The Development of a Selective Longline System for the Capture of Ray's Bream (*Brama brama*)

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FISHERIES
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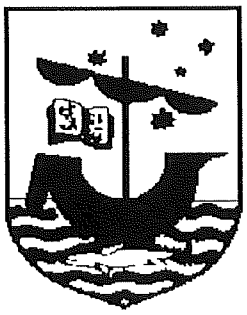
CORPORATION



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NON TECHNICAL SUMMARY

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OBJECTIVES:

1. To develop and trial a selective longline system to specifically target Pomfrets and in particular Ray's Bream.
2. To establish baseline data on catch rates and catch composition from a standard longline system (control)
3. To develop a longline system that optimizes catch in relation to maximizing target catch but minimizing Southern Bluefin Tuna catch and seabird mortality
4. Endeavor to quantify, both individually and cumulatively, improvements in efficiency and selectivity that can be achieved through alterations to both the physical components of the longline and it's method of deployment.
5. Establish preliminary growth and mortality rates to provide preliminary stock turnover estimates and to provide advice on TAC levels.

NON TECHNICAL SUMMARY

Ray's Bream is one of several species of Pomfrets that has been taken as a by-catch by Japanese longliners fishing for Southern Bluefin Tuna in Southern Australian Waters. Most of this bycatch has in the past been discarded. A well established Ray's Bream longline fishery exists in Spain. The Pomfrets have high quality white flesh, and if landed in quantity and with proper marketing, could form the basis of a valuable new Australian Fishery.

Little is known of the species abundance and distribution in Australia's EEZ. Australian observers placed on the Japanese tuna longliners report that Ray's Bream appear to be associated with the 11°C - 13°C surface water temperatures.

Existing Australian longline fisheries are tightly regulated and any new fishery must be developed so as to minimise interaction with these established fisheries. Catches of Southern Bluefin Tuna are already strictly controlled through quota management and a new longline fishery would need gear developed that would not catch Southern Bluefin Tuna nor seabirds.

There were therefore a number of areas requiring attention if Pomfrets were to be exploited on a sustainable basis. Research into harvesting technology, particularly longlining, needed to be conducted to improve the ability to target the Pomfrets. Information on basic gear arrangements, hook sizes, baits and fishing depth was required to meet management and commercial development needs. The establishment of gear specifications that produce little likelihood of retaining Southern Bluefin Tuna or the capture of seabirds is a prerequisite for the establishment of a Pomfret fishery.

The project developed two longline systems, the first was based on an Australian designed and manufactured system the RB1 longline and the second an adaptation of the Spanish longline system the AMC/FRDC longline. The latter system was developed as a result of a visit to Spain by project staff to observe the fishery. A report of this visit together with a description of the Spanish longlibe system is attached as Appendix 1 of the Final Project Report. Changes in the way non-trawl fisheries are managed in southern Australia forced the project to abandon the first system, as it would not have met new fisheries regulations. This project may have had greater success had it reached agreement with AFMA to establish the fishery as a developmental fishery and established the management requirements at the outset (Recommendation 1)

The AMC/FRDC longline was tested through a broad industry based trial. Prior to establishing the trial the project undertook extensive consultations with industry and management agencies to ensure the trial fishing obtained widespread support. Public expressions of interest were sought and ten fishers were provided with trial 2.5 km, 1000 hook test longline systems which were to be used on a voluntary basis by the fishers. Only one trial set was completed with inconclusive results being achieved. In the end the industry trial failed due to the high cost and risk of undertaking any long term fishing trials. This is understandable given the SEF non-trawl fish restructuring that occurred during the project life and the lack of any incentive to undertake the economic risk. If participants, who actively undertook the trials, obtained some future right of access then the incentive may have been sufficient to undertake some trial fishing.

Despite these problems a new AMC/FRDC longline system suitable for the capture of small to medium pelagic species was developed by the project. The light construction provides opportunities to use the gear to catch small-medium pelagics such as Ray's Bream and effectively operate outside the existing longline fisheries and thus truly establish a new fishery. However, existing AFMA regulations, which prohibit the use of autobaiting systems, will be a major impediment to such a development.

Longlining offers several advantages in that fish so caught fetch higher prices due to superior appearance and quality when compared to trawl caught fish. Both demersal and pelagic longlines cause little habitat interference or damage. Bycatch can be controlled to some extent with hook size and break load points. With appropriate deployment methods the seabird bycatch can be eliminated. The focus on both bycatch reduction and the mitigation of habitat damage caused by trawling suggests that some of the new small boat autolines should be trialed in a variety of benthic habitats to determine their impact on habitat, catch composition and rates. Such trials would provide a sound basis for AFMA to review its existing line fishing restrictions.

Recommendation 1
FRDC ensure that applicants reach agreement with the appropriate management agency as to the management parameters surrounding the developmental fishing project and where possible that these agreements include the establishment of the prospective fishery as a developmental fishery so that industry participants can gain some recognition for their pioneering activity.

KEYWORDS: Ray's Bream, Pomfrets, pelagic longline fishing.

1 BACKGROUND.

Pomfrets are epipelagic fish species taken in quantity (400 – 600 tonnes per annum), as bycatch by Japanese longliners fishing for Southern Bluefin Tuna (SBT), in southern Australian waters most of this by-catch is discarded by the Japanese boats. Japanese and Australian governments are currently in dispute over management arrangements for SBT and Japanese vessels are as a result excluded from the Australian EEZ.

The Pomfrets have gourmet quality flesh, and if landed in quantity and with proper marketing, could form the basis of a valuable new Australian Fishery.

Little is known of the species abundance, distribution and age structure in Australia's EEZ. What knowledge is available has been provided by Japanese research in the Southern Pacific region, anecdotal evidence from Japanese skippers, and Australian observers placed on the Japanese longline tuna boats. Ray's Bream is the major by-catch species captured and appears to be associated with the 11°C - 13°C surface isotherms.

A well established fishery exists for this species in the Northern Hemisphere. However, the equipment used to target this species is of lighter gauge and construction when compared to the fishing gear used to capture SBT and Yellowfin Tuna in the Southern Ocean and Western Pacific.

The potential to develop a new fishery based on this and other Pomfret species was highlighted by Last and Barron (1994). This article stimulated interest in the development of this "new " fishery.

The availability of an unexploited, high quality white fleshed fish generated industry interest in longline capture techniques for Pomfrets in an area already longlined for SBT.

The project discussed in the following report represents a program of research aimed at developing gear that achieves commercial catches of Pomfrets and minimizes the likelihood of catching SBT and the killing of seabirds.

2 NEED.

There were a number of areas requiring attention if Pomfrets were to be exploited on a sustainable basis. Information on the biological parameters was needed to establish the potential and sustainable yield of the fishery to allow managers to establish a preliminary total allowable catch.

Research into harvesting technology, particularly longlining, needed to be conducted to improve the ability to target the Pomfrets. Information on basic gear arrangements, hook sizes, baits and fishing depth was required to meet management and commercial development needs. The establishment of gear specifications that produce little likelihood of retaining Southern Bluefin Tuna or seabirds is a prerequisite for the establishment of a Pomfret fishery.

3 OBJECTIVES.

6. To develop and trial a selective longline system to specifically target Pomfrets and in particular Ray's Bream.

7. To establish baseline data on catch rates and catch composition from a standard longline system (control)

8. To develop a longline system that optimizes catch in relation to maximizing target catch but minimizing Southern Bluefin Tuna catch and seabird mortality

9. Endeavor to quantify, both individually and cumulatively, improvements in efficiency and selectivity that can be achieved through alterations to both the physical components of the longline and it's method of deployment.

10. Establish preliminary growth and mortality rates to provide preliminary stock turnover estimates and to provide advice on TAC levels.

4 METHODS

4.1 Longline Gear Testing Trials

4.1.1 Construction of Longline

Mainline was based on a 15km length of 3.5mm monofilament marked in 1000m intervals. Each standard 1000m segments or longline units formed an experimental unit the intention was to allow the experimental units to be located at random on the 15km line to remove placement bias. 5 standard units were designated as controls allowing 2 X 5 replicates of for testing different gear specifications.

4.1.1.1 The Control Longline Segments

Two distinct control longline configurations were developed. The first design was based on longline gear currently used in southern Australia although the snood and clip system used sought to test an experimental Australian designed and manufactured system that allowed prebaiting and rapid setting the second design was based on a detailed examination of the only operational commercial Pomfret fishery in the world – the Spanish Pomfret fishery

4.1.2 Experimental Variables to be Tested

4.1.2.1 Hook Shape

The experimental units were configured the same as the controls segments with only the hook shape being varied.

4.1.2.2 Hook Size

All fishing segments were constructed the same with only hook shape being varied.

4.1.2.3 Hook Spacing

All fishing segments were constructed the same with only hook spacing being varied.

4.1.2.4 Bait Type

All fishing segments were constructed the same with only bait type being varied.

4.1.2.5 Soak Time

All fishing segments were constructed the same with only soak time being varied.

4.2 Variation to the Proposed Experimental Design

The experimental methodology described above was abandoned once it became obvious that the catch rates were too small to justify this level of experimental design. The prerequisite was to establish a longline system that could target Pomfrets and not kill or retain SBT or sea birds.

The control 1 longline system was soon abandoned due to changing management requirements for line fishing in the SBT and East Coast Tuna Fisheries. It was also determined that the likelihood of causing seabird mortality was unacceptably high despite the use of Tory lines. Consequently the project designed longline system was abandoned.

The control 2 longline system which was developed following an in depth analysis of the Spanish longline system was trialed through an industry based trial.

4.3 Industry Consultation

Consultation with industry was established through regular meetings with interested fishers. Focus groups were used to progress commercial gear development through an industry trial.

4.4 Industry Trials

Although not forming part of the original methodology it was decided the only way to realistically attempt to determine the commercial potential and the distribution and abundance of Pomfrets in southern Australia was to involve the industry.

The industry trials were established after extensive consultation with industry, FRDC and AFMA to establish:

- the best and fairest method of selecting industry participants,

- the conditions applying to any catches taken during the trials,
- the development of scientific permits to allow the trial to proceed and
- the design and construction of the trial longlines

4.4.1 Expressions of Interest

4.4.1.1 Development and Publication

A public "expression of Interest" was identified, through the formal industry consultation phase of the project, as the most equitable process for selecting commercial operators in the industry trial program. Prior to the publication of such material however it was necessary to determine the specific operational requirements that would need to be recognized by interested parties and the subsequent criteria for assessment of such applicants to the program. This was achieved through consultation with AFMA, FRDC and industry members with a number of drafts being distributed for review.

It was acknowledged that it would be difficult to achieve broad industry coverage through an advertisement for "Expression of Interest" through conventional channels, that is, advertisement in regional newspapers. The costs associated with such a strategy and the need to cover all of southern Australia made such a strategy too cost prohibitive for the project and therefore the project relied on the industry representative bodies communicating this information to their constituents in Victoria and New South Wales.

It was determined that a majority of the suitable applicants would be based within Tasmania and the major regional newspapers the "Examiner" and the "Mercury" were used to advertise for "Expression of Interest". The "Expression of Interest" article was forwarded to the previously identified industry contacts for distribution to the respective industry members. Furthermore, members of the fishing industry who were in regular liaison with research staff were asked to forward information regarding the commercial trial program to other industry operators within there home ports.

4.4.1.2 Assessment of Applicants

Each application was assessed by the Project team against the commercial trial objectives and the participation criteria.

4.4.1.3 Commercial Trial Objectives

Undertake a series of fishing trials over a broad geographic range to determine if there were and spatial and or temporal variations in distribution and apparent abundance. Trial and develop the AMCFRDC Pomfret Longline system in relation to its commercial potential and detrimental interaction with tuna, shark and sea birds.

4.4.1.4 Participation Criteria

Operator suitability based on line fishing experience.

Vessel suitability based on capacity to deploy and retrieve the AMCFRDC Pomfret Longline

Acceptance of the provisions of the Scientific Permit

4.4.2 Scientific Permits

The establishment of operational and administrative guidelines for the issuing of Scientific permits and the development of appropriate restrictions was a lengthy process. Project staff liased with AFMA and FRDC staff as well as participants in the trial program in an attempt to produce a permit structure that facilitated the achievement of the commercial trial objectives, allowed for integration of the developmental gear operation into existing fishing activities and recognized a number of key threatening processes in addition to the industries political sensitivities.

4.4.3 Design and Construction of Longlines

4.4.3.1 AMCFRDC Pomfret Longline

The AMCFRDC Pomfret Longline configuration was between 1250m and 2500m of 3mm monofilament mainline with line crimps positioned every 5m. The length of the mainline segments was ultimately determined by the capacity of the shooting, hauling and storage equipment on each vessel. The line crimps, of either plastic crimp and stainless steel clip construction or alternatively an aluminium swage, were positioned 300mm apart. This allowed a suitable distance for the snood clip to be fastened whilst the mainline was deployed.

The snoods comprised of a 1m length of 0.8mm monofilament nylon with a q-clip positioned at one end and an Anzuelo no 9 steel hook at the other. The snoods with attached hooks were purchased from suppliers in Spain as they were considerably cheaper than domestic suppliers. Whilst comparable equipment could be found locally, the Spanish suppliers were able provide snoods with hooks already attached. This was significant a significant advantage as it obviated the need to individually tie the snoods to each hook and as ten sets of gear were being manufactured provided a significant saving in cost and time.

The snoods were constructed using a team of 3 individuals, the project technician, one casual staff employee and one volunteer. This proved to be an optimum number of people with the system of construction adopted. For ease of handling the bundles of snoods were divided into lots of 50. Each snood was then threaded with a 0.7mm aluminum swage and a length of plastic line protectant (Figure 1). The Q-clip was then threaded over the line protectant and the snood tail doubled back into the line swage (Figure 2). A pair of crimping pliers were then used to lightly fix the swage in position (Figure 3) before applying a hand swage press to securely fasten the swage.

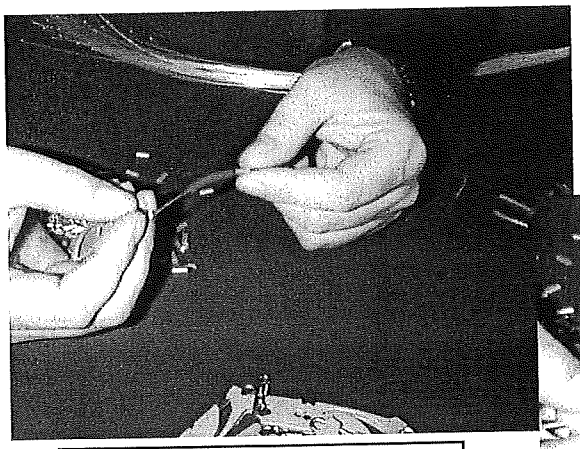


Figure 1. Snoods threaded with swage and line protectant

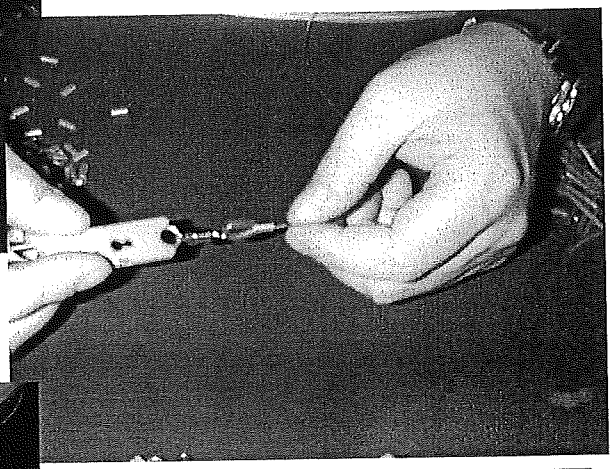


Figure 2. The Q-clip is threaded and the snood tail doubled back into the swage

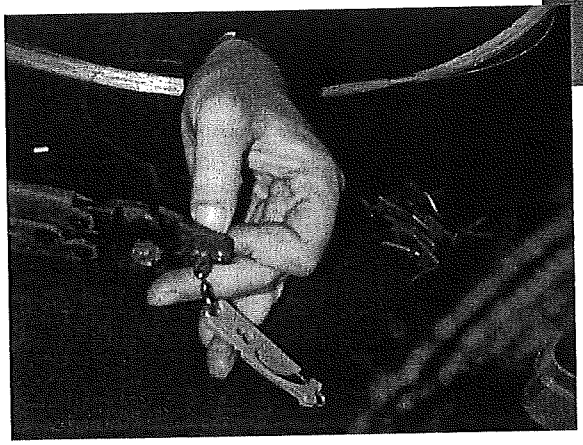


Figure 4. The manual line drum used to store the mainline during construction

A second team was established for the construction of the mainline units. This team consisted of a number of student volunteers on a roster system in addition to the project technician. A workshop was established with two large manual line drums (Figure 4) and a number of work desks positioned 5 meters apart (Figure 5).

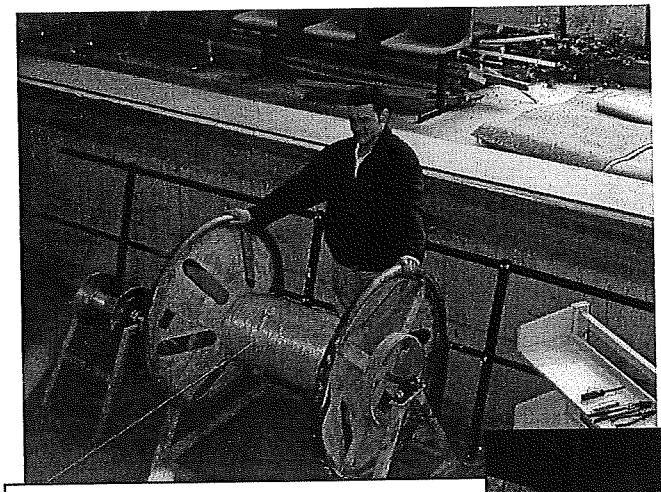


Figure 3. A pair of crimping pliers are used to lightly fix the swage in position

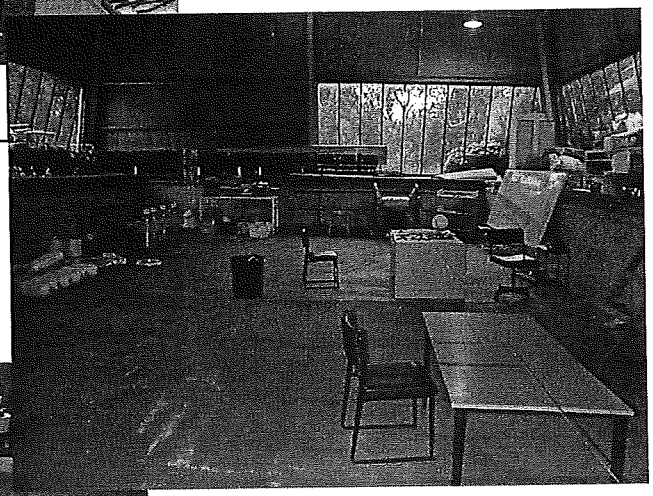


Figure 5. The workshop space configuration with two work descks (right) positioned 5m apart

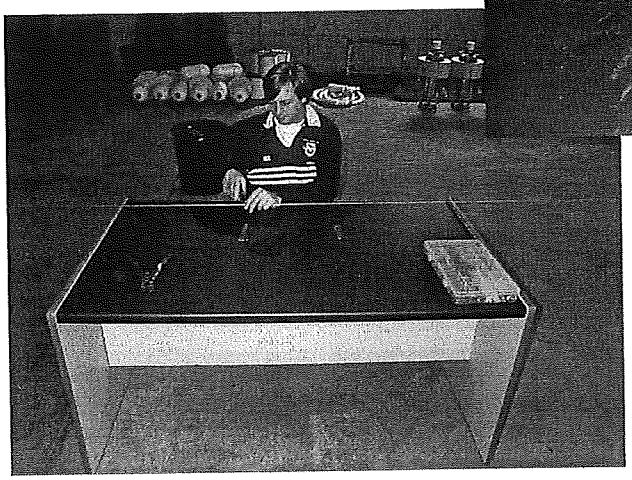


Figure 6. The mainline is reeled past at 10m before the two sets of swages are fixed 300mm apart, at each work desk.

The 3mm monofilament mainline was purchased second hand from a commercial fisher in liaison with the project. It was established that the 1200lb breaking strain of the 3mm monofilament mainline material was far above the operational requirements of the longline system and therefore the fact of it being second hand was not material and this had provided significant cost savings for the project.

The system employed for the mainline segment construction began with one person manning the line drum and one team member at each work desk. Initially, plastic line crimps were used which involved a single stainless steel line crimp secured to the line; a plastic swage was then coupled around this crimp; two more stainless steel crimps were then fastened over the top of the plastic line swage. With two complete swages being required 300mm apart and at 5m spacing it proved to be a particularly labor intensive system. A problem was also recognised with the stability of the plastic swages with regard to slipping along the mainline. Whilst attempts were made to overcome this problem through using a large hand swage press, it did not prove successful.

An alternative method was achieved using aluminum swages. These provided both time and cost savings however as these swages required threading onto the mainline before they could be crimped, this effectively created sub units of approximately 500m within each mainline segment. The difficulty in feeding the line crimps on such a long length of line was considered to be a worthwhile cost as the slippage experienced with the other stops made this system prone to tangling and snood hookups. Accordingly 200 aluminium swages were threaded onto the mainline. As the mainline was reeled from one storage drum to the other, a set of swages were crimped 300mm apart, every 5m, at each work desk (Figure 6).

The mainline was then reeled onto each storage drum, the configuration of which was determined be the individual operator's requirements.

Three major systems for shooting and hauling the longline were established. Firstly, a number of operators decided that the mainline segments could be deployed and retrieved using the existing hydraulic line drums fitted to their vessels. These line drums are currently used for the shooting and hauling of up to 40km of 3.5mm

monofilament nylon for longline operations targeting Southern Bluefin Tuna. The mainline segment for these operators were then provided on wooden storage drums.

A second storage arrangement for two operators was established using small aluminum spools. These ranged between 400mm and 500m in diameter and 150mm to 250mm in width. These spools are mounted horizontally to the hydraulic pot hauler and are typical of the method used to deploy and retrieve vertical dropline.

A third method was developed on the basis of the vertical dropline system with aluminum spools fitted to a spool stand that was then bolted to the top of a hydraulic pot hauler this system was used by industry participants who weren't set up to longline or vertical dropline. These spools and spool stand systems were constructed in stainless steel and aluminium in as shown in Figure 7.

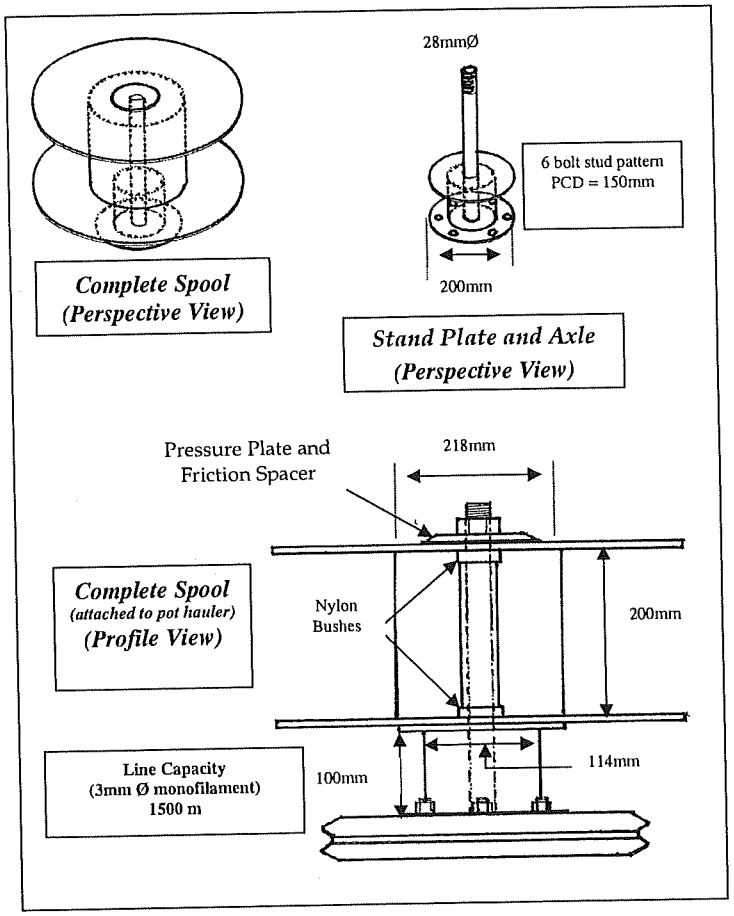


Figure 7. A diagramatic representation of the spool and spool stand configuration used for two vessels within the commercial trial program for the shooting, hauling and storage of the modified longline system.

Through the construction phase of developing the selective longline system, every attempt was made to minimise costs in equipment and labor. Whilst the methods previously described were particularly labor intensive, there was significant cost savings achieved through importing components from Spain and with the significant contribution from student volunteers at AMC's School of Fisheries.

5 RESULTS

5.1 Review of the Ray's Bream Fishery in Spain and Portugal.

5.1.1 Introduction.

During October 1996, a visit was undertaken to Spain and Portugal to examine, in detail, the fisheries for Ray's Bream in these countries. It was seen as a vital part of the project objectives to gain an intimate understanding of operational parameters of an existing fishery as well as attempt to gather other available information relating to this species.

More specifically, a number of areas were evaluated including gear type and fishing techniques employed by professional fishers; a number of valuable contacts established with fisheries experts, gear manufacturers and professional fishers in both Spain and Portugal. Samples of gear currently used in the fishery were purchased and possible adaptation of the fishing techniques into the current project objectives was evaluated.

A copy of the review report has been provided (Appendix 1) which details the Spanish and Portuguese fishery. However, For the purposes of this report, only portions of the operational information has been extracted and summarized.

5.1.2 Behavioral Characteristics of Ray's Bream, *Brama brama*.

Discussions with fisheries scientists, gear technologists and fishers have provided some valuable information related to the behavior of Ray's Bream. Whilst this information is anecdotal it should still be seen as an important resource because of the experience of the individuals providing the information.

The condition, which determines whether the fish are schooling or dispersed, is the state of feeding at the time. If feeding, the fish tend to be dispersed. They will come

together for protection when not feeding. Over a sand bottom Ray's Bream will generally be found in the water column between 130 and 200 fathoms (230 to 360 m).

Professional fishers and research scientists have declared that Ray's Bream are strongly influenced by the moon's phase, and this will have a direct bearing on the fish's position in the water column. On a full moon the fish are found close to the surface, within 40 m however, if there is no moon they may drop to a depth of 140m.

Dr Antonio Vazquez, who studied the Spanish fishery, noticed two periods of high feeding activity during the night. These correlated to 20 minute periods at dusk and dawn, and the periods occur just as light fades or increases. During this time the fish come to within 40 m of the surface. Dr Vazquez postulated that the fish were at this level during the entire night but had difficulty in seeing the bait after the light has gone. In the morning as light intensifies the fish dive to the darker depths for protection.

In the past completion of the long-line set occurred just before dark, then jigging was undertaken by the crew in order to supplement their incomes. Catch rates from hand jigging were quite high. The development of the auto recovery system enabled fishing to occur throughout the day and, much lower in the water column.

However the typical professional fisher sets his long-lines at about 2 am and recovers them after daylight. He only fishes if either there are adequate fish around, which he locates by sounder, or when there is a moon. On a full moon he may make two sets commencing at 4 or 5 PM. The line is left for a few hours then it is hauled and readied for another set early the following morning.

It would appear then that the fish may be high in the water column throughout the night but may only actively feed during the period just at dawn or at dusk,
In all instances the vessels fishing for Ray's Bream use surface long-lines

5.1.3 Setting Operation.

A full description of the fishing equipment, with photographic evidence, employed in the Spanish fishery is provided in the review report (Appendix 1). The following is summarized extract from this report with reference to the setting and hauling operations that will be used for comparison in the discussion of gear development for the initial fishing trials.

The gear employed in this fishery is primarily a component system comprising of 200m meter segments of 2.5mm monofilament mainline with snoods fixed at 1 to 2m intervals. These mainline segments are coiled and placed in plastic shooting trays. This tray has two compartments, one large one for the line and one smaller compartment into which the baited hooks are placed as they are baited and, prior to shooting of the line. The line in one box is joined to the preceding box's line and the one following. A buoy is placed at the junction of each line.

One vessel may carry 200+ of these shooting trays. The trays are stacked ready for baiting. Once baited and ready for setting they are placed onto a stainless steel shooting tray. Each segment of mainline, with its permanently fixed snoods, is placed in the tray. The unbaited hooks are stored on a foam strip between the two compartments.

Prior to setting the hooks are baited and placed in sequence in the metal lined compartment. The metal lining has been fitted by the fisherman to assist cleaning and, to aid the setting operation; there is less chance of the hooks digging in as they might with the plastic surface.

Storage of hooks and mainline in the shooting trays. The hooks are stored on a foam strip placed along the top edge of the partition between the two compartments of the tray. When the tray is being prepared for shooting the hooks are baited and placed in the aluminum-lined open end compartment. The metal lining prevents the hooks from digging into the plastic. The hooks are placed in the order of shooting.

Shooting-tray rack positioned in the stern of the vessel. The rack can accommodate up to four prepared trays. As each tray is emptied it is removed and a replacement tray is

added to the end of the rack, pushing the other racks towards the stern. Each new tray is connected to the proceeding shooting tray. The smaller channel on the left-hand side of the rack is used for baited hooks attached to multifilament long-lines used for swordfish and tuna fishing.

Prior to attachment of bait, the hooks are stored by placing their points into a thin, long piece of high density foam placed between the two compartments. Note, the snoods and hooks always remain attached to the mainline segment.

Setting the line usually takes a little over two hours at approximately 8 knots. The long-lines may have been deployed in one continuos line or, as is often the case, shorter segments are deployed in different locations. The shorter lines allow the fisher to target the school by continually moving ahead of it.

Shooting of the line is from the stern of the vessel. There are basically two types of stern arrangement. However, in both instances the crew work under cover. The stern may or may not have hatch covers

5.1.4 Hauling Operation.

The line is recovered using an hydraulic hauler with a vertically mounted rotor. This is located in the fully enclosed fore deck of the vessel and, the line is retrieved through the portside hatch.

The line is not passed around the drum, as is the case with a pothauler capstan. The inside surface of the two flanges contain rubber blocks which are separated from the opposite flange block by a small gap into which the mainline fits. The two flanges are not parallel to each other but rather are closer together at the top.

This can be adjusted to give better gripping of the line by the adjusting wheel in the center of the left-hand flange. The line itself is actually pinched between the opposing blocks on the inside flange surfaces which tighten as the flanges rotate until they reach the 3 o'clock position where they release.

As the line passes through the line hauler it is manually coiled into circular, plastic bins or retrieval baskets. As each snood is retrieved its hook is placed on a foam pad on the upper edge of this bin.

Once each line segment has been retrieved and coiled the line is transferred to the shooting trays in preparation for the next shot or, for storage. A vessel will have many of these circular bins because the transfer operation requires vigilance to ensure the hooks are laid in the correct order.

Two, almost vertical metal bars, to the left of the flanges, are close together to prevent fish from being dragged through the hauler. The wheel in the center of the flange allows for adjustment of the gap between the metal flanges and hence the tension on the mainline.

Line coiling bin into which the mainline is manually coiled as it is retrieved. This is bin or basket is mounted on a metal frame positioned on the starboard side of the vessel, opposite the line hauler. A crewmember sits behind this basket, which is tilted slightly towards the line hauler, and manually coils the retrieved line into the basket. At the same time the hooks are placed in order around the rim. At a later stage, prior to the next fishing shot, the line is transferred to the shooting tray for storage and shooting preparations.

5.2 Preliminary Fishing Trials

5.2.1 Introduction.

The initial commercial trials were aimed at testing the RB1 longline system under commercial conditions. This system utylises a magazine system to hold baited hooks and has the advantage of being able to be baited and loaded on shore allowing for rapid deployment at sea. This system was developed to overcome the AFMA's autobaiting restrictions. Clearly any effective pelagic longlineing for Ray's ream will require the deployment of several thousand hooks to be commercially feasible and the hand baiting on shooting gear will restrict the number of hooks that can be set to around 2000 per day. Autobaiting would allow setting of up to 12,000 hooks per set

whilst the magazine system could achieve similar results although the number of sets is restricted by the storage space available for loaded (baited) magazines.

The magazine system is clip based and provides a capacity to prebait hooks and then allow for the rapid deployment of gear. The hook and line size needs to be large enough to provide sufficient mass to slide in the magazine track this has selectivity implications in terms of larger pelagics.

The gear was to be trialed on *FTV Bluefin* during March through to May and made available to commercial boats on an *ad hoc* basis. Unfortunately a major engine breakdown on the *FTV Bluefin* limited the trials undertaken on Bluefin. Only one commercial boat trialed the gear but abandoned the gear due to impending management arrangements in the non-trawl sector.

5.3 Gear Description

5.3.1 RB1 Ray's Bream Longline

Mainline:

- 1 X 3600m mainline - monofilament
  - 3.0mm diameter
  - Negatively buoyant
  - Line crimps at 10m spacing
  - Float marks 200m spacing
- 1 X 4800m mainline - monofilament
  - 3.0mm diameter
  - Negatively buoyant
  - Line crimps at 20m spacing
  - Float marks 200m spacing
- 1 X 5100m mainline - monofilament
  - 3.0mm diameter
  - Negatively buoyant
  - Line crimps at 20m spacing
  - Float marks 200m spacing

Snoods, Hooks and Floats:

- 600 x snoods (constructed) – monofilament
  - 1.5m diameter
  - 1m length
  - Configuration: Clip – swivel – eyelet – crimp – line – bead – crimp – eyelet – hook
  - Provisions for a further 400 snoods of this type
- Hooks – 1000 units of No5 and No6 Kirby type hooks.
- Floats – polystyrene
  - 9 inch diameter
  - 6mm multifilament float lines
  - 25 m length segments

Magazines:

- 2 X Storage Magazines – aluminum channel
  - 3m length
  - Capacity of 200 hooks per magazine
  - T-stands for location on deck
- 4 X Dry Storage racks (post – haul)

Pelagic Droplines:

- 6 X pelagic dropline spools – aluminum line spool

- Polystyrene float
- Braided monofilament mainline

- 6 X monofilament branch line segments - 10m length per segment
  - 1m snood spacing

Radio Beacons:

- 6 X Radio Beacons
- 8 X D-cell battery packs.

5.4 Operational Method

5.4.1 Preparation

The gear was prepared by manually baiting the hooks and transferring them from the dry storage racks to the shooting magazines baits consisted of 70% squid and 30% mackerel. Each snood was located on the shooting magazine using the polyethylene slide bead so that it moved freely along the track (Figure 8). Once the baiting operation was completed the shooting magazines could be stored in the freezer or chiller depending on when it was to be used.

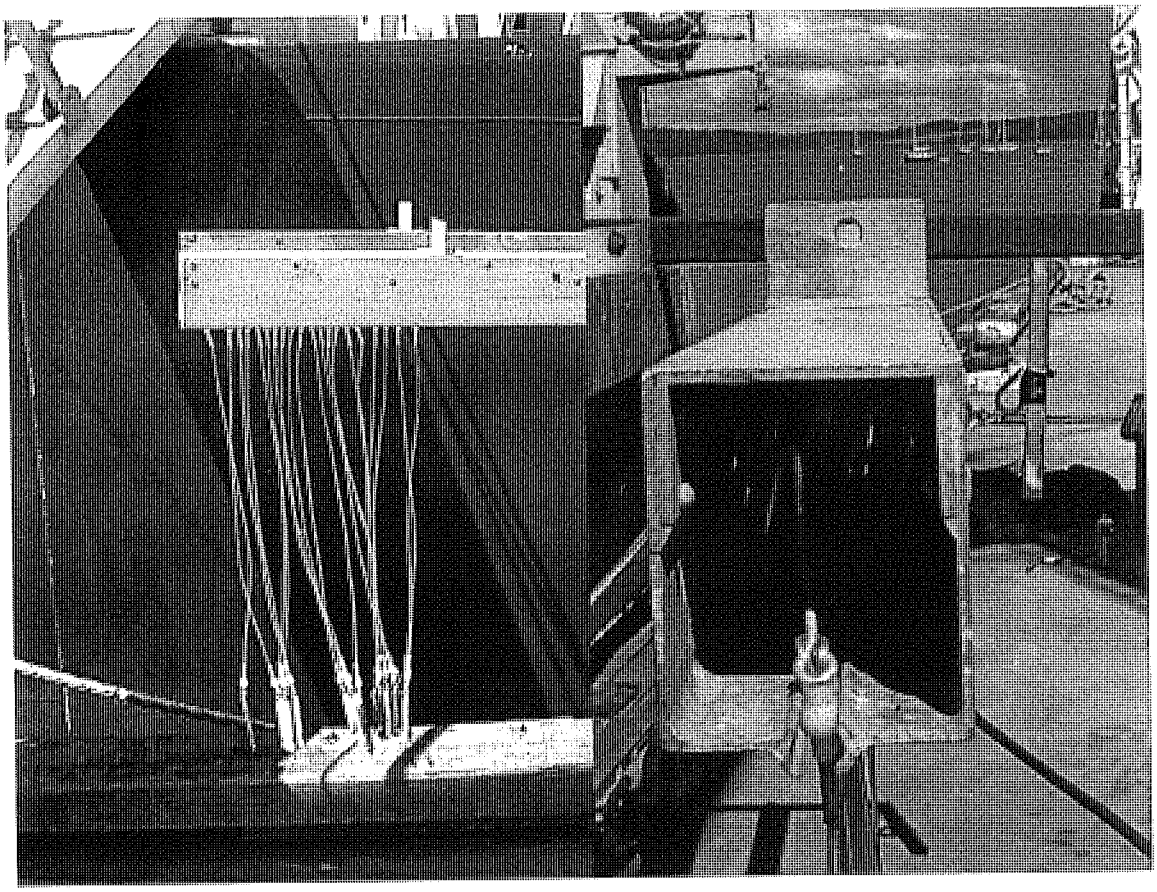


Figure 8. Snood located in the aluminium shooting magazine using the polyethylene slide bead

For shooting the magazines were loaded on the T-stands on the aft deck. The mainline float lengths are determined by the desired fishing and storage system was employed to minimize the chance of these lines tangling as the are deployed. A tori line system was deployed and inspected to ensure they were operating correctly prior to the commencement of any setting operation.

5.4.2 Deployment

Once a suitable echo target was located the gear can be deployed relatively quickly. Firstly a radio beacon and large float securely attached to the leading end of the mainline is deployed. It should be noted that due to the short length of the mainline units, a maximum of two radio beacons were attached, one at either end. This avoided any problems associated with tidal drag on the beacons causing them to drift in such a manner as to tangle the gear.

The mainline drum was spooled out at a speed determined by vessel speed and the need to ensure the line remains tensioned at the point where the snoods are attached. As the line crimps pass the shooting magazines, the q-clips are simply snapped on between the crimps. The q-clips (Figure 9) then slide along the line until stopped by the line crimps at which point the snood comes under tension and pulls free from the magazine. The shooting speed is only limited by the capacity to clip the q-clips to the mainline and the odd snood tangle.

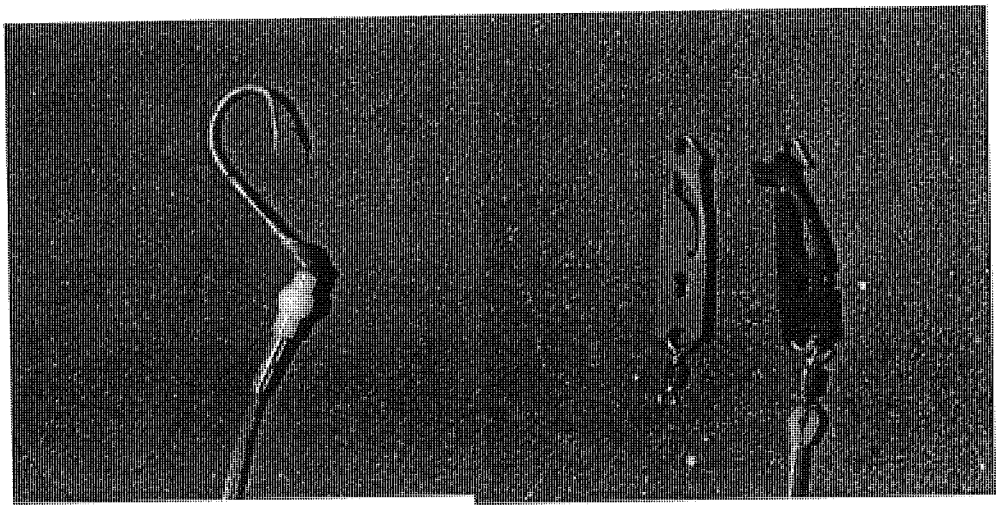


Figure 9. Hook and polyethylene slide bead and Q –clips used to clip snoods to the mainline.

Floats are attached in the same manner at 200m spacings. This operation generally requires a separate crewmember. An effective method employed by domestic tuna longliners is to set up a timed beeper that indicates the snood and float intervals.

5.4.3 Hauling

The hauling operation involves firstly locating the end of the set line using the direction instruments that detect the transmission from the radio beacons. This can be quite difficult in adverse weather conditions so a general GPS position needs to be plotted. Currents and wind cause drift and bunching of the line in gusty conditions and care needs to be taken to maintain track of the gear.

Once the beacon has been located and secured aboard, the mainline can be passed through the fairleigh and joined to the mainline drum. The storage racks and bins are prepared prior to retrieval so that the gear can be quickly stowed as it is brought onboard. Once the mainline drum has been engaged at an initial speed the crewmember or members tending the fairleigh must monitor line tension adjust the hauling speed as required.

Each snood is quickly detached and located on the dry storage racks ready for re-baiting. Any Fish caught are detached from the hooks and iced down as quickly as possible to preserve flesh quality. The float lines are coiled either by hand or directly into a storage basket.
Species and quantity caught are presented in Table 1 below:

Table 1. Species caught during fishing trials aboard *FTV Bluefin* on the 3rd and 4th of April 1997.

SPECIES	SCIENTIFIC NAME	NO.	TOTAL WEIGHT (kg)
Ray's Bream	*Brama brama`*	2	4
Albacore	*Thunnus alalunga*	1	1.5
Blue-eye trevalla	*Hyperoglyphe antarctica*	10	49
Pink ling	*Genypterus blacodes*	5	16
Blue grenadier	*Macruronus novaezelandiae*	7	16

5.5 Biology.

Due to the small numbers of Ray's Bream caught few of the biological objectives were achieved.

5.5.1 Length Distribution

Lengths were obtained for Ray's Bream caught during the initial trials using the RB1 Longline system. These are presented in Figure 10. No length composition data has been collected for the AMC/FRDC Longline System used in the commercial fishing trials as no fishing has occurred at the time of reporting.

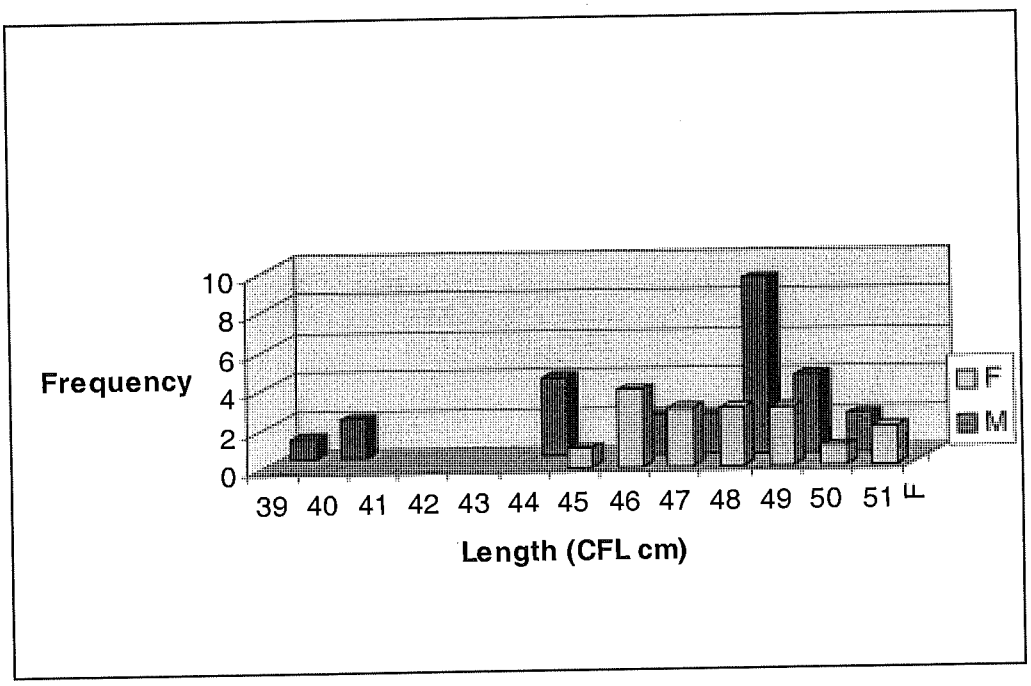


Figure 10. Length composition of Ray's Bream caught during fishing trials.

5.5.2 Length Weight Relationships

The length (caudal fork length) to weight relationships for both male and females were determined using a least squares method and these are presented in Table 2.

Table 2. Ray's Bream length weight relationship

Males:	$Wt\ (kg) = 5.8 \times 10^{-8} + (CFL(mm))^{2.816}$	$r^2 = .98$
Females:	$Wt\ (kg) = 1.89 \times 10^{-7} + (CFL(mm))^{2.629}$	$r^2 = .81$

5.6 Industry Consultation

5.6.1 Port Visit Program

Throughout the project there was extensive consultation with members of the Tasmanian, Victorian and New South Wales commercial fishing industry. This typically took place under the auspices of a port visit program, which was instituted to provide a method of dialogue with the industry. Fishers involved in the meetings included domestic tuna longlining operators, dropline operators, crayfish fishermen and a number of other small-scale fishers. Project staff regularly visited the ports of Hobart, Triabunna and St Helen's to discuss and jointly develop a longline system that would be not only acceptable but "owned" by the industry. It was considered that a voluntary commercial trial could only be implemented if industry felt part of the development process.

Cooperation was also sought from line fishers in the use of their historical catch records. Despite indications of cooperation only one operator in the SEFNT and one operator in the ECLTF formally agreed to the project obtaining access to their catch data. The project hoped to analyse the by catch records of Ray's Bream to obtain further insights into the spatial and temporal distribution of Ray's Bream. This objective had to be abandoned due to a lack of worthwhile data and the limited use to which the available data could be put. Fishers cited issues of commercial confidentiality as the primary reasons for their lack of cooperation. In addition, a number of the skippers approached agreed to make the data available but were over ruled by the owner.

The changing management arrangements in the non trawl sector, which was shifting to quota allocation based on historical catch history, increased the degree of commercial sensitivity in relation to the use of historical catch data.

5.6.2 Formal Industry Meetings

Recognising the political sensitivities of the proposed commercial trial the project made presentations to the peak industry organisations and relevant management advisory committees to provide full exposure of the characteristics of the gear and the nature of the proposed commercial trial. Specific presentations were made to the

Tasmanian Fishing Industry Council, the South East Fishery Non-Trawl Consultative Committee and East Coast Tuna Management Advisory Committee. Industry support was sought and obtained in these representations. Industry concerns related to bycatch (fish and seabird species), licensing and future access to a developing fishery. Subsequently, consultation with these groups would serve to establish the operational conditions the commercial gear trial program had to meet in order to satisfy key threatening processes and the participant profile acceptable tot he industry.

5.6.3 Commercial Trial - Industry Liaison Outcomes

- Fishers were interested in the setting and retrieval process used by Spanish fishers. There was no similar gear in terms of design, gauge or setting and retrieval methodology in use in Australia. Cost of the equipment and fishing gear was also sought, as was information on import duties and suppliers.

- Industry agreed that a trial of the new longlines system would provide the best opportunity for testing the gear and the commercial feasibility of targeting Ray's Bream. The gear provided needed to be both workable by existing operators and be adaptable to their current line fishing equipment. In addition the longline section needed sufficient hooks to make it worthwhile deploying. After consultation it was agreed that the experimental unit should be approximately 2.5 km in length with a 1000 snoods.

- Industry agreed the fairest selection process would be through a public "expression of interest" and that a broad geographic distribution be achieved, within the boundaries of those fisheries where this developmental gear be most effectively targeted for the capture of Ray's Bream.

- Three major operational restrictions were discussed with industry. Firstly, that all vessels participating in the trials would be required to use tori poles in order that they met regulations introduced to reduce the incidental take of seabirds during pelagic longline operations. Secondly, each vessel would need to agree to a specific position and catch reporting system. Lastly, a special permit would be required by participants to cover the use of the experimental pelagic longline system.

- Questions were invariably raised concerning AFMA regulations with regard to the use of commercial vessels in the trials and future access to a fishery.

5.7 "Expressions of Interest"

Twenty one interested parties contacted project staff within a four-week period following the placement of the advertisements.

The operators selected for the commercial trial program were:

1. *Operator:* Brian K Bailey
   Company: B.K.Bailey Commercial Fisherman and Processor
   Vessel: "the Karina B"
   Port: Bellerive, Tasmania
   License in Fishery: SEFNTP

2. *Operator:* Terry J Horton
   Company: Karangi Fishing
   Vessel: Unknown
   Port: Eaglehawk Neck, Tasmania
   License in Fishery: ECTLFP, Charter Survey

3. *Operator:* Kerry Tatnell
   Company: Blue Eye Fishing Pty Ltd
   Vessel: Unknown
   Port: Port Arthur, Tasmania
   License in Fishery: SEFNTP, State CBFL, ECTLFP, Squid

4. *Operator:* Matthew Cruse
   Company: Spring Bay Tuna
   Vessel: Unknown
   Port: Triabunna, Tasmania
   License in Fishery: SEFNTP, ECTLFP

5. *Operator:* Jock Nichols
   Company: Tasmanian Tuna Company

Vessel: Makaira

Port: Hobart, Tasmania

License in Fishery: ECTLFP

6. *Operator:* Charles Saunders

   Company: CA & MP Saunders

   Vessel: Flo Baby

   Port: Coffs Harbour, New South Wales

   License in Fishery: State License

7. *Operator:* William Mure

   Company: Mures Fishing Pty Ltd

   Vessel: F.V Kiella

   Port: Hobart, Tasmania

   License in Fishery: SEFNTP

8. *Operator:* Lisle Elleway

   Company: Arrow Fisheries

   Vessel: Unknown

   Port: Portland, Victoria

   License in Fishery: Squid jigging license, Octopus Trap License, State License

9. *Operator:* Louis Green

   Company: Green Willou

   Vessel: Unknown

   Port: Portland, Victoria

   License in Fishery: SEFNTP, Squid Jigging License.

All of the successful applicants for the commercial trial program were provided with an information package. This information package contained:

- a description of the objectives of the commercial trial program
- a detailed report of the Ray's Bream fishery in Spain and Portugal
- use of tori line systems; provisions for applications for Scientific Permits

- Procedures for the Disposal of Catch and
- the log book system implemented for the trial program.

5.7.1 Development and Implementation of Scientific Permits

The Scientific Permit conditions couldn't be finalised until the participants were selected and their license package assessed against the regulatory requirements of the states and commonwealth. Whilst a number of the operators already possessed adequate licensing for the use of pelagic longline systems, it was felt that the best situation was for all participants to apply for a Scientific Permit. This was to have a number of benefits including avoidance of dual carriage of gear restrictions, in addition to satisfying the regulatory authorities with regard to affective control of fishers within the program.

The establishment of operational and administrative guidelines for the issuing of Scientific permits and the development of appropriate operational conditions was a lengthy process. Project sought to produce a permit structure that facilitated the achievement of the commercial trial program objectives, allowed for integration of the developmental gear operation into existing fishing activities and ensured operational procedures that mitigated the key threatening processes.

The final scientific permit structure and operational restrictions were homogenous across all participants in the trial program although they were issued for two areas of operation.

Area A: "That part of the Australian fishing zone (excluding any waters administered in accordance with the laws of a State or Territory) adjacent to New South Wales and Queensland, specifically those waters defined by **Zone B (Northern Inshore)**, as determined by Management zones for the East Coast Tuna Pelagic Longline Fishery.

(Specific to Charles. A. Saunders operating from Coffs Harbour, NSW)

Area B: That part of the Australian fishing zone (excluding any waters administered in accordance with the laws of a State or Territory) adjacent to the coastal waters of Victoria and Tasmania.

SCIENTIFIC PERMIT CONDITIONS FOR FRDC/AMC PROJECT TO DEVELOP A SELECTIVE PELAGIC LONGLINE SYSTEM FOR RAY'S BREAM

SCHEDULE 2 - AREA OF WATERS

That part of the Australian fishing zone (excluding any waters administered in accordance with the laws of a State or Territory) adjacent to the coastal waters of Victoria and Tasmania (OR NSW AND QUEENSLAND - as appropriate)

SCHEDULE 4 - CONDITIONS

1. This Scientific Permit allows the boat specified in Schedule 3 to conduct research activities in the area of waters specified in Schedule 2 in accordance with the Fisheries Research & Development Corporation project 95/102: **The development of a selective longline system for the capture of Ray's Bream,** only using the experimental Pelagic Longline developed and provided by the Australian Maritime College, Beauty Point, Tasmania for the purpose of fishing for Ray's Bream (Brama brama). The experimental Pelagic Longline is to consist of a mainline of no more than 3.5mm diameter monofilament, and branch lines / droppers / snoods of no more than 1.5 m in length and 40 lb breaking strain.

2. The Scientific Permit does not allow the taking of gummy shark (Mustelus antarcticus), school shark (Galeorhinus galeus), Southern Bluefin Tuna (Thunnus maccoyii), gemfish (Rexea solandri) , blue grenadier (Macruronus novaezelandiae),blue warehou (Seriolella brama), pink ling (Genypterus blacodes) or blue-eye trevalla (Hyperoglyphe antarctica). If any of these above species are taken in the course of fishing under this Scientific Permit, they must be returned to the sea immediately and recorded in the logbook.

3. Subject to Condition 2 of this Scientific Permit, any product that is taken in accordance with the activities specified in Condition 1 above,

other than that taken for research purposes at the direction of an Australian Maritime College officer, may be retained or sold.

4. This Scientific Permit is not transferable.

5. This Scientific Permit does not allow the carrying of fish taken with the use of another boat.

6. This Scientific Permit does not allow the transshipping of fish.

7. The grant of the Scientific Permit is made on the basis that the permit's grant, any catch and effort accruing under this permit, and any economic investment arising from the grant of the permit are matters not likely to be taken into account in determining future access to any Commonwealth fishery.

8. This Scientific Permit, or a true copy, must be carried on board the boat at all times and must be produced on the request of a Fishery Officer or an officer of AFMA.

9. The Scientific Permit holder shall facilitate the carriage on board the boat of scientific observer/s. The Scientific Permit holder must ensure that the scientific observer/s is/are given reasonable access to all areas and facilities of the vessel required by these scientist/s to collect data, samples, photographs and other information necessary to permit independent assessment of the vessel's total catch and effort, and other information for this project.

10. The Scientific Permit holder must ensure that the scientific observer/s is/are provided with a satisfactory standard of accommodation, victualling, medical care to an adequate standard and a safe and healthy living and working environment in which these scientific observer/s is/are free from harassment and undue influence.

11. The Scientific Permit holder must make available reasonable daily access to the vessel's radio and satellite communication facilities if available to permit these scientific observer/s to make scheduled communications with their research agency.

12. The Scientific Permit holder must ensure that for each trip, AFMA is notified before commencing fishing under this permit.

13. The Scientific Permit holder must ensure that for each trip, AFMA is notified of the conclusion of fishing under this permit.

14. The notification referred to in conditions 12 and 13 must be made by calling telephone number 132 222 and quoting pager number 375 105. A message containing the following information should then be provided to the operator:

a) the boat's name;

b) the boat's distinguishing symbol; and

c) the intention to conduct fishing pursuant to FRDC project 95/102, **OR** that fishing has been concluded under FRDC project 95/102 (as appropriate)

15. The Scientific Permit holder shall ensure that the Australian Tuna Longline Logbook (AL04) is completed for every day of pelagic longline fishing in the area specified in Schedule 2 in accordance with the instructions contained in that logbook and clearly marked FRDC research project number FRDC 95/102.

5.7.2 Log Book Program

It was the realization of research staff from the outset of the project that without an efficient and practical system for information recording, the benefits of the trial program would be easily negated. With this in mind, research staff obtained templates for a log book system from a range of sources including commercial operators vessel logs, official log books from AFMA and a range of data recording material from the operation of AMC's training vessels and field work studies.

The data requirements of the project were assessed by research staff in liaison with other staff, with expertise in this area, at AMC's school of fisheries. Needs of the project not only involved data requirements but also integration of the log book system into the existing data records of operators within the commercial trial program. It was noted that fishers may be concerned if a high proportion of the information they are collecting as part of their vessel logs need be duplicated in a separate log book system for the trial.

It was the final decision of the research staff to use the existing AFMA Australian Tuna Longline Logbook (ALO4) for the data recording system for the operation of the developmental longline system. This as to have a number of advantages both in the range of data achieved and the administration of the commercial trial program with respect to regulatory authorities such as AFMA and FRDC.

5.8 Industry Trial

5.8.1 Fisheries Management Environment

As the project sought to develop a longline system that met both commercial and fisheries management requirements, project staff have had to operate in an changing environment. The inclusion of the South East non-trawl sector in the SEF quota management arrangements resulted in considerable tension within this sector. Many fishers receive quota that was significantly less than their previous catch history. The process of verification of catch history and subsequent allocation consumed the attention of fishers in this sector. Whilst many fishers recognised the potential and desirability of developing the Ray's Bream fishery they nevertheless were focussed on the level of access they had for their traditional fisheries. Within this climate it was difficult to enlist voluntary participation in costly and speculative fishing trials.

Bycatch issues in both the SBT and East Coast Tuna received increased attention and regulation. The project was always cognizant that seabird bycatch had to be eliminated but in its initial design accpeted that a mechanism existed for purchasing SBT quota to overcome SBT bycatch. The altered structure of the SBT fishery and the dramatic increase in quota price and the lack of available quota meant the project

had to change the characteristics of the longline system to accommodate these factors. Accordingly, the AMC/FRDC longline system was developed to meet all these needs and the approval of the regulatory authorities, management advisory bodies and the commercial fishing industry and their representative groups.

The introduction of quota management arrangement in both the non trawl and Tasmanain Rock Lobster fisheries reduced catch in both fisheries and Ray's Bream was seen as offering an opportunity for operators to target a new species for exploitation in an attempt to maintain earnings which in some cases were drastically cut by quota arrangments. However, only operators with an east coast tuna permit had the right to use pelagic longlines. AFMA's 1998 Management Arrangements for the Southeast Non – Trawl Fishery established specific management arrangements with regard to bycatch provisions for both state and commonwealth operators. Within these are **specific possession limits for Ray's Bream which as of 1998 stood at 10 fish (SA and VIC operators) and 10 fish or 40kg, which ever is greater (TAS operators) for State licensed operators. On this basis interested had no incentive to undertake exploratory fishing for Ray's Bream.**

Other administrative requirements complicated the commercial trial program as operators were using a specific gear type but held licences in several different fisheries – some of which specifically excluded the use of pelagic longlines. Existing regulations also prohibited the carriage of this gear. Whilst the scientific permit was established specifically for the operation of developmental gear, the industry participants viewed the trials from several different perspectives depending on their State and fishery of origin and whether or not they had a Commonwealth or state or both fishing licences.

In the case of the Tasmanian dropliners many were so impacted upon by the reduced quota that they claimed they could not afford to undertake experimental fishing and risk a loss on the venture. Other operators stopped droplining and leased their quota.

These dramatic changes in fisheries management arrangements coincided with significant fluctuation in environmental conditions attributed to *El nino* and *La nina* cycles with resultant altered oceanographic and meteorological conditions. This was

typically indicated by higher than average water temperatures, increased rain fall etc. Poor catch rates were recorded for both SBT and Blue eye due to apparently to a delay in the "normal" seasons and was further examplified by the behaviour of other pelagic species (mackerel, squid, etc) and the presence of comparatively large numbers of killer whales who intefered with normal line fishing operations off Tasmania.

Market forces impacted on the capacity for Tasmanian fishers to continue to line fish in these conditions as market prices were poor despite decreased catches. Altered fisheries management and industry structural arrangements contributed to a dramatic increase in quota leasing costs. Prior to 1998-99 SBT quota prices averaged between $5-$7/kg, for the 1998-99 season quota prices averaged $12/kg.

The fish farms in South Australia were taking large volumes of quota as their product was achieving a better market price. Conversely, export market price for longline caught fresh Southern Bluefin Tuna experienced significant downturn due to a number of factors including large volumes of Bluefin Tuna from domestic Japanese suppliers.

As a result the domestic tuna longliners were working on a very narrow profit margin, effectively reducing the level of fishing effort during the commercial trial program and hence reducing the opportunity for the deployment and trial of developmental gear. In addition, during periods of good weather and where conditions prevail for likely catches of target species, fishers were forced to achieve absolute maximum operational efficiency, exploiting known grounds with well developed methods. In these circumstances industry participants in the trial were not prepared to bear the cost and risk associated with the use of new pelagic longline gear and the project had insufficient funds to charter industry boats to undertake the trials.

6 CONCLUSION

The project was beset by drastic management changes, industry restructuring and restrictions that related directly to the gear design and the incentive for industry to bear the risk of exploratory fishing trials. These dramatic changes in fisheries

management arrangements coincided with significant fluctuation in environmental conditions attributed to *El nino* and *La nina* cycles with resultant altered oceanographic and meteorological conditions and as a consequence no two fishing seasons were the same though the period of the project. In these circumstances industry participants were not prepared to bear the cost and risk associated with the use of new pelagic longline gear. This was despite the project arranging scientific permits and complete test longline units, only one fisher out of ten fishers issued test gear, used the longline.

Despite these problems a new AMC/FRDC longline system suitable for the capture of small to medium pelagic species was developed by the project. The light construction provides opportunities to use the gear to catch small-medium pelagics such as Ray's Bream and effectively operate outside the existing longline fisheries and thus truly establish a new fishery.

The project undertook extensive and regular contact with industry through workshops and regular port visits and was as a result able to achieve significant industry input into the design of the gear and commercial trial. It would have been easy for the Eastcoast tuna or SBT fishers to resist the commercial trials but through effective consultation the project gained widespread support.

In the end the industry trial failed due to the high cost and risk of undertaking any long term fishing trials. This is understandable given the SEF non-trawl fish restructuring that occurred during the project life and the lack of any incentive to undertake the economic risk. If participants who actively undertook the trials obtained some future right of access then the incentive may have been sufficient to undertake some trial fishing.

Projects that seek the assistance of industry to undertake exploratory fishing must have sufficient funding to lower the economic risk to the fisher or alternatively must get the prospective fishery classified as a developing fishery and thus provide for the fomal recognition of the risk takers in any future allocation of access. Indeed effective coordination between a developmental fishing programme and the relevant administrative authority could prove mutually beneficial. By establishing the

prospective fishery as a developmental fishery most of the difficulties encountered by this project could be settled prior to the commencement of the project. A changing management environment is inevitable if the experimental fishing project is required to meet the management requirements of at least two jurisdictions and 5 different fisheries.

An added benefit to a project, of such and arrangement, is that if the project succeeds and results in the development of a new fishery the opportunity and actual costs borne by the industry participants can be recognised in the new fishery. This would act as a positive incentive for participation in such projects.

Recommendation 1
FRDC ensure that applicants reach agreement with the appropriate management agency as to the management parameters surrounding the developmental fishing project and where possible that these agreements include the establishment of the prospective fishery as a developmental fishery so that industry participants can gain some recognition for their pioneering activity.

7 BENEFITS

The testing and trialing of a unique Australian designed and manufactured longline system has provided significant benefits for the manufacturer as the q-clips and magazine are now used in other Australian line fisheries and exported.

The AMC/FRDC longline has altered the thinking of many fishers considering pelagic longlining. The light construction provides opportunities to use the gear to catch small pelagics such as Ray's Bream and effectively operate outside the existing longline fisheries.

The extensive industry consultation, the industry trial and the distribution of commercial trial units has significantly increased the level of awareness of the potential for a new fishery and provided industry with a longline system that meets management and community expectations in relation to bycatch. These are significant benefits tot he industry. However, these benefits will not be utylised until

the industry restructuring in the SEF non-trawl sector has been completed and fishers have sorted out their operational capacity.

From an administrative viewpoint the trial has established the likely fishery profile of small pelagic fishery and most of the operational conditions developed for the scientific permits can be directly adapted to a Commonwealth permit. It is suggested that one strategy that could promote development of the fishery would be the classification of a Ray's Bream Developmental Fishery and the seeking of expressions of interest to participate in the fishery.

8 FURTHER DEVELOPMENT

Progress in the development of the fishery is contingent upon the establishment of an appropriate environment to facilitate exploratory fishing by industry. There are several impediments to the development of such a situation. Firstly, the industry has no traditional experience in the operation of light longlines requiring the deployment of several thousand hooks per set. Indeed most boats are ill equipped to undertake such fishing operations. Secondly, existing AFMA restrictions make it unlikely that such an operation could be economically viable as the banning of autobaiting and thus the imposition of manual baiting, results in a comparatively high cost per hookset.

The current restriction on autobaiting should be removed in fisheries where output controls are in place as there is no rational fisheries management or economic argument for the restriction. Thirdly, administrative restrictions interms of permit conditions that restrict the carriage of such longline equipment effectively prevents fishers from undertaking exploratory fishing. Fourthly, it is unlikely given the above and the significant cost and risk associated with a full commercial trial that any fisher will bear such a risk.

On this basis further longline trials should be pursued and funding provided to offset some of the financial risk for a fisher to undertake these trials. Sufficient funds remain within the project to achieve this. The remaining funds could be used to cover a portion of operational costs to ensure a dedicated commercial trial of the AMC/FRDC longline.

Recommendation 2

That the remaining project funds be used to allow the Principal Investigator to offset some of the operating costs of fishers trialing the AMC/FRDC longline to facilitate the trial of the gear during the next fishing season.

Longlining offers several advantages in that fish so caught fetch higher prices due to superior appearance and quality when compared to trawl caught fish. Both demersal and pelagic longlines cause little habitat interference or damage. Bycatch can be controlled to some extent with hook size and break load points. With appropriate deployment methods the seabird bycatch can be eliminated. The focus on both bycatch reduction and the mitigation of habitat damage caused by trawling suggests that some of the new small boat autolines ought to be trialed in a variety of benthic habitats to determine their impact on habitat and catch composition and rates. Such trials would provide a sound basis for AFMA to review its existing line fishing restrictions.

Promoting New Fisheries

This project provides a useful case study to highlight the difficulties faced by industry in developing new fisheries based either on new techniques or new species or both. These difficulties should not be seen as a reflection of a lack of cooperation and goodwill on behalf of staff of AFMA nor the industry rather it should be seen as a reflection of the

9 REFERENCES

Last, P. and Baron, M. (1994). *Rays Bream – A New Pelagic Fishery?* P19 – 24 Australian Fisheries. August, 1994.

APPENDIX 1

INTELLECTUAL PROPERTY

No commercially valuable intellectual property has resulted from this research.

APPENDIX 2

STAFF

Marc Wilson - Principal Investigator

Richard Bond - Research Assistant

Daniel Casement - Research Assistant

Jim Blackburn - Research Assistant

APPENDIX 3

A Review of the Ray's Bream Fisheries in Spain and Portugal.

Introduction

Portugal and Spain both capture and land Ray's Bream *Brama brama*, Those caught by the Portuguese are taken as a by-catch from the swordfish longline fishery, however, the Spanish target this species using longlines.

The fish does not bring a high price in Portugal, conversely it commands good, steady prices in the Spanish markets. The fish is popular with the Spanish people.

This article outlines the Spanish techniques and experiences. The information was sourced from scientists, fishers and wholesalers. Some mention is made of equipment manufactured in Portugal and supplied to the longline industry in both Spain and Portugal.

The Fisheries

The Portuguese fleet fishes for swordfish and yellowfin tuna. Most of the fleet is located in Southern Portugal, on the Algarve, in the Mediterranean. Ray's Bream are taken as a by-catch from these fisheries and hence the gear employed is very heavy.

The fishing season for swordfish is around May when the water temperatures are greater than 18° - 19°C. The fish tend to move south when the water temperatures drop below this temperature. Ray's Bream (Xaputa in Portuguese) appears to have been exhausted in the northern and western waters off Spain, and the fish stock appears to have moved south to the northwest coast of African, off the coast of Morocco.

Catches of Ray's Bream have been taken off the coast of southern Africa, between Algoa Bay, Port Elizabeth, South Africa to Walvis Bay on the West Coast of Africa. New Zealand mid-water trawlers have also been successful in targeting this species.

Ray's Bream are epipelagic fish which spend most of their lives in the open ocean. In Australian waters this fish is generally captured by tuna longline fishing vessels and, more recently by dropline fishers. The latter capture the fish in deep water off the shelf break and, usually when the line is being deployed or retrieved. Most reports from these dropline fishers suggest that Ray's Bream are taken on the top hooks of the droplines which indicates the fish are not found near the bottom.

This species may grow to 60 cm in length and approxmately 3.5 kg in weight. However, the size range of fish taken by longline fishing vessels is between 35 and 50 cm, with most between 40 and 45 cm in length, and 2.5 kg in weight.

Fish samples taken in Tasmanian waters have not been gravid although reproductive activity has been indicated by the presence of spent females in the samples taken; it is not known where they breed or when. However, being pelagic fish it is likely that they spawn in the open ocean. Of twenty-seven fish taken by longliners during September 1995, 14 were females and, all were spent. There ovaries indicated they had spawned within the month.

Distribution of the fish, in Australian waters, is quite widespread and, ranges from south-west Tasmania and along the east coast as far up as Bermagui. Their distribution may change with seasons and currents. Also the distribution is based on limited information provided by the AFMA catch database for the Japanese Southern Bluefin Tuna fleet. This information may be biased due to the seasonality of the fishing effort.

Equipment.

a. Portugal

The Portuguese longline fishing gear is extremely robust, and indeed it needs to be because of the size that swordfish can attain (300 - 500 kg). One Portuguese manufacturer, FACMIL, produces hydraulic line-drums, and line-setters which are either hydraulic or electrically operated. The line-drums, used by the average Portuguese longlining boat, will hold approximately 100 miles of 4.5 mm diameter, monofilament line. The flanges are constructed of steel for added strength and, are heavily galvanised for protection (see figure 1).

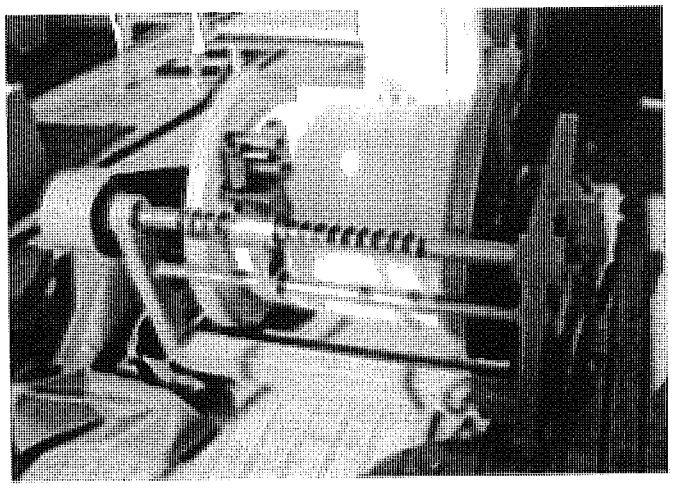


Figure 1. Longline drum, manufactured by FACMIL, Portugal and, installed on a Portuguese fisheries research vessel. Steel was employed in the manufacture of the strengthened flanges. The manufacturer claims that the retrieval process stretches the monofilament, and upon release of this tension the monofilament relaxes and the diameter of the line increases. This puts added pressure on to the flanges of the linedrum.

Although monofilament line is used for both the swordfish and tuna longline fisheries there is a belief that multifilament longlines have a better fish attracting power. It is postulated that this is due to the retention of bait and

small fish material between the filaments. This material adds to the "smell" contributed by the bait.

In addition to the linedrum FACMIL also manufacture a line setter, this has controls which enable the speed at which the line is stripped from the drum to be varied. The setter is also able to record the speed of line stripping in m/s and the total length of line pulled off the drum; the distance between hooks and buoys remains independent of the line setting operation. The line setter is operated either electrically or hydraulically. (see figure 2.)

Figures 2a & 2b illustrate front and side views of the line setter. This setter is able to record information such as the speed of line stripping from the drum and the length of line set. It also permits variation in the distance between hooks and buoys.

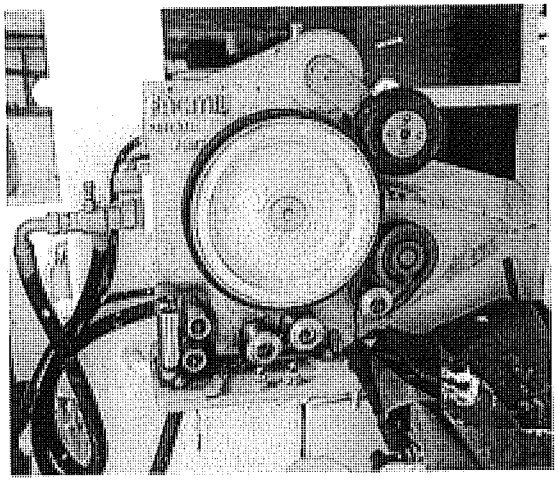


Figure 2a Side view of line setter.

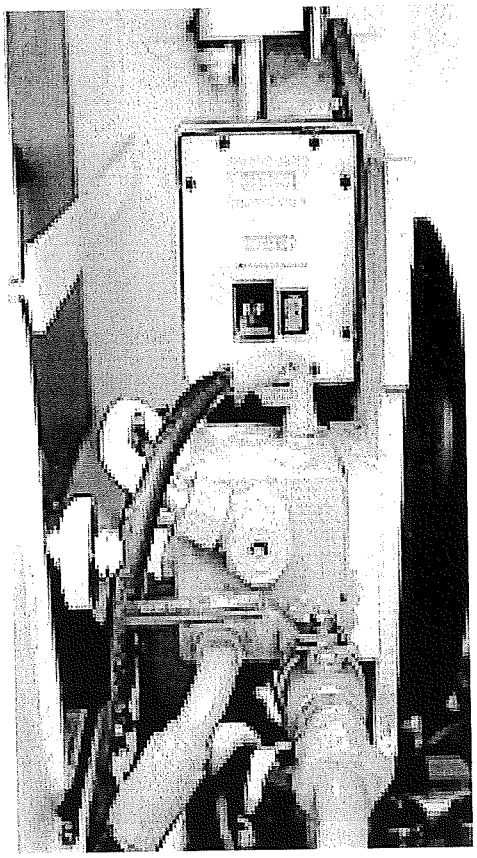


Figure 2b Frontal view of line setter. Note the counter at the top of the picture.

Larger vessels in the longline fleet tend to have a lower CPUE than the smaller vessels. This is due to the conflict which arises between captains and fishers, who on the larger vessels are different individuals. Smaller vessels are usually operated by a master/fisher. The control of both the direction and speed of the vessel during line retrieval operations is crucial, particularly when the size of swordfish may be very large, however, a ship's master may have different priorities to that of the fisher.

Setting of longlines for swordfish is both temperature and seasonally dependant. Bait used for the swordfish are glass eels, which are caught in nets at night. However, 90% of the eels caught are exported to Spain. Squid are also used as swordfish bait but is very expensive and, fishers must compete with buyers purchasing for human consumption. The price paid for squid, of about 20 cm in length, to be used as bait is approximately Aus $12/ kg.

b. Spain

The Spanish Ray's Bream fleet is based in Vigo, on the west coast of Spain, in the region of Galicia. Although the vessels are based here most of their fishing effort is south, along the coast of Morocco. This is largely due to the unexplained, southerly movement of the fish resource and, possibly because the fishing effort applied in the early development of the fishery may have

exhausted stocks along the shelf break off the Spanish coast (refer to figures 3a and 3b).

Figure 3a. Map of Western Europe showing the locations of Spain and Portugal. Galicia is the region of Spain just north of the northern Portuguese boarder.

The demand for Ray's Bream is much greater in Spain than in Portugal. As a result of the greater market acceptance in Spain the Spanish fleet will specifically targets this species and hence their fishing gear is more appropriate for its capture.

To maintain prices at reasonably stable levels the existing fishers have entered into an informal agreement to limit the amount of fish landed. This is a good example of cooperation between competing fishers to maintain both the stock levels and financial returns by preventing market saturation.

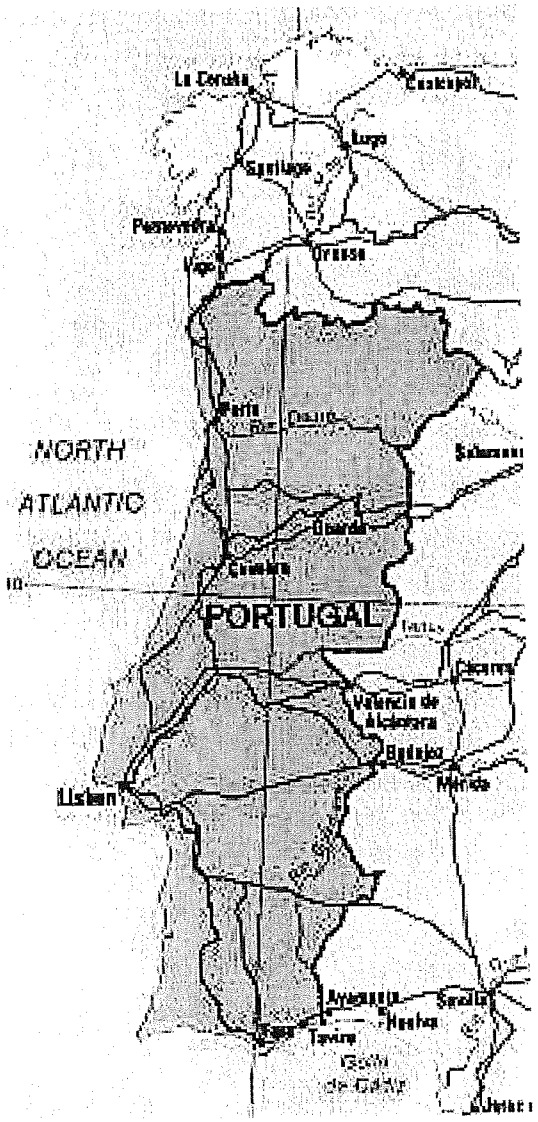


Figure 3b. This map illustrates the location of Vigo, which is just over the Portuguese boarder in the region of Galicia, Spain. This city has one of the major fish markets in Europe.

Vigo is one of three major ports where Ray's Bream are landed and sold through the wholesale market, auction system. On the early morning that we visited the Vigo fish market, two vessels unloaded approximately 10 tonnes each of Ray's Bream (refer to figure 4). Landings also occur in the northern ports and in Alcathedros in southern Spain. Vigo boasts the largest fish landings of any single port in Europe and, fish are distributed throughout Spain and Europe from this city. The wholesale market is currently undergoing major extensions. Ray's Bream landings for some past years are shown in Table 1. The average price per kilogram wet weight is also shown for these years. Currently a good first class catch will receive about 450 pesetas/ kg, which is approximately AUD $4.30.

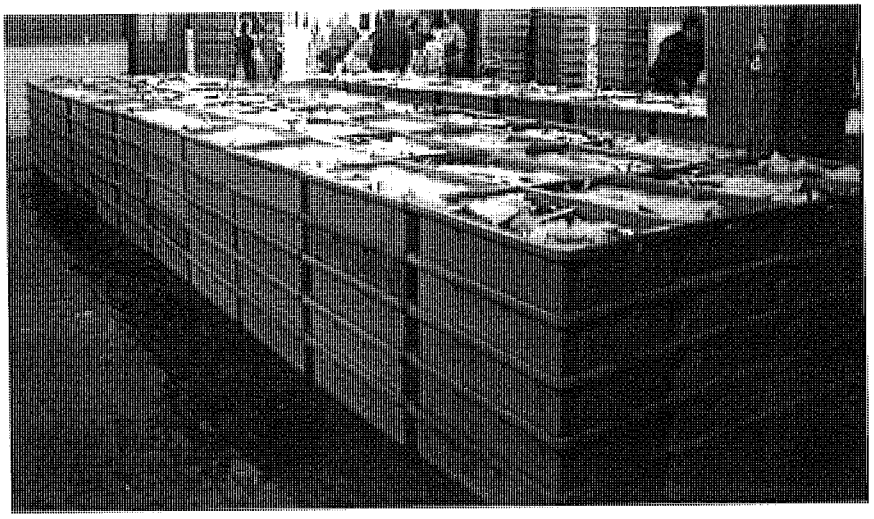


Figure 4. Part of the 10 tonnes of Ray's Bream off loaded at Vigo fish market, by two vessels, during October 1996.

The industry underwent radical changes between 15 and 17 years ago. Some people have stated that the industry was destroyed at this time due to labour conflicts. It is interesting to note that after a longline is set the crew are able to jig for the fish. The ones they capture by this means they are permitted to keep and, this often subsidises their income. The crew frequently do better by this method than the vessel does using the longline.

Table 1. A comparison of annual Ray's Bream landings at the Vigo fish market for the years indicated. The average price in pesetas is also listed.

Year	Average Annual Landings (tonnes)	Price (Pesetas)
1981	3552	123
1992	2770	315
1994	3950	295
1995	3707	312

The Behavioural Biology.

Discussions with fisheries scientists, gear technologists and fishers have provided some valuable information related to the behaviour of Ray's Bream. Whilst this information is anecdotal it should still be seen as an important resource because of the experience of the individuals providing the information. Particularly the fishers, whose livelihood depends on an intimate knowledge of the behaviour of the target fish.

The condition which determines whether the fish are schooling or dispersed is the state of feeding at the time. If feeding the fish tend to be dispersed. They will come together for protection when not feeding. Over a sand bottom Rays Bream will generally be found in the water column between 130 and 200 fathoms (230 to 360 m).

Professional fishers and research scientists have declared that Ray's Bream are strongly influenced by the moon's phase, and this will have a direct bearing on the fish's position in the water column. On a full moon the fish are found close to the surface, within 40 m. However, if there is no moon they may drop to a depth of 140 m. A Tasmanian fisher has also related, to the author, instances where Ray's Bream have been seen feeding at or near the surface and, have been captured in gill nets. In all cases the moon was full.

Dr Antonio Vazquez, who studied the Spanish fishery, noticed two periods of high feeding activity during the night. These correlated to 20 minute periods at dusk and dawn, and the periods occur just as light fades or increases. During this time the fish come to within 40 m of the surface. Dr Vazquez postulated that the fish may be at this level during the entire night but have difficulty in seeing the bait after the light has gone. In the morning when the light intensifies the fish dive to the darker depths for protection (see figure 5).

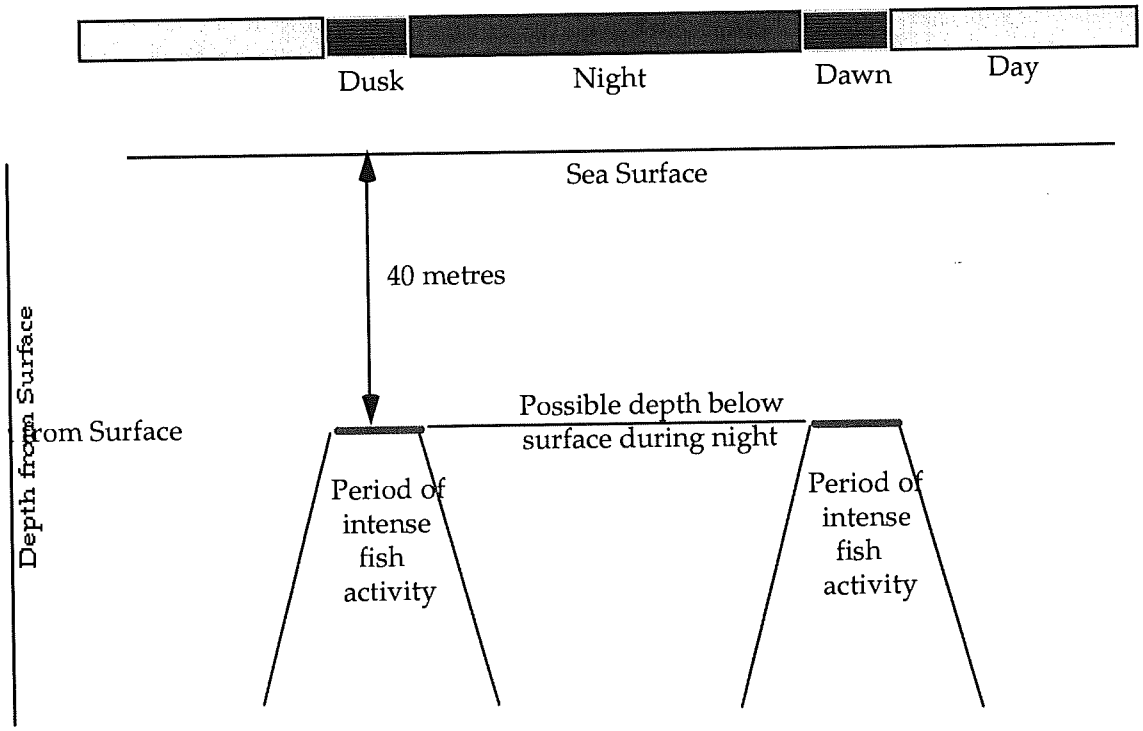


Figure 5. Hypothetical representation of Ray's Bream feeding activity. The red line indicates the fish rising toward the surface prior to nightfall. It is not known whether the fish stay at this depth throughout the night or whether they descend to the depths only to rise again during the dawn period. An alternative scenario is that the fish stay close to the surface but are less likely to see the bait after dark. No matter what the reason, the period of intense fish activity, toward the baited hooks, is of very short duration.

Similarly the fishers will not set lines for Ray's Bream unless there is a full moon or good moonlight. Dr Vazquez indicated that a full moon extended the catching period. Contrary to this behaviour, the food fish tend to stay closer to the surface during the day and then migrate to the depths during the night.

In the past completion of the longline set occurred just before dark, then jigging was undertaken by the crew in order to supplement their incomes. Catch rates from hand jigging were quite high. The development of the auto recovery system enabled fishing to occur throughout the day and, much lower in the water column.

The stomach contents, of all captured fish which were sampled, were very fresh which indicated the fish were in feeding mode.

Fishing methods have changed since the commencement of the fishery. Information provided by a fisher who targets Ray's Bream indicates that on nights with good moonlight the fish are near the surface. However, when no moon or, when there is little moonlight the fish may be down around 140 m. This fisher's method is different than that related by Dr Vazquez in relation to the former fishery off NW Spain. The professional fisher sets his longlines at about 2 am and recovers them after daylight. He only fishes if either there are adequate fish around, which he locates by sounder, or when there is a moon. On a full moon he may make two sets commencing at 4 or 5 pm. The line is left for a few hours then it is hauled and readied for another set early the following morning.

It would appear then that the fish may be high in the water column throughout the night but may only actively feed during the period just at dawn or at dusk,

In all instances the vessels fishing for Ray's Bream use surface longlines

Little is known of the reproductive behaviour of this species. No spawners have been taken in the catch. Spawning is thought to occur in the open ocean, in the south and, outside the fishing zone. Currently there is no knowledge of spawning activity or area. Water temperatures in the summer are around 20 °C and in the winter the temperature is around 10 °C.

Fishing Method and Gear Employed in the Spanish Ray's Bream Fishery.

Comments on the Ray's Bream fishery are restricted to the Spanish experience as this is the only country whose fishers specifically target this species and, as such the fishers have developed gear and methods to improve their capture rates.

a. Longline Equipment.

The longline is composed of shorter segments which are joined together as the line is deployed. These shorter segments equate to one basket. Each basket contains 100 hooks spaced 1 to 2 metres apart and, one vessel will deploy between 100 and 170 baskets per day. Hence the total line may be upto 34 km in length.

The snoods are attached to swivels placed on the mainline during construction of the segment. The snoods are kept apart by the placement of two knots on the mainline at each snood position. these knots are 10 cm apart and prevent the swivels sliding down the mainline (figure 6).

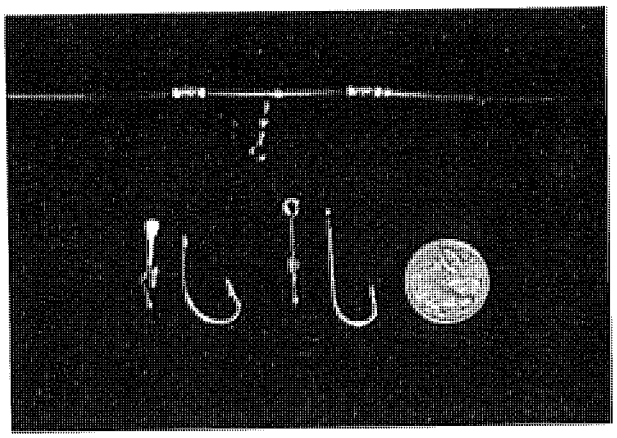


Figure 6. This photo illustrates the attachment of the snood to the mainline via a swivel held in place by two knots. Also illustrated are to two different type of hooks preferred by the fishers. The hook on the left is a reversed, flatted shank. The swivel is retained in position on the mainline by two knots on the monofilament. The coin is an Australian 20 cent piece.

Details of the mainline and snoods are as follows:-

Diameter of mainline		4.5 mm
length of line segment		200 m
N° of segments		100 to 170
Diameter of snood		0.8 mm
Length of snood		50 cm
hook type -	2 types used; one has a flattened shank and is a reversed kirb whilst the other has an eye and is straight shanked	
hook size -	flattened shank type	3/0
	eye shank	n°9
	(see figure 4 for both hooks and relative sizes.)	

The segments of line are coiled and placed in a plastic tray. This tray has two compartments, one large one for the line and one smaller compartment into which the baited hooks are placed as they are baited and, prior to shooting of the line. (figure 7) The line in one box is joined to the preceding box's line and the one following. A buoy is placed at the junction of each line.

One vessel may carry 200+ of these shooting trays. The trays are stacked ready for baiting. (figure 8.) Once baited and ready for setting they are placed onto a stainless steel shooting tray. (figure 9a and 9b.)

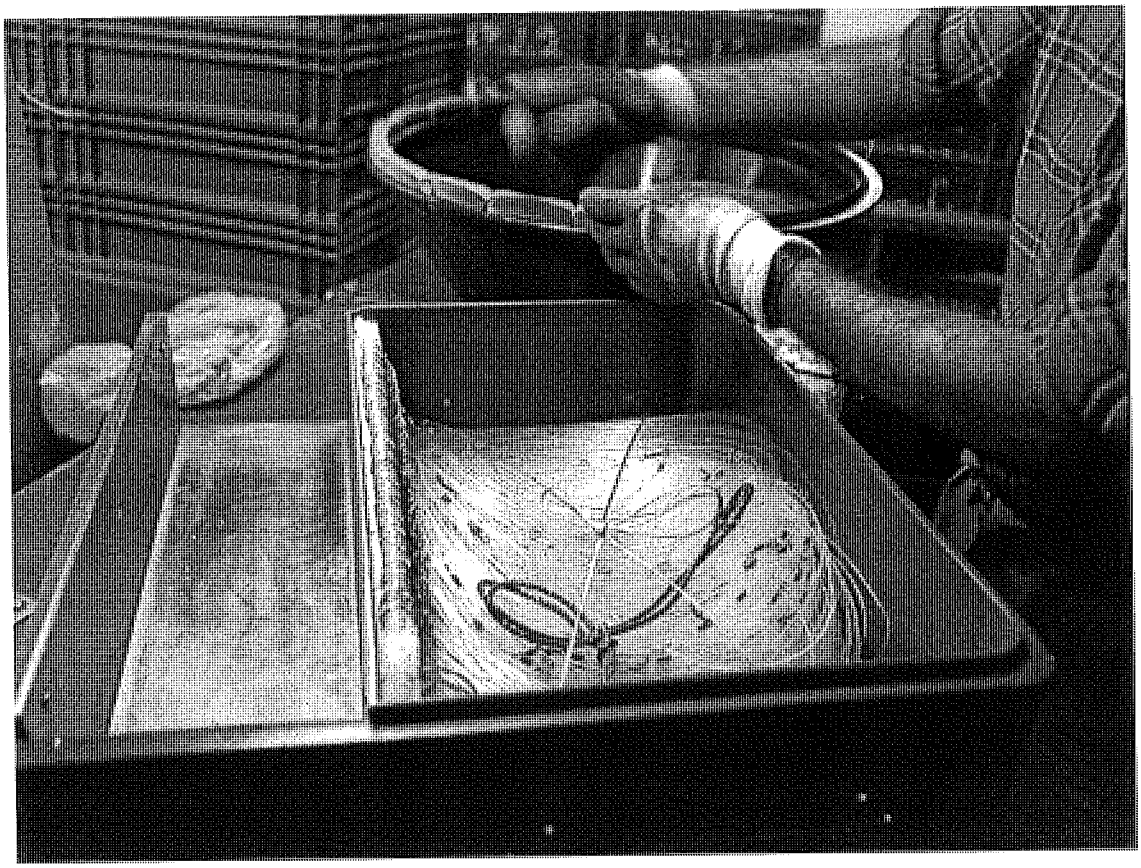


Figure 7. Mainline shooting tray. Each segment of mainline, with its permanently mounted snoods, is placed in the tray. The unbaited hooks are stored on a foam strip between the two compartments. Prior to setting the hooks are baited and placed in sequence in the metal lined compartment. The meat lining has been fitted by the fisherman to assist cleaning and, to aid the setting operation; there is less chance of the hooks digging in as they might with the plastic surface. The trays are manufactured by a French company.

Figure 8. This illustrates the storage of hooks and mainline in the shooting trays. The hooks are stored on a foam strip placed along the top edge of the partition between the two compartments of the tray. When the tray is being prepared for shooting the hooks are baited and placed in the aluminium-lined open end compartment. The metal lining prevents the hooks from digging into the plastic. The hooks are placed in the order of shooting.

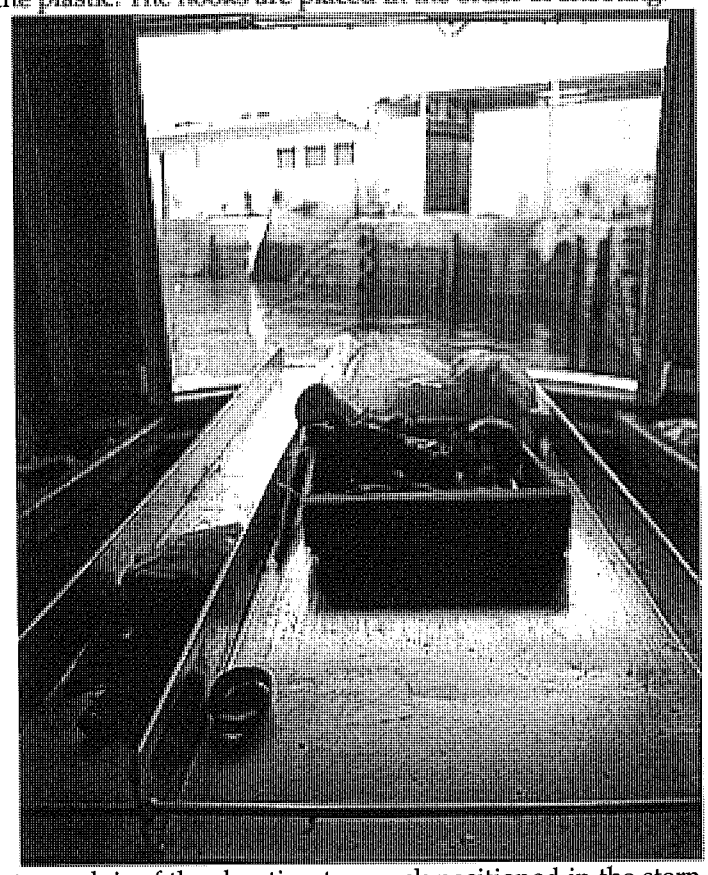


Figure 9a. This photograph is of the shooting-tray rack positioned in the stern of the vessel. The rack can accommodate upto four prepared trays. As each tray is emptied it is removed and a replacement tray is added to the end of the rack, pushing the other racks towards the stern. Each new tray is connected to the preceding shooting tray. The smaller channel on the left hand side of the rack is used for baited hooks attached to multifilament longlines used for swordfish and tuna fishing.

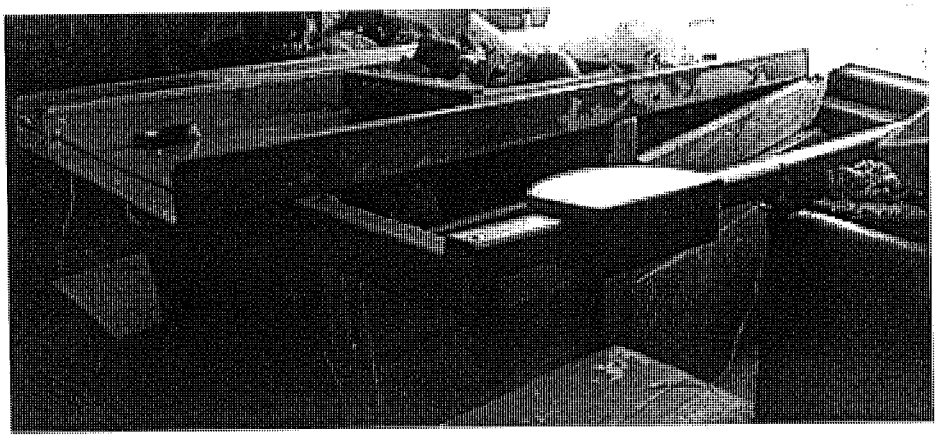


Figure 9b. This is a side view of the same shooting-tray rack. Note the seat for the operator in the foreground.

Prior to attachment of bait, the hooks are stored by placing their points into a thin, long piece of high density foam placed between the two compartments. (Figure 5.) Note, the snoods and hooks always reamin attached to the mainline segment.

While setting the line may take a little over 2 hours at approximately 8 knots, retrieval may take upto 15 hours to fully recover the line. The longlines may have been deployed in one contiuous line or, as is often the case, shorter segments are deployed in different locations. The shorter lines allow the fisher to target the school by continually moving ahead of it.

The line is recovered using an hydraulic hauler with a vertically mounted drum (see figures 10a & b). This is located in the fully enclosed fore deck of the vessel and, the line is retrieved through the port-side hatch (see figure 9). The line is not passed around the drum as is the case with a pot-hauler capstan. The inside surface of the two flanges contain rubber blocks which are separated from their opposite flange block by a small gap into which the mainline fits. The two flanges are not parallel to each other but rather are closer together at the top. This can be adjusted to give better gripping of the line by the adjusting wheel in the centre of the left hand flange. The line itself is actually pinched between the opposing blocks on the inside flange surfaces which tighten as the flanges rotate until they reach the 3 o'clock position where they release.

As the line passes through the line hauler it is manually coiled into circular, plastic bins or retrieval baskets. As each snood is retrieved its hook is placed on a foam pad on the upper edge of this bin (figure 11). Once each line segment has been retrieved and coiled the line is transferred to the shooting trays in preparation for the next shot or, for storage. A vessel will have many of these circular bins because the transfer operation requires vigilance to ensure the hooks are laid in the correct order.

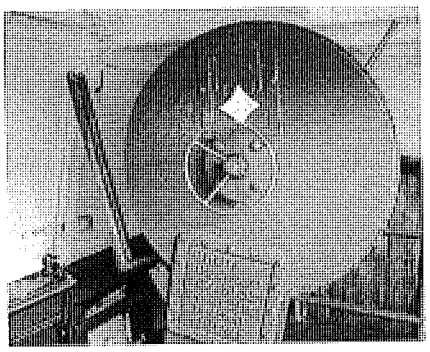
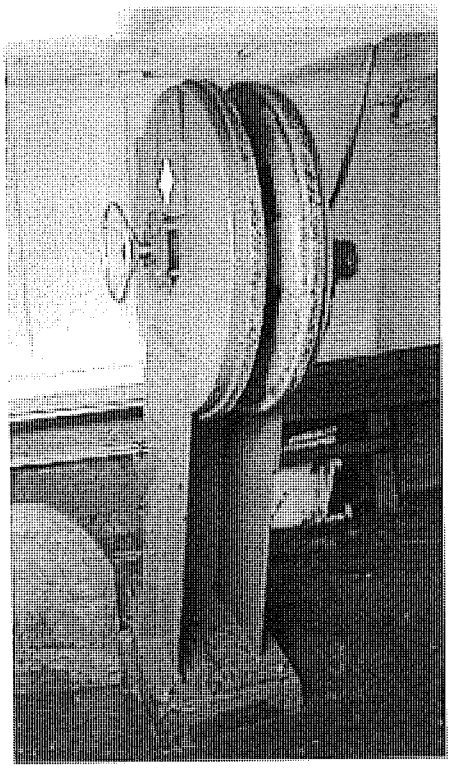


Figure 10a. A side view of the hydraulic mainline hauler . Two, almost vertical metal bars, to the left of the flanges, are close together to prevent fish from being dragged through the hauler. The wheel in the centre of the flange allows for adjustment of the gap between the metal flanges and hence the tension on the mainline.



Figures 10b. The vertically mounted hydraulic line hauler. The blue painted wooden boards in the lowre left of the picture guide the fish towards the hauler.

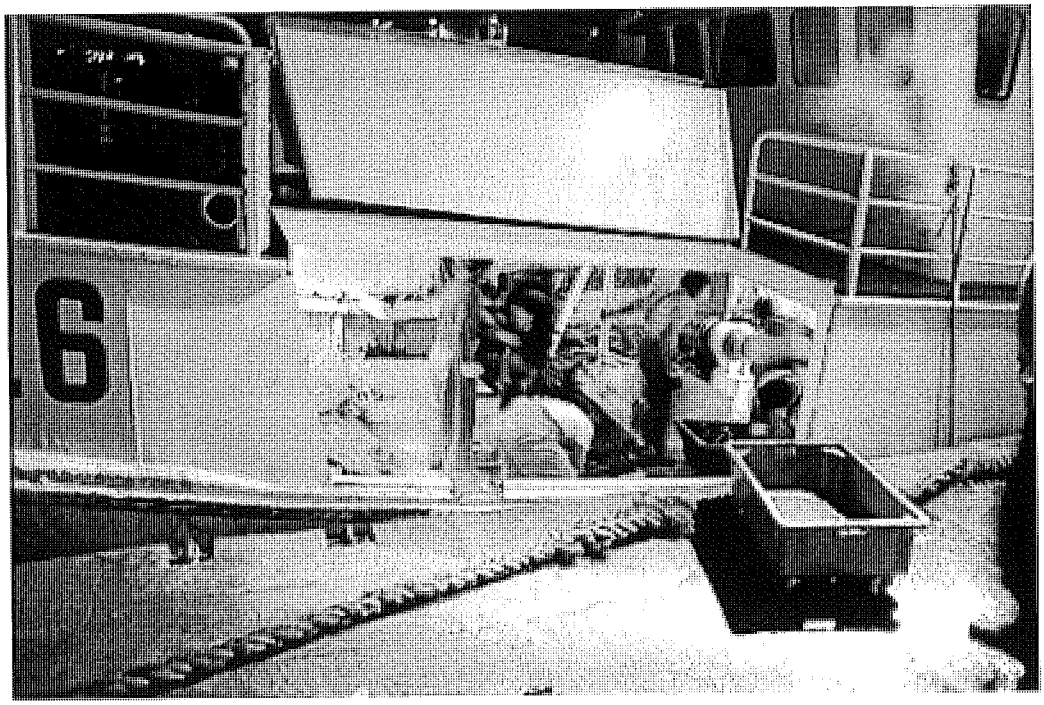


Figure 11. This photograph shows the open hatch on the port side, for'ed deck. The work area is completely enclosed and, the mainline is hauled is retrieved through this hatch.

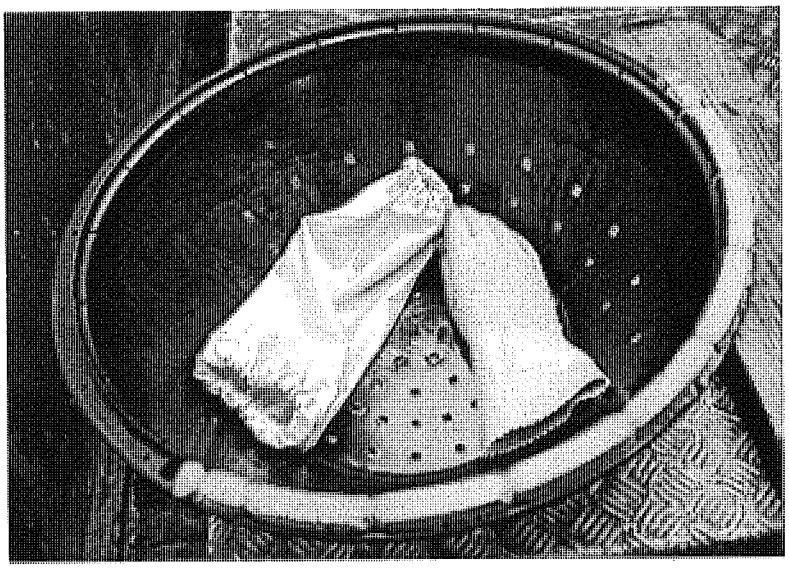


Figure 11. The the line coiling bin into which the mainline is manually coiled as it is retrieved. This is bin or basket is mounted on a metal frame positioned on the starboard side of the vessel, opposite the line hauler. A crew member sits behind this basket, which is tilted slightly towards the line hauler, and manually coils the retrieved line into the basket. At the same time the hooks are placed in order around the rim. At a later stage, prior to the next fishing shot, the line is transferred to the shooting tray for storage and shooting preparations.

b. Fishing Technique.

Shooting of the line is from the stern of the vessel. There are basically two types of stern arrangement. However, in both instances the crew work under cover.

The stern may or may not have hatch covers (Figure 13a and 13b).

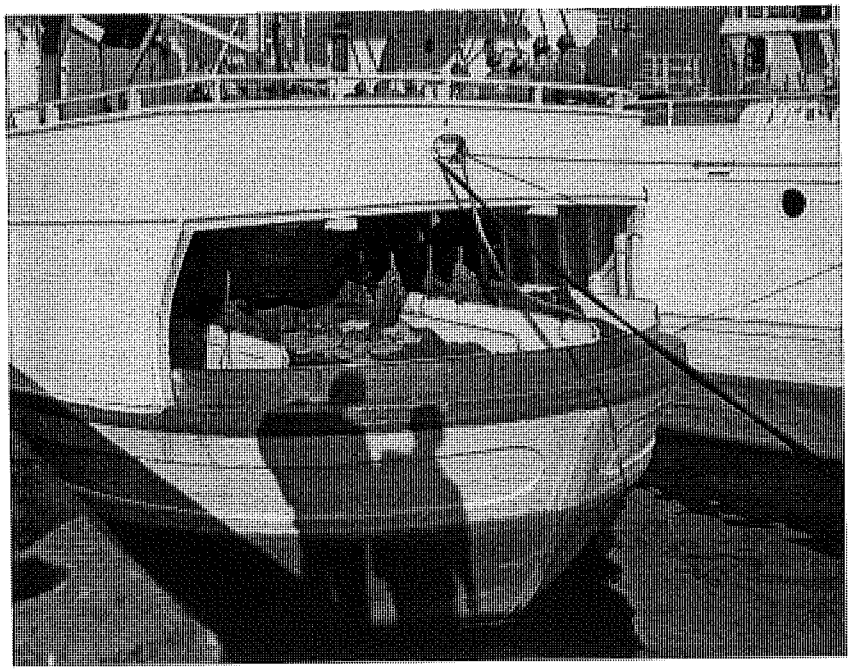


Figure 13a. The older style of vessel.

Figure 13b. A more modern longline vessel showing closed hatch covers. Note however, in both vessels the crew work in a fully enclosed area.

Hooks are pre-baited with salted sand eels (called bolo) and, left in the shooting trays. The bait used is frozen and salted; the salt making it easier to handle the slippery eels and, provide firmness to the bait.

A number of shooting trays are placed on the stainless steel rack. The line in each tray is attached to the line in front and the line behind. As a tray empties it is removed and a new one is loaded at the top of the rack and joined to the preceding tray. Buoy lines are attached at the junction of the two segments.

When targeting Ray's Bream the longline is set close to the surface on moonlit nights. The same equipment is used by the fishers when they target hake. However, in this instance deployment is very different. Hake are found close to the bottom during daylight hours in depths of about 280 fathoms (500 m). In this instance the line is weighted using stones alternated with small pressure floats.

Final Cost

	Actual	Project Budget	Difference
Project	176797.66	186437	9639.34
Salaries	113398.54	98635	-14763.54
Travel	15919.94	21450	5530.06
Operating	28486.58	28823	336.42
Capital	18992.60	37529	18536.40