A NEW GERMAN FISHERIES RESEARCH VESSEL

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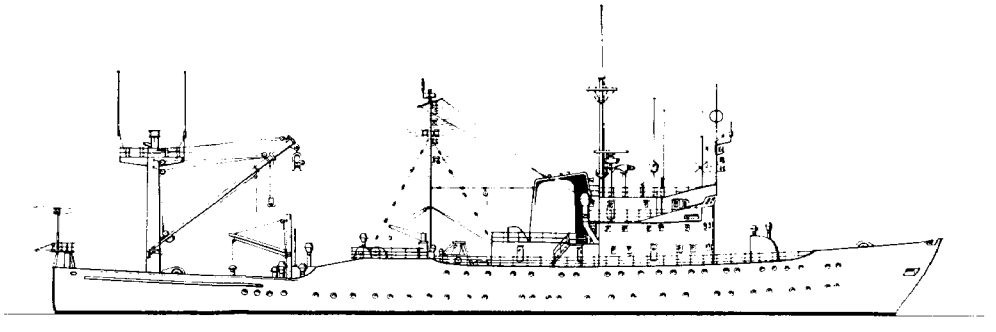
During the last few years the German deep-sea fishing industry has lost traditional catching grounds with considerable harvests due to the extension of the fisheries boundaries of some of the North European states. Besides a diminished population, since dynamic and hydrographic changes have at times a somewhat unfavourable influence on the nature and productivity of the remaining catching grounds, the fisheries conditions have considerably deteriorated following the shift in fisheries boundaries. Thus, the German fisheries fleet is forced to change its structure by not only modifying the traditional trawling vessel but also by introducing new methods of catching. A greater variety in the employment of fishing craft must be achieved, and a better adaptation to the differing seasonal and local catching conditions (J. SCHÄRFE, 1963). This will lead to better exploitation of the remaining catching grounds and the discovery of new possibilities for catching. Anticipating this development, and in view of the fact that the German fisheries cannot alone bear the costs and carry out the work involved, on 31 January 1962 the Bundesministerium für Ernährung, Landwirtschaft und Forsten placed an order with the Seebeckverft of the A.G. " Weser " at Bremerhaven to construct a second German



F.R.V."WALTHER HERWIG"

fisheries research vessel, and this was in addition to other measures to improve the fisheries situation in Germany. Since 28 October 1963 the FRV *Walther Herwig* has been aiding the German deep-sea fisheries in their efforts to improve and enlarge both the techniques and the range of fishing, and thus it supplements the activities of the first fisheries research vessel *Anton Dohrn* (placed in service on 3 March 1955) which is mainly devoted

to the basic exploration of fisheries conditions (H. BERTRAM, 1955). FRV *Walther Herwig*, like the FRV *Anton Dohrn* and the fishery protection vessels *Frithjof*, *Meerkatze* and *Poseidon*, is managed from the Fischwirtschaft section of the Bundesministerium für Ernährung, Landwirtschaft und Forsten. The scientific side of the planning and the realization of the employment of vessels rests with the Bundesforschungsanstalt für Fischerei in Hamburg, and in particular with the institutes of net and materials research, of sea fishing and of processing.

1 016 tons of steel were needed to construct the research vessel which was christened on 8 June 1963. Her name signalizes the special tasks of the vessel, outlined only roughly at the beginning of this paper. Dr. Walther HERWIG (25/2/1838 to 16/12/1912) founded the Deutscher Seefischerei-Verein, and from 1885 to 1907 was its first president. His outstanding merit was that in this function and through this organization he developed and promoted the interests of the German deep-sea fishing industry.

In view of her expected employment and performance FRV *Walther Herwig* is designed as a stern trawler with high speed and large cruising range, suited for operating in distant catching areas. She was built as a two-compartment vessel in accordance with the rules laid down at the International Conference on the Safety of Life at Sea, 1960, and as a passenger vessel, class I, in respect of fire protection. She has a $+ 100 \frac{A}{4}$ (E +) class certificate issued by the German Lloyds.

A tabular comparison with the latest fisheries research vessels (G. DIETRICH, 1962) will demonstrate what performance may be expected from the *Walther Herwig*. The fisheries research vessels chosen are :

Name of vessel	*Walther Herwig*	*Anton Dohrn*	*Thalassa*	*Explorer*	*Ernest Holt*
Nationality	German	German	French	Scottish	English
Year of construction	1963	1955	1960	1955	1948
Length o.a. (m)	83.2	62.3	66.1	61.6	59.2
Beam (m)	12.5	10.2	10.4	9.8	9.2
Displacement (t)	2 395	1 325	1 500	862	1 100
Speed (knots)	14.5	11	12	12	11
Cruising range (nm)	11 000	9 000	17 000	8 000	4 500
Cruising time	60-90	60	60	34	17
Propulsion	Diesel	Steam	Diesel	Steam	Steam
SHP	2 000	850	1 100	1 200	900
Number of propellers	1+2 Pl	1+1 Pl	1+1 Pl	1	1
Scientists and technicians	9	15	18	10	4
Officers	13	12	7	7	4
Crew	27	19	24	21	25
Laboratory space (m^2)	85	76	104	37	14

FRV *Walther Herwig* is a single-screw vessel and, for the purpose of an almost continuous regulation of the propulsion power, is diesel-electrically driven by three Maybach motors MD 330 and one Maybach motor MD 655 which deliver their output to two main motors (2 000 SHP). The motors are double-elastically fitted on a common frame and indirectly cooled via heat exchangers. A Pleuger active rudder with an output of 250 SHP and a Pleuger bow thruster plant of 400 SHP serve as emergency propulsion and help to increase the manoeuvring capacity, particularly in

narrow waters, and to maintain an exact position during measurements at sea [1, 1964].

In order to avoid sea water corrosion in the water cooling systems, the cooling systems of the supercharged cooler of the four Maybach motors, of the circuit heat exchanger for the main and auxiliary generators, of the main motors and of the compressors for the air conditioning, the cargo hold and cold storage refrigeration are all converted to fresh water. For these purposes, and for each cooling system separately, there is provided the possibility of cooling through the surface of the shell plating since the heat received is dissipated through these plates. Only in the case of high outboard temperatures must sea water take the place of fresh water.

Connected to the motors is a combined waste heat boiler for the heating of the air conditioning, fish meal and liver plants, fired by the exhaust gas of the main motors at sea, and oil-fired in port. The output of this boiler is 2 tons per hour.

The vessel can carry about 435 tons of fuel oil and 60 tons of drinking water. Fresh water is replenished by a De Laval sea-water evaporator (output 10 tons per 24 hours).

The fuel oil is carried in double-bottomed tanks floated in sea water so as to maintain as far as possible a draught of 5.20 m. There is a double-bottomed tank in both the fore and the aft part for the trim of the vessel; these may be carried empty or filled with fuel oil or sea water, respectively.

The fuel oil double-bottomed tanks are emptied by a turbo-oil extractor made by the Deutsche Werft, Hamburg, which secures the highest possible degree of oil and ballast water separation.

Direct current is used for the running of the main propulsion plant, 3-phase current for the ship's general network. Besides the propulsion motors which are also partly connected with the ship's general network there is a Deutz port diesel motor plant with an output of 290 BHP. An emergency current plant of 50 BHP with automatic starting gear feeds the most important consumers in the case of a breakdown in the ship's general network.

The ship has a revolving-type steering gear with two pumps, and a rudder angle of 90°. The windlass is electrically driven.

There are stores for dry provisions, vegetables and meat, for housing the ship's provisions.

The officers are accommodated in single-berth cabins, the crew in double-berth or three-berth cabins. There is, moreover, spare accommodation for two. All cabins have daylight.

There are shops for the engineer, the carpenter and the electrician. Diving equipment with cutting appliances, and a Pleuger salvage pump (output 200 tons per hour) (A. v. BRANDT and E. WEBER, 1963) are among the special devices.

The complement consists of 38 men including the master. Moreover the meteorologic office on board is always manned by one meteorologist and a meteorologic radio operator from the Seewetteramt, Hamburg, who

advise the fishery fleet. Since long cruises are planned, a small four-berth hospital under the care of a surgeon, an operating room with X-ray apparatus, and a dentist's station equipped according to the latest achievements in this field are to be found on board. The vessel is provided with a large radio station and with the latest aids to navigation such as : Decca navigator with course recorder, visual direction finder, Loran, two echo-sounders with flashing lights, registering equipment, cathode ray display, etc., a gyro compass, a log, and automatic steering which, together with the large cruising range, allow the ship to reach the remotest catching grounds. As the vessel is to operate in the northern North Atlantic as well as in the tropics, her accommodation and laboratories are fitted out for all climatic conditions. The command, control, and signal stations are adapted to the special requirements and conditions of the ship's employment. Besides a control panel with an observation stand on the bridge, the research vessel has a fishing control station with voice radio in the aft part of the chart house. For trawling and dragging the instruments usually installed on modern stern trawlers are all available. The winches are operated from a central winch control panel giving a full view of the after-deck. The large electrically driven trawl winch consists of two separately installed drums each for 3 000 m of trawl warp. The hydraulically driven auxiliary winches, which are separate from the large fish-net winch, serve for dragging as well as for fishing with big purse seines for which a hydraulic power block is available (H. HARMS, 1964). Purse seining for herring, mackerel and pilchard can be performed by means of two purse seine boats, each having a purse seine net on board. These two boats, equipped with 300 HP motors and power blocks, are placed amidships. The large purse seining is performed by the research vessel herself, a skiff of American construction being used to run out the seine. The purse seine is taken in by a hydraulically driven power block suspended to a derrick which can bear almost 10 tons and can be swung round by about 180°. This derrick is fixed to a mast on the after-deck, port side, and is of such a length that the seine can be fitted on a platform situated above the rear gangway. For pelagic fishing there is a modern deep-sea trawling net with an electric cable winch for 2 000 m of cable. In order to be able to process at least some of the fish, besides those needed for the fisheries biological investigations, there are on board the following : a fish hold of 63 m^3 (about 500 baskets) which can also be used as a deep-freeze cargo hold; a deep-freeze cargo hold of 73 m^3 (about 50 tons of fillet made from about 3 000 baskets of fish); and a pre-refrigerator of 30 m^3 which is necessary, above all in the tropics, for the short-term storage of fish. This pre-refrigerator can also be used for storing deep-frozen goods. When fully utilized, the storage capacity for frozen fish corresponds to a haul of 1 300 baskets and in respect of fillet (about 115 tons) to a haul of 5 500 baskets. In addition to this there is a hold of 72 m^3 where offal or meal from about 1 100 baskets of fish may be stored. As permanent installations for fish processing there are available a washing machine, a deep-freezer plate with an output of 2.2 tons per 24 hours for the freezing of fillet, a tunnel-type deep-freezing plant for freezing the fish whole with an output of 1.8 tons per 24 hours, a fish meal plant (output 10 tons per 24 hours), and a liver-boiling plant (J. SCHÄRFE, 1963).

The tasks of the research vessel cover three main subjects :

(1) A thorough biological and hydrographic investigation of the traditional catching grounds with a view to giving direct assistance to the fleet operating in that area, and to be of help in the detection and exploration of profitable stocks of fish hitherto not harvested in the Atlantic Ocean in general.

(2) Improvements in traditional fishing gear and methods, as well as the development, testing and introduction of new instruments and techniques, or those not hitherto applied in the German deep-sea fishing industry. These tasks are now split into a greater number of individual fields of activity.

New net production techniques will be tested. These include cotton twine made of new synthetic fibres, or mixtures of fibres, a more rational fabrication of netting by using knotless methods, and the construction of modified nets made of pre-fabricated pieces of tube.

One of the tasks related to the techniques of fishing is to improve the methods hitherto applied, i.e. to introduce both trawling by new net constructions and drift netting by adapting the fleet to catching herring shoals at greater depths. As trawling and drift netting are the only methods hitherto used in German deep-sea fishery, the vessel will serve to introduce other such well-known techniques of fishing as purse seining for herring and mackerel-type fish, and long-lining for tunny fish. These are methods allowing fishing operations in new and not yet harvested catching grounds even outside the traditional northern North Atlantic. Purse seines are especially suited for catching pelagic schools of fish when near the surface. Long lines are the characteristic fishing gear for deeply-placed tunny fish, and other fish of this category, randomly distributed over larger areas. The vessel will further aid in the development of new and not generally used catching techniques, since pelagic drag netting from a single craft is possible. Thus it will be feasible to harvest stocks at all depths, off the bottom as well as from near the surface, which will mean the detection of fish shoals not hitherto exploited. A combination of these or other techniques with the method of fishing by means of electricity is also being considered. The use of electricity will probably increase the hauls considerably. It envisages attracting, concentrating, and deadening the fish. Thus the range of the drag net will be enlarged and the escape of the fish ahead of the net avoided. The fish may probably also be guided by electricity to grounds more suitable for fishing. Furthermore drag netting at great depths with gear meant also for trial scientific catches will be promoted.

The improvement of existing methods of fishing and the introduction and development of new methods require a modification of the deck arrangement on fishing vessels so as to advance the mechanization of fishing techniques. This means not only improvements in the handling of fishing gear but also the rationalization of all the working processes from catching to landing. Manual work on board will be reduced by the introduction of suitable machines. Moreover, the behaviour of the net during the process of fishing will be observed from the vessel and registered. The results will be of help in the construction of nets allowing a better flow

of water through the net, due to the smaller resistance of the drag net, and thus leading to a more rationalized way of fishing.

The construction of the vessel as a stern trawler is an important prerequisite for carrying out modern investigations. Through the combination of different techniques of catching the vessel will become an example for future constructions. Thus, discussions between designers of fishing craft and technicians engaged in the development of different fishing techniques on how to construct better fishing vessels will be stimulated.

On board the vessel the behaviour of fish will also be studied. A knowledge of the behaviour of fish ahead of the fishing gear helps to improve the output of the gear. Moreover the study of the behaviour of fish will also further our knowledge of the daily rhythm of fish. The rhythmical visits to certain water layers and the succession of active and inactive phases in behaviour lead to favourable and unfavourable periods for fishing, and these have not hitherto been duly observed by the German fishing industry.

New or improved methods of fishing necessitate modifying fishing tactics. Therefore the vessel will also serve as a base for studying meteorologic and hydrographic influences on the hauls. Concentrations of fish by means of artificial attraction, such as chemical bait, light or electricity will serve this purpose as will the enclosing of catching grounds by air bubble curtains, and the expulsion of fish from unfavourable catching grounds by means of electric shocks.

The improvement in the detection of fish by depth echo-sounders and sonar equipment is also part of the activities performed on board the new research vessel. The conventional recording-type detection gear, underwater photography and television, and direct observations by scuba divers all serve this end. The vessel will also be used for work in the field of marine bio-acoustics.

(3) Studies for better treatment and processing of fish on board the research vessel. A fishing technique is not useful only because it renders good results with a minimum of expenditure; it must also be on test for its influence on the quality of the hauls. A fish carefully caught from the fisheries point of view is not necessarily carefully caught as regards its processing. The co-operating food chemists and technicians engaged in the development of fishing techniques will pay regard to these activities on the new research vessel. Besides measures taken for the treatment and storage of fish so as to increase the quality of the hauls, refrigerating and processing installations, as well as methods of unloading the hauls, will also be improved (A. v. BRANDT and E. WEBER, 1963).

The scientific and technical personnel entrusted with research tasks are accommodated in four double-berth cabins. The scientific leader of a cruise is given a double cabin. For the three main fields of activity the following laboratories and instruments are available :

(1) For biological and hydrographic investigations of the catching grounds a fish laboratory and an oceanographic laboratory with an inductive salinometer (L. N. BROWN and B. V. HAMON, 1961) are available, as well as a read-out room with 16 Nansen bottles, a combined hydrau-

lically driven winch for use with a bathythermograph and with a deep-sea winch for 10 000 m of 4 mm-thick rope and for 1 000 m of 6 mm-thick rope.

(2) For fishing techniques there are a special sounding and recording room, a special laboratory, devices for measuring the trawl warp stress and angle as well as the engine propeller data, and a motorized rubber boat.

(3) A special laboratory and space for the installation of processing machines to be tested have been designed for the processing of fish.

The research vessel *Walther Herwig* has stood her test excellently during several research cruises. She has been so equipped that problems not existing at the time of her design can be studied as well as questions of pressing present importance.

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