Description of the Southwest Nova Scotia Groundfish Fishery: 1962–1983

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Fisheries and Aquatic Sciences

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Abstract

Hurley, G. and R.N. O'Boyle. 1984. Description of the Southwest Nova Scotia Groundfish Fishery: 1962-1983. Can. Ind. Rep. Fish. Aquat. Sci. 153: 130 p.

This report chronicles vessel and gear development in the southwest Nova Scotia groundfish fishery from 1962 to 1983. The focus of the study was on otter trawling and longlining, the two most important fisheries in NAFO Division 4X.

The study was commissioned to inform stock assessment biologists of gear efficiency changes so as to enable more precise estimation of catch/effort indices.

The topics covered include hull characteristics, deck equipment, propulsion systems, electronics, otter trawls and longlining methods. Information was gathered mainly from industrial sources, that is representatives of fishing gear manufacturers and distributors.

The report provides commentary by experienced fishermen regarding their useage of different gear types.

Résumé

Hurley, G. and R.N. O'Boyle. 1984. Description of the Southwest Nova Scotia Groundfish Fishery: 1962-1983. Can. Ind. Rep. Fish. Aquat. Sci. 153: 130 p.

Ce rapport rend compte de l'évolution des bateaux et des engins utilisés dans la pêche des poissons de fond dans le sud-ouest de la Nouvelle-Écosse, au cours de la période de 1962 à 1983. L'étude porte avant tout sur le chalutage et sur la pêche à la palangre, qui sont les deux pêches les plus pratiquées dans la division 4X de l'OPANO.

L'étude avait été commandée afin de reseigner les biologistes chargés de l'évaluation des stocks sur les changements dans l'efficacité des engins de pêche, leur permettant ainsi d'estimer de façon plus précise les indices de prises par rapport à l'effort de pêche.

Les sujets traités comprennent les caractéristiques des coques, l'équipement de pont, les systèmes de propulsion, les appareils électroniques, les chaluts et les méthodes de pêche à la palangre. Les renseignements proviennent en majorité de l' industrie, c'est-à-dire des représentants des fabricants d'engins de pêche et des distributeurs.

Le rapport fait également état des remarques faites par des pêcheurs d'expérience au sujet de l'utilisation qu'ils font de divers types d'engins de pêche.

1.0 Introduction

1.1 Background

Since 1962, the groundfish fishery in NAFO (Northwest Atlantic Fisheries Organization) Division 4X, the fishing zone adjacent to southwest Nova Scotia, has undergone dramatic changes. During the 1960s, the Canadian and foreign fleets expanded rapidly, which led to declines in many fish stocks. In 1970, the International Commission for the Northwest Atlantic Fisheries (ICNAF - now NAFO) imposed quotas on several stocks and introduced a closed area to protect haddock spawning. ICNAF continued to provide management advice up to and including 1976 at which time Canada extended her 200-mile limit and established the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC). During this period, a series of regulations have been imposed, including catch restrictions, and limited entry of certain vessel categories into a specific fishery.

Regulations have had a profound effect on the design, size, and efficiency of vessels entering the fishery. For example, in August of 1973, a freeze on the issuance of new groundfish mobile gear licenses was imposed. When amended in November of 1975 to exempt vessels under 45 feet, a building-boom of small draggers began. Many

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Mention of trade names or commercial firms does not imply endorsement by the author or the Department of Fisheries and Oceans.

of these vessels were built to a length of 44 feet and 11 inches, or just under the maximum length permitted by the regulation. With the additional number of boats in the fleet, fishermen began competing with each other to see who could catch the most fish before the quota was reached. Boats were built with more fish carrying capacity and fitted with more powerful engines which could tow bigger nets. Improvements in fish- finding and navigational equipment made it easier for fishermen to locate fish.

1.2 Purpose of the Study

Commercial catch/effort statistics are an integral part of the present stock assessment process. Catch-per-unit effort is taken as a linear function of abundance. The constant of proportionality differs according to gear used and time of year. Much of the assessment process involves standardization of these constants in order to use catch/effort data from a variety of gears and different times of year. These standardizations are done without specific knowledge of inter-annual gear changes. Data on these do not exist in a readily analysable form.

The purpose of this report is to chronicle the development of fishing vessels and gear in the southwest Nova Scotia groundfish fishery during the 1962-83 period in order to facilitate interpretation of catch rate data. The focus of the study was on otter trawling and longlining, the two most important fisheries in NAFO Division 4X.

1.3 Method of Collecting Information

Information was gathered mainly from industrial sources such as fishing gear manufacturers, and distributers, electronics suppliers, and boat builders. Experienced fishermen were consulted for their views on how the various changes and development in vessels and fishing gear affected their operations.

Specifically, the report has been structured to include changes in hull characteristics, deck equipment, propulsion systems, electronics, and otter trawl and longline fishing methods.

2.0 Hull Characteristics

2.1 Otter Trawlers

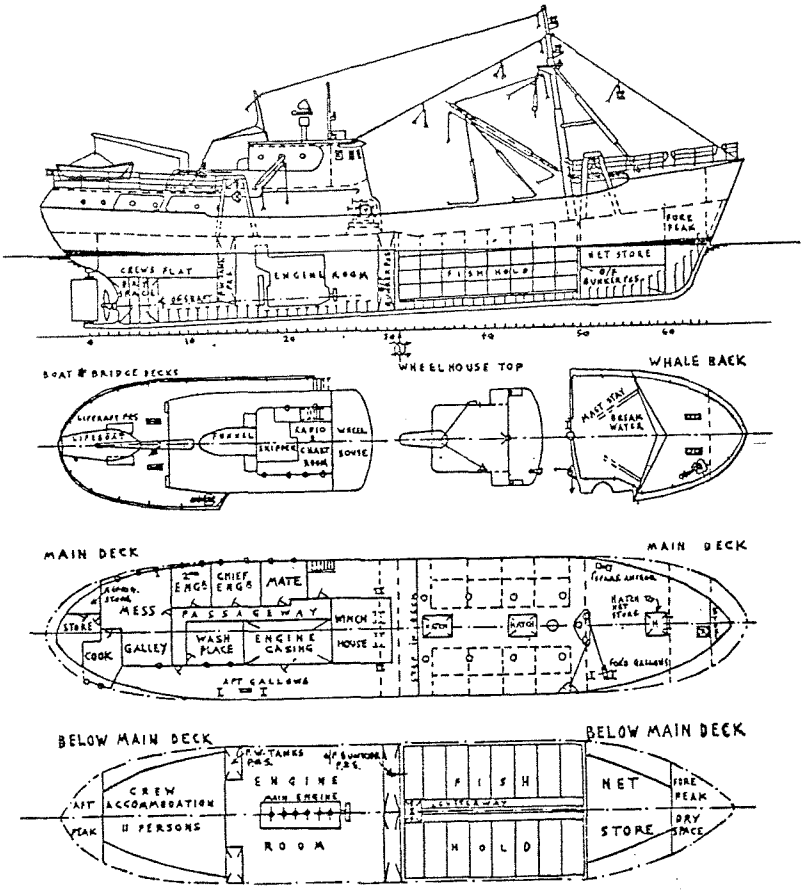
Over the past two decades the type of otter trawler entering the fishery has changed dramatically. For example, the deep sea fleet has evolved from the 125 ft. side trawlers built in the early 1960's e.g. Cape Race, Cape Aspy, and Cape Mira (Figure 2a) to the modern 164 ft. trawlers e.g. Cape Fame, Cape Brier, Cape Beaver (Figure 2b) of the 1980s which have a fish carrying capacity nearly triple that of the older sides. The first stern trawlers built for National Sea Products Ltd. (Figure 2c) and H.B. Nickerson and Sons Ltd. (Figure 2d) in the mid-1960s and other versions since then were intermediate in size. The hulls of these large trawlers were made of steel.

There has been a great deal of variation in the hull structure of small trawlers (less than 125 ft. in length), both in the design and in the type of material used in their construction.

Small stern trawlers have been the dominant vessel type built since the early 1960s (Appendix "A"). Small side trawlers were built as recently as 1967 (Figure 2e). Some of these have since been converted to enable them to tow from the stern (Figure 2f) Except for two vessels (Figure 2g) which utilize a stern ramp, the majority of small draggers have to lift their fishing gear over the side of the vessel (Figure 2h). There has been a general trend to building wider and deeper boats. For example, the modern 45 and 65 ft. trawlers are 2-3 feet wider and 1-2 feet deeper than the same sized vessels built in 1964-65 (Appendix "A"). The design of the smallest trawlers (35-42

ft.) in the fleet has not changed over this period. These "lobster" boats, which are wooden Cape Island type vessels, were first converted over to dragging in the early 1950s. Since 1980, there have been about 15 to 20 fibreglass draggers built in southwest Nova Scotia. One of the largest was the Jason and Natasha (Figure 2i), which fishes out of Pubnico. There are only 4 or 5 small steel trawlers (Figure 2j) in the fishery probably because of their higher initial cost. There was only one vessel reported which had a hull made of aluminum, Rose Croix ex. Meteghan.

Some fish holds have been improved for the storage of fish by adding insulation (since 1974) and refridgeration systems (since 1979). Modern 45 ft. draggers have a fish hold capacity of between 50-70,000 lbs. which is 25-50% more than that of a vessel of the same length built during the 1960s.



125ft. Canadian steel-built trawlers.

CANADA

CAPE RACE, CAPE ASPY and CAPE MIRA

George T. Davie & Sons, Ltd., have designed and built three identical side trawlers at their Lauzon, Quebec, yard for National Sea Products Ltd., Lunenburg, Nova Scotia.

They are built of all-welded steel and are 125 ft. overall with a moulded breadth of 24½ ft. and depth of 12 ft. 9 in.

Accommodation is provided in them for a crew of 16—five in single-berth cabins on the bridge and the port side of the main deck, and 11 in a group cabin aft.

Fishroom capacity is 6,500 cu. ft., the holds being completely insulated and lined with aluminium. Penboards and divisions are also of aluminium.

The trawlers are powered by single-acting, direct-reversing, turbo-charged Deutz RBV 6 M diesels which develop 650 bhp at 310 rpm and drive four-bladed propellers. Top speed is 10 knots.

Auxiliary machinery includes two Magnicon 38 kW. 220 v. D.C. generators, one driven from the trawl winch engine and the other by a Russell Newbery diesel. Main switchboards and electrical equipment were designed and installed by Bedard & Girard Ltd. All pumps were manufactured by Houttin.

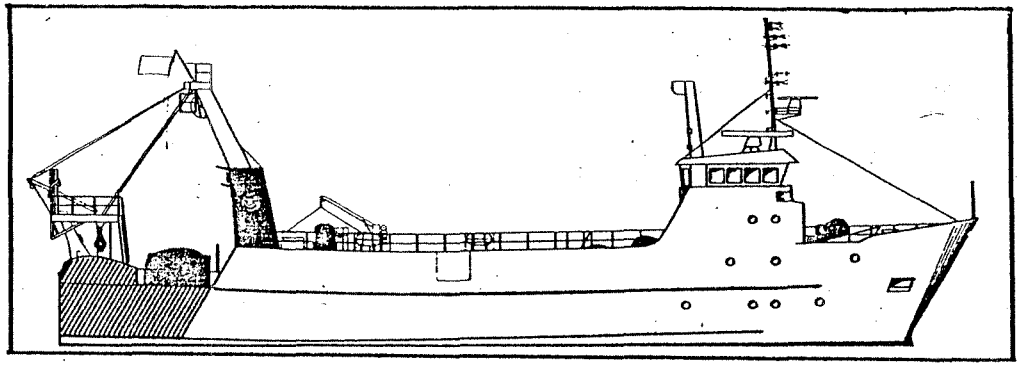
Van der Giessen trawl winches, capable of developing a pull of 6 tons, are installed. They are hydraulically driven by two Norwinch pumps and 190 hp Deutz diesels. Gallows are fitted on the starboard side and single-arm davits are employed for hoisting the boats.

Tenfjord hand-electro-hydraulic steering gear is fitted in each vessel and also a Wood-Freeman autopilot.

Bridge equipment includes echo sounder and fishscope, radio-telephone, radar, Loran and a Decca Navigator.

Figure 2a. Early side trawlers. (Source: Fishing News International, December 1963)

Canada's 'ideal' trawler



LAST YEAR Canada issued 17 additional new building licences for the deepsea fleet. Six of these were obtained by the big trawler owners, National Sea Products of Halifax, Nova Scotia and the ships are being built in Japan and Canada.

Before the orders were placed studies were made to get the most efficient possible design within the size permitted. C. Birkhoff & Associates, naval architects of Montreal and Hamburg, were entrusted with the design work.

In close co-operation with the owners, a wet fish stern trawler 49.9 metres (163 ft 10 in) long was conceived, strengthened for operations in Arctic waters and arranged with a double arena system which permits immediate shooting of one trawl as the other cod-end is hauled.

Three of the ships were placed with Narasaki Shipbuilding Company of Musroran in Hokkaido, Japan. The other three were ordered from the Canadian builder. Halifax Industries.

The first delivery is expected this month and the others will be completed at six weekly intervals.

With a length b.p. of 42 metres, the trawlers have a moulded breadth of 11.8 m, depth to upper deck of 6.87 m and fish hold capacity of 470 cu. m.

The main winch is being supplied by Brusselle of Belgium. This is electrically driven by a thyristor-controlled BBC constant power DC motor. Aft of and below the big eight-drum winch is a Brusselle net reel.

A cod-end winch with drums and warping head is located on the port side upper deck aft. Two vertical capstans at the aft end of the ship will handle shooting, rolling the cod-end, moving trawl doors and berthing the ship.

Between the fairlead sheaves and blocks, is a drying-up spool at the bipod post.

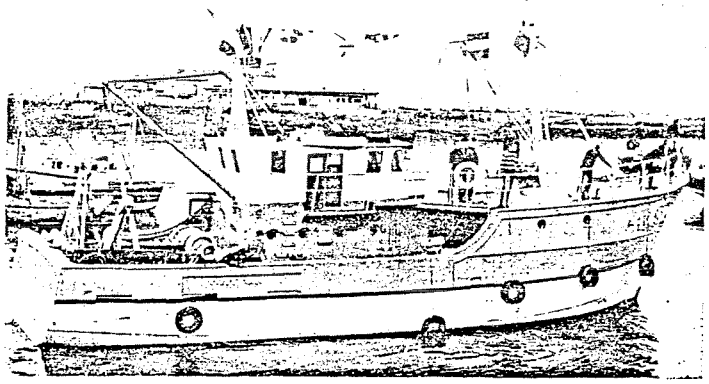
Besides their ice-strengthened hulls, the ships have ram bulbous bows for breaking the ice, and ice fins in front of the propeller nozzle and aft of the rudder. To help the vessels to trawl in ice conditions, they will be fitted with Birkhoff ice davits. These permit remote controlled lowering of the blocks so that the warps enter the water right aft of the ramp.

Although designed as wet fish trawlers, the ships' holds will have overhead coil cooling to slow down melting of the ice.

The processing room has three gutting machines and four hand gutting tables.

The ships are powered by a German MaK model 453AK diesel of 2000 hp turning a Liaaen controllable pitch propeller in a Koprt nozzle through a Lohmann & Stolterfoht reduction gear.

Figure 2b. Modern stern trawler. (Source: Sou'wester, 1981)



Built at two French shipyards and operating from Cherbourg the stern trawler and longliner, the "Precurseur".

is a Brusselle Neptune NC1 3.5-ton unit with a main drum capacity of 850 m. of 16.5 mm. cable.

The fish room has a capacity of 40 cu. m. and is refrigerated to a temperature of from 0 to 2 deg. C by means of a Branchet two-cylinder BF 350 compressor of 4,500 k.cal./hr. capacity using Freon 12 as refrigerant.

Tenfjord H 76 hydraulic steering is fitted and bridge equipment includes Radio Ocean radio telephone, Radio Ocean direction finder, Elac echo-sounder, Decca Navigator and Decca Track Plotter.

CANADA

Cape Nova, Cape Morrow & Cape Pictou

Three stern trawlers

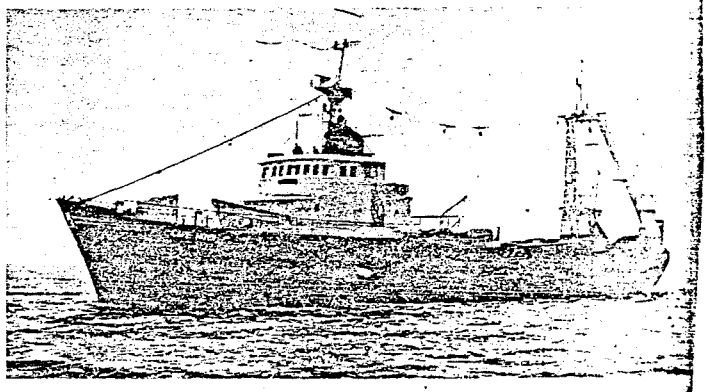
DOSCO Industries' Halifax Shipyards have built three 617-ton stern trawlers to a design by Conrad Birkhoff for National Sea Products Ltd.

Named *Cape Nova, Cape Morrow* and *Cape Pictou*, the vessels are 155 ft. oa with moulded breadths of 33 ft. and depth of 16 ft. Each has crew accommodation for 20.

The 10,000 cu. ft. capacity fish room of each vessel is insulated with 5 in. rigid foam urethane and lined with aluminium.

Propulsion engines are 1,080 bhp, eight-cylinder Deutz diesels which drive Liaaen S–63 controllable-pitch propellers to give the vessels a speed of 12 knots.

Two 70 kW Siemens generators



The "Cape Nova", one of three stern trawlers built at Halifax for National Sea Products Ltd.

are installed in each vessel to provide 220 V, 60 cycle, a.c. power. Houttuin bilge and deckwash pumps are fitted.

On deck each vessel has a Van der Giessen 7T trawl winch powered by a Mannesmann-Meer HAM 40 hydraulic motor and also a Van der Giessen sweepline winch. One ten-man inflated rubber work boat is carried in addition to two 20-man inflatable liferafts in each vessel.

Steering gear is of the Tenfjord electric-hydraulic type and connected to a Wood Freeman autopilot.

Bridge equipment of the vessels includes Simrad EH2A echo sounder, Canadian Marconi CN.86 radio telephone, Decca Mark 12 Navigator and Track Plotter, DX Navigator Loran, Marconi 'Raymarc' and LN–55 radar sets.

BELGIUM

Klondyke

Compact French stern trawler

THE Beliard Murdoch [illegible] at Ostend in Belgium [illegible] delivered the medium-[illegible] fishing trawler *Klondyke* to [illegible] owners. This vessel has been [illegible] to the highest class of the [illegible] Veritas for the joint ownership of Nord Pecheries S/A of Boulogne and the Armement Leporc & [illegible] of Fecamp.

Designed for both pelagic and demersal fishing operations, the vessel incorporates a transom stern and well-flared tulip bow form.

Ship model tests for resistance and propulsion were carried out at the Hamburg towing tanks prior to construction, and a low block coefficient and careful design of the hull form give the vessel good seakeeping qualities in addition to a speed of 14 knots.

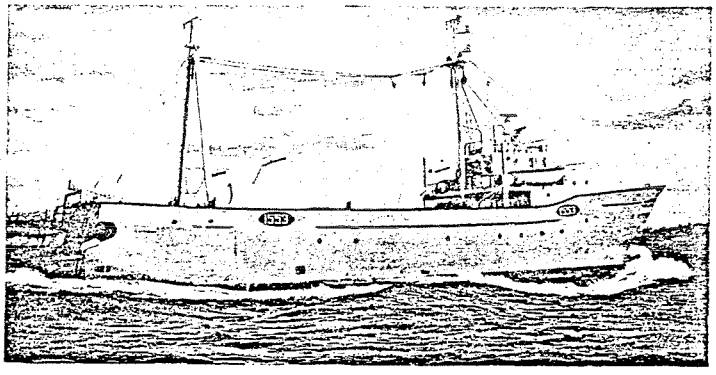
The 715-gross ton vessel is 58.2 moa, length bp 50.63 m., moulded breadth 10.10 m. and depth moulded to main deck 6.12 m. Fuel oil tanks have a 150-ton capacity while fresh water tanks have 43 tons capacity.

Main engine

Main propulsion unit is a nine cylinder MAN type G9V 30/4 unidirectional diesel engine developing 1,425 hp at 428 rpm, which drives a single propeller through a Renk multiple reduction type SW 71/2-1 gearbox. The latter consists of two gear ratios forward, one for full speed and the other for fishing and one aft.

An air-operated brake is fitted to immobilize the propeller during manoeuvers. Controls for the ma

Figure 2c. Some of the first stern trawlers built for National Sea Products Ltd. (Source: Fishing News International, December 1966)



The wet fish stern trawler "Atkinson".

CANADA

Atkinson

Wet fish stern trawler

THE second in a series of stern trawlers building at the Halifax Shipyards at Halifax, Nova Scotia, the *Atkinson*, has been delivered recently to her owners, H. B. Nickerson & Sons of North Sydney, Nova Scotia.

Designed for fishing off the eastern seaboard of Canada and Newfoundland, the vessel has an overall length of 41.65 m., length bp 36.15 m. moulded breadth 8.2 m., depth 4 m. and draught 3.7 m. Gross tonnage is 371 and net tonnage 129.5.

The vessel is propelled by a Brons type 16 GV diesel engine of 1,250 hp which drives a Liaaen three-bladed 2,250 mm. controllable pitch propeller to give a trial speed of 12.6 knots. Fuel oil tanks have a 78 ton capacity and fresh water tanks 26 tons. A cruising range of 4,400 miles can be attained.

Full length trawl deck

Accommodation is provided in the superstructure and on the shelter deck for 19 men with one spare cabin. The bridge superstructure is set well forward in order to give a full length trawl deck. Beneath the after end of the superstructure is sited the Van der Giessen No. 6 trawl winch, which has a capacity of 1,200 fathoms of warp on each of its two drums, and a hauling speed of 270 ft. per minute.

The vessel is a good example of a simple alternative to a conventional side-fishing trawler. No freezing or refrigeration equipment is installed as this is not necessary for her areas of operation. The fishrooms have a total capacity of 8,500 cu. m.

On the bridge are installed Canadian Marconi CN 86 60 W radio telephone, two Decca 202 radar installations, Simrad EH2A fish finder, Simrad 512–12WL fish finder, Canadian Marconi–DX Navigator Loran, and Robertson autopilot.

ADEN

Federal Star 2

Multi-purpose vessel

ADEN Dockyards Ltd. have built a vessel for the Government of Aden Fisheries Department, named *Federal Star* 2, which can be used for purse seining, tuna long-lining, trawling and other methods of fishing.

The dimensions of the vessel are as follows: length 40 ft., beam 14 ft., depth 6 ft. 6 in.; draft at the heel 4 ft. 6 in. The vessel has a gross tonnage of 35 and is of all steel welded construction with the wheelhouse and main propulsion unit situated in the forward half of the boat.

The after part of the vessel is a large spacious working deck with clear run aft over the wide transom stern which gives considerable facility in the operation of purse seine and other nets. The vessel is further equipped with a belt driven vertical capstan with attached hydraulic line hauler, supplied by a Scottish firm.

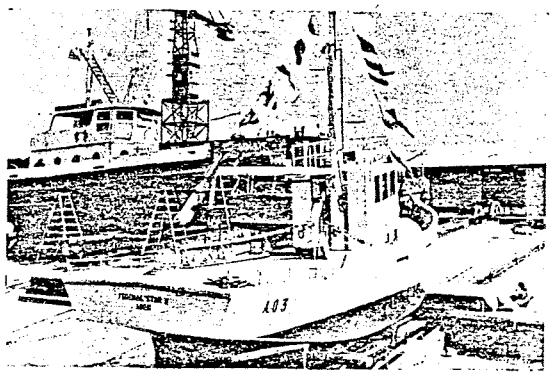
Propulsion

The main propulsion unit is a Parsons 'Barracuda' 6-cyl. marine diesel engine, capable of developing 60 bhp at a speed of 1,450 rpm for continuous operation, operating through a mechanically operated gear box, including reverse gear. The engine is fitted with heat exchanger cooling, having an independent internal fresh water cooling system assisted by a sea water jacket cooling system. Power to the 32 in. propeller is through a 3:1 reduction gear. The engine is fitted with a 24 V generator which supplies power for a Marconi Ferrograph echo sounder.

A unique feature for this vessel is the Simms Inertia Starter which eliminates the use of starter batteries and which in comparison with overhead hand starting is a very easy operation. The fishroom to which access is obtained through a small fish hatch on the port side is woodlined and is surprisingly large for this size of vessel. *Federal Star* 2 will eventually be fitted with a Marco Puretic Power Block which is hydraulically operated.

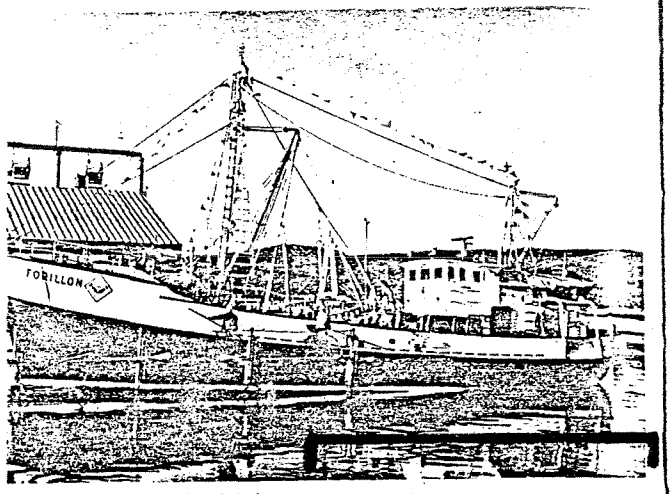
The proto-type vessel which will be operated by staff of the Fisheries Department, is the first of a series of five vessels to be constructed for the fishing fleet of Aden.

A unique aspect of the technical



"Federal Star 2" a multi purpose vessel which will be operated by the Aden Fisheries Department

Figure 2d. One of the first stern trawlers built for H.B. Nickerson and Sons Ltd. (Source: Fishing News International, March 1966)



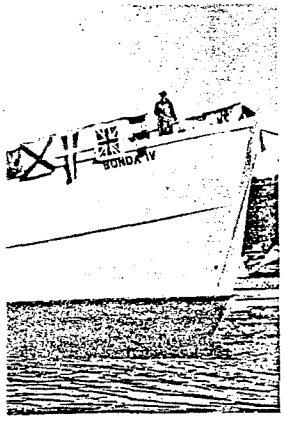
23-ton wooden side trawler on", built at Sandy Beach, c, and powered by a Caterpillar diesel engine.

er through a Twin Disc reduction gearbox. It gives essel a speed of 11 knots. ary machinery includes a 5 kW generating set and two Products bilge and general pumps.

deck, a Hathaway 653–62 and a Dugas & Hachè windlass talled. A 13 ft. dory is carried ition to a ten-man inflatable

gner T.15 hydraulic steering fitted and wheelhouse equip- includes a Danforth-White ss, two Simrad EH2A echo ers, Canadian Marconi CN.86 telephone and 48 mile radar DX-Navigator loran set.

ited out for her owners, Bonda



Bonda IV

Starboard side trawler

McLEAN'S SHIPBUILDING LTD have built a 200-ton wooden side trawler at Mahone Bay, Nova Scotia for Bonda Draggers Ltd. of Yarmouth, Nova Scotia.

Called the *Bonda IV*, she is 102 ft overall with a moulded breadth of 24 ft. and depth of 12 ft. Accommodation is provided for a crew of 14. Wet fishroom capacity is 240,000 lb. and fuel oil capacity 6,500 gallons.

Auxiliary equipment

Propulsion machinery consists of a Deutz RBA8M 528 diesel developing 620 bhp at 750 rpm and driving a Liaaen controllable pitch propeller through a Liaaen 2½:1 reduction gear. Auxiliaries include a 15 kW Kato generator driven by a Deutz diesel, a 25 kW generator driven by a Deutz diesel, a Quincy air compressor and two Marine Products 3840 bilge pumps. Electrical system is 120/240 V a.c.

On deck the *Bonda IV* has a Hydraulik Brattvaag winch. In addition to two Lunenburg dories she carries a Dunlop 'Seafarer' liferaft.

Tenfjord H 115 T hydraulic steering gear is installed; and to it is connected a Wood Freeman autopilot.

Wheelhouse equipment includes a Simrad EH2A echo sounder, Canadian Marconi CN 86 radio telephone, Decca Navigator, two Marconi loran sets and Marcom 'Raymarc' radar.

JAPAN

Yabase Maru

Stern trawler with 68-man crew

THE Usuki Iron Works have completed at their Saiki yard in Japan the stern trawler the *Yabase Maru* for the Hoko Fishing Co., Ltd. of Tokyo.

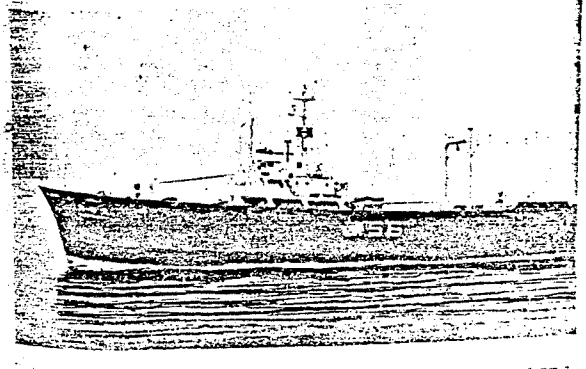
Main dimensions of the vessel are length oa 76.46 m., length bp 74 m., moulded breadth 13 m. and depth 9 m. Gross tonnage is 2,411 and net tonnage 1,221. Main power unit is an Akasaka 6UET45/75 diesel engine of 2,800 hp at 235 rpm which drives a single Kawasaki Kawazyu c.p. propeller of 2,950 mm. diameter to give a speed of 14.72 knots. Fuel oil tanks have a 885 cu. m. capacity and fresh water tanks 193 cu. m. Auxiliary power supplies are derived from two Akasaka KH6CC–A 625 hp diesels.

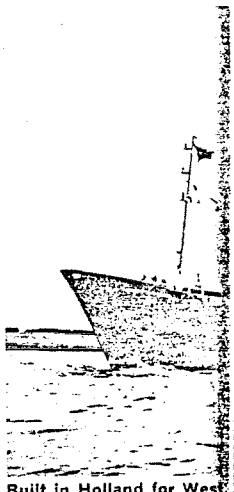
Accommodation is provided for a total of nine officers and 68 crew members. The 16-ton hydraulic trawl winch, mounted aft of the superstructure, has a drum capacity of 2,000 m. of 26 mm. warp and a hauling speed of 70 m/m.

The fishroom has a capacity of 2.81 cu. m. and is refrigerated to —25 deg. C. Refrigeration is provided by four Nihon-Sabroe ammonia compressors, two of 60 kW and two of 75 kW. The catch is frozen by contact freezers made by Nihon-Sabroe and which have a 53 ton output per day.

Electronic equipment installed includes Asahi transmitters of 1,000 500 and 50 W and a 27 mc SSB unit, two Anritsu AR–40 40-mile radars, Sanken NTE 500 and NTL 1500 fish finders and Koden ML–1 loran. There is also a Tokyo Keiki autopilot and gyro compass.

The freezer stern trawler "Yabase Maru", built for a Tokyo fishing company.





Built in Holland for West stern

NETHERLANDS

Milly Ekken

Versatile trawler/purse s

THE Scheepswerf De Woubrugge in Holland pleted the stern tra *Ekkenga* for the West G 'Fortuna' Heringsfische stadt. Designed for demersal stern trawli possibility of purse catch can be landed in or salted form.

Gross tonnage

The vessel has an o of 49.15 m., length moulded breadth 8.5 upper deck 6.62 m. and m. Gross tonnage is tonnage 266.

For propulsion ther RBV8M 545 diesel en hp at 380 rpm whic coupled to a four-blad diameter propeller to of 13.1 knots. Auxi comprise one Deutz BF

Figure 2e. Side trawler built in 1967. (Source: Fishing News International, June 1967)

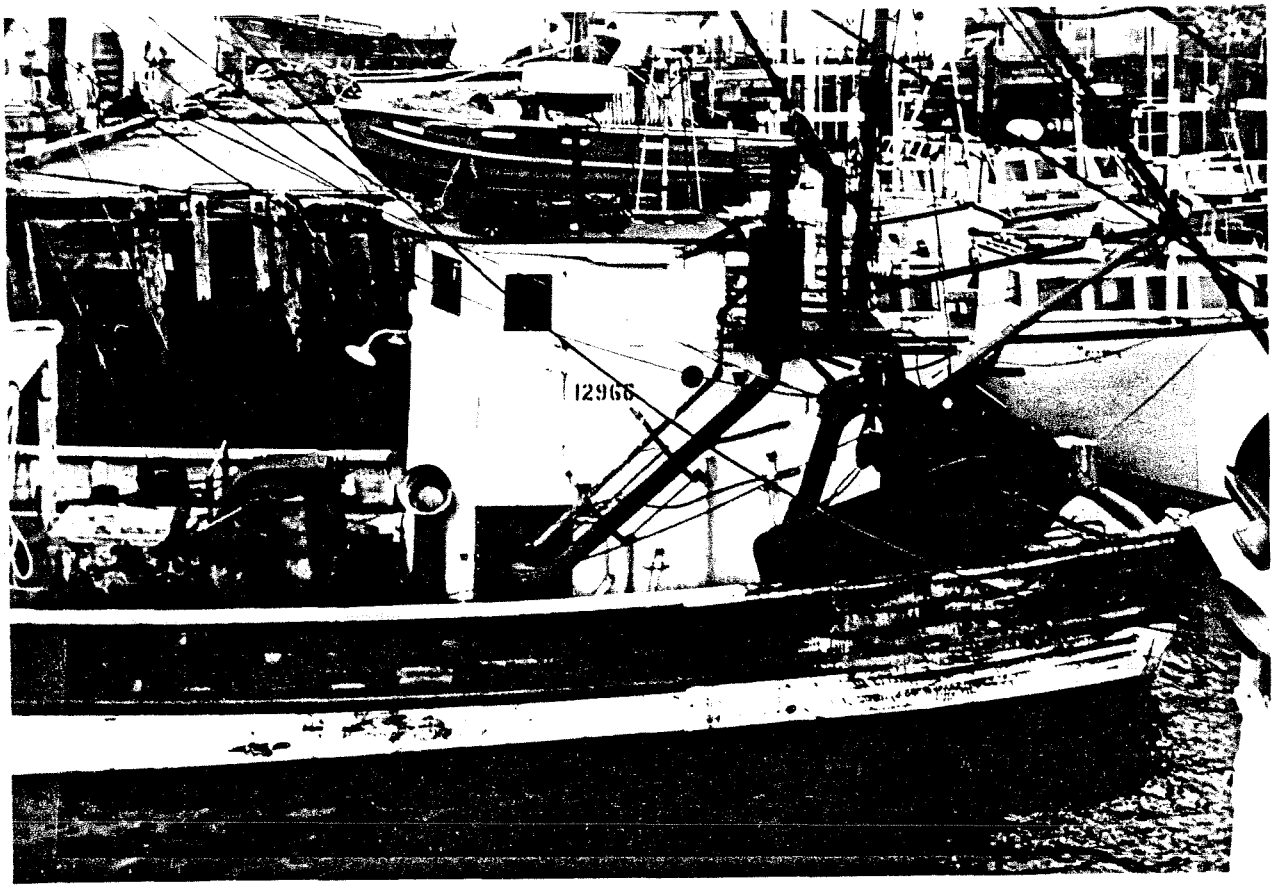


Figure 2f. Side trawler converted to towing from the stern. One of the Carmelle boats based in Pubnico. (Photo - G. Hurley)

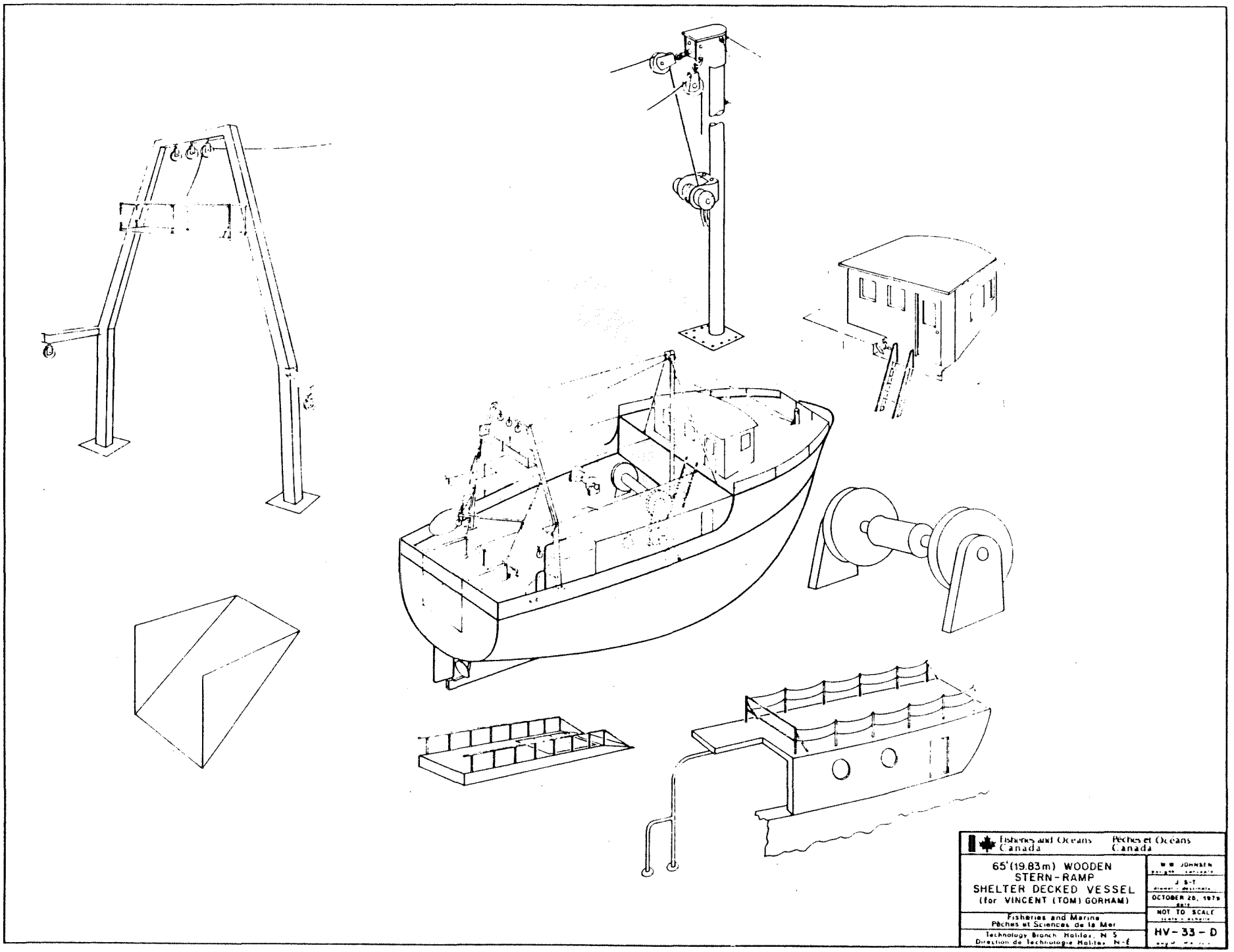


Figure 2g. Small stern trawler with a ramp. (Courtesy of DFO)

Figure 2h. Conventional squared-off stern of a 45 ft. trawler. (Photo - G. Hurley)

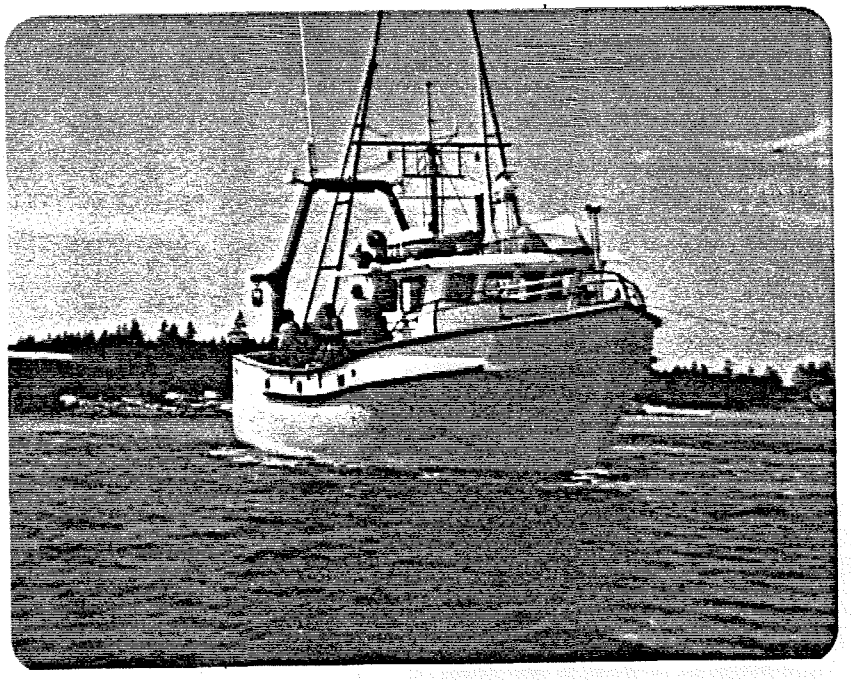
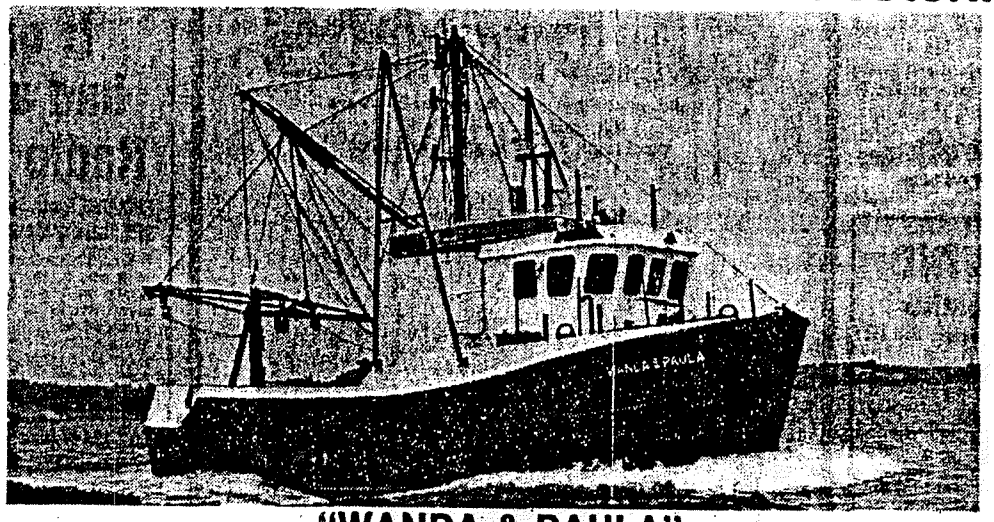


Figure 2i. Fibreglass trawler, the Jason and Natasha, based in Pubnico. (Courtesy of Camille d'Eon Boat Builders Ltd. - middle West Pubnico, Yarmouth Co.)

THE BIGGEST SMALL BOAT IN THE FISHERIES

A 45 Footer that Fishes like a 65 Footer...



"WANDA & PAULA"

Constructed by the Lunenburg Foundry & Engineering Limited

Length Overall ..... 44'-11" Beam ..... 17' Draft ..... 8'

Fish Hold Capacity

70,000 lbs. Iced Fish Fuel Capacity ... 1,900 Imp. Gals.

Fresh Water Capacity .. 400 Imp. Gals. Displacement ..... 55 Tons

If you want your fishing capacity to be increased contact....

Lunenburg Foundry & Engineering Limited

Telephone (902)634-8827 or 455-2461 Telex 019-21509 Lunenburg, N.S. B0J 2C0

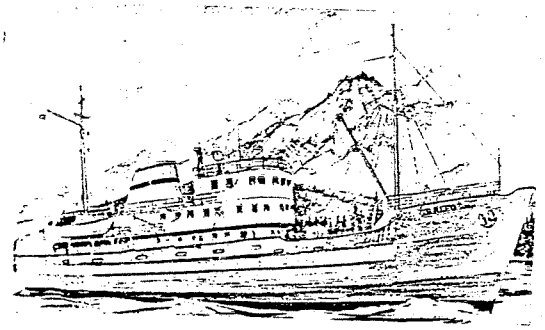
Figure 2j. First small steel trawler built in Lunenburg. (Courtesy of Lunenburg Foundry and Engineering Ltd.)

2.2 Longliners

The Cape Island design of longliners has not changed significantly from those built in the early 1960s (Figure 2k). Although this has been the most popular type of longliners, there have been other designs used as well (Figure 2l). Probably the most significant development in longliner construction has been the widespread use of fibreglass hulls beginning in 1980 (Figure 2m). Within the past year or so, a burgeoning business in fibreglassing old wooden hulls has begun in the area (Figure 2n).

CANADA

G. B. REED—Fisheries research vessel.



LOA: 54 m. Moulded breadth: 9·75 m. Moulded depth: 5·18 m. Built of steel with all aluminium superstructure by Yarrows Ltd., Esquimalt, British Columbia, for the Canadian Government's Department of Fisheries.

Accommodation for crew of 36—nine scientists, six officers, 18 men and three spare bunks. Fish hold capacity: 725 cu. ft. Fuel oil capacity: 170 tons.

Powered by Burmeister and Wain Alpha 498-RVO driving a B & W controllable pitch propeller. Speed 12 knots. Two 100 kW. Russell Newbery—Laurence Scott diesel generators. One 20 kW. Ruston Hornsby, Lancashire, A.S.R. emergency diesel generator.

James Robertson electrically driven trawl winch. Norwegian "Hydrapilot" HS40 hydraulic steering gear. Sperry autopilot and Sperry Mark E.1 minor gyro compass. Canadian Marconi 6N-35 and Decca D.7 radar sets. Canadian Marconi radio sets. "Discovery" D/F set.

Special equipment includes oceanographic winches, a puretic power block, a gill-net boat and scientific laboratories.

The ship is being built to the requirements of the Minister of Fisheries and the Fisheries Research Board of Canada. She is of usual East Coast commercial fishing trawler form but instead of a large cargo fish hold, there will be a relatively small fish hold and space thus made available will be utilized for the accommodation of laboratories, special fishing gear, and much electronic equipment to assist the scientists in their research work, as well as the most modern electronic navigational instruments.

The ship will be classed by Lloyd's and will also be constructed to the requirements of Steamship Inspection Service for a ship for Foreign Voyages Class I with highest requirements regarding life saving appliances and fire extinguishing equipment.

There will be three sets of recording echo sounding equipment of different types to ensure great accuracy at the extreme, medium, and shallow depths at which the various species of fish are located.

Main purposes for which this ship will be utilized may be stated briefly as follows:—

(a) Exploratory fishing for pelagic fish, principally salmon, on the high seas up to 2,000 miles off shore; defining the available resources, and the possibility of their use by Canadian fishermen.

(b) Exploratory fishing for bottom fish, such as flounders, cod, etc., on the Continental Shelf.

(c) Study of primary production of small life in the sea, upon which all other life depends.

(d) Oceanographic work with main emphasis on fishing areas.

The vessel will be equipped with five laboratories which will be outfitted with the most modern hydrographic, chemical and biological instruments and facilities for studying and storing samples of sea life and for mapping forms and physical features of the sea and sea bottom. Facilities will also be provided for quick-freezing fish samples and for the normal cold storage of fish in the frozen and unfrozen state.

Accommodation for crew and personnel throughout will be of a very high class, with special attention being paid to heating, ventilation, and insulation arrangements throughout the ship to ensure comfort inside with a wide range of temperature outside, from 0° to 90° F.

BURFISH—built in Holland for Newfoundland owners.

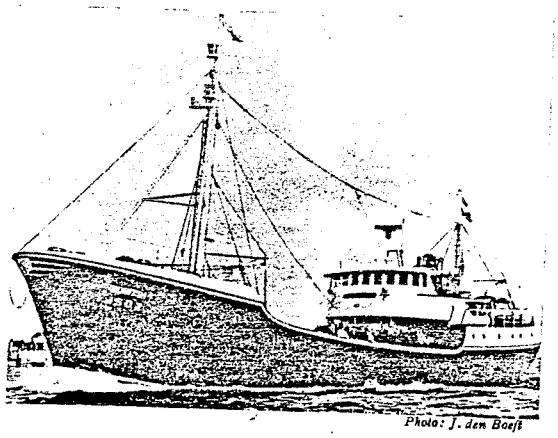


Photo: J. den Boer

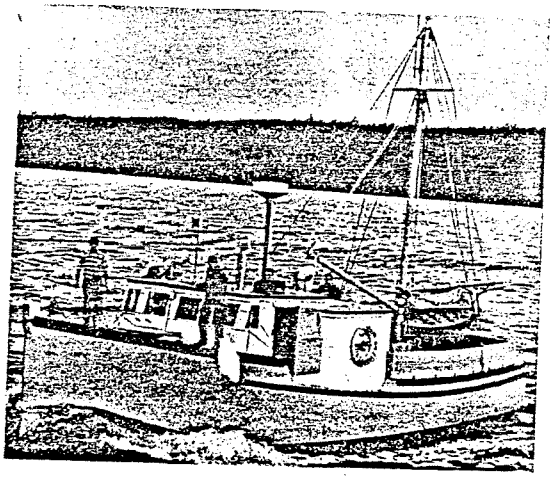
LOA: 36·58 m. Beam: 7·62 m. Draught: 3·96 m. All-welded steel (aluminium wheelhouse) trawler built by Shipyard Boot-Leiden Ltd. at Leiden, Holland, for Burgeo Trawlers Ltd., St. John's, Newfoundland.

Accommodation for 15. Fuel oil capacity: 33·5 tons.

Powered by a 6-cylinder, 4-stroke Werkspoor TMAS 336 diesel developing 650 bhp at 325 rpm, and driving a fixed 4-blade propeller. Speed 10·2 knots. One 6-cylinder Lister JP616MA auxiliary developing 70 bhp at 1,200 rpm, and one 6-cylinder Mercedes-Benz MB846A auxiliary developing 225 bhp at 1,500 rpm.

Van der Giessen, NR VI trawl winch. Tenfjord steering gear and autopilot. Magnetic compass. Two Simrad fish finders. Marconi radar and radio sets, and two Loran receivers.

LATOUR—Halibut longliner from Nova Scotia.

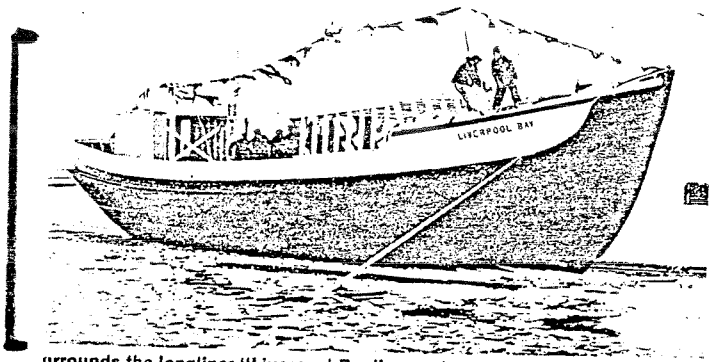


LOA: 14·63 m. Beam: 4·57 m. Draught: 2·13 m. Built by Harley S. Cox & Sons, Ltd., in Nova Scotia for H. Newell of Shelburne County. Accommodation for a crew of four.

Powered by a Rolls-Royce C6NFLM diesel driving a fixed blade propeller through a Capitol 2:1 reduction gear.

Hydraulic steering gear. Autopilot. Ekolite ER 4 echo sounder. RCA radar. Marconi radio-telephone.

Figure 2k. Early wooden longliner - Cape Island type. (Source: Fishing News International, January 1962)



urrounds the longliner "Liverpool Bay", seen here soon after launching prior to being fitted-out.

reverse gear to give a speed of
ıots.
ıxiliary machinery includes two
nators driven by Caterpillar
0 diesels, Morse controls and
es pumps.
deck a Marco purse line
h, windlass and Marco 'Puretic'
r block are installed, and two
liferafts are carried.
ckers power-assisted steering
is installed; and to it is con-
d a Wood Freeman autopilot.
heelhouse equipment includes a
orth White compass, Simrad
sounder, Bendix 430 radio
hone and Bendix A.160 radio
tion finder.

TED KINGDOM

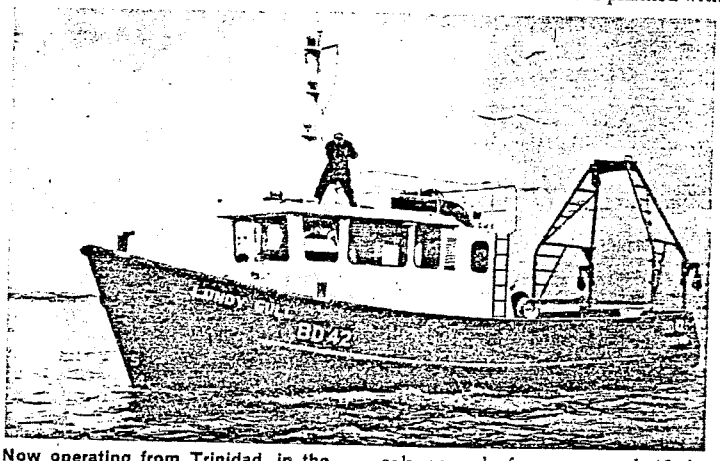
ndy Gull

l steel stern trawler

LEDORE SHIPBUILDERS
. (as briefly mentioned in the July
of *Fishing News International*)
built a 12-ton steel stern
er in their yard at Appledore,
h Devon, and the vessel has
sailed for Trinidad in the West
s.

room capacity

med the *Lundy Gull*, she is
overall with a beam of 13½ ft.
draught of nearly 6 ft. She
ccommodation for a crew of six
/ decks and a fishroom with a
ity of 400 cu. ft. Fuel oil
ity is 800 gallons.
pulsion machinery consists of
General Motors 330T diesels,
developing 85 hp at 1,800 rpm,
g two Bamford 'Ajax' pro-
s through a 3:1 reverse and



Now operating from Trinidad, in the West Indies, the 12-ton steel stern trawler "Lundy Gull".

reduction gearbox. It gives the vessel a speed of eight knots.

Nine 24 V batteries are charged off the main engines and Morse controls are fitted for controlling the engines from the wheelhouse. Jabsco engine driven and Whale 'Gusher' hand-operated pumps are fitted for bilge pumping and general service.

A Smallwood two-ton trawl winch, operated by a Young constant speed hydraulic power pack, is installed immediately aft of the deckhouse.

See Between Ourselves (yellow page inset) for many interesting gossip points worth noting. A regular feature this. Watch for it. Your own comments welcomed.

The vessel has a fixed gantry and stern ramp aft.

In the wheelhouse are fitted a Sestrel overhead compass, Kelvin Hughes MS.39 echo sounder, Sailor radio telephone, Wynstrument straight line window wiper, Decca Navigator and Decca D.101 radar.

CANADA

Liverpool Bay

Longliner for Nova Scotia

MCLEANS SHIPBUILDING INC. have built a 90 ton longliner at Mahone Bay, Nova Scotia, for Carmen and Duncan Frolick of Liverpool, NS.

Called the *Liverpool Bay*, the vessel is 78 ft. overall with a beam of 20 ft., draught of 10 ft. and accommodation for a crew of ten. She is planked with oak on oak frames spaced 19 in. between centres, has pine decks and is galvanized iron fastened. Fishroom capacity is 100,000 lb. and fuel oil capacity 4,000 gallons.

Propulsion engine is a Rolls Royce diesel which develops 350 bhp at 1,800 rpm and drives a 54 by 42 in. five-bladed Michigan propeller through a Capitol gearbox. Auxiliary machinery includes a Lister SL 2 air-cooled diesel, which drives a 5 kW generator, and Marine Products pumps.

On deck a line hauler made by the Lunenburg Foundry is installed; and two eight-man liferafts are carried in addition to two dories.

Svendborg electric hydraulic steering gear is fitted and wheelhouse equipment includes a Simrad EH 2A echo sounder, Canadian Marconi CN.S6 radio telephone, DX-Navigator loran, and Marconi radar.

Figure 21. Early wooden longliner - schooner type. (Source: Fishing News International, September 1967)

December 1, 1980

THE SOU'WESTER, Yarmouth, N.S.

Guildfords Ltd. Launch 45-ft. Fiberglass Multi-Purpose Vessel

Guildfords Ltd. of Dartmouth, who pioneered the use of fibreglass for inshore fishing boat construction, moved into the multi-purpose fishing boat field with the launching recently of the Reyno Sisters, a 45-ft. fiberglass longliner which can be used as a seiner and a swordfisher.

The vessel was built for Frank Reyno, a 22-year-old fishing captain from Sambro, N.S.

Tom Guildford, president of the firm, forsees a greater number of 45 footers being constructed of fibreglass. While initially more expensive, the added cost is more than made up by the lack of maintenance costs and the longevity of fibreglass. The first boat ever built of this material is still is use.

Another advantage of the fiberglass vessels is that they cost "substantially" less than their steel-hulled counterparts, he added.

Mr. Guildford said the Dartmouth-based company began constructing small work vessels for the Bedford Institute of Oceanography, the federal department of fisheries, and the Canadian navy in the 1960s on a contract basis.

But it was not until 1975 that the company embarked on a regular boat building program. It then produced 21, and 42-foot vessels for use as survey launches, fishing work boats, and patrol craft for the RCMP.

Now that the company has begun to produce 45-foot [illegible] fish holding capacity – from 30,000 to 60,000 pounds. This goal was achieved not only by extending the length of the vessel by three feet, but also by increasing the boat's depth and beam.

Mr. Guildford said the 45-foot class vessels, which will cost in excess of $200,000 each, also are equipped with refrigeration to maintain the catch quality.

The Reyno Sisters, designed by Guilfords marine designer John MacMillan, was assembled at the company's plant in the Burnside Industrial Park, 21 McCurdy Avenue.

The locally owned company manufactures insulation and fiberglass products, and is one of two firms in the Atlantic region specializing in the construction of 45-foot fiberglass fishing vessels.

Figure 2m. Fibreglass longliner. (Source: Sou'wester, December 1, 1980).

Glassing old hulls boon to C.F. Marine Boats

WEDGEPORT,N.S. — A tough economic climate in the fishing industry has had a serious effect on boatbuilders, as fishermen cancel plans to replace aging fishing vesels due to rising fishing costs and stagnant fish prices.

This downturn in the industry came after boatbuilders enjoyed relative success in the 1970's as fishermen invested heavily in new boats and equipment in the euphoria surrounding Canada's declaration of a 200 mile fishery management zone in 1977.

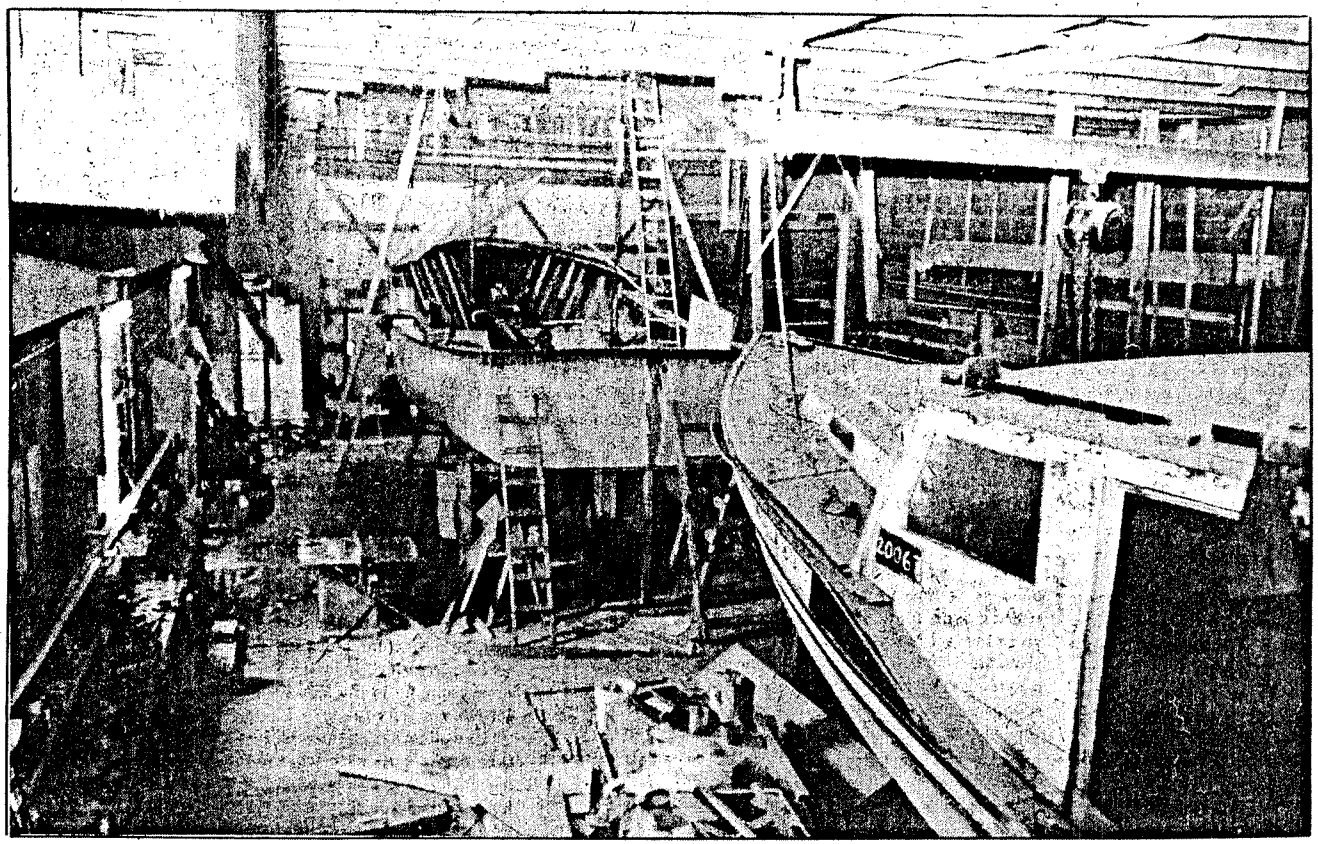
Boatbuilders sprang up all along the coastline of Nova Scotia; times sure have changed.

Melvin Cottreau had a blossoming business, producing a number of quality wooden fishing boats up to 55 feet. But last summer, due to a lack of business, he had to close shop.

The assets of the company were purchased by George Fitzgerald, who now heads C.F. Marine Boats Ltd.

And as a number of Nova Scotia boatbuilders have

continued on pg. 10



The C.F. Marine Boatyard was busy completing a 42-ft. glass fishing boat for a customer in Grand Manan where the Sou'wester visited. The vessel in the foreground belongs to boatshop owner George Fitzgerald.

Glassing old boats will keep this firm busy for most of the year. (Meuse/SW).

Figure 2n. Fibreglassing hulls. (Source: Sou'wester, March 15, 1984).

3.0 Deck Equipment

3.1 Winches

Hydraulic winches, which were developed in the mid-1960s, have several operational advantages over mechanical winches. The main trawl winch can be controlled from the bridge rather than the deck. A throttle valve provides smoother control over winch speed compared to the awkward operation of declutching while changing gears. When a net snags on bottom, the strain on it from the winches is removed by an automatic relief valve which allows the hydraulics to be bypassed. Mechanical winches work off the main engine. This means that several connecting shafts are required. These take up a lot of room under the deck in the fish hold area. Modern versions of the mechanical winch (Figure 3a) are still sold today probably because they are about 25% cheaper to purchase initially. However this saving is more than offset by the increased maintenance costs of lubricating and replacing worn-out bearings.

Early hydraulic trawl winches consisted of two winches on a single frame usually mounted in the centre of the deck. With a reduction motor, which was attached straight out from one end of the axel (Figure 3b), this arrangement took up much more deck space than the L-shaped split winches (Figure 3c) on either side of the deck. The latter were brought in during the early 1970s. Each of the "split" winches is angled to line up with the main towing block on that side of the vessel (Figure 3d). This presents an improved mechanical advantage over the earlier one-frame set-up because there are less secondary

blocks to pass through. At the same time there is less wear and tear on the warps and cables. The level wind modification (Figure 3e) was a further improvement to lay the warps evenly on the drum. This eliminated the need for a crewmember slowing down the winches and manually performing the same task.

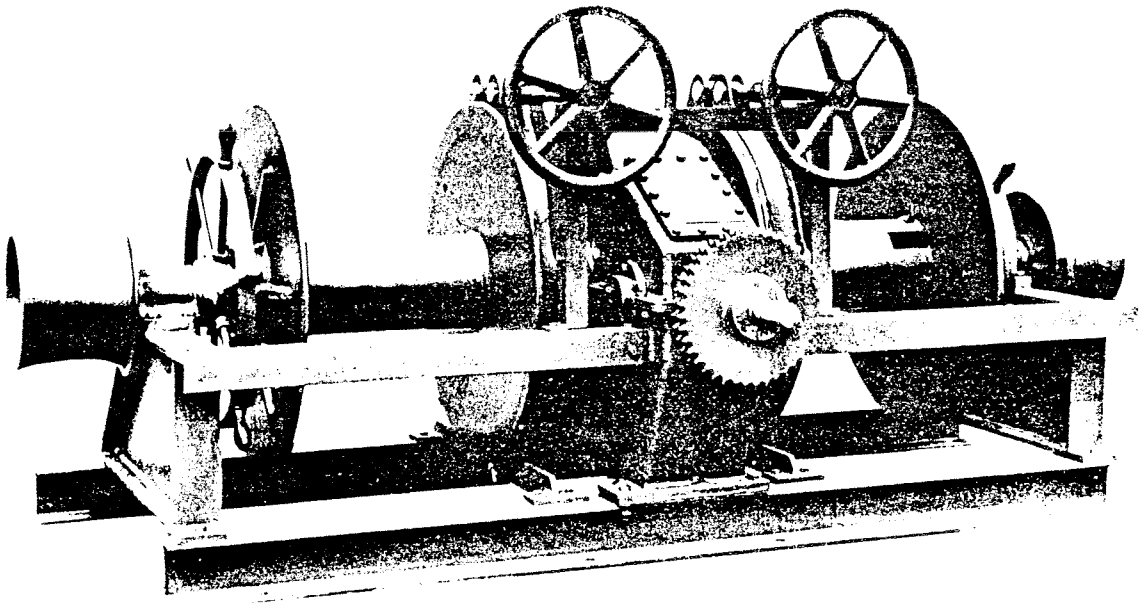


FIG. 46

"LUNA" TRAWL WINCH

Model LT 264A
for boats 55 to 75 feet in length

Model LT264A "Luna" trawl winch, steel fabricated with two steel frames assembled on 90" x 40" base, overall length 109". Using brass bushed double drums for longer life, the "Luna" trawl winch is also equipped with bronze main bearings, self adjusting drum engagements, two cast iron winch heads and with gear box containing cut steel gears—11 to 1 ratio. Drive can be forward or aft of winch.

Wire capacity in fathoms on one drum					
Wire diameter	½"	9/16"	⅝"	11/16"	¾"
20" x 33" Drums	680	520	430	350	300

8" x 4" hanging, upright and flat blocks available for the above unit.
Weight 3700 lbs.

29

Figure 3a. Modern mechanical winch. (Courtesy of Lunenburg Foundry and Engineering Ltd.)

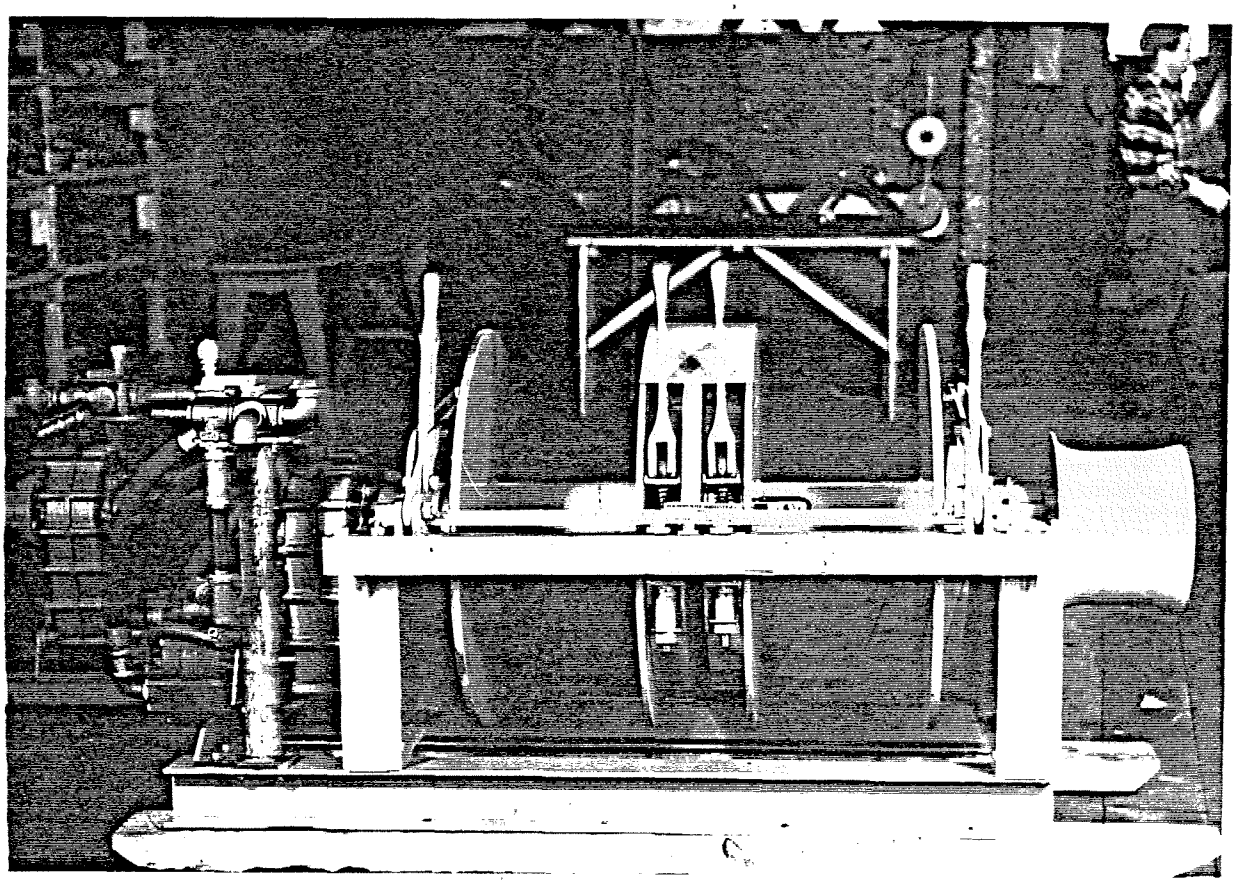
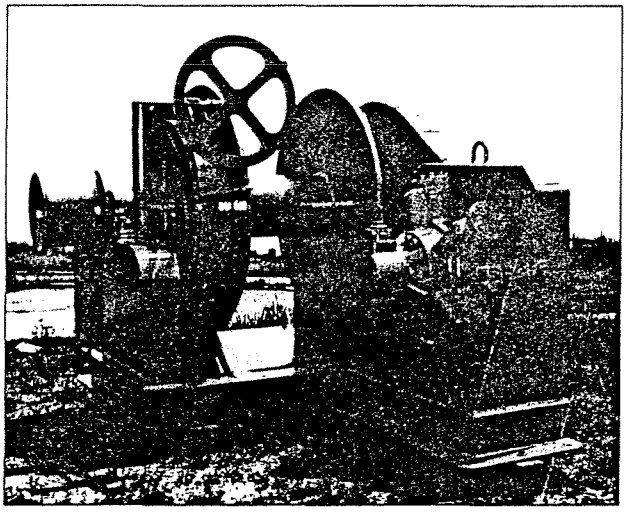


Figure 3b. Early hydraulic winch. (Courtesy of Hawboldt Industries Ltd.)

HAWBOLDT

SPLIT HYDRAULIC TRAWL WINCHES

MARINE EQUIPMENT



The most widely used Trawl Winch in Canada, the industry standard!

Extremely rugged steel construction featuring:
High Torque radial piston hydraulic motor.
Wide Band type mechanical brake.
Positive no-slip dog clutch.
Hardened Warping Head.
Chain drive.

Available with optional Automatic Hydraulic Spooling, Galvanizing, Oil Bath Drive and Remote Controls.

WINCH	WARP SIZE & DRUM CAPACITY IN FATHOMS								DRUM LINE PULL			WORKING	DRUM SPEED	H.P. PER WINCH (APPROXIMATE):
SIZE	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1	BARE	MID	FULL	PRESSURE	VARIABLE	
HSF1432	750	570	450	350	300	200	150	115	10500	5500	3000	2200	0-45 RPM	54 H.P.
HSF1632	870	650	500	400	340	240	160	130	10500	5500	3000	2200	0-45 RPM	54 H.P.
HSF2032	1080	820	640	500	400	300	200	160	12000	6000	3450	2200	0-45 RPM	60 H.P.
HSF1536	1025	780	600	480	400	280	200	150	16800	9000	6000	2200	0-45 RPM	95 H.P.
HSF2036	1370	1030	800	650	525	375	260	200	16800	9000	6000	2200	0-45 RPM	95 H.P.
HSF2236	1500	1140	880	700	580	400	290	220	16800	9000	6000	2200	0-45 RPM	95 H.P.
HSF2436	1650	1240	960	770	630	440	320	240	16800	9000	6000	2200	0-45 RPM	95 H.P.
HSF2636	1780	1340	1040	830	680	480	340	270	16800	9000	6000	2200	0-45 RPM	95 H.P.
HSF2836	1920	1450	1120	900	740	520	370	290	16800	9000	6000	2200	0-45 RPM	95 H.P.
HSF2242	2150	1620	1260	1000	820	580	420	320	20000	10000	7000	2200	0-45 RPM	125 H.P.
HSF2442	2350	1770	1370	1103	900	630	450	350	20000	10000	7000	2200	0-45 RPM	125 H.P.
HSF2642	2540	1920	1490	1190	970	690	490	380	25000	11000	8000	2200	0-45 RPM	150 H.P.

HAWBOLDT INDUSTRIES LIMITED
Head Office: P.O. Box 80, Chester, Nova Scotia B0J 1J0
(902) 275-3513 Telex: 019-22603

Figure 3c. Split winch. (Courtesy of Hawboldt Industries Ltd.)

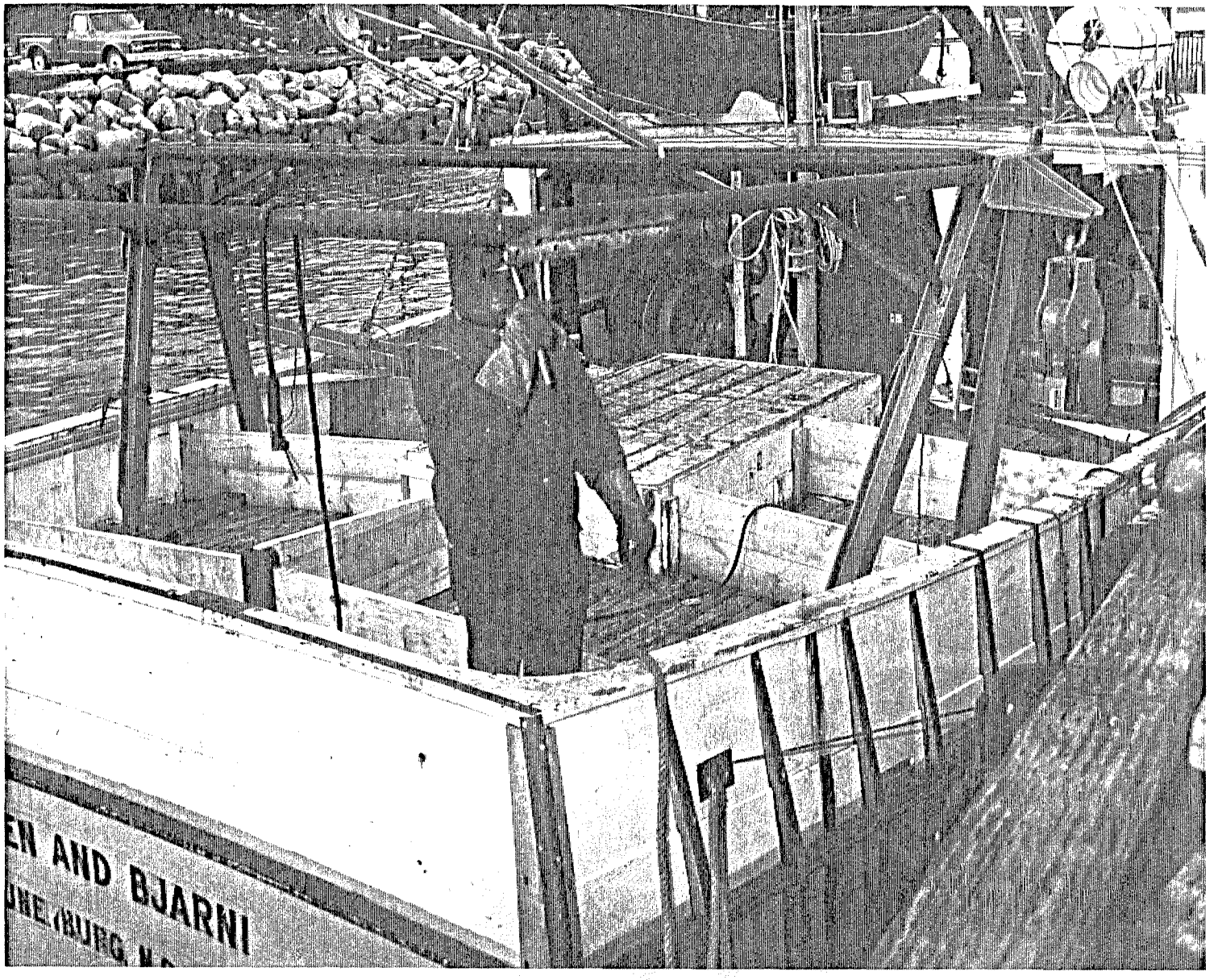


Figure 3d. Split winch/towing block arrangement. (Courtesy of Hawboldt Industries Ltd.)

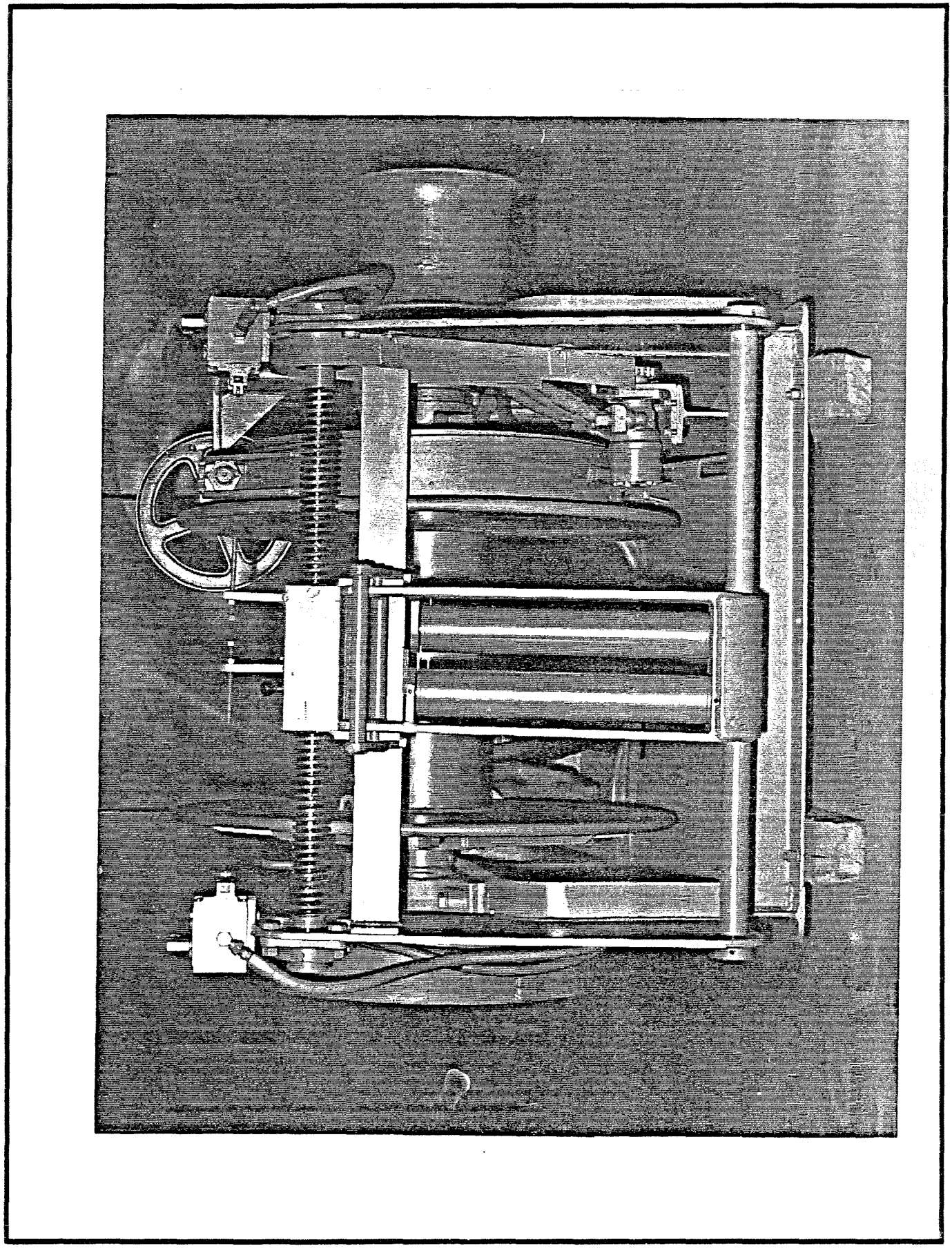


Figure 3e. Winch with level wind. (Courtesy of Hawboldt Industries Ltd.)

3.2. Net Reel

When early models of the net reel were experimented with during the 1960s, they were designed such that both the sweep lines and the net would wind on to the same drum (Figure 3f). By the early 1970s, the original design had been modified so that each sweep line wound on to its own drum. This is accomplished by having a inner flange and a snap gate on each side of the reel (Figure 3g). The net itself winds on to a long, smaller diameter, central drum. With this arrangement there is less tangling and chafing of the net from the wires. Also the sweep lines can be taken in faster because the sweep drum has a larger diameter than the net drum (24 inches vs 8 inches). Most net reels are positioned near the stern of the vessel (Figure 3h).

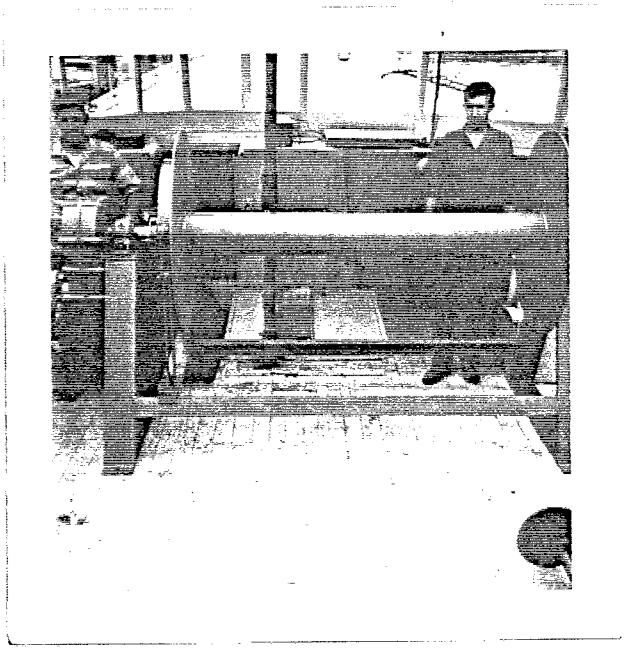
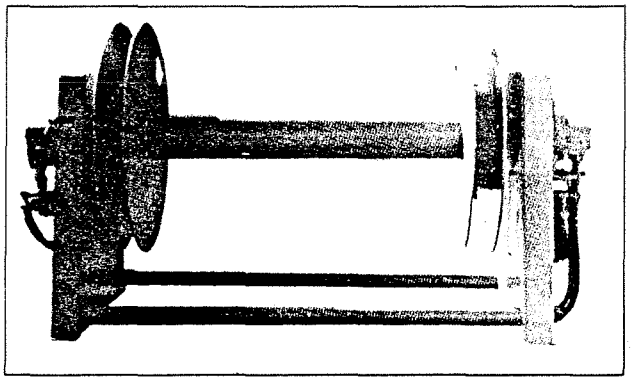


Figure 3f. Early net reel. (Courtesy of Hawboldt Industries)

HAWBOLDT HYDRAULIC NET REEL

MARINE EQUIPMENT



A complete range of net reels for vessels from 30' to 85'.

Standard features include rigid all steel construction, direct drive radial piston hydraulic motor, sweep wire flanges, and stainless steel snap gates.

Optional features include fully independent winch head and galvanizing.

Additional sizes available upon request.

MODEL	REEL LINE PULL (BARE DRUM)	DRUM SPEED	WORKING PRESSURE	MAX. LENGTH ADD 12" FOR IND. WINCHHEAD	WEIGHT APPROX.
A48-48	9000 Lbs.	0-60 RPM	2200	8'	2375 Lbs.
A60-48	9000 Lbs.	0-60 RPM	2200	9'	2400 Lbs.
A72-48	9000 Lbs.	0-60 RPM	2200	10'	2425 Lbs.
C60-54	18000 Lbs.	0-60 RPM	2200	9'	3300 Lbs.
C72-54	18000 Lbs.	0-60 RPM	2200	10'	3325 Lbs.
C84-54	18000 Lbs.	0-60 RPM	2200	11'	3350 Lbs.
2A-60-54	18000 Lbs.	0-60 RPM	2200	10'	3700 Lbs.
2A-72-54	18000 Lbs.	0-60 RPM	2200	11'	3725 Lbs.
2A-84-54	18000 Lbs.	0-60 RPM	2200	12'	3750 Lbs.
2A-96-54	18000 Lbs.	0-60 RPM	2200	13'	3775 Lbs.
SA-48-54	9000 Lbs.	0-60 RPM	2200	8'	2775 Lbs.

HAWBOLDT INDUSTRIES LIMITED

Head Office: P.O. Box 80, Chester, Nova Scotia B0J 1J0
(902) 275-3513 Telex: 019-22603

Figure 3g. Modern hydraulic net reel. (Courtesy of Hawboldt Industries Ltd.)

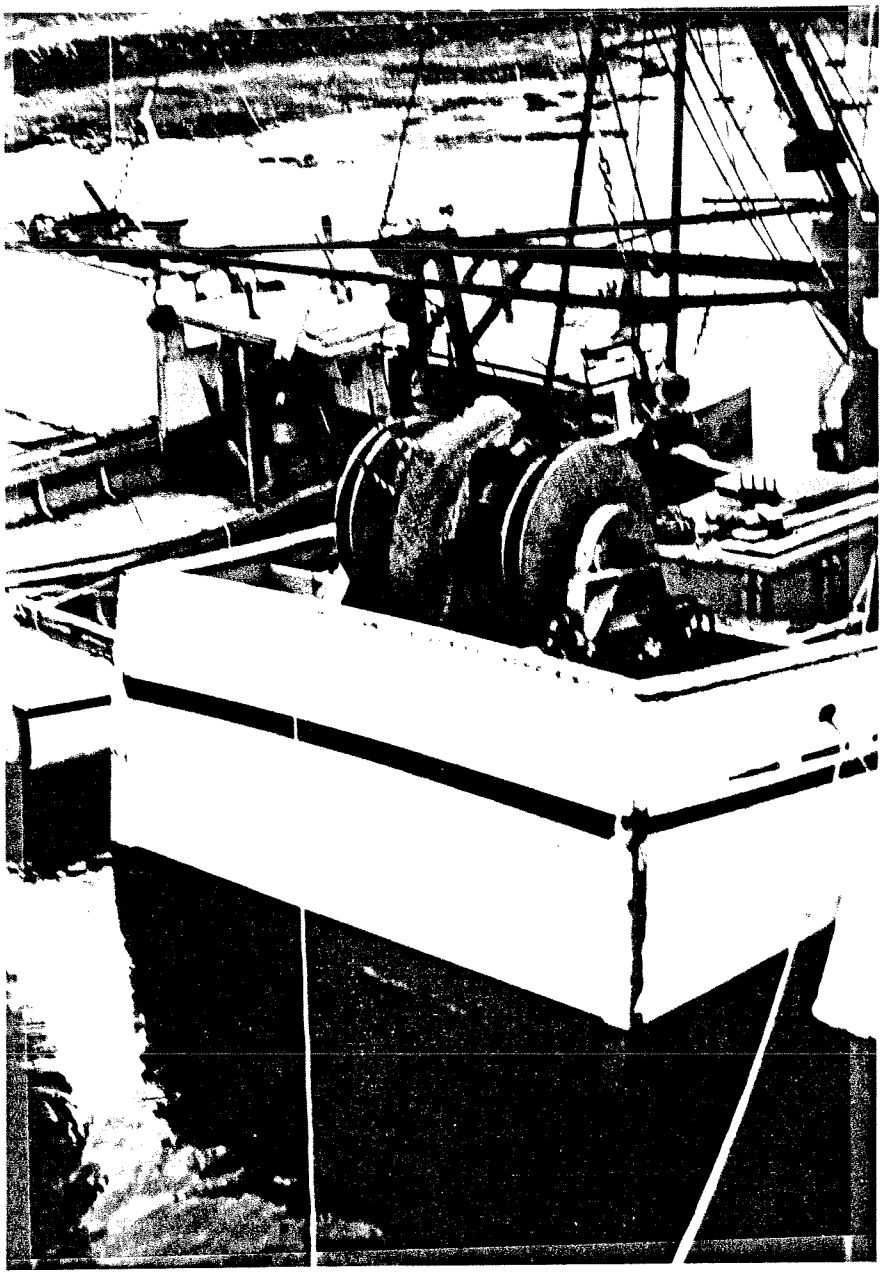


Figure 3h. Net reel ready to fish. (Photo - G. Hurley)

3.3 Boom Stabilizer

The boom stabilizer (for example see Figure 2j), which was introduced to the fishery around 1978, is used almost universally on small trawlers throughout the region to increase stability during heavy seas.

4.0 Propulsion Systems

4.1 Engines

Prior to the widespread useage of marine diesel engines beginning in the late 1950s, most small draggers were equipped with gasoline engines. These were typically 1 or 2 engine systems depending on the size of the vessel. Their 6 volt starting system was often affected by salt water condensation. They were difficult to overhaul since the cylinders were not sleeved. Durability was a problem because they operated at high speeds.

The changeover to diesel engines promised to be a big improvement over the gas engines. Diesel engines have a long service life because they operate at less than half the engine speed. The cylinder liners are easy to replace. They are about 50% more fuel efficient. The one drawback is that they cost 2 to 3 times more to buy than a gas engine.

There were several types of marine diesels available to fishing vessels in the early 1960s: low speed or high speed engines and one or two engine systems. The selection of the size or power of the engine depends on the size of the vessel and the type of fishery the vessel is involved in.

Side trawlers and larger stern trawlers have always utilized the heavy, slow-turning type of engine typically offered by European manufacturers. For example, side trawlers which were built in 1963, such as National Sea's Cape Race, Cape Aspy, and Cape Mira, had Deutz RBV 6M diesels which developed 650 h.p. at 310 rpm. (Figure 2a). The

first large stern trawlers had engines which were 50% more powerful than those of the sides (Figure 2c). More recently-built sterns are equipped with engines in the range of 2000 h.p. (Figure 2b).

In contrast, smaller trawlers and longliners have been powered with high speed (greater than 1200 rpm) diesels since the early 1960s e.g. the Rolls Royce marine diesel rated 236 h.p. and 1800 rpm (Appendix "A" and Figure 2k). This type of engine was well-suited to the small vessels since it was lighter and the operational maintenance was less because they were self-lubricating. This meant that the vessel did not have to carry an experienced engineer on board while fishing. A few groundfish draggers in the Shelburne area, in an effort to double their power, installed a two-engine system made by Detroit Diesel e.g. G.M. 6-71 Twin which gave them 510 h.p. at 2300 rpm (Figure 4a).

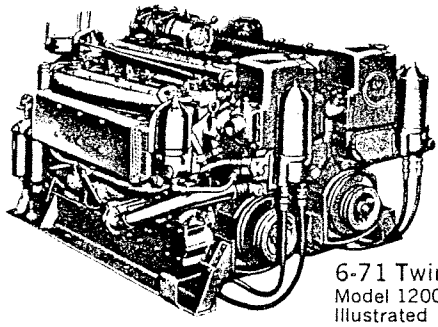
The trend toward diesel coincided with the development of turbocharging. Advances in metallurgy, improvements such as aftercooling and further modifications to the turbocharger over the last two decades have contributed to boosting the power/weight ratio of the engine. This has resulted in more full-efficient engines with up to twice the horsepower of naturally aspirated engines.

Modern 45 ft. and 65 ft. trawlers, equipped with engines such as the 365 h.p. Cummins KT-1150 and 700 h.p. Cummins KT-2300 M (Figure 4b) have nearly twice the power of older, similarily-sized vessels (Appendix "A").

295-1400 H.P.

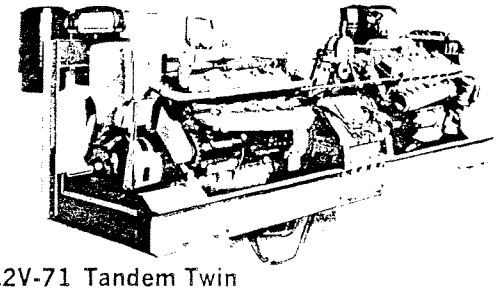
Multiple Engines for Power When You Need It

Highly flexible Detroit Diesel multi-engine units are designed to provide unequalled dependability for larger vessels. Two or four engines are coupled to a single output shaft through a heavy-duty gearbox. Two engines may be mounted side by side as "close coupled twins," or end to end as "tandem twins" for craft with narrow engine rooms. Either engine may be shut down and the other kept running if only part power is required or if adjustment must be made on the engine. This arrangement gives you double guarantee of reliability and at the same time cuts operating costs because you use only the power you need.



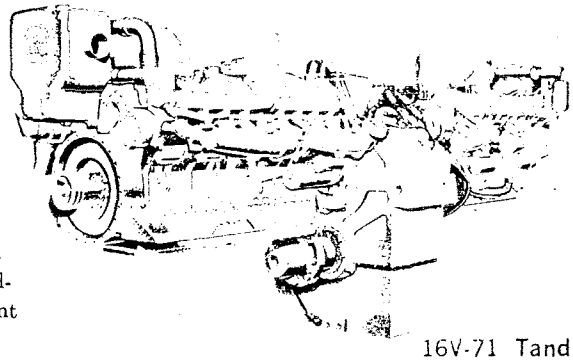
6-71 Twin
Model 12005A
Illustrated

Harbor pilots and tug fleet owners prefer Detroit Diesel twins because their extraordinary flexibility results in maximum maneuverability and low cost per horsepower in many workboat operations. The 24V-71 and the 32V-71 have been particularly adaptable to tugs and towboats where big power is a must. In addition, the extra long life of these units makes them even more attractive as a profit-making investment. Many large pleasure boats, especially those used for extended open seas cruising, require the safety and dependability that only Detroit Diesel twins can offer. In any application where engine reliability is a major consideration or where speed and load variations are great, Detroit Diesel multi-engine units are the exact answer.



12V-71 Tandem Twin
Model 7242N
Illustrated

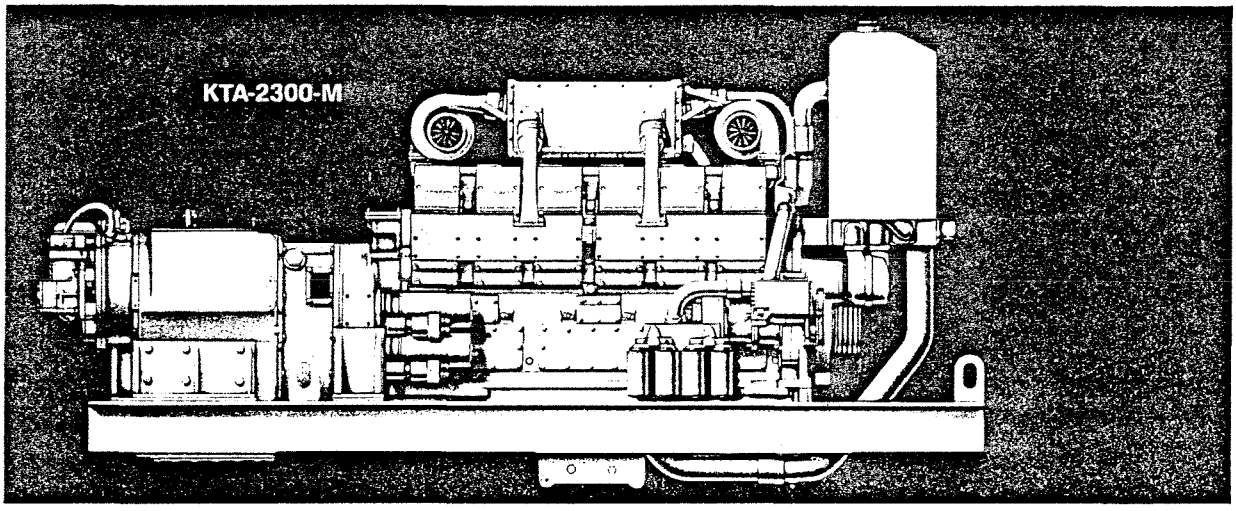
The 6-71 is available as a close coupled twin. The 6-71, 12V-71 and 16V-71 are available as tandem twins. A wide range of reduction gears is also available as well as a complete line of optional equipment to custom-fit the engines to your boat.



16V-71 Tandem Twin
Model 7322N
Pictured

Figure 4a. Early two engine diesel system. (Courtesy of Seaboard G.M. Diesel Ltd.)

KT/KTA-2300-M and KTA-3067-M Series 700-1250 hp continuous

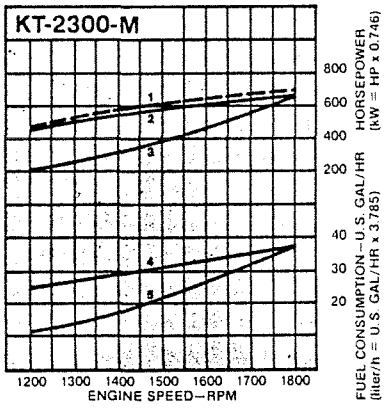


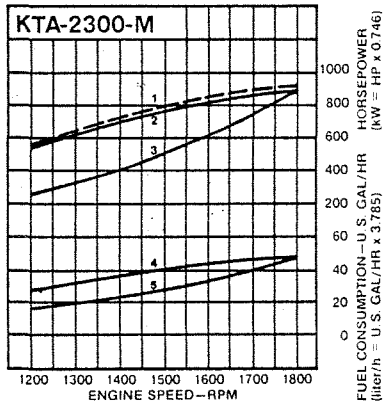
2300 and 3067 Series

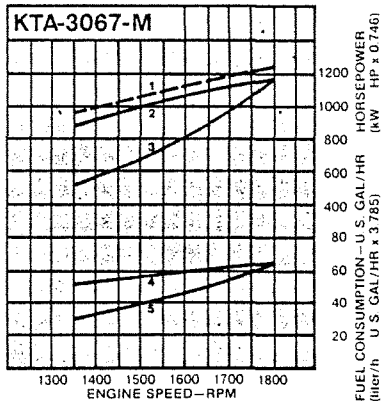
The 2300 and 3067 Series engines were developed for applications requiring high horsepower, combined with reliability, durability, and fuel economy. The 2300 Series engines were introduced in 1974, and are setting new performance standards for workboats and fishboats. The basic 3067 engine is in production. Marine accessories and equipment are being developed and the complete propulsion package is expected to be available in 1979. Consequently, all data for this model is preliminary.

These engines are 12 cylinder V configuration design with 6¼ x 6¼ inch (159 x 159 mm) cylinder bore and stroke. Displacement is 2300 cu. in. (37.8 liters). The KTA-3067-M is a 16 cylinder model of the same cylinder size. It has 3067 cu. in. (50.3 liter) displacement. The KT-2300-M is turbocharged, and the KTA-2300-M and KTA-3067-M are turbocharged and aftercooled.

Continuous duty performance







Specifications	KT-2300-M	KTA-2300-M	KTA-3067-M
Continuous duty hp (kW)	700 (522)	940 (701)	1250 (932)
Governed rpm	1800	1800	1800
Light duty commercial hp (kW)	780 (582)	1045 (779)	1385 (1033)
Governed rpm	1950	1950	1950
Length—in (mm)	149 (3794)	152 (4263)	132 (3353)
Width—in (mm)	53 (1355)	53 (1355)	53 (1346)
Height—in (mm)	76 (1939)	76 (1939)	76 (1930)
Weight—lbs (kg)	11.700 (5312)	13.450 (6106)	10.700 (4854)

Dimensions and weights of KT-2300-M are with MG-530 gear, of KTA-2300-M with MG-540 gear, of KTA-3067-M are less gear.

11

Figure 4b. Modern 700 h.p. for 65 ft. trawler. (Courtesy of Cummins Diesel)

4.2 Nozzles

Since the late 1970s, several small draggers have been fitted with a ducted propeller or nozzle e.g. Kort nozzle (Figure 4c). It is estimated that this addition can increase thrust up to 20% for either more towing power without reducing speed or for towing a larger net.

"Benric" – 65ft. Stern Dragger

The Kort nozzle conversion on this boat was carried out by the A.F. Theriault yard, Nova Scotia for Captain Raymond King.

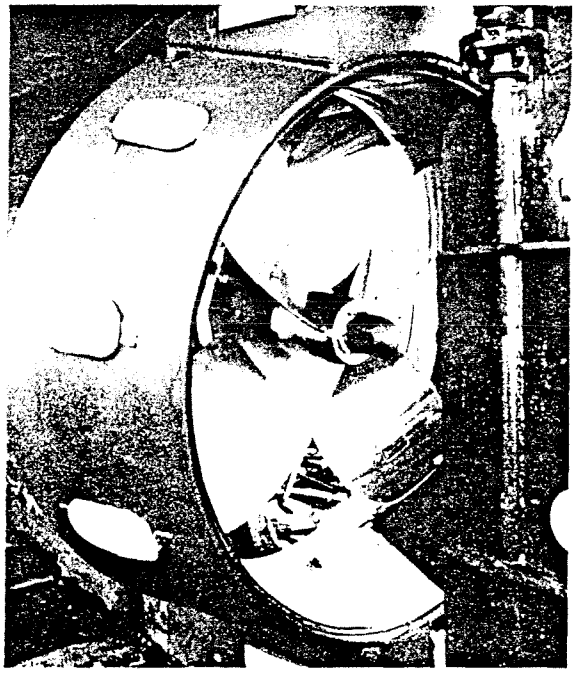
As mentioned earlier in the paper, the question of propeller diameter was discussed at length before an order was placed and **figure 5** shows thrust curves over the boat speed range for the alternative nozzle systems and original open propeller. The 'design condition' for all propellers is 3½/4 knots towing.

At the time of printing this paper bollard pull trial results for the new Kort nozzle system were not available to substantiate these curves, however, it has been reported that the maximum reading of a 10,000 lbs. gauge was exceeded!

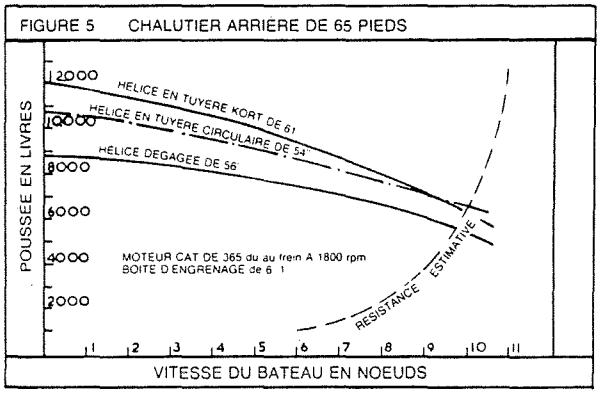
The curves are given in good faith as attainable figures with this engine producing the full rates power of 365 b.h.p. at 1800 r.p.m.

It should be noted that the open propeller bollard pull trial gave 7400 lbs. and the curve shows 8700 lbs., which suggests that the engine may not have been developing full rated power when these trials were held.

The illustrations show that the Kort nozzle was fitted following a straightforward procedure and the installation looks 'right' for this boat.



Kort nozzle installation "Benric"



Conclusion

Probably due to the traditionally conservative nature of the fishing industry world wide, owners are either 'for' or 'against' a Kort nozzle system depending on their own experience in comparison with an open propeller.

Some feel that their fishing methods would not be improved, whilst others are quick to report the 'tremendous' increase in towing performance. Two conflicting arguments which underline the fact that it is the operators requirements which are of prime importance at the design stage.

One factor to emerge from this paper, which has been proved in reality, is that there is more involved in Kort nozzle design than simply 'bolting one on and off we go' – as more than one enterprising skipper has found out to his cost!

With the major fishing nations of the world seeking exclusive limits and developing countries expanding their own industry, traditional operations and fleet requirements are changing. At this time of change where owners are encouraged to improve their existing boats or forced to invest in new boats for a different operation, a Kort nozzle system can be the simplest and most effective method of uprating performance and give economic operation.

Power with fuel economy – it's worth thinking about!

Acknowledgements

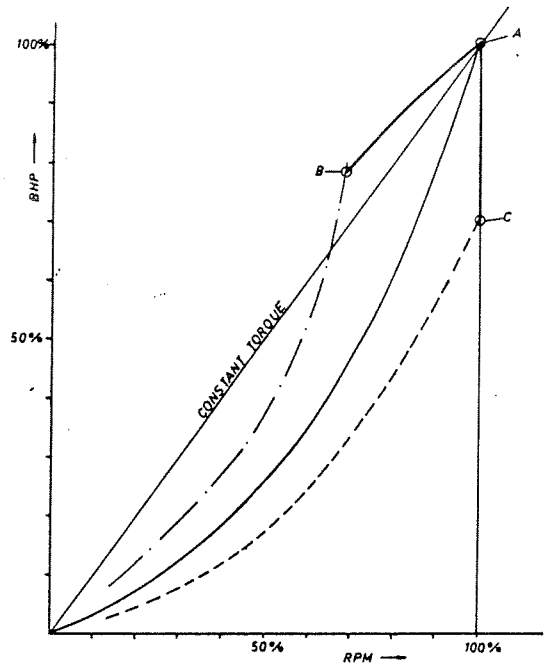
The opinions expressed in this paper are entirely my own although I am indebted to Kort Propulsion Co. Ltd. for access to design data, trial results and experience gained. Special thanks are due; to colleagues for constructive comments; to my wife for patience whilst writing this paper; to Sylvia Bellamy for the speed with which the manuscript was typed; and to the many boat owners whose often forthright comments bring practical reality to the designer.

Figure 4c. Kort nozzle. (Source: "Energy and Fish Harvesting" - DFO publication, p. 75)

4.3 Variable Pitch Propellers

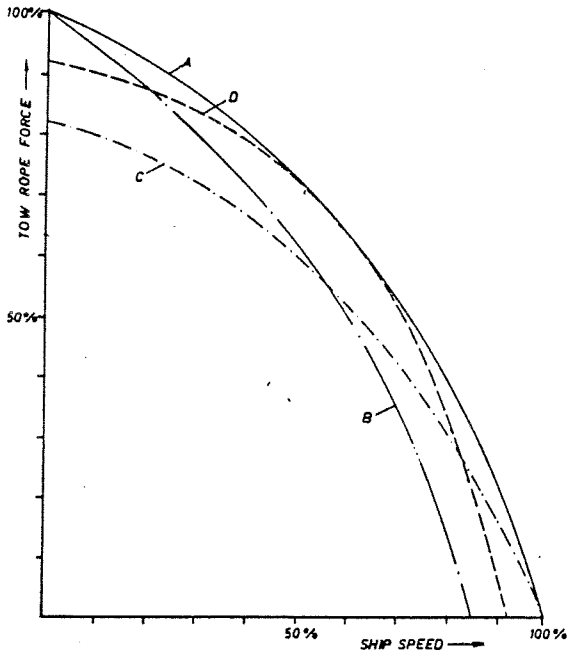
A variable pitch propeller can be adjusted to give maximum thrust and fuel efficiency at any speed (Figure 4d). Virtually every trawler over 100 feet is equipped with one but despite its obvious advantages, only one small trawler has one. There are two major reasons for this. The initial purchase and installation costs of a variable pitch propeller are much higher than a fixed propeller. Because the variable pitch propellers can sometimes become fouled with sand and other particulate matter, the maintenance costs can be significant.

WHY A CONTROLLABLE PITCH PROPELLER?



In a ship with a fixed pitch propeller the main engine load is varying with the different propulsion conditions. The full engine load at full RPM can only be achieved in one single condition (Fig. 1, Point "A"). At heavy conditions, caused by for example strong wind and sea, uncleaned hull or by tow rope pull, the engine will be overloaded (Fig. 1, Point "B"), with a corresponding decrease in engine RPM. At light conditions, however, the engine cannot be fully loaded and thus the maximum available engine power cannot be utilized (Fig. 1, Point "C").

With a controllable pitch propeller the pitch can be adjusted to give maximum propeller efficiency under all varying conditions. That means full utilization of the machinery at maximum efficiency without overload.



For ships where very different propulsion conditions are normal, for example tugs, supply vessels, trawlers and draggers, a controllable pitch propeller offers extreme advantages. Fig. 2 shows the propeller thrust (tow rope force) at different ship speeds with different propellers.

Curve B: Fixed pitch propeller designed for maximum bollard pull (Note: the extreme loss of full speed).

Curve C: Fixed pitch propeller designed for maximum free speed (Note: the decreasing thrust at lower speed).

Curve D: Fixed pitch propeller designed for a compromize between free speed requirements and bollard pull.

Curve A: Controllable pitch propeller. Maximum thrust at any speed, i.e. maximum pull at for example towing or trawling, as well as maximum speed at free running.

JW BERG

S-430 90 ÖCKERÖ - SWEDEN

Figure 4d. Variable pitch propeller - method of operation. (Courtesy of N.S. Dept. of Fisheries)

5.0 Electronics

5.1 Fishfinding Equipment (Sounders)

One of the first of the early echo sounders for fishing was known as the "Ekolite" (Figure 5a). This was a big improvement over the earlier "flashing" units (Figure 5b) which indicated depth only. The modern versions are still popular with some of the Digby scallopers probably because they require no paper and are relatively cheap to buy.

The "Ekolite" was partly made of war surplus parts and operated on a distributer sparking system. Echo recordings were made on wet paper that had been sensitized by a starch-iodide solution to discolour when an electrical impulse passed through it. A new version of this type of sounder is still used to fish herring on the Pacific coast because of its broad beam.

By the mid-1950s, two developments to the echo sounder were introduced. The first of these was the CRT or cathode ray tube, scale expansion unit. This "scope" or "lupe", translated from the German meaning magnifying glass, had the capability of expanding a section of the echo signal up to a maximum of 15 m at any depth from surface to bottom (Figure 5c). They were popular with the deep sea trawlers which commonly had the Elac fish "lupe" (Figure 5d). A combination CRT, dry paper recorder (Figure 5e) manufactured by Atlas, was introduced into Nova Scotia around 1955. Another Atlas machine, the Monograph 58 (Figure 5f), is an example of one of the first dry paper only sounders to be sold in Nova Scotia. It featured a larger format paper for easier viewing. Installation was simple. It was the most accurate

sounder to date since it had precision drive and an improved spark-gap transmitter.

The next major development was the white line innovation which allowed echos from fish to be recorded on the sounding paper above the bottom echos. Models such as the Simrad EH_2 (Figure 5g) which recorded on wet paper, operated using a transmitter audiopulse generated mainly by transistors. This made them more reliable and accurate than the earlier spark gap type. The white line saved strain on the eyes compared to the "lupe". The sensitivity of the receiver could be controlled by the operator (Figure 5h) which allowed skippers to change boats without having to refamiliarize themselves with a new echo sounder. This was an obvious advantage in fleet operations. They became the most popular type of sounder for the next decade (1962-72) after their introduction into the fishery in the Digby area.

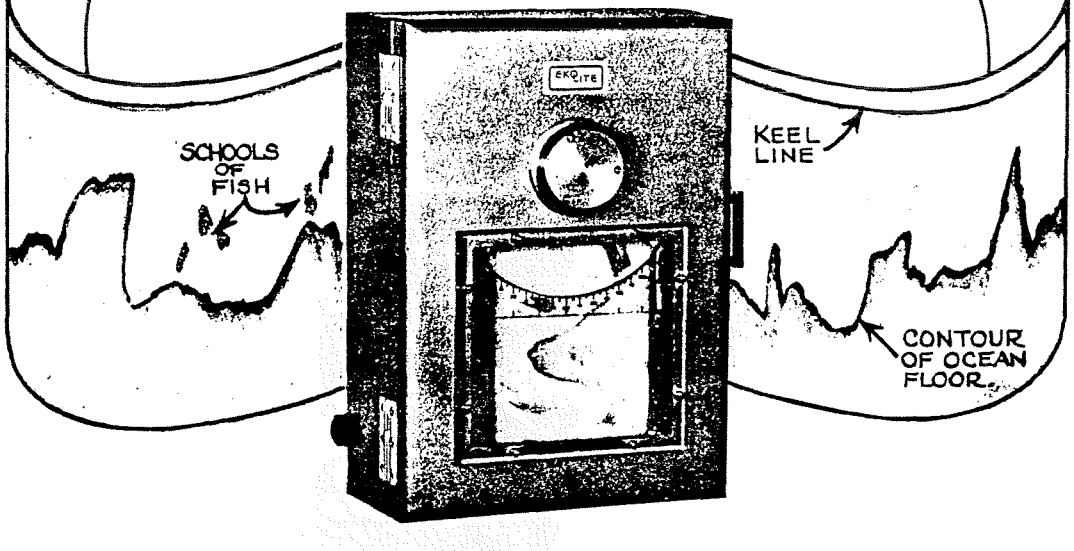
Later models e.g. the Simrad EQ gave basically the same performance as the EH_2 but wider (8 inches) dry paper instead of wet paper was used. The dry paper sensitivity was as good or better than the wet, allowing for the detection of temperature/plankton layers and even fish having no swim bladders e.g. mackerel. The Atlas Fischfinder 700, which had in addition to paper a CRT (Figure 5i), was very popular on National Sea and Nickerson trawlers.

The application of integrated circuits to echo sounders in the late 1970s made them more reliable, and reduced their physical size considerably. The commercialization of these sounders by Japanese manufacturers made very sophisticated machines affordable to the

smallest inshore fishing vessel e.g. Furuno model FE-400 (Figure 5j). Japanese-built sounders like the Skipper 802 (Figure 5k) offered equivalent performance to the early European-built models e.g. EH_2, EQ and soon became the standard type of paper sounder used on larger fishing vessels.

Since 1982, most vessels have replaced one of their paper-recording sounders with a colour unit e.g. Simrad CS112 (Figure 5l). The initial capital cost is about the same as a modern paper sounder but the savings on paper during operations can be significant. Cassette storage of sounder information is available but not currently utilized in the fishery. Fishermen claim that they can recognize certain species such as shrimp, dogfish, and pollock and distinguish bottom types from their specific colour patterns. The built-in microprocessor allows the picture to be "frozen" and held on the screen for closer study of details. As well, unwanted echos can be suppressed. The bottom expansion feature combines the best of the older "lupe" and white line sounders by expanding the area just above the bottom while distinguishing the fish echos from the bottom echos via colour differences. Safety improvements include depth and hard bottom alarms.

RECORDING ECHO SOUNDING EQUIPMENT
BY
EKOLITE



MODEL 40—GENERAL PURPOSE RECORDER

330 FATHOMS, SCALE READING 0-130 AND 100-230 AND 230-330. 45 SOUNDINGS PER MINUTE. PAPER SPEED 18 IN. PER HOUR.

MODEL 20—FAST SPEED RECORDER

265 FATHOMS, SCALE READING 0-65, 50-115, 100-165, 150-215 AND 200-265. 90 SOUNDINGS PER MINUTE. PAPER SPEED 36 IN. PER HOUR.

MODEL 100—SURVEY RECORDER

130 FEET, SCALE READING 0-130, 100-230, 200-330, 300-430 AND 400-530. 267 SOUNDINGS PER MINUTE. PAPER SPEED 58 IN. PER HOUR.

● These three models are within a reasonable price range, and are noted for economy of operation, compactness, and reliability. The Ekolite Recorder produces an instantaneous, permanent record of the ocean bottom in natural profile, and shows runs and ledges where fish are found, hidden reefs or shoals, wrecks, and feed as well as schools of fish. Estimates of size and tonnage may be made with this information, as well as accurate determination of depth below the keel. It is obvious how earnings can be greatly increased by enabling the fisherman to set his nets profitably.

● The recorder's value as a navigation aid and safety factor is apparent in fog or darkness, when bottom readings are compared with chart markings, and warning is given of underwater obstructions.

● The unit is of rugged construction, and can be quickly installed in any convenient place. It records soundings in graph form on constantly moving paper. Recorder components are housed in a non-corroding, splash-proof case, and are easily accessible by means of a hinged cover and removable case. A large plastic window reveals six inches of recorded paper. This paper is available in 75-foot spools and is easily placed in the airtight paper tank. In addition to the central phasing knob which changes the scale reading, the recorder has sensitivity and illumination brilliancy controls. A second small case houses the Voltage Control Unit which is comprised of OFF-ON switch to start or stop operation of the Sounder, a large, easy-to-read Voltmeter to indicate AC voltage output, a Rheostat to control DC voltage input, and fuse holder.

● All electronic components such as tubes, resistors, condensers, etc., are standard stock items, procurable anywhere.

● The Power Supply is a rotory converter, which changes the ship's DC battery voltage to 110 volts, 60 cycle AC. This output is fed to the Recorder Unit which is designed to consume 60 watts. Input voltages available are 6, 12, 24, 32 and 110 volts DC and battery drain is 75 watts. The unit is amply fused against overloads. Vibrator type power supplies are available on special order.

Figure 5a. Ekolite sounder. (Courtesy of Canadian Marconi Co.)

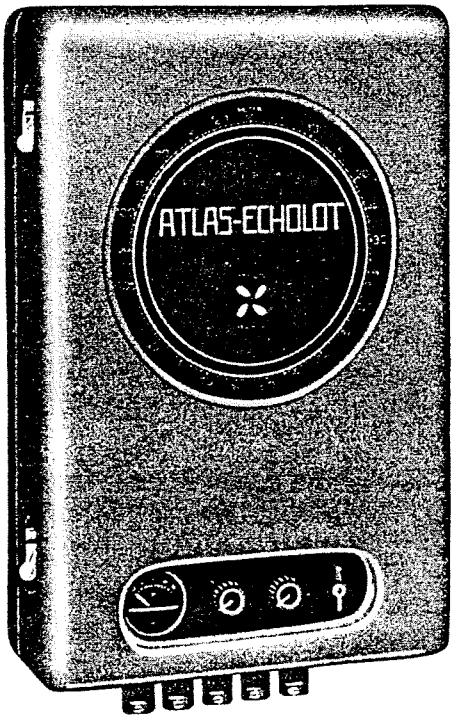
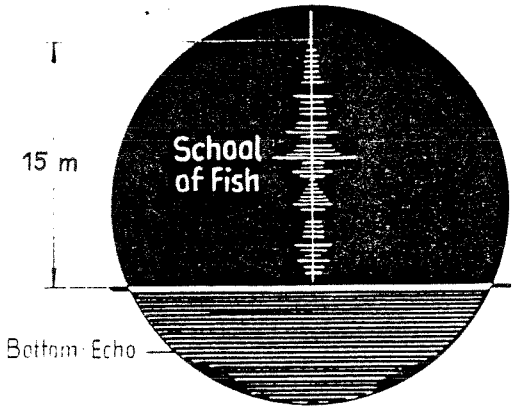


Figure 5b. "Flashing" type depth sounder. (Courtesy of Canadian Marconi Co.)



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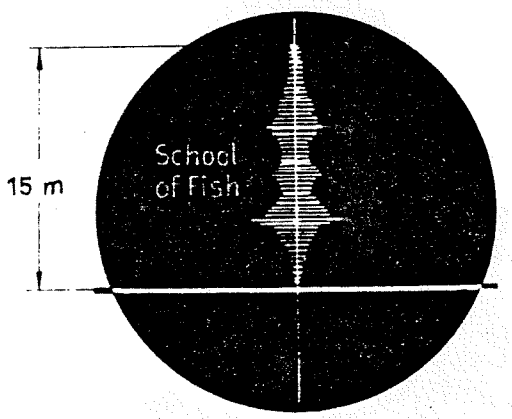

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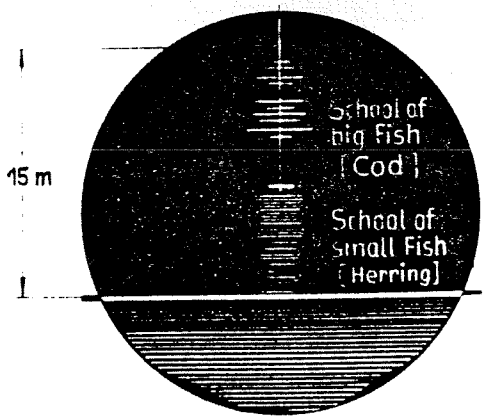

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Electroacustic G.m.b.H. Kiel

Figure 5c. Expansion capability of "lupe". (Courtesy of Canadian Marconi Co.)

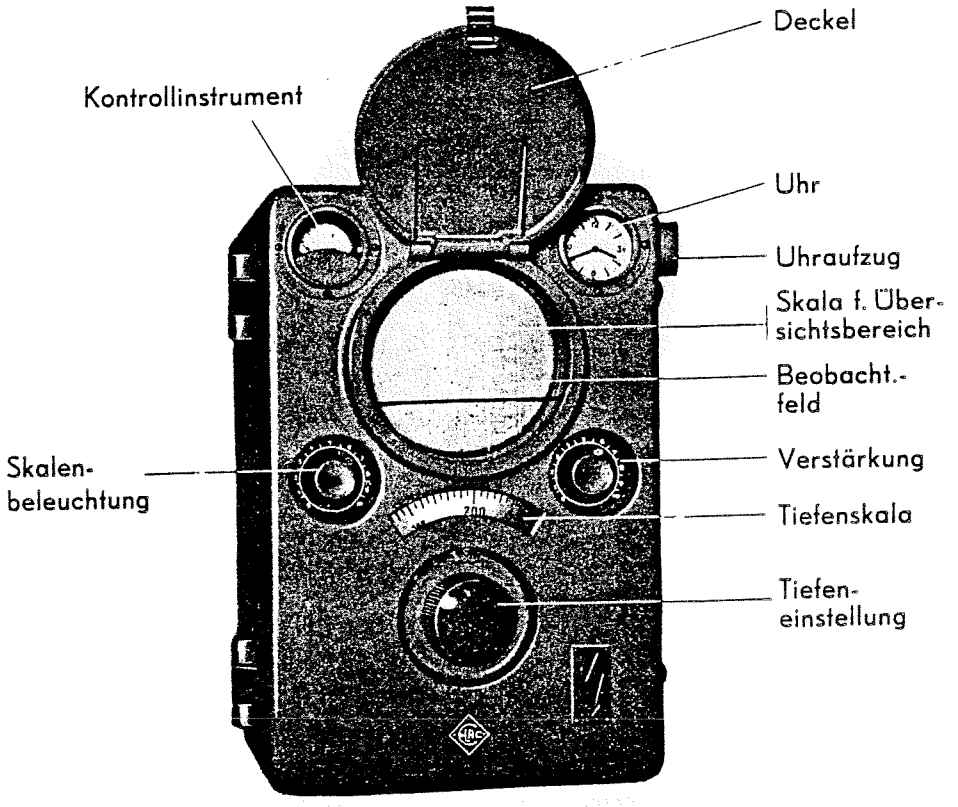


Figure 5d. Elac fish "lupe" sounder. (Courtesy of Canadian Marconi Co.)

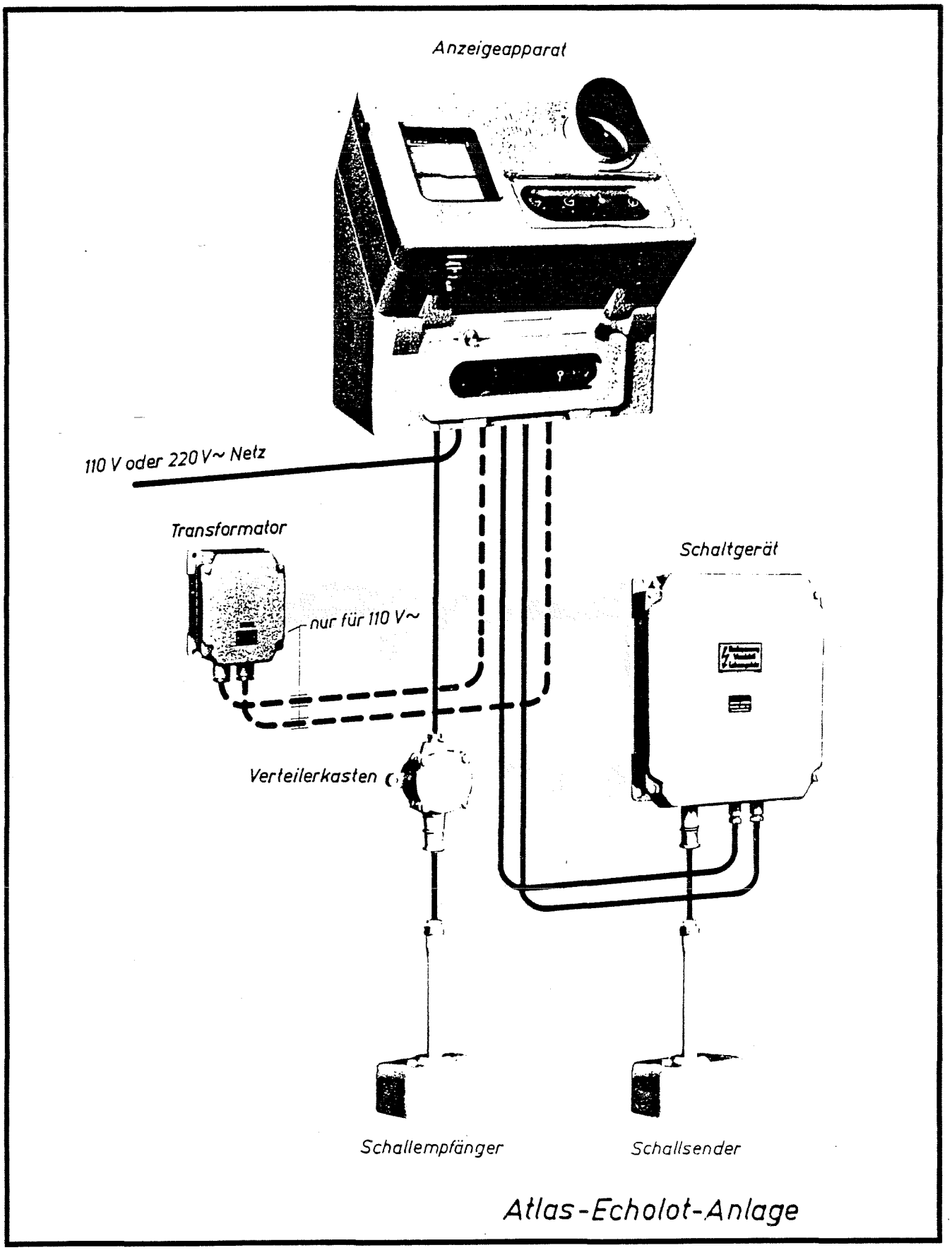
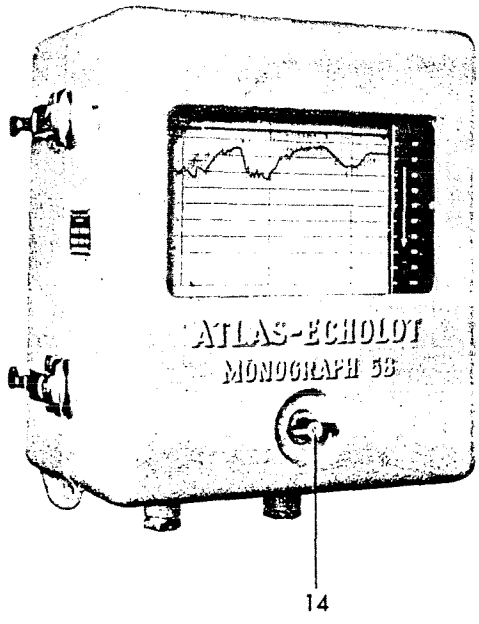


Figure 5e. Atlas - Echolot - Anlage sounder. (Courtesy of Canadian Marconi Co.)



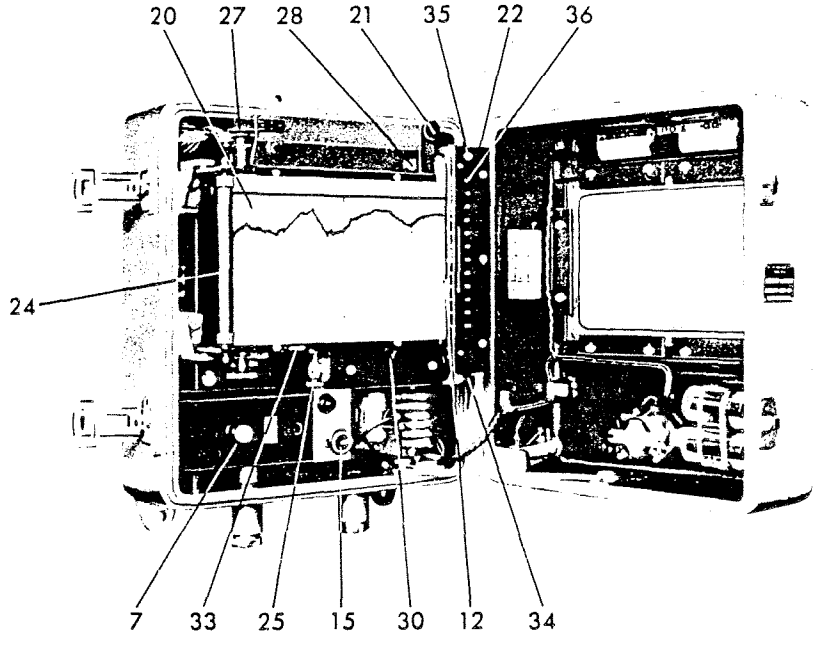


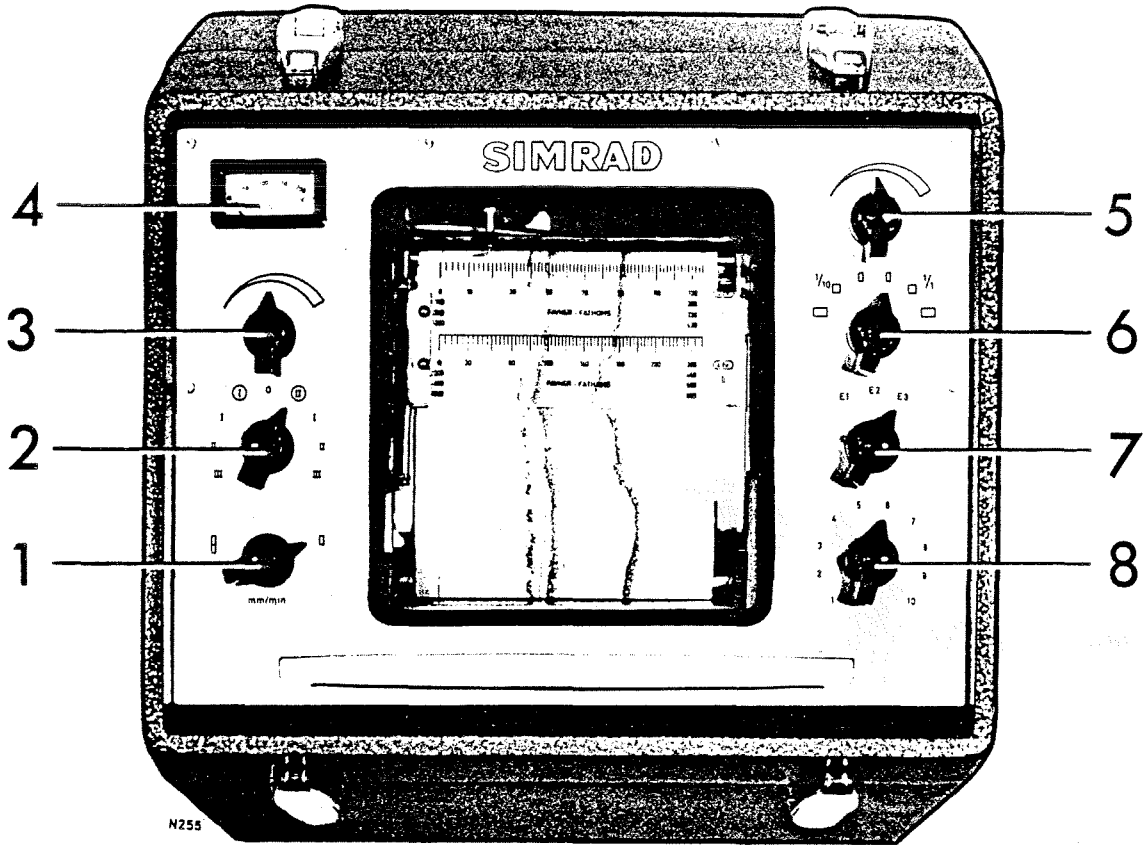
Abbildung F 138

Monograph 58

7	Abgeschirmter Eingang	25	Rändelmutter
12	Schreibgriffel	27	Einstellen des Papiervorschubes
14	Ein/Aus-Schalter	28	Fenster (Meßbereichziffer)
15	Verstärkungsregler A	30	Feineinstellen der Nullmarkierung
20	Streifenführung	33	Einstellen der Drehzahl (Bandumläufe)
21	Rändelschraube	34	Meßbereichschieber
22	Meßbereich-Skala	35	Feststellschraube
24	Papiertransportrolle	36	Fenster (m oder fm)

Figure 5f. Atlas monograph 58 sounder. (Courtesy of Canadian Marconi Co.)

OPERATING CONTROLS



1. PAPER SPEED SELECTOR
2. RANGE SELECTOR
3. MAINS SWITCH - VOLTAGE REGULATOR
4. VOLTMETER
5. DIMMER
6. POWER PULSE LENGTH SELECTOR
7. FUNCTION SELECTOR
8. SENSITIVITY CONTROL

Figure 5g. Simrad EH_2 sounder. (Courtesy of Canadian Marconi Co.)

E2

On the left hand side of the echogram the bottom trace is relatively coarse.
The function selector is in E2 position.

This shows that a rather large echo is necessary to fire the white line circuit.

The pulse length has been changed at intervals from 1 to 12 milliseconds.

E3

In the middle of the echogram the function selector is turned to E3. It is now evident that a smaller echo has fired the white line circuit.

The fish shoals near the bottom are clearly revealed by use of the white line.

E1

At right of the echogram the function selector is placed in its E1 position which is echo sounding without the white line.

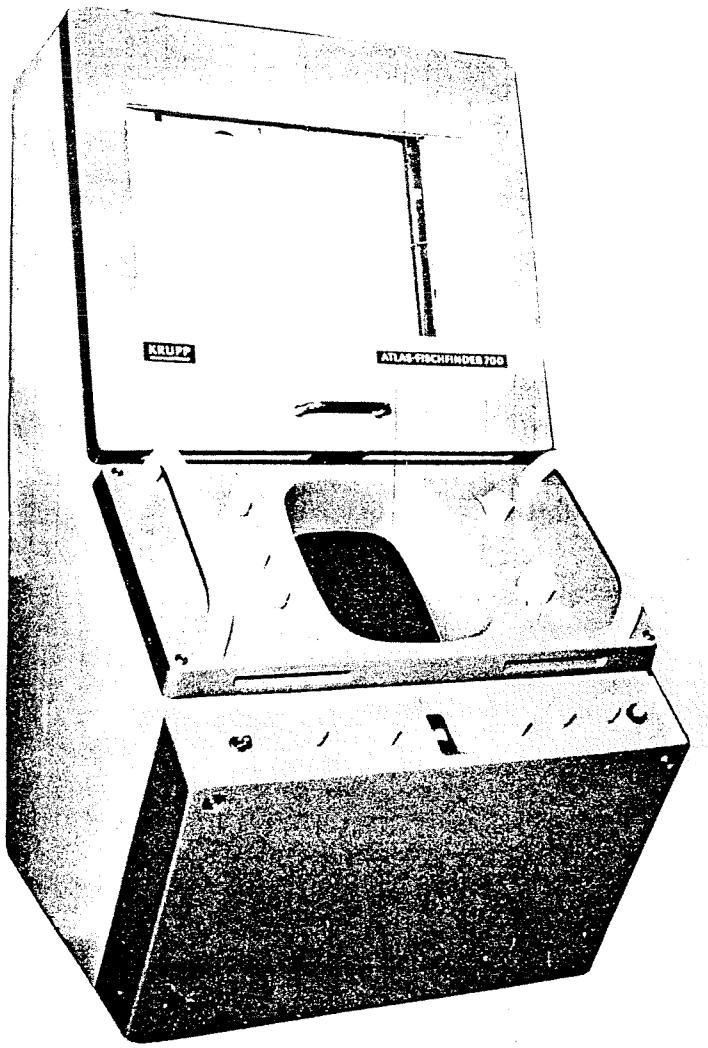
AUTOMATIC SUPPRESSION CIRCUIT

The EH sounder is fitted with an automatic initial suppression circuit.

In the upper layers of the sea the receiver amplification is reduced to avoid the recording of plankton and other unwanted organisms.

The effect of this circuit is seen right below the zero line on the echogram.

Figure 5h. Sensitivity control - Simrad EH_2. (Courtesy of Canadian Marconi Co.)



ATLAS-FISCHFINDER 700

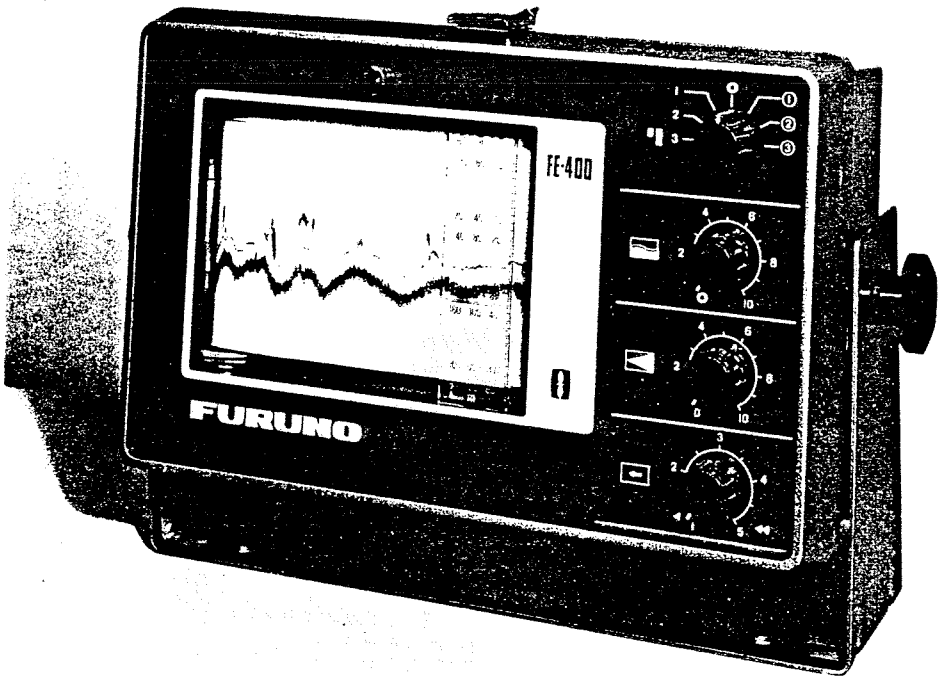
Anzeigegerät
INDICATOR
AZ 6015

Figure 5i. Atlas fishfinder 700 sounder. (Courtesy of Dolphin Electronics Ltd.)

FURUNO®

NEW STANDARD OF INEXPENSIVE ECHO SOUNDER

MODEL FE-400



* **Low cost with great reliability and performance.**
* **Attractive, compact and handy design.**
* **Linear recording for easy depth readouts.**
* **Rugged die-cast aluminum housing.**
* **Three types to offer the best choice of depth range and ultrasonic frequency.**
* **High power, high sensitivity.**
* **White Line, TVG, Adjustable Paper Speed, Zero-Line Shift.**

The FE-400 is a new standard, low cost fish finder for coastal fishermen. Attractive, rugged die-cast aluminum cabinet is splashproof and ensures commercial reliability in severe marine environments. Trunnion bracket affords flexible installation anywhere, with an adjustable viewing angle. Detachable front window permits easy access to the paper and zero-line shift control.

The 100 mm (4") wide dry paper with a linear recording mechanism produces easy-to-read echograms of fish schools and seabed. The paper speed is continuously adjustable - slow speed for economical use and fast speed for detailed underwater observation.

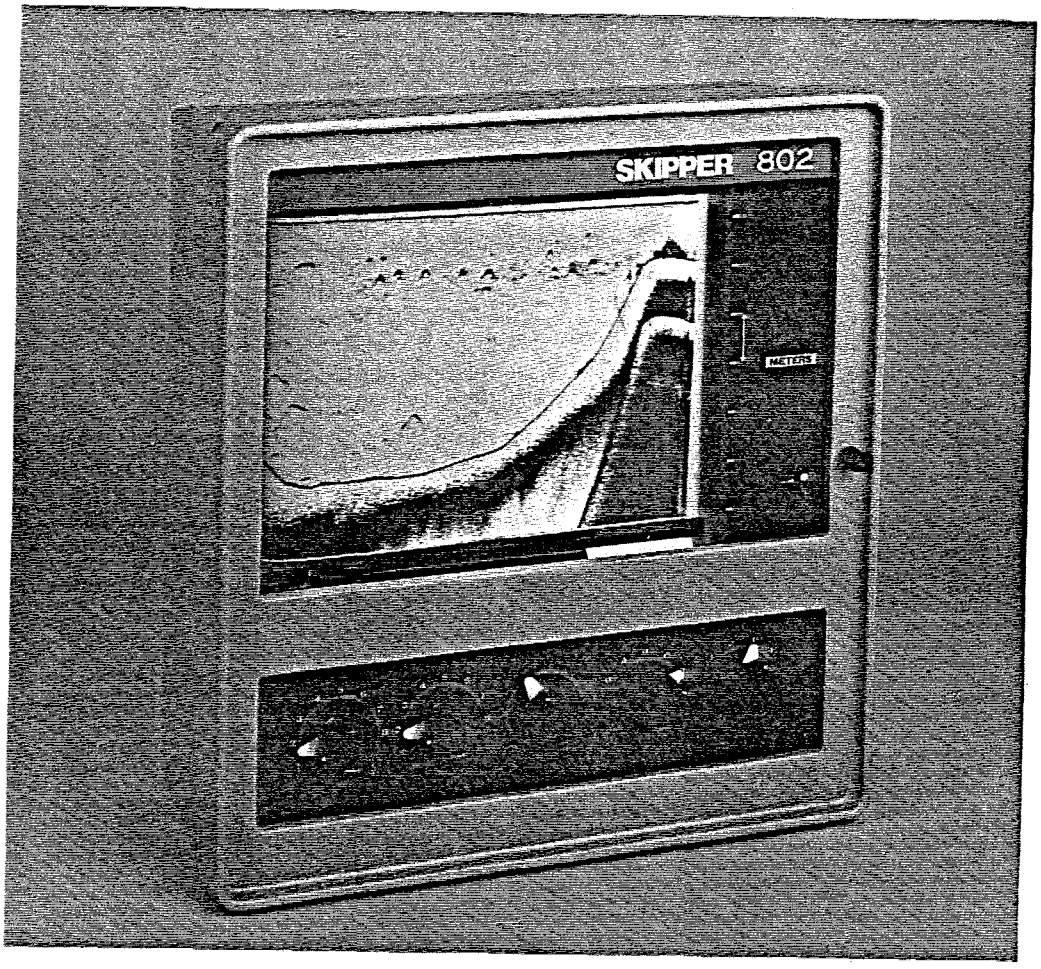
Choice of 3 types is available to suit your specific requirements. The type A ranges to 90 fathoms, B to 120 fathoms, and C to 240 fathoms, the transducer frequency being 200 kHz or 50 kHz in type A and B, and 50 kHz in type C. Readout scale is calibrated in meters, fathoms or feet whichever you need.

The FE-400 operates on a high power of 100W. The amplifier is a highly sensitive design based on the proven FE-500 sounder. It is furnished with all necessary controls found only in more expensive equipment, i.e., "white line" to detect bottom fish, "TVG" to effectively suppress surface noise, "zero-line shift" to offset ship's draft and enable re-use of paper.

The FE-400 operates on DC12V, and for DC24 or 32V operation, the power adaptor is available for installation in the recorder unit. The equipment comes complete with the transducer, spare parts and accessories.

Figure 5j. Furuno model FE-400 sounder. (Courtesy of Dolphin Electronics Ltd.)

SKIPPER 802 Echosounder



SKIPPER 802. The echosounder for professional fishermen who need a reasonably priced top performance echosounder.

- Skipper 802 features 8 inch recording paper.
- 4 basic ranges - 60, 120, 300, 600 meters.
- Phaseable down to 2100 meters.
- Digital scale indication and exact bottom depth
- 750 Watts minimum power to the transducer.
- Pulse length, paper speed, receiver gain and STC/TVG - all continuously variable.

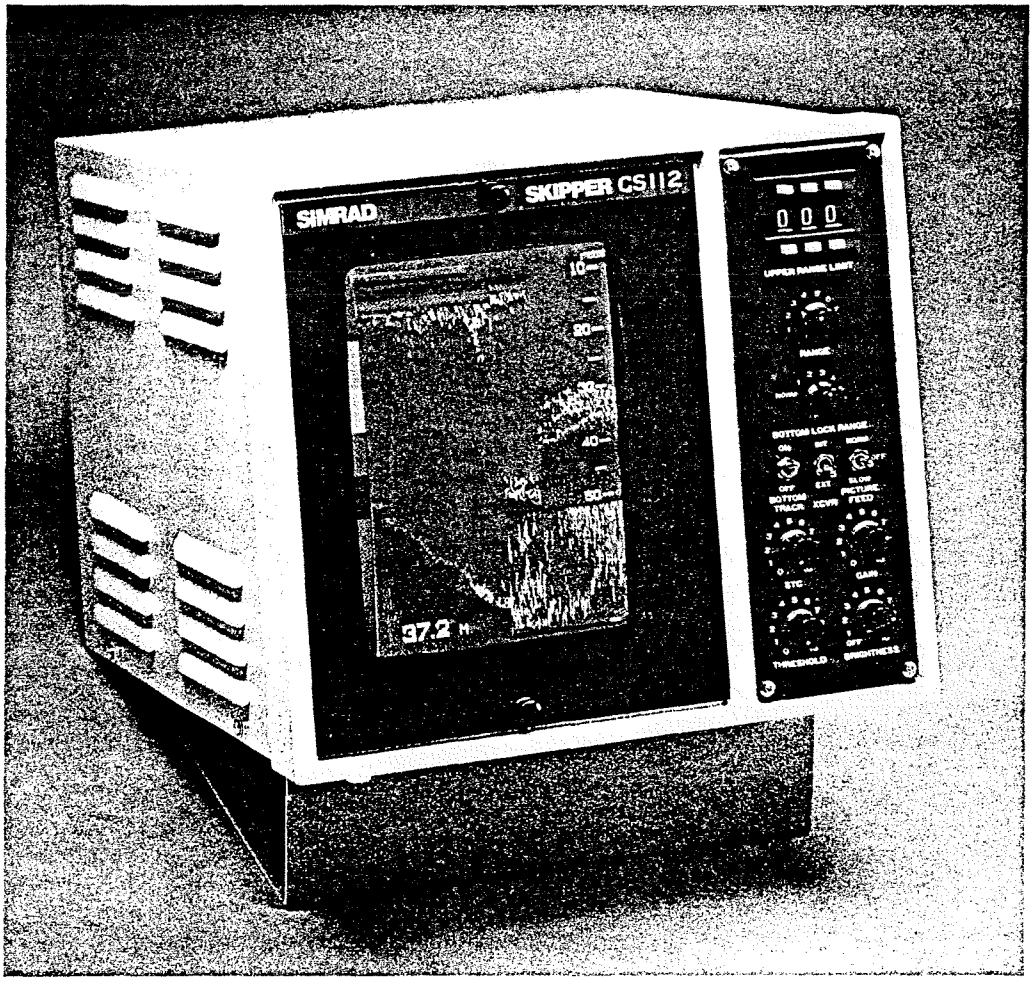
SKIPPER 802 is a refined tool for detailed echosounder information from fish and bottom exactly for your needs, your particular way of fishing. The modern splashproof cabinet is designed for installation on bulkhead or in panel. The Skipper 802 has meter, foot, fathom scales. Switchable to your local applications.

The echosounder's digital bottom depth readout may be operated even when the recorder is switched off.

SKIPPER 802 operates from all DC voltages between 10,5 and 48 volts and 220 V AC.

Figure 5k. Skipper 802 sounder. (Courtesy of Dolphin Electronics Ltd.)

SKIPPER CS 112 Colour Sounder



SKIPPER CS 112 colour sounder emphasizes the practical fishfinding details needed in a small fishing boat, it needs a minimum of adjustments while fishing.

- The compact cabinet fits into the smallest wheelhouse.
- 8 inch CRT colour screen with excellent discrimination.
- 8 different colours in a scale from red (strong echoes) to light blue (weak echoes) give an easy-to-read picture of fish size, quantity and bottom conditions.
- Weak, unwanted echoes may be suppressed. the picture which "means money" is then clearly seen.
- 8 ranges from 10 to 1280 metres (corresponding in fathoms, feet and brazzias) may be phased down 999 metres in 1 metre steps. The range is measured to the top of the screen.
- Pulse lengths are automatically selected to the range in use.
- Bottom track with automatic phasing keeps the bottom echoes locked to the lower half of the screen. When the depth changes and the bottom moves out of the displayed range, the range is automatically phased up- or downwards.
- The picture may be "frozen" and held on the screen for closer study of details. The depth is still continuously beeing displayed digitally on the screen.
- The area just above the bottom may be expanded and presented on the lower 1/3 of the screen. The expanded area may be from 2 to 40 metres in height. The normal picture is reduced in size and presented on the upper 2/3 of the screen.
- Transmitting power is 800 Watts. This may be reduced in 4 steps to 1/125 of full power.
- Self test for all main functions of the echosounder and its microprocessor.

Figure 51. Colour sounder. (Courtesy of Canadian Marine Ltd.)

5.2 Navigational Equipment

Until the 1950s, the ability to find one's position accurately on the fishing grounds was gained by long experience, by detailed observations of depth, landmarks, type of bottom, wind, tide, and course and distance run. With the introduction of Decca and Loran-A navigational systems to eastern Canada the fisherman's job became a lot easier.

5.2.1 Decca

The Decca Navigator, which was developed in the United Kingdom, is a continuous wave system with a number of frequencies in the 70-130 KHz band, that measures the phase difference in signals from three shore stations. The precision of position fixes was about 300-400 metres within a working distance of 0-200 kilometres from the shore. Outside this range, the precision became worse. Reception trouble often occurred at dawn and dusk. The modern version of the instrument is housed in one unit (Figure 5m) compared to the three units (receivor, indicator unit, and converter) of the older version (Figure 5n). The Nova Scotia chain closed 31 March 1982.

THE MARK 21

SOLID STATE ELECTRONICS

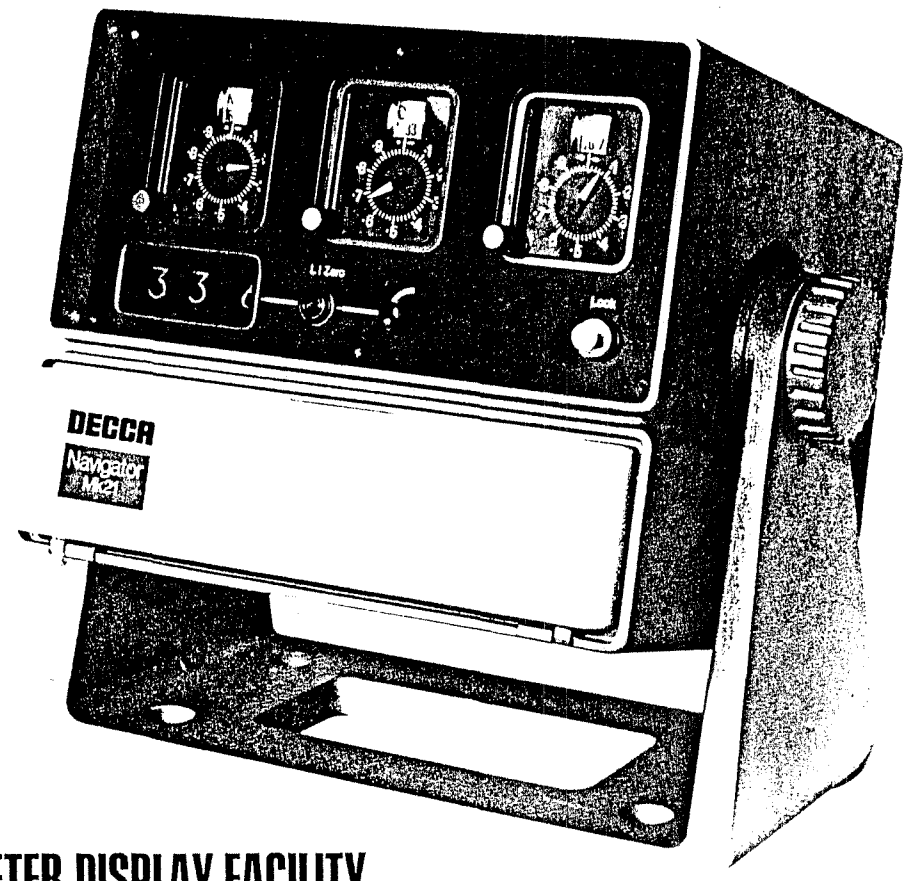
COMPACT SINGLE UNIT

LOW POWER CONSUMPTION

SPECIAL CIRCUITS FOR HIGH NOISE LEVEL PERFORMANCE

DIGITAL LANE IDENTIFICATION

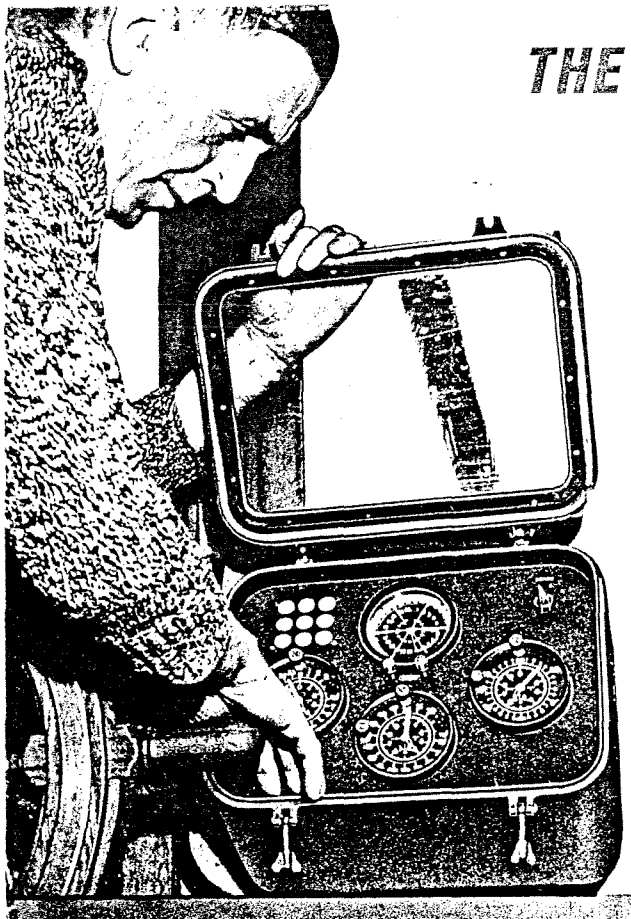
EASY INSTALLATION



PLUG-IN TRACK PLOTTER AND REMOTE DECOMETER DISPLAY FACILITY

OPTIONAL BINARY OUTPUT OF 'MULTIPULSE' READINGS FOR AUTOMATED NAVIGATION SYSTEMS

Figure 5m. Decca Navigator - modern unit. (Courtesy of Racal-Decca Ltd.)



THE DECCA NAVIGATOR the

Here is an aid to fishing which pays its way over and over again and which takes its place among the great advancements in fishing vessels' equipment. It requires no special knowledge to operate and can be used successfully after instruction of only an hour or so. It is fitted in over 1700 fishing vessels of all types including deep sea and middle-water trawlers, drifters and small wooden seiners.

The Decca Navigator is robust, reliable and simple to operate and enables you to fish with a precision never before possible, resulting in increased catches, fuel savings and reductions in gear losses. It operates in conjunction with land transmitting stations and enables fixes to be obtained whenever required in a matter of seconds, everywhere within range of the stations. All the important middle-water fishing grounds are covered in North-West Europe and recently coverage has been provided over the fishing grounds of Newfoundland and Nova Scotia.

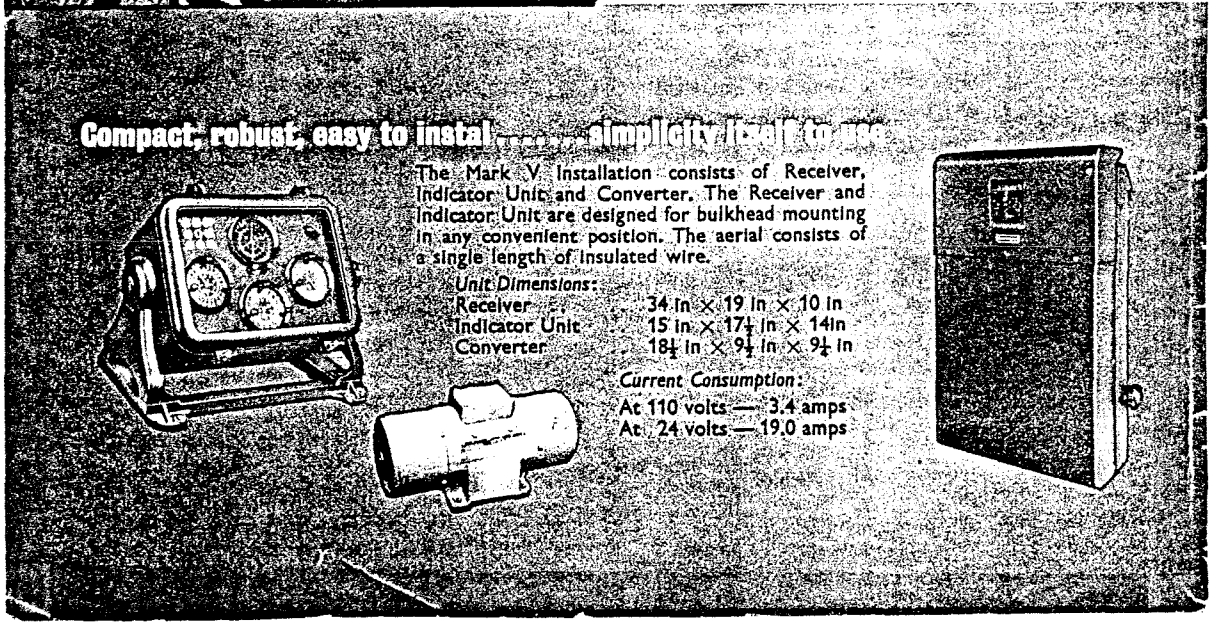


Figure 5n. Decca Navigator - older unit. (Courtesy of Racal-Decca Ltd.)

5.2.2 Loran-A

Loran-A, developed in the U.S., was a high frequency (1900 KHz), skywave tracking, pulsed system. Although its range was somewhat greater than Decca's, its position fixing was much less precise, in the order of 2 to 3 km. Like Decca, the operation of Loran-A was affected by weather particularly at the limits of its range. It became non-functional as of 31 December, 1983. Both Decca and Loran-A were replaced by Loran-C.

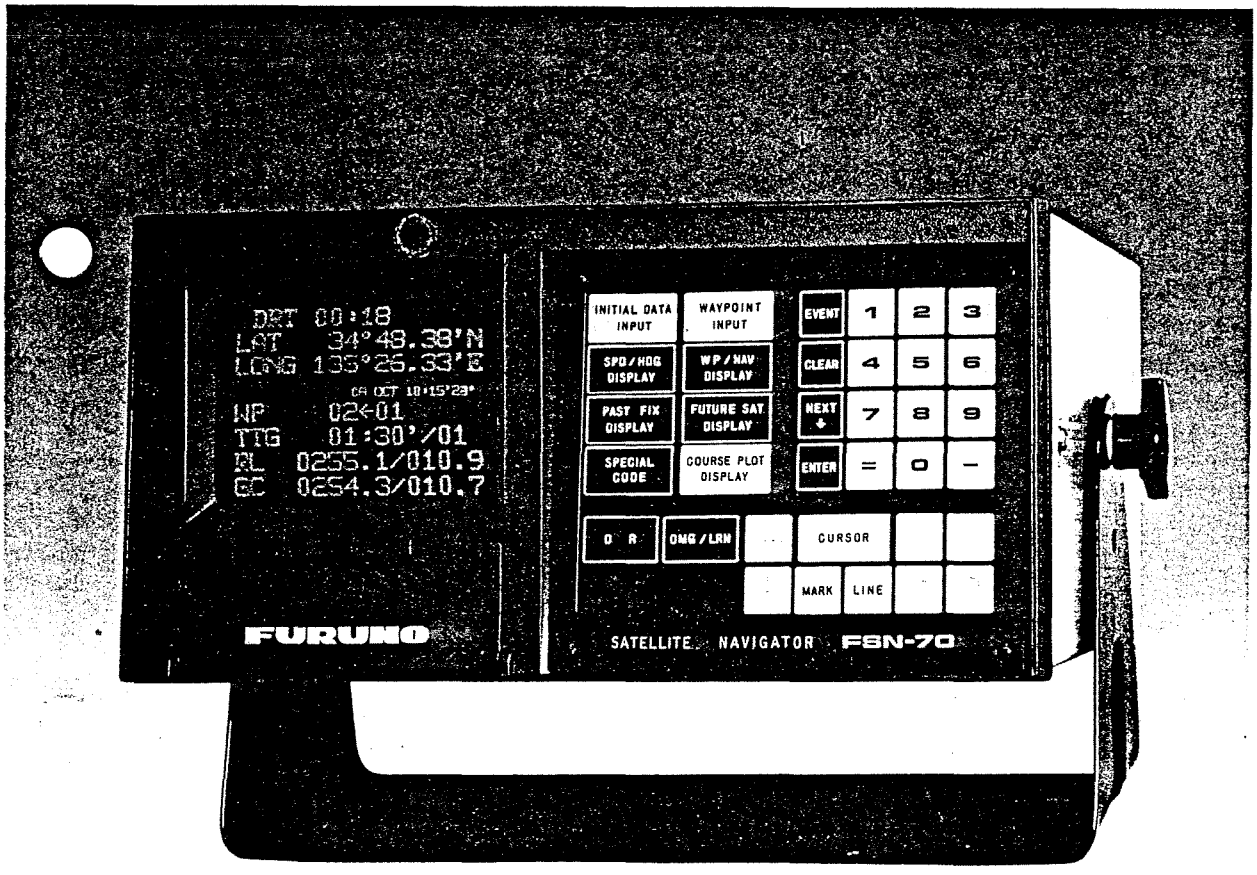
5.2.3 Satellite Navigation

During the late 1960s, satellite navigation was put into place by the U.S. Navy. The system at present consists of four OSCAR and one Nova satellites. Each satellite is in a circular, polar orbit at an altitude of 1000 km. A position fix by a fishing vessel for example can only be taken when the satellite tracks overhead which means a fix intermittently every few hours. For this reason, it is not popular with fishermen who need continuous position information during a tow. Some fishermen use it (Figure 5o) as a back-up navigational aid for safety reasons.

FURUNO®

ALL-WEATHER GLOBAL SATELLITE NAVIGATOR

Model FSN-70



Advanced transit satellite navigator including all possible navigation information for safety and efficiency at sea.

The FSN-70 fulfills the U.S.C.G. requirements on vessels 1600GT or more for carriage of electronic position fixing devices. (U. S. FEDERAL REGISTER 33 CFR Part 164.41 (d))

Catalogue No. N-810

The future today with FURUNO's electronics technology

FURUNO ELECTRIC CO., LTD.

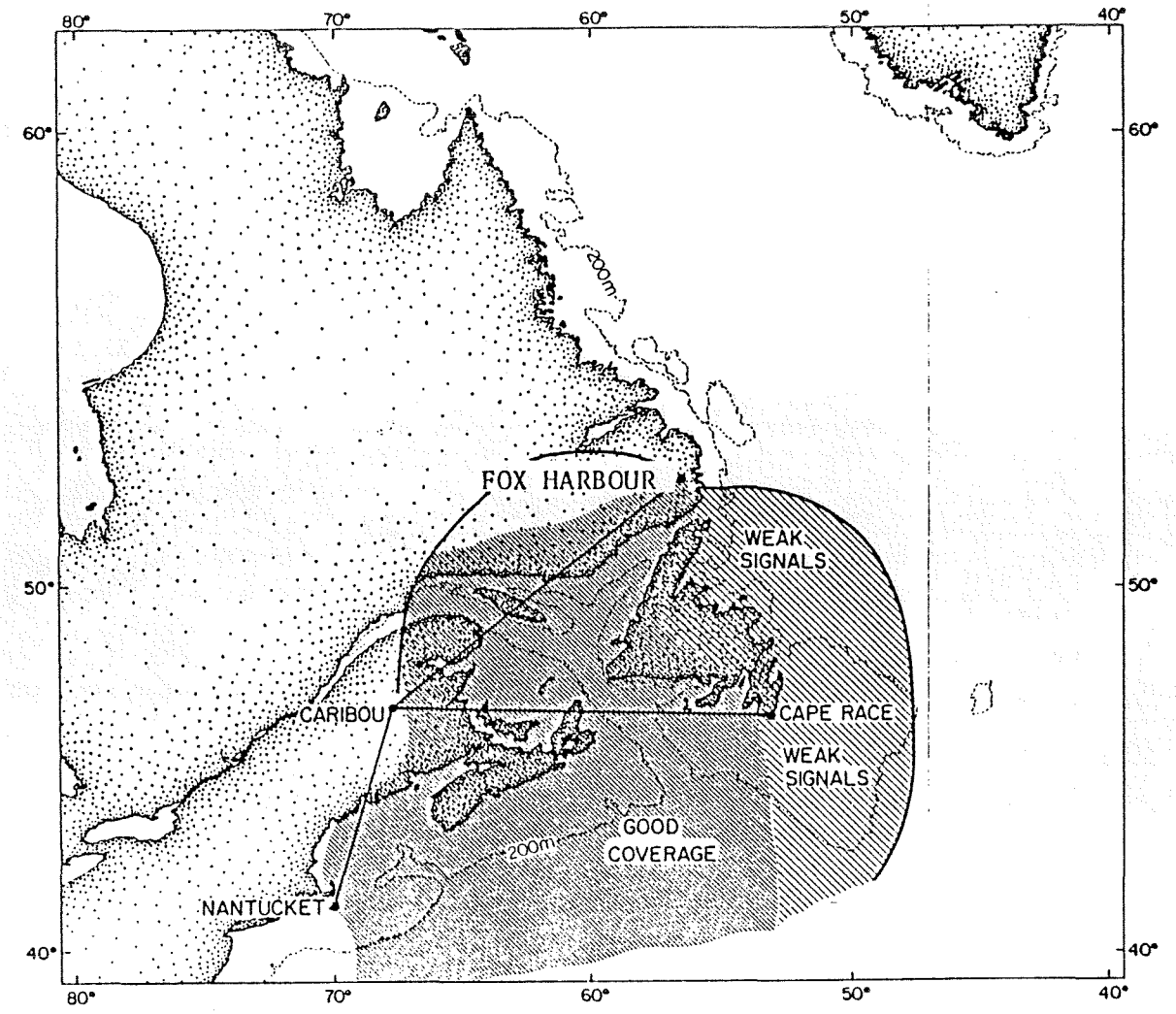
9-52, Ashihara-cho, Nishinomiya City, Japan

Cable: FURUNO NISHINOMIYA, Telex: 5644-325

Figure 5o. Satellite Navigator. (Courtesy of Dolphin Electronics Ltd.)

5.2.4 Loran-C

Loran-C coverage in eastern Canada commenced in 1979 and with the commissioning of the Fox Harbour station in January, 1984 consists of three chains. Of these the Canadian east coast chain is the most useful in Nova Scotian waters (Figure 5p). Loran-C is a low-frequency, ground pulsing system. Because of this, its range (1000 km) is much greater than either Decca or Loran-A. Using coordinate convertors, the output from the Loran-C instrument can provide a direct readout of latitude and longitude (Figure 5q) therby eliminating the need for special charts. It can be interfaced with other navigational equipment such as autopilot, video plotters, and paper plotters.



CANADIAN EAST COAST CHAIN 5930 (SII7)

("Weak Signals" means that cycle errors may occur.)

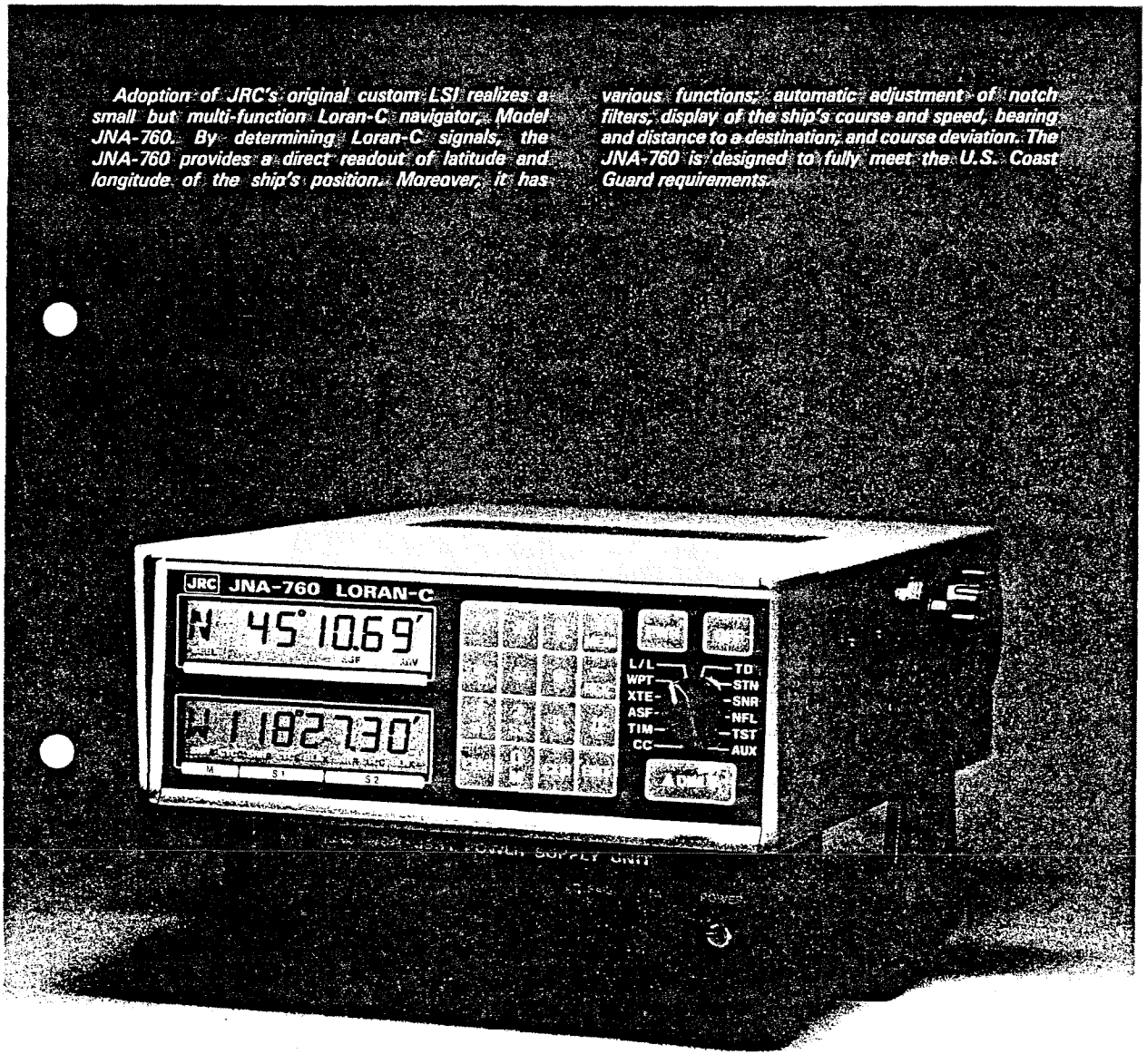
Figure 5p. Loran-C, Canadian east coast chain. (Courtesy of Canadian Hydrographic Service)

Small, but Multi-function with a High Positioning Accuracy to Meet U.S.C.G. Requirements.

JRC FULLY AUTOMATIC LORAN-C NAVIGATOR

JNA-760

Adoption of JRC's original custom LSI realizes a small but multi-function Loran-C navigator, Model JNA-760. By determining Loran-C signals, the JNA-760 provides a direct readout of latitude and longitude of the ship's position. Moreover, it has various functions; automatic adjustment of notch filters, display of the ship's course and speed, bearing and distance to a destination, and course deviation. The JNA-760 is designed to fully meet the U.S. Coast Guard requirements.



JRC Japan Radio Co., Ltd.

Figure 5q. Loran-C unit. (Courtesy of Canadian Marconi Co.)

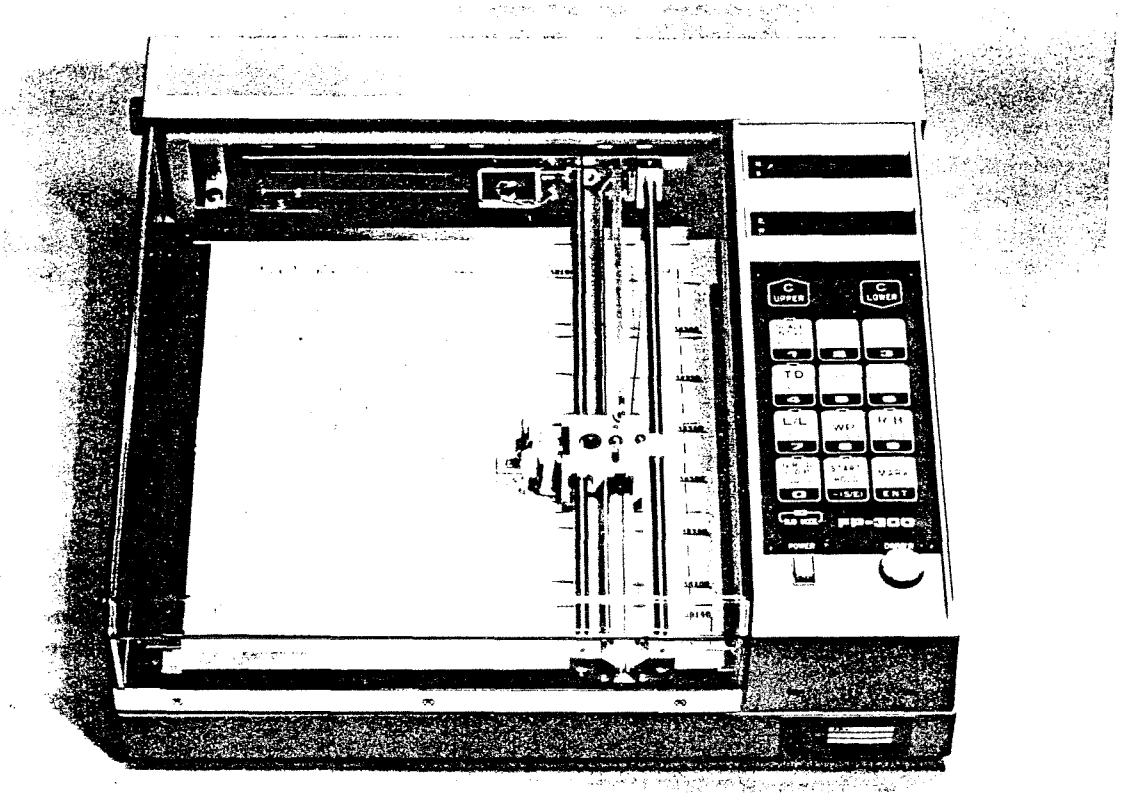
5.2.5 Plotters

Plotters have been available since the 1950s. A hard copy plotter could be linked to the early Decca Navigators and often was on the large trawlers. However only in the last 3 or 4 years has their popularity become widespread. Paper plotters such as the Furuno FP-300 (Figure 5r) have been sold exclusively to date since the colour video type e.g. Furuno GD-170
(Figure 5s) has only recently been advertised. Usually they are connected to a Loran-C receiver. As regards fishing the start, destination, and other event positions along a tow can be plotted. The resulting permanent record of the tow course facilitates retracing the tow or avoiding a previously discovered obstacle.

FURUNO®

With built-in Loran coordinator **COURSE PLOTTER**

Model FP-300



- Built-in processor converts Loran TD data into Latitude/Longitude position.
- Pinpoint accuracy by digital control and precision mechanism.
- Event marks and waypoint marks.
- Blank paper, loran chart or navigation chart with various scales.
- L/L grids and Loran LOP's are automatically drawn with any selected interval.
- Easy to find the course-to-steer avoiding navigation dangers.
- Saves fuel consumption.
- Avoids refishing the same ground.
- Wide coverage up to 1400 n.m. square.
- Dimmerable lighting for nighttime operation.
- Easy-to-operate touchpad controls.
- Data are preserved in memory by the back-up battery.

Connected with FURUNO Loran Receiver LC-200 or LC-200 Mark-II, the Course Plotter model FP-300 indicates own ship's position in latitude/longitude converted from GRI and TD data fed from the receiver.

Ship's course is continuously plotted in a north-up format on a blank paper, loran chart or standard navigation chart with any scale between 1/1,000 to 1/9,999,000. When the blank paper is used, L/L grids and Loran LOP's are automatically drawn with any selected interval. Other functions include range and bearing display to destination, approach alarm and ground speed and true course display.

Plot start, destination and event positions are marked to ensure the utmost labor saving and navigational safety under any weather condition. The event marks are instantly drawn by pressing MARK touchpad (in the L/L function mode only). This will facilitate to retrace lobster or crab pots.

Data on scale, plot interval, chart interval, chart area etc. are preserved in memory by the backup battery when the main power is switched off.

Figure 5r. Paper plotter. (Courtesy of Dolphin Electronics Ltd.)

FURUNO

COLOR VIDEO PLOTTER

Model GD-170

- Visual readout of Own Ship course, navigation marks in 7 colors.

  Compact cabinet containing 10" color screen.

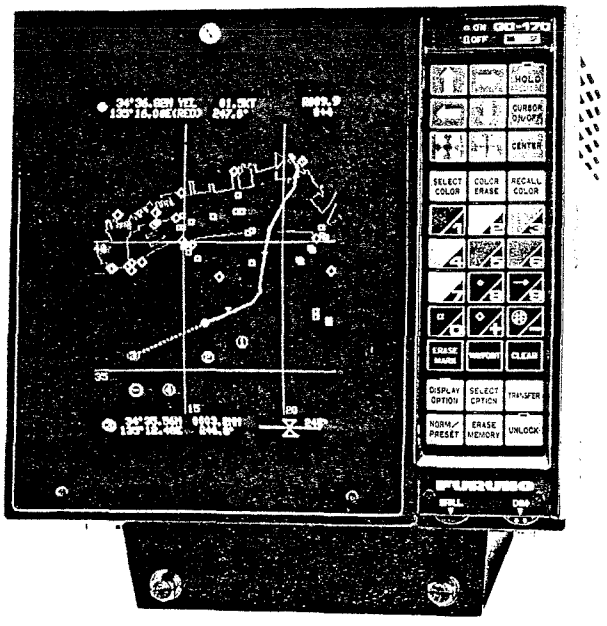
- Works together with a FURUNO Loran (LC-70/80), Satnav FSN-70

- Memory capacity 1000 points.

- Optional memory board providing 3 pages (1000 points/page) of free use plus up to 6 pages of map data (1000 points/page/ROM).

- Easy entry of up to 10 waypoints.

- Water temperature and depth can be displayed with optional interface.



The GD-170 is a compact, inexpensive visual plotting instrument. Connected with the FURUNO satnav, loran or satnav-omega hybrid, the Video Plotter GD-170 automatically plots the course of own ship with the accuracy of the navigator used.

Visual plotting not only facilitates positioning but can greatly increases safety of voyage and efficiency of fishing. Navigation dangers, waypoints and other event positions can be easily marked by adjusting the cursor lines.

Courseline, event marks, waypoint marks, etc. can be drawn in 7 colors. Any specific color plotting can be erased or recalled at will. The data is stored by the built-in backup battery when the equipment is switched off.

The standard memory capacity includes 1000 data points. This capacity is generally enough for operation in a local area, but for a special case requiring more data points or storage of complicated water areas, the optional RAM/ROM memory board is available to fit in the cabinet.

This memory board offers the storage of 3 pages of operator-entered data and up to 6 pages of nonvolatile map data. The former 3 pages accept the transfer of the current plotting data. PROM chips for the latter 6 pages can be ordered from FURUNO on necessary water areas. Any of 9 pages can be superimposed with the current plotting data.

Figure 5s. Colour video plotter. (Courtesy of Dolphin Electronics Ltd.)

5.2.6 Radar

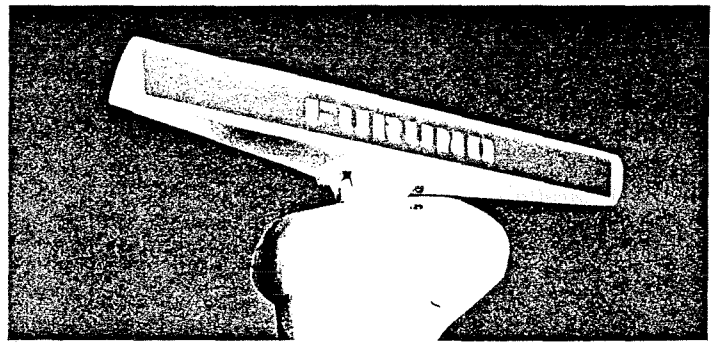
Prior to the introduction of colour radar in the early 1980s, radar equipment had undergone mostly internal improvements. Gradual replacement of bulbs by transistors in the late 1960s and transistors by integrated circuits in the late 1970s contributed to the development of smaller, more reliable, and lower cost units. Modern radar systems are made up of a scanner unit usually mounted outside on the superstructure of the vessel and a display unit in the wheelhouse (Figure 5t).

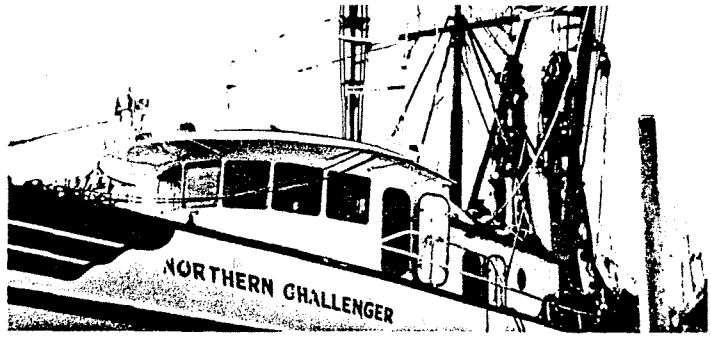
Colour radars (Figure 5u) contain a microprocessor so that the picture on the screen can be temporarily frozen making it easier to measure the bearing and distance of targets electronically. In addition, the course of targets can be plotted as they proceed across the screen. The multicoloured, continuous picture can be seen at a glance in daytime without the viewing hood necessary in the "scanning" type (Figure 5t) radars. The "scanning" type is by far the most popular on fishing vessels. This may be due to familiarity or perhaps because colour radar is relatively new on the market.

Stamina in a Small Radar

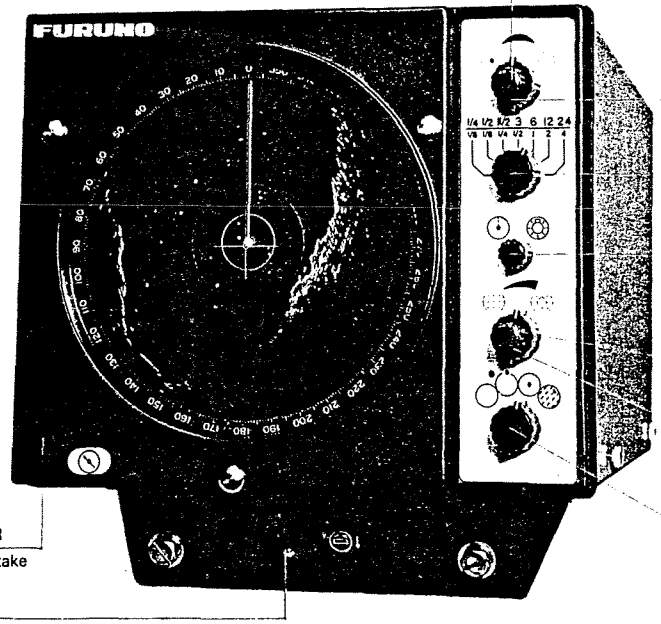
FR-240 MARK-III ANTENNA

Antenna and X-Band microwave transceiver are combined in this good looking, lightweight and waterproof cast aluminum housing for maximum signal power. High 24 rpm rotation rate renews display every 2.5 seconds to maintain a bright image. The same antenna unit is used in the FR-240 MARK-III and FR-360 MARK-II.





EASY TO OPERATE AND MAINTAIN



BRILLIANCE RANGE RINGS
Adjusts picture brightness. Pulling this knob provides range rings on the screen.

TUNING
Fine tunes receiver for best target definition

RANGE SELECTOR
7 ranges - 1 4 to 24 n.m.

PANEL DIMMER HEADING
Adjusts illumination of front panel escutcheon plate and bearing scale. Pulling this knob turns off heading marker.

STC (Anti-Clutter Sea)
Reduces undesired sea return in rough weather

GAIN
Adjusts system for optimum sensitivity

FUNCTION SWITCH
- Radar Off
- Power on, standby
- Transmitter On
- FTC (Auti-clutter rain) reduces rain/snow return.

BEARING CURSOR
Rotates cursor to take relative bearings.

SCANNER
Turns on/off antenna rotation

Figure 5t. Standard radar set-up i.e. transceivor and display unit. (Courtesy of Dolphin Electronics Ltd.)

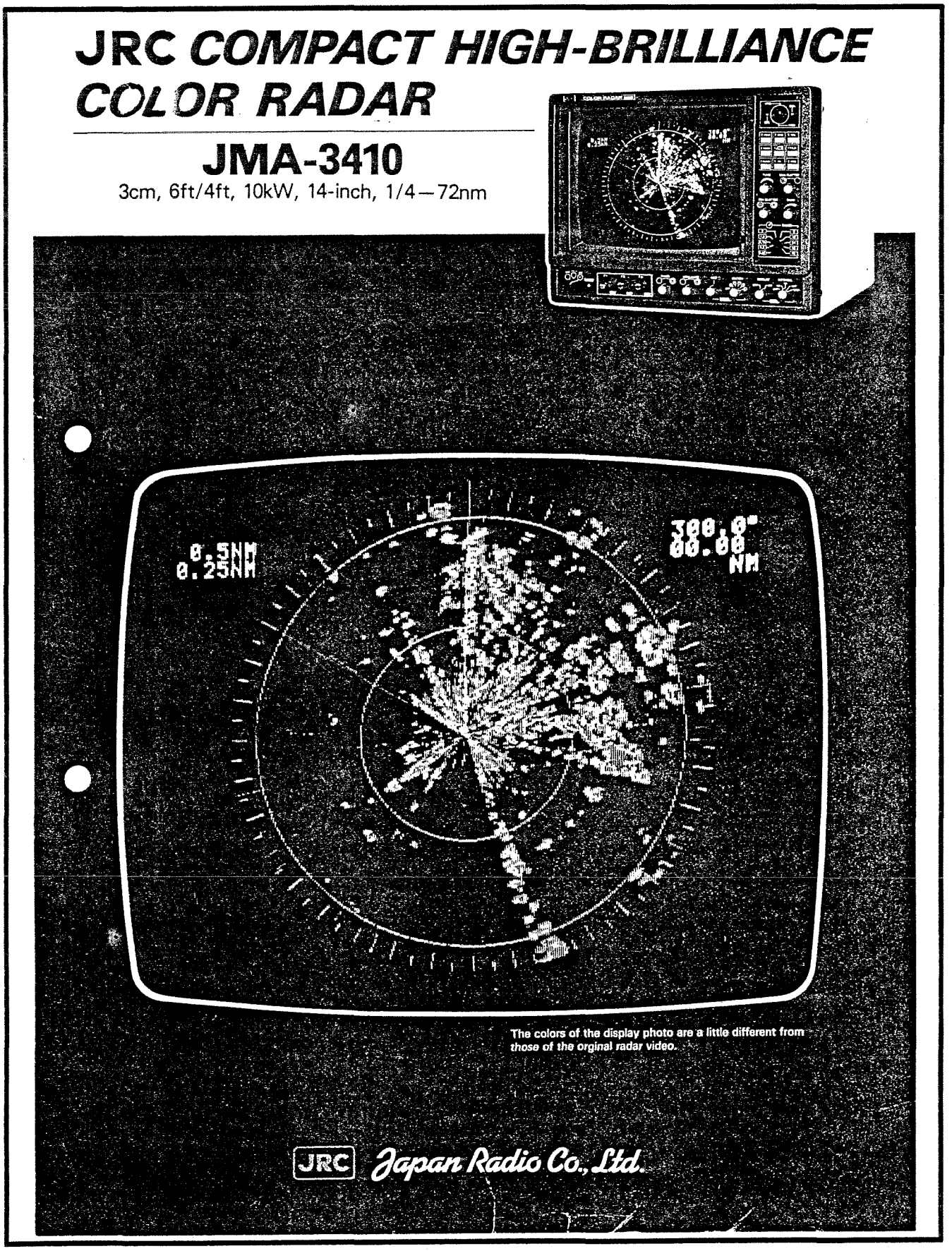


Figure 5u. Colour radar. (Courtesy of Canadian Marconi Co.)

5.3 Communication Equipment

Communication between fishing vessels is essential for monitoring the movements or success of other fishing vessels and of course for safety reasons. Included in the latter is the need for frequent, updated weather information.

The VHF radio telephone (Figure 5v) and single side band (SSB) are found almost universally in the modern fishing vessel. VHF became popular in the late 1960s for short range marine operations when the air waves of the older citizen band (C.B.) units often became cluttered with land-based communications. SSB has proven useful for receiving marine weather forecasts and for long range communication since its introduction in the early 1970s. Individual channels can be purchased for SSB for parties interested in private communication.

Figure 5v. VHF radio telephone. (Courtesy of Dolphin Electronics Ltd.)

6.0 Fishing Gear

6.1 Otter Trawling

6.1.1 Nets

During the 1950s, trawlers fishing out of S.W. Nova Scotia were using what were considered flounder trawls. These were two-seam nets (Figure 6a) noted for their rather long wings (120 ft.) and low headline (6-9 ft.). Small vessels used a scaled down version of the Skagen and Granton trawls fished by the larger trawlers. The small flounder net was succeeded by the Yankee trawl in the late 1950s, while the use of the Granton and Skagen trawls lasted until 1965 in the Lunenburg fleet and 1972 on the Riverport vessels.

The Yankee trawls began a trend toward higher lift nets aimed at catching other groundfish species such as cod and haddock. Modified Yankee trawls such as the "cut-back 41" reduced the length of each wing which gave the net more lift and lessened the amount of net exposed to possible damage by obstacles on the bottom.

The Western trawl (Figure 6b), a four-seam net, was introduced into southwest Nova Scotia in 1965. The model IV was used by the small "lobster" boats under 25 tons fishing out of the Yarmouth area. The Western IIA was popular with 45-64 ft. boats in all areas. The larger vessels of the Lunenburg fleet had by this time begun to change their vessels over to the model III. Because there was more twine on the sides on the net and less in contact with the bottom, the Western nets were not as vulnerable to lower belly damage while offering up to 30% more lift than the Yankee trawls. By the early

1970s most vessels had changed over to the Western with a few noteable exceptions such as the two boats out of Little River, Digby County which still fished pollock with an Aberdeen trawl, a two-seam net with a big square. They too eventually switched to the Western IIA.

In 1973, National Sea commissioned Hans Herman Engel from Germany to design a net for their stern trawlers. He came up with the so-called Engel Hi-Lift trawl, a two-seam net (Figure 6c) which gave about 50% more headline height and used a considerably longer foot rope (145 ft.) and heavier foot gear than did the Western III. The side trawlers, which could not handle this size of gear, continued to fish with the Western trawl until Gourock Trawls of Halifax, Nova Scotia came up with a modified Engel with a shorter foot rope (116 ft.).

The next major innovation was the Danish balloon trawl (Figure 6d) which was introduced into Newfoundland in 1978. Small boats out of Clarke's Harbour first experimented with it in 1981. It achieved virtually the same mouth opening as the Engel 145 net but the nature of its design including lighter foot gear made it possible for small draggers to tow it. Because of its short toggle chains, it fishes cod well on the medium to good ground generally encountered on the Scotian Shelf. Its large lower belly was not well-suited to the bad bottom commonly found in the Bay of Fundy.

In 1982, a few Digby neck vessels fishing in the Bay of Fundy began having good success with the Gourock rockhopper (Figure 6e), a four-seam trawl. With the lower wings removed, only the bosom netting

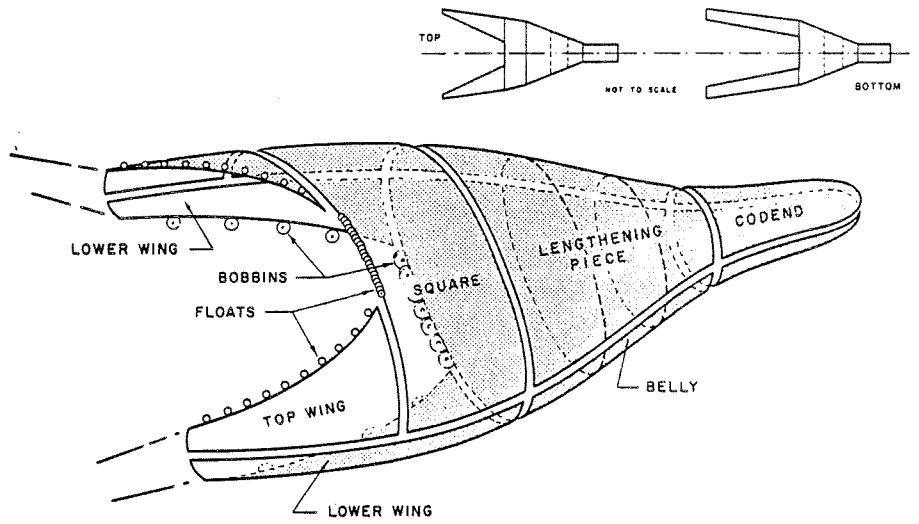
was fixed to the foot gear. This allowed boulders and rocks to pass through its "flying wing". By 1983, more than 90% of the Fundy-based vessels had adopted the rockhopper trawl.

TRAWL NETS

Trawl nets have always played an important part in Gourock's business. Having long experience, the best quality nets, and a large and modern net loft in the Halifax area, we can definitely serve you well, whether your needs be for Deep Sea Groundfish or Midwater Trawl Nets, either fully rigged or by sections.

GOUROCK TRAWL NETS ARE TRULY DIFFERENT.

Because Gourock trawl nets are made with *round twine* they do not collect sand which cuts the fibre and contributes to short life. In addition because of the use of *round twines* Gourock trawl nets tow more easily.



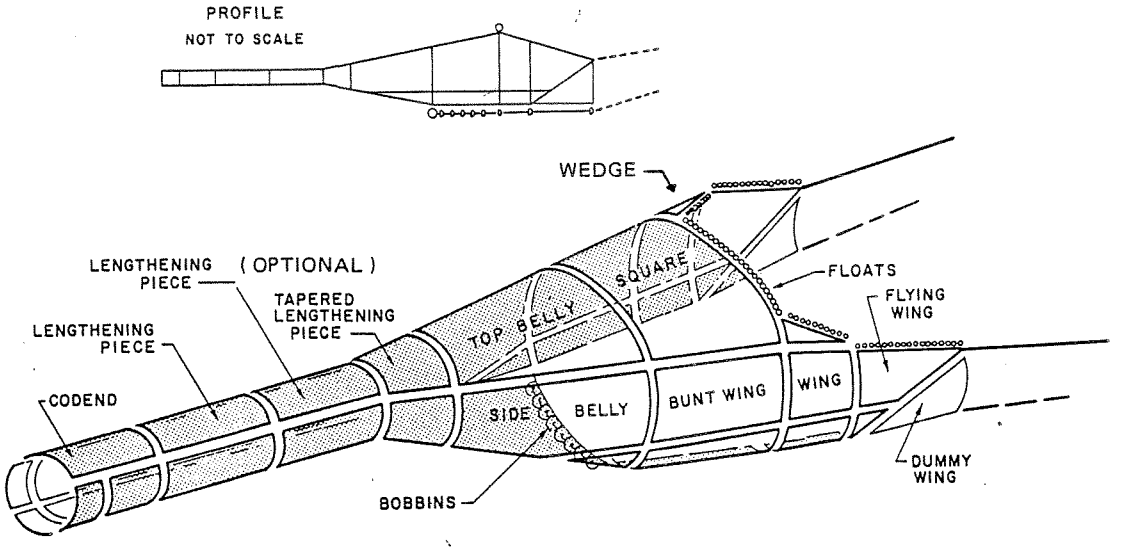
SECTIONS IN A TYPICAL TWO SEAM TRAWL
IN PERSPECTIVE.
NOT TO SCALE.
SMALL DETAILS OMITTED FOR CLARITY

Gourock Ground Trawl Net Sections ex Twisted Poly Twines

# 35	Yankee Trawl Sections ex 15/24 Twisted Twine orange colour
# 36	Yankee Trawl Sections ex 15/24 Twisted Twine orange colour
# 41A	Yankee Trawl Sections ex 15/24 Twisted Twine orange colour
# 41	Yankee Trawl Sections ex 15/32 Twisted Twine orange colour
40'	Flounder Trawl Section ex 15/18
50'	Flounder Trawl Section ex 15/18
60'	Flounder Trawl Section ex 15/18
70'	Flounder Trawl Section ex 15/18

Figure 6a. Typical two-seam trawl. (Courtesy of Gourock Trawls)

TRAWL NETS



SECTIONS IN A TYPICAL ATLANTIC WESTERN TRAWL, IN PERSPECTIVE.
NOT TO SCALE.
SMALL DETAILS OMITTED FOR CLARITY

Gourock Groundfish Trawl Net Sections
ex Braided Poly Twine

#41 Yankee Trawl Sections ex 3 mm.

Skagen Trawl Sections ex 3 mm. or 4 mm.

Granton Trawl Sections ex 3 mm.

Model 3/4-4 Western Sections ex 3 mm.

Model 4 Western Sections ex 3 mm. or 4 mm.

Model 2A Western Sections ex 3 mm.

Model 3 Western Sections ex 3 mm.

Model 1C Western Sections ex 3.5 mm.

600 H.P. Lofoten Sections ex 3 mm. or 4 mm.

1000 H.P. Lofoten Sections ex 4 mm.

1400 H.P. Lofoten Sections ex 4 mm.

Small Engel Sections ex 4 mm.

Large Engel Sections ex 4 mm.

Gourock Groundfish Trawl Net Sections
ex Braided Nylon

Large Engel Sections ex 100 yd/lb.

Small Engel Sections ex 100 yd/lb.

600 H.P. Lofoten Sections ex 100 yd/lb.

1000 H.P. Lofoten Sections ex 100 yd/lb.

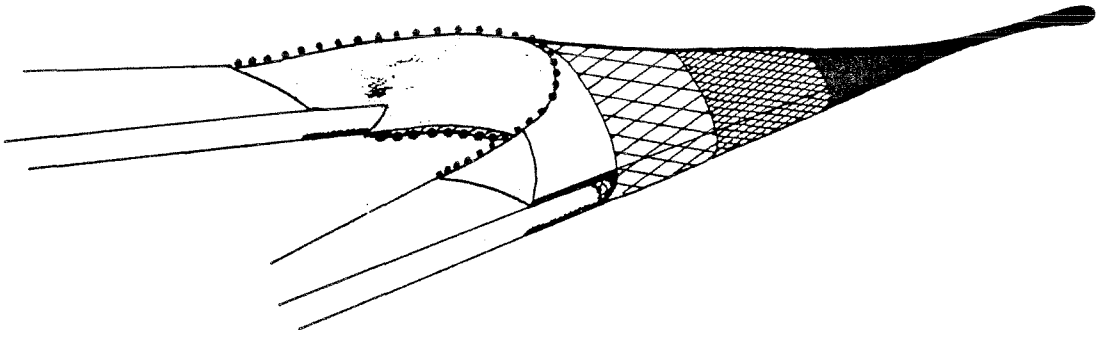
1400 H.P. Lofoten Sections ex 100 yd/lb.

Gourock Shrimp Net Sections
ex 15/12 Twisted or 1.8 mm. Braided
Available in green or orange colour
60'-80' (#36 Yankee) ex 1-1/2" or 1-1/4"
80' - 108' (#41 Yankee) ex 1-1/2" or 1-1/4"

NOTE: *All of these trawls are available fully rigged or laced, and can be joined exactly as per plans or customers' specifications.*

Figure 6b. Western trawl. (Courtesy of Gourock Trawls)

German Hi Lift Trawl



German Hi Lift Trawl:

2 seam, 3 bridle, high lift trawl for all round fishing, used exclusively by larger vessels and fleet operators. Rigged traditionally with heavy footropes. A good net for medium to hard ground.

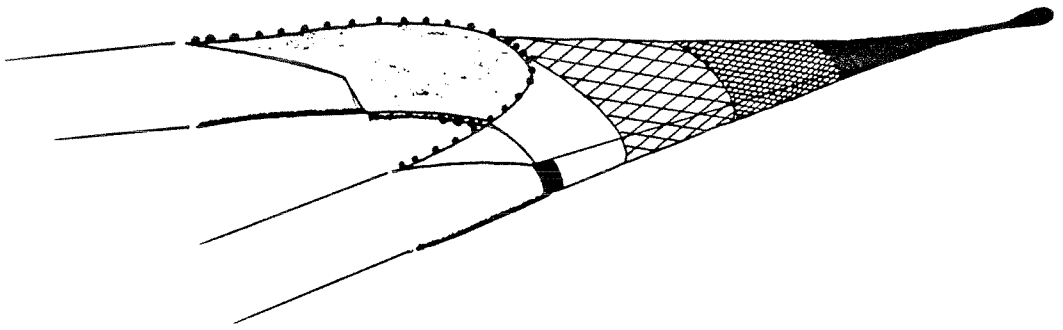
Model Series:

98' Footrope
116' Footrope
145' Footrope
170' Footrope

HP Range: 475 to 2000

Figure 6c. Engel Hi-Lift trawl. (Courtesy of Gourock Trawls)

Gourock Balloon Trawl



Gourock Balloon Trawl:

2 seam trawl for medium ground conditions featuring a "Balloon effect" using more netting across the top panels for additional headline height. Also available in a 3 bridle hook up. An excellent net for medium ground when Cod and Flats are a priority.

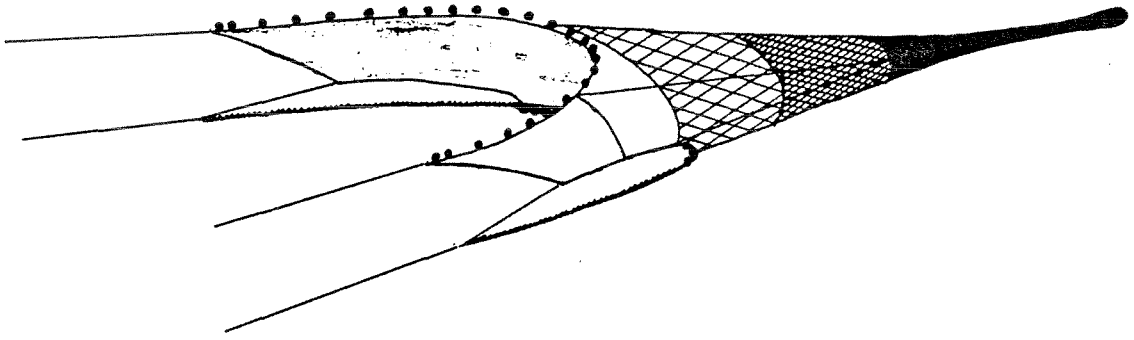
Model Series:

No. 220 Trawl at 5½" mesh.
No. 260
No. 280
No. 300
No. 350
No. 400
No. 450
No. 580

HP Range: 180 to 2000

Figure 6d. Danish balloon trawl. (Courtesy of Gourock Trawls)

Gourock Rockhopper



Rockhopper:

4 Panel net for use on hard ground, highlighted by the flying wing which rises sharply away from the footrope with only the bosom netting fixed to the footgear, thus reducing drag to the trawl. Alterations can be quickly made for a bunt wing or a full length wing. Optional 8" or 12" mesh size in the top section for reduced drag.

Model Series:

No. 286 Trawl at 5½" mesh.
No. 324
No. 356
No. 400
No. 440
No. 476
No. 500
No. 580
No. 530 Trawl at 6" mesh.
No. 610 Trawl at 6" mesh.

HP Range: 125 to 2000

Figure 6e. Gourock Rockhopper. (Courtesy of Gourock Trawls)

6.1.2 Twine

Prior to the 1960s the twine used to make nets had undergone a gradual evolution from cotton to hemp to manila and finally to nylon and synthetic "poly" materials.

Over the last two decades, polyethylene netting has been the most popular with the small dragger fleet for several reasons. Nets made from this material maintain their original shape longer. This facilitates repairs since a new section of netting can readily fit an old net. Because the poly material is buoyant, it is not as liable to chafe while being dragged over rough bottom. During a 1982 survey of codend mesh size covering 67 small draggers, only one vessel was encountered which was not entirely made up of poly netting.

The first nylon used in nets was unstable and would unpredictably stretch or shrink in size. Eventually this undesirable characteristic was overcome by various treatments at the time of manufacture such as heat setting and wax impregnation. Because nylon is stronger than polyethylene a smaller diameter twine can be utilized to achieve the same strength. The smaller diameter twine creates less drag which contributes to more fuel efficient operations. On the other hand, nylon twine is closely knit and often collects a build-up of sand, and weeds making it increasingly heavy with use. The Engel high-lift trawl was made entirely from nylon for National Sea.

6.1.3 Doors

Up until the mid-1970s, both large and small draggers predominantly used rectangular wooden doors e.g. Brompton (Figure 6f) and the similar Westapeake door. Steel V-doors were experimented with during the late 1960s. Fishermen have shown some renewed interest in them recently. With V-doors, fishing gear can be turned quickly and the fact that they upright themselves easily under slack water conditions reduces the risk of the doors crossing over each other. They have never gained acceptance in the Bay of Fundy because they are too light to withstand the strong tides there and boulders trap easily in their extended towing bracket (Figure 6g).

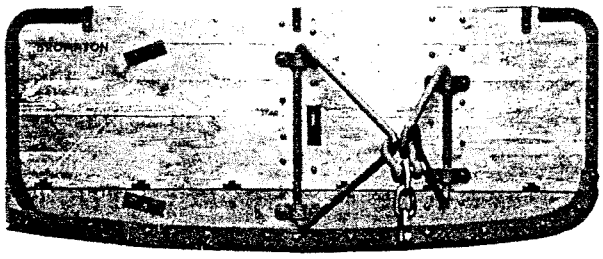
The lowered polyvalent door (Figure 6h) because of its cupped and oval design, rides well over rough bottom while maintaining a good wing spread even with heavy foot gear. It works well in the Bay of Fundy for these reasons and because of its high weight to size ratio and compact towing bracket. National Sea and Nickerson have used them on several of their trawlers over the past decade.

Doors

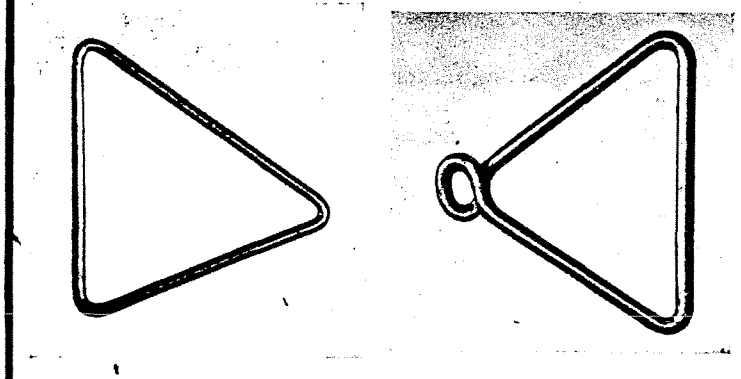
COSALT

TRAWL/OTTER

DA



A. Brompton Type, complete with bracket.			DA
9′ x 4′ 6″/2.74³ x 1.37² m.	double shoe	23 cwts./1168 kgs per pr	1
	single shoe	20.5 cwts/1041 kgs per pr	2
9′ 6″ x 4′ 6″/2.89⁴ x 1.37² m.	double shoe	24 cwts/1219 kgs per pr	3
	single shoe	21 cwts/1067 kgs per pr	4
10′ x 4 6″/3.04⁸ x 1.37² m.	double shoe	25 cwts/1270 kgs per pr	5
	single shoe	22 cwts/1118 kgs per pr	6
10′ 6″ x 4′ 6″/3.20 x 1.37² m.	double shoe	28 cwts/1422 kgs per pr	7
	single shoe	25 cwts/1270 kgs per pr	8
11′ x 5′/3.35² x 1.52⁴ m.	double shoe	36 cwts/1833 kgs per pr	9
	single shoe	32 cwts/1629 kgs per pr	10



DB

Pair Spare Brackets For:		DB
9′/2.74³ m.	119 lbs/54 kgs per pr	11
9′ 6″/2.89⁴ m.		12
10′/3.04⁸ m.		13
10′ 6″/3.20 m.	129 lbs/58.5 kgs per pr	14
11′/3.35² m.	146 lbs/66.25 kgs per pr	15
Spare Shoes For Welding:		**DC**
9′/2.74³ m.	162 lbs/73.5 kgs each	16
9′6″/2.89⁴ m.	169 lbs/77 kgs each	17
10′/3.04⁸ m.	177 lbs/80 kgs each	18
10′ 6″/3.20 m.	181 lbs/82 kgs each	19
11′/3.35² m.	220 lbs/100 kgs each	20
Spare Shoe For Bolting:		**DD**
9′/2.74³ m.	197 lbs/89 kgs each	21
9′ 6″/2.89⁴ m.	206 lbs/93.5 kgs each	22
10′/3.04⁸ m.	216 lbs/98 kgs each	23
10′ 6″/3.20 m.	254 lbs/115 kgs each	24
11′/3.35² m.	268 lbs/121.5 kgs each	25

When ordering please state Number or Number of pairs, code letters/reference number, e.g. Six Pairs DB11 = 6 pairs spare brackets for 9′ × 4′ 6″ Brompton Door

Figure 6f. Brompton door. (Courtesy of Leckies)

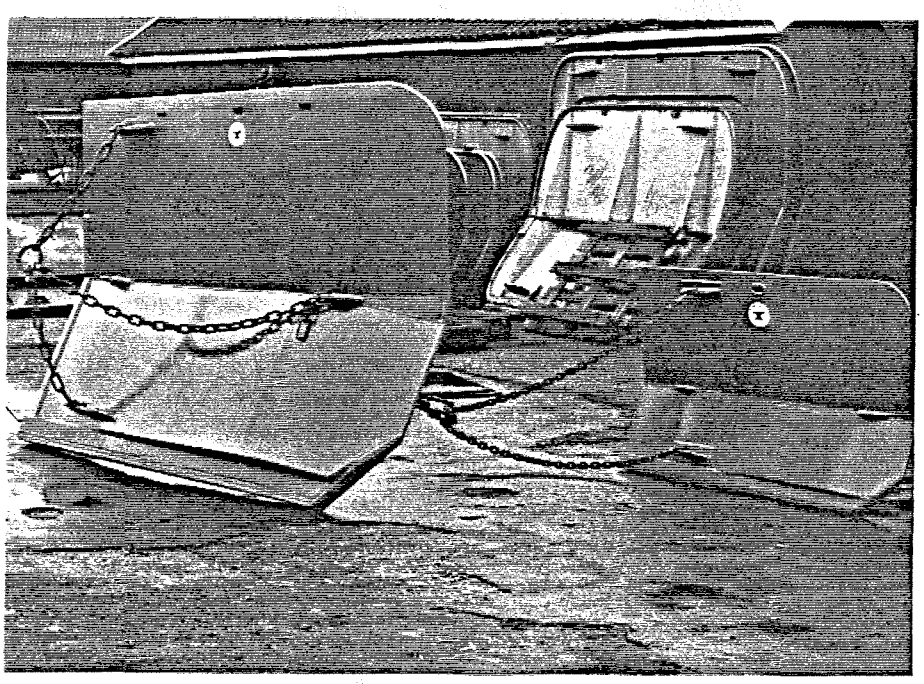
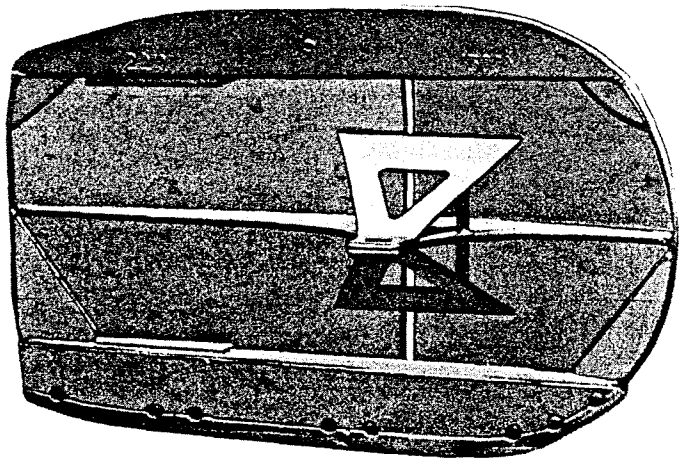


Figure 6g. V-Door. (Courtesy of Gourock Trawls)

FRANCE
Ets. MORGÈRE
B. P. 170 - 35408 SAINT-MALO CEDEX
Téléphone (99) 56.14.36 - Telex 950373



PANNEAU DE CHALUT POLYVALENT "R"

BREVETÉ

POLYVALENT "R" TRAWL DOOR PATENTED

DIMENSIONS et POIDS

RANGE OF SIZES AND WEIGHTS.

TYPE	Long. × Haut. - Length × H.	KGS	
PS 0	1.200 × 700	100 - 120	POIDS
PS 1	1.400 × 800	120 - 140	
PS 2	1.600 × 900	160 - 180	INTERMÉDIAIRES
PS 3	1.800 × 1.000	200 - 240	
PS 4	2.000 × 1.100	250 - 350	A LA
PS 5	2.200 × 1.200	350 - 450	
PS 6	2.400 × 1.300	500 - 600	DEMANDE
PS 7	2.600 × 1.400	650 - 750	—
PS 8	2.800 × 1.500	800 - 900	ALL
PS 9	2.900 × 1.600	950 - 1.050	
PS 10	3.000 × 1.800	1.150 - 1.200	INTERMEDIATE
PS 11	3.200 × 1.900	1.250 - 1.350	
PS 12	3.250 × 2.000	1.400 - 1.450	WEIGHTS
PS 13	3.500 × 2.100	1.500 - 1.800	
PS 14	4.000 × 2.200	1.850 - 2.000	ON REQUEST

IMP. PORCHER

Figure 6h. Polyvalent door. (Courtesy of Gourock Trawls)

6.1.4 Foot Gear

Wooden rollers with spacers and rubber discs were commonly used up until the early 1960s. It usually took a few trips for a net to fish effectively until a new wooden roller became fully water-logged.

The large trawlers prefer steel bobbins with steel, plastic, or rubber spacers. The smaller Fundy boats changed to molded rubber rollers but found that they dug into the bottom too much. To overcome this weight problem rubber rollers with the sides scooped out of them and a mixture of rubber and plastic rollers became popular. In the last few years, in conjunction with the rockhopper trawl, large rubber discs with a wire running through the top of the disc to hold them in place have had some acceptance.

6.2 Longlining

6.2.1 General

The traditional method of longlining, that is setting out and retrieving hand-baited gear, is still used by 90% of fishermen in S.W. Nova Scotia. There have been some developments over the past two decades to make it easier and more efficient for the fishermen to accomplish this.

The most significant of these was the change from mechanical (Figure 6i) to hydraulic line haulers. The increased reliability of hydraulics is evidenced by the fact that there are several units which were sold in the early sixties that are still being used in the fishery today. Modern hydraulic haulers, which are considerably more compact than the early models (Figure 6j), can be outfitted in even the smallest inshore boat.

The efficiency of haulers has also been improved with the addition of two accessories in the late 1960s, the helper wheel and the "knife". The helper wheel (Figure 6k) holds the trawl line in the heads as well as helping to ease knots through the hauler. This reduces the frequency of interruptions while hauling back the gear. With a more constant strain on the line, a fish is less likely to shake the hook free from its mouth.

The "knife" (Figure 6k) is a metal finger inserted into the hauler head on the side opposite the helper wheel. Its function is to help remove line from the head as it passes through the hauler. A minor but significant modification was made to the "knife" a few years

later. By adjusting the angle at which the "knife" contacted the line, in conjunction with a change in orientation of the hauler from a horizontal to vertical position, the line could be made to self-coil into a tub. It was no longer necessary for a man to stand over a tub and manually coil the gear into it. Most haulers are supported on a metal stand. In 1981 Atkinson and Bower Ltd. of Shelburne, Nova Scotia began manufacturing haulers that could be used on a stand or hung on the rail of the boat. The flexibility created by this modification, combined with the ability to accommodate different diameter lines in the heads by interchanging heads or by the use of spacers, gave the fishermen the option to easily switch from one type of fishery to another e.g. longlining to gillnetting or hauling lobster pots.

Regarding other types of longline gear such as ropes, radar reflectors (Figure 61), and hooks, there have been very few radical design changes. Poly ropes today are stronger and snarl less. Fishermen choose between regular shank, offset, and circle hooks. The latter have recently proved successful on halibut and smaller sizes are currently being tried for cod and haddock.

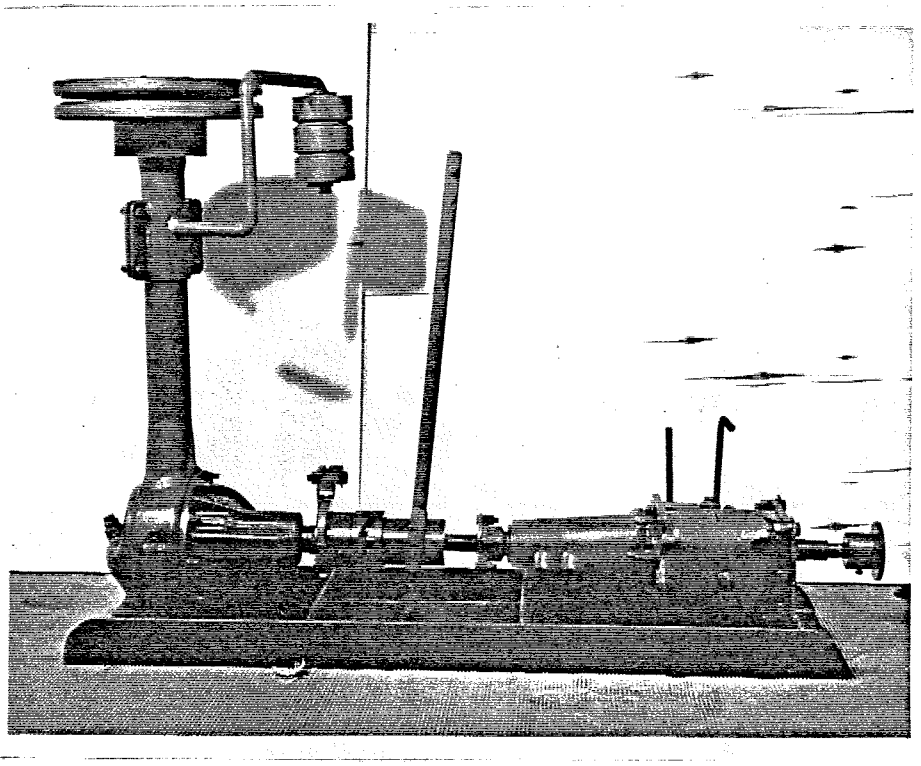


Figure 6i. Early mechanical hauler. (Courtesy of Hawboldt Industries)

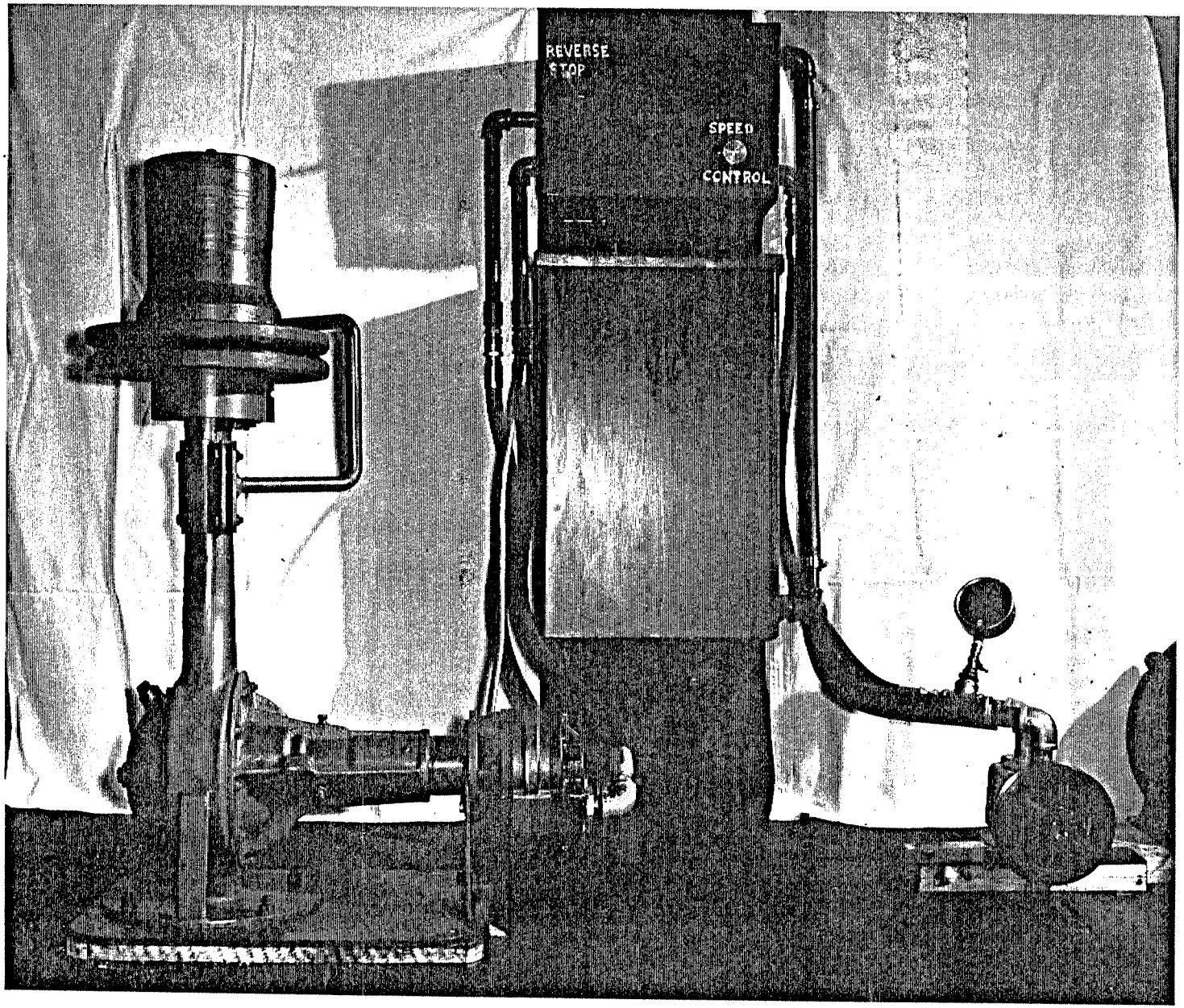


Figure 6j. Early hydraulic hauler. (Courtesy of Hauboldt Industries)

THE ONE MAN HYDRAULIC TRAWL HAULER

(Designed and Manufactured by Atkinson & Bower Ltd.)
01 0000 01

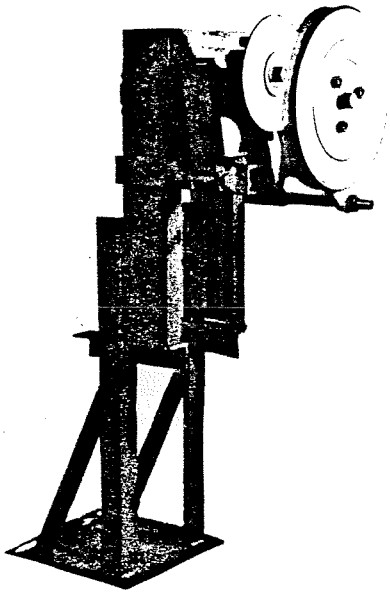
The fishermen here fish an eight or ten line tub. They separate it into two parts, as when the trawl tub gets near the top, the trawl coils small like an ice cream cone. Coiling the tub half full, then moving to another tub does a better job.

If the extension is taken out, and three pennies are put between the heads, it will haul lobster traps.

The helper wheel is extra. The helper wheel holds the trawl line in the heads when the trawl knots come through the heads or when the trawl gets slack.

This hauler includes:

- Hydraulic unit with DKS motor and coupling
- Motor turns from 1 to 189 RPM's at 12 gallons per minute
- Dowty or Gresen pump on adjust - able base
- Galvanized hydraulic tank and filter
- Hydraulic speed and reverse control
- Strap and stainless steel post and nuts
- Cast bronze finger
- Complete set of 12″ cast iron gurdy heads
- Two-way hauler stand
- Self-control extensions



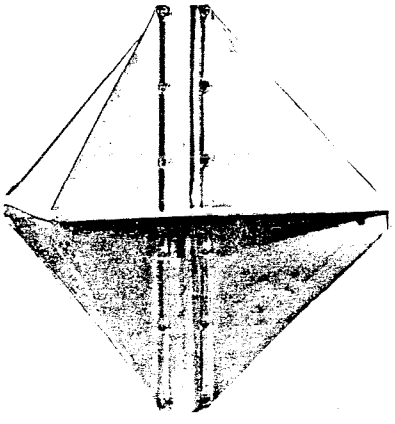
1

Figure 6k. Modern hydraulic hauler. (Courtesy of Atkinson and Bower Ltd.)

RADAR REFLECTORS

Made by Atkinson & Bower Limited from .025 aluminum. We always have at least a few hundred radar reflectors on hand at all times. If you purchase over 25, you get 20% off.

#1 Regular
Approximately 18" high and 14" square.
20 0001 14



#1 Super Duper
Exactly the same as the #1 Regular except it has more partitions.
20 0002 14

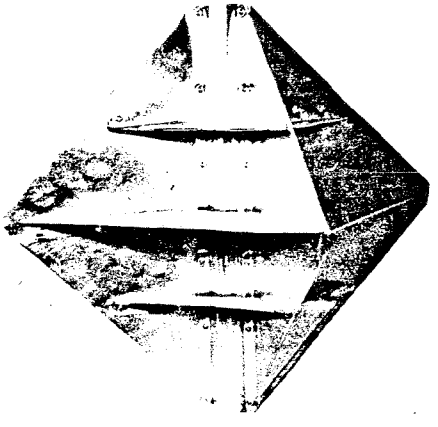


Figure 61. Radar reflectors. (Courtesy of Atkinson and Bower Ltd.)

6.2.2 Automated Longlining

Several mechanized longline systems have been introduced into southwest Nova Scotia beginning in the early 1970s. Most of these have aimed at offering an alternative to the laborious procedure of hand-baiting each hook. In their fully automated configuration, they include hook cleaners, gangion untanglers, hauler, bait cutter, and hook and line storage devices. They can be broadly categorized as those utilizing random or mechanized non-random baiters.

The latter probably is best exemplified by the Mustad Autoline System (Figure 6m). The introduction of this system to Canada in 1972 was an installation on a longliner operating out of Cape Sable Island. Need for further development delayed additional sales until 1977 when the Clara and Linda in Hubbards was converted (Figure 6n). Since then another 2 or 3 systems have been sold in southwest Nova Scotia. The Autoline has gained more popularity in other provinces such as Quebec and Newfoundland where nearly two dozen systems have been sold. There are many reasons for its lack of widespread adoption, the most important of which is its high initial cost (about $100,000). A new mini version of the Autoline, which is soon to be available, is aimed at appealing to the small boat fisherman. Quota restrictions, licensing, and financial problems are other factors which have hindered its sales.

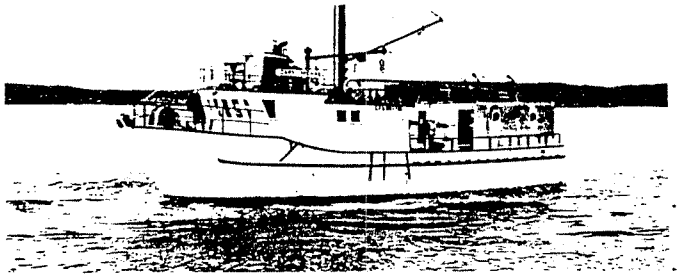
Mechanized systems using a random baiter have only been available in Canada over the past 5 or 6 years. They are much cheaper than the Autoline system, and for this reason have been tried by more

fishermen. Hook and line storage can be into either tubs e.g. Marco System (Figure 6o) or on racks e.g. Jennex System (Figure 6p) or either e.g. Global System (Figure 6q). The early Marco system used to store hooks on a spool (Figure 6r) but this was found to be a slow procedure. Manufacturers generally acknowledge that the use of squid as a bait results in the highest baiting efficiency. Despite this, fishermen claim that bait loss can be a problem particularly when other types of bait such as herring are utilized. The significance of this loss to the fishermen, becomes even greater during a period of high bait prices such as over the last three years.

Another noteworthy transfer of technology into the southwest Nova Scotia halibut fishery took place in 1983 with the introduction of the Pacific snap-on/drum system long-lining system. Fishing trials aboard a 60 ft. longliner out of Lockeport, Nova Scotia show the system to have several good features. Rack storage of snap-on gangions exposes hooks for easy baiting. The large groundline drum means that gear can be set and retrieved faster than the traditional hauler.

Complete mechanization.

By going one step further and installing the Combihauler instead of the standard hauler, twist removal and hook separation will be combined and done automatically. Hooks slide automatically on to the racks.
Hauling speed increases considerably and the crew becomes more productive. This means more hooks per day. Alternatively, the crew may be reduced if an increase in fishing intensity is not desirable. For baiting, there is a choice between the Mark II baiting machine and the random baiter.



SYSTEM CONFIGURATION:

Hook cleaner
(small/large)
Combihauler
Magazines
Baiting machine
or random baiter
Hydraulic power
High pressure water pump

EXPLANATION OF DRAWING

This illustration shows one way of installing the components when choosing complete mechanization with no separate hauling equipment. This is suitable for all kinds of fishing vessels. The storage magazines may of course be placed along one of the ship's sides.

BAITING OPERATION
When the baiting operation begins, one magazine is placed in position (A), and the lines transferred manually over to the shooting magazine (B) by a cross-over magazine (C). During setting the lines go through the baiting machine (D). When one magazine (A) is empty, another is placed in position and the lines transferred over to the shooting magazine.

HAULING OPERATION
During hauling the lines go through the hook cleaner (1). Then the lines go through the twist removing tank (2). The lines are pulled by the linehauler (3) mounted on the tank. The hooks are automatically guided onto the transfer magazine (4). The lines are then transferred manually back to the storage position (A). When one magazine is full, it is moved away for storage and another empty one is placed in position (A).

Figure 6m. Mustad Autoline System. (Courtesy of O. Mustad and Son (Can.) Ltd.)

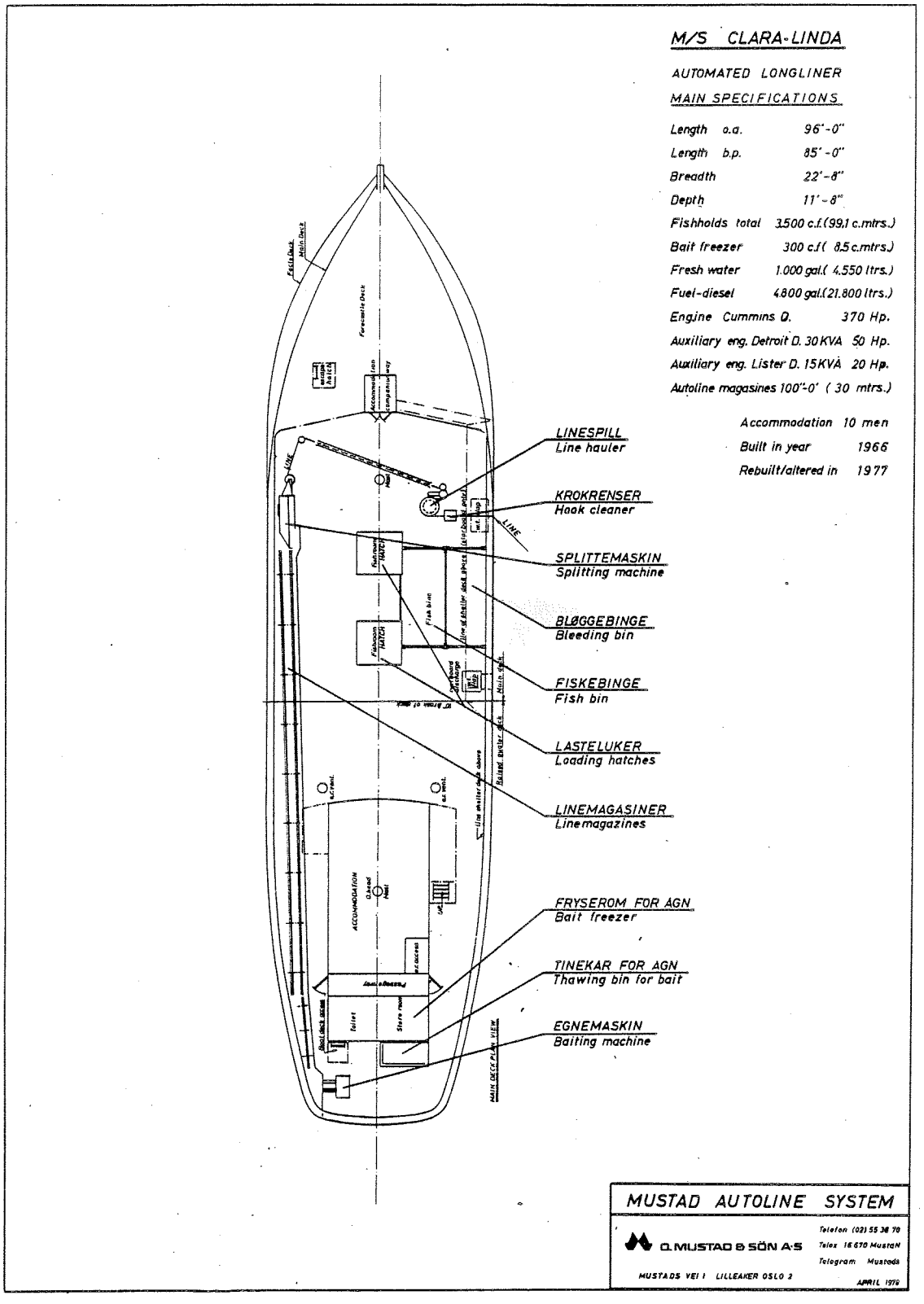
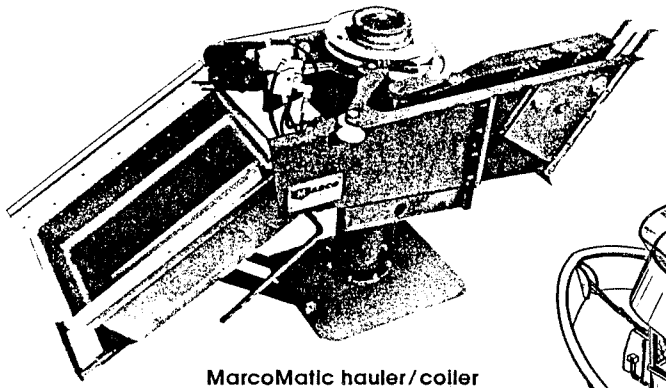


Figure 6n. Mustad Autoline System on the Clara an Linda ex. Hubbards. (Courtesy of O. Mustad and Son (Can.) Ltd.

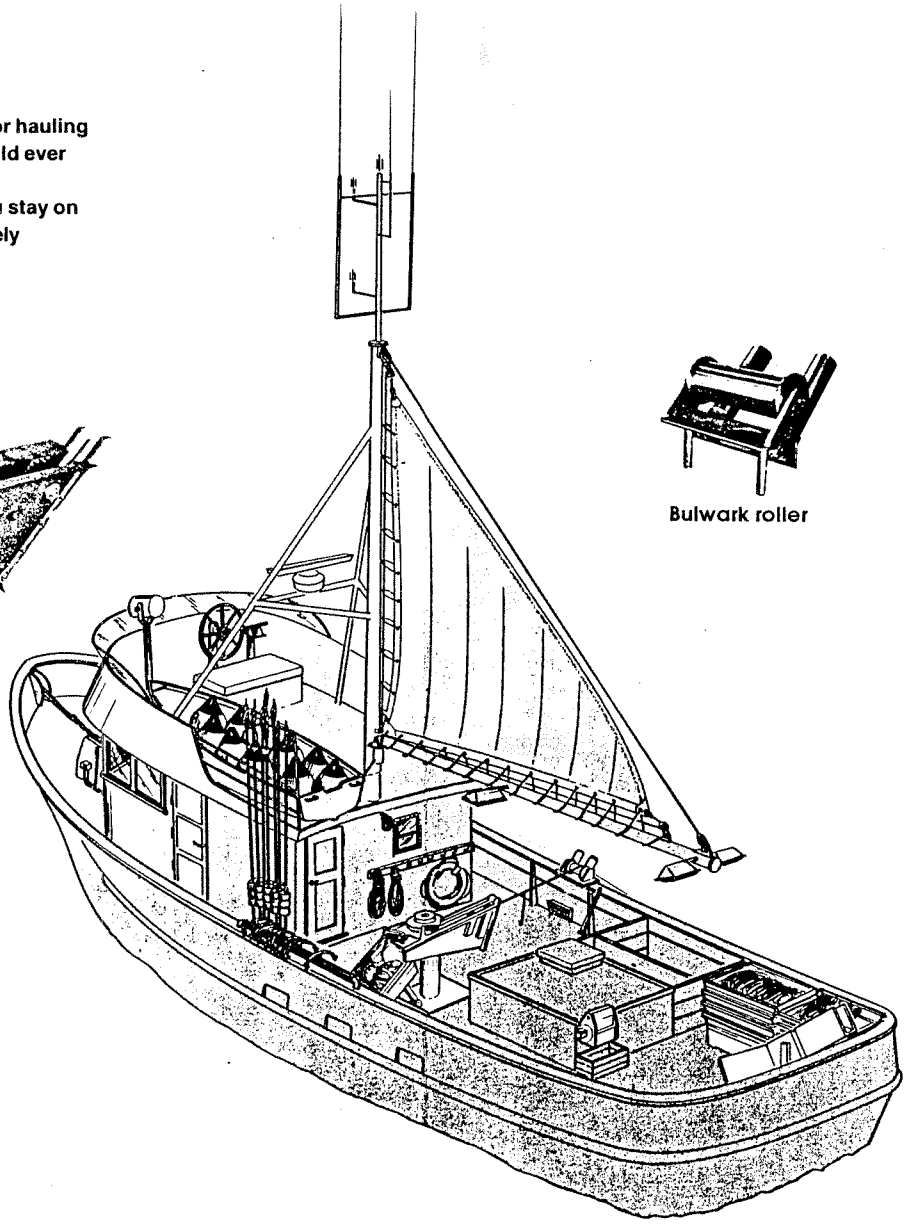
MarcoMatic T.M.

AUTOMATIC LONGLINE SYSTEM

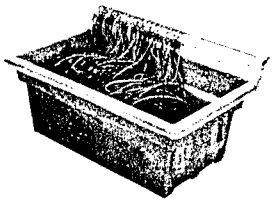
- *SAFER* — no manual handling of hooks during setting or hauling
- *FASTER* — can haul gear faster than any fisherman would ever want to retrieve it
- *MORE ECONOMICAL* — eliminates hand baiting, so you stay on the grounds longer, fishing more gear more productively
- *EASY TO INSTALL* — requires very little deck space



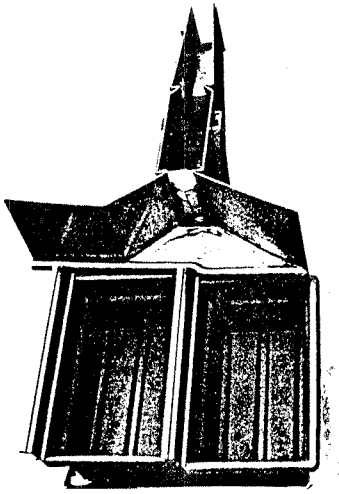
MarcoMatic hauler/coiler



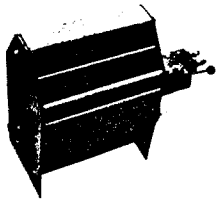
Bulwark roller



TrackMatic T.M. storage tub



Continuous baiter/setter



Bait cutter

Figure 6o. Marcomatic automatic longline system. (Courtesy of Gourock Trawls)

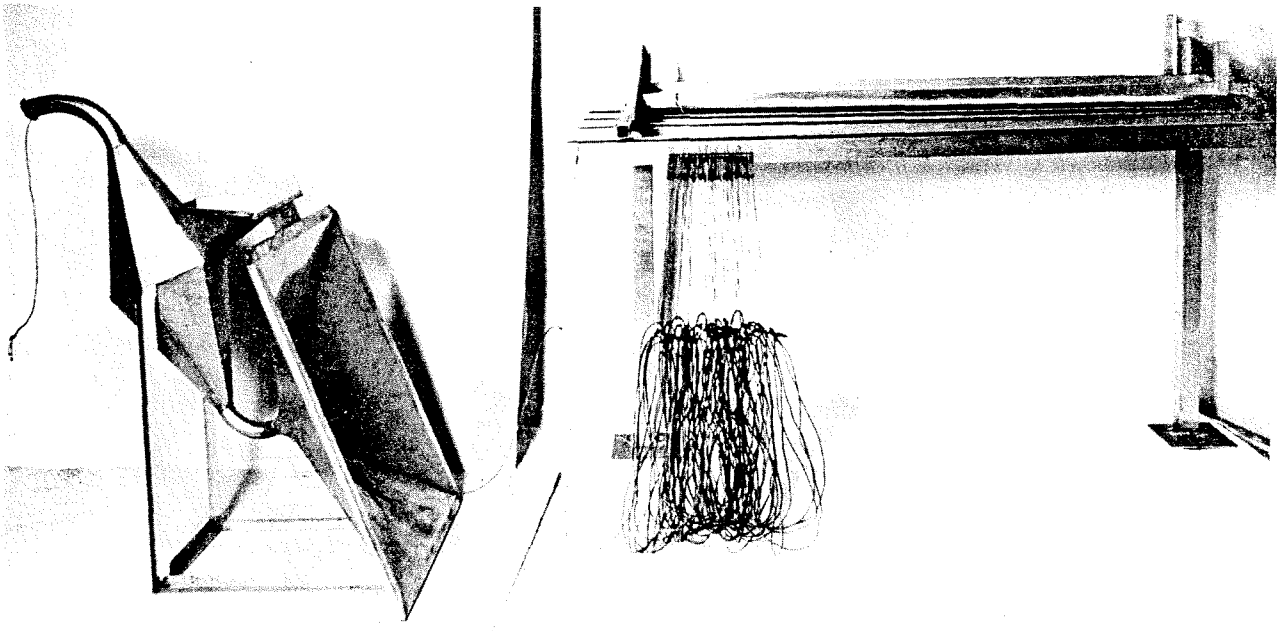


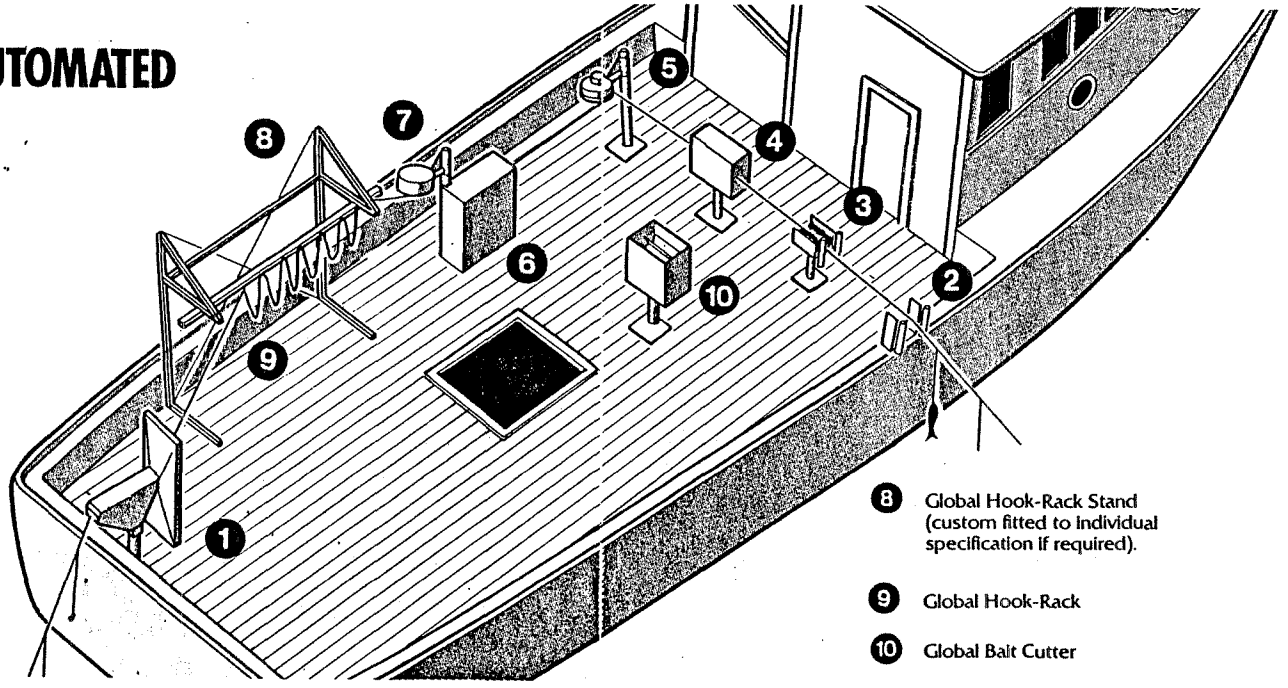
Figure 6p. Jennex baiter and rack. (Courtesy of Jenkins Industries Ltd.)

GLOBAL FULLY AUTOMATED LONG-LINE SYSTEM

The Global System and its components are priced well below other automated long-line systems presently on the market.

1. Global Baiter I or II
2. Global Roller II
3. Global Hook and Bait Cleaner
4. Snood Untangler*
5. Global Hauler I or II
6. Automatic Hook-Racker*
7. Global Slack-Taker

*available in 1983



8. Global Hook-Rack Stand (custom fitted to individual specification if required).
9. Global Hook-Rack
10. Global Bait Cutter

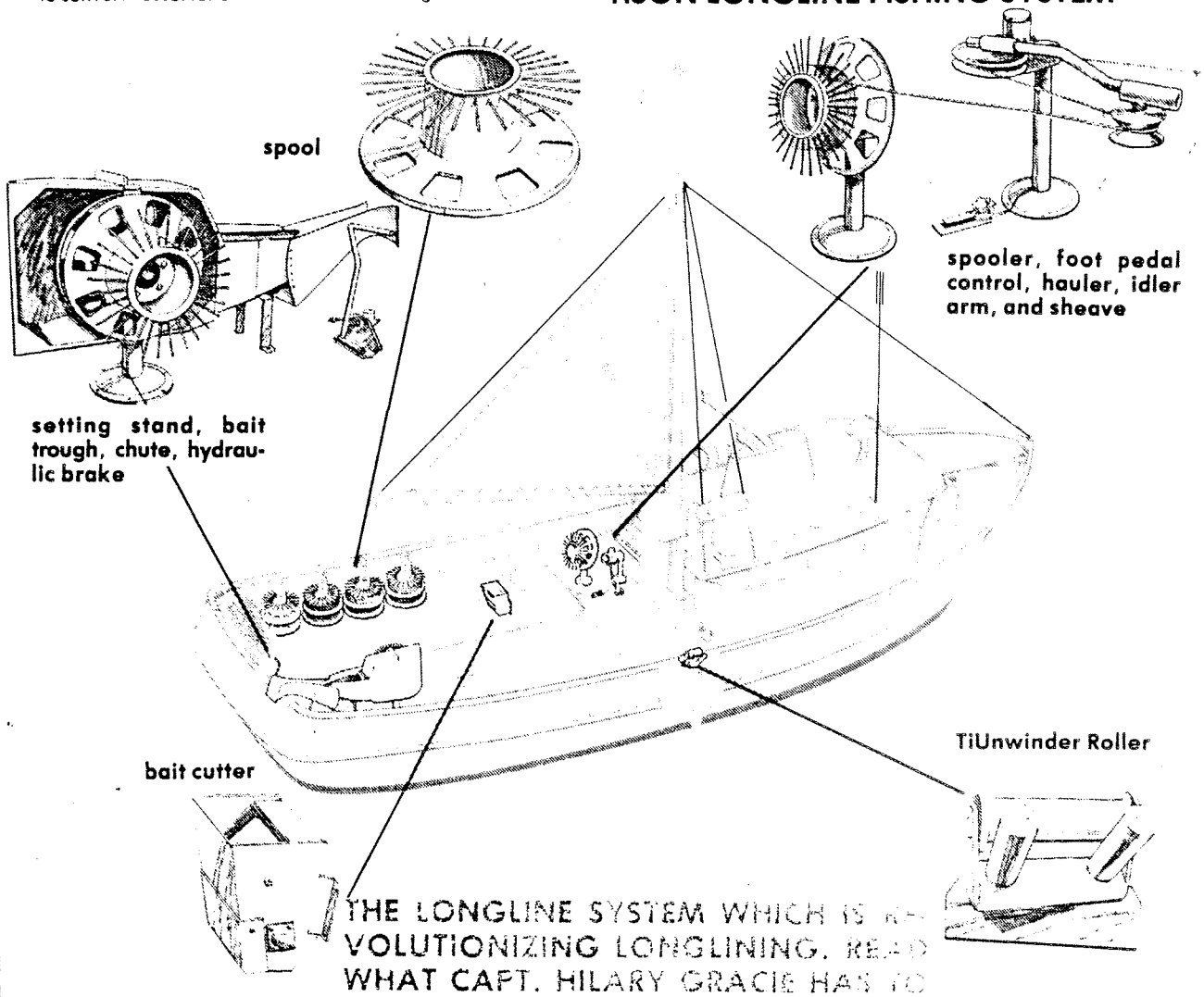
Figure 6q. Global Automated Long-Line System.

MARCO

TiLINER

TiLiner system components install easily on deck of traditional longliners, purse seiners, small trawlers, and other types of fishing boats. Components later can be removed in several hours and stored on shore to convert vessel for other methods of fishing.

LEADS THE WAY IN NEW PRODUCTS
TISON LONGLINE FISHING SYSTEM



THE LONGLINE SYSTEM WHICH IS RE-
VOLUTIONIZING LONGLINING. READ
WHAT CAPT. HILARY GRACIE HAS TO
SAY ABOUT HIS TILINER SYSTEM.

(1) HARDLY EVER MISSES A BAIT
(2) 20-30 FISH IN A ROW
(3) CREW HAS 1 EXTRA DAY PER WEEK ASHORE WITH NO WORK
(4) NO MORE SOUR OR WASTED BAIT
(5) READY TO GO FISHING AS SOON AS ICE 'N' FOOD ARE ABOARD
(6) SAVES BIG DOLLARS IN BAITING COSTS AND DOWN TIME IN BAIT SHED

Figure 6r. Early Marco Long-Line System - Tilener

7.0 New Developments in Fishing Gear

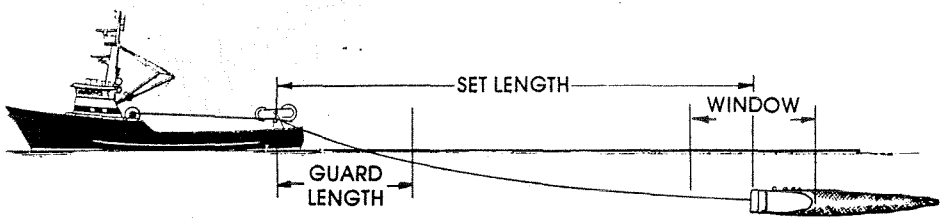
There are several recent developments in the manufacture and operation of fishing gear, which, if adopted on a widespread scale, would increase the catching capability of the fleet in 4X.

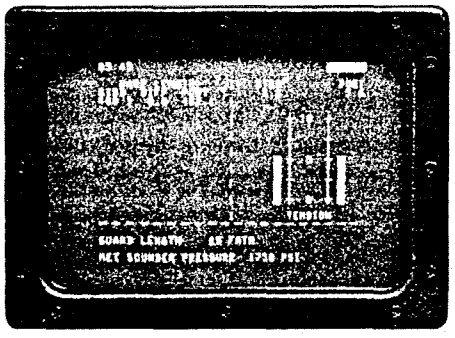
For example, computer-aided design techniques are being used to develop new fishing trawls. Information on the behaviour of fish in relation to fishing gear from remote video cameras is becoming important to gear designers. Towed fishing gear can now be microprocessor controlled (Figure 7a) for more efficient trawling. Colour sonars (Figure 7b), used extensively in the Pacific groundfish fishery and Atlantic herring and mackerel fisheries, have not only the same capability of echo-sounders, but also allow fish to be seen in front of the vessel and as they enter the net. Net-monitoring systems (Figure 7d) can measure various aspects of the net while towing such as quantity of fish, depth, or temperature, distance of the headline from the footrope and whether the net is on bottom. Stronger and more fuel-efficient synthetic twines such as "Kevlar" are available now. Use of a two trawl/two net reel set-up (Figure 7d) similar to that used on the Pacific coast, can mean uninterrupted fishing even if one net is torn up.

A low-cost, automated longlining system with a non-random baiter has yet to be developed. New systems, such as the Mustad Miniline, use monafilament line because of its increased fishing capability. Circle hooks, which have proven to increase productivity

in the Pacific halibut fishery, show good promise for the Nova Scotian halibut fishery based on the success of early commercial fishing trials.

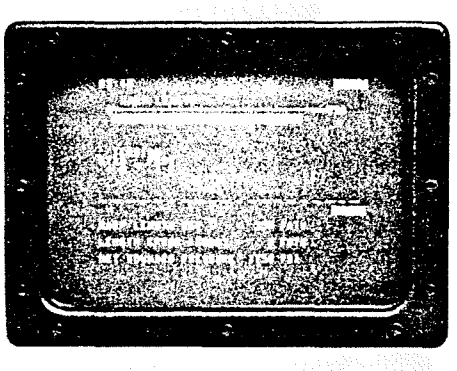
4 BASIC IntelliTrawl™ MODES





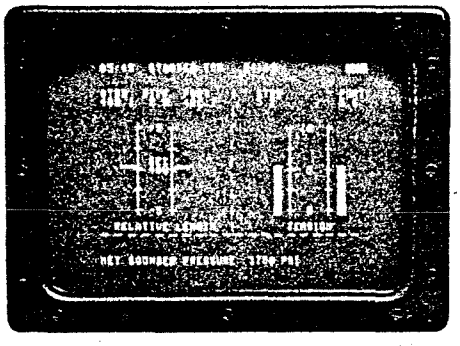
MANUAL MODE

- Pay-out or haul-in manually through guard length
- Low-speed or high-speed selection



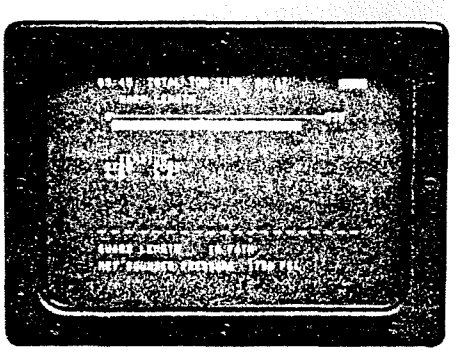
SHOOTING MODE

- Automatic pay-out from guard length to set length
- Pre-set deceleration prior to stop



TOWING MODE

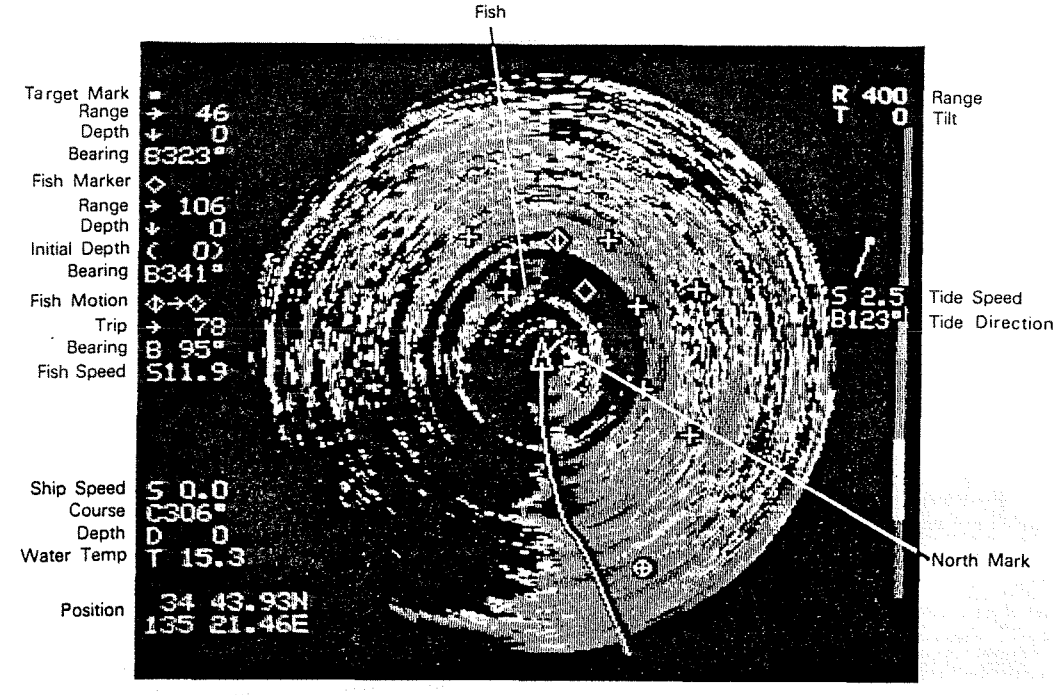
- Automatic pay-in and pay-out within window
- Constant, equalized tension
- Automatic pay-out in the event of hang-up
- Automatic length adjustment during turns



HAULING MODE

- Automatic haul-in from set length to guard length
- Pre-set deceleration prior to stop
- Return to manual mode

Figure 7a. Automatic warp adjustment system. (Courtesy of Marco Seattle)



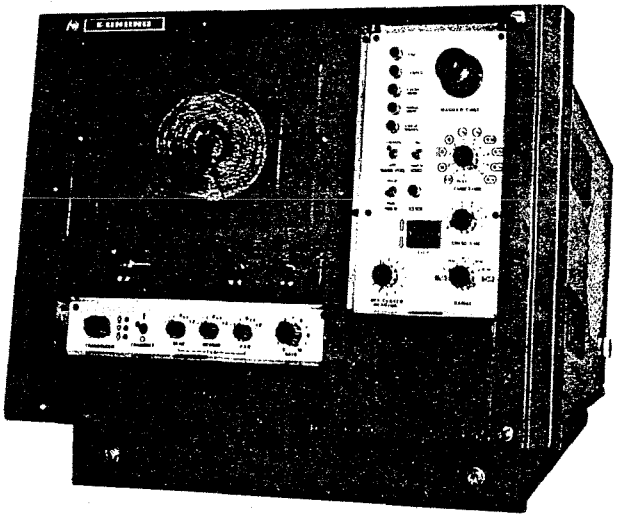
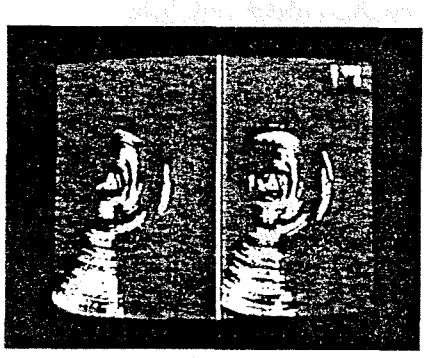
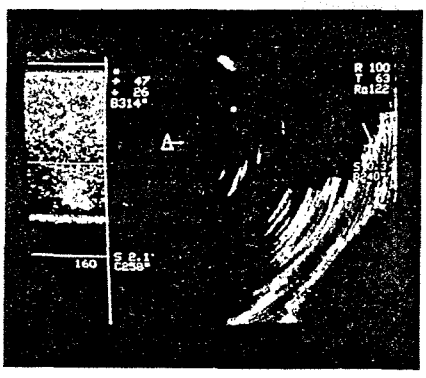


Table-Mount Display



Dual sonar display. Left: fixed tilt, Right: auto tilt scan.



Echo sounder/sonar combination display. Left: Echo sounder. Right: scanning sonar display (FSS-75B in this photo).

Figure 7b. Colour sonar. (Courtesy of Dolphin Electronics Ltd.)

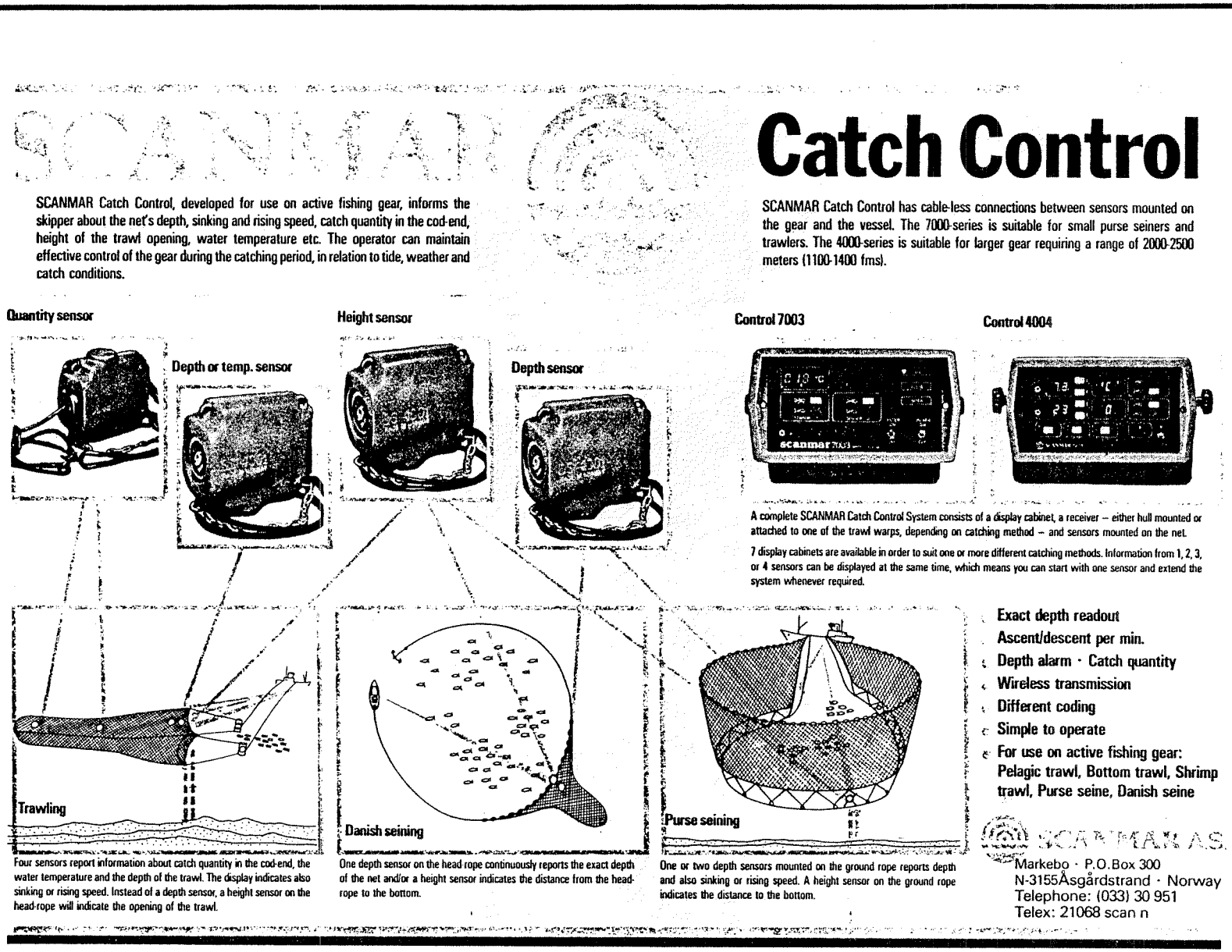


Figure 7c. Catch monitoring system. (Source: Fishing News International, December 1983)

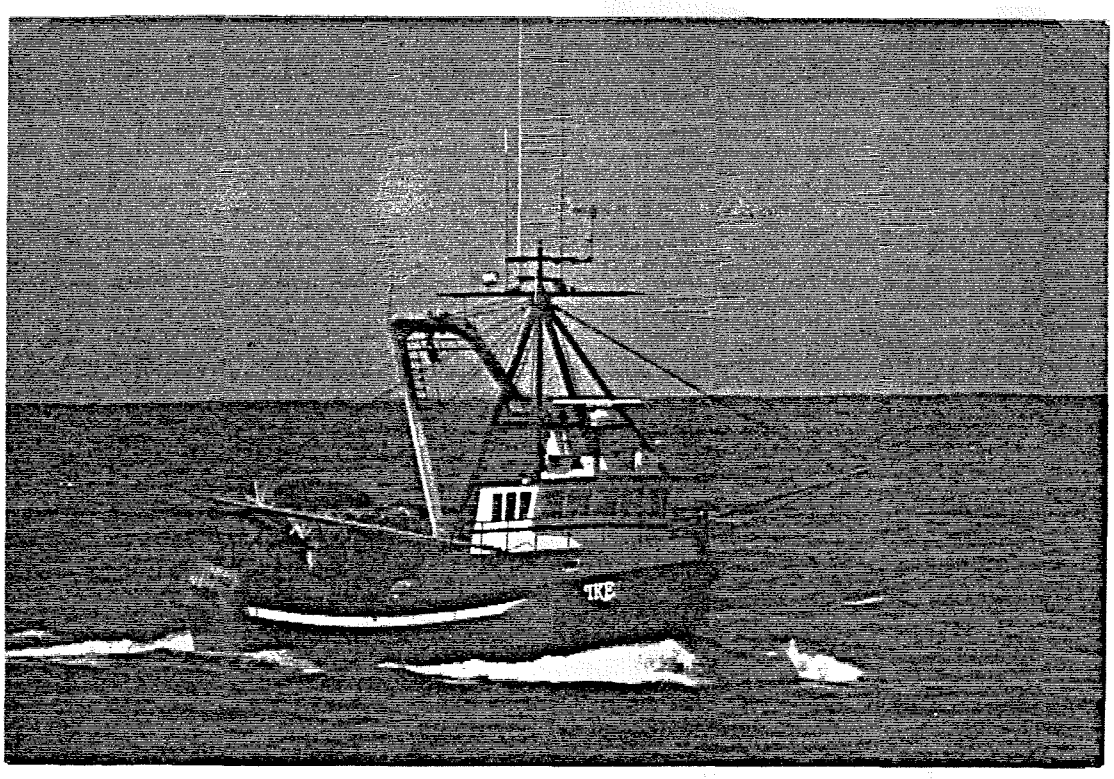


Figure 7d. Two net/two net reel set-up. (Courtesy of Gourock Trawls)

8.0 Comments From Fisherman Interviews

8.1 Hull Characteristics

8.1.1 Vessel Types

- A stern trawler can outfish a side trawler by a factor of 1.5
- My first stern dragger was a small 38 ft. lobster boat converted over in 1952 for inshore fishing.
- There have never been any side trawlers in Meteghan.

8.1.2 Hull Material

- A boat made with wood has more buoyancy.
- Fibreglass hulls require less maintenance because they have no seams, don't rot, and are easier to wash.
- Repairs on steel vessels are very expensive.
- Some small fibreglass boats are unsafe even with a full load of fish because they are tippy.

8.1.3 Fish Hold

- There is no benefit from insulating or refrigerating the fish hold since there is no premium paid for better quality fish.
- One problem with insulated fish holds is that they trap moisture which may eventually cause rotting.
- Refrigerated hold maintain better quality fish, especially if the boat gets delayed in off-loading.
- Insulation adds an extra half day of ice at the end of a trip.

8.2 Deck Equipment

8.2.1 Winches

- The hydraulic main winch provides fingertip control of the net.
- I've had a hydraulic winch for the last 4 years and found it to be quieter and more powerful than the mechanical winch I had before.
- The hydraulic winch has no ropes, or chains to deal with. Reduced maintenance and repairs might save one or two trips per year.

Current Useage %:

	Hydraulic	Mechanical
Digby	15-30	70-85
Meteghan	50	50
Yarmouth (under 25 tons)	0	100
Woods/Clarkes Harbour	100	0
Pubnico	20	80

8.2.2 Net Reel

- Because most of the net is hauled out of the water directly on to the reel, there is little chance that the net will get fouled up on the propeller.
- Can handle the gear in rougher water.
- Because less of the net has to be "fleeted" on board with the net reel, there are fewer fish that escape while the net is alongside the boat. Also the fish end up on deck a lot quicker.
- It's a nuisance to unroll the net off a net reel for repairs. Others said that this disadvantage can be overcome with practice.

Current Useage %:

Digby	- 5 (3 boats)
Methghan	- 0
Yarmouth (less than 25 tons)	- 0
Pubnico	- 25
Woods/Clarkes Harbour	- 30

8.2.4 Boom Stabilizer

- Over the course of a year, it probably gives me an extra week of fishing time.

Current Useage %:

Digby	- 100
Meteghan	- 90
Yarmouth (less than 25 tons)	- 0
Pubnico	- 100
Woods/Clarkes Harbour	- 100

8.3 Propulsion Systems

8.3.1 Engines

- In small and mid-sized draggers over the past 2 or 3 decades the physical size of diesel engines has stayed about the same but the power has doubled.
- Some 45 ft. draggers have as much or more power than the 65 ft. ones.

- The increase in power over the years allows fishermen to tow bigger gear.
- Gas engines run too hot for dragging. Fuel consumption is 3 times that of a diesel.

8.3.2 Nozzles

- They save fuel and therefore money.
- They add another 25% more towing power.
- They are not popular because they slow down your maximum steaming speed and decrease manouvering ability close to the wharf. Others said that with practice you can overcome the poor manouverability. This characteristic partially depends on how well the nozzle was installed in the first place.
- More fuel efficient operation with the nozzle; keeps the engine revolutions down during towing which makes it easier on the engine.

8.3.3 Variable Pitch

- One boat I know with one works out of a shallow, sandy harbour. Over the past two years, the variable pitch propeller has been nothing but trouble. It has cost several thousand dollars to maintain and repair not to mention the two weeks of down time it has cost that fisherman each of the two years.

8.4 Electronics

8.4.1 Sounders

8.4.1.1 Colour Sounder

- Can find small concentrations of fish which we used to pass over before. When fish are scarce we estimate that we catch 50% more fish using the colour sounder.
- Modern sounders with expanders can detect fish even while steaming which couldn't be done in the 1960s.
- Can distinguish shrimp, pollock, and dogfish from other fish species.
- Takes practice to familiarize oneself with the proper gain setting on the expander.
- Estimates of current general useage ranged from 5 to 50% of the small dragger fleet. The large draggers have installed very few of them to date.

8.4.1.2 White Line Recorders

- Could distinguish fish from large rocks for the first time.
- Dogfish showed up as fine grey markings.
- Permitted fishing on new grounds.
- Paper recorders were a big help to longliners because they not only identified the edges of banks we fish on but also the bottom type.

8.4.1.3 Flasher

- Could only detect hard bottom.
- Could recognize herring in the mid-water but not groundfish.

8.4.2 Loran, Decca

- Allows you to keep on the tow better because its stations are steadier.
- Can more accurately pinpoint the location of a difficult tow compared to Loran-A.
- More accurate because of a better signal. For the first while, I had to constantly compare Loran-C positions with Loran-A or Decca bearings designating old catch and wreck positions. Later models would do this automatically.
- No improvement with Loran-C would rather have the old combination of Loran-A and Decca which I have fished with all my life.

8.4.3 Plotter

- After each trip, I library all the plotter printouts from a trip for future reference.
- I use Loran C to interface with the plotter but I have the system programmed to record on Decca or Loran-A charts.
- Not used yet by very many longliners.

8.4.4 Radar

- Since I installed radar on my inshore vessel in 1972, I can fish more confidently particularly in the fog. Estimate 30% increase in catch due to this alone.
- No real improvement in the last 25 years.

8.4.5 Communication Equipment

8.4.5.1 SSB

- Because the SSB is noisy, most fishermen do not monitor it continuously. For this reason, it is useful for more personal or private conversations.
- We use the SSB as a ship to shore radio because of its greater range.
- We listen to it for the New England marine weather forecasts which are updated every 6 hours.

8.4.5.2 UHF

- We never have it off during a trip.
- It is important for safety reasons because it is clearer than the old C.B. sets.
- At times it is useful for fleet communication but usually the school of fish has been scared off by the time you get there.
- I feel that it does not provide any noticeable help from other fishermen since fishermen are not apt to reveal information on a good catch.

8.5 Fishing Equipment

8.5.1 Otter Trawl Gear

8.5.1.1 Nets

- The Rockhopper is more suited to fishing haddock in the Bay of Fundy compared to the Western trawl because it tears up less. An estimate of the catch difference over a season would be between 15 and 30%.

- The Western trawl because of its higher lift was a better cod and haddock new than the Yankee. The Yankee trawl was a good flounder net.
- If fish are tight to the bottom there is no difference in catching among the various types of nets. However if the fish are slightly off bottom, the Balloon and Rockhopper trawls will do better.
- Over the year, the Rockhopper saves 2 extra weeks of down time compared to the Western because of fewer repairs.
- The Balloon and Western trawl fish better on good ground than the Rockhopper because of the longer foot rope.

Current Useage %:

	Rockhopper	Balloon	Western IIA
Digby	80-95		
Woods/Clarkes Harbour	10	60	30
Meteghan	50	20	30
Pubnico	25	25	50

8.5.1.2 Twine

- Poly is easier to mend since the holes can be found easier; holds its shape better; new poly doesn't let sand in so it stays lighter; will lose about 2 years.
- Nylon doesn't wear like poly but is 3 times as expensive; a nylon net drags on the bottom; it wouldn't outfish a poly net.
- I used a nylon codend attached to a poly net up until 1981 before switching to a completely poly net.

- Poly floats better and is cheaper than nylon.
- In 1965 100% of the small dragger nets were made of poly and 50% of the codends. The other 50% of the codends were nylon.
- Poly doesn't braid well.

8.5.1.3 Doors

- I use steel doors in the Bay of Fundy because they don't wear as bad as wooden ones. Also they come in various sizes and shapes.
- The size of doors (175 lb. each) on the converted lobster boats has remained the same since 1965. The modern 45 ft. dragger has doors weighing 700 lbs a piece.

8.5.1.4 Bottom Gear

- On my 45 ft. boat, I switched from wood to rubber rollers in 1974-75. Currently every boat uses rubber rollers.
- Years ago they used to use auto tires for rollers.
- In 1970, I changed from wooden to rubber tire discs shaped like dumbells.

8.5.2 Longline Gear

- The biggest development in longlining since 1960 has been in the price of bait.
- Marginal returns caused by high bait prices since 1979 have forced fishermen to use twice the gear today.

- There has been a gradual increase in the size of vessels since 1960 allowing fishing further offshore.
- Low-cost automated systems with mechanized non-random baiters are the answer for the future.
- Random baiting becomes an alternative if low-cost squid is available which it hasn't over the past 2 or 3 years.

9.0 Acknowledgements

I would like to thank the many individuals and companies, government personnel, and fishermen that provided their expert advice and donated illustrative material for this report. Several of these are identified below.

Name(s)	Company/Department/Occupation
J. Morton	Gourock Trawls
F.A. (Red) Hurst	Cummins Diesel
R. Wood	Dolphin Electronics, Ltd.
J. Cullen	Seaboard G.M. Diesel Ltd.
L.W. Conrad	Lunenburg Foundry and Engineering Ltd.
R. Meir	Canadian Marconi Co.
B. Hawkins	Colwell Enterprises Ltd.
S. Bower	Atkinson and Bower Ltd.
T. Goudy	Racal-Decca Canada Inc.
S. Jenkins	Jenkins Industries Ltd.
M. Kaulback	Hawboldt Industries Ltd.
F. Caines	Leckies
C. d'Eon	Camille d'Eon Boat Builders Ltd.
R. Theriault	A.J. Theriault and Sons Ltd.
W. Cox	Harley S. Cox and Sons Ltd.
A. Boylston	N.S. Dept. of Fisheries

N. Kimber	Dept. of Fisheries and Oceans
J. Rycroft	Dept. of Fisheries and Oceans
F. King	Dept. of Fisheries and Oceans
W. D'Entrement	Dept. of Fisheries and Oceans
D. Peeling	Dept. of Fisheries and Oceans
M. Eaton	Canadian Hydrographic Service
C. Sprules	Fisherman
B. Bourque	Fisherman
I. Morton	Fisherman
R. d'Entrement	Fisherman
B. Nickerson	Fisherman
N. Smith	Fisherman
L. Longmire	Fisherman
R. LeBlanc	Fisherman

Appendix "A"

Vessel specifications for three small trawlers:

1964 - 46 ft.

1965 - 65 ft.

1983 - 65 ft.

(Courtesy of A.J. Theriault and Sons Ltd.)

[redacted]

ANNAPOLIS COUNTY, N. S.
B0S 1K0
Tel; 532-7032
April 16, 1981

1983 - 65' dragger

Proposed Hull similar to M/V Listeven. Department of Transport approval date August 26, 1964. This vessel will be rigged for stern dragger and side scallopper with chucking houses on both sides.

PRINCIPAL DIMENSIONS:

Length overall	64'	11"	Approx.
Beam moulded	22'	0"	Approx.
Depth	11'	3"	Approx.

MATERIALS AND FASTENINGS:

Hull to be constructed of oak, birch and spruce of first class quality and fastened according to the architect's fastening schedule, boat caulked throughout to be as tight as possible.

TRIALS:

All trials to be conducted by the Builder at his expense and shall be witnessed by the owner or his representative. Trials will be conducted to comply with the Canadian Steamship Inspection Service.

HULL AND ACCOMMODATIONS:

Bunks to be provided for 8 men in forecastle.

Captain's room to be provided with 2 bunks.

4 bunks to be fitted in the galley.

1 settee or bunk to be fitted in wheelhouse.

Sealing in way of berths to be sheathed with birch plywood.

Galley to contain the necessary cupboards and drawers and to be according to plan.

Galley sink and pump.

Magazine racks to be fitted to each berths.

All floors in accommodations to be fitted with Battleship linoleum or tiles.

Oil clothes lockers to be furnished with coat hooks.

Galvanized oval iron to be fitted to the Hull where required.

Ice sheathing on bow to be of stainless steel fastened with stainless steel screws.

Side and stern sheathing to be of birch or oak.

3/16" steel plate sheathing on rail in way of gallows.

Wheelhouse to be fitted with windows similar to M/V Sylvialyn II.

One drop window on starboard side and one drop window on port side.

Fishole and bulkheads to be insulated, fishole deck to be insulated.

Penboards to be of aluminum and stanchions to be of aluminum.

Fishole floor to be of cement on each side and aluminum in centre.

.....2

Fishole to be fiberglassed.

Fishole to be installed with copper tubing type refrigeration system. Compressor to run from main engine.

Ballast to be cement poured flush with keelson.

NOTE: Builder will provide up to 6 tons of ballast if required.

MAST, FITTINGS, RIGGINGS, CHOCKS, BITTS AND HAND RAILS:

8 side rings and 1 bitt to be fitted as shown on the drawing. (12 1/2" x 9" base).

2 bow chocks to be fitted on deck.

1 mast to be of steel construction.

1 boom to be of steel construction.

2 boom stabilizers.

TANKS:

1 Fuel tank capacity approximately 4000 gallons.

1 Water tank capacity approximately 500 gallons.

1 only Hydraulic tank approximately 250 gallons with proper fittings and filter.

1 only Lube oil tank 60 gallons.

NOTE: Water tank to be stainless steel construction.
Fuel tank to be 3/16" steel plate.

PLUMBING:

Vessel will be fitted with one stainless steel sink in forecastle, cold and hot water.

STOVE AND HEATING:

One only ABCO No. 10 Marine Furnace or Pot Burner type hot water furnace. Hot water operation with radiators in wheelhouse, forecastle, 1 in engine room and captain's cabin. Hot water system in radiators to be arranged in such a way to enable the use of the engine to heat the system.

1 only propane stove.

C. S.I. & MISCELLANEOUS EQUIPMENT:

1 only 2 1/2 gallon dry chemical fire extinguisher in engine room.

3 only 5 lbs. ABC type fire extinguishers to be stationed to the satisfaction of the Canadian Steamship Inspection.

1 only pair of brass electric and oil side lights.

1 only electric and oil brass stern light.

1 only electric and oil brass anchor light.

2 only 30" life buoy rings.

1 only life buoy light to be installed on life buoy with line.

6 only life jackets.

1 only 200 lbs. Marine Kedge anchor.

7 fathoms 1/2" galv. chain.

1 only 6" brass ship's bell to be mounted in centre of wheelhouse front.

1 only compass to be supplied by Auto Pilot.

.....3

2 only 8 men inflatable liferaft.

1 only dory fully equipped with dory plugs (2) for each hole, 1 galv. bucket, 4 eight feet oars, 1 hatchet, 12 only red flares, 6 rockets, drink cups or bung dippers, 1 lantern and 1 gallon kerosene, 4 rowlocks or 4 sets of thole pins, 1 boat hook or gaff, one only box of matches, 1 bailer and 1 dory compass.

50 ft. of fire hose and nozzle to fit fire hose.

1 Halon system installed in engine room.

VENTILATION:

1 only 8" cow vent.

8 only 14" manhole to be secured on deck.

Aluminum door to gain access to transom.

ELECTRICAL

A switchboard of adequate size to be fitted to handle the electrical circuits. (Closed from type for 32 volts DC).

3 light fixtures will be installed in forecastle, 2 under the raise deck, 2 in wheelhouse, 1 in back of each winch, 3 in fishole, 1 in transom, 2 on gallows frames, and one at the head of each berths.

One half mile Ray search light.

Two only 12" Crouse Kinds floodlights.

2 sets V Batteries GTNS33 Surrette.

2 only 32 volts, 115 AMP alternator to be installed on main engine.

1 only Constavolt -- La Marche A5-20-32, with 200 ft. shore cable.

PUMPS:

One only 2" Centrifugal Bilge pump on Lister Engine.

One only 2" Monarch pump on main engine.

DECK GEAR:

1 only Hawboldt 2236 Split Hydraulic winches with guard on gear or equal.

2 only Hydraulic bagging winches. (H7B-3-30 Pull Master or equal).

2 only Hydraulic winches for Boom Stabilizer.

1 pair trawl doors -- 7 1/2 feet.

1 1/2 pair gallows -- 5" H Beam.

1 only pipe frame on stern of boat. (Pipe gantry on AFT).

3 Hanger blocks 6 x 12.

2 only Flat blocks 6 x 12.

1 only Upright block 6 x 12.

1 Offshore Dumping deck.

1 Digby Dumping deck.

2 trawl warps 350 fathoms each of 3/4" galv. wire rope.

1 - 12 ft. Scallop rake - complete.

Hydraulic hoses and fittings to be installed on winch to be H. D.

Necessary blocks and tackles for fish dragging.

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MECHANICAL:

1 only KT 2300 Cummins 700 HP @1800 RPM or equal -- Twin disc MG 527 - 5.17 to 1 ratio or equal.

1 only 5 1/2" stainless steel tail shaft to comply with C.S.I.

1 only 5 1/2" Intermediate shaft to comply with C.S.I.

Size of shaft to comply with C.S.I.

1 pair Intermediate couplings.

2 only 5 1/2" Intermediate bearings, or equal.

1 only 5 1/2" Lunenburg Foundry stuffing box or equal.

1 only 5 1/2" Lunenburg Foundry Ryertex stern bearing or equal.

1 only 5 1/2" bulkhead stuffing box.

Brass sleeves to be fitted to above stern bearing, stuffing box in order to make both watertight as possible.

1 only 4 blades RH propeller approximately 54" dia. x 48" pitch bore 5 1/2" std. taper, keywayed, one brass nut and locking pin, size to be confirmed by engine manufacturer with a cork nozzle.

1 only steel engine bed fastened to frames for lister engine.

1 only steel engine bed for main engine.

1 only 32 bolt Air horn. All pipine to be done to the satisfaction of C.S.I.

1 only Lister generator with 2" bilge pump as mentioned above, one one 115 Amp. alternator or equal.

STEERING:

Steering apparatus to be a Wagner Model T 18.

Steering system to be connected between pump and cylinder with aeroquip hose and heavy-duty fittings and heavy-duty pipe.

Rudder to be 4 1/2" steel stock with steel packing with steel collar to prevent rudder from rising.

1 only cast iron rudder bearing.

1 only bronze stuffing box for rudder, rudder stock to be metalized abreast of stuffing box.

1 only steel skey with brass bushings.

1 only brass or chrome steering wheel.

MISCELLANEOUS:

Zinc plates to be installed on rudder stock, stern bearing and seacocks.

Mooring lines to be of 1" nylon, one stern line, one bow line, two spring lines.

Boat to be copper painted on bottom, above water line to be painted to the satisfaction of owner.

Putty will be put in each seam except for below water line, cement will be put in place of the putty to satisfaction of owner.

Cuprinoil will be painted on keel, frames bilge stringers, ceilings, clamps, shelfing and planks.

All bilge pumping , fire fighting, life saving equipment to be installed to satisfaction of Board of Canadian Steamship Inspection.

Refridgerator to be propane type.

....5

ELECTRONICS:

1 only JMA 300 Radar 24 mile range c/w magnifier lens or equal.

1 only JMA 310 Radar 64 mile range c/w magnifier lens and V.R.M or equal.

1 only 802 Simrad Skipper Sounder c/w Scale expander, 19° transducer or equal.

1 only 802 Simrad Skipper Sounder c/w 19° transducer or equal.

1 only CH100 SSB Radio c/w voice operated squelch, internal tuner, 32 V. DC, mount kit, 8 simplex, 2 duplex channels 208 B antenna or equal.

2 only C-Master Dual Loran C c/w interface for C-Plot II, line steering option, antenna and cable or equal.

1 only C-Plot II position plotter 32 V DC or equal.

1 only Wagner Auto Pilot or equal.

1 only V100X Robertson V.H.F. c/w 476 antenna, 32-12-20 Power supply or equal.

1 only Simrad automatic V.H.F. direction finder or equal.

1 only 500 K V.H.F. programable scanner c/w antenna 399-1 or equal.

Installation in Meteghan River with shipyard mounting equipment, making hydraulic connections to Auto Pilot, supplying radar stands, supplying power to equipment.

For the purpose of this quote we have used a figure of $60,000.00 (sixty thousand dollars) for electronics including compass.

A. F. THERIAULT & SON LIMITED

PER _____
ARTHUR F. THERIAULT.
Vice-President Finance.

CERTAIN WORK TO BE EXECUTED AND MATERIALS TO BE FURNISHED BY THE BUILDER PURSUANT TO THE FOREGOING AGREEMENT.

1965 - dragger

Amount shown in Section 8 of the Agreement shall be payment in full for the vessel ready for sea except dishes and loose fishing gear and shall include supplying and installing the following:

65 ft. L.O.A.
19'-8" BEAM
DRAFT- 9'-9"

7 only Mattresses
#52 D. Enterprise stove, 32 V. Motor, oil burner
1 only toilet
1 only #58 Federal Marine Horn
1 only #1 Fog Horn
1 only 8" Brass Bell
2300 gals. fuel tanks
900 gals. diesel fuel oil
225 gals galvanized water tank
1 T-15 Wagner Hydraulic steerer
1 30" brass sterring wheel & hub
steel engine beds
1 only 200 lbs. Danforth Anchor
1 only Spar and all rigging
wiring and all navigation lights
2 only 12" Flood lights
1 only 16' dory equipped C.S.I.
1 Smith Webasto Hot Air Heater
10 only 14" Galv. bunker plates
P.T.O. Control
Pipine & Valve etc.
1 only 5" x 12' Tobin Bronze Shaft
1 66 x 58 x 4 blade Manganese Bronz small engine
1 6" Syertex Bushed stern bearing
1 6" stuffing box
1 Stern tube
1 only Bulkhead Stuffing Box
2 6" Steady bearings on intermediate shaft
1 set Companion flanges
1 6" x 16' Forged steel shaft
1 1353 Hathaway Winch - 20" drums
2 only 5" Gallow Frames
6 only #639 Gallows & Deck Blocks (6 x 12)
Jackshaft, Roller Chain and all sprockets
48" x 7'4" Westerbeke trawl doors
3 set Batteries 32 V.
2 coil 350 fathoms 9/16" Galv. Trawl Warps

Schedule "A" (page 2)

1 only Pressure Pump

Deck pump

4 10" Port lights

4 8" Port lights

1 stainless steel sink and 1 aft.

2 outside blocks

3 brass door levers

1 Navy Bilge Pump

Dry Chemical Extinguisher

5 2½ lbs. fire extinguisher

Battery blower

Zinc plates

Copper ground plates

Anchor Chain 7 fathoms 7/8"

Mooring line

Bow and stern chocks

4 10" Ventilators

4 8" ventilators

1 20" Manhold

1 Rudder indicator

Ballast

Paint

Oakum

Cotton

Putty

Cuprinol

~~One radar Ray Mac LN51~~

1 EM2A Simrad Sounder

1 CN86 Marconi Radio Telephone

Auxiliary Set - Lister Model SL-2 air cooled, 2 cyl.

Main Engine:

One VT-12 700-M Cumains marine diesel with 6:1 reduction gear, rated 455 B.H.P. @ 1800 R.P.M., standard equipment, 130 H.P., front power take-off with 3:1 reduction, heat exchanger, wheel house controls, bilge pump, exhaust silencer, battery alarm etc.

Fire-fighting and life saving equipment, bilge pumping, anchors and lights to satisfaction Steamship Inspector

Price shown in section 3 of the Agreement shall be payment in full for the vessel, ready for sea, except messing gear, bedding and loose fishing gear and shall include supplying and installing the following:

1964 - dragger

One new Rolls Royce marine diesel engine with capitol hydraulic 5:1 reduction gear, rated 335 H.P. @ 1800 R.P.M. with 3 to 1 front power take-off.

1500 watt generator on engine

4 inch bronze shaft

one 4-blade bronze propeller, suitable diameter and pitch

one 4 inch stuffing box with cutless rubber

one 4 inch inside stuffing box

one 5 inch bronze stern tube

2 - 4 inch steady bearings for shaft

2 sets 32 volt turrette batteries

fuel filter

water trap

alarm system

2-300 gallons each fuel tanks if this size can be put aboard

1 water tank

1 stove, pitcher pump, small sink

1 steel rudder stock in side stuffing box with quadrant 3/8" flexible wire rope

1 Kingsbury foundry bulkhead strainer

Boat to be piped throughout with manifold valve and check valve

Seacock

One pump on main engine

one fire hydrant outlet

Boat to be completely wired throughout

One spar, boom and rigging

1 K.K. 10 am

One 2" deck pump

Hathaway winch No. ~~1635~~ 1335 B

2 - 4" gallows frames

2 manger blocks

1964

46 ft. L.O.A.
16 ft. BEAM
10 ft. DEPTH

" (Continued)

deck blocks

winch to be driven with countershaft with front power take-off, off main engine

300 fathoms ⅝" flexible steel wire on each drum

One pr. doors, rope, tackle and blocks

One anchor

Fish pens

Sheathing

One dory

Bunks in forecastle

Linoleum on galley floor

Insulated bulkheads

One compass

One Model 512-11 White Line Simrad [illegible] Sounder

One C.M. 86 Marconi radio telephone with crystals for six channels

Fire-fighting and life-saving equipment, anchors, bilge pumping equipment as required by Steamship Inspector