# Fishing Trials to Evaluate the Relative Selectivity and Efficiency of Different Netting Yarns used in the Construction of Static Nets used in the Fisheries for Sole and Plaice in the Eastern English Channel

MAFF Commission

Seafish Report No.382

April 1990

MAFF R&D Commission 1989/90

SEA FISH INDUSTRY AUTHORITY
Seafish Technology

# FISHING TRIALS TO EVALUATE THE RELATIVE SELECTIVITY AND EFFICIENCY OF DIFFERENT NETTING YARNS USED IN THE CONSTRUCTION OF STATIC NETS USED IN THE FISHERIES FOR SOLE AND PLAICE IN THE EASTERN ENGLISH CHANNEL



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## Contents



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## SUMMARY

Static nets are becoming increasingly popular in the inshore fisheries of England and Wales. Currently (1988 figures) some 450 vessels, mostly under 10m in length, take an annual catch of sole, plaice, cod, turbot, brill and other demersal species.

However, very little scientific or quantative data exists on the effectiveness of different set net types, materials and mesh sizes. Moreover, it is known that some of these nets are causing high mortalities in the non target species and to other forms of marine and bird life. It is therefore essential to build-up enough information both to defend their use and at the same time draw-up accepted codes of practice which are helpful to all concerned.

The trials were carried out in the sole and plaice fishery of the Eastern English Channel on the 10m Hastings vessel ST. RICHARD during 1989. The sole fishery normally runs from March to July and is followed by the plaice fishery. However, the warmer water temperatures in the Channel in 1989 resulted in an extended season for sole and an occurence of plaice as late as November. Thus the trials were carried out in an abnormal year, during which the overall catch rates were down on previous years.

Two types of gear were investigated - trammel nets and gill/tangle nets. Both are in common use and the trials consisted of trying variations in material and mesh size to determine various catching coefficients and characteristics:-

- Selectivity
- Catchability (efficiency)
- Ease of clearing the nets
- Ease of handling and stowage
- Cost
- Fish quality

These variations were related to the standard gears in use by the Channel fishermen.

The data on selectivity and catchability are summarised in the tables attached to the Summary which also appear in Section 6 of the main report.

The trials have highlighted the large number of variables encountered in set net fishing and it is not possible to draw firm conclusions from this series. In addition any results from the Eastern Channel are almost certainly different in other fisheries of the British Isles.

The trends, however, showed that in terms of catchability, e.g. efficiency, the best material was multifilament PA (bonded) twine with a 3.5in mesh. It was closely followed by multimonofilament. On the other hand, from a selectivity point of view, monofilament was the best. These results are backed-up by fishermen's views.

A minimum mesh size of 3.5in gave good selectivity irrespective of material type.

The gill/tangle nets however, showed a very poor performance in relation to the trammels for the sole and plaice.

Although these results cannot be regarded as definitive they provide a practical and quantitive insight into the set net fisheries of the English Channel and indicate the need for further work before the suggested code of practice can be drawn up.

TABLE 1

# SUMMARY OF THE PERFORMANCE OF THE EXPERIMENTAL TRAMMEL NETS (A-D) IN THE SOLE FISHERY OF SOUTHEAST ENGLAND, 29th APRIL - 7th MAY 1989

| | 3.5" MESH SIZE | | | 4" MESH SIZE | | |
|---|---|---|---|---|---|---|
| | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH |
| MONOFILAMENT | 5 | 100% | 76 | 17 | 99% | 64 |
| MULTIMONOFIL. | 14 | 99% | 99 | 10 | 99% | 110 |
| MULTIFILAMENT | 12 | 99% | 139 | 14 | 99% | 81 |

RETAIN RATIO is the proportion of fish (%) above the minimum legal size.

RETAINABLE CATCH is the actual numbers of fish above the minimum legal size.

SELECTIVITY RATIO: A LOW selectivity ratio indicates a HIGH degree of selectivity. This is defined as the numbers of size classes divided by the proportion of fish occurring in the peak class.

TABLE 2

# SUMMARY OF THE PERFORMANCE OF THE EXPERIMENTAL TRAMMEL NETS (A-D) IN THE PLAICE FISHERY OF SOUTHEAST ENGLAND, 25th TO 28th JULY 1989

| | 4" MESH SIZE | | | 5" MESH SIZE | | |
|---|---|---|---|---|---|---|
| | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH |
| MONOFILAMENT | 21 | 69% | 43 | 14 | 89% | 50 |
| MULTIMONOFIL. | 11 | 49% | 40 | 16 | 93% | 79 |
| MULTIFILAMENT | 19 | 67% | 64 | 15 | 94% | 81 |

RETAIN RATIO is the proportion of fish (%) above the minimum legal size.

RETAINABLE CATCH is the actual numbers of fish above the minimum legal size.

SELECTIVITY RATIO: A LOW selectivity ratio indicates a HIGH degree of selectivity. This is defined as the numbers of size classes divided by the proportion of fish occurring in the peak class.

TABLE 3

# SUMMARY OF THE PERFORMANCE OF THE EXPERIMENTAL TRAMMEL NETS (C-D) IN THE PLAICE FISHERY OF SOUTHEAST ENGLAND, 13th NOVEMBER 1989

| | 4" MESH SIZE | | | 5" MESH SIZE | | |
|---|---|---|---|---|---|---|
| | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH |
| MONOFILAMENT | 14 | 77% | 61 | 12 | 88% | 75 |
| MULTIMONOFIL. | 10 | 45% | 15 | 13 | 92% | 80 |
| MULTIFILAMENT | 12 | 49% | 48 | 10 | 97% | 97 |

RETAIN RATIO is the proportion of fish (%) above the minimum legal size.

RETAINABLE CATCH is the actual numbers of fish above the minimum legal size.

SELECTIVITY RATIO: A LOW selectivity ratio indicates a HIGH degree of selectivity. This is defined as the numbers of size classes divided by the proportion of fish occurring in the peak class.

TABLE 4

# SUMMARY OF THE PERFORMANCE OF THE EXPERIMENTAL TRAMMEL NETS (A-D) IN THE PLAICE FISHERY OF SOUTHEAST ENGLAND, 7th, 9th & 12th NOVEMBER 1989

| | 4" MESH SIZE | | | 5" MESH SIZE | | |
|---|---|---|---|---|---|---|
| | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH |
| MONOFILAMENT | 14 | 78% | 212 | 11 | 94% | 255 |
| MULTIMONOFIL. | 15 | 57% | 81 | 14 | 94% | 354 |
| MULTIFILAMENT | 19 | 64% | 168 | 14 | 98% | 326 |

RETAIN RATIO is the proportion of fish (%) above the minimum legal size.

RETAINABLE CATCH is the actual numbers of fish above the minimum legal size.

SELECTIVITY RATIO: A LOW selectivity ratio indicates a HIGH degree of selectivity. This is defined as the numbers of size classes divided by the proportion of fish occurring in the peak class.

TABLE 5

# SUMMARY OF THE PERFORMANCE OF THE CONTROL NETS (FLEET G) IN THE PLAICE FISHERY OF SE ENGLAND, 7th, 9th, 12th & 13th NOVEMBER 1989

| | MULTIMONOFILAMENT | | |
|---|---|---|---|
| | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH |
| 6" | 15 | 98% | 510 |
| 6.5" | 15 | 100% | 497 |
| 7" | 11 | 100% | 273 |

RETAIN RATIO is the proportion of fish (%) above the minimum legal size.
RETAINABLE CATCH is the actual numbers of fish above the minimum legal size.
SELECTIVITY RATIO: A LOW selectivity ratio indicates a HIGH degree of selectivity. This is defined as the numbers of size classes divided by the proportion of fish occurring in the peak class.
NOTE: Unequal numbers of different nets were used in this trial, therefore the data has been modified in proportion. Net G1: n=174 (x3=522). Net G2: n=71 (x7=497). Net G3: n=13 (x21=273). The figures in brackets give fish totals as if 21 nets of each mesh size had been fished.

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## 1 INTRODUCTION AND BACKGROUND

Static nets are increasingly used around the coasts of England and Wales and are currently (1988) employed by some 450 full-time vessels to take an annual catch approaching £10 million in value.

There are continual calls for control however; both because the method is thought to be too effective and will have a drastic impact on fish stocks and in view of fears for other marine wildlife and seabirds. There is an especially strong lobby to ban the use of monofilament yarns in gill nets. There is an increasing importance to establish more effective management of static net fisheries and to investigate the relationship between netting effort, catches and fish stocks. This is particularly so where enmeshing nets comprise a large proportion of the effort directed at heavily exploited stocks, e.g. bass, cod, hake and sole. Data already exists for cod and bass caught in static gears and it is hoped that the work carried out under this programme will provide the opportunity for collection of data that will aid the development of a management programme for the sole and plaice fisheries under consideration.

The work was commissioned by the Ministry of Agriculture Fisheries and Food under the Chief Scientists Programme for 1989-90.

The sea trials were carried out on the South East coast of England from Hastings Beach, East Sussex. The vessel chosen for the fishing trials was a typical beach vessel currently exploiting the Eastern English Channel sole/plaice fisheries. The vessel employed was the MFV ST. RICHARD (RX60), skippered and owned by Mr Graham Coglan (see later for vessel details).

The area of Hastings was chosen as a base fairly typical of this type of fishing operation. Most of the fishing activity in these areas is conducted from the beaches. There is a considerable concentration of static net fishermen working in this area of the South Coast, working mainly trammel and tangle nets. The main target species being Dover sole and plaice.

The beach at Hastings is a base for approximately 44 vessels involved in the fishery. This figure includes both full-time and "part-time" fishermen. Only 1 vessel is over 10m registered length.

The sole fishery season usually commences in March and continues through to July with the best catches usually occuring around April/May. Plaice are usually taken as a by-catch during the sole season. By the end of July the plaice usually take-over as the predominant species caught. Market prices usually determine whether plaice then become the main target species; if prices are poor, fishing effort may be concentrated elsewhere.

Trammel netting is the method predominantly used in these fisheries. However, recently there has been increased interest shown in monofilament tangle nets. It is claimed by some fishermen involved in these fisheries that, although tangle nets are not as effective at catching soles as the trammel nets, they are much easier to work from both a handling and clearing point of view. This enables more nets to be worked in a given fishing period and hence comparable and often improved catches can be achieved over the trammel nets.

A considerable amount of concern has arisen among fishermen concerning the quantities of small, immature "brood stock" of species like plaice, dab and sole, that are being caught and destroyed in the monofilament nets. It is claimed that trammel nets do not catch anything like the quantities of "brood" taken by the tangle nets.

The general pattern of operation involves approximately 10-12 fleets of nets (dependant on vessel size). Each fleet consists of 8-10 nets of approximately 50-60 yards fishing length. Most vessels work "two-handed" but occassionally three crew members are required when catch rates are high. Catch rates of up to 40 stones per day of Dover soles are not uncommon at the height of a good season.

There is general concern regarding the quantities of static gear now being operated in these areas of the Channel. Particular reference has been made to the number of "part-time" operators who appear to show little concern over the numbers of small unmarketable fish that are being destroyed by the indiscriminate use of tangle nets constructed in very fine monofilament PA material. Access to the fishing grounds is becoming more and more difficult with the growing quantities of gear being used. The increasing amounts of static gear on the grounds and the wide ranging movements of demersal trawlers, in particular beam trawlers, is also adding to the conflict between the static net men and the trawlers.

## 2 OBJECTIVES

The objective of the programme was to examine the typical static net fisheries for sole (Solea solea) and plaice (Pleuronectes platessa) in the Eastern English channel, and to assess the relative selectivity and efficiency of different netting yarns currently in use in the construction of gill/tangle and trammel nets used in these fisheries.

The trials were conducted on the basis of a normal commercial fishing exercise wherever possible using otherwise identical nets made up with monofilament, multimonofilament and twisted multifilament polyamide (nylon) yarns. The basic rigging of the nets including overall dimensions, floatlines, leadlines etc, were those commonly in use in the particular area chosen for the trials. The nets were constructed in two mesh sizes - that normally employed in the fishery plus another approximately 15% larger, in order to investigate selectivity.

The six different net types were fished in fleets of six (or multiples of six), using a total number of nets which approached the quantity in commercial usage but allowed adequate data to be obtained during the fishing operation.

Catch data included species composition, length frequency distributions and catch weight per net type, plus some estimate of fish quality and net handling characteristics including amount of debris caught and net cleaning times. The work included an assessment of "non-catch" mortalities with particular interest in crabs as well as non-marketable fish species wherever appropriate.

It was proposed that from the analyses of these data it should be possible to assess the relative selectivity of the different netting materials, their effectiveness (fishing power) and efficiency. Wherever possible catch rates were to be compared to other commercial catches taken on the same grounds.

**NOTE** : By "non-catch" we refer to by-catches of unwanted/unmarketable species of both fin fish and shellfish.

3 **TRIALS VESSEL** (see photographs)

| | |
|---|---|
| Name | - ST RICHARD (RX60) |
| Built | - Tankerton Marine, Whitstable, Kent - 1969 |
| Length of Vessel | - 9.8m (32.15ft) |
| Beam | - 4.0m (13ft) |
| Draft | - 1.1m (3ft 6in) |
| Main Engine | - Gardner 5LW - 70hp |
| Gearbox | - UC2 2:1 reduction |
| Wheelhouse Equipment | - Decca Mk 21 Navigator<br>- Navstar 2000 Navigator<br>- Ferrograph G500 Paper Sounder<br>- Vigil RX Daylight Viewing Radar<br>- Racal/Decca Multi Sea Voice VHF Radio |
| Deck Machinery | - Trawl Winch 2 Barrel 1.5T pull<br>- Net Hauler, North Sea Winches Conveyer Type |

## 4 FISHING GEAR AND EQUIPMENT

The traditional design of static nets normally used in the sole/plaice fisheries in the Eastern English channel is the trammel net. However, there is growing interest in the use of very loosely hung gill or tangle nets and so it was proposed to examine this type of gear alongside the traditional trammel net design.

In order to obtain a sufficient amount of data, the proposal was to use a quantity of nets which approached commercial practice, but at the same time permitted adequate data collection during the commercial fishing operations. To this end, the trammel nets were rigged into four fleets each consisting of six nets, one of each of six net types. The gill/tangle nets were rigged into two fleets, once again each fleet consisting of six nets, one of each type. This gave a total of 36 nets.

### 4.1 Specification of typical trammel net used in channel sole/plaice fishery

A typical nylon trammel net would have the following specifications:-

Twisted continuous filament polyamide (PA) lint of 210/9 - 3# twine with 4in mesh x 50 meshes deep x 100 yards stretched length. This netting is then set back to approximately 50 yards fishing length (i.e. hanging coefficient, Ex = 0.5). The lints are heavily bonded (stiffened) to make them easier to clear. The amourings are constructed in buoyant polyethylene (PE) of 10/24 construction with 26in mesh x 3½ meshes deep x 100 yards stretched length. Again the hanging coefficient is 0.5. This gives a fishing height of approximately 6½ft.

The nets are rigged with 6mm diameter twisted or braided polypropylene (PP) rope headlines with 3¼in floats attached at approximately 6ft spacings. The sinkage is provided by No. 4 reinforced leadline having a weight of 12.8kg/100m.

## 4.2 Specification of gill/tangle net used in channel sole/plaice fishery

A typical monofilament nylon tangle net would have the following specifications:-

Monofilament PA of 0.4mm diameter twine with 4¼in mesh x 15 meshes deep (some are only 12½ meshes deep) x 200 yards stretched length. This netting is hung slack to perform as a tangle net. Usually a 200 yard stretched sheet would be set back to fish at approximately 60 yards (i.e. hanging coefficient E = 0.3). This gives a fishing height of just over 5ft.

Floatation is provided by either double 6mm or single 10mm diameter twisted or braided PP rope for the finer meshed nets. Some nets are constructed in mono twines as fine as 0.25mm. These very fine nets have proven very effective mainly due to their almost invisible nature in water and high level of undetectability. Alternatively a single 6mm diamter PP rope fitted with 3¼in floats at 12ft spacings is used with the heavier mono materials. The net maintains bottom contact by use of a No. 4 reinforced leadline (12.8kg/100m).

## 4.3 Trials fishing gear

The construction of the trials fishing gear was such as to conform as closely as possible to the typical design of gear currently being used in the fisheries under consideration.

From examination of the following gear specifications it will be seen that the armourings (outer walls) of the trammel nets were all constructed in 10/24 PE twine. The same armourings were used on all the nets constructed of the three different materials under examination. The option of varying the materials used in the construction of the armourings to be compatible with the lints or inner walls (i.e. mono lint with mono armouring etc.) was discounted due to the problems involved in obtaining these materials particularly in the non-standard mesh sizes required for the nets with a 15% increase in mesh size.

It will also be noticed that no adjustment was made in the depth of the nets with respect to the difference in mesh size from standard to 15% variance. The 3½in and 4in mesh lints were all 50 meshes deep as was the situation with the 4in and 5in mesh plaice trammels. All armourings were 3½ meshes deep. The result of this was that the nets having the 15% increase in mesh size were of a slightly greater fishing height than the standard mesh size nets. This arrangement was used to simplify the rigging of the nets. The percentage of slack netting in the lints of both mesh sizes remained the same. It was envisaged that the slight height difference would have little effect on the comparative results.

## 4.4 Description of Trammel Nets for Sole Fishery

The following includes details of Trammel nets used to examine the sole fishery in the Eastern English channel. A more detailed description is given in Appendix I.

The nets used were constructed in three different materials and in two mesh sizes in order to examine the selectivity of the mesh size and material composition. The materials used were:-

1. Monofilament polyamide (PA)
2. Multimonofilament polyamide (PA)
3. Multifilament polyamide (twisted continuous filament - PA)

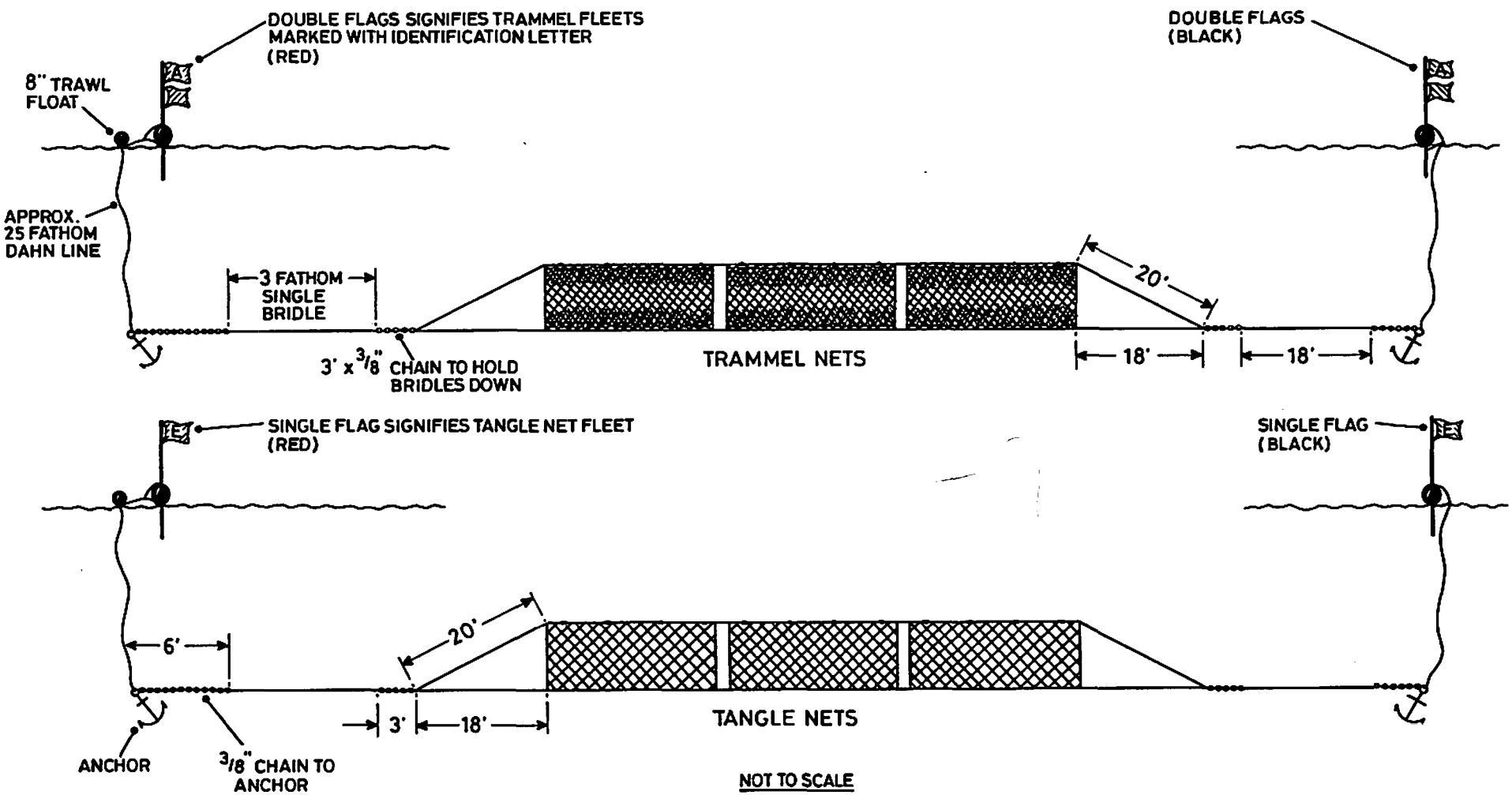
The two mesh sizes used were:-

1. Standard for the local Hastings fishery - 4in
2. An approximate 15% decrease in mesh size to 3½in

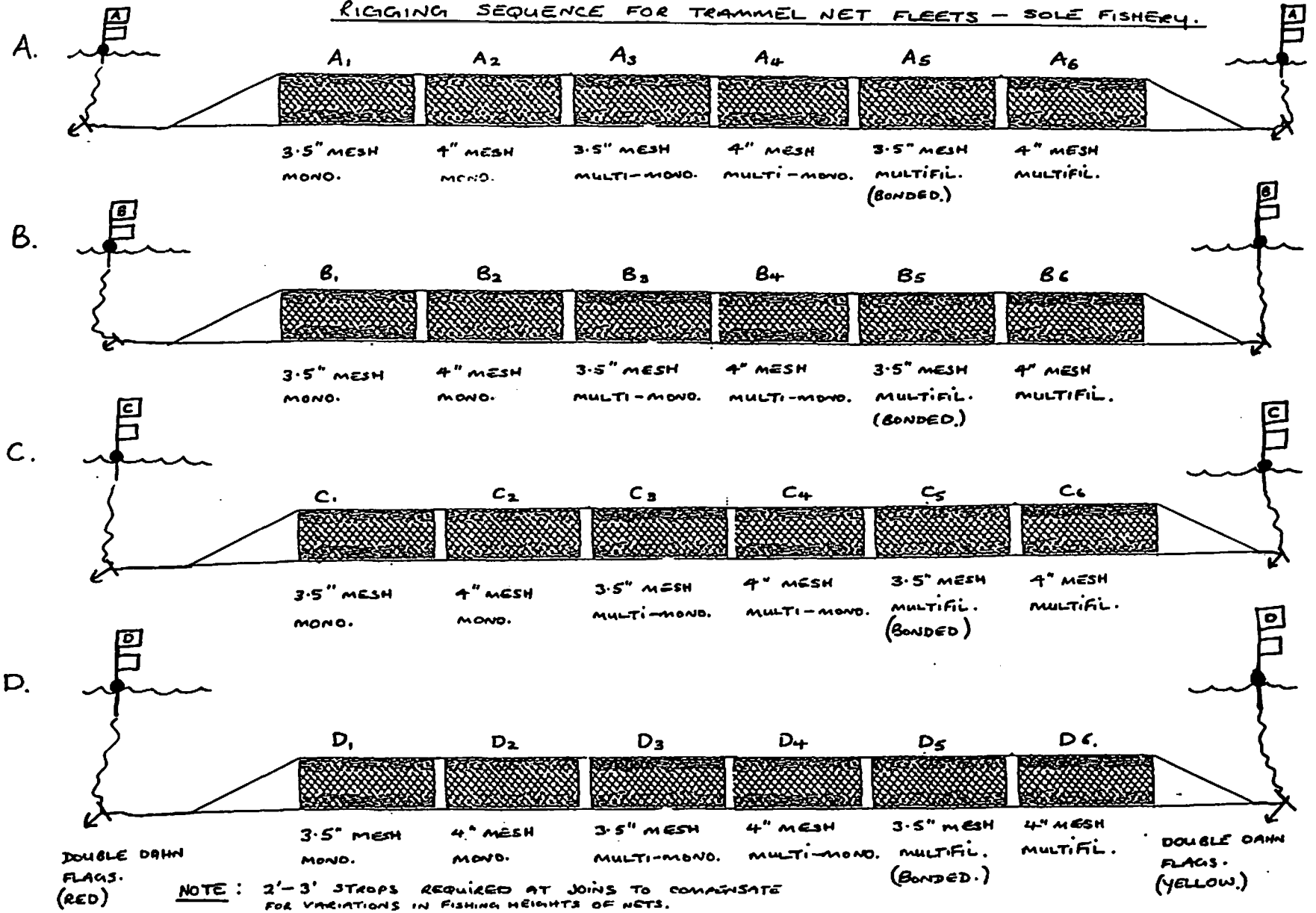
The nets were rigged as close to the specifications as used by the local fishermen. The standard net used by local Hastings fishermen is the 4in multifilament PA net with the 26in PE armourings. The nylon lint is traditionally heavily bonded to produce a stiffer, more open mesh. This type of material has proved more effective in catching a better class of soles and also reduces the amount of rubbish and seabed debris picked up by the nets.

For the experimental work the trammels constructed in the smaller mesh size were bonded, the others being left untreated for comparison.

# DIAGRAM SHOWING BRIDLE & DAHN ARRANGEMENTS



# RIGGING SEQUENCE FOR TRAMMEL NET FLEETS – SOLE FISHERY.




NOTE : 2'–3' STROPS REQUIRED AT JOINS TO COMPENSATE FOR VARIATIONS IN FISHING HEIGHTS OF NETS.

## 4.5 Description of Gill/Tangle Nets for Sole/Plaice Fishery

The following includes details of Gill/Tangle nets used to examine the static net fishery for soles/plaice in the Eastern English channel.

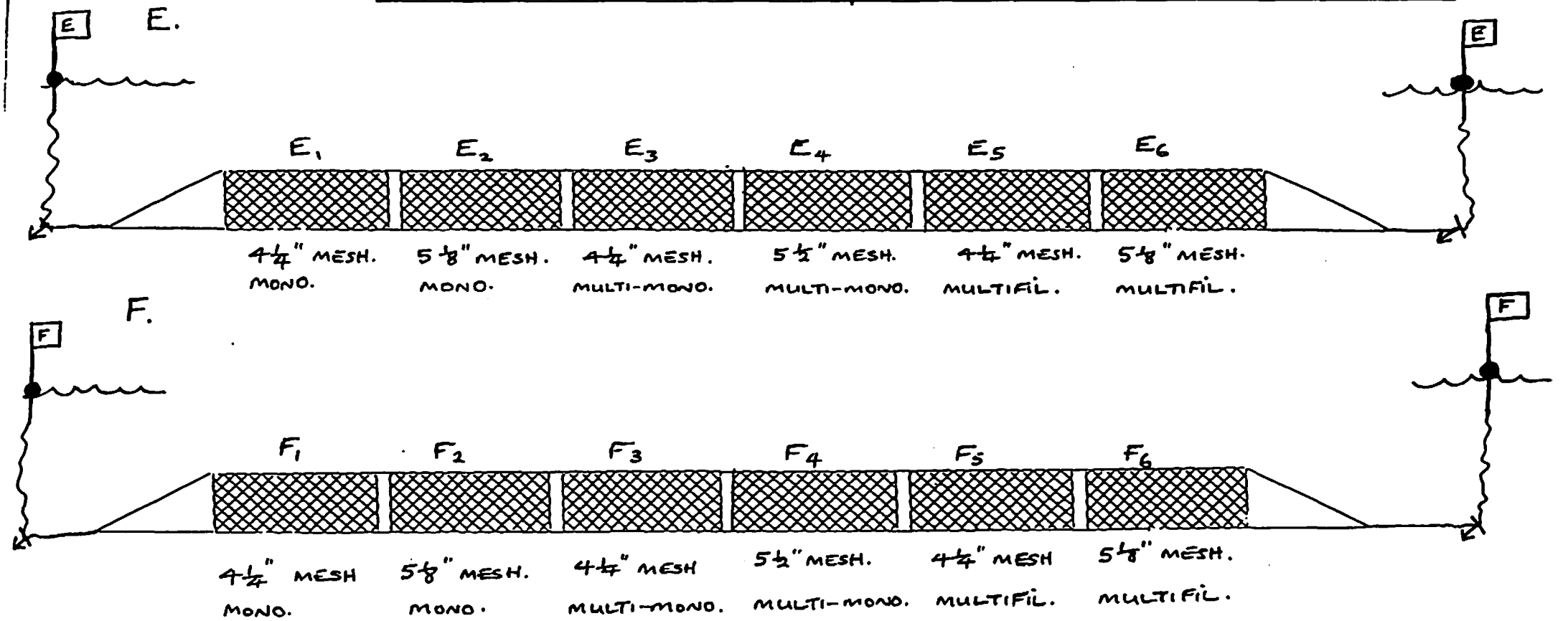
The nets used were constructed in three different materials and in two mesh sizes, namely:-

1. Monofilament polyamide (PA)
2. Multimonofilament polyamide (PA)
3. Multifilament polyamide (PA)

Mesh sizes of 4½in (standard) and an increase of approximately 20% to 5-1/8in were used.

More detailed descriptions of the specifications and rigging are given in Appendix II.

# RIGGING SEQUENCE FOR GILL/TANGLE NET FLEETS — SOLE FISHERY.




SINGLE DAHN FLAGS INDICATING GILL/TANGLE NET FLEETS. (RED)

SINGLE DAHN FLAGS. (YELLOW)

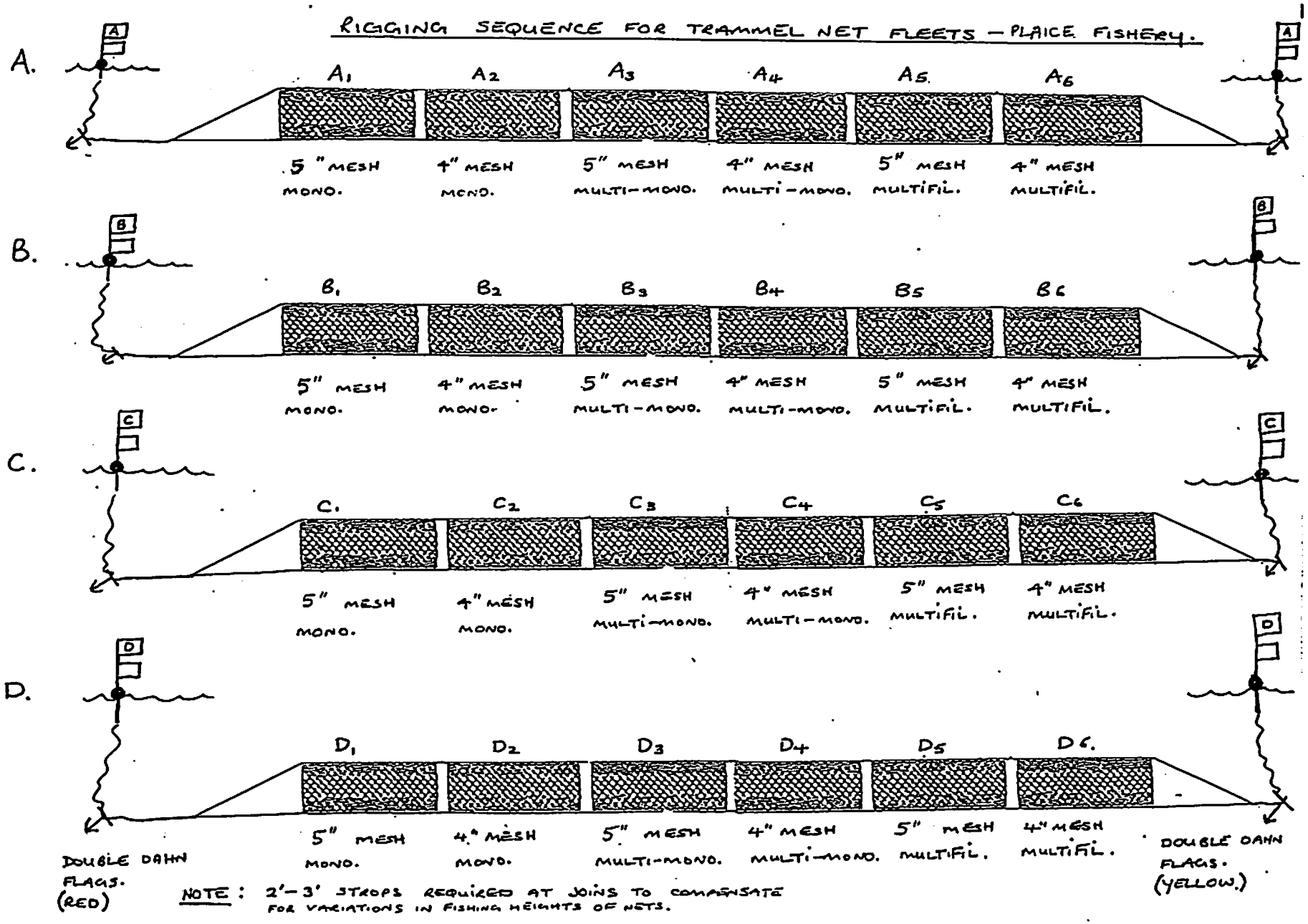
## 4.6 Description of Trammel Nets for Plaice Fishery

The following includes details of the trammel nets used to examine the plaice fishery in the Eastern English Channel.

The nets were similar to those used for the sole fishery except that the two mesh sizes that were used were 4in (as standard) and 5in as the approximate 15% increase.

Since the rigging details were similar to those for the sole nets, it was not felt necessary to repeat the diagrams illustrating the construction of the plaice nets. The same tangle nets as were used for the sole exercise were used for the plaice. The rigging sequence of the net fleets for the plaice fishery were re-arranged slightly for convenience. In effect the 3½in mesh size nets from the sole configuration were replaced by the 5in plaice nets (see Fig 4.6.1).

See Appendices for detailed descriptions of specifications and rigging.


RIGGING SEQUENCE FOR TRAMMEL NET FLEETS — PLAICE FISHERY.
A.
A1 A2 A3 A4 A5 A6
5 "MESH MONO.
4" MESH MONO.
5" MESH MULTI-MONO.
4" MESH MULTI-MONO.
5" MESH MULTIFIL.
4" MESH MULTIFIL.
B.
B1 B2 B3 B4 B5 B6
5" MESH MONO.
4" MESH MONO.
5" MESH MULTI-MONO.
4" MESH MULTI-MONO.
5" MESH MULTIFIL.
4" MESH MULTIFIL.
C.
C1 C2 C3 C4 C5 C6
5" MESH MONO.
4" MESH MONO.
5" MESH MULTI-MONO.
4" MESH MULTI-MONO.
5" MESH MULTIFIL.
4" MESH MULTIFIL.
D.
D1 D2 D3 D4 D5 D6.
5" MESH MONO.
4" MESH MONO.
5" MESH MULTI-MONO.
4" MESH MULTI-MONO.
5" MESH MULTIFIL.
4" MESH MULTIFIL.
DOUBLE DAHN FLAGS. (RED)
DOUBLE DAHN FLAGS. (YELLOW.)
NOTE: 2'-3' STROPS REQUIRED AT JOINS TO COMPENSATE FOR VARIATIONS IN FISHING HEIGHTS OF NETS.

## 5 FISHING OPERATION AND TRIALS NARRATIVE

This section contains brief descriptions of the daily operations of the charter vessel during the course of the sea trials.

The areas of operation during the trials are given in Appendix III along with tidal information relating to the periods of operation in Appendix IV. Examples of daily catch logs are also included in Appendix V.

The description includes the trials involving the sole fishery and the plaice fishery which was carried out in two separate stages.

### 5.1 Sole Trials 28/4/89 - 7/5/89 inclusive

During the course of the sole trials, as a means of control, three fleets of the vessels own standard 4in mesh multifilament trammels were shot in the same area as the experimental fleets. The control gear consisted of about 27 nets compared to the 36 experimental ones.

During the course of the exercise the positions of the fleets varied by only small distances. This is the usual practice until drastic changes in the fishing dictates otherwise. In other words, the alterations of position are influenced, as would be expected, by fish movements, but also to a great extent by constraints imposed by the excessive amounts of static gear present on the grounds. Once a productive area of ground is located fishermen are reluctant to move for fear of losing their 'berth'. The competition for space on the channel grounds is intense. The fishing activity is further constrained by the activity of trawlers and in particular beam trawlers. Their operations effectively restrict the static net men to inside the 6 mile limit up to which the beamers are allowed to fish. It is a common occurence for static gear to be 'towed away' by beam trawlers. This often results in conflict between the two modes of operation.

5.1.1 **Narrative**

**Friday 28th April - Day 1**

Having loaded all the trials fishing gear onboard the charter vessel ST. RICHARD the vessel sailed at 0500. Weather conditions were fine with wind force 3-4 from the NE.

The charter vessel had it's own gear in the water to be hauled from the previous day's shot. As the vessel's own nets were hauled, the anchors and dahn arrangements were rigged onto the Seafish nets ready for shooting. In this way the Seafish gear was guaranteed a berth on the congested fishing ground.

The vessel's standard gear consisted of 4in multifilament PA, 3½ inners with 26in PE outers. Three fleets of the vessel's own nets were 'shot-back' with the experimental gear to act as a control.

Some minor problems were encountered when shooting the Seafish gear. Because the nets were new, the headlines had not been under any amount of tension which resulted in some of the headline floats fouling the net as the unstretched headline tended to 'kink'. The problem was eased by shooting at slower speeds allowing time to clear any fouled floats. This was envisaged as a temporary problem that would resolve itself once the net had been fished.

A comment was passed by the skipper to the effect that the Seafish gear may have been over-buoyant for local conditions. Note was made of the comment and acted on later.

The catch from the vessel's nets consisted of approximately 13 stones of soles and mixed fish (including plaice, cod and dogfish). Very little 'rubbish' (seabed debris, starfish, masked crabs etc) was encountered.

Throughout the trials a note was made of the amount of seabed debris and unwanted by-catch (namely whelks, starfish, masked crabs and also edible crabs) taken in each net. This information was to be used to compare the relative efficiency of the various materials with respect to net clearing.

**Saturday 29th April - Day 2**

The charter vessel sailed at approximately 0600 to haul the gear after the first 24 hour 'swim'. Conditions were fine with a south westerly wind of force 3-4. Catch rates were low, a total of 33 soles for a weight of about 16lbs. The rest of the catch was made up of dogfish, dabs and the odd codling. Once again the nets were 'clean' with very few starfish or masked crabs etc, and fishing in the area was generally poor. Other commercial vessels reported catches of 80 soles from 9 fleets (approximately 72 nets) and 140 soles from 7 fleets (approximately 56 nets).

The problems encountered on Day 1 during the shooting operation did not re-occur. Acting on the skipper's comments with reference to the floatation on the Seafish nets, the opportunity was taken to remove some of the floats from Fleet C prior to shooting back. It was hoped to see if there would be any difference in the catch rates between this fleet and the unaltered ones.

All the gear was shot on undulating clean sandy ground in about 10-12 fathoms of water.

**Sunday 30th April - Day 3**

The charter vessel left the beach at 0700 in very fine conditions with very light winds allowing flat calm conditions for operation. As the day went on a south westerly breeze of force 2-3 developed. Day 3 produced improved results. A total of 69 soles from the experimental nets compared to 112 soles from the 27 control nets. It was also noticed that soles taken in the vessel's control nets were of a better class (larger) than those caught in the experimental nets.

The explanation offered by the skipper for this difference was that the vessel's own nets were heavily bonded producing a stiffer lint in comparison to the majority of the Seafish nets (only the 3.5in mesh multifilament nets were bonded). Over the years, it has been the skipper's experience that the more heavily bonded multifilament nets produce fewer soles but of a larger size class.

It was noticeable that the gill/tangle nets, even at this early stage, were not as effective as the trammel nets.

The fishing gear was shot back in the same general area but the pattern of the fleets was changed. The positions of the fleets were moved slightly towards the position of the most productive fleet and re-arranged into two parallel banks of nets instead of one continuous line.

One of the dahn markers from one of the gill net fleets had to be replaced after being towed away by another vessel.

Other vessels operating in the same area reported mixed success - some with improved catches of 40 soles per 8-10 net fleet, others reporting numbers as low as 20 in comparison with the previous day's work.

**Monday 1st May - Day 4**

The weather conditions on Day 4 changed to overcast with heavy rain showers. Sea conditions were moderate with a south westerly wind force 3-4. The day's work started at 0600. The Seafish gear produced 69 soles compared to the 3 control fleets which produced 46, 28 and 41 soles. Reports from other vessels were varied. Some were reporting an average of 40 soles per fleet and one vessel, the MFV SANDRA, had 70 soles from one fleet.

The gear was shot back in the same berths. The patchy fishing did not warrant a move. It was noticeable that the size run of fish caught in the Seafish nets was smaller in comparison to the control nets, obviously mainly due to the smaller meshed nets included in the experimental fleets. Again it was noticeable that the gill nets were not catching their share of soles.

**Tuesday 2nd May - Day 5**

Sailing delayed due to insufficient water to float the vessel off the beach. The vessel eventually cleared the beach at 0630. Early morning fog in the very calm conditions hampered the pin-pointing of the gear. As the day progressed a south westerly day breeze developed, force 2-3, which cleared the fog improving visibility.

The Seafish experimental gear produced 67 soles, virtually all from the trammels. The gill/tangle nets produced very poor results. Once again the run of soles from the Seafish gear were smaller in comparison to the control nets which produced 132 soles from the 3 fleets.

A very heavily bonded control net was shot to try and demonstrate even more the selectivity of this material compared to the untreated.

Other vessel reports were generally down on the previous day's work.

**Wednesday 3rd May - Day 6**

Sailing time put back to 0700 due to lack of water on the beach (small tides). Poor visibility (down to 50 yards) slowed up the operation slightly. Sea conditions were very calm with a very light easterly wind. Similar catch rates to Day 5 were taken, 71 soles from the Seafish nets, compared to 133 from the controls (4 fleets). Both sets of gear were producing the usual small quantities of mixed fish including dogs, dabs and flounders (see daily log sheets).

All the gear was shot-back in the same berths. Tidal strength was increasing to a maximum on Friday 6th May, however the increase would not be expected to hamper the trials.

Up to this point in the trials, the Seafish experimental trammels were averaging between 2 and 3 soles per individual net as compared to between 3 and 4 for the control nets. This also compared quite well with other vessels. For example on this particular day, MFV SANDRA was averaging just under 4 soles per net.

**Thursday 4th May - Day 7**

After the clearance of early morning fog Day 7 turned out to be another very warm day with slight sea conditions in a light easterly breeze. Catch rates remained similar to the previous days. However, it was noticeable that Fleet C having the reduced floatation was showing indications of better catch rates compared to the other nets. For this reason it was decided to reduce the floatation on another fleet - Fleet D. The gill nets continued to show very poor results. It was also noticeable that the vessel's multifilament nets were catching more 'rubbish' than the monofilament and multimonofilament experimental nets.

**Friday 5th May - Day 8**

The fine weather continued with only a slight easterly wind. The Seafish gear produced 87 soles plus a number of dogfish mainly from the gill nets. The vessels and control fleets produced 129 soles. To compare, other vessels e.g. MFV SANDRA, reported 150 soles from 5 fleets for a double swim (two tides) and the MFV GEORGINA MARIE reported as few as 10-15 soles per fleet. Again it was evident that the multifilament nets were picking up more weed and 'rubbish'. No position moves were made, all gear shot back.

**Saturday 6th May - Day 9**

The easterly wind that had been consistent for the last few days continued but freshened overnight resulting in a moderate swell. The moderate to fresh wind pushed the sea state up to about 4-5.

The charter vessels catch rates remained steady, 67 soles from the Seafish fleets and 107 from the control fleets, but other vessels were reporting a marked drop-off in numbers. This change was blamed on the stronger easterly wind which in this area of the channel regularly has an adverse affect on fishing.

The gear was shot back for the last time.

**Sunday 7th May - Day 10**

The vessel sailed at 0300. Similar conditions prevailed as for the previous day and there were no major changes in the catch rates. All the Seafish gear was hauled and remained onboard for off-loading once ashore. This marked the end of the trials period.

## 5.2 Plaice Trials

The exercise to examine the plaice fishery was broken down into two stages. The decision to exercise this option was taken based on the results obtained at the end of the first 5 days of the trials in July. Very poor catch rates did not justify a continuation of the work at that stage.

The plaice fishery had not followed the normal pattern. Normally good catches of plaice occur in July but for some reason the high numbers of fish did not materialise until much later in the year.

In November the charter skipper contacted Seafish with the news that large quantities of small/medium plaice had shown on the inshore grounds. The decision was taken to re-start the trials on 6th November 1989.

### 5.2.1 Plaice Trials 23/7/89 - 28/7/89 inclusive

The plaice trials followed exactly the same procedure as the sole trials. In this exercise the two mesh sizes to be examined were 4in and 5in. In fact the same 4in nets that were used in the sole trials were used in the plaice work. In affect, the only change in the fleet arrangements was to replace the 3.5in nets with 5in nets in the same materials (see Section 4.6.3 showing fleet arrangements).

None of the multifilament materials used in the plaice nets were bonded.

As a further comparison, a fleet of the vessel's own plaice gear consisting of 5 x 6in mesh and 4 x 6½in multimonofilament nets were used. The skipper regularly uses these larger mesh size nets to catch very large plaice on selected areas of ground at certain times of the year.

Prior to the commencement of the trials the local fleet had been experiencing relatively low catches of plaice. However, the situation was improving slightly but the run of plaice was smaller than expected. An observation trip was carried out just prior to starting the actual trials to establish whether the catches being experienced would be sufficient to provide adequate data. The decision was taken to carry on and undertake the work.

Normally at this time of the year the fishing effort on soles tends to tail-off with the interest turning to plaice. However, catches of soles have remained relatively high and linked with the small size run of plaice and the poor market price at the time, the local fishermen continued to concentrate their effort on soles.

5.2.2 **Narrative**

**Sunday 23rd July**

All fishing gear and equipment was loaded onboard the charter vessel. The nets were rigged to the anchors and dahn arrangements all ready for shooting the following day.

**Monday 24th July - Day 1**

The charter vessel sailed at 0400, weather conditions were very fine with only very light south westerly winds. The Seafish gear was shot along with 1 control fleet consisting of 6 and 6½in mesh nets.

Other vessels in the area which were concentrating on sole had been catching relatively large quantities of small plaice (of no real marketable value). Unfortunately, it appeared that this run of small plaice had finished.

**Tuesday 25th July - Day 2**

After another early morning sailing in flat calm conditions the gear was hauled producing very few fish. Sea conditions changed later in the day as a moderate south westerly breeze developed. Considering the poor reports received from other vessels, the charter skipper suggested a gear move onto harder ground inshore where he suggested prospects may be better.

A large percentage of the local fleet were working grounds just outside the 6 mile mark where they were catching relatively high numbers of soles. This area is also fished by local trawlers putting static gear at risk. This risk was highlighted by the MFV SANDRA which had two full fleets of trammel nets towed away by a trawler during the previous night.

**Wednesday 26th July - Day 3**

Day 3 saw a fine start at 0630 with fine sea conditions which rapidly freshened during the morning to south westerly force 5-6 with a moderate swell. Once again very few fish were caught. The reports from the rest of the fleet indicated very patchy fishing.

It was decided to split the gear into two sections in an attempt to locate some concentrations of plaice. Three fleets were shot back on the inside hard ground and four fleets, including the large mesh nets, were moved off towards the areas where the other vessels had been encountering some numbers of plaice. These fleets were shot approximately 4¼ miles off the beach. It was not thought worth the risk at this stage to move the gear outside the 6 mile limit.

**Thursday 27th July - Day 4**

A fresh south easterly breeze prevailed throughout Day 4. No improvement in the fishing despite the change of ground. Two vessels, the MFV SANDRA and MFV GEORGINA MARIE, fishing outside of our position, reported catches of around 20 plaice per net. The decision was made to move closer to their berths.

**Friday 28th July - Day 5**

Vessel sailed at 0500 in fine weather. A slight swell remained in the water from the south easterly breeze on the previous day. The wind direction had changed round to the south west. The majority of the fleet reported a drop-off in the numbers of soles but once again one or two vessels reported high numbers of small plaice - up to 40 per net. The fishing remained very 'patchy'. The vessels that were catching these numbers were finding that some nets were showing these quantities while others in the same fleet were blank.

Because of the very patchy fishing and resulting low numbers of plaice encountered, it was decided to postpone the trials at this stage in the hope of an improvement in the fishery that would provide more consistent fishing. Insufficient data was being collected to justify proceeding with the trials.

The fishing gear remained onboard and was off-loaded ashore later that day.

## 5.3 Plaice Trials 6/11/89 - 12/11/89 inclusive

It was initially thought that completion of the examination of the plaice fishery would have to be postponed until the following season (Summer 1990). However, an unexpected improvement in the plaice fishing occured at the latter end of 1989. Considerable numbers of small to medium plaice were being caught in trammel nets during late October. It was decided to conduct a second stage of the trials early in November.

### 5.3.1 Narrative

**Sunday 5th November**

All trials gear and equipment transported to Hastings. On arrival in Hastings part of the gear was loaded onboard the charter vessel MFV ST. RICHARD.

**Monday 6th November - Day 1**

Loading and rigging of the gear was completed on the morning of the first day. This consisted of 6 experimental fleets as in previous trials, i.e. 4 fleets of 6 trammels and 2 fleets of 6 gill/tangle nets.

The vessel had two fleets of its own gear in the water, these were to be hauled and re-shot with the experimental fleets to give further comparisons. The two vessel's fleets were made-up of 12 nets each consisting of 6in, 6½in and 7in trammels. These fleets were labelled Fleets G and H for the purpose of data collection.

Once all gear had been rigged aboard, the vessel proceeded to sea to shoot. Weather conditions were fine and bright with only light westerly winds. Water temperature was 15°C. This was thought to be unseasonally high and may have been one of the contributory factors to the later appearance of these large quantities of plaice. The gear was shot to the east of the harbour approximately ½ mile from the beach.

**Tuesday 7th November - Day 2**

The vessel sailed at 0600 in good conditions. However, shortly after launching the weather deteriorated and within a short time wind strength had freshened to south-south westerly force 6-7 with moderate to rough seas.

The experiemtnal gear was hauled first producing a good show of fish - up to 50 fish per individual net length. The size run of the plaice was small. The gill nets showed very poor results, being virtually blank apart from the nylon material nets which in both fleets showed a few fish.

It was noticeable from the start that any seabed debris, weed etc, cleared more easily from the mono and multi-mono materials. These nets did not hold as much weed or 'rubbish' as the multifilament nets.

On hauling the vessels large mesh fleets it was very noticeable that they were taking a much larger size run of plaice. The Seafish nets were taking small numbers of very small whiting and dabs. These fish were absent from the vessel's large mesh gear.

One large mesh fleet was cleared and shot back and all other gear was taken ashore where it was cleared and the fish measured. It was felt that the deteriorating weather conditions warranted this decision. No experimental gear was shot back.

It was noticeable that the large fish in the vessel's fleets were almost all females with a high percentage of them 'in spawn'.

**Wednesday 8th November - Day 3**

No trials took place due to weather - storm force 10 south westerly.

**Thursday 9th November - Day 4**

The weather moderated considerably on the Thursday morning. Despite a very poor forecast the vessel sailed at 0700. A moderate south westerly swell remained from the previous day's storm. The forecast was for a severe south westerly gale so it was decided that in order to keep the trials going, half the experimental gear would be shot (2 fleets of trammels and 1 fleet of gill/tangle nets). The vessels own gear was hauled from the previous days shot. This produced approximately 10 stone of plaice from the 11 nets.

With the impending bad weather it was decided to optimise the days work by hauling the Seafish gear after only a short soak time. To increase the chances of high catch rates, the trawl was shot and towed up and down along the edge of the static gear - the intention being to drive any fish on the ground into the trammel nets.

The trawl was towed for about 1½ hours and hauled for about 20 stone of small to medium plaice. High numbers of plaice brood were present amongst the catch. The trammel nets were hauled after only 2 hours fishing time (over the slack water period) and produced a good catch rate, approximately 25 stone of small to medium plaice. The tow with the trawl had given a good indication of the fish present on the grounds and had also appeared to have aided the performance of the gear.

Some small dab 'brood' were taken in the multi-mono nets but not in the other materials. Once again it was apparent that only the multifilament gill nets were catching, and then only very low numbers in comparison to the trammel nets.

The weather was freshening all during the morning. The vessels large mesh fleet was hauled resulting in very few large plaice. Once all gear was onboard the vessel ran for the shelter of the beach.

**Friday 10th November - Day 5**

Friday morning saw continued poor weather - severe gales from the south-west. One vessel risked launching from the beach during a short lull to recover 2 fleets of nets from the previous days shot. Nets were recovered heavy with weed and debris and with very few fish.

**Saturday 11th November - Day 6**

The forecast for the Wight and Dover areas was for gales. Locally, winds were southerly force 6 easing to 5 later and backing south-easterly force 4 for Sunday. No work was carried out for this second day in a row.

**Sunday 12th November - Day 7**

Better weather prevailed for Day 7. The vessel proceeded to sea and shot half the gear (3 trammel and gill net fleets with 1 fleet of the vessels own gear). The first half of the gear was shot to the east of the harbour. The second half of the gear was shot closer to the beach in order that the trawl could also be shot to follow the same pattern as carried out on Day 4. A 2 hour tow was carried out alongside the second half of the nets that had been shot. The first half of the gear was hauled after a 4 hour soak time over the high-water slack. This shot produced very good results with over 100 fish in some nets. By this time the weather had 'fined away' to produce good working conditions allowing all work to be completed. Approximately 30 stone of medium plaice were recovered from the first half of the Seafish gear. Only about 4 stone of large plaice were caught in the large mesh nets belonging to the vessel.

The large mesh fleet was cleared and shot back alongside the second half of the experimental gear for an overnight shot. The remainder of the Seafish gear was taken ashore.

All nets were relatively clear of weed and rubbish apart from the nylon material trammels and gill nets. These contained noticeably more than the other materials. All vessels reported improved fishing for this days work.

**Monday 13th November - Day 8**

The forecast for Monday was promising - south-easterly backing east force 3-4 and moderating to force 2-3. The early part of the morning had poor visibility in calm conditions which allowed all work to be carried out.

On hauling the vessel's large mesh fleet, the 6in nets produced good numbers of fish with fewer in the 6½in and 7in. The Seafish nets produced good numbers of fish but this was offset by a lot of weed and rubbish, particularly in the multifilament trammels. There were noticeably high numbers of dab 'brood' in the multimono nets in comparison to the other materials.

With the increasing numbers of fish on the ground, the gill nets seemed to start taking more of their share of fish. They appeared to only be effective when large concentrations of fish were on the grounds.

Two short tows with the trawl were carried out to give an indication of the concentrations of fish on the ground. Both hauls produced good quantities of good medium sized plaice. Very few undersize plaice were retained in the 5½in mesh codend.

This was to be the last day of the trials. The remainder of the gear was un-rigged and off-loaded ashore for return to Hull.

# 6 RESULTS AND ANALYSIS

## 6.1 Data Collection

During the first trial involving the sole fishery, all data collected was recorded using specifically designed log sheets (see Appendix V). Because of the large numbers of nets and numerous configurations involved in the trials, the result was a considerable amount of paperwork. Data collection on sea trials using this method can prove difficult to manage effectively particularly under adverse conditions at sea.

In order to simplify the initial collection and subsequent analysis of data obtained during this work, it was decided to evaluate the use of a portable and hand-held field computer.

The computer used to collect this fishery data was a 'Fieldworker FW60' harsh environment hand-held, manufactured by IBS Radix of Milton Keynes. This machine has a memory capacity of 256K, but is available in versions holding up to 1MB.

The machine was used to run a BASIC data acquisition program under its CP/M operating system. The acquisition program which was devised by Seafish enables storage of fish length data as separate files. These files may be retrieved for printing or for subsequent data processing. It was usual at the end of a day's work to print out the fish data for the day on a small portable 40 character printer. This provided a hard copy back-up in case of machine failure.

Further processing of this data was done using an IBM PC. The data was transferred from the FW60 hand-held to the IBM using a serial interface link cable. Once the data had been transferred to the IBM, it was manipulated into the desired format using the 'Lotus 1-2-3' spreadsheet and printed as high quality graphs using 'Lotus Graphwriter II' software.

## 6.2 Analysis of Results

The information and data collected from these trials was, after careful analysis, intended to provide an evaluation of the relative selectivity and efficiency of the various net types under examination. Considering that the numbers of fish caught were relatively small, and the short time period of examination of the fisheries, the results should not be considered definitive and should be accepted as good indications to be backed-up by further work.

The data collected was analysed with reference to the following considerations:-

1. Selectivity - the ability of the gear type to catch fish in the size range intended, i.e. ideally only fish of lengths above the minimum legal landing size (MLS).

2. "Catchability" - i.e. the ability of the gear/material to catch the maximum numbers of fish presented to it.

3. Clearing/cleaning of gear - the net type must be relatively easy to clear of fish and clean of debris, weed, unwanted by-catches etc.

4. Ease of handling/stowage - it is important that the gear can be handled, i.e. hauled and shot easily and with minimum risk to operations. The bulk of the material used is an important consideration with regard to the vessel's carrying capacity. This is linked to clearing/cleaning in determining how much gear a vessel can safely operate, i.e. fishing capacity.

5. Cost - the relative cost of the materials used in the construction and rigging of the gear is a factor influencing choice of gear.

6. Fish quality - the effects on quality that may be directly attributable to the materials used in the construction of the gear.

In order to summarise the performance of the net types in the two mesh sizes compared, the figures have been presented in the form of two ratios, i.e. the "retention" ratio and the "selectivity" ratio. These ratios are specific to these data. When considered in conjunction with the actual numbers of retainable catch, the result is a good indication of the relative performance of the net types.

The selectivity ratio is defined as the number of size classes divided by the proportion of the fish occuring in the peak size class. This gives an indication of how selective a net is over a range of size classes. A low selectivity ratio indicates a high degree of selectivity. When considering the importance of the "selectivity ratio" used in the summary tables, attention must be given to the region of the size distribution in which the selectivity is occuring. The selectivity ratio expresses how narrow the range of fish sizes is. A highly selective net (i.e. low selectivity value) will therefore catch fish that differ little in size.

As a further indication of how selective the net is with respect to the minimum landing size (MLS) for the fishery, a figure described as the "retention ratio" is given. Expressed as a percentage, this is the ratio of the numbers of fish above the MLS to the numbers below. If the net in question has a low selectivity ratio and a low retention ratio, then that net is being highly selective but among undersize fish - not a desirable attribute. Similarly, if the net has a low selectivity ratio and a high retention ratio, then the net is being highly selective among the large size marketable fish - a desirable result. These ratios are then compared in conjunction with the actual numbers of retainable fish caught, i.e. those above MLS to determine the relative performance of the net type in question.

Using these parameters in conjunction with the data presented in its other forms the data from all three trials have been analysed in the same manner. This has resulted in certain indications as to the most suitable net type with respect to material and mesh size for each target species.

## 6.3 Presentation of Results

### 6.3.1 Sole Data

Appendix VI contains the results and data collected from the sole trials of 29/4/89 - 7/5/89. It has been presented in a number of formats. Each net type under examination is displayed as a reference letter and number as per the associated key (Table 1).

Table 2 shows the total numbers of soles per net type for each day of the trials.

Table 3 gives the size distribution of soles (in cms) for each net type for the duration of the trials.

Tables 4-12 give size distributions of each species (sole, plaice, flounder, dogfish, cod and others) caught by each net type for each day of operations. From these tables it can be seen which net types were fishing better for each species relative to each other on each day of operation.

The next format of data presentation uses bar charts to compare the catching performance of the three netting materials at the two selected mesh sizes (namely 3.5in and 4in for the trammels and 4.25in and 5.125in for the gill nets). This is presented in Figures 13-16.

The catching performance of the nets in the two selected mesh sizes, for each material type, is then displayed in the same bar chart presentation in Figures 17-22.

In order to summarise the species make-up caught during the trials, Figures 23 and 24 once again in bar chart format, show the scaled composition of fish species for each net type for the total trials period for both the trammel net and gill net fleets.

All this data has been summarised for simplicity in the following table. Effectively it is a summary of the performance of the three material types in the two mesh sizes compared.

TABLE 1

# SUMMARY OF THE PERFORMANCE OF THE EXPERIMENTAL TRAMMEL NETS (A-D) IN THE SOLE FISHERY OF SOUTHEAST ENGLAND, 29th APRIL - 7th MAY 1989

| | 3.5" MESH SIZE | | | 4" MESH SIZE | | |
|---|---|---|---|---|---|---|
| | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH |
| MONOFILAMENT | 5 | 100% | 76 | 17 | 99% | 64 |
| MULTIMONOFIL. | 14 | 99% | 99 | 10 | 99% | 110 |
| MULTIFILAMENT | 12 | 99% | 139 | 14 | 99% | 81 |

RETAIN RATIO is the proportion of fish (%) above the minimum legal size.

RETAINABLE CATCH is the actual numbers of fish above the minimum legal size.

SELECTIVITY RATIO: A LOW selectivity ratio indicates a HIGH degree of selectivity. This is defined as the numbers of size classes divided by the proportion of fish occurring in the peak class.

SEAFISH 1989

### 6.3.2 Plaice Data

The data for the first and second stages of the plaice trials are presented in Appendices VII and VIII respectively. It has been presented in the same format as the data for the sole trials.

The keys for the various net types and fish species are contained in Tables 13 and 14 and apply to both stages of the plaice trials.

As in the sole data the information has been presented in bar chart form using the same parameters. These data are displayed in Figures 25-36 for the first stage and Figures 38-59 for the second stage. It will be seen that for the second stage of the plaice trials the data are separated into sections - one covering the dates 7th, 9th and 12th November and the other covering 13th November. This has been done to take into account that towards the end of the trials period on some occasions only half the experimental gear was used to optimise the exercise during either inclement weather conditions or when large quantities of fish were being caught.

The plaice data also includes a breakdown of the numbers of plaice caught into the two sexes. This information (displayed in Figures 37, 48, 60 and 61) was collected on behalf of MAFF to enhance their on-going data collection in the area.

Appendix VIII also includes data collected from the use of the vessel's own 6, 6½ and 7in trammel nets. This is contained in Figure 59.

(**NOTE**: Since unequal numbers of nets of each type were used during the trials the results have been adjusted to take this into account).

Once again as in the sole exercise the performance of the experimental trammel nets and also the vessel's own large mesh nets has been summarised in the following tables in order to make for a simpler analysis.

TABLE 2

# SUMMARY OF THE PERFORMANCE OF THE EXPERIMENTAL TRAMMEL NETS (A-D) IN THE PLAICE FISHERY OF SOUTHEAST ENGLAND, 25th TO 28th JULY 1989

| | 4" MESH SIZE | | | 5" MESH SIZE | | |
|---|---|---|---|---|---|---|
| | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH |
| MONOFILAMENT | 21 | 69% | 43 | 14 | 89% | 50 |
| MULTIMONOFIL. | 11 | 49% | 40 | 16 | 93% | 79 |
| MULTIFILAMENT | 19 | 67% | 64 | 15 | 94% | 81 |

RETAIN RATIO is the proportion of fish (%) above the minimum legal size.

RETAINABLE CATCH is the actual numbers of fish above the minimum legal size.

SELECTIVITY RATIO: A LOW selectivity ratio indicates a HIGH degree of selectivity. This is defined as the numbers of size classes divided by the proportion of fish occurring in the peak class.

TABLE 3

# SUMMARY OF THE PERFORMANCE OF THE EXPERIMENTAL TRAMMEL NETS (C-D) IN THE PLAICE FISHERY OF SOUTHEAST ENGLAND, 13th NOVEMBER 1989

| | 4" MESH SIZE | | | 5" MESH SIZE | | |
|---|---|---|---|---|---|---|
| | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH |
| MONOFILAMENT | 14 | 77% | 61 | 12 | 88% | 75 |
| MULTIMONOFIL. | 10 | 45% | 15 | 13 | 92% | 80 |
| MULTIFILAMENT | 12 | 49% | 48 | 10 | 97% | 97 |

RETAIN RATIO is the proportion of fish (%) above the minimum legal size.

RETAINABLE CATCH is the actual numbers of fish above the minimum legal size.

SELECTIVITY RATIO: A LOW selectivity ratio indicates a HIGH degree of selectivity. This is defined as the numbers of size classes divided by the proportion of fish occurring in the peak class.

TABLE 4

# SUMMARY OF THE PERFORMANCE OF THE EXPERIMENTAL TRAMMEL NETS (A-D) IN THE PLAICE FISHERY OF SOUTHEAST ENGLAND, 7th, 9th & 12th NOVEMBER 1989

| | 4" MESH SIZE | | | 5" MESH SIZE | | |
|---|---|---|---|---|---|---|
| | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH |
| MONOFILAMENT | 14 | 78% | 212 | 11 | 94% | 255 |
| MULTIMONOFIL. | 15 | 57% | 81 | 14 | 94% | 354 |
| MULTIFILAMENT | 19 | 64% | 168 | 14 | 98% | 326 |

RETAIN RATIO is the proportion of fish (%) above the minimum legal size.

RETAINABLE CATCH is the actual numbers of fish above the minimum legal size.

SELECTIVITY RATIO: A LOW selectivity ratio indicates a HIGH degree of selectivity. This is defined as the numbers of size classes divided by the proportion of fish occurring in the peak class.

TABLE 5

# SUMMARY OF THE PERFORMANCE OF THE CONTROL NETS (FLEET G) IN THE PLAICE FISHERY OF SE ENGLAND, 7th, 9th, 12th & 13th NOVEMBER 1989

| | MULTIMONOFILAMENT | | |
|---|---|---|---|
| | SELECTIVITY RATIO | RETAIN RATIO (%) | RETAINABLE CATCH |
| 6" | 15 | 98% | 510 |
| 6.5" | 15 | 100% | 497 |
| 7" | 11 | 100% | 273 |

RETAIN RATIO is the proportion of fish (%) above the minimum legal size.
RETAINABLE CATCH is the actual numbers of fish above the minimum legal size.
SELECTIVITY RATIO: A LOW selectivity ratio indicates a HIGH degree of selectivity. This is defined as the numbers of size classes divided by the proportion of fish occurring in the peak class.
NOTE: Unequal numbers of different nets were used in this trial, therefore the data has been modified in proportion. Net G1: n=174 (x3=522). Net G2: n=71 (x7=497). Net G3: n=13 (x21=273). The figures in brackets give fish totals as if 21 nets of each mesh size had been fished.

## 6.4 Results - Discussion

Considering the sole data, the net types showing the best results with respect to actual numbers of fish caught were firstly 3.5in multifilament then the 4in multimono and 3.5in multimono. As was probably expected the smaller mesh sizes caught more soles in the small size classes, namely 24-27cms (98 soles for the 3.5in mesh compared to 43 for the 4in mesh). This is an appreciable difference. The numbers of sole caught from the larger size classes (32cms and upwards) were greater than the 4in mesh nets, again significantly greater, almost double (99 compared to 51). However, neither mesh size caught any significant quantities of undersize soles (minimum landing size 24cms). Only 3 soles below 24cms were taken from each of the two mesh size nets.

Indications from the charter skipper were that the more heavily bonded standard multifilament nets used by local Hastings fishermen caught fewer numbers of soles but of better quality, i.e. larger size. This was highlighted to Seafish during the trials when some of the vessel's own heavily bonded nets were used. Based on these indications, it was expected that the stiffer monofilament materials would perform better than the untreated multifilament and multimonofilament being softer and more subtle. However, the results indicated that this was not necessarily the case. The 4in multimono outfished the mono and the untreated multifilament. The difference was more significant in the 4in mesh size. In the 3.5in mesh size, the difference in catch rates for the mono and multimono were not so significant.

When considering the results obtained with the gill/tangle nets, it was apparent (for whatever reason) that they could not compete for catching soles in this fishery. It was noticed that, with only a slight increase in mesh size in comparison to the trammel nets, (i.e. 4in compared to $4\frac{1}{4}$in gill nets) that the few soles that were caught were predominantly in the larger size class of 32-35cms and above. This compared to the majority of soles being in the class 28-31cms for the trammels.

This seems to indicate the possibility that the size class of fish caught can be influenced to a relatively large extent with only a small change in mesh size.

No really meaningful conclusions can be drawn from the results relating to the fishing performance of the various materials used in the construction of the gill/tangle nets as insufficient data were collected due to the low catch rates achieved with this gear.

When comparing the two different mesh sizes for the three materials under consideration, one of the most noticeable factors concerns the bonded multifilament nets in 3.5in mesh. The 4in mesh size equivalent multifilament was left untreated, i.e. in its less stiffened more supple form. The 3.5in bonded nets caught considerably more (119 as opposed to 30) soles in the size classes 24-27cms and 28-31cms* than 4in mesh. The opposite situation occured for fish in the size class 32cms and above, i.e. the larger mesh was catching a larger class of fish, as would reasonably be expected. However, the interesting point to note is that compared to the other materials, i.e. mono and multimono in the two different mesh sizes, it can be seen that the difference in numbers of soles caught in the 3.5in and 4in mesh sizes is noticably smaller. For example, referring to the multimono nets in the size class 24-27cms, the 3.5in nets caught 30 soles compared to 28 in the 4in nets. In the class 28-31cms, 51 soles as opposed to 64. The suggestion from this is that the bonding is a significant factor in improving the fishing performance of the net/material.

As a generalisation, when studying the data, there appears to be a "cut-off" point in the size classes where the effectiveness of the two mesh sizes changes. This point appears between the size classes 28-31cms and 32-35cms. Up to size class 28-31cm the 3.5in mesh is more effective, catching more soles than the 4in mesh. The same applies to the multifilament nets but with a more noticeable differential. The larger mesh size taking over in effectiveness between class 28-31cms and 32-35cms once again.

* Most common size range.

With the multimono material, the trend is not as noticeable - there does not appear to be as clear a "cut-off" point.

It appears that the stiffer material would be more selective. This is backed-up by the indications from the performance summary and also supported by the skippers comments and observations relating to bonding of the material. The previously mentioned trends are apparent with the stiffer mono materials and the bonded multifilament but not with the softer multimono materials.

Considering what we understand about the effect of material "stiffness" on mesh shape and hence catching performance, it is reasonable to assume that the poor relative performance of the mono material compared to the multifilament and multimono materials, could be due to the stiffer mono material allowing the meshes of the net to maintain their shape and remain more open hence allowing smaller soles to escape. The multimono and untreated multifilament being softer and more "catchy" does not allow the soles to pass-through as easily.

The summary of the performance of the experiemental trammel nets shows the two best net types to be the multifilament PA in the 3.5in mesh size and the multimonofilament in the 4in mesh size. The table shows that the monofilament net in 3.5in was considerably more selective than the others having a selectivity ratio of 5 and a retention ratio of 100%. But in comparison to the other types it caught very few fish, i.e. low "catchability" in comparison. The only other net type to catch fewer fish was the monofilament in 4in. This suggests the material rather than mesh size is the important factor in this case.

The multifilament net in 3.5in mesh (bonded) gave good selectivity and retention ratio values and out-fished the other types by numbers of fish. This was followed closely in performance by the 4in multifilament nets.

The 4in multifilament trammels, being the standard traditional net type were expected to have ranked higher. It was suspected that it's relatively poor performance in comparison to the other net types would have been due to the fact that the nets were not bonded, i.e. stiffened to compare to the standard traditional net. For this reason it is fair to say that the 3.5in multifilament trammels were closest in specification for comparison to the traditional net type.

With reference to the plaice data; considering the performance of the different netting materials during the first stage of the trials, the trend in performance was for the multifilament and multimono to out-perform the mono nets. This applied to both mesh sizes. In the second stage, a similar trend applies but only in the larger mesh size. Looking at the 4in mesh size in the second stage, the monofilament seems to out-perform the other materials. There does not appear to be any real apparent reason for this marked change in the performance trend.

There is very little difference between the performance of the multimono and multifilament materials in the two mesh sizes from both the stages of the trials. In the 5in mesh, their respective performances are very similar as can be seen from the performance summary tables. The multimono appears to be slightly more selective for fish at the lower size ranges, seen from the low retention ratios compared to the multifilament.

Once again, as with the sole trials, the gill/tangle nets did not perform anywhere near as well as the trammels. The multifilament nets did appear to out-fish the other materials on almost all occasions by appreciable amounts. Considering the low numbers of fish taken in these nets, the results do seem to indicate that this particular gear type is not suited to these fisheries.

Apart from the "anomaly" with the 4in materials in the second stage, the multimono and multifilament consistently out-fished the mono, the differential being greater in the first stage where the multimono and multifilament out-fished the mono by at least 50% and up to 100% in the case of mono to multimono in the size class 23-26cms.

The trend in the larger size classes (31-34cms and 35=38cms and above) was for the differential between mono and the other materials to decrease. Over the full range of size classes there was very little difference in the numbers of fish caught between the multimono and multifilament materials.

Comparing the 4in and 5in materials there is a definite shift to the right on the bar charts, i.e. an increase in the size of fish caught with the 5in materials. This is as would be reasonably expected. For the first stage with the 4in mesh the numbers peak in the 23-26cms class, with 5in they peak at 31-34cms. With the second stage the peak class is 27-30cms for both mesh sizes but there is a marked increase in numbers of fish in the 31-34cms and above classes. A similar situation occurs for the gill nets.

Considering the monofilament material in the two mesh sizes, the results show that the smaller mesh size is more effective for fish in the smaller size classes as would be expected. The first stage results show that the 5in mesh starts to take over in performance from the 4in in the 27-30cms class, although the numbers do not indicate any real significant improvement. The same trend applies to the second stage of the trial with the only difference being that the change over has moved more towards the next size class of 31-34cms where the difference is more marked than in the first stage.

With multifilament the change over of effectiveness of the two mesh size is much more marked occuring in the 27-30cms size class. The difference is particularly noticeable in the bar graphs from the second stage results. This suggests a clearer indication as to the effectiveness of the multimono material at 5in at selecting for fish above the MLS of 27cms.

On examination of the multifilament results, once again a similar trend to the multimono is apparent - the first stage results showing a less marked difference compared to the second stage. In both stages the change-over occurs in the 27-30cm size class (as with the multimono).

These marked change-over points in the 27-30cms classes for multimono and multifilament materials seem to indicate that the material type is a more important factor in determining the selectivity of the gear than the mesh size when compared with mono nets.

The summary of the performance of the trammels for the plaice trials shows that the multifilament nets in both 4in and 5in to be the most effective. The selectivity ratios are not the best of the 6 net types but on consideration of the other factors of retention ratio and the numbers of fish caught, the multifilament material in both 4in and 5in mesh sizes appears to be the more effective for the fishery (considering a MLS of 27cms).

## 6.5 Cleaning/Clearing of Nets

Considering by-catches of unwanted material, e.g. weed, bottom debris etc, and unwanted species, e.g. "maybugs" (Corystes spp), crabs, whelks, starfish etc, these factors were monitored wherever possible during the course of the trials. The numbers of species including "maybugs", starfish, whelks and crabs were recorded for each material type as an indicator of their ability to catch/retain unwanted by-catch.

For the first stage of the trials a total of 1071 "maybugs", whelks, starfish etc, were caught from the nets of all 3 materials - 21% were taken from the mono, 30% from the multimono and 49% from the multifilament.

The multifilament PA material is by far the harder material to clean of debris, particularly weed. This problem is reduced to a limited extent by the bonding/stiffening treatment. As a generalisation the stiffer the material, the easier it is to clean and clear of catch and debris. The multi stranded multimono is a very 'catchy' material with respect to small crabs and 'maybugs' etc. This is borne out by the above figures. The multifilament was found to be the material picking up the most unwanted by-catch and the mono catching the least with the multimono between these two.

The trials have highlighted the large number of variables involved in trying to decide on the best choice of netting for a particular fishery. From the fisheries point of view there is also the conflicting requirements to maximise catch of marketable fish whilst reducing non-catch mortality.

Future trials should narrow down the variables and for the sole and plaice fishery this would suggest trammel nets made from multifilament PA bonded with variations in mesh size from 'X'in to 'Y'in to measure catchability.

OR

Future trials should narrow down the variables and for the sole and plaice fishery this would suggest trammel nets of a selected mesh size made from different materials to determine the best material from a selectivity point of view.

## 7 CONCLUSIONS

The complexity of the trials, the large number of variables involved and the relatively low catches of plaice and sole do not permit firm conclusions to be drawn from this trial on the best choice of materials and mesh size for this particular fishery.

Any conclusions that can be drawn from this work with respect to the performance of the materials and mesh sizes under consideration can only be applied to these species (sole and plaice) in this particular fishery.

It would be wrong to draw general conclusions and suggest that they would apply to all similar fisheries. Without examining other similar fisheries, it should be realised that the following conclusions only apply to the fishery under consideration. Indications however can be taken which would narrow down the work on future trials to obtain a more conclusive result.

Considering the sole data; the performance summary, considering the main aspects of the gears performance, showed the multifilament PA (bonded) material in the 3.5in mesh to come out on top. This was closely followed by the 4in multimono. The most selective material was shown to be the monofilament. The results suggest that the type of material is equally, if not more, important as a factor influencing selectivity than mesh size. This is backed-up by the fishermens observations comparing bonded and unbonded nets.

The fact that virtually no undersize soles were taken in the gears under consideration suggests that the minimum mesh size of 3.5in used was a good selection for this fishery.

No real meaningful conclusions can be drawn from the results of the fishing performances of the materials used in the construction of the gill/tangle nets as insufficient data were collected due to the relatively poor catching performance of this gear type. The trammel nets consistently appear to out-perform the gill nets.

With reference to the plaice data; the two stages of this trial produced slightly different results. The trend in performance was for the multifilament and the multimono to out-perform the mono nets, in both mesh sizes. In the second stage, the same trend appeared but only in the larger mesh size. The 4in mono nets seemed to out-perform the other materials in the second stage.

As with the sole trials the gill/tangle nets could not compete with the trammels for performance. However, it appeared that for this type of gear the multifilament material was more successful at catching fish.

When considering the selectivity aspect of the 4in and 5in materials, there is a shift in the size groups of fish caught, i.e. an increase in the size of fish caught as mesh size increased from 4in to 5in. This is as would be reasonably expected. The data suggests that for a minimum landing size (MLS) of 27cms for plaice a 5in mesh would be better suited to this fishery in order to reduce the numbers of undersize fish being caught. There is again the suggestion that the material type has a strong influence on the selectivity of the gear. The monofilament material showed itself to be more selective.

From the point of view of ease of handling, more specifically cleaning and clearing of the nets, the monofilament material fairs better than the other materials. This observation is backed by fishermens observations and experience (not only in this fishery). The stiffness and twine construction of the material is an important factor in this context.

These trials produced some very interesting and valuable data on the sole and plaice fishery based on this area of the English Channel.

Although the results can not be considered as definitive they provide a good insight into the ways in which mesh size, net material and construction influence the fishing performance of the gear.

Similar exercises in similar sole/plaice fisheries and also in other static net fisheries could provide ever more valuable information to enhance these findings and also lead to an even better understanding as to how gear 'works' in order to produce more effective selective gear designs.

The increased use of netting in many English and Welsh fisheries and the lack of information about catch rates, selectivity and non-catch mortality indicate that more trials are necessary. These however, will have to be more selective in the data collection and information will have to be built-up progressively over several seasons.

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