LONGLINING IN SOUTH AFRICA

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This paper discusses past, present and future demersal longlining in South Africa. It is a summary only. Key references have been put in the text and these should be referred to if further information is required. Longlining in South Africa and its possible future is a highly emotive issue. Presently (November 1992) a ***Sea Fisheries Advisory Council Sub-Committee*** is considering the longline issue. This paper is in no way intended to preempt the decisions of that body and attempts only to stick to the facts and scientific rationale. However, some opinions and interpretations expressed are entirely the authors own.

HISTORY OF THE DEMERSAL LONGLINE FISHERY IN SOUTH AFRICA

Early History

Longline fishing is probably one of the oldest fishing techniques known to man and has been practised in many parts of the world (Holdsworth 1874). Technological advancements, increased demand for fish and competition for limited resources has resulted in the emergence of longlining as a viable commercial fishing technique that can compete with the established commercial fisheries (such as bottom trawling). Prior to 1983 only pelagic longlining for tuna and a small-scale longline fishery for sharks was known to exist in South Africa. Established longline fisheries for hake and other species exist in Portugal and Spain (Lleonart and Camarasa 1987) and, based on the activities of these fisheries, the motivation for the first demersal longline (deep-water) permits were made in South Africa in 1983 (Badenhorst 1988). Nine 'experimental' permits for longlining were granted towards the end of 1983 (issued to the demersal trawling companies with hake quotas and directing effort mostly at hake). Not all permit holders fished actively in the beginning and in 1984 only eight vessels reported landing longline catches. Longline effort was directed mostly at the West Coast and only towards the end of 1984 and in Spring of 1985 was large amounts of effort directed at the South Coast (Figure 1).

Longline methods developed

Although initially intended for hake, longlining in South Africa developed with kingklip as the target species. Longliners were naturally excluded from the established trawl grounds but found kingklip plentiful on the rough substrata. The ***Demersal Bottom Double Longline*** became an established longline technique in 1984 (Figure 2). This method was developed to cope with the rough grounds, harsh weather, strong currents and other hydrographic features encountered on the South African Coast.

The longline methods that were developed are intensive and the lines, when set, occupy a large area of the seabed. A single longliner can use up to 15 000 hooks on a line and, with a hook spacing of about 1.7 - 2.0 m, the line can be 30 km long (Japp 1989). The longline consists of an anchor line and floats (with markers) at either end and two continuous lines set on the bottom. The two lines are set and hauled simultaneously and if the bottom line (fish line) breaks, the rest of the line can still be recovered using the stronger top line (that is unlikely to foul). A longline of this type directed at bottom fish (such as kingklip), has none or only a few floats attached and lies flush on the seabed. It is weighted at regular intervals and is prone to fouling.In order to raise the line so that effort can be directed at hake, less

weights are put on the bottom line, floats are attached instead and the gear is set later at night and left in the water for longer periods during the day. The depth at which the gear lies in the water depends on the frequency and spacing of the floats and weights attached to the bottom line.

Development of the longline fishery

In 1985 the longline fleet began targeting on the abundant kingklip resource (for which there were no restrictions) on the South-east Coast (Figure 1). Total kingklip landings increased sharply. Longline effort was further increased with the issuing of six additional permits to 'independent operators'[1] towards the end of 1985 and by the end of the year the longline kingklip catch had increased to nearly 7 000 t and the hake catch to 1 500 t (Japp 1988, 1989).

In 1986 the kingklip catch (longline) increased further, with most fish being caught on the South Coast where, due to spawning aggregations and a slackening of the current, the kingklip were more available (Scott 1950, Hecht 1976, Payne 1986, Japp 1989). Catches of kingklip, particularly in the peak spring period, began to drop sharply (Figure 1) and the longline operation began to target more on hake. By the end of 1987 trawl by-catches of kingklip were showing signs of decline and longline catches were nearly treble that of the trawl fleet. The longline method selectively caught mature, spawning hake and kingklip and concern was expressed that the removal of the adult spawning stock was likely to have a detrimental impact on recruitment to both the trawl and longline catches (Japp 1988). The same selectivity pattern also applied to longline-caught hake. Longliners caught exclusively large hake whereas trawl-caught hake comprised mostly of fish < 50 cm (Figure 3). By the end of 1989 kingklip catches (trawl and longline) had declined from a peak of 11 370 t in 1986 to 5 446 t in 1989. Longline catches of hake peaked at 5 514 t in 1988 and dropped off to 322 t and 386 t in the following two years (Japp 1989).

Early Assessments

The first assessment of the kingklip resource (in South African waters) based on the longline data showed that the longliners were exploiting the kingklip resource in excess of the rate required to retain the stock at a sustainable yield (Japp 1989, Japp and Punt 1989). In 1989 a 5 000 t kingklip ***TAC*** and a closed season and area on the South Coast to reduce the impact of exploitation on the kingklip spawning aggregations was introduced. Hake caught by the longline fleet was also restricted to 10% of the kingklip catch.

By 1989 there were indications that the trawl by-catch of kingklip was decreasing significantly and that the decline in longline catch rates on the South Coast was continuing. The kingklip assessment was extended to include the historical trawl kingklip catches. From this it was concluded that the longline fishery had had a severe impact on the kingklip spawner stock on the South Coast and that there were visible signs that recruitment to both the trawl and longline fisheries was being affected. The kingklip ***TAC*** for 1990 was subsequently reduced to 2 500 t. Revision of the assessment (Punt 1990) suggested that the kingklip resource was already overexploited by the trawl fleet prior to longlining and that longlining had accelerated the decline by overexploiting the kingklip spawner biomass on the South Coast. Demersal longlining was stopped at the end of 1990.

Longlining Subsequent to Closure of the Longline Fishery

Interest in longlining remained however and several groups continued to lobby for longline permits. In 1991 'shark longline' permits were issued for the first time. These were given to those fishermen who could prove 'traditional' shark-directed effort. This resulted in a resurgence of interest in longlining and

[1] The new entrants to the fishery were referred to as 'independents'. This was because they did not hold hake quotas and were smaller operators by comparisons with the initial participants in the fishery.

a substantial illegal longline fishery emerged, targeting on hake. The situation threatened to get out of control as hake catches were not within the scientifically recommended ***TAC***.

A further development was the growth of the handline fishery for hake on the South and East Coast. Fishermen in these areas had traditionally caught hake in unrestricted quantities to supplement their line and squid catches. With the increase in demand for line-caught hake and the decline in catches of other linefish species, line fishermen developed techniques to improve their hake catches. This included the use of special linehaulers that could lift lines with large numbers of hooks i.e. longlines. The situation therefore arose where a species was on the open list for the 'line' fisheries but was strictly controlled by quotas and other means for the deep-sea trawl industry. The prospect of an open access fishery became a real threat to the hake resource. Legislation was subsequently introduced limiting the number of hooks on a line, defined a longline, took hake off the open species list and limited the number of hake and kingklip that could be landed per day per fisherman. At present the only legal longlining allowed is the shark-directed longline fishery. There are strong motivations by several groups for, or against longlining from nearly all sectors of the South African fishing industry including the deep-sea, inshore, squid and linefish fisheries.

POTENTIAL FOR A HAKE-DIRECTED LONGLINE FISHERY

Given the history of the demersal longline fishery in South Africa, scientists and managers need to ask themselves if a hake-directed longline fishery is viable. Before exploitation of a resource is begun, the likely effect of the fishing method on the resource needs to be understood, although only actual exploitation is likely to provide real answers. A good understanding of the status of a resource as well as the likely effect of the fishing method to be employed on the stock(s) before exploitation is begun can be achieved through modelling. Because of the high degree of uncertainty in fisheries, management approaches are normally cautious and err on the conservative side.

Present Status of the Hake Resource

Historical catch records of hake show clearly the overexploitation of the resource in the 1970s. This was followed by a strict management policy and subsequently by a gradual recovery of the stocks. Production model estimates suggest that the hake resource on the South Coast is at about 52% and the West Coast at about 45% of the pristine stock size. The hake resource on both coasts is recovering slowly and if the present management strategy is retained ($f_{0.2}$) the hake biomass should continue to increase.

The Effect of Hake Catches Outside of the *TAC*[2]

By running the production model for hake with catches greater than the present strategy dictates, a simple but clear indication of the likely impact on the hake resource is predicted i.e. simulating line catches outside of the recommended ***TAC***. Given that catches do not exceed 10 000 t and 20 000 t on the South and West Coast respectively the effect is to reduce the rate of recovery of the hake stocks. Should catches exceed those amounts the resource biomass declines. At the extreme, catches of hake extra to the ***TAC*** of 100 000 t on the West Coast and 50 000 t on the South Coast leads to rapid resource collapse by the year 2000.

[2]The modelling described here is credited to Prof. D. Butterworth and others in his team from the Applied Mathematics Department of the University of Cape Town. No figures are provided in this summary. Relevant papers that refer to the modelling are available on request (*Demersal Working Group* confidential documentation - Sea Fisheries Research Institute).

Biological Effects

One way of modelling biological effects is to use a Beverton and Holt ***Yield-per-recruit*** type model where biological characteristics are an essential component of the model. Most of the biological characteristics of Cape hake are known and were used in models to compare the ***yields-per-recruit*** and ***spawner biomass-per-recruit*** of longline and trawl fisheries. The essential questions that were asked were: **1)** if the two fisheries had the same level of catch which would result in a lesser reduction in the hake spawner stock?, or **2)** for the same reduction of spawner stock would longlining allow a greater catch?

Selectivity of the two gears (trawl and longline) is fundamental to the calculations. The results of these models showed that for the same level of catch, longlining would result in a lesser reduction of the spawning stock than does trawling and, for the same extent of reduction of the spawning stock, longlining would allow a greater catch. The results therefore suggest that longlining is biologically preferable to trawling. Further tests showed that the selectivity patterns used are robust to a wide range of assumptions. For example, if it is assumed that there is no mixing of the adult hake between the longline and trawl grounds, longlining gives a marginally better ***yield-per-recruit*** and poorer ***spawner biomass-per-recruit***. If mixing does take place then a longline fishery is preferable in term of both ***yield-per-recruit*** and ***spawner biomass-per-recruit***.

CONCLUSIONS

Resource consideration therefore favours (biologically) the introduction of a longline fishery. Several important questions still need to be answered. The selectivity curves used in the models were based on old longline data and were extracted from a fishery that was mostly kingklip-directed. Would the selectivity patterns of a strictly hake-directed longline operation be the same now? What are the selectivity patterns for a longline fishery on trawl grounds and do they differ from those on rocky grounds? Does the longline fishery selectively catch adult spawning females i.e. what is the sex ratio of the longline catches? A further problem that needs to be addressed is the possibility of spatial and seasonal shifts in hake abundance that may affect the selectivity of the longline and trawl gear (this may include hake spawning aggregations).

It should be clear from these questions, that although the models suggest longlining is preferable to trawling, there is still much uncertainty. The question of mortality on lines also needs to be addressed. Only a well structured research program will answer these questions.

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FIGURE CAPTIONS

Figure 1: Seasonal catch rates of kingklip (kg/1000 hooks) in the kinglip-directed demersal longline fishery from 1983 to 1990 on the South African West and South Coasts.

Figure 2: Schematic representation of the demersal longline method as deployed in South African waters in the years 1983 to 1990. Note the application of two methods targeting either on kingklip or hake.

Figure 3: Comparison of the length frequency distributions of hake (1985 figures) caught in the South African demersal trawl and longline fisheries. Note the distinct difference in the mean size of fish caught in the two fisheries highlighting the differences in selectivity between the two gear types.