CONSTRUCTION AND OPERATION OF THE "COBB" PELAGIC TRAWL (1964)

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SUMMARY

1. The "Cobb" pelagic trawl has caught large quantities of Pacific hake while being towed through the water at a speed of only 2 to 3 knots.

2. The quadruple armored, six-conductor towing cable has withstood repeated tows under test fishing conditions.

3. Accurate depth positioning of the trawl was essential for making repeated large catches of midwater fish.

4. Trawl depth was easily controlled by changing engine speed.

5. The "Cobb" pelagic trawl was effectively operated by a 73-foot Pacific Coast commercial trawler.

INTRODUCTION

During 1964, substantial catches of Pacific hake (Merluccius productus), Pacific ocean perch (Sebastodes alutus), and anchovy (Engraulis mordax) were made by the U. S. Bureau of Commercial Fisheries' 93-foot research vessel John N. Cobb and the chartered 73-foot commercial trawler St. Michael using experimental "Cobb" pelagic trawls (fig. 1). Catches up to 30 tons of mostly Pacific hake have been made in a single 30-minute tow (figs. 11, 12 and 13).

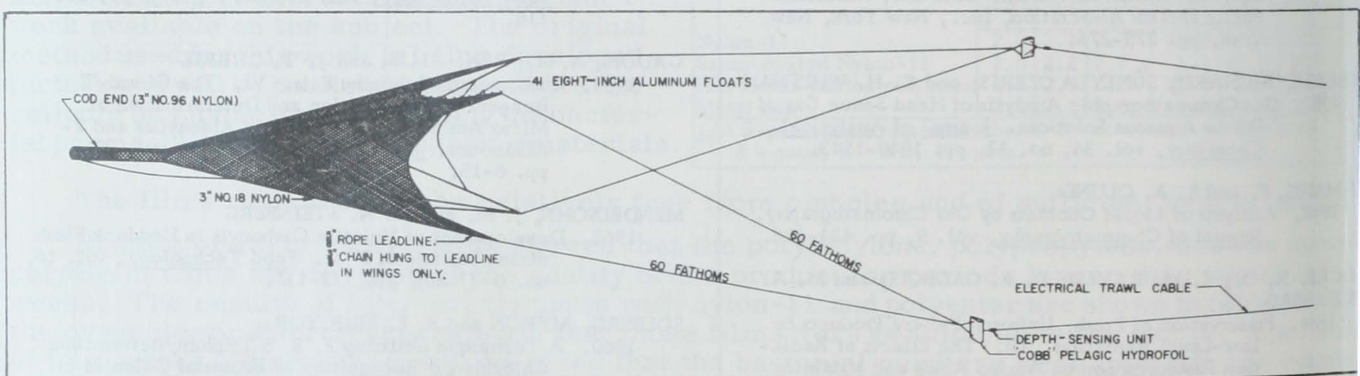

Fig. 1 - "Cobb" pelagic trawl (1964).

The "Cobb" pelagic trawl has been under development since 1961 at the Bureau's Exploratory Fishing and Gear Research Base in Seattle, Wash. (Alverson 1962). The details of construction have primarily resulted from modifications shown to be necessary during direct underwater observation by SCUBA-equipped scientists traveling along with the gear (McNeely 1963). Excellent catches taken during the past year show that a large net towed at 2 to 3 knots would be effective in harvesting midwater species.

Consistently good catches of hake by the St. Michael during gear research experiments and by the John N. Cobb during pelagic explorations have resulted in an unusually large number of requests for information concerning details of construction and operation of the new gear. This report will satisfy such requests.

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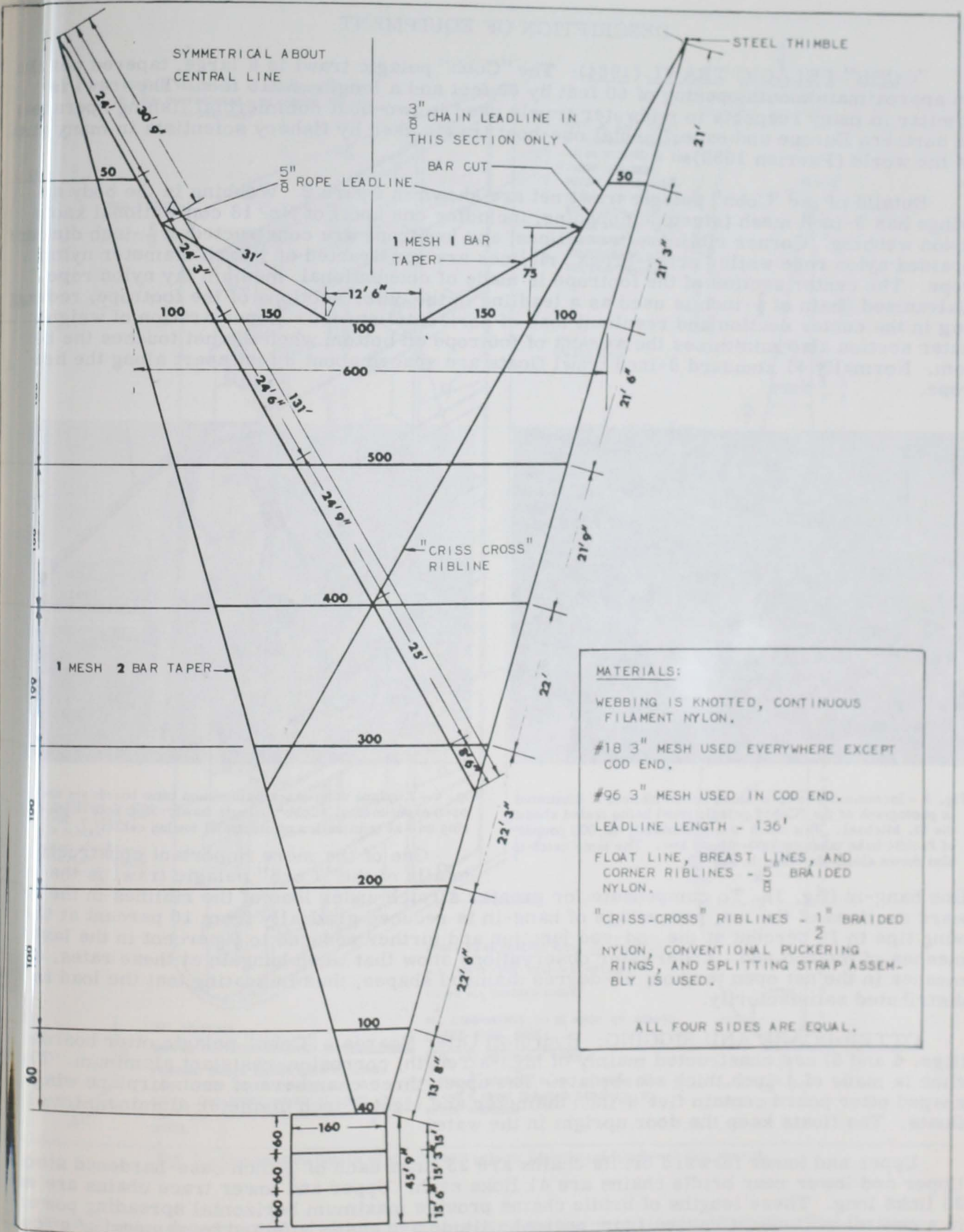

Fig. 2 - Construction details of the "Cobb" pelagic trawl.

DESCRIPTION OF EQUIPMENT

"COBB" PELAGIC TRAWL (1964): The "Cobb" pelagic trawl is a large, tapered net with an approximate mouth opening of 60 feet by 60 feet and a length of 215 feet. The trawl is similar in many respects to midwater trawls used in two-boat commercial fishing operations in northern Europe and experimental one-boat trawls used by fishery scientists in many parts of the world (Parrish 1959).

Details of the "Cobb" pelagic trawl net are shown in figure 2. Webbing in the body and wings has 3-inch mesh (stretched opening, including one knot) of No. 18 conventional knotted nylon webbing. Corner riblines, breastlines, and headrope are constructed of $\frac{5}{8}$-inch diameter braided nylon rope while "criss-cross" riblines are constructed of $\frac{1}{2}$-inch diameter nylon rope. The center section of the footrope is made of conventional, medium lay nylon rope. Galvanized chain of $\frac{3}{8}$-inch is used as a leadline in the outer sections of the footrope, reducing sag in the center section and resultant loss of horizontal spread. Concentration of weight in outer section also minimizes the amount of footrope on bottom when the net touches the bottom. Normally 41 standard 8-inch trawl floats are spaced about 3 feet apart along the headrope.

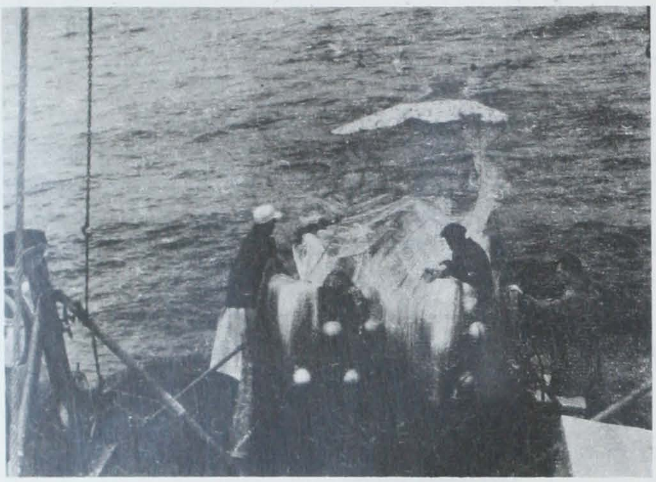

Fig. 3 - Incremental hang-in along corner riblines is illustrated in photograph of the "Cobb" pelagic trawl being reeled aboard the St. Michael. This catch is approximately 42,000 pounds of Pacific hake taken in a 60-minute tow. The same catch is also shown alongside vessel in fig. 12.

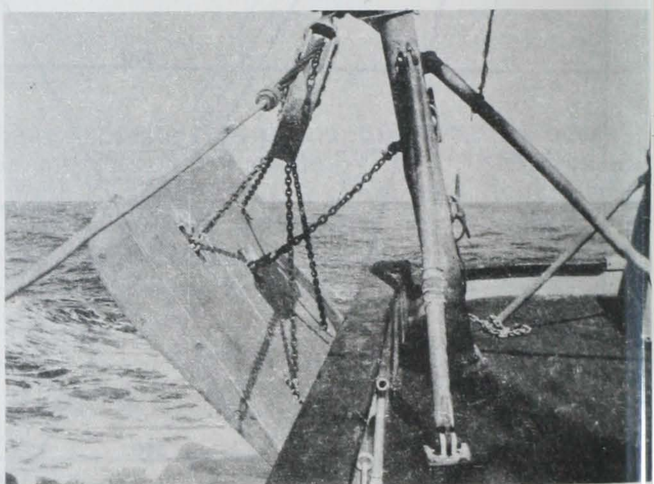

Fig. 4 - Airplane wing-shaped aluminum otter boards are used to open experimental "Cobb" pelagic trawl. Also note depth-sensing unit at termination of electrical towing cable.

One of the more important construction details of the "Cobb" pelagic trawl is the ribline hang-in (fig. 3). To compensate for greater stretch under load of the riblines in the forward sections of the net, percentage of hang-in is reduced gradually from 16 percent at the wing tips to 10 percent at the cod-end junction and further reduced to 0 percent in the last 60 meshes of the cod end. Underwater observations show that when hung-in at these rates, all meshes in the net open to about 60-degree diamond shapes, thus indicating that the load is distributed satisfactorily.

OTTER BOARD AND RIGGING: Hydrofoil Otter Boards: "Cobb" pelagic otter boards (figs. 4 and 5) are constructed mainly of high-strength, corrosion-resistant aluminum. The shoe is made of $\frac{1}{2}$-inch thick steel plate. The upper three chambers of each airplane wing-shaped otter board contain five 8-inch diameter and eight 5-inch diameter aluminum trawl floats. The floats keep the door upright in the water.

Upper and lower forward bridle chains are 25 links each of $\frac{3}{8}$-inch case-hardened steel. Upper and lower rear bridle chains are 41 links each. Upper and lower trace chains are each 86 links long. These lengths of bridle chains provide maximum horizontal spreading power in a neutral attitude. Changes from neutral attitude are easily affected by removal of a few links from either upper or lower trace chains depending on the diving or climbing attitude desired. Any change from neutral attitude causes a loss of horizontal spreading power.

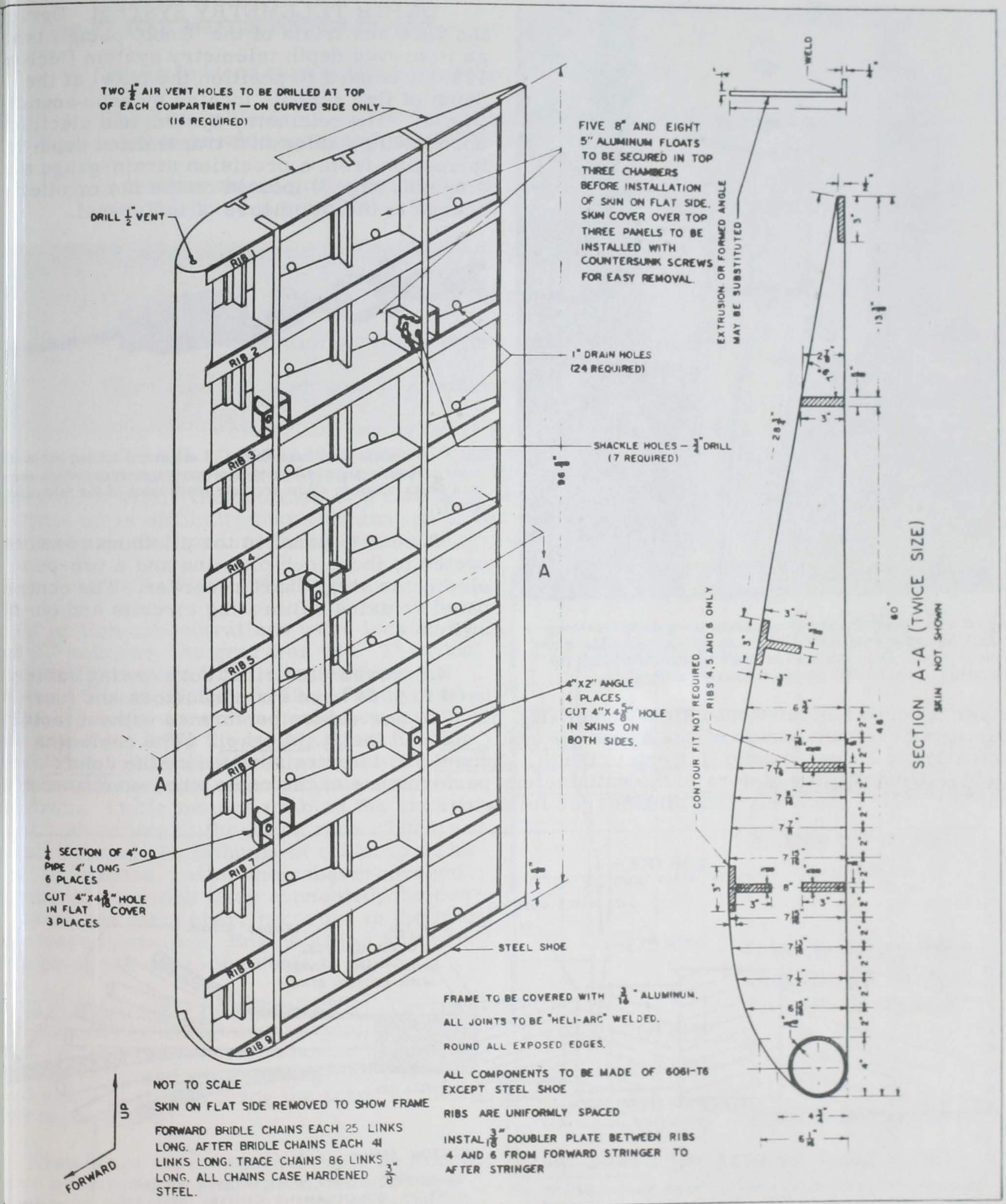

Fig. 5 - Construction details of the "Cobb" pelagic otter board (starboard side shown).

Sweeplines: A conventional bridle system connects the net to the hydrofoils. Bridle sweeplines are 60 fathoms long and are made of $\frac{1}{2}$-inch diameter steel cable.

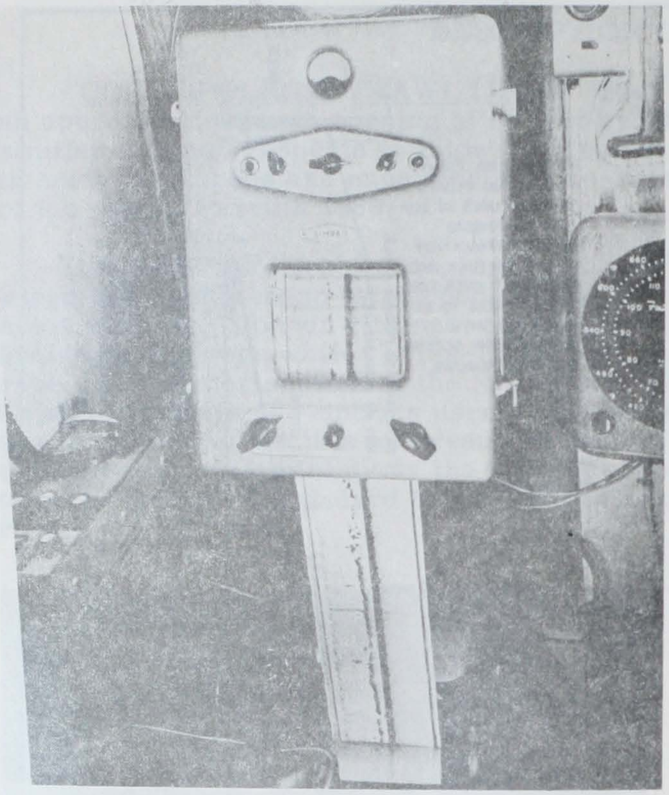

Fig. 6 - Echogram of fish concentration shows 4- to 6-fathom thick layer approximately 10 fathoms off bottom in 62-fathom water depth. Drag made while this echogram was being recorded yielded 50,000 pounds of mostly Pacific hake.

DEPTH TELEMETRY SYSTEM: During the 1964 sea trials of the 'Cobb" pelagic trawl, an improved depth telemetry system (McNeely 1958) was used to position the trawl at the depth of fish schools located by echo-sounding (fig. 6). The telemetry system had electrical core towing cables that transmitted depth information from a precision strain-gauge sensing unit (fig. 7) located on the net or otter boards to the pilothouse of the vessel.

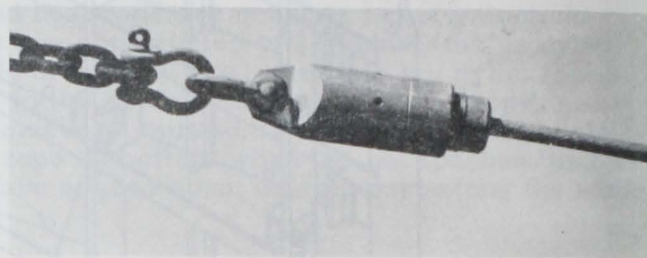

Fig. 7 - Stainless steel case on end of electrical towing cable contains precision strain-gauge type pressure transducer which serves as a depth sensor to allow accurate positioning of the midwater trawl.

A control panel in the pilothouse was connected to the winch plug-ins and a two-pen electronic strip chart recorder. The control panel contains calibrating circuits and on-off switches.

Improved electrical core towing cables used in 1964 have six conductors and four-layer opposed helical-wound steel armor (fig. 8). The new cables performed without fault during a 10-month period of use by the John N. Cobb and the St. Michael. (The cable was transferred from the John N. Cobb to the St. Michael and later reinstalled on the John N. Cobb.) Contributing factors to the satisfactory performance of the cable when compared with earlier cables (McNeely 1961) include the following:

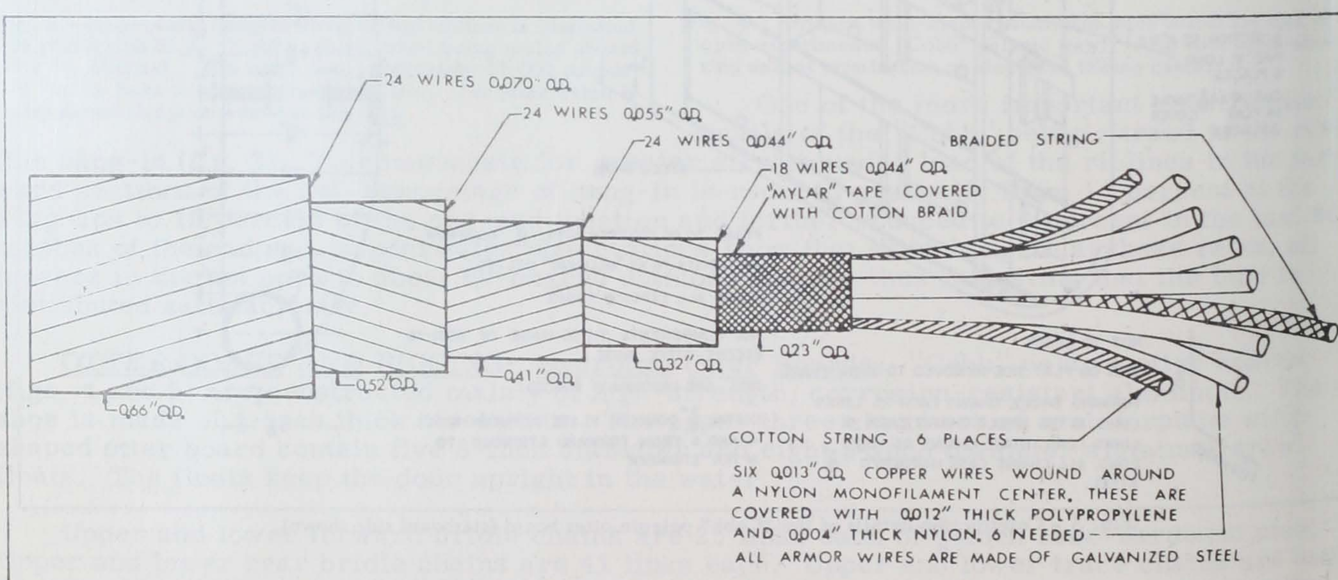

Fig. 8 - Scale drawing of the electrical towing cable shows the 4 layers of steel armor and 6 insulated conductors.

1. Four-layer steel armor construction.

    a. Strain induced torque has been reduced.

    b. The new cable has a 47,000-pound breaking strength compared to the 19,000-pound breaking strength of earlier experimental cables.

    c. A thicker shield protects the electrical core from physical damage, particularly at the point of emergence from the sensing unit cable termination socket.

2. Electrical core construction has been improved.

    a. Conductors are made of six twisted strands of 28-gauge copper.

    b. Conductor insulation consists of two layers of tough plastic.

    c. Core size has been kept to a minimum.

Termination of the electrical towing cable at the sensing unit was accomplished using er molten babbitt or epoxy to secure a short section of unwound and curled steel strands ide the termination socket (McNeely 1960). Bending and curling the four layers of steel nds to fit within the confines of the sensing unit termination socket was accomplished little more difficulty than termination of two-layer cable. Continuity at the winch was ided by quick-disconnect, waterproof plug-ins.

OPERATION OF GEAR

After fish concentrations were located by echo-sounder, the gear was set. The trawl sweeplines were first unwound from the ling net reel (Wathne 1959). The hydro- trawl boards were then hooked up, and the e payed out from the towing winch. Cable rs attached to the towing warps were used dicate the amount of cable unwound from drum. Cable meters enabled the crew to t both cables at the same rate. The trawl, plines, and 100 fathoms of cable could be 10 minutes. After the rubber-covered -ins at the winch were connected, the con- panel and strip chart recorder in the pilot- e were turned on. Engine speed was var- o bring the net to the desired depth.

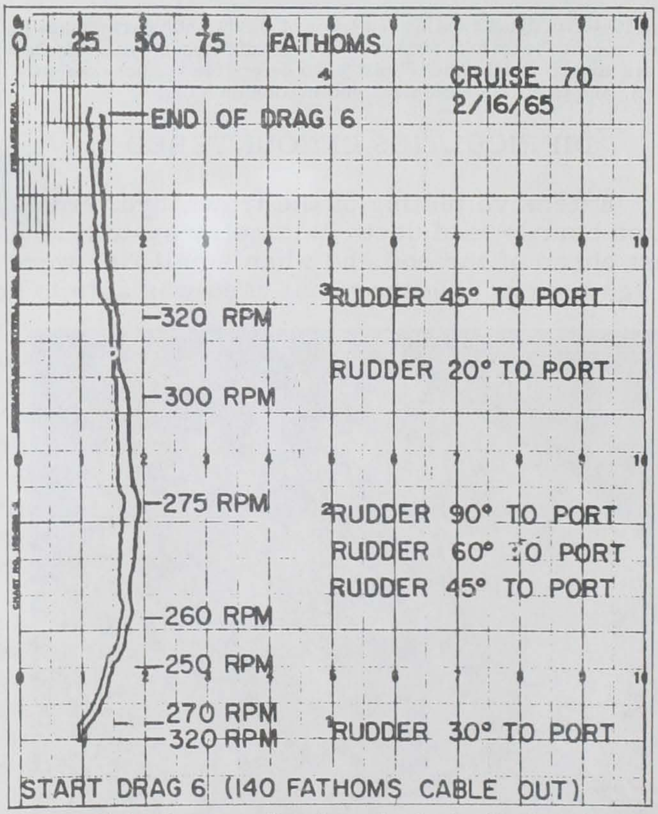

Fig. 9 - Strip-chart recording shows the depth of both starboard and port hydrofoil otter boards. The starboard hydrofoil is nearer the surface because the net banks like an airplane as the boat turns. When the turn becomes tighter the net banks more. The trawl rose in the water as engine speed was increased.

CONTROL OF TRAWL DEPTH: The trawl h was easily changed by varying engine ed. If the echo-sounder showed the depth ish had changed while towing, the engine ed was adjusted to bring the trawl to the de- d depth (fig. 9).

Even large depth changes could be accom- ied by varying engine speed. In a recent aboard the John N. Cobb, 200 fathoms of le were unwound and the trawl towed at an ine speed of 260 r.p.m. The net was at 75 oms. The engine speed was then increased 10 r.p.m. The net rose 25 fathoms in 10 minutes. The engine speed was then dropped to r.p.m. causing the net to drop to 100 fathoms. This depth change took 15 minutes.

At the end of the tow, the net was hauled out. First, plug-ins at the winch were disconnected and the cable wound in. If the net was being towed near bottom, the engine was run at full speed for about 10 minutes to bring the net well clear of the bottom before reeling in cable. When the hydrofoils were brought up to the davits, idler chains were disconnected from the hydrofoils and connected to the net reel. Sweeplines and net were then wound onto the net reel. Two crewmen guided the sweeplines and net evenly onto the reel. About 40 minutes were required to wind in 150 fathoms of cable, sweeplines, and net.

Fig. 10 - Fish caught during sea trials of the "Cobb" pelagic trawl are brought aboard to determine the weight of catches (dynamometers were used to weight each "split"), to determine species composition, and to obtain biological information on hake.

Large catches were swung around to the side of the vessel and brought aboard in repeated "splits." Proficiency in estimating the weight of catches was gained through use of a precision dynamometer to weigh each split after noting the size of the bag of fish alongside the vessel (fig. 10).

Fig. 11 - A catch of 60,000 pounds of Pacific hake taken in a 30-minute tow by the U. S. Bureau of Commercial Fisheries exploratory fishing vessel John N. Cobb using an experimental "Cobb" pelagic trawl.

DIFFICULTIES ENCOUNTERED

Extensive testing of the trawl, hydrofoil otter boards, and depth-telemetry system revealed several deficiencies. Many fish gilled just ahead of the cod end when small fish were encountered. Webbing ripped on contact with rough bottom. Neither boat used was able to hold a course when towing across a strong tide.

Fig. 12 - A catch of 42,000 pounds of Pacific hake taken in a 60-minute tow by chartered commercial trawler St. Michael using an experimental "Cobb" pelagic trawl. Fish on deck and those in net were taken in same tow.

Fig. 13 - Six-thousand-pound catch of rockfish (mainly Pacific ocean perch) in cod end of "Cobb" pelagic trawl. Meshes of cod end are 3 inches (stretched measure). Note conventional splitting stap assembly.

o, electrical connections at the winch and inside the sensor housing failed. Changes in the tmetry system were made to eliminate the cause of such failures.

REASONS FOR LARGE CATCHES IN 1964

Larger catches obtained during 1964 sea trials compared to those taken in 1962 and 1963 trials are probably due to two important factors. First, during recent trials, the trawl usually fished only after the echo-sounder indicated moderate to heavy concentrations of were present. In 1962 and 1963 the trawl was usually set without regard to size of fish centrations indicated by the echo-sounder. The second factor is the improved telemetry em, which more accurately positions the depth of the trawl.

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TROUT EGGS EXCHANGED BETWEEN UNITED STATES AND YUGOSLAVIA

The hatching of about 90,000 to 100,000 Ohrid trout eggs, received from Yugoslavia earlier this year in an exchange of fish eggs with that country, was reported by the U. S. Bureau of Sport Fisheries and Wildlife National Fish Hatchery at Manchester, Iowa. In exchange, an equivalent number of Donaldson strain rainbow trout eggs from the United States were flown to Yugoslavia.

United States biologists say the eggs from Yugoslavia were quite large and exceptionally well colored, and since hatching, the "fry" were reported strong and vigorous. The imported eggs were divided between the Bureau's National Fish Hatchery at Manchester, Iowa, and the State Hatchery at Lanesbore, Minn. Some of the Ohrid trout will be retained at the Manchester Hatchery as brood fish and others will be stocked in suitable lakes on an experimental basis.

The Ohrid trout, named for a lake in Yugoslavia, normally spawn on gravel beaches and do not require flowing water as do many other trout. For that reason, researchers believe they may prove useful for stocking some lakes in the United States. Adult Ohrid trout sometimes attain a weight of 8 pounds.