Tangle Net Fishery for Spider Crabs *(Maia squinado)*

Seafish Report No. SR499

December 1996

Sea Fish Industry Authority

Technology Division

Tangle Net Fishery For Spider Crabs (*Maia squinado*)

Seafish Report No. 499

Author: G. N. Dunlin

Date: 2 December 1996

Contents

Sea Fish Industry Authority

Technology Division

Tangle Net Fishery For Spider Crabs (*Maia squinado*)

Summary

In March 1995, representatives from the Hastings Fishermen's Protection Society approached Seafish for assistance in developing a tangle net fishery for spider crabs from Hastings on the south coast of England.

Arrangements were made for two Seafish gear technologists and three Hastings fishermen to visit the Guernsey port of St. Peterport. An observation trip was organised for the visiting party onboard the MFV MIDNIGHT EXPRESS (GU 367), skippered and owned by Mr Dougal Lane.

Gear specifications were obtained from the Guernsey fishermen based on those nets currently being used successfully by both French and Channel Island spider crab netters. This gear type and design was selected for evaluation in the southeast Channel fishery.

Three vessels were used for observation voyages during this exercise:

i. MFV ST. RICHARD (RX 60)
ii MFV SANDRA (RX 83)
iii MFV GRACE GEORGINA (RX 150)

Soak times varied between 24 hours and 72 hours depending on weather and spider crab activity.

Two basic methods of removing spider crabs have been identified within these trials. Both appear to be as fast and effective as each other when carried out by experienced crews.

Three methods of storing the crabs on board were observed. Mortality levels as a result of these handling procedures were generally low, however, it is essential that the crabs are handled with care from the first point of contact to the last.

Seafish Report No. 499

Author: G. N. Dunlin

Date: 2 December 1996

1. Background and Objectives

In August 1994, a party comprising of Seafish gear technologists and fishermen representing the Hastings Fishermen's Protection Society (HFPS), visited St. Malo in France to investigate a trap fishery for cuttlefish. The aim was to investigate methods of exploiting cuttlefish other than by their traditional method of gill and/or trammel netting.

Whilst in St. Malo, contact was made with a Jersey based vessel that was targeting spider crabs with tangle nets. This vessel was able to target spider crabs for most of the year by regularly changing operational areas. Very good catch rates were achieved with high returns from French and Spanish markets.

The Hastings fishermen were extremely interested in this operation. They felt that if they could access suitable markets and develop suitable netting gear, they could utilise the abundant resource of spider crabs that they were currently discarding.

In March 1995, representatives from the HFPS approached Seafish for assistance in developing a tangle net fishery for spider crabs from Hastings on the south coast of England.

Contact was made with the Guernsey Fishermen's Association (a constituent organisation of the NFFO). They recommended a visit and meeting with one of their members, who is currently successfully involved in the Channel Islands spider crab fishery.

Arrangements were made for two Seafish gear technologists and three Hastings fishermen to visit the Guernsey port of St. Peterport. An observation trip was organised for the visiting party onboard the MFV MIDNIGHT EXPRESS (GU 367), skippered and owned by Mr. Dougal Lane.

The knowledge gleaned from this visit convinced the Hastings Fishermen that there was potential to develop a similar fishery on the English side of the Channel.

After further consideration the HFPS requested Seafish assistance in prosecuting this fishery. The established gear designs currently being used by the French and Channel Islands fishermen were seen as the most promising option to evaluate for the English fishery. Some minor modifications to the floatation and weighting arrangements were required to adapt the gear specification to suit the local fishing conditions. It was felt that existing gear designs should be tried before investigating alternatives.

Seafish's Gear Technology section responded to this request for assistance by setting up some monitored fishing trials.

The main aim was to establish if tangle netting for spider crabs is a viable option for Hastings fishermen.

If such a fishery could be operated it was necessary to establish and encourage responsible catching and handling practices in an attempt to maximise returns from the fishery.

The fishing trials aimed to examine catch rates, soak times, evidence of selectivity, catch handling and onboard storage methods to try and ascertain the best methods (with due regard to vessel limitations) needed to keep the catch in optimum condition for live, onshore storage.

A shore based live holding facility was under construction at the time these trials took place. The tanks had been designed with this spider crab fishery in mind but were also expected to accommodate other shellfish species as and when required.

Seafish's Fish Technology department assisted with advise at both the design and building stages of this venture.

2. Biological Features Of The Spider Crab (*Maia squinado*)

The spider crab *(Maia squinado)* is a member of the Majid family of crabs and is found on a wide variety of substrate types along the Atlantic coasts of Europe from Britain to North Africa and in the Mediterranean in depths of up to 100m. This distribution is thought to reflect the species preferred temperature range of 7 to 20°C. It requires fully saline conditions of between 33 to 36 parts per thousand. Sensitivity to low ambient temperatures is believed to have been responsible for the total loss of spider crabs along the southeast coast of England after the severe winter of 1962/1963. Merchants have also reported high mortalities in storage tanks during cold winters. The run of recent mild winters has probably resulted in the increase in stock abundance and the extended distribution along the Channel to the Dover Strait.

Spider crabs mature at 2-3 years old and have a puberty moult over a wide range of body size. For males and females, the minimum size at maturity is 80mm carapace length (CL) up to 170mm and 150mm CL for males and females respectively. They reach a maximum size of 230mm CL (males) and 190mm CL (females) and can weigh up to 4kg. Spider crabs can reach 8 years of age and the females produce up to three batches of eggs per year from February to October. Female spider crabs are usually hard bodied during mating but can store sperms in the spermatheca for successive spawning without mating.

Spider crabs have a terminal moult and a total of twelve other moults can occur from the benthic stage to the terminal moult with just two of these occurring after year one. Percentage moult increments range from 20 to 40% and the moulting period has been observed between March and November, with the terminal moult more restricted to the period July to November.

Little is known about the migration patterns of spider crabs off southern England but it appears that they migrate inshore and aggregate in high densities between April and August. Offshore overwintering grounds have not been identified and are consequently not fished.

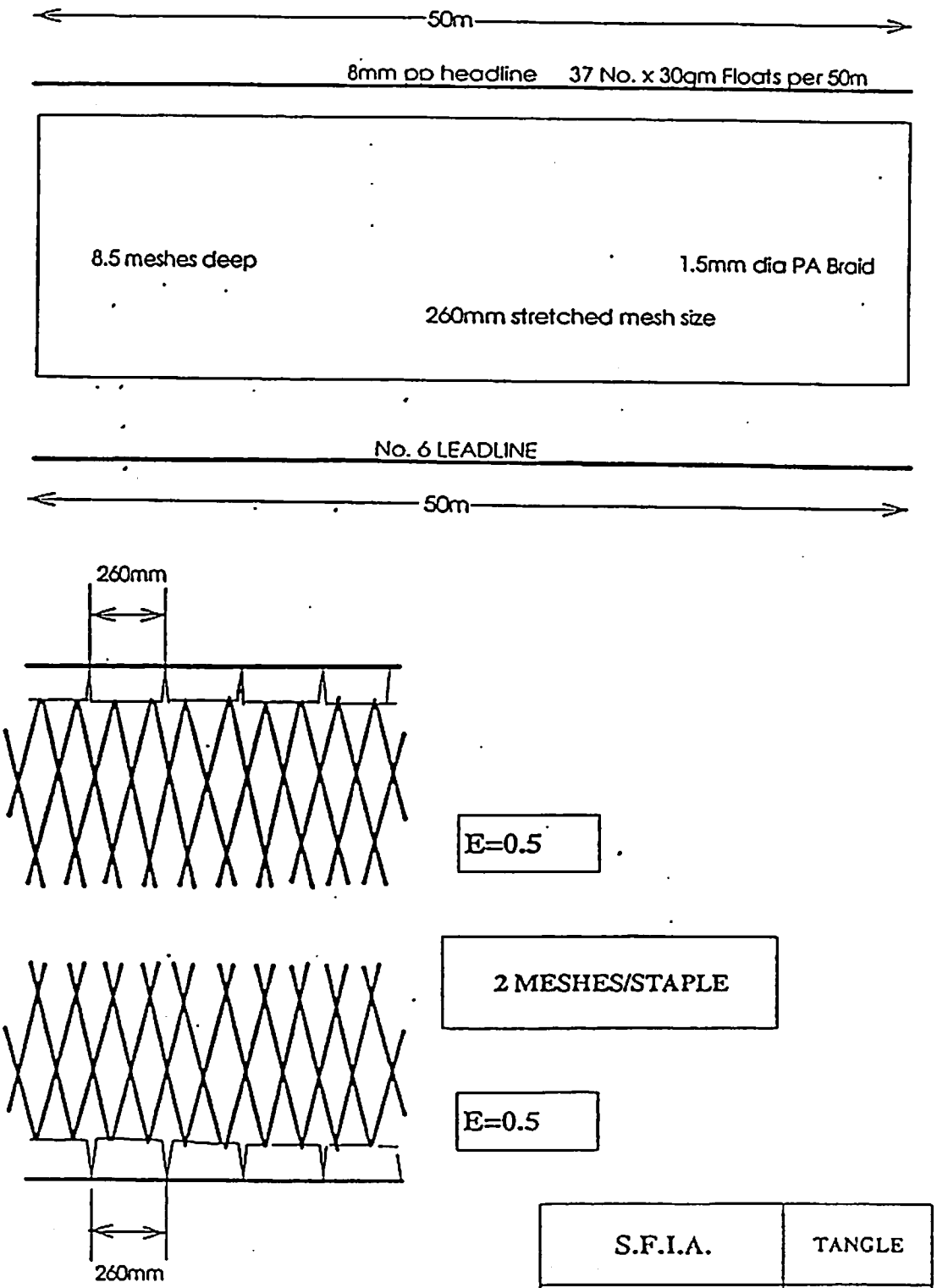
A study in the Channel Island fishery on migratory patterns concluded that both male and female spider crabs move into depths of 50m during the winter and return to shallower zones in spring. There appear to be clear patterns of sexes and size groups staying together. Last season's adults may well start their migration to deep water very early in July, whereas this season's adults, becoming mature in the Autumn, will move to deeper water much later. This can result in a lag of up to two months between the offshore migration of 'hard' adults and that of 'soft' adults. It has been hypothesised that similar migratory patterns occur off the south coast of England.

3. Fishing Gear

Gear specifications were obtained from the Guernsey fishermen based on those nets currently being used successfully by both French and Channel Island spider crab netters. This gear type and design was selected for evaluation in the southeast Channel fishery.

The netting is constructed of 1.5mm (diameter) braided nylon PA of 'hard' construction and has a mesh size of 130mm bar length. The choice of mesh size used was based on the experience of the Guernsey fishermen as being the most selective for targeting cock crabs. The netting is mounted onto a headline of 8mm, hard lay PP rope with a horizontal hanging coefficient of 0.5 (100m of netting set onto 50m of rope). The netting panels are 8.5 meshes deep. Staples are made from 2mm braided (PA) and pick up two meshes at each setting (see Fig 1). These are machine stitched onto the headline. The footrope is set identically to the headrope and again machine stitched. Floatation is provided by 37 x 30 gm floats to each 50m net and is countered by a No. 6 leadline (reinforced). Monofilament nets are also sometimes used, constructed in a minimum of 0.65mm diameter monofilament PA material. This material does not last as long as the braided PA. Soak times must be reduced with mono materials to reduce damage caused by the spider crabs 'chewing' the meshes.

Figure 1 - Net specification



4. Fishing Operations

Three vessels were used for observation voyages during this exercise:

i. MFV ST. RICHARD (RX 60)
ii. MFV SANDRA (RX 83)
iii. MFV GRACE GEORGINA (RX 150)

These small (<10m) inshore vessels operate as gill/trammel netters They are part of the Hastings fleet which is the largest beach launched fleet (40 vessels) in the country.

All vessels were supplied with 16 nets of the type specified (see Fig.1). These nets were made up into two fleets of 8 nets. These nets were fished alongside the boats own standard sole trammel nets on the ST. RICHARD and the GRACE GEORGINA. The SANDRA used only the tangle nets for the duration of the trials. The sole trammel nets used were in a poor state and ready for discarding. It is the standard practise in Hastings when fishing in areas known to have spider crabs to use these old nets so as to avoid damaging newer nets. Soak times varied between 24 hours and 72 hours depending on weather and spider crab activity. The nets were easy to handle during hauling and shooting and sank in the water as quickly as the normally fished trammel nets. The grounds used in these trials were around the Royal Sovereign light vessel in depths of between 8 and 14 fathoms. These grounds are normally fished for plaice and soles and brown crabs.

The vessels used their existing conveyor type net haulers for these operations unlike the Guernsey vessels which used the "Bandolier" type. The Hastings fishermen felt that their conveyor haulers would cause less damage to the crabs during the hauling operation. One man controls the vessel, one man pulls the net through the hauler and the other crew stows the net containing the crabs. The nets are stowed clear of the hauler, in preparation for clearing after all nets have been recovered. It is important that the net is stowed with care, with the crabs laid belly down to discourage them from moving around and further tangling the net.

A fleet of nets is often cleared and re-set before hauling another fleet. This depends on the number of spider crabs in the nets and the degree of entanglement. The time taken to remove the crabs is often proportional to the soak times. With extended soak times, the crabs have more time to entangle themselves deeply in the net. 'Fresh run' crabs are more easily removed. The tangle nets are relatively simple to clear compared to the trammel nets; unless the trammels are so badly damaged that it is necessary to simply 'rip' the crabs out along with a sizeable piece of netting. The tangle nets can be easily cleared before re-shooting, irrespective of soak time.

5. Catch Handling

The removal of spider crabs from any netting is a difficult operation. Rough handling inevitably results in the crabs shedding limbs and these damaged or "crippled" crabs are less valuable to the market. Their size, shape and spiny carapace can make extraction a time consuming task. Removal must be completed without sustaining damage to the animal, netting or fisherman's fingers. As with any operation the task becomes easier and faster with experience.

Two basic methods of removing spider crabs have been identified within these trials. Both appear to be as fast and effective as each other when carried out by experienced crews:

i. A tool known as a 'picker' is used for crab removal . It consists simply of a piece of heavy wire with a right angled hook at the end attached to a handle. This is used to 'tease' the meshes over the body of the crab and pull them clear of the legs and claws.

ii. The crabs are cleared from the nets by simply using the hands to pull the meshes over the spider crab and down the legs.

It is a matter of personal preference as to which method is used. Hastings' fishermen have handled these crabs for so long that most prefer to use method number two. However, method number one is less damaging to gloves and hands.

Once removed from the nets, the crabs are checked for damage. Any broken limbs are removed at the 'casting joint' which naturally forms a seal to prevent bleeding. Any bleeding crabs are separated from the main catch and landed as bait. Crabs that have lost one or more of the main claws are also classed as "cripples" and are also separated. Undersize crabs and "berried" (egg carrying) females are returned to the water as soon as they are cleared from the net.

5.1 Onboard Catch Storage.

Three methods of storing the crabs on board were observed:

i. Crabs were placed in a large net bin and covered with sea water. The water was allowed to run slowly out of the bin and when empty was re-filled with fresh sea water. The bin had a capacity of approximately 200kg of crab.

ii. The crabs were sorted into males, females and "cripples". These were placed in fish boxes and stacked on top of each other. They were then covered in old sacking or carpets and soaked with water. They were soaked frequently throughout the trip until the boat landed. This served to keep the catch cool and prevent the crabs from drying out.

iii. The crabs were sorted, stored and soaked as above but not kept wet throughout.

Mortality levels as a result of these handling procedures were generally low, however, it is

essential that the crabs are handled with care from the first point of contact to the last. Rapid changes in temperature (cold or hot) or exposure to wind can quickly stress these animals and cause casting of limbs and death.

5.2 Landing, Handling and Storage Ashore

In an ideal situation the crabs should be stored onboard in large net bins and have fresh sea water circulated through them at regular intervals. Once in harbour the catch should be split into manageable quantities and put into bags constructed of old trawl netting, wire mesh cages or old pots. The bags etc should then be stored in sea water until required. The quality of the sea water has to be very good to reduce danger of contamination. In Hastings and similar fishing ports this is not always possible.

In Hastings the boats are launched and recovered from a beach and there are no suitably sheltered areas to store the crabs once ashore. The vessels are unable to use water pumps because they are beached high above the water line. Once the vessels are ashore , any crabs waiting to be cleared may have been out of the water and exposed to the elements for anything up to two hours.

Once the boxes of crabs are put ashore they are transported to a live holding facility some 300–400 yards away. They are then examined, sorted and weighed before being put into the live holding tanks. This can result in crabs being exposed and under stress for up to an hour prior to being returned to the water.

During this monitoring period, problems with the design of the holding facility and poor procedures resulted in heavy losses (the highest being 75%) when the holding tanks were first opened. The position of the building in relation to the water line meant that water could not be continuously flushed with fresh sea water. The water had to be pumped into storage tanks and the system flushed at the right states of the tide. In between tidal cycles the water was recirculated around the tanks and aeration achieved by water being forced out of small bore holes in the pipes. Crabs were sorted into hens, cocks and cripples and placed into separate tanks. As a result of the majority being cock crabs, tanks were very often over crowded. Some cripples were still losing blood and not spotted. This resulted in contamination of the water. Overcrowding quickly led to oxygen depletion in the water and this, combined with blood loss, resulted in mortalities. Once the crabs start dying it often results in a chain reaction of more mortalities particularly when the water circulation is via recycling rather then re-newing.

Meetings were held with the holding facility designer, Seafish technology staff and the facility managers to try and overcome these problems. As a result, new pipes were put into each tank and aeration achieved by air being forced through by an electric pump. Tighter controls on animal selection and pumping procedures also helped to alleviate the problem of animal loss.

When the holding tanks had a sufficient number of crabs, a buyer was contacted and the animals were consigned to a vivier lorry. They were then transported to continental markets were they were sold. After sale, the buyer would then pay the fishermen based on the market price minus the losses en-route to the markets.

6. Discussion

At certain times of the year the infestation by spider crabs is such that it prevents virtually all types of static net fishing. The use of tangle nets to target the spider crabs can be the only source of income open to the boats in this area. At the time of these trials the top earning boats were all fishing for spider crabs. One or two were trawling through the night but with little success. This fishery conveniently follows and can be used in conjunction with the cuttle fish fishery. If more were known about the migration patterns of the spider crab then they could also be targeted in late November and through December to hit the lucrative Christmas markets on the continent.

The careful selection of mesh size can aid both size selectivity and to a degree sex selectivity. Although poor catch rates towards the end of the trial prevented this being proved in the trials (see Table 1). The Guernsey and other fishermen targeting the spiders have all increased mesh sizes gradually. Looking at the catches in table 1, it can be seen that the trend was towards cock crabs being caught. The vessel owners all expressed an interest in increasing the mesh size further to 150mm bar length (300mm stretched mesh) This can be advantageous when meeting restricted market demands and when females are carrying eggs.

Soak times can be controlled to take account of prevailing circumstances and catch mix. Heavy concentrations of animals in an area require hauling to be carried out every 24 hours with up to six fleets being easily handled. If the fleets can not be hauled due to weather, an abundance of crabs or other problems then they can be left for another day without difficulty. Longer soak times however, should be monitored carefully and avoided if possible. Very little by-catch was observed in the tangle nets during these fishing trials (see table one) whether they had been left for 24 or 72 hours. Three cod and three brill were caught over the trial period in the tangle nets in contrast to 12 plaice, three Dover soles, two dog fish and one wrasse in the trammel nets.

The skippers of the vessels used for the project all expressed confidence in being able to leave the tangle nets in the water for extended periods as they were so easy to clear. The crews agreed that the tangle nets were much quicker and easier to clear then their normal trammels.

Some net damage by the crabs was noticed towards the end of the trials. This however was not as excessive as damage incurred by the multi monofilament or monofilament nets. Gear costs using this particular type of tangle netting are very high and a long fishing life is required to give good returns on investment.

For future development it would be worth considering the use of alternative materials for construction. The use of heavy grade monofilament PA, up to 1.0 mm diameter may be one cheaper alternative. Other materials of interest are 'Dyneema'™ and 'Spectra'™; their high strength:diameter ratios and hard wearing properties could be beneficial for this particular fishery. Manufacturers are not willing at the moment to run off small quantities of this yarn in the required mesh sizes. A net maker from Grimsby expressed interest in obtaining the yarn directly from the manufacturer and making up the nets by hand braiding. It is not yet known what the cost of this would be, but it may still be prohibitive economically.*

* *contact Seafish Gear Technology for details*

A number of observations were made with regard to catch handling:

i) Due to space limitations, the best way to keep crabs on board until landing is to put them into boxes and cover as quickly as possible.

ii) They should be sprayed with water at regular intervals and kept out of the wind.

iii) Bringing nets in to clear onshore should be avoided if possible.

iv) Once landed, the crabs should be transferred to the live holding tanks as quickly as possible and care should be taken not expose them to the sun or wind for too long.

vi) Increased aeration added to the holding tanks and improvements to monitoring and handling procedures will result in decreased crab mortalities and better returns for both the fishermen and the merchants.

An improved knowledge of the European markets would be advantageous to the merchants when arranging sales of the crabs. This could be used to encourage the fishermen to be more size/sex selective and perhaps to mimic the Channel Island men in 'catching to order'. Spider crabs are specifically targeted when the price is favourable particularly around Easter and Christmas

Quality is a very important factor in marketing the spider crab. Soft recently moulted crabs have a high water content and consequently a poor meat yield. Soft crabs should not even be targeted as any that are rejected at sea usually suffer high mortality rates. In Europe, where the main trade is in live crabs, it is important to minimise storage and handling mortality. Recently moulted spider crabs do not survive well in live storage facilities and should not be landed. Quality control is in the hands of the merchants who should impose restrictions on the condition and size of spider crab they are prepared to buy from the fishermen.

Dead spider crabs are particularly good as whelk bait and subsequently merchants are accepting crabs of any condition to meet the ever growing demand from the whelk catching sector. This practise will not help to promote responsible catching and handling practises and should be discouraged.

In Europe the only common regulation for spider crabs is the minimum landing size (MLS) of 120mm CL which applies in Economic Community (EC) Regions 2 and 3 (ICES areas IV and VII). It was probably chosen more to match market requirements than to give protection to juvenile spider crabs as a proportion of immature crabs are larger than the minimum landing size (see Biological Features). Conversely, a proportion of mature crabs are below the MLS and therefore not exploited.

Regulations are in place in France, Spain and the Channel Islands for seasonal closures. In France and the Channel Islands it is, by industry cooperation, 26 August to 29 October. In Spain it varies between geographic areas (in relation to the sea temperature and differences in the moulting cycle), starting 1 June until 30 October or 15 July to 14 December.

The landing of ovigerous (berried) spider crabs is banned by national legislation in Spain. This ban was probably initiated to protect reproduction and is not thought to be widely enforced. The presence of eggs is considered by the consumer to be an indication of good quality. There is at present no legislation by the Ministry of Agriculture Fisheries and Food preventing the landing of berried females in this country. Local Sea Fisheries Committees may have bye-laws in place to prevent this.

Table 1 - Catch Composition

Boat	Length net	Type of net	Soak time	Cocks (kg)	Hens (kg)	Berried hens (No.)	Cripples (kg)	Bait (kg)	Undersize (No.)	Fish
ST. RICHARD	800	Tangle	48	166	22	44	50	47	34	Cod, cod
	800	Trammel	72	172	39	24	33	79	45	
	800	Tangle	24	92	5	53	15	8	6	
	1600	Trammel	3x24,1x72	183	33	106	39	70	45	2ds,6pl,2dogs
SANDRA	800	Tangle	72	152	28	20	36	98	12	
	800	Tangle	48	40	3	10	4	2	4	
GEORGINA	800	Tangle	48	29	2	10	0	2	3	brill,cod
	800	Trammel	48	45	9	15	0	3	10	
ST. RICHARD	800	Tangle	24	16	9	2	0	12	0	brill
	800	Trammel	24	8	0	0	0	0	2	6pl,ds,wrasse

Key ds - Dover Sole
pl - Plaice