New Purse Seining Techniques in the Menhaden Fishery Employing the Power Block

PETER G. SCHMIDT, JR.
Marine Construction & Design Co.
Seattle, Washington

THREE YEARS AGO a practical system of mechanically hauling fish nets out of the water was introduced on the west coast of this country. For many years various methods and mechanisms had been tried to solve this problem, but in each case they were either too complicated or not adaptable to the heterogeneous mass comprising a fish net. Some success had been obtained in British Columbia and the Puget Sound area of the State of Washington in the use of large drums, together with a spooling mechanism for handling salmon and herring nets. The partial success of this system stirred the imagination of many fishermen, and there was a willingness to try other new systems which were proposed.

The immediate acceptance and success of the new system using the Puretic Power Block* has been well documented in most of the fisheries journals throughout the world. To date, over 1,500 vessels have converted to mechanized fishing using the power block and other new techniques which have since been developed. In addition to the United States, this system has been introduced to many of the foreign fishing areas with considerable success.

The importance of the power block and a mechanized system for handling nets is far greater than would appear on the surface. In most fishing areas throughout the world, including the East Coast and Gulf menhaden fisheries, the crudest form of hand labor has been taken for granted in the fishing operation. Since before Christ, fish nets have been hauled by hand, and very few fishermen have seriously considered that a simple, practical solution could be found whereby their work could be lightened and made more efficient. It would be the same as if farmers everywhere assumed that the way the coolies cultivated rice paddies in Asia was the only way to accomplish this type of farming, because their imagination could see no other solution to the problem.

Mechanization had come to fish factories and fishing vessels in many ways, including the use of the airplane for spotting fish, fish pumps for brailing, and large, modern, efficient refrigerated fishing vessels. But little had been done to cut the manpower requirements or increase the efficiency of handling the net. Today fishermen and factory operators who have worked with us in applying mechanization to the handling of fish nets have found that this is just the beginning in the modernization of the fish-catching technique and the rational design of fishing vessels to best accomplish the job intended. More and more fishermen are coming up with suggestions and are willing to try new things than ever before.

Through the results that we have seen, it is safe to predict that the mechanization of handling fish nets will be the beginning of a long line of useful improvements which will make it possible for the fishing industry to keep pace

*A complete technical description of the Puretic Power Block and its application to many different types of fishing throughout the world, with suggested new designs of vessels, was presented in Hamburg at the 1957 International Fishing Gear Congress, sponsored by the FAO. Copies of this well illustrated paper can be obtained direct from the FAO, Rome, Italy, or from the author, 2300 Commodore Way, Seattle 99, Wash.

with agriculture and other industry in raising its efficiency and thereby increasing productivity. The use of electrical attraction in fishing is another step in the right direction, and in years to come it may make the use of nets and power blocks obsolete. In the meantime, we, as well as many others, are going to continue our search to improve the efficiency of catching fish by an objective study of each phase of the fishing operation, including the design and arrangement of the vessels.

After the introduction of the power block and the Puretic system to the West Coast, word spread rapidly throughout the United States as to the success of the method. In 1955, just five months after the introduction of the system, we were invited to attend the Gulf & Caribbean conference, to show a movie of the new methods. Those who saw the movie realized that we had solved the problem of pulling in a net on west coast fishing vessels and possibly the problem of pulling any net out of the water. There were still doubts as to whether this could be applied to the menhaden purse seine nets used on the Atlantic and Gulf coasts.

At that time we knew very little about menhaden, and even less about the vessels and systems that were used for catching this valuable industrial fish. We knew, however, that these purse seines were hauled from the water by more than twenty men, and that these nets were considerably smaller than most of the nets on the West Coast. It appeared that this would be a simple problem to solve. With the cooperation of a number of the leaders in the menhaden fishery an initial experiment was made at Fernandina Beach in December, 1955, using two conventional purse boats rigged with power blocks supported in rather crude davits. These first blocks were open on one side so the net could be easily placed in and out of the block. Enough was learned from that experiment to find out that: it was possible to pull the menhaden net with the rubberized V-sheave. There were, however, many operations connected with the system currently in use that would make it difficult to solve the problem without considerable developmental work.

This work was broken down into the following categories:

1. It was necessary for us to learn as much as possible about the present systems being used.
2. Power blocks which had previously been used could not easily be adapted, and it was necessary to design a completely new model which would adapt to the peculiarities of the menhaden system.
3. It would not be practical at this time to change the present two-boat system, but a system was required which could be used in the conventional purse boats with some improvements in design and arrangement.
4. A better method of supporting the block was required.
5. The system of handling the purse line needed to be revised.
6. An improved mechanical system of drying up the fish was required.

Rather than give a detailed account of what occurred from 1955 till 1958, let it suffice to say that this period was filled with experimental work coupled with some success and much failure. There was never any question of whether it was possible to pull the net from the water. The question was, "Can a system be developed which will cut down the large crew required and increase the efficiency of the operation?".

From the beginning most of the captains and fishermen were skeptical, and many of them were belligerently opposed to any system which would differ

from that which they had historically practiced. There were, however, a few captains who took a little more interest than others. One of these was Captain Wallace Lewis, who had done some experimenting with the blocks on and off during this period. In late 1956, Captain Lewis proved to himself and to the Standard Products Company that the system was feasible, and his firm took the lead in installing power blocks in four pairs of purse boats. The operation during the 1957 season of the Standard Products boats was successful, but not spectacular, inasmuch as they were pioneering the new system in practical fishing, and they dared not cut down the crew by the maximum amount thought feasible. For the 1958 season, however, each of the larger companies on the Atlantic Coast decided to convert to the new system and to take the maximum advantage of reduced crews. The following results were obtained:

Approximately 150 purse boats were equipped with power blocks, and all of the boats fishing from Long Island down through Lewes, Delaware, have converted to the new system. In Chesapeake Bay most of the boats have converted. All told, approximately 750 fewer men were used this year to handle the nets from Long Island to Chesapeake Bay than were used last year. Initially, the owners would have been pleased to obtain the same fishing efficiency and speed that they had before; however, it has been found that not only has the crew been reduced by ten men per net, but more hauls can be made per day. The work has also been made easier for the fishermen, who are now able to maintain their efficiency even after many hours of intensive fishing. Many other advantages are being found and one need only talk to captains, fishermen, and factory owners to learn of the success of the new methods.

A number of things had to be solved before the power block was a success. First of all, a far better method had to be devised to support the power block in the purse boats. After the initial experiments in Florida, it appeared to Puretic and others that a hydraulically-powered crane supported by a revolving mast would provide the ideal support. Much more development work was done on this crane than on the power block itself, because to handle the block and net as quickly and conveniently as possible it was necessary that this device could be easily and quickly raised and lowered and swung from side to side. Of the many details taken into consideration in the development of the crane the most notable feature is a pantograph motion which always supports the power block in a vertical plane, but allows it to swivel. Rubber shock mounts were developed to dampen the motion of the block in a seaway.

The problem of pursing was re-analyzed, and it was found desirable to introduce purse rings which could be snapped open, similar to those in use on the Norwegian herring nets. An alternate system is to use a Brummel hook, figure eight hooks, or other connector in the middle of the purse line to disconnect the purse line so that the rings would be free to go on up through the power block. At the present time most of the boats are using either the snap purse rings or a combination of the "disconnect" in the middle of the line, with a few snap purse rings on each end.

A better system had to be devised for drying up the fish or, in other words, lifting the fish up to the points of where they could be pumped. With ten or more men in each purse boat, this was done by physical brute strength. To gain any advantage from the power block, it was necessary to cut down the crew. With this reduced crew, it was not feasible to lift the fish by hand; therefore, something had to be developed to solve this problem before it would

be worthwhile to adopt the power block. Two developments have been made in this regard. The first is an adaptation of the West Coast strapping method, in which a fall is used which runs from the gaff on the steamer down to the bunt of the net. The bight of the net is gathered and lifted high in the air by this fall. At the present time, most of the steamers are using a two-drum winch for this purpose. A special hydraulic winch was devised by Marco which is being used by many of the boats. This winch operates from the same hydraulic pumping system which is used to lift the purse boats in the davits. With a two-drum winch and two single falls, it is possible to lift the bunt of the net up, hold it, and take another lift with the second fall, lower the first bight, and lift another bight of the bunt. Initially, when we proposed this idea most of the eastern fishermen thought that the bunt of the net would be torn by the tremendous weight of the fish. It was not until a group of fishermen visited the West Coast and saw this system in use in Canada that an attempt was made to adapt this to the menhaden net. Once it was tried, in the latter part of 1957, the captains caught on very quickly, and this has been a great help in making the new system possible.

The second factor in solving the problem of lifting the fish to the pump has been the use of electrical attraction. A number of boats have been equipped with an electrical system, which helps lead the fish to the pump. This speeds up the pumping operation and eases the job of drying up. Unfortunately, with large sets, a number of fish still appear to either be stunned, or to die in the process, and it is necessary to use the winch and straps in addition to the electrical device. Eventually this problem may be solved.

One of the major factors in the success of the new system has been the use of larger and more stable purse boats. The outstanding boats that have been developed so far are the aluminum purse boats built by RTC Shipbuilding Company of Camden, New Jersey. These boats have proved that aluminum is a superior material for use in construction of boats for this service. To gain a better fishing platform, it was desirable to make the boats longer and wider. To do this out of steel would have made them so heavy that it would have been impossible to lift them with the existing davits and boat-lifting gear. By the use of aluminum the hulls of the boats are about 50 per cent lighter than the older, smaller steel boats. These bigger aluminum boats are thirty-four feet in length with a nine foot beam, and have vastly improved operating characteristics. The bigger, lighter boats are dryer, more stable, and more seaworthy. This allows the fishermen to fish in much heavier weather, and to obtain more of the potential out of the mechanical net hauling methods. They are more convenient boats to work in for the large size has allowed some rearrangement which includes placing the purse winch and davit forward of the engine. This rearrangement is but the first step in the complete reanalysis of the purse boat design, and much improvement still can be made. In this regard, the author's company has completely redesigned the purse boats into what we feel would be a much more efficient operating platform.

Finally the success of the system has been helped by the many little things which have had to be unlearned and new things learned in the operational procedure which uses a crew of five less men per boat. No longer are there hands and bodies swarming over the boats, available for all kinds of details in the operation; likewise, the problem of teamwork and coordination is simplified with the smaller crew once they become well trained. Now that nearly

two-thirds of the menhaden fleet has converted to a new and more efficient fishing procedure it is suggested that they not rest, but continue to experiment with such things as improved pursing techniques, including the use of wire purse line for the purpose of reducing purse line expense and simplifying the pursing operation. The fishermen should seek further rearrangement of the purse boats into a more efficient fishing vessel, modification of the hull lines of the purse boats to allow better use of net protection in the stern, and continued experimentation in a thorough and systematic manner of widely different fishing systems, including the use of small catcher boats. The development should lead to each working a net by itself, together with carry-away steamers, and larger self-sufficient seine boats similar to those used on the west coast, but designed specifically for catching menhaden.

It has been gratifying to see the results of a complete modernization of a historic method. Whether we realize the fact or not, progressive work of this type is being done in fisheries throughout the world, and in many cases the underdeveloped areas are producing fish with cheaper labor at less man hours per ton than we are in this country. We must devote every effort toward mechanization if we are to maintain and improve our present position in world fisheries.

The Use of Electricity in Commercial Fishing in the Sea

CONRADIN O. KREUTZER
Smith Research and Development Company, Inc.
Lewes, Delaware

THE USE OF ELECTRICITY for the purpose of fishing goes as far back as the beginning of the century. The oldest literature about electric fishing with direct current known to me was written in 1908. Since that time the application of this fishing method has increased steadily, especially in middle European countries.

At the same time fresh water fishing with electricity was introduced, physiologists started to examine the specific reactions of fish under the influence of electric fields. Depending on the voltage to which the fish is exposed, three different reactions can be observed. At a certain minimum voltage in the water, the fish shows a jerking of the whole body and will escape from the electric field. If the voltage necessary for the escape reaction is doubled, the fish will not swim out of the field, but in the direction of the current field lines toward the positive electrode. If the voltage is increased again by the same amount, the fish will stop all swimming movements, turn over on one side and go into a state of narcosis. If the current is disconnected soon the fish immediately recovers from the narcosis, without suffering any damage.

The threshold values of the necessary potentials for each of these reactions is found to be constant for fish of the same species, independent of the length of the particular fish. If the chosen voltage in the water is just enough to reach the reaction when fish of a certain desired length will swim toward the positive electrode, smaller fish will have a potential across their body which will only