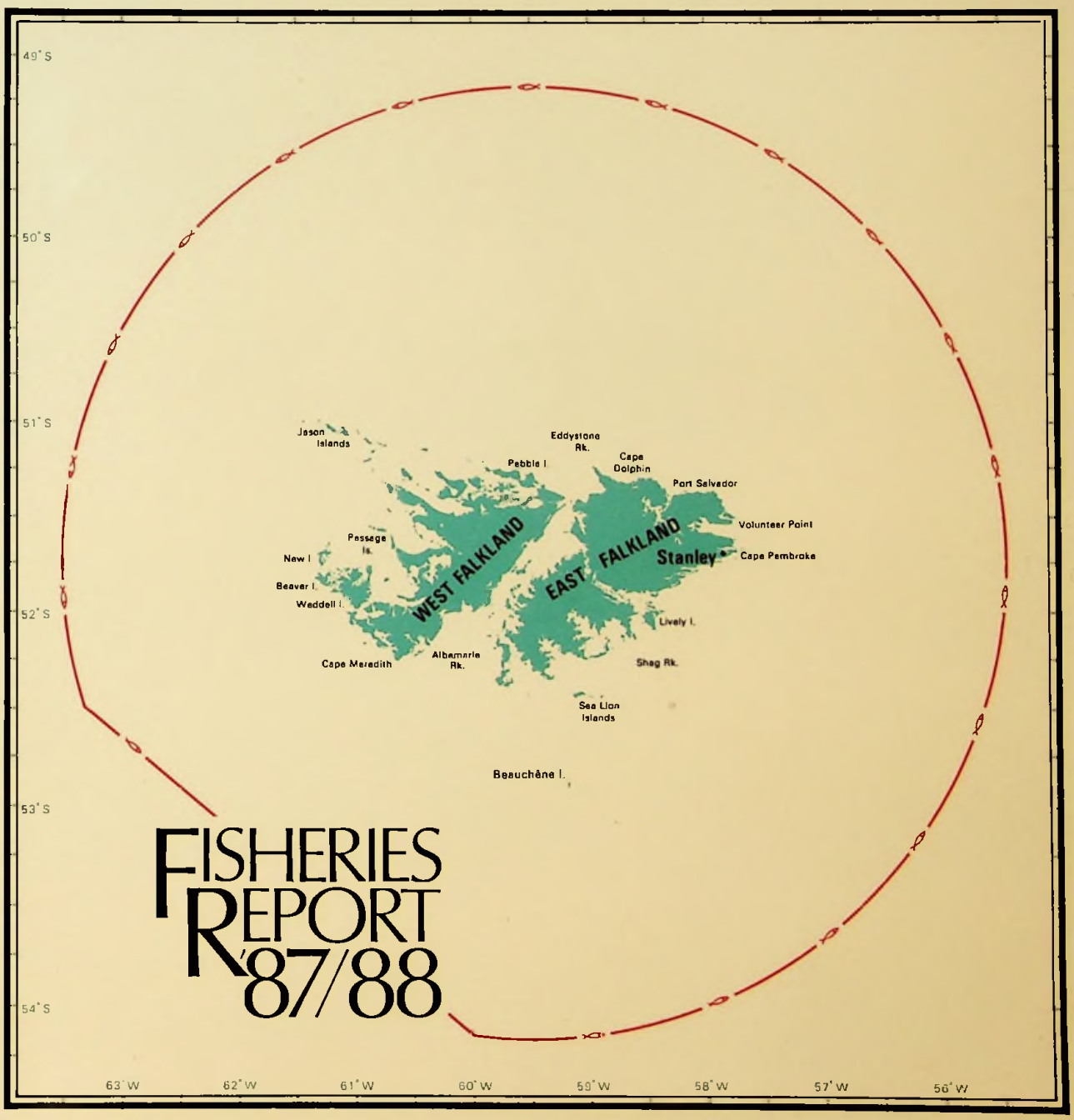
FALKLAND ISLANDS

INTERIM CONSERVATION & MANAGEMENT ZONE



FISHERIES REPORT '87/88

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Fisheries Department,
Falkland Islands Government,
Port Stanley, Falkland Islands.
Telephone: Port Stanley 2615
Facsimile: Port Stanley 2614
Telex: Port Stanley 2426

Falkland Islands Government Office,
29 Tufton Street, London SW1P 3QL.
Telephone: 01-222-2542
Facsimile: 01-222-2375
Telex 8950476 FIGLON

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CORRECTIONS

page 12, para 2. last word should read 'Mediterranean'.

page 15, para 2. second sentence should end 'box on page 6.'

page 26, para 2. third sentence should read 'Following this analysis, the number of vessels licensed to fish in 1988 was substantially reduced.'

INTRODUCTION

The South-West Atlantic supports one of the richest but, until recently, least developed fishery resources in the world. Concern about the increased level of uncontrolled fishing in the 1980's and the failure to secure multilateral co-operation on conservation led to the establishment of the Falkland Islands Interim Conservation and Management Zone (FICZ) in 1986.

The fishery's major resources are *Illex* squid, fished principally by Far Eastern and Polish fleets; *Loligo* squid and a variety of finfish species, fished mainly by the European vessels. 1987 and 1988 were abundant years for *Illex* the most important resource both in volume and total value. 1988 saw a decline in the level of the *Loligo* catch and a cut-back in the number of licences issued. Finfish stocks are now being studied more closely.

The management system reflects the particular situation of the Falkland Islands and the short lived and fluctuating nature of the squid species. To ensure that conservation targets are achieved fishing effort is controlled by limiting the number of vessels licensed to fish, and catch data is collected on a daily basis to ensure accurate and continuous monitoring of the state of the stocks. Co-operation between the fishing fleets and the Falkland Islands Government has been excellent.

Licence revenue was £13.7 million in 1987 and £16 million in 1988. In the financial year 1987/88 £6.5 million was spent on scientific work, general administration and policing. Continuing emphasis is placed on scientific research to develop greater knowledge of this new fishery.

This report covers the first two years of the operation of the FICZ, and describes the nature of the fishery, its management, scientific monitoring and research.

THE FALKLANDS FISHERY AT A GLANCE

MAJOR COMMERCIAL FISH SPECIES

Argentine Shortfin Squid	*Illex argentinus*
Common Squid	*Loligo gahi*
Red Squid	*Martialia hyadeshi*
Common Hake	*Merluccius hubbsi*
Patagonian Hake	*Merluccius polylepis (australis)*
Southern Blue Whiting	*Micromesistius australis*
Kingklip	*Genypterus blacodes*
Hoki / Whiptail Hake	*Macruronus magellanicus*
Red Cod	*Salilota australis*
Patagonian Toothfish	*Dissostichus eleginoides*
Falkland Herring	*Sprattus fuegensis*

FLAG VESSELS

Chile	Netherlands
France	Poland
Greece	Portugal
Italy	Spain
Japan	Taiwan
Rep.of Korea	United Kingdom

FALKLAND ISLAND GOVERNMENT LICENCE REVENUE COLLECTED

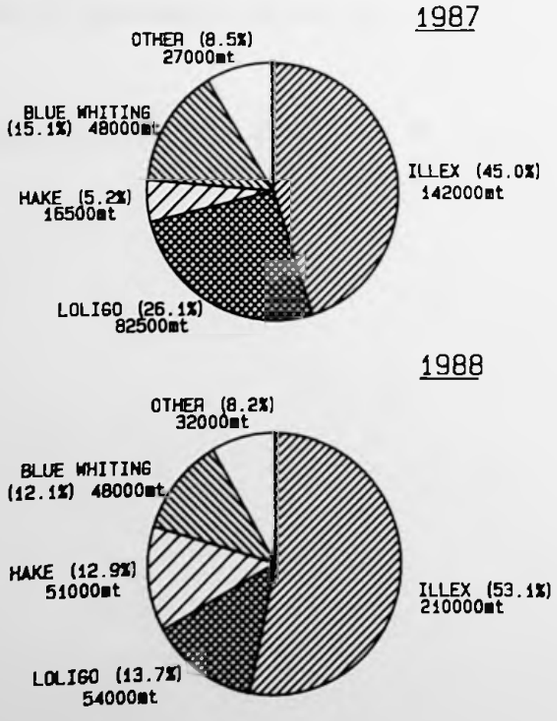
1987	1988
£13.7 million	£16 million

STANLEY FISHERIES Ltd. INVESTMENT INCOME

£7.2 million	£9.0 million

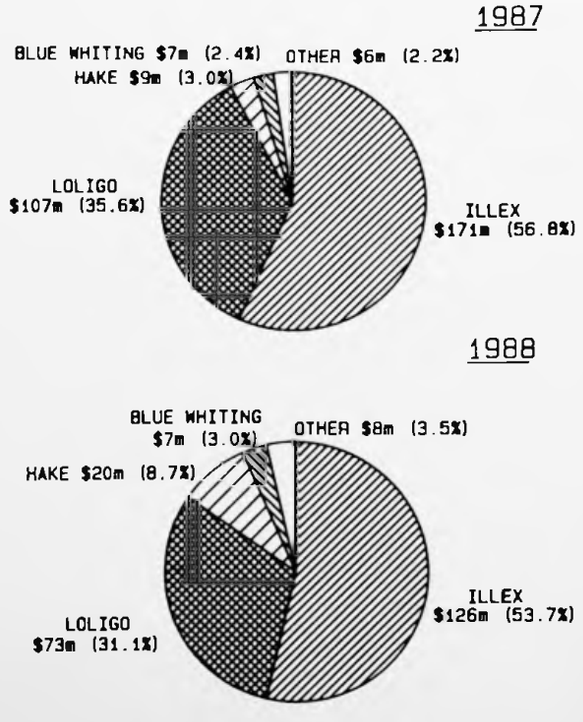
TOTAL CATCH BY SPECIES

(in metric tonnes)



ESTIMATED VALUE OF THE CATCH

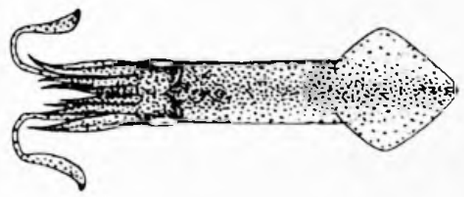
(in US dollars)



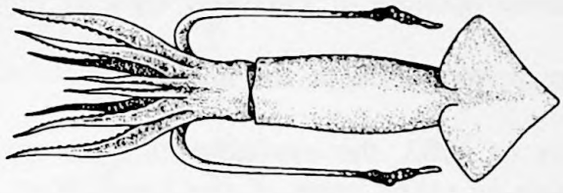
THE FISHERIES

Squid

The fisheries for squid are based on two species, the common squid (*Loligo gahi*), and the shortfin squid (*Illex argentinus*).



The common squid *Loligo gahi*



The shortfin squid *Illex argentinus.*

Both species are, like most squid, short-lived, spawning when about a year old and usually dying after spawning. The fishery in each year is therefore entirely dependent on the success of the spawning in the previous year and the assurance of a good spawning population has, therefore, to be a prime objective of management.

Two methods are used for fishing for squid: *Illex* is fished mainly by jiggers. These vessels are equipped with powerful lights and start fishing at dusk. The squid are attracted to the lights, and are caught on lures on lines attached to winches. The lines are electronically controlled and operate in a continuous motion, jerking the squid on board. Once on board, the squid are released from barbless hooks and flow down a chute to a processing deck, where they are frozen into blocks. A typical squid jigger can catch up to 80 tonnes on a good day and can hold about 300 tonnes before needing to tranship to a carrier vessel. Jigging vessels vary in size from 300 to 1500 Gross Registered Tons (GRT) as well as in the number of jigging machines they carry, and whether these machines operate one or two lines. A typical Far Eastern jigger is around 900 tonnes, with 90 jigging lines and a crew of 25.

Loligo as well as finfish are caught by trawlers, which range in size from 500 to 3000 GRT. A typical European trawler would be of 1500 GRT with a crew of 35, capable of catching some 40-60 tonnes of squid per day. There are a few combination vessels in the fishery, equipped for both jigging and trawling, their fishing method being determined by the prevailing conditions.

The largest fleets are from Japan, Republic of Korea, Taiwan, Poland and Spain. Japan and the Republic of Korea operate mostly jiggers, with a few trawlers and combination vessels, and are primarily interested in *Illex* for the domestic markets, where much of it is processed for food. Taiwan operates only jiggers, fishing for *Illex* which is sold on the world market.

Poland has fished in the South-West Atlantic since 1970, and operates trawlers, a few jiggers which have been converted from trawlers and combination vessels. The Poles are

interested in squid, but also catch southern blue whiting for their domestic market.

Spain began fishing in the South-West Atlantic in 1983, operating trawlers, and one jigger, with the main targets being *Loligo*, and hake, though some *Illex* is also taken. Several other European nations are beginning to take an interest in the Falkland fisheries. Italy, Portugal and Greece send trawlers for *Loligo* and trawlers from France and the Netherlands have fished in the area. Three United Kingdom registered vessels were granted licences in 1987 and eight in 1988.

The development of the fishery

Prior to 1982, the available data do not distinguish fishing around the Falklands from fishing in other parts of the South-West Atlantic . The first record of squid catches by distant water vessels appears to be in 1977, and by 1980 Japanese and Polish vessels were taking 10 - 20,000 tonnes. In 1982 the total squid catches from the South-West Atlantic exceeded 200,000 tonnes for the first time, with Poland alone taking 110,000 tonnes and Japan and Soviet Union also taking substantial quantities. It is likely also that in that year for the first time squid catches around the Falklands exceeded those from the more traditional grounds fished by Argentina and Uruguay further north.

The increased fishing activity in the region prompted two reports from the Food and Agriculture Organisation of the United Nations (FAO). In 1983 an ad hoc working group presented background information on the fisheries of the region and summarized research survey work on the potential of the resources (FAO 1983; Report of the Ad hoc Working Group on fishery resources of the Patagonian Shelf. FAO Fish.Rep. 297). This report was updated and extended by FAO in 1987 using catch data and assessment results contributed by Argentina, Uruguay, Japan, Poland, Bulgaria, GDR, the Republic of Korea and the United Kingdom (Csirke J. (1987); The Patagonian fishery resources and the offshore fisheries in the South-West Atlantic. FAO Fish.Tech.Pap 286). These FAO reports along with analysis of data collected by the Falkland Islands Government on activities around the Islands highlighted the concentration of the squid fishery within 150 miles of the Islands. By 1985, the annual catch of *Illex* alone in the South-West Atlantic was greater than 230,000 mt. In addition over 50,000 mt of *Loligo* was caught. *Illex* had emerged as the most important resource and, given the rapid increase to high levels of catch gave the greatest cause for concern.

With such a short history, and with evidence of significant variations between years, it is perhaps premature to talk about a typical pattern of fishing for either *Loligo* or *Illex*. However, so far two peak fishing seasons each year are evident. *Illex* is targeted by the fishing fleets of Japan, Republic of Korea, Taiwan and Poland during the first half of the year with peak catches in April and May. This fishery is confined to the north of the Islands. The *Illex* move south from feeding grounds well north of the Falklands early in the year (Figure 1). These feeding grounds at 46^{0}S also attract fishing vessels from January-March. However, catch rates (e.g. catch per day) tend to be lower on the northern grounds and the squid landed from that area are smaller and of lower value than squid caught later in the year further south.

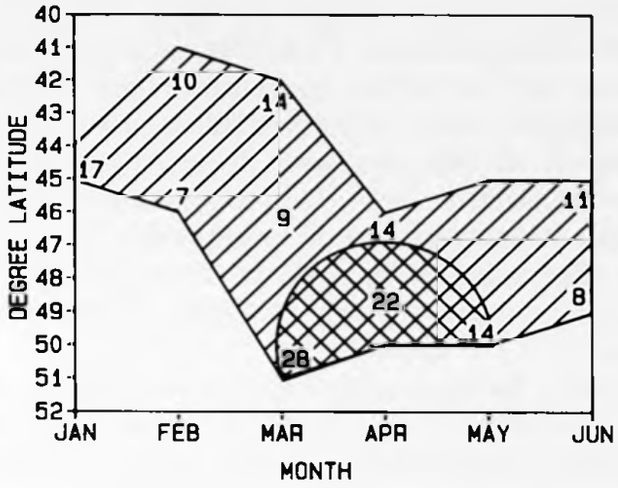


Figure 1 Schematic representation of the movement of the fishing effort directed at *Illex* during the fishing season

Fishing vessels move into Falklands waters in March and catch rates quickly build to a peak. After which, as the stock is fished and other predators take their toll, the catches decline. By June, catch rates are very low and the surviving *Illex* move out into deeper waters to spawn. Figure 1 gives a schematic representation of the movement of the fishing effort directed at *Illex* during the fishing season. The lightly shaded areas depict the range of the fishery in each month while the dark shading shows the areas and months with the heaviest effort. The numbers within the shaded area represent the average catch rates in tonnes per hour for the given latitude and month.

There appears to be considerable variation from year to year in the proportion of the total stock which enters the Falklands fishing zone. In 1988, many more *Illex* moved into Falkland waters than in 1987, and the migration seems to have lasted longer, giving a broader peak in the catch rates. Total *Illex* catches were 209,000 tonnes compared with 140,000 in 1987 (Figure 2).

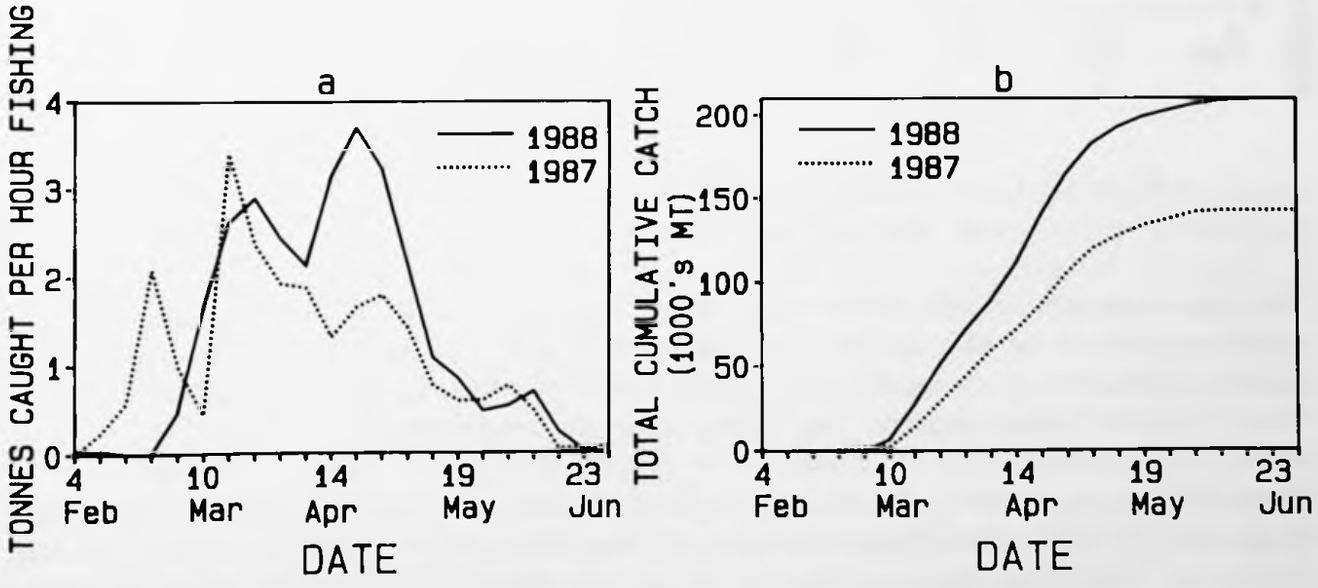


Figure 2 Comparison of catch statistics for *Illex* in 1987 and 1988
a) Average catch rate b) Cumulative catch

Loligo are caught in both fishing seasons. From February to June vessels from Poland, Spain, the UK and the other EEC countries, concentrate their trawling activities for *Loligo* around Beauchene Island to the south of East Falkland. Two thirds of the annual catch is taken during this period. In the second season, from August to October, the squid are more dispersed. They are fished in an area that stretches from Beauchene Island around the east coast of the Falklands to an area to the north east of East Falklands. The relation between the groups of *Loligo* taken in two seasons is unclear, but the most recent data suggest they consist of a single stock with two different breeding seasons.

In 1987 the pattern of *Loligo* fishing during the first season was very similar to that of *Illex*; a simple pulse of migration gave increases in catch rates up to a peak in the second half of March, followed by a steady decline. In 1988 catch rates were moderately good right at the start of the season, but never built up to a high level, and by March were very much less than in 1987. As a result many of the vessels switched to fishing for other stocks (mainly hake and *Illex*). However, there was not much decline in catch rates, which remained reasonably steady until the close of the fishery in June. The first season catch in 1988, 48,000 tonnes, was down on the 64,000 taken in the same season in 1987. (Figure 3).

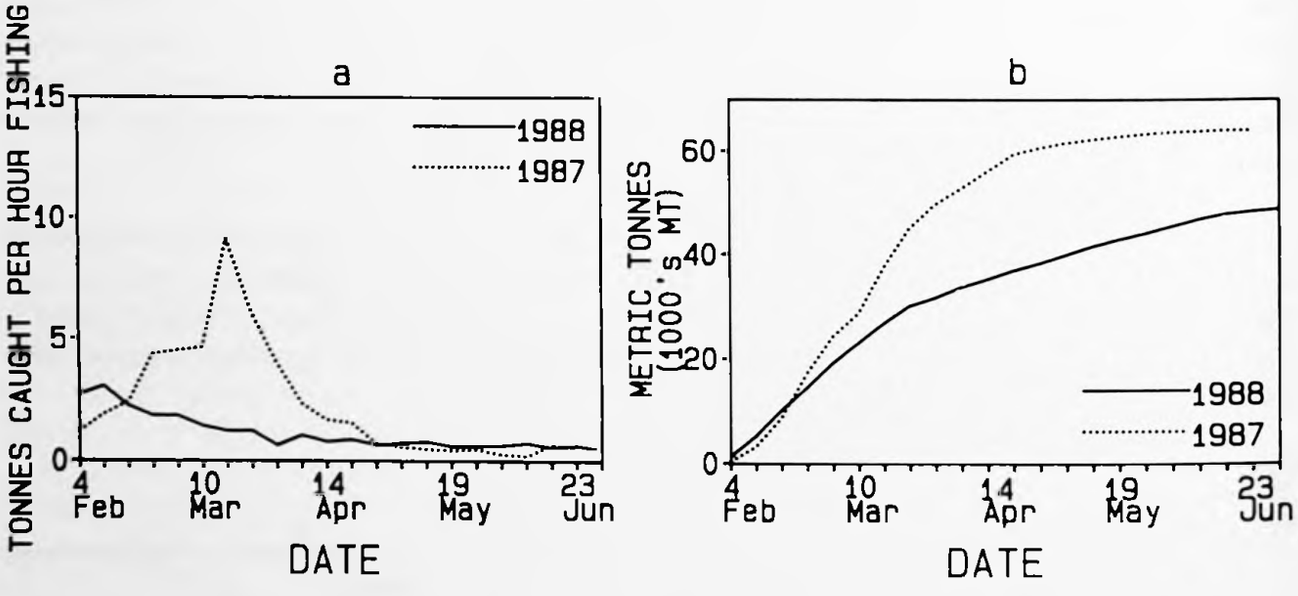


Figure 3 Catch statistics for *Loligo* in the first season 1987 and 1988
a) Average catch rate b) Cumulative catch

The inconsistency in this picture for *Loligo* probably results from variability in the migratory pattern of this species. Preliminary research results indicate that, unlike *Illex*, which migrates in from outside the FICZ, *Loligo* is probably migrating from shallower inshore waters to deep waters. The fishing focuses on aggregations of squid at one depth. Some evidence that *Loligo* are continuously moving through this "target" depth comes from examining the size of the animals in the catches through the season. There is little change in the size of *Loligo* from February to June. *Illex*, on the other hand, shows the expected pattern of increasing size over time as the animals grow. Of course, this does not mean that *Loligo* do not grow, but rather that they are only vulnerable to the fishery over a small range of sizes (11-14 cm mantle length). Research trawling catches of small *Loligo* in shallower water and larger animals in deeper water corroborates this idea. It follows

that, if growth is very variable, squid will reach this vulnerable size and depth throughout the season.

The second *Loligo* season, during August and September, appears to be based on a second brood of squid, which are small at the beginning of the season, and grow rapidly to spawning size by October/November. In 1987 there was no clear trend in catch rates, which remained moderate around 1 tonne/hour for most of the season. The rise in catch rates in October may indicate a third brood. In 1988 the catch rate at the beginning of the season was reasonably high at some 700 kg/hour, it then steadily declined to about 200 kg/hour at the end, a pattern consistent with a single brood of squid entering the fishery in the second season. As little additional fishing occurred after the end of the season it is not possible to determine whether the rise in catch rates seen in 1987 would have been repeated. The total catches for this season in 1987 amounted to some 18,000 tonnes, in 1988 the total catch was only slightly in excess of 5,000 tonnes (Figure 4).

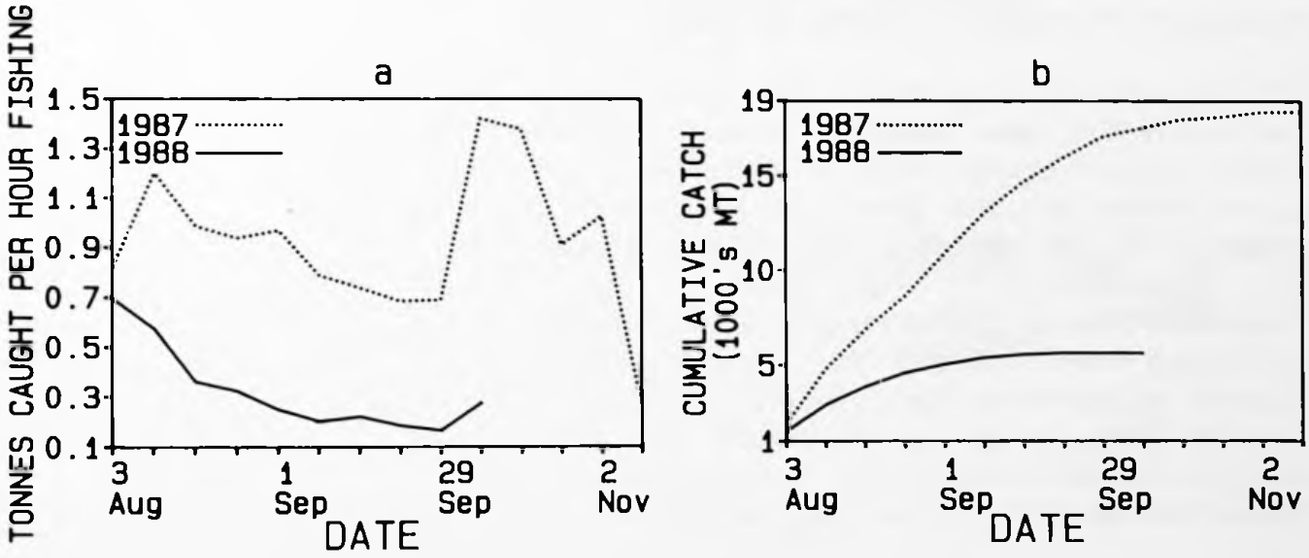


Figure 4 Catch statistics for *Loligo* in the second season 1987 and 1988
a) Average catch rate b) Cumulative catch

Marketing the catch

The main markets for squid are in southern Europe, and the Far East, particularly Japan. A few of the fishing vessels take their catches (frozen on board after preliminary processing) directly back to their home ports, but the great majority of the catch is transferred to carrier vessels. Many of the foreign fleets use Berkeley Sound, to the north of Port Stanley, for this transhipment, as well as for the re-supply of the fishing vessels with fuel and stores. Others use Montevideo, Uruguay, for transhipment and for exchange of crews, though this involves a longer absence from the fishing grounds.

Japan has the largest market for *Illex* and this is protected by import quotas. Thus the price for *Illex* obtained by Japanese vessels is substantially higher than the world market price. The difference varies from year to year, but can be as high as 100%.

Foreign companies seeking to sell *Illex* in Japan can only do so once the Japanese fleets

have sold their catches. The Japanese Government estimates a demand, then calculates the likely catch of the Japanese vessels, and then sets an import quota at some proportion of the difference.

The Republic of Korea market is also protected, although not as rigidly as the Japanese. Both Republic of Korea and Taiwanese fleets attempt to sell their catch on their own markets, as well as in Japan and the Meiterranean.

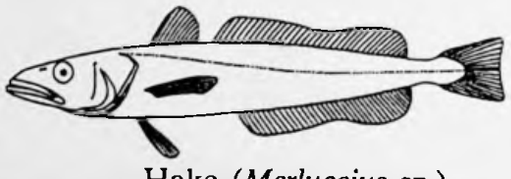
Spain is the main Mediterranean market, but Greece and Italy also import *Illex*. Spain buys *Illex* caught by Polish, Soviet Union and Far Eastern vessels.

Products from *Illex* vary during the season as the squid grow. Small *Illex* may be marketed whole to companies wishing to use it to bait hooks on the long lines of tuna vessels. Larger *Illex* are processed into "tubes" - the body of the squid once the tentacles and innards have been removed. Tentacles are sold separately, and there are substantial markets for them in the Far East, particularly in Hong Kong and Singapore.

The price of *Illex* has fluctuated dramatically over the past few years, with 1988 being a particularly poor year. The price has been depressed by high catches over the past two years. Prices are usually quoted as "FOB Falkland Islands" (free on board), or as delivered to a specified port, that latter price being the FOB plus freight charges. *Illex* fetched roughly US.$1,200 a tonne in 1987, US.$600 a tonne in 1988.

Spain dominates the Mediterranean market for *Loligo*, and much of this market is supplied by Spanish vessels fishing off the Falklands. Vessels from Poland, the Soviet Union, the Republic of Korea and EEC countries also supply this market. United Kingdom vessels catching *Loligo*, market it in the Mediterranean as there is little demand for squid in the UK. The smaller *Loligo* is sold unprocessed and tends to be cooked whole. This squid fetched around US.$1,300 per tonne in 1987 and slightly more in 1988.

Finfish



Hake (*Merluccius sp.*)

Much the most important finfish on the Patagonian shelf are the hakes (*Merluccius spp*). The scientific study of this fishery is made more difficult by the existence of two very similar species, common and patagonian hake, which are not distinguished by the fisheries, or in most commercial statistics. Prior to the late 1970's fishing was concentrated in the River Plate Basin and was dominated by the short-range fishing fleets of Argentina and, to a lesser extent, Uruguay, catching mainly common hake, though there was a short-lived fishery by the Soviet Union which produced a peak of over 600,000 tonnes in 1967, but which ended when Argentina moved to extend its fishing limits.

In 1979, Argentina introduced larger factory vessels into the hake fleet, allowing the fishery to move further south to include the area around the Falklands, where they fished

until 1982. By that time other nations fishing for hake in the area included the Federal Republic of Germany, Japan and the Soviet Union. Total catches of hake in the South-West Atlantic between 1970 and 1986 are shown in Figure 5.

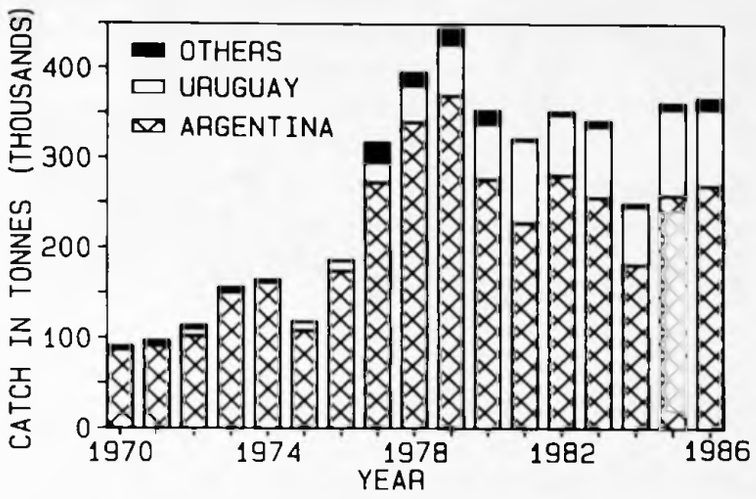
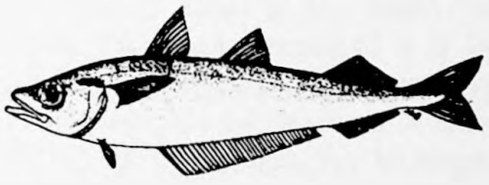


Figure 5 Catches of hake in the South-West Atlantic since 1970

The other finfish species that has supported a directed fishery in the South-West Atlantic is the Southern blue whiting (*Micromesistius australis*). This is found further to the south than the hakes, and is also less attractive on the world markets. Prior to the late 1970's it was unexploited. The first recorded catch was some 2,000 tonnes taken by Poland. The trends in catches since that time are shown in Figure 6.



Southern Blue Whiting
(*Micromesistius australis*)

A number of other finfish species occur around the Falklands. The most significant are probably hoki (*Macruronus magellenicus*), red cod (*Salilota australis*) and kingklip (*Genypterus blacodes*). These, like blue whiting, are all southern species, and the same or similar species occur in the waters around New Zealand and southern Africa, where they are attracting increasing attention. Their contribution to the South Atlantic fisheries is likely to increase as they become more acceptable on the international markets.

All the finfish appear to live much longer than squid, though the life cycle of some of the species has not yet been fully studied. Catches of blue whiting include fish from the first year class (in small numbers) up to as old as 30 years. In the recent samples the fish born in certain years - 1965-68, 1970 and 1973-74 - have appeared in particularly large numbers. It may be that fish of these ages are particularly accessible to the fishery, but it is more probable that conditions for spawning and the survival of young fish were unusually favourable in these years. If the latter is true, the future of the fishery will depend on how often similar conditions recur.

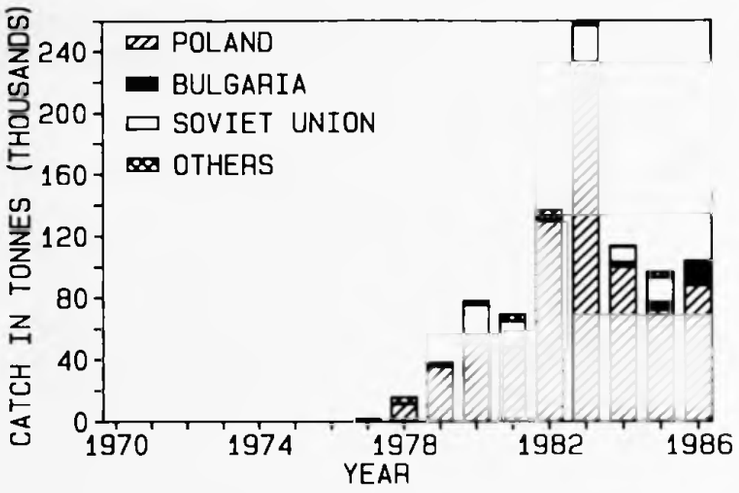


Figure 6 Catches of Southern Blue Whiting in the South-West Atlantic since 1979

Being longer-lived, the finfish have more opportunity to move over considerable distances - and more particularly between the waters around the Falklands and the other parts of the Patagonian shelf. The common hake is distributed mainly to the north of the Falklands, being found as far north as the River Plate. Though it is not clear whether the hake forms a single stock, or if there is some north-south separation, it is probable that the fish around the Falklands are part of a larger stock, and the success of the fisheries in Falkland waters is, to a great extent, determined by fishing in other areas. As can be seen in Figure 5, most of the catches of hake (both species combined) are taken by Argentina, with much of the rest by Uruguay.

The Patagonian hake is found further south, and the same species is found off Chile. In recent years little of the hake reported as caught around the Falklands is of this species. Hake are taken all around the Islands during most of the year.

The southern blue whiting stocks are concentrated to a much greater extent around the Falklands, and it has been estimated that some 90% of the stock is found within the FICZ. Since the fishery began in 1977 there has been a shift in the main fishing grounds. Up to 1982 fishing was mainly on fish that were feeding to the east and north-east of the Islands, but since then most fishing has been on the spawning concentrations to the west and southwest where the catch rates are high during August, September and October.

The hake are sold on the world wholefish market but, compared with other species of hake, the quality is poor and the prices fetched are relatively low. The Patagonian hake fetches a slightly higher price than the common hake. In 1987 hake from the Falklands brought about US.$500 per tonne, but only some US.$350 per tonne in 1988. The flesh of the blue whiting contains many parasites, and this makes them difficult to sell. The bulk of the catch is taken by Polish vessels, and sold on their domestic market.

Other resources

Several species of crab occur around the Falklands. A pilot commercial fishing project was begun in 1987 and operations have been centred on Choiseul Sound, East Falkland, The catch consists almost exclusively of the false king crab (*Paralomis granulosa*), with occasional individuals of the larger and more valuable southern king crab (*Lithodes antarcticus*) being found in the crab pots. The catch is processed on shore in Port Stanley.

Southern King Crab
(*Lithodes antarcticus*)

The value of the fisheries

In terms of both volume and value the dominant species in the fishery in 1987 and 1988 has been *Illex*. This can readily be seen in the box on page 3 . The next most important species is *Loligo* and together these two squid contributed over 70% of the catch in weight and 90% in value in 1987. This situation is unlikely to change in the near future as the potential of other stocks in the area is limited. An exception is the blue whiting which in biological terms is capable of very substantial production. However it is of low value due to the heavy infestation of a parasite which renders it unpalatable. Unless this parasite problem is solved, blue whiting is unlikely to produce substantial benefits to the fishery.

The importance of the two squid species presents management problems as both are short lived and such species, even in the absence of fishing, are known to fluctuate substantially in abundance. In the last two years the stock of *Illex*, the main species, has been particulary abundant. Even with successful conservation measures it is unlikely that the stock in future years will be as high. To some extent these stock fluctuations, which are reflected in the catch, are compensated for by price changes. In abundant years the market price tends to be low in less abundant years it is higher. Nevertheless, it is by no means an exact correlation and the price is affected by the catch of squid elsewhere in the world.

MANAGEMENT

By 1985 it was clear that fisheries around the Falkland Islands and especially the *Illex* squid fishery, had entered a phase of very rapid expansion, and that problems of management and conservation were likely to arise. The United Kingdom and Falkland Islands Governments had a choice of the following options:

- to do nothing, and hope that economic factors would put a brake on expansion before serious damage was done to the resource

- to promote the implementation of appropriate management measures through some form of international cooperation

- to extend jurisdiction over the resources and impose unilateral controls.

The first of these was clearly unacceptable. It has been the almost universal experience that when a profitable fishery develops on a resource supplying, like squid, a world market, that fishery will expand until it has a severe impact on the resource. At best, this will result in catch rates falling to the point at which they are so low that the fishery is no longer profitable, and expansion ceases. At worst, the stock may collapse, and fall to the point at which commercial fishing is no longer possible. Fears of such a collapse were increased by the short life of squid, so that one or two poor spawning seasons could lead to such a collapse within one or two years.

Attempts by the United Kingdom Government to achieve a multilateral agreement on conservation of the fish stocks were unsuccessful. The *Illex* squid were considered to be under particular threat from the increasing level of fishing activity and in 1985 the United Kingdom Government proposed to countries involved in the fishery that there should be voluntary restraint on the part of their fleets. Figure 7 shows how the effort changed between 1984 and 1986. Clearly the attempt at voluntary restraint was having little or no effect.

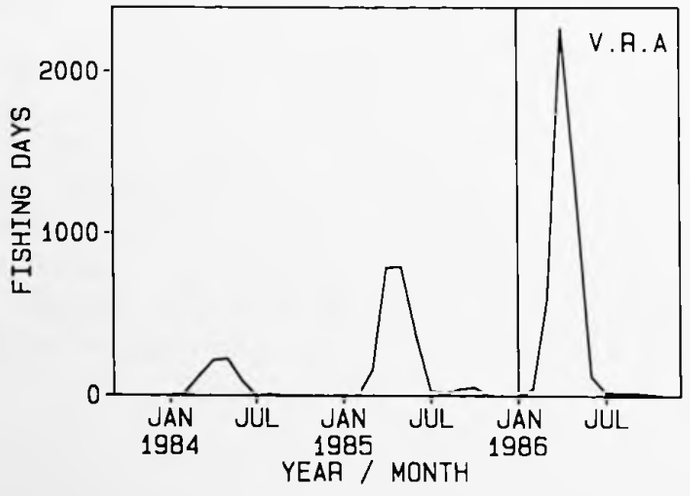


Figure 7 Jigging effort around the Falkland Islands from 1984 to 1986.
The voluntary restraint agreement applied to the period from January 1986

By that time, concern about the stocks had led the Falkland Islands Government (FIG) to ask the Renewable Resources Assessment Group (RRAG) at Imperial College of Science Technology and Medicine, London, to make recommendations for the management of the resources. Earlier FIG had set up a team of scientific observers to work on the fish stocks. The data and analyses produced by these groups indicated that the *Illex* stock was in danger of being over-exploited, especially if fishing effort were allowed to increase.

Accordingly on 29 October 1986 the United Kingdom Government declared that the

Falkland Islands were entitled under international law to fishery limits of a maximum of 200 nautical miles from the base lines from which the breadth of their territorial sea is measured. These limits are subject to the need for a maritime boundary with Argentina in areas where national claims overlap. Within these limits the Falkland Islands Interim Conservation and Management Zone (FICZ) was established covering an area of 150 nautical miles radius from a point in the centre of the Islands (excepting an area in the southwest).

Basic objectives

In managing the FICZ, the Falkland Islands Government had three main objectives.

- to conserve the resource, and thus ensure its continued productivity
- to maintain the economic viability of the fisheries as a whole
- to enable the Falklands to enjoy greater benefits from the resource.

The dynamics of squid stocks are not well understood, and while the studies of the Falkland squid stock are being intensified, it is not possible to categorically state the precise conditions needed to ensure high productivity of the stocks. A key factor is maintenance of the spawning stock at a level high enough to have a good chance of producing a strong brood in the next season. For the present, therefore, a conservation target has been chosen which is intended to ensure that the spawning stock does not fall below 40% of the level that would have occurred in the absence of fishing. Given that the individual squid can produce a large number of eggs, a very small stock has the potential of producing a large number of offspring, so this target should be a conservative one. Computer simulation studies incorporating the available information on squid biology reinforce the view that the 40% target is conservative.

Many other coastal states, faced with similar opportunities to the Falklands, as a result of establishing exclusive economic zones (EEZs), and jurisdiction over rich fisheries currently being fished by foreign distant-water fleets, have made a principal objective in their management schemes the replacement of these fleets by domestic vessels. In the Falklands such an option is clearly impractical. At the peak of the season there may be 225 fishery and supply vessels operating around the Falklands; and their crews totalling some 3-4000 people, well in excess of the total population of the Falklands. Though it is hoped that an indigenous, Falkland-based, fishery will develop, for the foreseeable future most of the fishing will be done by foreign vessels. The Falklands stands to increase the benefits it obtains from these vessels from transhipment, supply and support facilities, but the greatest benefits will be obtained from licence fees.

It might appear that the imposition of substantial licence fees would threaten the economic viability of the foreign fishery, and would therefore be strongly opposed by the fishing nations. This need not be the case. The licence scheme aims to reduce the total fishing effort well below that which would occur in an open-access, un-managed fishery and thus to achieve much higher catch rates per vessel. In simple terms it makes better the

catch per vessel. It may be an exaggeration to say that fishing countries have welcomed the control and licensing system that has been introduced, but they do recognise that it does have positive aspects for them.

The mechanics of management

Once the principle of limiting the amount of fishing had been established, there was a choice between measuring this in terms of the output (the tonnes of fish or squid caught) or input (the number and size of vessels etc). In many international fisheries the former measure has been used and limits have been expressed in terms of Total Allowable Catch (TAC). This has some advantages, e.g. in facilitating the comparison between countries and in allocating shares in the TAC, but there are disadvantages, most obviously, in the problems of enforcement and control, and in encouraging mis-reporting of the quantities caught.

The decision was therefore taken, that the basic licensing system would be in terms of inputs and that fishing effort would be controlled by limiting the number of vessels licensed to fish in the FICZ. Because of the complexities of the fishery, a number of different types of licences were issued, specifying the season, area, and type of fishing that was permitted. This enabled there to be a reasonable balance of fishing between the more valuable, but more immediately threatened stocks of squid and the less valuable finfish. The nature of these licences in 1987 and 1988 is set out in Table 1, which shows that there were some changes in 1988, in the light of experiences gained during the 1987 fishery.

Applicants for licences are required to provide full details of the vessels concerned covering size, power, fishing gear, and freezing capacity. This information is used in assessing the fishing power (catching ability) of the vessels and in establishing the appropriate level of licence fee.

The catching ability of the vessels applying for licences is then set against the conservation limits and the total allowable fishing effort, in terms of licences for specific vessels, can be calculated. To date the demand for licences, especially for the *Loligo* and *Illex* fisheries, has greatly exceeded the number available. Applications are considered by the Executive Council of the Falkland Islands Government and the allocation decided upon. The allocation of licences in 1987 and 1988 is shown in Tables 2 and 3.

In 1987 the main conservation concern was over *Illex*, and the chief factor in setting the number of licences was the requirement to maintain the *Illex* spawning stock at not less than 40% of its unexploited level. From past records it was possible to calculate how many vessels of a standard fishing power could operate without exceeding this level. For convenience the standard has been taken as the smallest class of vessel in each licence category in the fishery. Thus a larger and more powerful vessel capable of catching three times as much fish during the season would be counted as three standard vessel units. The calculations of performance (or relative fishing power based on the previous season's records of catch and amount of fishing) are used both in setting the upper limit to the

Table 1

First season 1987

A North of $51^{0}20'$. All species but main species Illex. 1 February to 30 June.
B South of 51^{0} 20'.All species but main species Loligo. 1 February to 30 June.
X All species North and South.

Jiggers were only licensed to fish in the area to the north of $51^{0}20'$ for the period February 1 to June 30 1987.
Trawlers were allowed to apply for more than one area per vessel.

Second season 1987

A All species West and East of 60^{0}. 1 July to 31 December
B Finfish. West and East. 1 July to 31 December
C Finfish. West only. 1 July to 31 December.

Only trawlers fished for the second season.

First Season 1988

For the 1988 season a finfish licence was introduced for the first time

A Finfish only. 1 January to 30 June, but could be granted to 31 December
B North of 51^{0} 20' All species 1 March to 30 June. Main target Illex. Licences issued to jiggers, trawlers and combination vessels.
C South of $51^{0}20'$.All species 1 February to 30 June Main species Loligo. Granted to trawlers and combination vessels.

It was possible to have a finfish licence in addition to B or C. It was also possible to have a B + C licence but a large premium was charged in addition to the two licence fees.

Second Season 1988

X All areas, all species, 1 August, to 30 September
Y All areas, finfish, 1 July to 31 December
Z West area finfish. 1 July to 31 December

Vessels were allowed to have Y or Z licences in addition to the X licences which were for two months only.

Table 2

FIRST SEASON 1987

	North All Species Illex	South All Species Loligo	All areas North & South All Species	Total
FLAG VESSELS				
France	0	0	1	1
Greece	0	1	0	1
Italy	0	2	4	6
Japan	58	6	7	71
Republic of Korea	25	0	0	25
Netherlands	0	2	0	2
Poland	14	12	14	40
Spain	1	33	2	36
Taiwan	30	0	0	30
United Kingdom	0	3	0	3
Total	128	59	28	215

SECOND SEASON 1987

	All Areas All Species	All Areas Finfish	West Area Finfish	Total
FLAG VESSELS				
Greece	1	1	0	2
Italy	2	5	0	7
Japan	6	14	0	20
Republic of Korea	0	5	0	5
Poland	0	0	30	30
Spain	17	24	0	41
United Kingdom	1	5	0	6
Total	27	54	30	111

Table 3

FIRST SEASON 1988

FLAG VESSEL	Finfish Only	North All Species	South All Species	Total
France	0	0	1	1
Greece	0	0	2	2
Italy	0	0	3	3
Japan	6	63	0	69
Republic of Korea	11	16	0	27
Netherlands	0	0	1	1
Poland	29	23	6	58
Portugal	1	0	3	4
Spain	26	6	16	48
Taiwan	0	25	0	25
United Kingdom	9	8	8	25
Total	82	141	40	263

SECOND SEASON 1988

FLAG VESSEL	All Areas All Species	All areas Finfish	West Area Finfish	Total
Greece	2	0	0	2
Italy	3	0	0	3
Japan	4	5	1	10
Republic of Korea	2	4	0	6
Norway	0	1	0	1
Poland	3	0	30	33
Portugal	1	1	0	2
Spain	15	32	24	71
United Kingdom	8	8	0	16
Total	38	51	55	144

total number of licences issued, and in setting the level of licence fee for each size and type of vessel. Similar principles apply to the licensing of vessels for *Loligo* and finfish, and although the data to permit the appropriate calculations to be made were almost non-existent in 1987, it has been built up since.

An important condition on holding a licence is that the vessels are required to make daily catch reports to the Fisheries Department by telex or radio, giving their position and the quantities and species of fish caught within each 24 hour period. Vessels are also required to maintain fishing log books providing details of the weather conditions, fishing activity, catch by species and size and the manner in which it is processed.

Surveillance and policing

The responsibility for ensuring that fishing within the FICZ is carried out in accordance with the management regulations lies with the Falkland Islands Government's Fisheries Department. The Department has a relatively small staff considering the size of the task and in comparison with similar agencies in other countries, consisting of a Director of Fisheries, Chief Inspector, four Senior Fisheries Officers, a Licensing Officer, a Senior Fisheries Scientist, four scientific observers and office support staff. During the period of greater fishing activity, in the first season of each year, the scientific staff is supplemented by the recruitment of temporary observers.

The expenditure of the Department on policing, scientific work and general administration was £6.5 million in the financial year 1987/1988.

To assist in the setting up of the surveillance operation in the first few months of 1987, the Falkland Islands Government was able to call on the Ministry of Agriculture Fisheries and Food in the United Kingdom, which provided both professional advice and seconded experienced fishery protection officers, whilst arrangements were made for more permanent staffing.

Surveillance is carried out by a Dornier 228 aircraft and two chartered patrol vessels, The "Falklands Desire" and the "Falklands Right" (their names being derived from the Falkland Islands motto "Desire the Right"). In addition to her surveillance role the "Falklands Right" has a research capability and has been used for surveying *Loligo* and hake stocks and for mesh selection trials.

During the first season of 1987 the distribution of the fish stocks was such that unlicensed vessels operating outside the FICZ achieved reasonable catches and there was little or no pressure from illegal fishing activity. The patrol vessels and fishery officers were principally involved in vessel inspection, advising fishing skippers on the regulations, and placing scientific observers on board fishing vessels. As a result of this experience a system of individually briefing fishing skippers when they collect their licences from the Fisheries Department in Port Stanley was introduced, which resulted in much improved catch reports and has reduced the requirement to board the vessels at sea.

In the first season of 1988 a large proportion of the *Illex* stock migrated into the FICZ, with the consequence that the catches outside the zone were poor and the incentive for unlicensed vessels to attempt illegal fishing was increased. In response to this situation patrol plans were developed with both patrol vessels and the Dornier aircraft working in concert. A number of arrests were made and successful prosecutions brought against vessels for illegal fishing.

The Department provides assistance to vessels with sick or injured crewmen requiring medical treatment, and liaises with the military authorities in cases requiring the deployment of search and rescue helicopters. In 1988 some 800 foreign seamen were treated by the King Edward VII Memorial Hospital in Port Stanley.

The Fisheries Department is also responsible for monitoring the activities of vessels using Berkeley Sound for bunkering or transhipping, frequent visits being made by the harbour patrol launch "Warrah". Navigational aids and a twenty four hour radio watch are being established to improve the services for the fishing fleets.

Revenues

The revenue from licence fees was £13.7 million in 1987 and £16 million in 1988. Prior to the establishment of the FICZ revenue deriving from fishing activity was only obtained through the payment of harbour dues and transhipment fees (introduced in April 1986) by vessels using Berkeley Sound. In 1986 income from these two sources amounted to some £652,000.

In addition to licence fees an important source of revenue has come from joint ventures. In 1987, Stanley Fisheries Limited (SFL), a wholly-owned subsidiary of the Falkland Islands Development Corporation, entered into joint venture arrangements with 17 companies or associations representing the Falkland Islands, Greece, Italy, Japan, New Zealand, Republic of Korea, Spain, Taiwan and the United Kingdom.

Locally registered and controlled companies were formed by a shareholding of 51% by SFL and 49% by the fishing company. The funding of these companies was provided in total by the fishing companies by way of joint venture "premiums". In 1987 and 1988, the licence fee payable to the Falkland Islands Government was matched by an additional fee of the same amount payable into a joint venture in association with SFL - the so-called joint venture premium. In the past, joint venture companies applying for licences were given preference within any national allocation. In 1987, the total income derived from the joint venture premiums was £7.2 million. In 1988 it was £9 million.

The income derived has been used for investing in the development of the commercial side of the fishery; to establish new related businesses providing services to the fishing fleets such as fuel, agency services, housing and office accommodation for fisheries personnel.

RESEARCH

If the Falkland Islands are to continue to increase the benefits obtained from their fisheries resources, and to ensure that these resources are properly managed and conserved, the administrative work of management has to be backed up by research. Before the establishment of the FICZ the Falkland Islands had very limited scientific capacity in the specialised fields of fisheries science and stock assessment. The research work has therefore been largely contracted to RRAG in Imperial College, but as the volume of research has increased other groups in the United Kingdom and elsewhere have become involved, including a growing scientific capacity in the Falklands themselves.

The research work is concerned with three main fields - the real-time monitoring of the fishery, the assessment of the squid and finfish stocks, and other biological research.

Monitoring

The monitoring of the fishery uses three sources of data - the daily radio or telex reports from the fishing vessels; their fishing log books, and the biological data gathered by the observers. These observers are distributed on fishing vessels throughout the FICZ to sample as wide a range of the resource as possible. Squid and fish are measured to estimate the size composition of the catch; the sex and maturity are recorded; and finfish otoliths (a small bone in the head on which growth rings form) are removed for later age determination. Altogether these programmes generate a very large amount of data, and this is ultimately stored on computers at the Fisheries Department and Imperial College.

The daily radio reports are first received by the Fisheries Department in Stanley, where the data are entered onto the computer and checked for errors and inconsistencies. Each week a computer disk containing a week's reports is then sent to RRAG in London and incorporated into the main data base used for monitoring the fishery and assessing the stocks. The data are tabulated by catch and effort for each vessel size class in each national fleet for each species. Maps of catch and catch rates of each species are drawn by computer to monitor the movements of both stocks and fleets.

Fishing logbooks of vessels are collected each month by the fisheries officers. They are computerised by a commercial data entry company on contract. Data tapes are then sent to RRAG for analysis on the Imperial College mainframe computer. The logbook reports are compared with radio reports as a check on data quality. The log books also contain information on processed fish products which is tabulated so that different vessel operations may be compared.

Biological data gathered by the observers are entered into the computer at the Fisheries Department and tabulated. A computer disk is sent once a month to RRAG for inclusion in the assessment analyses. Computer facilities at the Fisheries Department are being updated and expanded, with a new software system to be added for the coming season. Six micro computers have been purchased by the Falkland Islands Government for use under a local area network system.

Stock Assessment

Squid

The immediate task of the stock assessment scientists is to keep the day-to-day data received from the monitoring programme under review to ensure that the fishery is progressing in the expected way, and in particular that the stock abundance is not starting to fall towards a dangerous level.

The main input data to this is the corrected catch per unit effort, i.e. the catch per hour trawling, or catch per jigging vessel per day, corrected for fishing power (tonnage of trawlers, number of jigging machines etc). When properly corrected this information reflects the size of the stock at the time and can be combined with biological information on the growth of the individual animal (squid or fish) and the losses due to natural causes (predation, disease etc) to provide estimates of the current biomass (the weight of animals present on the fishing grounds) and the escapement (how many animals will be present at the end of the fishing season). This latter is usually expressed as a percentage of the escapement that would have occurred in the absence of any fishery. Because of the greater concern over the squid stocks this short-term, within-season analysis has so far been confined to the squid stocks. Figure 8 shows the results for *Illex*.

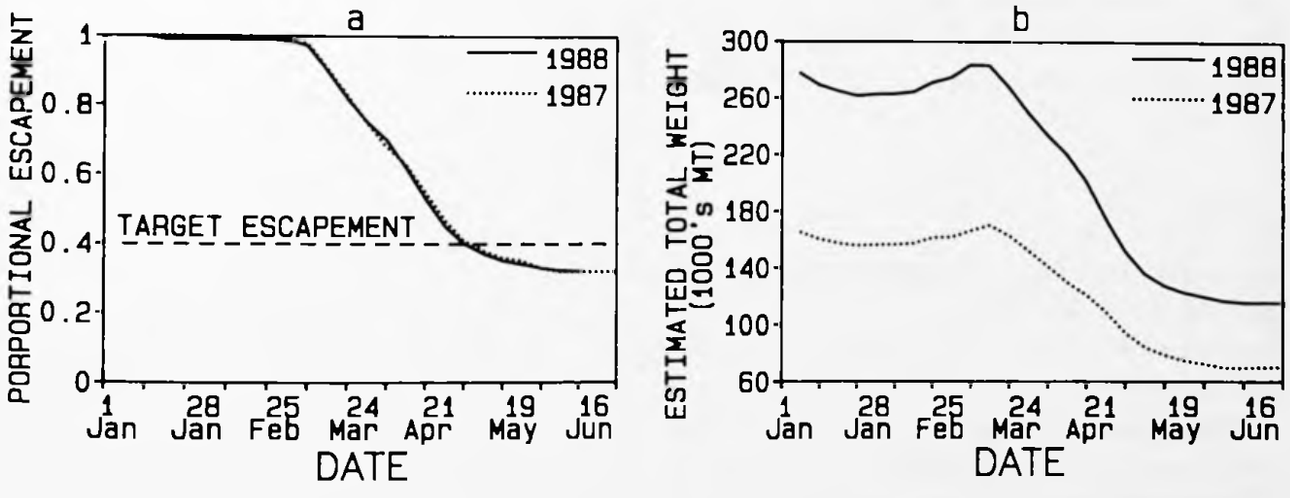


Figure 8 Comparison of assessment results for *Illex* in 1987 and 1988
a) proportional escapement b) estimated population biomass

The pattern for the two seasons is remarkably similar. It is clear that many more squid came into Falkland waters in 1988 than in 1987. The biomass in 1988 reached a peak of around 290,000 tonnes, compared with only 165,000 tonnes in 1987. It is also clear that the relative escapement failed to reach the target of 40%, being about 32% in both years. To that extent the conservation aims of management were not fully achieved. Fortunately, this failure occurred during periods when the stock size was large and hence the absolute number of squid surviving to breed was probably adequate. That the 1988 stock was so large provides support for this view. Nevertheless, the failure to achieve the conservation goal is serious and demonstrates the need to further reduce fishing effort on this stock. This was attempted after the results of 1987 were known, but was unsuccessful as the

efficiency of the part of the fleet increased over the period. Monitoring such increases in vessel efficiency is critical for successful conservation.

For *Loligo* the assessment of the first season of 1987 indicated that the stock abundance reached a peak of 140,000 tonnes but that the relative escapement was below 20%. This was well below the target figure of 40%. Following this analysis, the1800Xnumbevessels licensed to fish in 1988 was substantially reduced. The pattern of fishing in the first 1988 season was so different from that in 1987 (see Figure 3) that it is difficult to assess the effect of this reduction.

The estimates of relative escapement and the biomass of *Loligo* during the second seasons of 1987 and 1988 are shown in Figure 9. In 1987 the biomass which had a peak of little over 50,000 tonnes at the beginning of the season, from which a catch of 24,000 tonnes was taken, was less than in the first season of 1987 but it appears that the relative escapement was better, at around 50%, above the 40% target. In 1988 as indicated by the reduced catch rates (Figure 4 above) the total biomass estimate was a little less than 10,000 tonnes. In addition to the target for proportional escapement was exceeded at slightly under 30%. Both these figures indicate a need for further caution in the management of this *Loligo* stock.

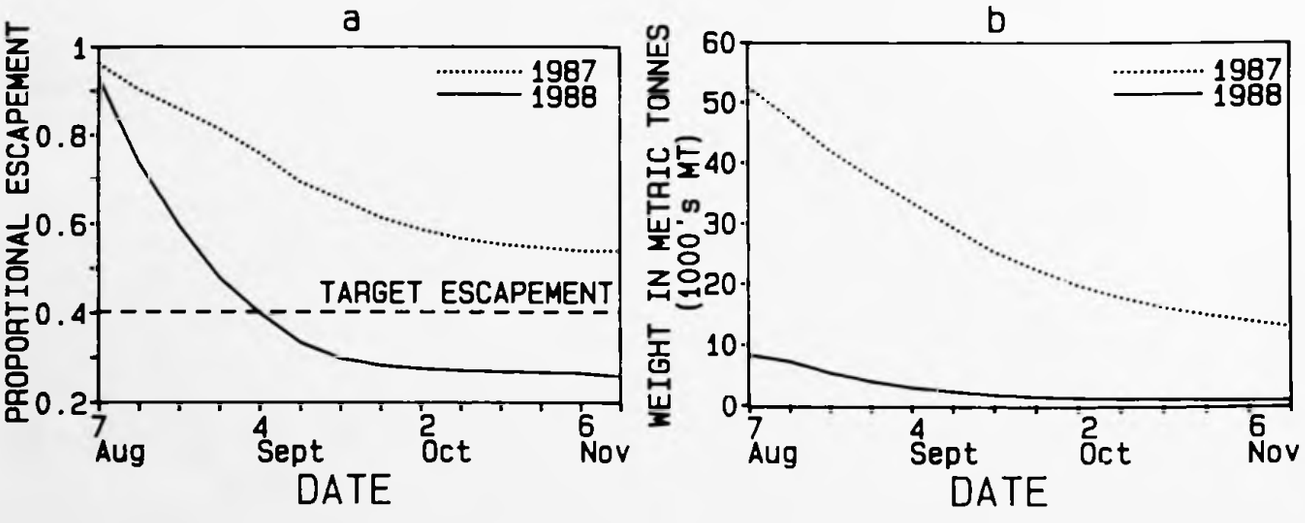


Figure 9 Assessment results for *Loligo* in the second season 1987 and 1988
a) proportional escapement b) estimated population biomass

Finfish

The stock assessment work on the finfish, primarily hakes and blue whiting, is concerned with longer-term problems, in particular with establishing the current state of exploitation of the stock. This is done by collecting age and length data, from which estimates can be made of the growth and mortality rates of the fish. Analyses are made of the changes in the average annual abundance, as measured by the mean catch per unit effort, and of how these changes are related to changes in the amount of fishing.

These studies are only beginning, but a preliminary assessment made by the UN Food and

Agriculture Organisation in 1987 suggested that the blue whiting stocks were only lightly to moderately exploited. Provided that the pattern of fishing remained unchanged, the fishing effort could be safely increased up to the level occurring in 1983. This was the year of highest fishing effort so far, when the total effort in the whole South-West Atlantic was some 6,000 fishing days. The amount of fishing for blue whiting inside the FICZ in 1987 was only 900 days.

Work on hake stocks within the FICZ is complicated as the species occurs throughout the South-West Atlantic and the relationship between the stocks in the FICZ and elsewhere is unknown. Nevertheless, there is some cause for concern about the common hake (*Merluccius hubbsi*). In the first season of 1988 many of the vessels licensed to fish for *Loligo* moved to target this species because catch rates on *Loligo* were poor. The resulting level of fishing effort on the stock was thus much higher than had been anticipated. Preliminary analysis indicated that if this were to continue conservation problems would arise, and accordingly fishing effort on this species will need to be reduced in the near future.

Other research

A wide range of biological topics need to be studied to supplement the direct stock assessment work, so as to improve the details of that work and remove some of the uncertainties. Other biological studies are directed to increasing the market value of the product. Studies currently in hand include investigation of stock separation, squid growth, *Loligo* distribution and blue whiting parasitism.

Stock separation

The two distinct fishing seasons for *Loligo* have raised the question of whether there are two broods from a single population or two separate populations of this squid in the FICZ. Effective management of the fishery depends on knowing the answer. If there is a single population, the escapement criterion is applied to each brood successively; for separate populations, the allocation of effort must be made separately. Preliminary analyses based on the lengths of the squid caught each month suggested that there were two spawning populations. The Fisheries Department has commissioned two biological studies from United Kingdom research institutions to examine the issue in more detail.

Scientists at University College, North Wales, School of Animal Biology, are conducting population genetics studies of *Loligo* from Falkland waters using the technique of electrophoresis to investigate whether the squid are from more than one distinct population. Electrophoresis maps the chemical composition of specific enzymes extracted from individual squid. Individuals from different populations would be expected to have small chemical differences in their enzymes due to genetic variation. Results to date indicate that only one population of *Loligo* is harvested in the FICZ, but that two and possibly three distinct broods are produced.

Growth of squid

Scientists at the British Antarctic Survey, Cambridge, are studying the age and growth of *Loligo*. They determine the age of individual squid by counting growth rings laid down daily on their statoliths, small structures which are part of the balance organs of squid and are similar to the inner ear in humans. Obtaining ages of individual squid will provide information on the distribution of spawning times and so indicate the structure of the spawning stock.

Distribution of *Loligo*

A survey of *Loligo* inside and outside the FICZ was carried out in 1988 by the research vessel "Wieczno" of the Polish Sea Fisheries Institute as part of a cooperative study.

Samples and data on the *Loligo*, taken from depths both shallower and deeper than those normally fished by commercial vessels, will go to the British Antarctic Survey to contribute to the study of the squid's life cycle.

Blue whiting parasitism

The southern blue whiting is heavily infected with a myxozoan tissue parasite (*Kudoa allaria*) which forms cysts up to two centimetres long within the muscle of the fish. The parasite does not affect humans, but the cysts are unsightly and release enzymes into the muscle which leads to a rapid degradation of the flesh once the fish is dead. The cysts can be cut out of the fillets, but this is labour intensive and thus costly. The fish are therefore more difficult to process, and are not attractive to consumers. However, the species does produce a high quality fish meat, and if the parasite problem could be solved, the market value of Falkland Islands whiting would increase significantly.

RRAG are sampling blue whiting around the Falklands to gather information on the size of the problem and seeking to understand the dynamics of the infection process. This will allow appraisal of various management strategies in an attempt to reduce both the prevalence and intensity of infection. For example, the parasites accumulate in fish as they age. It could be that controlled heavy fishing over a limited time would reduce the amount of older fish, so that younger, less heavily infected fish predominate in future catches.

If management strategies that fulfil the requirements of the fishing industry and conservation can be found, then a substantial rise in both the value and importance of the commercial blue whiting catch is likely to occur.

THE FUTURE

Conservation continues to be the major consideration in the management of the fishery, and in this respect the FICZ cannot be viewed in isolation from the surrounding waters of the South-West Atlantic. The *Illex* squid appears to be particularly vulnerable to overfishing in the early part of the year, before the stocks move south into the zone and when the size of the individuals is small.

The Falkland Islands Government has raised this problem with the fishing fleets which operate outside the zone and proposed that they voluntarily delay the start of their fishing activities in 1989. It is believed that this should result in benefits both in terms of conserving the stocks and increasing their commercial value, as the small squid attract lower prices. An added incentive to fishing fleets is that if their restraint proves successful in terms of conservation it should be possible to make a further number of *Illex* licences available within the zone.

Given the particular nature of the fishery this type of cooperation could be significant in paving the way for the future successful management of fish stocks in the South-West Atlantic.

APPENDIX

This appendix contains figures and tables of general catch statistics from the fishery in the FICZ for 1987 and 1988:

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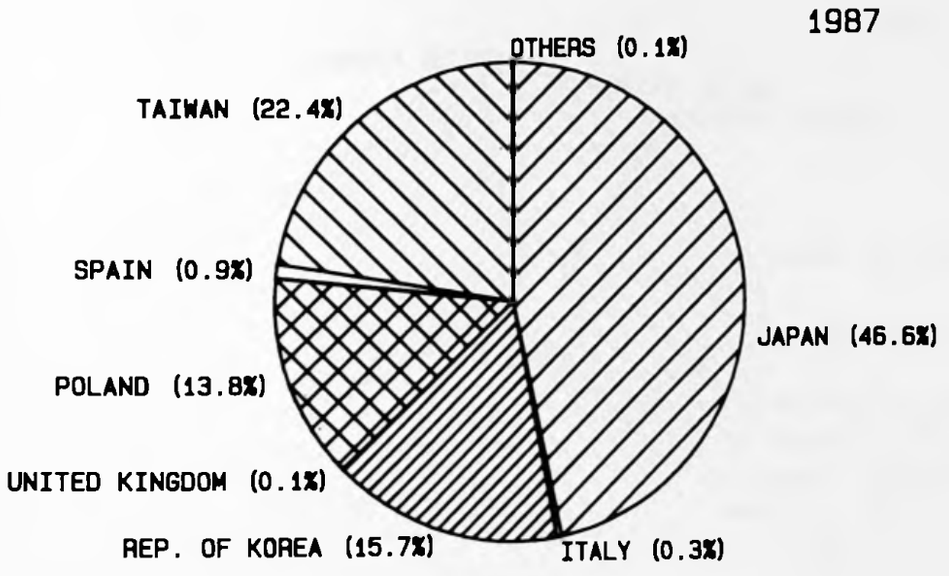
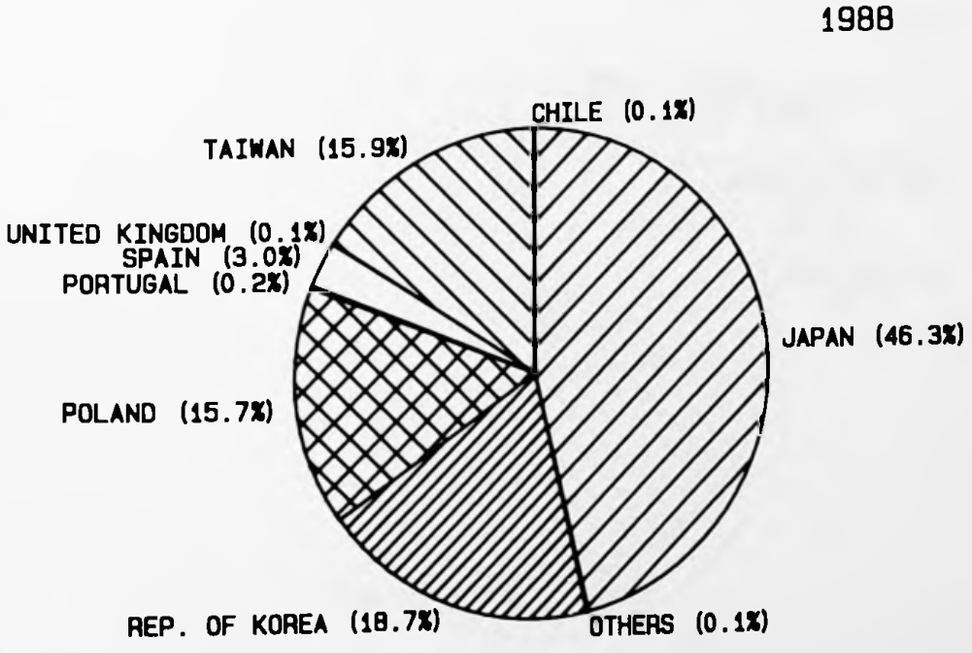
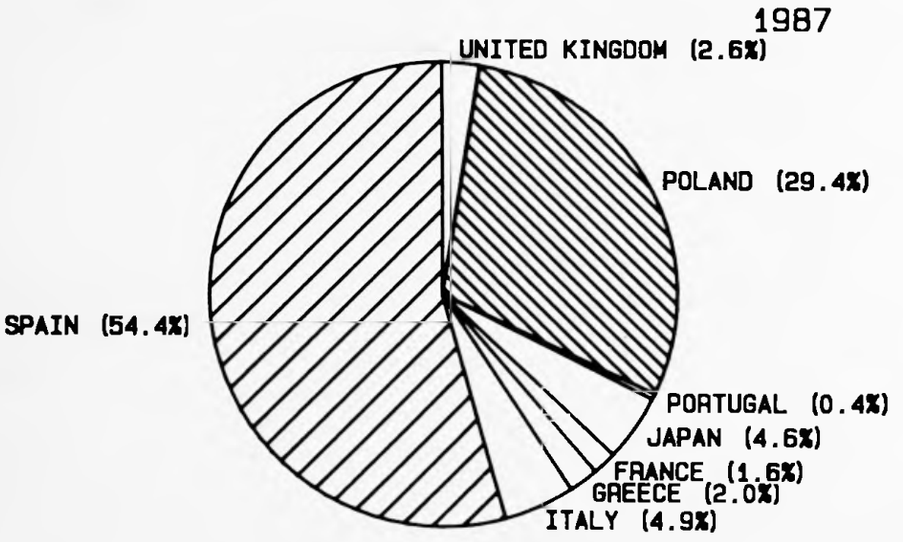
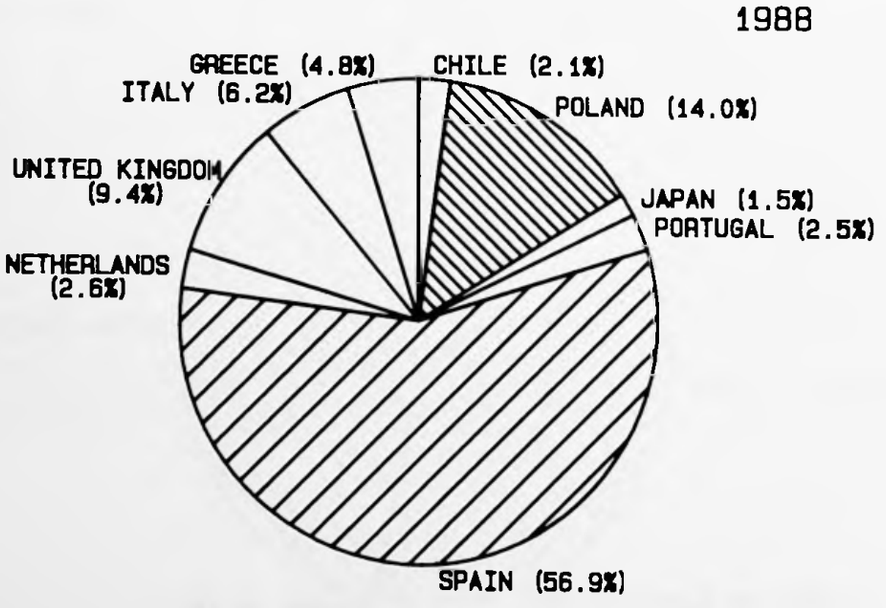
PROPORTION OF ILLEX CATCH BY FLAG VESSEL



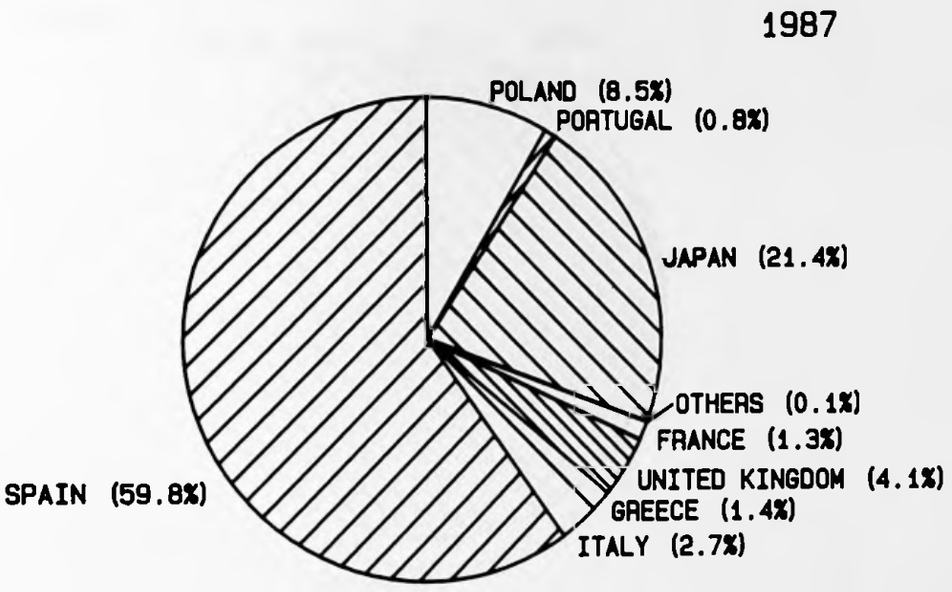


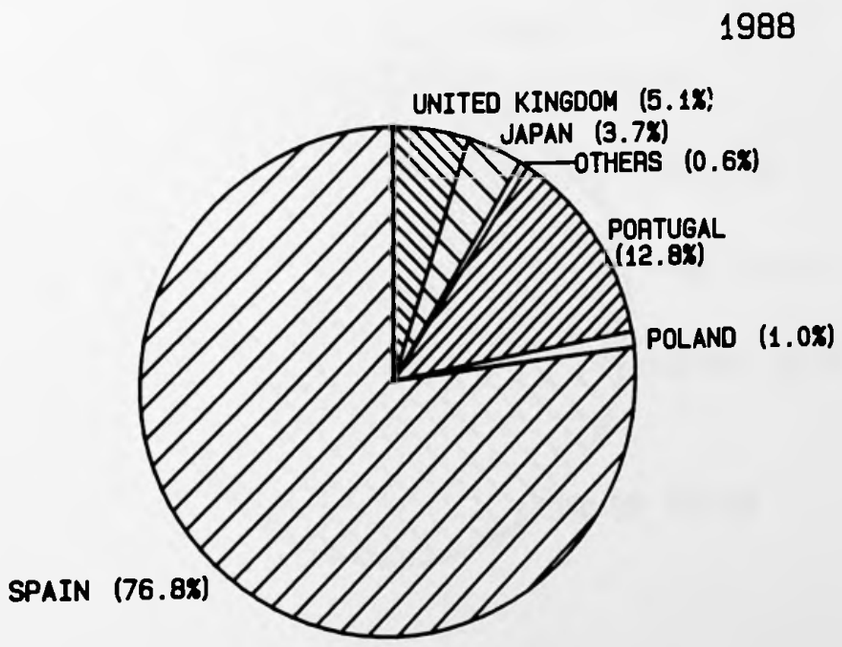
PROPORTION OF LOLIGO CATCH BY FLAG VESSEL



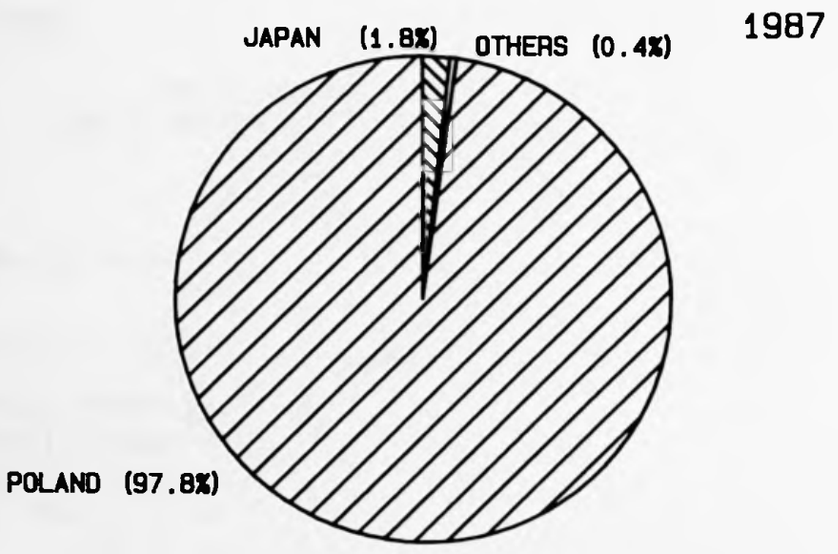


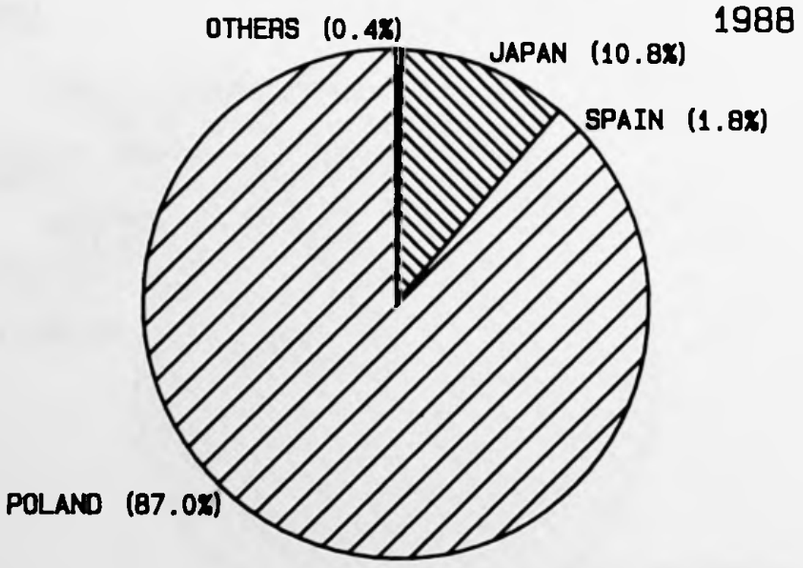
PROPORTION OF HAKE CATCH BY FLAG VESSEL





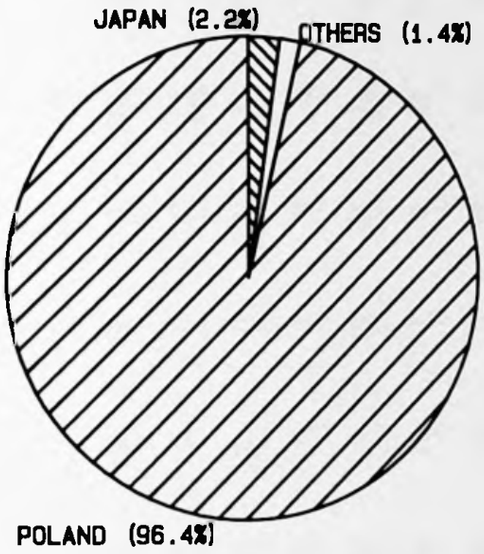
PROPORTION OF BLUE WHITING CATCH BY FLAG VESSEL



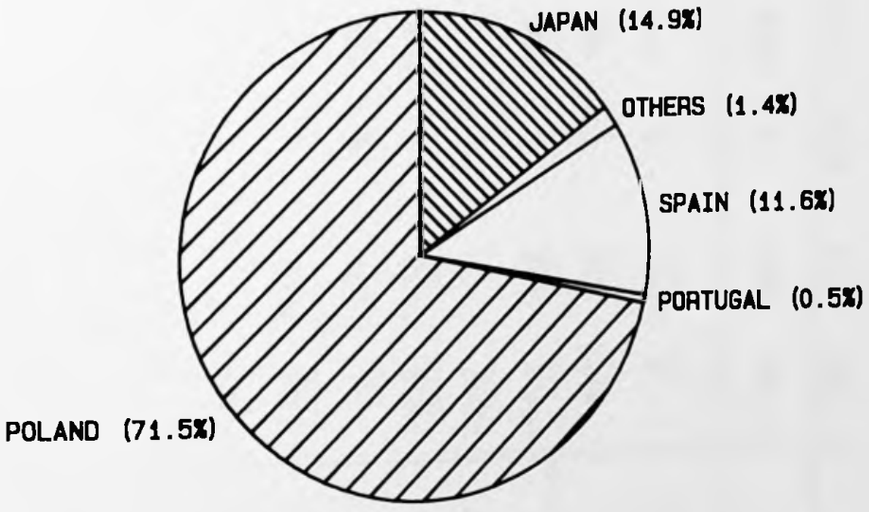


PROPORTION OF HOKI CATCH BY FLAG VESSEL

1987



1988



CATCH (IN TONNES) BY SPECIES BY FLAG VESSEL - 1987

FLAG VESSEL	SPECIES ILL	LOL	MAR	HAKE	BLU	HOKI	KING	TOOTH	SALI	RAY	OTH	TOTALS
FRANCE	65	1361	1	208	0	0	0	5	1	0	13	1654
CHILE	0	0	0	9	0	171	9	0	35	42	95	361
GREECE	9	1690	0	234	107	0	9	0	34	20	69	2172
ITALY	476	4056	1	444	0	0	10	1	3	54	116	5161
JAPAN	66454	3816	2	3530	867	426	271	10	11	37	399	75823
REP. OF KOREA	22363	0	0	0	0	0	0	0	0	0	0	22363
POLAND	19618	24280	3	1396	46908	18603	45	0	0	37	867	111757
PORTUGAL	71	327	0	134	0	0	2	0	0	4	5	543
SPAIN	1330	44871	0	9874	58	98	370	15	1	203	4289	61109
TAIWAN	31978	0	0	0	0	0	0	0	0	0	0	31978
UNITED KINGDOM	137	2146	5	678	45	9	32	0	0	29	456	3537
TOTALS	142501	82547	12	16507	47985	19307	748	31	85	426	6309	316458

KEY

ILL	-	ILLEX	TOOTH	-	TOOTHFISH
LOL	-	LOLIGO	KING	-	KINGCLIP
SALI	-	SALILOTA	OTH	-	OTHERS
MAR	-	MARTIALIA	BLU	-	BLUE WHITING

CATCH (IN TONNES) BY SPECIES BY FLAG VESSEL - 1988

FLAG VESSEL	SPECIES ILL	LOL	MAR	HAKE	BLU	HOKI	KING	TOOTH	SALI	RAY	OTH	TOTALS
GREECE	103	2603	4	95	6	1	0	0	0	0	10	2822
ITALY	67	3320	1	179	0	0	12	0	16	55	6	3656
JAPAN	97117	816	0	1719	4244	1637	177	33	190	38	351	106322
REP. OF KOREA	39150	2	0	0	0	0	0	0	0	0	0	39152
POLAND	32852	7569	5	543	42486	8925	6	1	67	31	10692	103177
PORTUGAL	383	1322	9	6588	73	64	227	27	613	468	74	9848
SPAIN	6278	30653	37	39129	707	1383	1392	36	3772	724	349	84460
TAIWAN	33224	5	0	0	0	0	0	0	0	0	0	33229
UNITED KINGDOM	136	5080	1	2578	68	196	130	21	436	180	39	8865
CHILE	153	1154	0	39	0	0	0	0	0	1	0	1347
NETHERLANDS	66	1406	0	0	0	3	0	0	0	0	0	1475
TOTALS	209529	53930	57	50870	47584	12209	1944	118	5094	1497	11521	394353

KEY

ILL	-	ILLEX	TOOTH	-	TOOTHFISH
LOL	-	LOLIGO	KING	-	KINGCLIP
SALI	-	SALILOTA	OTH	-	OTHERS
MAR	-	MARTIALIA	BLU	-	BLUE WHITING

CATCH (IN TONNES) BY SPECIES BY MONTH - 1987

MONTH	SPECIES ILL	LOL	MAR	HAKE	BLU	HOKI	KING	TOOTH	SALI	RAY	OTH	TOTALS
FEBRUARY	2466	20778	0	11	123	270	3	0	0	18	188	23857
MARCH	39649	28556	0	51	1	217	126	1	0	3	154	68758
APRIL	65938	11600	4	1139	74	358	23	5	2	53	84	79280
MAY	32578	2645	8	4661	4	604	108	4	3	31	257	40903
JUNE	1870	484	0	973	0	20	31	0	0	22	61	3461
JULY	0	35	0	590	5555	44	17	0	0	28	40	6309
AUGUST	0	9673	0	3844	17495	527	207	3	10	81	428	32268
SEPTEMBER	0	7370	0	4797	17514	81	158	8	0	104	373	30405
OCTOBER	0	1400	0	275	1720	6908	54	10	70	72	4409	14918
NOVEMBER	0	6	0	165	113	8078	15	0	0	14	142	8533
DECEMBER	0	0	0	1	5386	2200	6	0	0	0	173	7766
TOTALS	142501	82547	12	16507	47985	19307	748	31	85	426	6309	316458

KEY

ILL	-	ILLEX	TOOTH	-	TOOTHFISH
LOL	-	LOLIGO	KING	-	KINGCLIP
SALI	-	SALILOTA	OTH	-	OTHERS
MAR	-	MARTIALIA	BLU	-	BLUE WHITING

CATCH (IN TONNES) BY SPECIES BY MONTH - 1988

MONTH	SPECIES ILL	LOL	MAR	HAKE	BLU	HOKI	KING	TOOTH	SALI	RAY	OTH	TOTALS
JANUARY	6	0	0	1	24	1195	0	0	1	1	0	1228
FEBRUARY	70	17122	3	1329	486	3629	89	6	460	116	32	23343
MARCH	71439	14684	10	3221	236	214	162	19	710	170	51	90916
APRIL	99548	6986	13	9479	150	193	270	15	775	111	29	117569
MAY	34841	6252	2	15997	6	39	355	11	849	104	10	58466
JUNE	3620	3620	22	7415	76	782	249	15	571	214	75	16659
JULY	5	10	1	6063	37	2523	306	11	705	234	3590	13485
AUGUST	0	4328	1	3923	9326	550	205	22	278	158	5931	24721
SEPTEMBER	0	751	0	1952	17600	187	186	12	213	119	1335	22355
OCTOBER	0	142	3	1189	8191	1513	108	7	351	206	460	12170
NOVEMBER	0	23	0	257	3937	839	12	0	178	60	8	5314
DECEMBER	0	13	0	46	7514	545	2	0	4	3	0	8127
TOTALS	209529	53931	55	50872	47583	12209	1944	118	5095	1496	11521	394353

KEY

ILL - ILLEX
LOL - LOLIGO
SALI - SALILOTA
MAR - MARTIALIA
TOOTH - TOOTHFISH
KING - KINGCLIP
OTH - OTHERS
BLU - BLUE WHITING

CATCH (IN TONNES) BY SPECIES BY VESSEL TYPE - 1987

VESSEL TYPE AND CATEGORY (MT)

SPECIES	JIGGER	JIG/ TRAWL	TRAWL <1000	TRAWL 1000-2000	TRAWL >2000	TOTALS
ILLEX	119423	18861	369	1070	2778	142501
LOLIGO	0	10671	20785	27683	23408	82547
MARTIALIA	0	3	0	8	1	12
HAKE	0	546	3267	7453	5241	16507
BLUE W.	0	158	23	18446	29358	47985
HOKI	0	1390	61	5860	11996	19307
OTHERS	0	480	1884	3631	1604	7599
TOTAL	119423	32109	26389	64151	74386	316458

CATCH (IN TONNES) BY SPECIES BY VESSEL TYPE - 1988

VESSEL TYPE AND CATEGORY (MT)

SPECIES	JIGGER	JIG/ TRAWL	TRAWL <1000	TRAWL 1000-2000	TRAWL >2000	TOTALS
ILLEX	165913	34608	3044	3505	2458	209529
LOLIGO	7	28231	13528	27900	9672	53930
MARTIALIA	0	1	3	36	16	57
HAKE	0	734	5414	33503	11219	50870
BLUE W.	0	24115	1625	4721	18724	47584
HOKI	0	6901	4	1712	3592	12209
OTHERS	0	5435	1348	7420	5971	20174
TOTAL	165920	74617	23366	78797	51652	394353

CATCH (MT) BY SPECIES BY LICENCE TYPE - 1987

FIRST SEASON

SPECIES	LICENCE TYPE: ALL SPECIES NORTH & SOUTH	ALL SPECIES NORTH	ALL SPECIES SOUTH	TOTALS
ILLEX	13436	127765	1121	142322
LOLIGO	17572	208	46283	64063
HAKE	1051	358	5427	6836
BLUE W.	12	117	72	201
HOKI	54	1205	211	1470
TOTALS	32125	129653	53114	214892

SECOND SEASON

SPECIES	ALL SPECIES WEST & EAST	FINFISH ONLY WEST & EAST	FINFISH ONLY WEST	TOTALS
LOLIGO	7814	10603	67	18484
HAKE	1006	7701	965	9672
BLUE W.	434	640	46708	47782
HOKI	25	588	17226	17839
TOTALS	9279	19532	64966	93777

CATCH (MT) BY SPECIES BY LICENCE TYPE - 1988

FIRST SEASON

SPECIES	LICENCE TYPE: ALL SPECIES NORTH & SOUTH	ALL SPECIES NORTH	ALL SPECIES SOUTH	SPECIAL LICENCE	TOTALS
ILLEX	9995	196867	2654	7	209523
LOLIGO	6373	2427	39057	807	48664
MARTIALIA	33		17		50
HAKE	29865	2066	4793	717	37441
BLUE W.	920	25	28	5	978
HOKI	4041	1965	46		6052
TOTALS	51227	203350	46595	990	302162

SECOND SEASON

SPECIES	ALL SPECIES ALL AREAS (X)	FINFISH ONLY ALL AREAS (Y)	FINFISH ONLY WEST ONLY (Z)	EXTRA XY XZ YZ	TOTALS
LOLIGO	1545	85	77	3559	5266
HAKE	330	7516	2819	2763	13428
BLUE W.	1348	2555	38662	4040	46605
HOKI	14	1783	3795	565	6157
TOTALS	3237	11939	45353	10927	71456

CATCH RATE (MT/HR) AND CATCH (MT) BY VESSEL TYPE - FIRST SEASON 1987

SPECIES		JIGGER	JIG/ TRAWL	TRAWL <1000	TRAWL 1000-2000	TRAWL >2000
*ILLEX	CPUE	1.63	1.09	.01	.06	.34
	CATCH	119423	18861	369	1070	2778
*LOLIGO	CPUE	0	1.88	2.48	3.77	4.55
	CATCH	0	10670	15165	19471	18756
*HAKE	CPUE	0	.03	.39	.63	.81
	CATCH	0	546	778	3277	1791
HOKI	CPUE	0	.09	0	0	0
	CATCH	0	1390	0	0	0

* CATCH PER UNIT EFFORT FOR THESE SPECIES IS CALCULATED FOR HIGH SEASON ONLY.

CATCH RATE (MT/HR) AND CATCH (MT)
BY VESSEL TYPE - FIRST SEASON 1988

SPECIES		JIGGER	JIG/ TRAWL	TRAWL <1000	TRAWL 1000-2000	TRAWL >2000
*ILLEX	CPUE	2.19	2.58	.35	.16	.32
	CATCH	165914	34607	3044	3505	2454
*LOLIGO	CPUE	0	.10	.84	.83	.93
	CATCH	0	2103	12356	24719	9479
*HAKE	CPUE	0	.01	.31	.95	.82
	CATCH	0	270	3789	25377	8005
BLUE W.	CPUE	0	.01	0	.001	.01
	CATCH	0	178	0	304	484
HOKI	CPUE	0	.28	0	.01	.05
	CATCH	0	4457	0	654	940

* CATCH PER UNIT EFFORT FOR THESE SPECIES IS CALCULATED FOR HIGH SEASON ONLY

CATCH RATE (MT/HR) AND CATCH (MT)
BY VESSEL TYPE - SECOND SEASON 1987 & 1988

SPECIES		SECOND SEASON 1987			SECOND SEASON 1988			
		TRAWL <1000	TRAWL 1000-2000	TRAWL >2000	JIG/ TRAWL	TRAWL <1000	TRAWL 1000-2000	TRAWL >2000
LOLIGO	CPUE	.51	.41	.27	.09	.20	.20	.03
	CATCH	5620	8212	4652	720	1172	3181	193
HAKE	CPUE	.22	.34	.32	.01	.20	.40	.25
	CATCH	2347	3875	3450	463	1625	8126	3214
BLUE W.	CPUE	0	2.00	2.73	2.26	0	.50	2.35
	CATCH	0	18444	29316	23937	0	4417	18239
HOKI	CPUE	0	.84	1.07	.17	0	.06	.14
	CATCH	0	5846	11964	2443	0	1058	2652

CATCH PER UNIT EFFORT IS CALCULATED FOR HIGH SEASON ONLY

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