SEA FISH INDUSTRY AUTHORITY
Industrial Development Unit

DOUBLE RIG AND SEPARATOR TRAWL TRIALS HELD IN THE FIRTH OF FORTH

MAFF Reference IAA 16(b)

Internal Report No. 1297

January 1986

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SUMMARY

The principle of separating the catch within a trawl has been studied for some time by the Department of Agriculture and Fisheries for Scotland (DAFS) and by the Sea Fish Industry Authority (SFIA). It is particularly valuable as a means of separating demersal fish from prawns (Nephrops Norvegicus) and sea bed debris since the latter two tend to damage the former. The SFIA see value in such a trawl both to improve the quality of the catch and to make for easier work in the sorting of the catch on deck.

During 1983, trials were held onboard the MFV EUREKA using a fish/prawn separator trawl whilst surveying potential new prawn grounds in the Central North Sea by the SFIA (Technical Report No. 203 refers).

During 1984, trials were held onboard the MFV PROGRESS and MFV FAVOURITE in the Irish Sea using a standard fish/prawn trawl with separator panel and a standard prawn trawl also with separator panel fitted by the SFIA (Technical Report No. 253 refers).

In the period between the second and this series of trials opportunity was taken to investigate ways of extending the range of trials that could be adopted for the third series.

The trials described in this report present an evaluation of two trawls with the same geometry, with the addition of one of the trawls fitted with separator panel and double codends being towed simultaneously alongside each other in a double rig mode.

The separator device consisted of a tailored horizontal panel of netting set into a conventional dual purpose or prawn net. During the 1983 and 1984 trials it proved to be effective in separating whiting from the prawns and bottom debris although catch rates of other demersal species were too low to prove conclusively for these other species.

The trawls used in the trials described in this report were designed by the author. The combined total twine surface area of the two nets was approximately the same as one of the vessels standard dual purpose nets that are towed singularly.

The trials described in this report were supported by MAFF as part of their 1985/86 Commission of Fisheries Research Projects - Code 1AA 16(b) - Gear Selectivity.

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DOUBLE RIG AND SEPARATOR TRAWL TRIALS HELD IN THE FIRTH OF FORTH

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DOUBLE RIG AND SEPARATOR TRAWL TRIALS HELD IN THE FIRTH OF FORTH

1. INTRODUCTION

One of the recommendations for the development and introduction of separator trawls was to assist in reducing the catches of immature whiting that are invariably taken on prawn grounds. Also, the quality of demersal fish should improve tremendously with the ability to separate it from the prawns and seabed debris and therefore, command much better prices on the markets.

A separator trawl is one in which a trawl is divided into an upper and lower compartment by a horizontal sheet of netting - Figure 1.

The vessel chosen for these particular trials was ideally rigged mechanically for the intended double rig method of trawling when using three warps. The double rig was used as a means of towing two identical nets at the same time, one with a separator panel and one without as a direct comparison of catch rates and escape rate of immature fish.

Vessels fishing for prawns invariably encounter the problem of picking up large amounts of seabed debris at all times. Because of the stones and rubbish in the codend, most of the demersal fish that is caught is badly damaged. Long tows of 3 to 4 hours are usually adopted and the longer the towing time, the worse the condition of the fish becomes. An additional problem is that the by-catch of demersal species during the summer months can be predominantly undersized owing to the minimum legal mesh size being used for prawns.

Two SFIA 380 mesh dual purpose fish/prawn trawls both made in Hull were used, one fitted with a horizontal separator panel and two independent codends and one as a standard net (Figures 5-6). The mesh size for the standard cod end was 70mm and for the separator trawl 70mm in the lower codend and 80mm in the upper. In each series of trials carried out to date the trawl or trawls used have been a modified version of a trawl familiar to the Skippers and crews of the vessels involved.

2. OBJECTIVES

a) To assess the effectiveness and benefits of the separator panel for prawns and demersal fish when using the double rig fishing method, and the best configuration of the panel within the trawl.

b) To assess the effectiveness and commercial value of towing two nets simultaneously side by side using three towing warps.

c) To keep a fishing log indicating the gear used and gear changes on each tow as well as details of catches. In particular the catches in upper and lower codends in the separator trawl were to be measured, also the catches from the standard dual purpose trawl codends. In the case of prawns, check measurements of carapice lengths were made.

d) Comprehensive plots of tows were recorded using Decca navigator coordinates and RS 4000 navigator coordinates.

3. DETAILS OF VESSEL

MFV St Adrian II - KY 202

Skipper/Owner	:	David Tod
Crew	:	Skipper 2 Deckhands
Length	:	14.93m (49ft) Shelterdecked steel stern trawler
Main Engine	:	240 hp Cummings 5 : 1.1 reduction 1600 revs/min. 3 drum winch - 2 net drums
Navigation Equipment	:	Mk 21 Decca navigator and plotter Decca auto-pilot Decca 24 mile radar Shipmate RS 4000 navigator
Echo sounder	:	Simrad - KMC 12 Colour fish finder
Radio	:	VHF Sailor type RT 144B Receiver Sailor type R 501 Transmitter Sailor type T 76D Wireless Sailor type 66 TS
Built	:	1981 - Old Kilpatrick

4. NARRATIVE AND OBSERVATIONS

4.1 Trials Programme

The charter period was for five days duration, commencing Monday 7 October 1985.

Sunday 6th	Travel To Pittemweem
Monday	Fit and test all electronic equipment onboard, prepare and put onboard fishing gear
Tuesday	Fishing day
Wednesday	Fishing day
Thursday	Fishing day
Friday	Fishing day, take off part of trials equipment
Saturday	Take off remaining equipment, load up vehicles, travel back to Hull.

Prior to the trials starting, in addition to the Authority's electronic remote measuring system it was planned to use for appraisal, and as a direct comparison, a Scanmar hydro acoustic catch control remote measuring system which gives a similar pattern of information as the electronic system but in digital readout form on a small and compact control panel, (Scanmar 4004).

The effectiveness of the separator trawl when used in a double rig mode was to be assessed, and the warp loads obtained to be compared with the loads obtained when the standard gear is being towed. The standard warp loads were recorded at a previous trial by DAFS, these results are to be used.

Gear damage was only slight throughout.

4.2 Voyage

The St Adrian II sailed from Pittemweem at 0815 hours 8 October, 1985.

Altogether seven tows were completed during the three days fishing time, amounting to fifteen hours towing time. During the seven tows made, the leading edge of the separator panel height was adjusted by shortening and lengthening rope strops which are attached to the panel and ground rope at each quarter for that specific purpose.

The vessel docked each evening in Pittenweem where invariably an hour or more was spent in carrying out small repairs to the nets, taking off the depth sensor and the distance measuring sensor for recharging and in general preparation for the following day. Friday 11 October 1985 concluded the charter.

4.3 By-catch of Fish

There was virtually no whiting at all taken throughout the week and only a small amount of prawns and other round fish. The reason given to the author was that the prawn fishery is seasonal in the Firth of Forth and that there is a transitional period from the best fishing being during dark hours to daytime fishing in early October each year. It was understood that this transition had taken place and that the prawn fishing had settled down into a steady supply during daylight. For some unforseen reasons, whether it was due to the weather conditions or exceptional tides, this did not happen and although some good catches were taken the whole area became almost barren except for dabs and small crabs.

The small amounts of whiting, without exception, were taken in the codend of the standard trawl, i.e. the one without the panel and were so small (15.5cm - 18.5cm which is below the minimum legal size) it therefore suggests that the double codend trawl was taking the same amounts but were guided into the top compartment by the panel and allowed to escape through the 80mm mesh top codend. The amounts of dabs, crabs, prawns and seabed debris was about equal in both the lower codend and the single codend.

With the panel stropped down to 0.3m half the prawns, but no other debris, arrived onboard in the upper codend but were still of very small stature. At 0.5m most of the prawns went into the lower codend. The cod captured without exception was taken in the lower codend, with equal amounts from either trawl; this follows the same pattern as previous trials. Fortunately cod have a firm texture and therefore are not damaged when mixed with prawns and seabed debris.

4.4 Sorting the Catch on Deck

The normal sequence of events on deck are as follows:

i) Codends hove onboard from the stern, emptied into a holding space on the starboard side.

ii) Codends are re-tied and passed over the stern into the water, the whole gear then shot away and towing commenced.

iii) A hinged aluminium sorting tray which is stowed when not in operation in an upright position in the boats bulwarks is dropped into position on foldaway type legs on the starboard side near the catch in such a way as to allow the discarded part of the catch to be easily discharged over the side through an aperture with sliding cover plate in the vessels side.

iv) The catch is manually shovelled onto the tray where it is sorted and graded then put into baskets. The fin fish is put into boxes.

v) Prawns and whiting are washed in their respective baskets or boxes using a powerful deck hose.

vi) All the catch is stored in boxes and stowed in a holding area at the forward end of the shelter deck.

With the addition of the separator panel and extra codend, sequence (iv) could be virtually discontinued as the fin fish could be emptied into a separate holding space and put straight into boxes, washed and

then stowed in the fish hold. In the winter months when continuous bad weather is normal this would be ideal as whiting quickly deteriorate when left to slide about the deck.

4.5 Damage to Gear

Inevitably slight damage is done to prawn nets on almost every haul. This is due to the design of the nets, which are made specifically to cling closely to the seabed, therefore, they very quickly get chafed and the meshes part rather than split. This is only a minor problem. The main problem with these type of nets is that most of the trawl manufacturers stretch the netting upto 6-8% on the frame ropes. This helps them to dig in, consequently, if the gear touches an obstruction the tension causes the netting to split. It is because of the tightness of the netting the tear spreads quickly and much more damage is done. This trial was no exception, on haul 3 the gear became fast on an obstruction after 1 hour, and upon recovering the gear the port wing of the port trawl was badly damaged. The net was repaired within the hour and the gear was shot away again.

As an example of the chafing and abrasion to the prawn type nets, although only 15 hours total towing time was spent with the two nets, they both require a full overhaul and will need to be fully roped out on the frame ropes before being used again.

4.6 Handling the Gear

The vessel design and deck layout caused a number of problems in handling the dual trawl rig. The St Adrian is a small stern trawler and as such hauls and shoots the gear through a small opening in the stern bulwarks in a similar fashion to a conventional large stern trawler. Unlike the large vessels that have ramps and stern rollers to assist them, the St Adrian does not have this facility. This, consequently, means that all the gear that is towed behind the trawl doors is hove onboard in rather a jumbled pile of netting, ropes and wires, then onto a net drum. On this occasion the drum, in addition, had numerous electronic cables with wingend spread meters and headline transducers attached, therefore, a considerable amount of time was spend unravelling the gear on each haul.

As a consequence of the handling problem it was impossible to check the horizontal panel to see if it was taking up the correct configuration in the water as the trawls were fully closed up when hauling and shooting.

4.7 Quality

None of the whiting landed by the prawn boats in Pittenweem are gutted and iced at sea as the majority are day boats (sail in the morning, land the same evening), and the fish is graded by size not quality. The shortage of available fin-fish, and indeed all fish and prawns during the trials period, made it is impossible to establish whether a better price would have ben paid by merchants for whiting taken in the upper codend.

At this stage it would be reasonable to assume that a better price would not have been paid. The experience during previous trials when the better quality of the fish caught in the upper codend was obvious at the time of bringing the catch onboard was that few of the buyers admitted to any significant difference and were certainly not prepared to pay a premium for the better quality whiting. The crew members, therefore, had little incentive to make efforts to improve onboard handling techniques for the better quality whiting.

5. TRIALS DATA

5.1 The St Adrian II Trials

These trials have demonstrated that the double rig trawling method is a relatively simple operation once the gear handling techniques during the hauling and shooting operation are overcome.

Unfortunately, as already mentioned in a previous section, the catches were so low that any fish or prawn handling benefits that would occur with the advent of larger catches, were not realised.

Fuel flow measurements taken whilst working the double rig gave reasonably encouraging results, although there were no direct comparison figures available between the double and single rigs, the Skipper was of the opinion that fuel consumption was slightly less when towing the double rig (Figure 8).

It was intended to leave the Environmental Systems fuel flow meter onboard the vessel for a short period during commercial single trawl prawn fishing with the Skipper logging the information. However, the intricate system that had to be used to fit the meter into the main engine fuel lines in the first instance was such that the Principal Marine Engineer was reluctant to leave it unattended and it was dismantled at the conclusion of the trials (see also fishing logs - Appendix I).

5.2 Warp Loads relative to Ship's Speed and Engine Revolutions

As many readings as possible were recorded on each tow and a mean average was used to compile the graphs in Figures 2 and 3. These average readings covered the different weather conditions experienced and the various courses towed in relation to the weather and tide.

6. DISCUSSION

The method of towing two nets side by side using one set of trawl boards is becoming increasingly more popular in the U.K. prawn fleets. Unlike the twin boom method that is used in many other countries for shrimp fishing, the method being used by the UK, Danish, Dutch and Norwegians, is very simple and can be fished successfully with almost any gear currently in use. The cost initially would be the purchase of two nets, each one of slightly smaller dimensions than the one normally used by the vessel. The European method also does not involve any costly vessel modifications.

It was thought prior to the setting up of these trials it would be an ideal opportunity to evaluate not only the effectiveness of the separator panel when worked in a net of a smaller dimension than had been used on previous trials but to evaluate the potential of the double rig at the same time. It was also thought it would be an ideal opportunity to assess comparative catch rates and the separation of fin fish from prawns in upper and lower codends against the net with no panel and single codend. With hindsight this involved too many variables and the deck layout of the St Adrian II caused some unforseen difficulties in making valid companies.

There are three methods of towing the double rig currently in use, they are by using one, two or three towing warps (Figures 8, 8a, 8b) and as far as known at this time each one is being worked with some success.

Some of the British and Scottish prawn boats work the two and some the three warp rig with the Norwegians, Danes and Dutch working almost exclusively with the two warp methods.

The three warp method is the most costly to take up initially as a three drum winch is required and more warp needed for the centre towing wire.

The three warp method was used throughout the trials because the St Adrian II was initially designed for double rig fishing and therefore fitted with a three drum winch, two net drums, fairleads, bollards and rollers.

Any type of demersal trawl can be used. The Scottish and British boats are working prawn and combination fish/prawn nets. The Lowestoft boats use mainly Sole nets and the Scandinavian boats use cod nets. The Lowestoft boats have gone one step further and they have used three small Sole nets side by side with some success.

Regardless of the method used it is very important that warp lengths, bridle lengths and sweep lengths are measured accurately at the start and that these lengths are checked on a regular basis.

In the three warp combination if the centre towing wire is short it takes the load of the trawl doors and they become very unsteady and the correct spread is not obtained. The trawls, therefore, will start to close up and fishing area is lost.

In the one and two warp combination if the two centre wires are short, they also take some of the load off the trawl boards which then become unstable and very difficult to shoot. Any reduction of towing speed whatsoever causes them to very quickly collapse either onto their front or back and in this position are useless and the vessel will have to recover the gear.

7. GENERAL COMMENTS

It was unfortunate that at the start of the sea trials, for some unknown reason, all fish and prawns disappeared from the intended fishing area. Considering one of the main objects of the exercise was the separation of fish from prawns it was most disappointing, nonetheless, this in no way deterred the start of the charter as it must be borne in mind that the trial was to serve two purposes. On the one hand it was to assess the efficiency of the separator trawl when used in a double rig and secondly to evaluate the method of towing a double rig using the three warp method and to study the most efficient way it should be rigged. The opportunity was also taken to evaluate the Scanmar acoustic net monitoring system which had been acquired by the Authority on loan with a view to purchasing the system for use on sea trials.

It is generally agreed that far too much information had been sought and that time lost sorting out and replacing wires, spread meters and codends between hauls could have been better utilised in either more towing time or re-rigging the gear. It was intended to try the two warp method of double rig trawling but the charter time ran out before doing so.

The rig used throughout the trial has since been modelled in the Flume Tank. The method of joining the two centre wingends and footropes together and towing them off one bridle is not the most efficient for it restricts the flexibility of the two nets and does not allow them to spread correctly. It also restricts headline lift and, therefore, it has been left out of the diagrams attached. It was thought by keeping the two nets closely linked together it would ease the problem of heaving the gear through the small gate at the vessel's stern and allow for easy handling when guiding bridles and nets onto the net drum. The models are now part of the Flume Tank's extensive range of nets used during Gear Technology courses.

8. FURTHER WORK

At the time of writing this report there are no definite plans on the Authority's part for further trials work using the separator trawl either singularly or in a double rig.

Consultation is going ahead between the Authority and DAFS with a view to pooling all information gained by each establishment so as to establish the direction in which both should now be looking to further improve the performance of the separator trawl.

Further work is planned for 1986 for evaluating the double rig trawling method. All three combinations will be tried and assessed individually for its potential as the best and most cost effective.

Flume Tank facilities are being used to refine double trawl rigs, in particular the two and three warp rigs currently being towed by the Scottish and British fishing boats.

APPENDIX I

FISHING LOGS

VESSEL ST ADRIAN II				RIG DOUBLE RIG - 3 WARP METHOD. (6ft Vee Doors)										DATE 9/10-85		HAUL 1-2
SHOOT	HAUL	WIND TIDE.	WARP AFT (FM)	DEPTH (FM)	RPM PITCH	SPEED	TENSIONS - P	S	C.	FUEL FLOW LITRES HOUR		H/LINE HEIGHT (M)	WING END SPREAD. M	DOOR SPREAD M	
1115		SW 5	100	27	1250	2·39	·59	·55	·55	23·5		1·21		63·5	Doors Minimum Spread.
	1155	"	"	26	1300	2·5	·62	·62	·6	28·3		0·91		62·5	Towing down wind
	1225	"	"	26	1350	2·18	·65	·68	·65	32·2		0·91		62	Towing across wind
	1250	"	"	26	1400	2·23	·75	·7	·72	31·3		0·76		59	
	1315	"	"	26	1300	2·08	·66	·60	·58	26·4		0·76		60	
	HAULED	1330													It would appear doors are over spreading the gear.
															NIL FISH.
1515		Waltg S	100	24	1250	2·29	·48	·55	·55	22·7		1·37	10·97	64	Towing down wind
	1545	"	"	26	1250	2·44	·48	·5	·5	23·2		1·21	10·97	64	down wind
	1615	"	"	26	1300	2·61	·6	·45	·6	29·2		1·37	10·67	59	across wind
	1640	"	"	26	1350	2·8	·55	·55	·55	25·9		1·21	10·97	64	Towing into wind
	1700	"	"	26	1400	2·66	·52	·55	·58	30·0		1·21	10·97	65	Towing into wind
	HAULED	1710													6·36 Kg of dabs and crabs.

ST ADRIAN II   DANISH RIG - 3 WARP METHOD. (Van Dorn)   9/10-58

						C.				m			
1115	SW 5	100	27	1250	2.34	.57	.55	.55	23.5	1.21		63.5	Across Minimum Spread.
1155	"	"	26	1300	2.5	.62	.62	.6	28.3	0.91		62.5	Towing down wind
1225	"	"	26	1350	2.18	.65	.68	.65	32.2	0.91		62	Towing across wind
1250	"	"	26	1400	2.23	.75	.7	.72	31.3	0.76		59	
1315	"	"	26	1300	2.08	.66	.60	.58	26.4	0.76		60	

HAULED 1330

It would appear doors are over spreading the gear.

NIL FISH.

1515	WSW 5	100	24	1250	2.29	.48	.55	.55	22.7	1.37	10.47	64	Towing down wind
1545	"	"	26	1250	2.44	.43	.5	.5	23.2	1.21	10.47	64	down wind
1615	"	"	26	1300	2.61	.6	.45	.6	24.2	1.37	10.67	59	across wind
1640	"	"	26	1350	2.8	.55	.55	.55	25.4	1.21	10.47	64	Towing into wind
1700	"	"	26	1400	2.66	.52	.55	.58	30.0	1.21	10.47	65	Towing into wind

Hauled 1710

6.36 kg of dabs and crabs.

GEAR TRIALS — DATA SHEET

VESSEL	RIG	DATE	HAUL
ST ADRIAN II	5 ft 6 inch Vee doors. 20 fathom splits and 12 fathom singles.	10/10-85	1-

SHOOT	HAUL	WIND TIDE.	WARP AFT (FM)	DEPTH (FM)	RPM PITCH	SPEED	TENSIONS P	TENSIONS S	TENSIONS	FUEL FLOW LITRES HOUR		H/LINE HEIGHT (FM)	WING END m SPREAD.	DOOR m SPREAD	
1000		Westly 3	100	26	1250	2·6	·42	·42	·7	22·1		1·67	8·23	55	Head to wind and tide Centre warp 4 ft short.
	1025	〃	〃	26	1250	2·72	·42	·42	·68	24·3		1·46	9·45	55	
	1040	〃	〃	26	1300	2·8	·47	·48	·75	26·7		1·46	9·45	53	
	1110	〃	〃	27	1200	2·39	·36	·36	·6	20·2		1·37	9·45	54	
	1140	〃	〃	27	1200	2·0	·47	·48	·53	20·7		0·91	10·06	50	Centre towing wire 4 ft longer than Port + Starboard.
	1200	〃	〃	26	1250	2·75	·49	·48	·55	25·2		1·09	8·78	47	4 ft longer in centre
	1230	〃	〃	24	1300	2·96	·47	·52	·55	27·2		1·09	8·78	45	towing down wind
	1300	〃	〃	24	1250	2·42	·47	·47	·55	21·6		0·91	8·23	47	
	HAULED 1310														See over for catch details.

ST ADRIAN II   Set 6 inch Vee doors. 20 fathom splits and 12 fathom singles.   10/10-55   I-1

1000	3	100	26	1250	2.6	.42	.42	.7	23.1	1.67	8.23	55	Ahead to wind and tide. Centre much 4th short.
1025	〃	〃	26	1250	2.72	.42	.42	.68	24.3	1.46	9.45	55	
1040	〃	〃	26	1300	2.8	.47	.48	.75	26.7	1.46	9.45	53	
1110	〃	〃	27	1200	2.39	.36	.36	.6	20.2	1.37	9.45	54	
1140	〃	〃	27	1200	2.0	.47	.48	.53	20.7	0.91	10.06	50	Centre towing when 4th longer than Port & Starboard.
1200	〃	〃	26	1250	2.75	.49	.48	.53	25.2	1.09	8.78	47	4th longer in centre.
1230	〃	〃	24	1300	2.96	.47	.52	.53	27.2	1.09	8.78	45	towing down wind
1300	〃	〃	24	1250	2.62	.47	.47	.53	21.6	0.91	8.23	47	

HAULED 1310.

See over for catch details.

GEAR TRIALS — DATA SHEET

VESSEL ST ADRIAN II	RIG	DATE 10/10-85	HAUL 2

SHOOT	HAUL	WIND TIDE.	WARP AFT (FM)	DEPTH (FM)	RPM PITCH	SPEED	TENSIONS P	TENSIONS S	TENSIONS C.	FUEL FLOW LITRES HOUR		H/LINE HEIGHT (FM)	WING END SPREAD. m	DOOR SPREAD m	
1405		WSTLY 3	100	24	1200	2·3	·44	·43	·5	20·2		1·28	8·23	51	Contd towing wire 3 FM longer.
	1440	〃	〃	24	1200	2·37	·44	·41	·51			1·46	8·23	49	These readings suspect. Small problem with fuel lines
	1505	〃	〃	24	1250	2·8	·45	·46	·52			1·09	9·14	48	Towing down wind
	1535	〃	〃	23	1300	2·73	·53	·53	·6	26·4		1·09	7·31	47	Head into wind and tide
	1555	〃	〃	23	1350	2·98	·62	·55	·69	31·6		1·28	6·40	47	
	1615	〃	〃	23	1300	2·79	·52	·5	·6	25·4		1·09	7·31	46	
	1655	〃	〃	23	1200	2·28	·4	·4	·48	19·8		1·37	7·31	48	
	HAULING 1700														

ST ADRIAN II

	3 North	100											
[illegible]			24	1200	2.3	.44	.43	.5	20.2	1.28	8.23	51	Centre tuning [illegible] 3 lb longer
1440	"	"	24	1200	2.37	.44	.41	.51		1.46	8.23	49	These readings suspect. Small problem with [illegible]
1505	"	"	24	1250	2.8	.45	.46	.52		1.09	9.14	48	Tuning [illegible]
1535	"	"	23	1300	2.73	.53	.53	.6	26.4	1.09	7.31	47	Head [illegible] and [illegible]
1555	"	"	23	1350	2.98	.62	.55	.64	31.6	1.28	6.40	47	
1615	"	"	23	1300	2.76	.52	.5	.6	25.4	1.09	7.31	46	
1655	"	"	23	1200	2.28	.4	.4	.48	19.8	1.37	7.31	48	

HAWKINS 1700

1010-82

VESSEL ST ADRIAN II	RIG 58ft 6" Vee doors - minimum spread.	DATE 11-10-85	HAUL 1-2

SHOOT	HAUL	WIND TIDE.	WARP AFT (FM)	DEPTH (FM)	RPM PITCH	SPEED	TENSIONS P	TENSIONS S	TENSIONS C	FUEL FLOW LITRES HOUR		H/LINE HEIGHT (m)	WING END m SPREAD.	DOOR m SPREAD	
0945		WSW 6	100	26	1300	2·3	·45	·46	·5	27·2		1·09	9·10	47	Towing head to wind
	10·15	〃	〃	26	1350	2·6	·62	·58	·6	30·5		0·91	10·06	47	Weather very poor.
	1020				GEAR FAST ON SEA BED.					HAULING		NO DAMAGE			No fish
1225		WSW 6-7	〃	24	1350	2·9	·65	·58	·69	32·1		1·09	7·31	46	Turning to Starboard.
	1300	〃	〃	24	1250	2·75	·53	·53	·6	25·4		1·46	9·45	48	Towing down wind - tide
	1400	〃	〃	23	1300	2·45	·44	·48	·55	26·8		1·09	8·78	49	
	HAULING + WEATHER				NOT FAVOURABLE FOR TRAWLING.										WSW 8.
					END OF CHARTER.										

ST ADRIAN II   SEE 6" Vee doors - minimum speed   11-10-82

0925	WSW 6	100	26	1300	2.3	.45 .46 .5 27.2	1.09	9.10	47	Turning head to wind
10.15	"	"	26	1350	2.6	.62 .58 .6 30.5	0.91	10.06	47	Weather very good.
1020	Gear fast on sea bed. Hauling No Damage									No fish
1325	WSW 6-7	"	24	1350	2.9	.65 .58 .69 32.1	1.09	7.31	46	Turning to Starboard.
1300	"	"	24	1250	2.75	.53 .53 .6 25.4	1.46	9.45	48	Turning down wind + tide
1400	"	"	23	1300	2.45	.44 .48 .55 26.8	1.09	8.78	49	

Hauling - Weather Not Favourable for Trawling.   WSW 8.

END OF CHARTER.

ST ADRIAN II — SEPARATOR TRAWL

FISHING LOG

DATE HAUL NO		SPECIES: WHOLE PRAWNS kg	COD kg	OTHERS kg	WHITING kg	CRABS kg	DABS kg	TOTAL DISCHARGE
9-10-85 1	UPPER			BLANK HAUL				
	LOWER			TESTING ELECTRONICS				
2		NIL	NIL	NIL	NIL	NIL	NIL	6·36
		0·5	NIL	NIL	NIL	3	3·36	
10-10-85 1		NIL	NIL	2	2	NIL	NIL	25·44
		6·36	6·36	3·18	NIL	12·72	12·72	
2		NIL	NIL	NIL	NIL	NIL	NIL	34·99
		6	1·1	NIL	NIL	19·09	15·90	
11-10-85 1		DAMAGED TRAWL BLANK HAUL.						
2		NIL	NIL	1	1	NIL	NIL	7
		2	NIL	NIL	NIL	4	3	

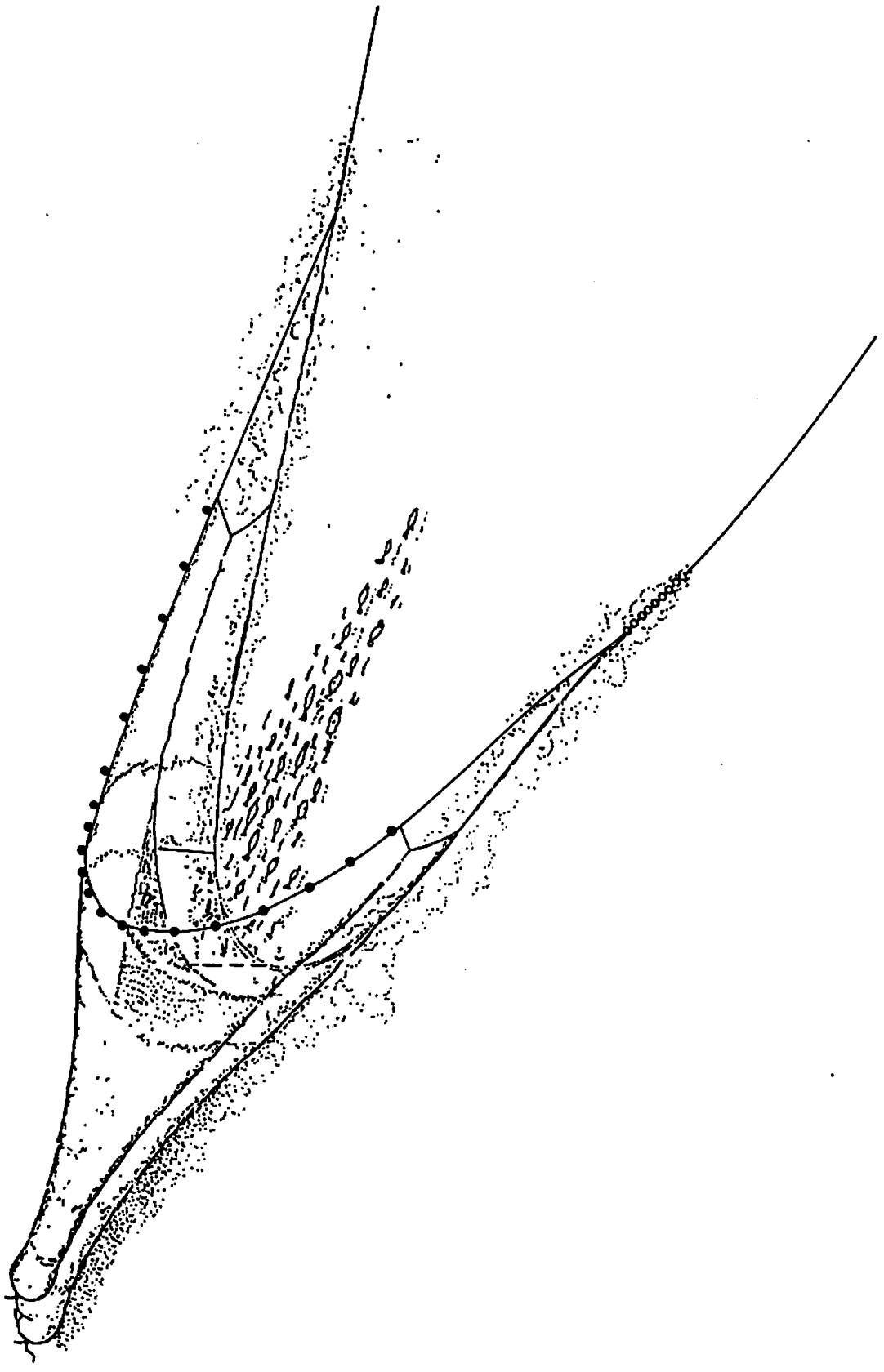
AVE CARAPACE LENGHT 22-27 mm — AVE WHITING LENGHT 15·5/18·5 cm
AVE COD LENGHT 17-18·5 cm

[illegible] II — [illegible] Trawl

Fishing Log

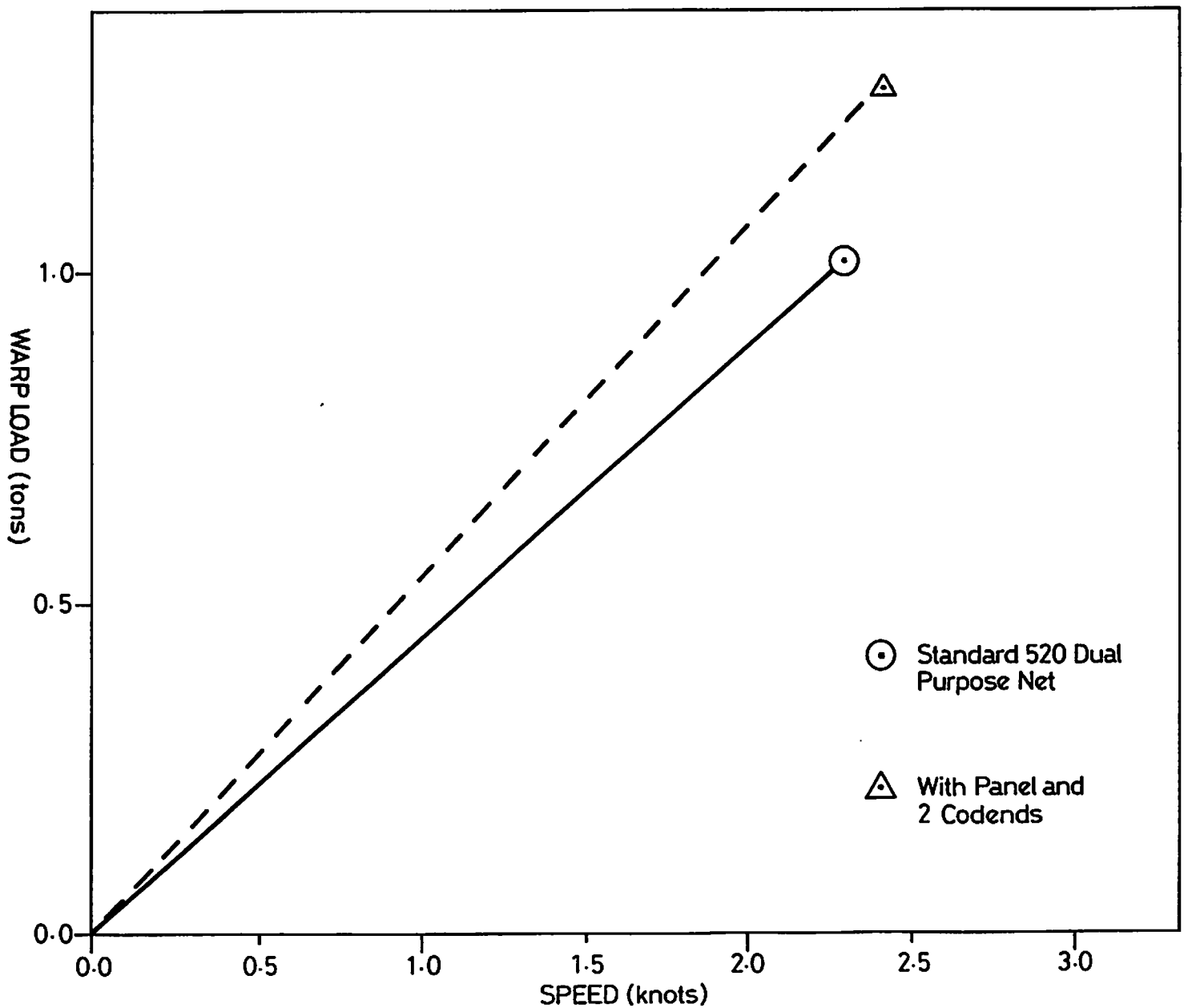
Date	Haul No	Whole Prawns kg	Cod kg	Others kg	Whiting kg	Crabs kg	Dabs kg	Total Discards
9-10-85	1	Blank Haul — Testing [illegible]						
	2	Nil	Nil	Nil	Nil	Nil	Nil	6.86
		0.5	Nil	Nil	Nil	3	3.36	
10-10-85	1	Nil	Nil	2	2	Nil	Nil	25.44
		6.36	6.36	3.18	Nil	12.72	12.72	
	2	Nil	Nil	Nil	Nil	Nil	Nil	34.99
		6	1.1	Nil	Nil	14.01	15.90	
11-10-85	1	Damaged Trawl — Blank Haul						
	2	Nil	Nil	1	1	Nil	Nil	7
		2	Nil	Nil	Nil	4	5	

Ave Carapace Length 22-27 mm ; Ave Cod Length 17-19.5 cm ; Ave Whiting Length 15.5/17.5 cm



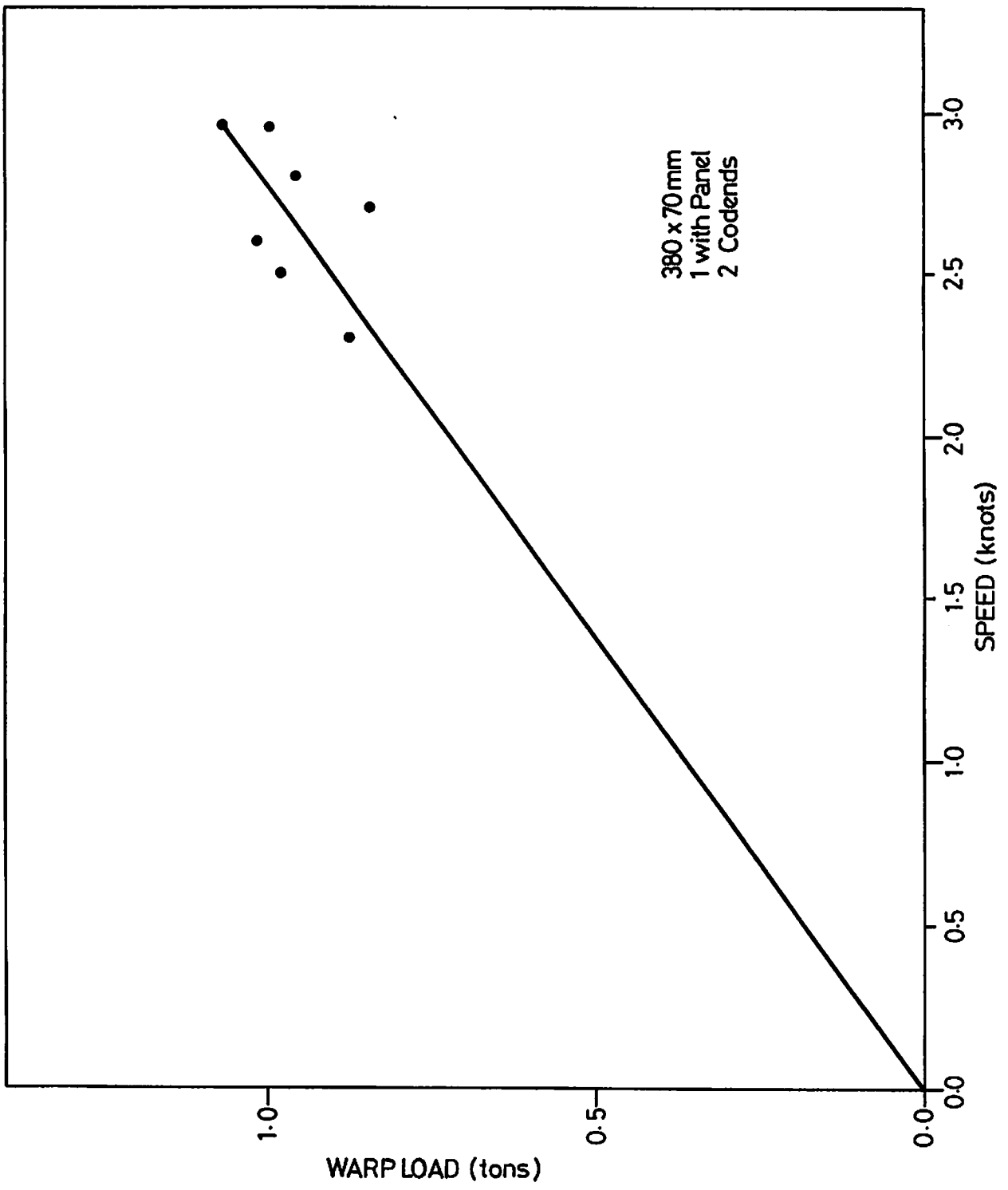
The Principle of the Separator Trawl

Fig.1



Warp Load - Speed

Fig.2



Warp Load – Speed Double Rig

Fig. 3

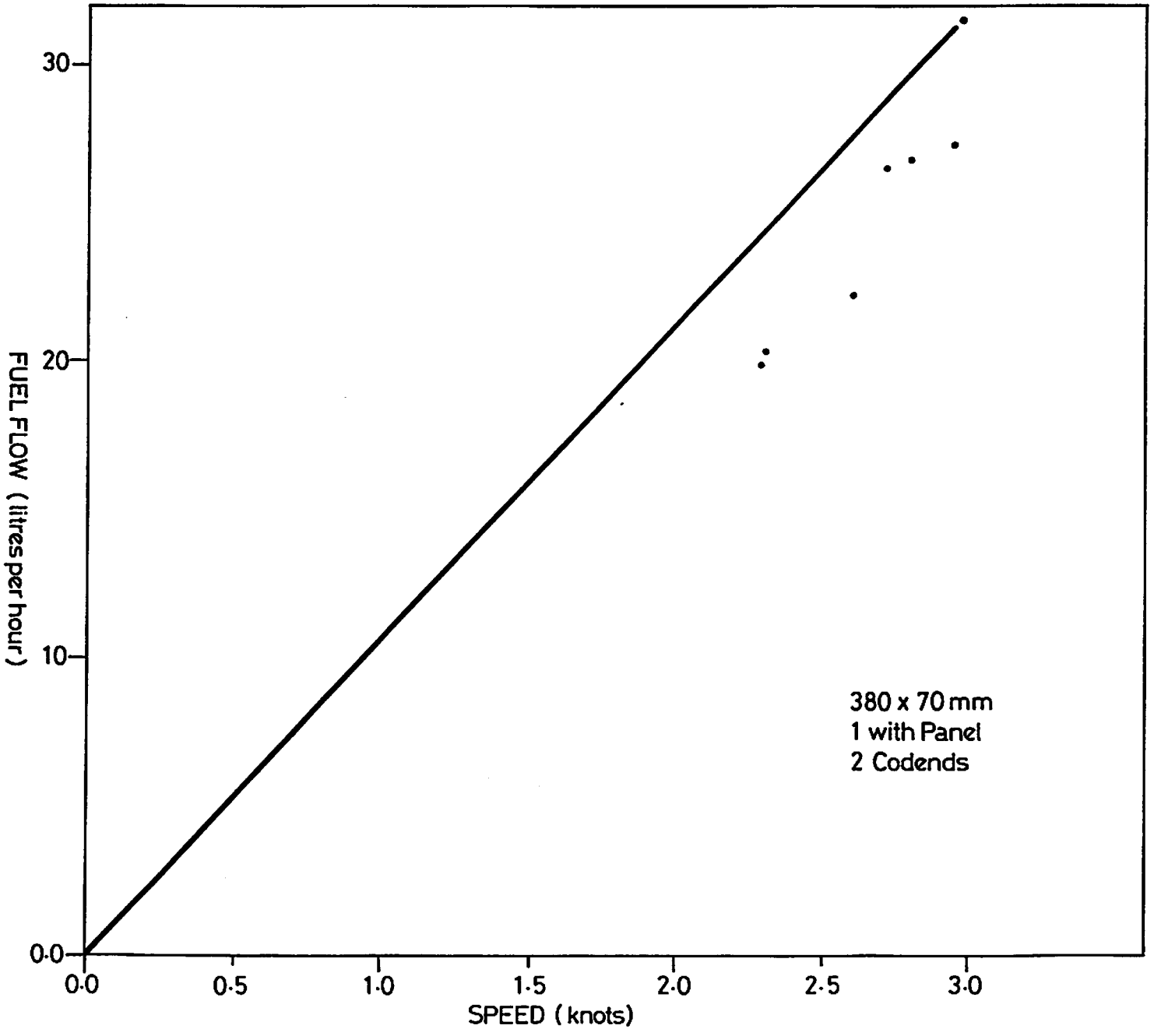
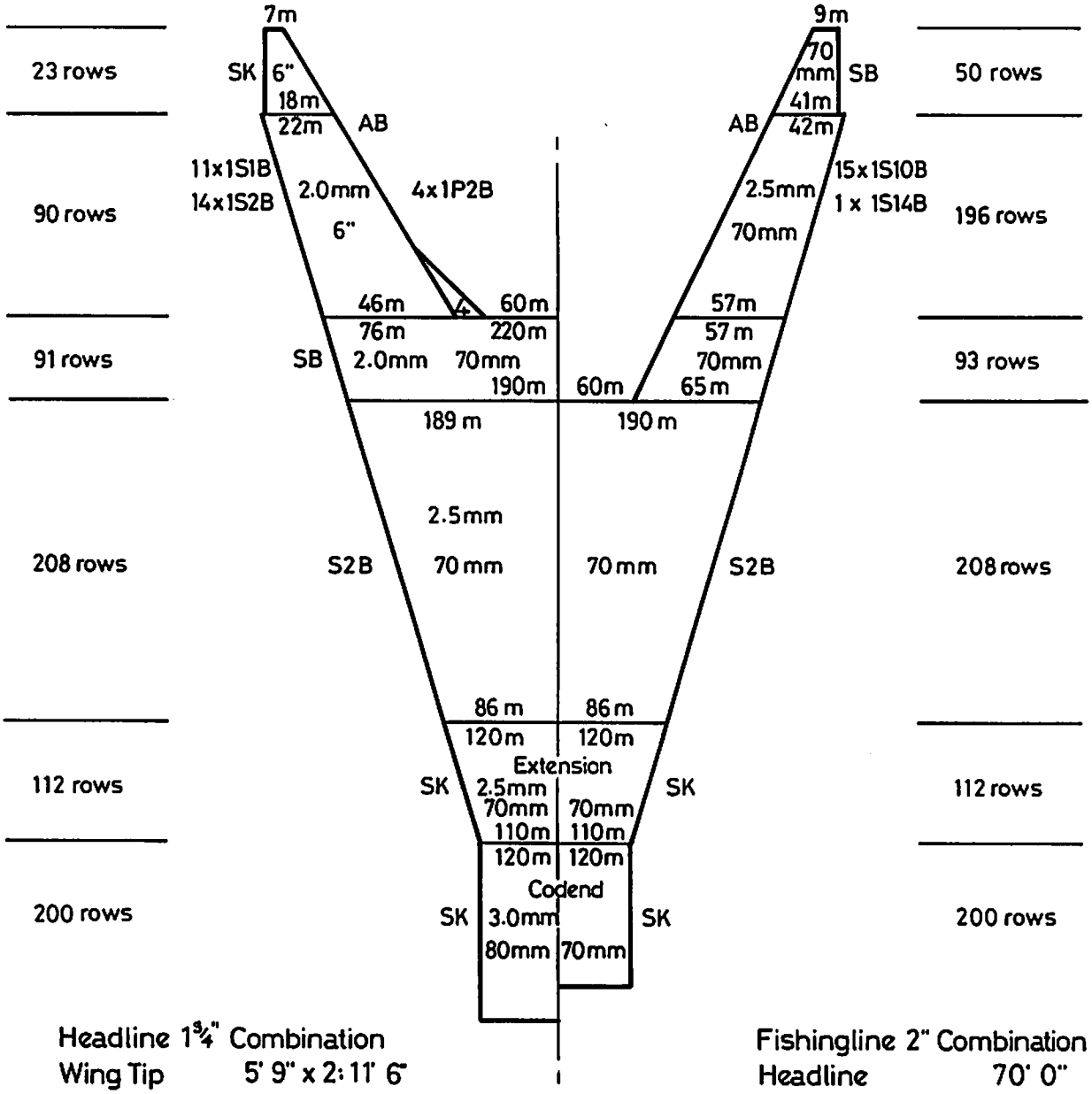


Fig.4 Fuel Flow - Speed



Headline 1¾" Combination

Wing Tip	5' 9" x 2: 11' 6"
Top Wing	22' 6" x 2: 45' 0"
Stretch in Wing	1' 0" x 2: 2' 0"
Bosom	5' 0" = 5' 0"
No. Net	3' 3" x 2: 6' 6"
Headline	70' 0"

Drop Meshes = 4 x 1P2B = 5 Spaces @ 1
Every 4·8": Stretch ⅓ of Bar

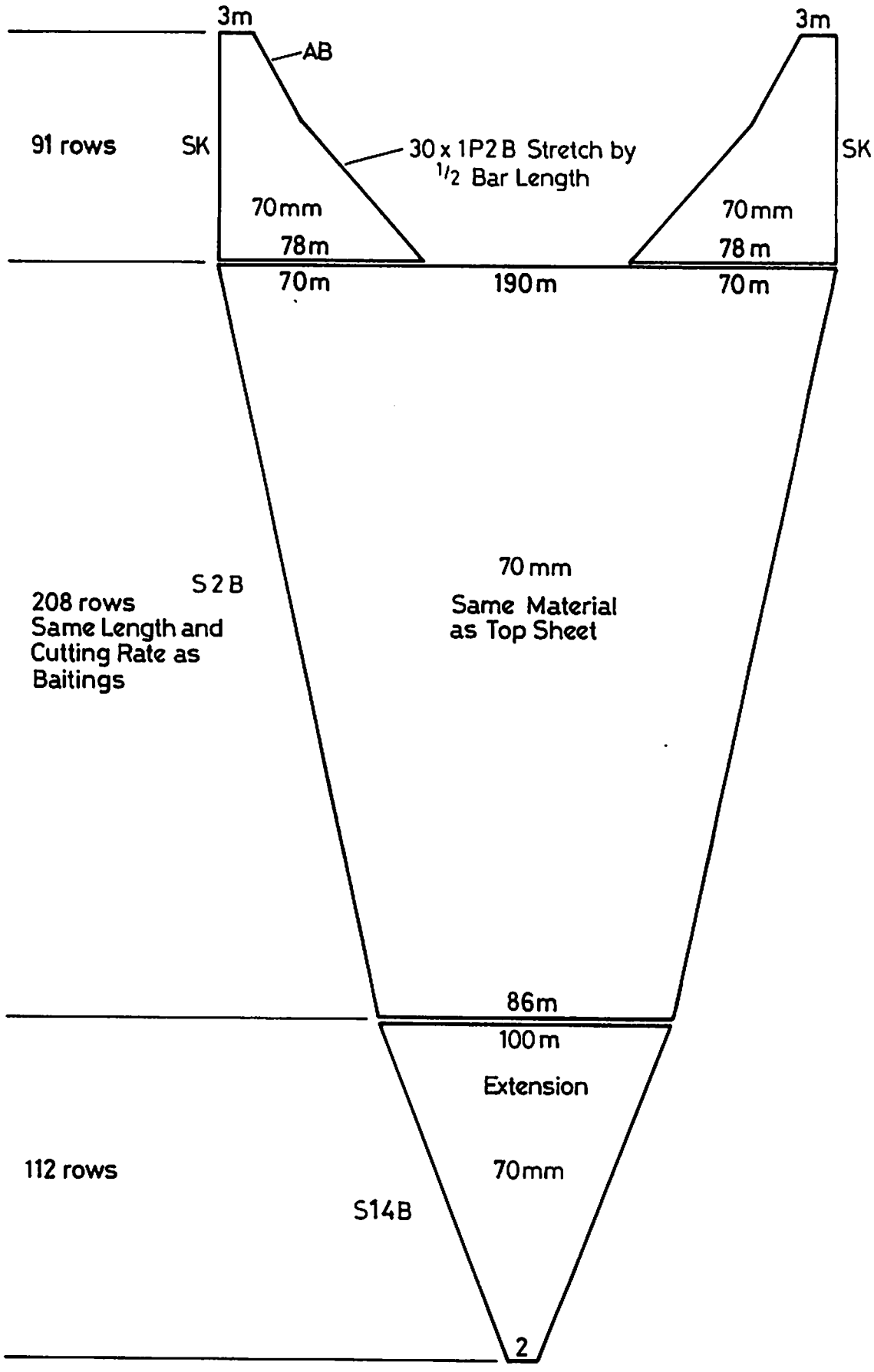
Fishingline 2" Combination

Headline	70' 0"
2 x Cover	21' 0"
+ 6" Stretch in Bunts	1' 0"
Fishingline	92' 0"

Footrope 14mm Wire
Length for Length with Fishingline
2½" Rubbers with Ring

380 x 70mm Dual Purpose

Fig. 5



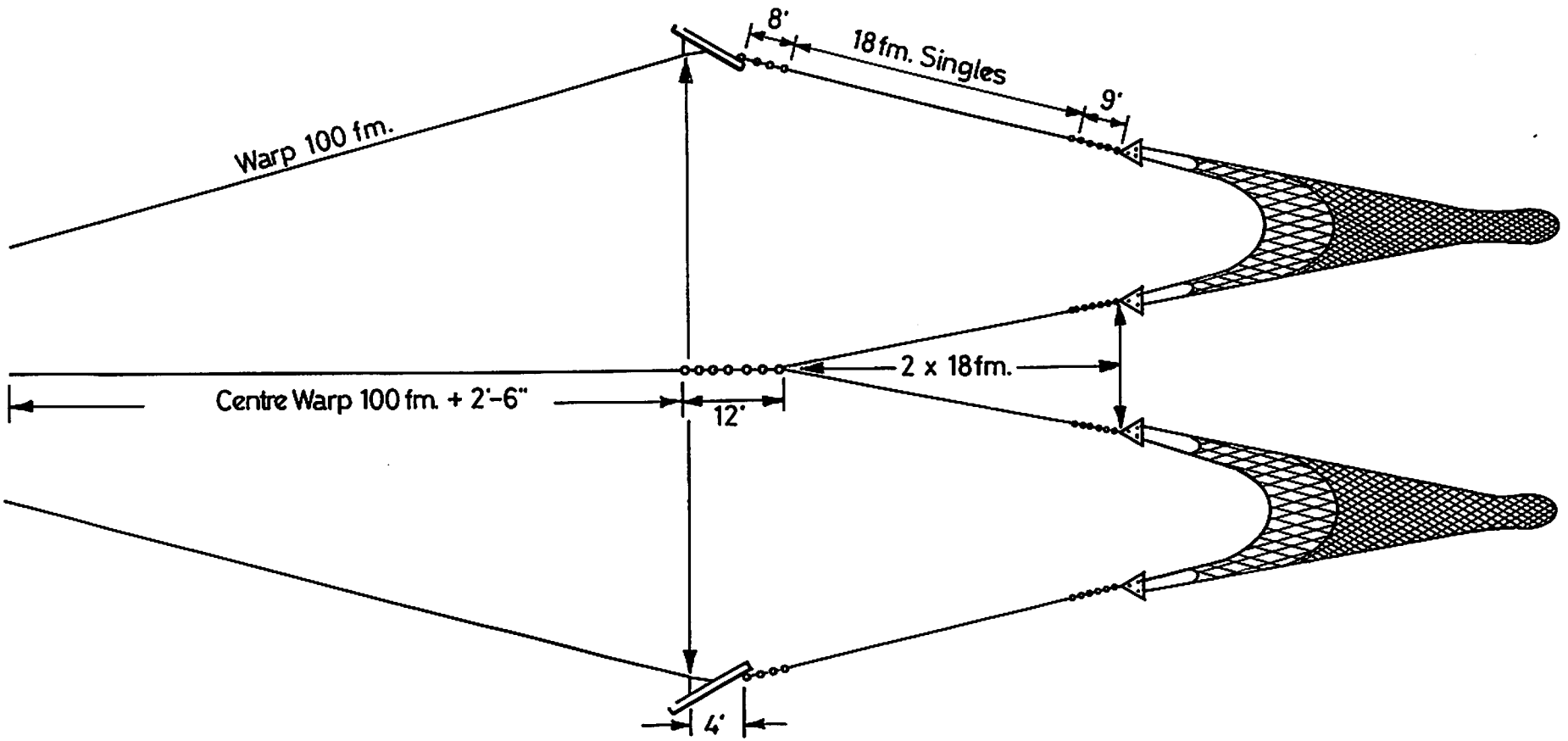
Separator Panel - Dual Purpose Trawl

Fig.6

Separator Panel and Double Cod-ends

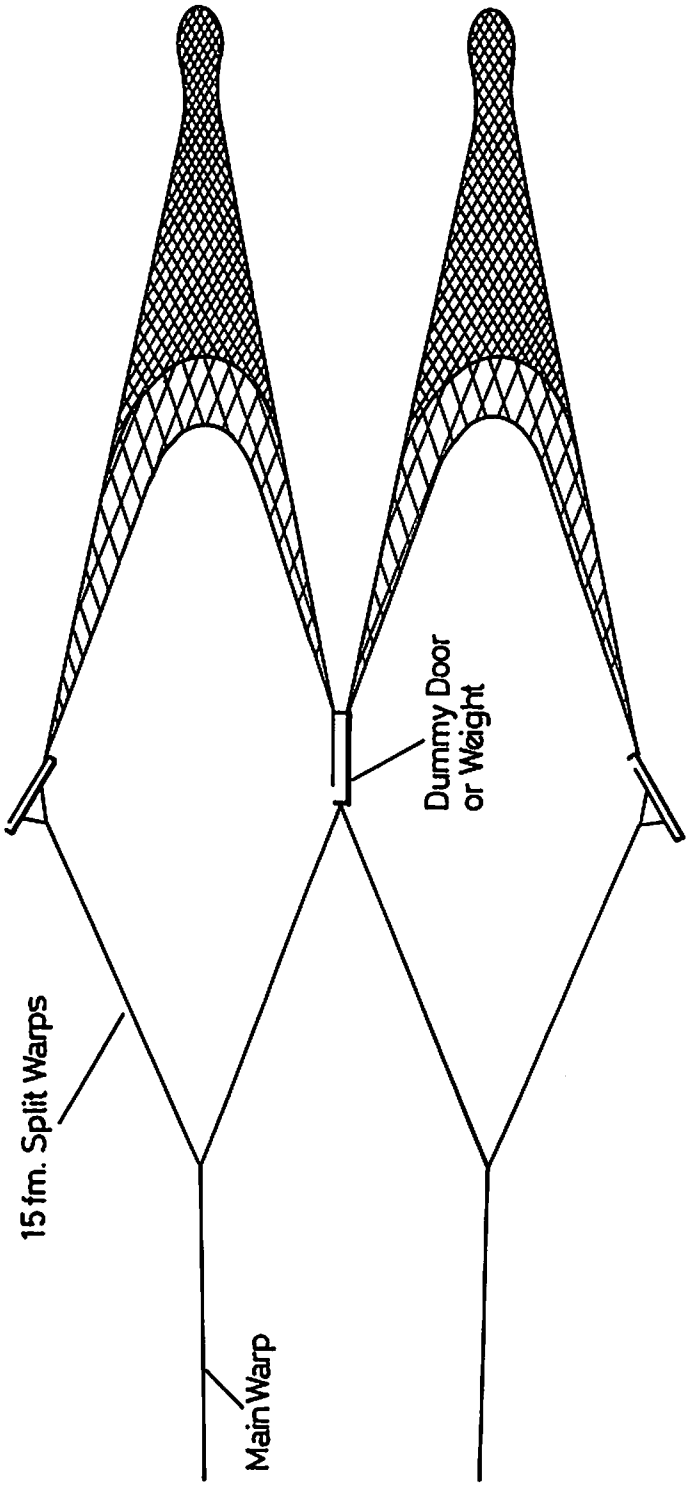
Fig.7

Chain on end of single sweeps to keep them down.
Centre chain weight at least 1½ times the weight of a
door that is being used e.g. 600 lb. door - 900 lb. centre weight.



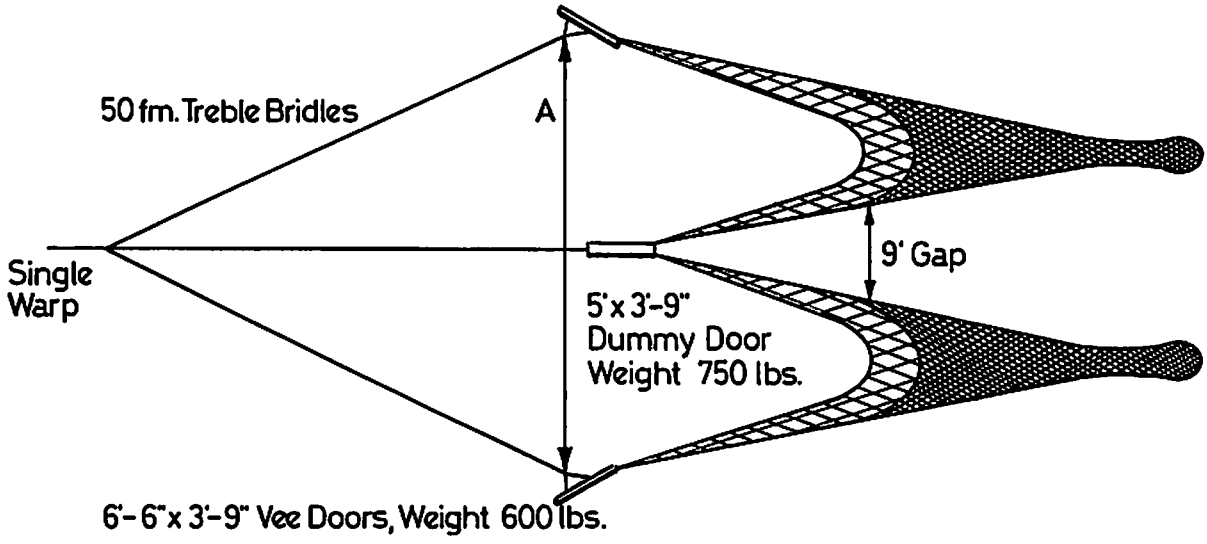
3 Warp Rig

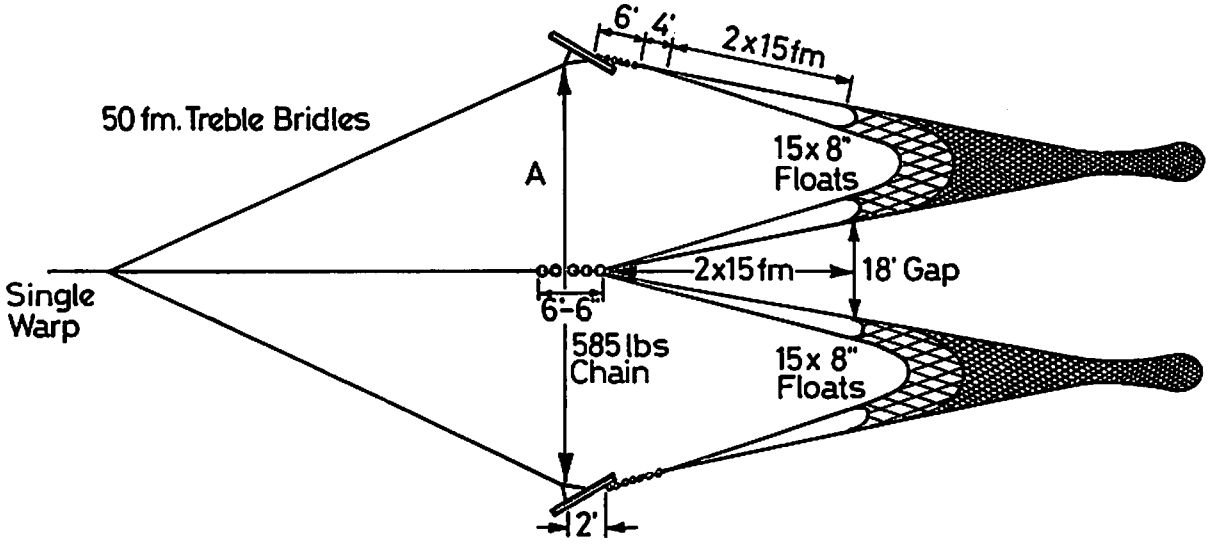
Fig. 8



2 Warp Rig

Fig.8a





1 Warp Rig

Fig. 8b