RECENT DEVELOPMENTS IN FISHING-VESSEL DECK GEAR

By C. B. Carlson*

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Among other problems, the fisheries of the United States are faced with increasing shortages of skilled manpower. This is encouraging increased mechanization of fishing operations and improved performance characteristics of deck gear.

PUMPS FOR UNLOADING MENHADEN

Pumps have been used for many years in segments of the California sardine industry for transferring fish from a hopper alongside the vessel to the shore plant or processing ship. More recently pumps were introduced into the Maine sardine and the Atlantic and Gulf menhaden fisheries to transfer fish from the vessel's hold to

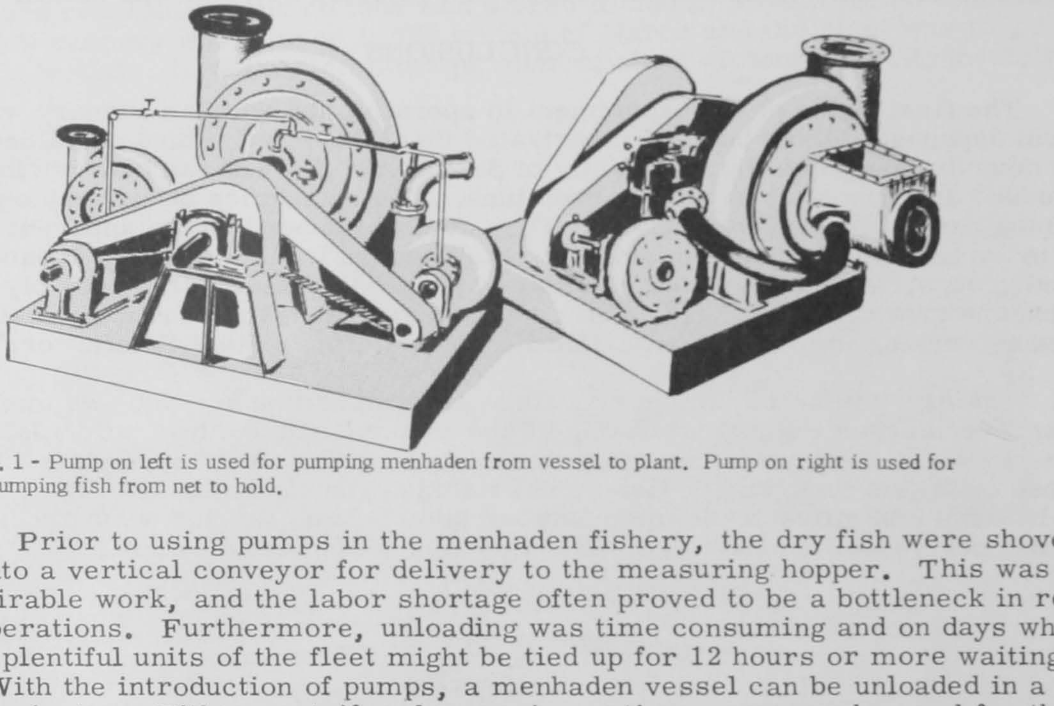

Fig. 1 - Pump on left is used for pumping menhaden from vessel to plant. Pump on right is used for pumping fish from net to hold.

the plant. Prior to using pumps in the menhaden fishery, the dry fish were shoveled by hand into a vertical conveyor for delivery to the measuring hopper. This was hard and undesirable work, and the labor shortage often proved to be a bottleneck in reduction operations. Furthermore, unloading was time consuming and on days when fish were plentiful units of the fleet might be tied up for 12 hours or more waiting to unload. With the introduction of pumps, a menhaden vessel can be unloaded in a matter of minutes. Either centrifugal or reciprocating pumps can be used for the shoreside operation. The menhaden vessels have a rectangular pipe with removable manhole plates built fore and aft into the bottom for the entire length of the hold. This terminates in a vertical pipe through the deck with a fitting for attaching an 8- to 10-inch diameter suction hose. The fish in the hold are wetted and sluiced to the manhole plates where they and the water are removed. When shoveling by hand, some fish were usually left in the hold and the wash down was inadequate. The use of pumps and large quantities of water for unloading have greatly reduced obnoxious odors and flies on the vessels and contributed to general cleanliness.

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PUMPS FOR BRAILING MENHADEN

The drying up of the menhaden in the fish bag and brailing the fish aboard the menhaden vessel is also a time-consuming and laborious task. The success of pumps for unloading at the dock led to testing their effectiveness for eliminating the brailing operation. Menhaden are caught by the two-purse-boat system and at least 10 men per boat are required to "harden" or dry the fish for brailing. When the catches are large, or the fish are "hard workers," it is almost impossible to harden the fish manually, and it may even be necessary to use a powered fall for assistance. Under these conditions the fish bag is likely to tear, resulting in the loss of most or all of the catch. The use of pumps greatly reduces the effort required to raise the fish because (1) it is not necessary to dry the fish to the degree required for conventional brailing and (2) the intake end of the suction hose can be lowered considerably below the surface and beyond depths that can be reached by a brailer. The saving in brailing time permits the making of additional sets.

Menhaden operators at Fernandina, Florida, believe the centrifugal type is more practical than the reciprocating type because of smaller space requirements. A very compact unit consisting of an 8- or 10-inch diameter main pump and a 2-inch diameter priming pump mounted on a single frame is now being manufactured for the industry. This same unit with the addition of a 5-inch diameter pump for sluicing the fish in the hold can be used for a shoreside installation to unload the vessels. Power is supplied to the main pump shaft by high-speed gasoline or diesel engines rated at 65 to 100 hp., and the auxiliary pumps are driven from the main shaft by sprockets and chain. Reinforced suction-type hose 8- or 10-inches in diameter and from 20 to 30 feet in length is used to carry the fish from the net to the pump. The hose is too heavy to conveniently manipulate by hand so a hand tackle or a powered single fall is used to govern its position. The intake end is fitted with 1/2-inch diameter iron bars in the form of a hemisphere to prevent the net from clogging, but the openings are sufficient to admit the fish. After leaving the pump, the fish and water are discharged on a screen consisting of 1/2-inch diameter bar irons at an incline of about 30 degrees to drain most of the water and to direct the fish to the hold. The separated water may either be discharged to the deck or piped overboard on the nonworking side of the vessel. Surplus water carried over with the fish is removed by the vessel's bilge pumps.

POWERED SEINE REELS IN THE SALMON FISHERY

The purse-seine fishery for salmon has long been considered highly efficient from a mechanized viewpoint because a crew of 8 or 9 men could haul a seine, over 300 fathoms in length and 25 fathoms in depth, 6 or 7 times per day. In the Alaska fishery 12 or 13 hauls per day, with a seine 200 fathoms in length and over 15 fathoms in depth, are not uncommon for a crew of 7 or 8 men. However, the recently introduced power reels, or drums, indicate 5 men can make up to 20 sets per day with a 300-fathom seine.

Salmon are caught by the "one-boat" method with the aid of a powered skiff. In established practice, as described by Carlson (1945), the seine is set and hauled from a turntable (mounted on the stern) which can be swung through a complete circle. The turntable is fitted with a roller which is powered to assist in hauling by friction between the net and roller and a clutch for free wheeling while setting. The seine is set over the stern and hauled over the side. Upon completing the circle, the purse lines--one from forward and the other from aft--are led through blocks on a davit amidships to the winch for power pursing. After the pursing is completed, the purse rings and lead line are lifted aboard. Meanwhile the cork line has been bunched on the working side of the vessel by men on the stern and in the skiff attached to the bow. When the turntable is in the hauling position, the cork line is piled on one side of the table over the stern; the lead, purse, and ring lines are piled on the forward side; and the netting laid between them. This arrangement permits the crew to haul various portions of the seine according to preassignment and keeps the lead and cork lines well separated while setting.

By the new drum system (Anonymous 1953), the net is set and hauled from a fixed reel set in a tank in the stern. The net is set in a fairly straight line or an elongated hook and the circle may be completed by towing on one or both ends by either or both the fishing vessel and the powered skiff. The procedure depends on the type of set most advantageous for the locality and the behavior of the fish. When "pursing" or closing the bottom, only the forward purse line is taken to the winch while the after purse line and a portion of the seine are wound on the drum. The purse line finally becomes taut between the davit and the reel. The remaining purse rings are picked up on an elongated "U" iron or "clothespin" suspended in a near horizontal position by a bridle from the boom. As the net continues to be reeled on, successive rings slip off the clothespin as the lead and ring lines become tight. A proportionate length of purse line is paid through the rings to be reeled on the drum with the seine. No effort is made to keep the cork and lead lines separated as in conventional practice, but one of the problems is to reel the seine evenly and tightly so that it will not bind while being set. Before being wound on the drum, the seine passes over a horizontal roller 8 to 10 inches in diameter and then between a pair of vertical rollers mounted on a traveler controlled by hand through a level wind gear. The vertical fair lead rollers are about 8 inches in diameter and 30 inches high with a free space of about 10 inches between them. They are mounted on a hinge so they can be tipped inboard to avoid tearing the net while setting. The power skiff plays an important part in drum seining for one of its functions is to tow the vessel from the nonworking side to maintain proper fair lead of the seine for hauling. The drum system requires close coordination of the entire crew for the chances of fouling the gear on the rudder or propellor are increased.

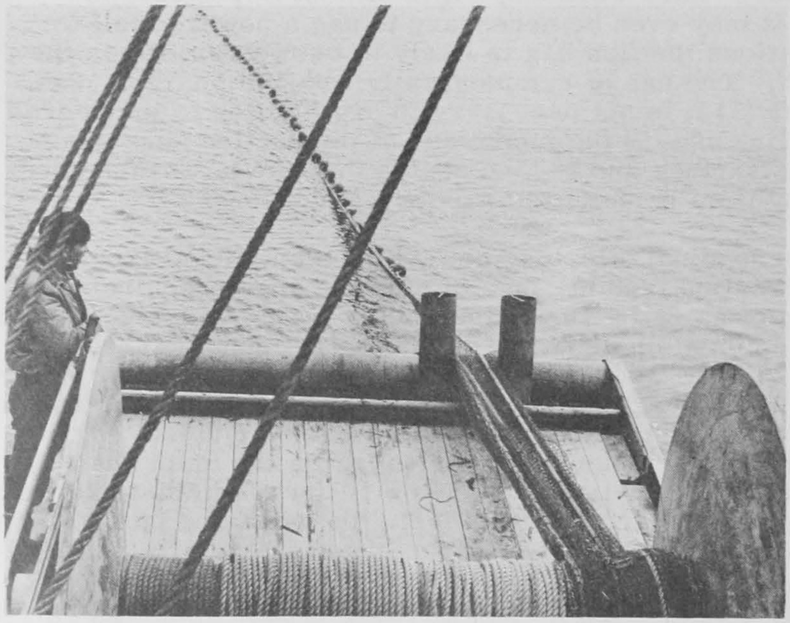

Fig. 2 - Taking in purse seine, shwoing drum, roller, and level wind device.

The drums are fabricated of steel and have ample capacity if the seines are tightly wound. The dimensions of the drum vary from 5 to 9 feet in diameter and wide enough to suit the space in the stern of the vessel and the volume of the seine. Reels now in use have a capacity from 225 to 400 cubic feet but one reel, measuring 9 feet in diameter by 10 feet in width with a capacity of 625 cubic feet, was to be installed on a Canadian purse seiner. The reels are set in a tank in the stern made watertight from the rest of the vessel but fitted with a self-bailing device to permit drainage. It would not be surprising if some enterprising fisherman devised a tight top for these tanks for additional fuel capacity for other fisheries where longer cruising range is required. Such tanks might also be made suitable for carrying live bait in the albacore tuna fishery.

The reels must be adequately and properly powered with variable speed running either forward or in reverse. When hauling it may be necessary to reverse the drum if it becomes evident that a "bind" is being made which will interfere with a subsequent set or to assist in starting the seine when a set is being made. Furthermore, the pursing strain may exceed 5,000 pounds line pull and variable speeds are required depending on the strain and the need to remove gilled fish or those caught in a "pocket." The drum must be free wheeling so that the seine can be set easily. A good brake must be provided to stop and hold the seine while it is in the water.

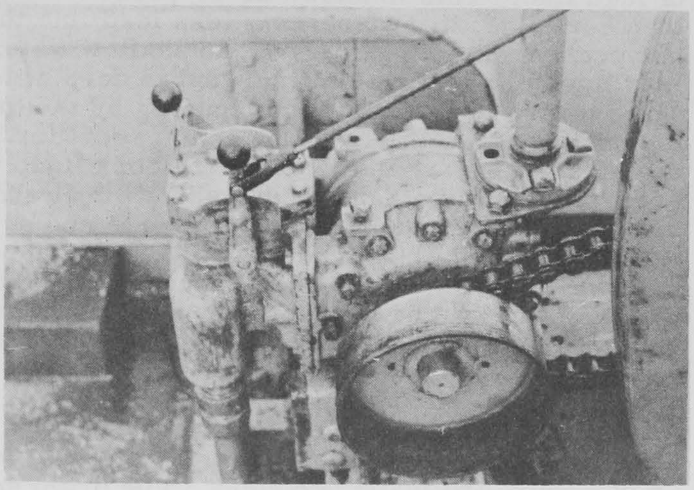

Fig. 3 - Hydraulic drive system on drum seiner Indiana. Rim of seine drum shows along right margin of photograph.

The reels are powered by either a hydraulic motor or a mechanical system. In the latter instance power is taken from the main engine and transmitted through a system of sprockets, roller chain, and shafting to a truck transmission short coupled to a truck differential and brake drum on the reel. Speed reductions up to 84 to 1 and reversing the reel are possible by this method. The hydraulic drive functions by oil under pressure from a pump through a reversible and free-wheeling hydraulic motor coupled by a chain and sprocket drive to the drum. Proponents of the hydraulic drive claim smoother and more positive control of the drum speed in either direction while exponents of the mechanical drive claim greater puller power when so required to haul the seine.

The present system of locating the drum on a fixed horizontal axis presents certain limitations which did not exist with the turntable system. The turntable roller can be moved from the stern to a fixed position over either side depending on how the set is made and better fair lead can be obtained while hauling. Fishermen are considering the feasibility of mounting the horizontal reel on a pivot to best suit the angle of the seine for hauling. If this was done the hydraulic drive system might well gain popularity because of the flexibility of the oil supply hoses against the fixed limitations of a mechanical drive. Some thought is being given to the feasibility of a drum on a vertical axis but level winding above and below the deck line then becomes a serious problem.

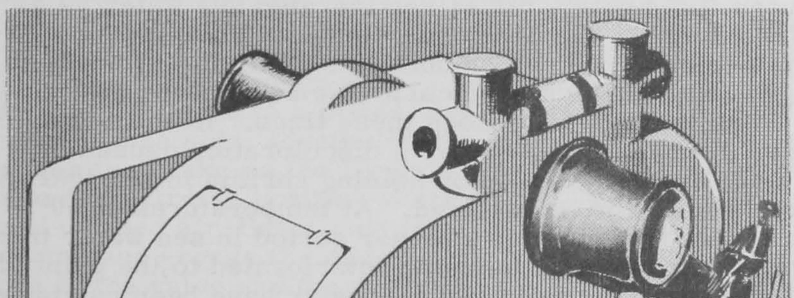

Fig. 4 - Air-control valve on combination purse-seine and otter-trawling winch.

A different method of hanging the seine is also essential for the drum system. Customary practice is to hang salmon seines in flights of 10 fathoms, consisting of 10 fathoms of cork line, 11 fathoms of stretched-measure netting, and 9 fathoms of lead line. This is known as 10-percent hanging, i.e., 10 percent more netting than cork line, and 10 percent less lead line than cork line. This type of hanging has proven quite effective both in shallow water where it tends to keep the purse to lead lines clear of the netting, and in deep water where it tends to form a bottom while towing the seine. When hauling by the drum method this system of hanging is unsuitable, as the lead line is too short for proper spooling because it would distort the meshes and loops in the cork line, which would bind when setting. However, the lead line can be hung about 3 feet shorter per flight, or 5 percent instead of 10 percent shorter than the cork line and be spooled evenly because of the greater bulk of the cork line. The backlog of experience indicates that a 5 percent hanging in of the lead line will not hold fish in deep water but proponents of the drum system maintain this can be overcome by hanging in an extra 2 or 2 1/2 fathoms or 30 to 35 percent of extra netting per flight, thereby creating a greater bag in the seine.

The use of drums for hauling nets is not a novel idea for it has been used in the salmon gill-net fishery for a number of years, but the problems in this fishery are simpler; the cork and lead lines are of equal length, the net is shallow, and only one or two hauls are made per night. The drum seining method was developed by Canadian fishermen several years ago and has been used by one boat on Puget Sound for some time. In the 1953 season 11 boats were fitted for drum seining.

Further development and modifications of the principles involved in drum seining may provide a marked contribution to reducing manpower requirements in the menhaden, herring, and mackerel fisheries. In the menhaden fishery a large crew is required both to haul the seine and to dry the fish for brailing. Menhaden seines are always set in a circle and the working of the fish toward the stern of the purse boats while the seine is being hauled suggest that the reels could advantageously be set at an angle to the boats. The use of pumps has naturally lowered the effort required to brail fish and power reels may carry this a step further.

CHILL TANKS IN THE SHRIMP FISHERY

Recently several shrimp trawlers, utilizing equipment designed by a commercial engineering firm, have been fitted with tanks of refrigerated sea water as a medium for cooling and holding shrimp. The University of Miami Marine Laboratory has been doing considerable research work on holding shrimp in this medium, and on means of surmounting some of the technological problems involved as described by Higman and Idyll (1952). Work is continuing along these lines. Results to date have demonstrated that the formation of "black spot," a discoloration caused by enzymatic action under the shell, can be retarded by holding shrimp in refrigerated sea water. An oxidase enzyme appears to be involved. At temperatures of 30° F. or lower, spoilage of shrimp can be retarded for a longer period in sea water than in regular ice. After 18 days, shrimp held in ice have deteriorated to the point of being unmarketable, but shrimp held in refrigerated sea water have been palatable after holding for 24 days. Unfortunately off-odors develop in the raw uncooked shrimp after being held in refrigerated sea water for 14 days, causing some buyer resistance. Unpublished results indicate the undesirable odor is caused by bacterial action which has been retarded by the use of aureomycin at concentrations of 10 parts per million. Experimental work is in progress in the hope of finding a more economical substance to achieve the same result.

Aside from this technological work and method of preserving shrimp, certain other applications have been made which are useful in fishing areas where ice is not available for the vessels. A practical use for chill tanks is found aboard freezer vessels. Several advantages occur because the headless shrimp can be chilled more rapidly and can be packaged for freezing as time permits. If large catches are made, the whole shrimp can be chilled pending disposition. Furthermore, the temperature of the shrimp is reduced from the ranges of 85°-90° F. to 34°-40° F., thereby retarding deterioration and easing the load on the freezer. The tanks are about 10x3x3 feet in size, well insulated by 4 inches of cork, and are refrigerated by the main system for freezing and holding the catch. When using freon systems, 5/8-inch diameter copper tubing on approximately 8-inch centers is a common practice. One exploratory vessel now operating from remote Central and South American ports has a similar tank having a capacity of about 5,000 pounds of headless shrimp. The refrigeration system is driven by a compressor requiring about 2 hp., and temperatures of 30° to 35° F. are maintained depending on the amount of shrimp admitted to the tanks. Before departure and when en route to the fishing grounds, the operators try to reduce the temperature of the sea water to 28° F., or lower, to form slush ice as a reserve of cold. The shrimp are thoroughly washed with sea water before immersion in the tank to reduce contamination. It is reported that shrimp can be held in excellent condition by this method for at least 5 days. However, the operators of freezer vessels maintain that shrimp should not be held for more than 48 hours in chill tanks as some difference in quality is detectable through loss of flavor between shrimp held over 48 hours and those frozen soon after catching.

AIR-PRESSURE CONTROLS FOR WINCHES

Mechanical controls for the brake and frictions of trawling and other winches are standard practice, but certain inherent hazards of manipulation exist which can be minimized by air controls. When controlling the brake and friction of trawl winches, either the use of 2 hands or 1 hand and a foot is required where 2 men operate the winch. In the southern shrimp fishery, where one man operates the double-drum winch, the use of both hands and both feet are required. Operators of shrimp trawling fleets are faced with increasing difficulties in finding skilled crews; they have generally avoided winches with superior brakes and frictions of a mechanical-control type for fear that full brake may be applied against a full friction thereby causing undue strain on and damage to the drive mechanism. When the vessel is rolling in a heavy sea, the difficulties in manipulating mechanical controls are increased.

By using a two-way valve with a neutral position, full brake or full friction and intermediate degrees of each can almost immediately be applied by a simple movement of one hand. In the neutral position the drum is in free wheeling. Air from the vessel's tanks is delivered through a reducing valve that maintains a working pressure of 125 pounds at the control valve. In one extreme position, full air pressure is delivered to a piston attached to the brake band. An unloading spring on the nonpressure side, together with a return release line to the valve, completely releases the brake as the lever is moved to neutral or free-wheeling position. At the opposite extreme position of the valve, full air pressure is delivered to a normally oval-shaped air-flex clutch tube fixed to the driving side. Air causes the tube to expand and engage the drum to provide full friction for hauling. A return relief line to the valve and the desire of the air-flex tube to resume its normal moulded form provides free wheeling of the drum as the control valve reaches the neutral position. By this system 1 operator can easily control 2 drums, 1 with each hand.

Air-control systems for trawling and purse-seine winches have been used for several years on the Pacific Coast and have proven satisfactory. Operators believe them safer than mechanical controls because of more rapid response and greater freedom in rough weather. Disadvantages are the need for an air supply and somewhat greater cost than mechanical controls. The air after compression is reasonably dry, but if the tanks are not periodically bled of water in accordance with good marine practice quantities of water could be drawn into the system and could freeze in cold weather.

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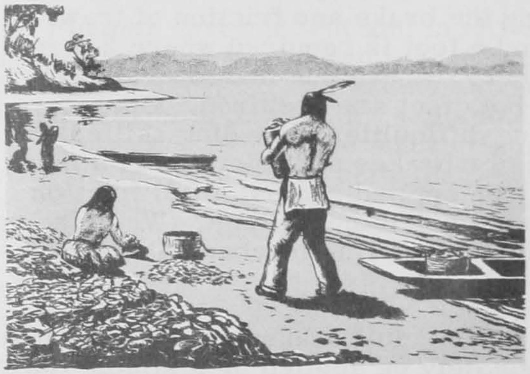
OYSTERS ARE GOOD THE YEAR-AROUND

The wide-spread notion that oysters are harmful to consumers when eaten during the "non-R" months is debunked by the Assistant Surgeon General of the U. S. Public Health Service in a statement issued on September 1, 1950. The opening date of the traditional oyster season each year is September 1. "Oyster are edible the year-around" the Assistant Surgeon General declares, "but they are fatter, more platable, and more plentiful on the market during those months that contain the letter 'R'. It is only conincidental that those months in which the oyster is most palatable happen to be the 'R' months."



The oyster was highly regarded as an article of food by the North American Indians. Large mounds of oyster shells left by them may be found along our East Coast.

The Assistant Surgeon General said the tradition that oysters must be eaten only in the "R" months may have originated somewhat as follows:

In that species of oyster eaten in the Old World for centuries, fertilization of the seed from which the baby oysters grow takes place within the shell of the parent oyster. Shortly before the baby oysters are ejected by the parent to fend for themselves, they begin to develop a shell. If the Old World oyster is eaten at this stage of incubation, the large number of almost microscopic baby oysters, each developing a shell, impart a gritty quality to the meat. Because the reproductive period of all oysters is in the summer, early settlers of this country, cognizant of this but mindful of their Old World variety, avoided placing New World oysters on the menu until later in the year.

Even after our forefathers discovered that the North American east coast oyster fertilizes its eggs in the sea water outside the parent shell, oyster consumption in this country continued, for the most part, to be a winter activiety. Partly responsible for this was the fact that only until recent years have refrigeration facilities been developed whereby oysters can be preserved in warm weather while being transported from the coastal growing areas.

Today, when perishable food products are transported thousands of miles by railroad and airplane, yet preserved by refrigeration, the greater portion of the country's shellfish consumers still cling to the old tradition.

The advent of quality frozen oysters available throughout the year, however, is beginning to change this custom.