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GREAT LAKES TRAWLER CONVERSION

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INTRODUCTION

Commercial fishermen of the Great Lakes have been forced to reconsider the economic feasibility of their methods of operation because of a recent decline in availability of traditionally used fish stocks and an explosive increase in other, little-used species. Many fishermen can no longer make a profit with traditional Great Lakes gear, and are left with the choice of modernizing gear and techniques or abandoning fishing.

The future of the Great Lakes fishing industry depends on producing fish and fish products at competitive prices. To meet competition, more efficient harvesting of existing fish stocks is necessary. For this reason, some fishermen have converted existing gill-net and trap-net vessels to trawlers, and several of these converted vessels were successfully producing industrial and food fish by the end of 1959.

Methods of converting from traditional Great Lakes vessels to stern-set trawlers or "draggers" are still evolving, and improvements will undoubtedly be made in the future. Only general principles are discussed here with the hope that prospective operators can determine the feasibility of particular conversion problems. Markets and economic factors, which should be considered by fishermen contemplating conversion to trawling, are also discussed. Finally, to highlight expense items, some estimated operating costs are included.

VESSEL CONVERSIONS

Profitable fishing depends to a great extent on good rigging of the vessel, adequate power, proper fishing gear, and efficient handling of the gear and catch. Most Great Lakes fishing vessels must undergo some changes if they are to be fitted out for dragging. These changes may be minor and entail only removal of portions of the superstructure and installation of a fish hold, or major changes may be necessary owing to limitations of hull and power.

Most of the wooden vessels now operating on the Great Lakes are not suitable for conversion. Most of them were not constructed to carry a boom, and their conversion without thorough

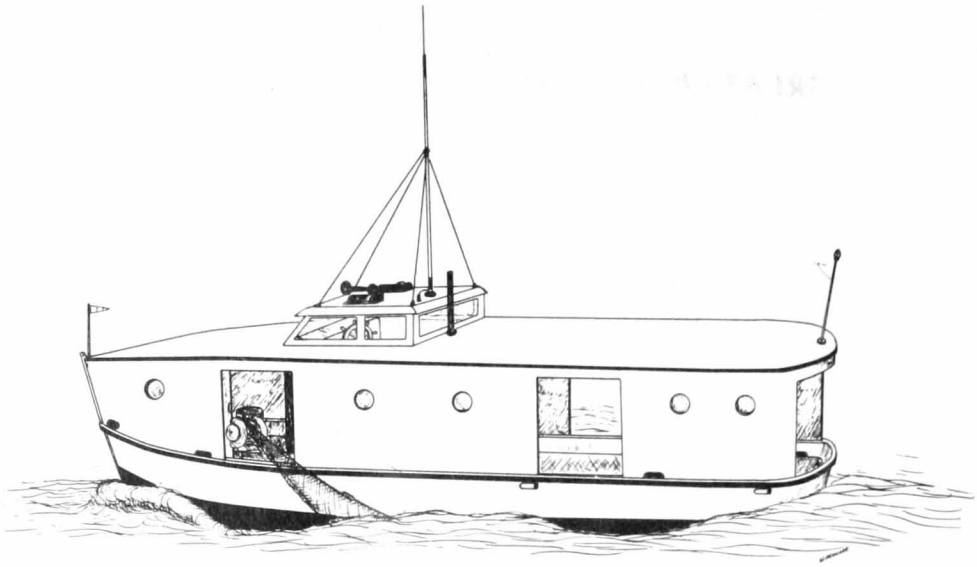

Figure 1.--Great Lakes gill-net tug before conversion.

consideration of factors of stability and safety could produce an unseaworthy craft. In an industrial fishery on the Great Lakes, the high cost of upkeep for a wooden vessel may result in a very narrow profit margin for the operation. Before deciding on conversion, appraisals should be made to determine whether the converted vessel will permit safe, efficient, and economical operation. Vessels large enough to bring in an adequate payload are essential, and for trawling, where the price may be expected to be low per landed pound, small vessels under 40 feet in length could not under ordinary operating methods, produce satisfactory earnings.

When trawling was first adapted to the smaller fishing vessels, particularly for shrimp fishing in the Gulf of Mexico, low-speed, heavy-duty, gasoline engines were used extensively. But trawling requires long hours of engine operation and the need for more dependable low-cost power led to the use of Diesel engines on all but the smallest vessels. Advantages in greater safety, lower fuel cost, and suitability for steady power supply appear to have been so great that Diesel engines are used almost exclusively.

Hull Modifications

Hull modifications may pose the most serious problem in conversion of Great Lakes vessels. Most of these vessels were not constructed to carry large quantities of fish or to be subjected to the severe strains on framing and deck that are experienced in

ast forward stays
hroud lines
Topping lift tackle
Boom vangs
Single block tackle
Double block tackle (Main fish tackle)
Dandyline block (Hung from stanchions
or gallows)
Leading blocks for trawl warp
Double drum trawl winch
Fish hold hatch
Trawl warps
Lead snatch block

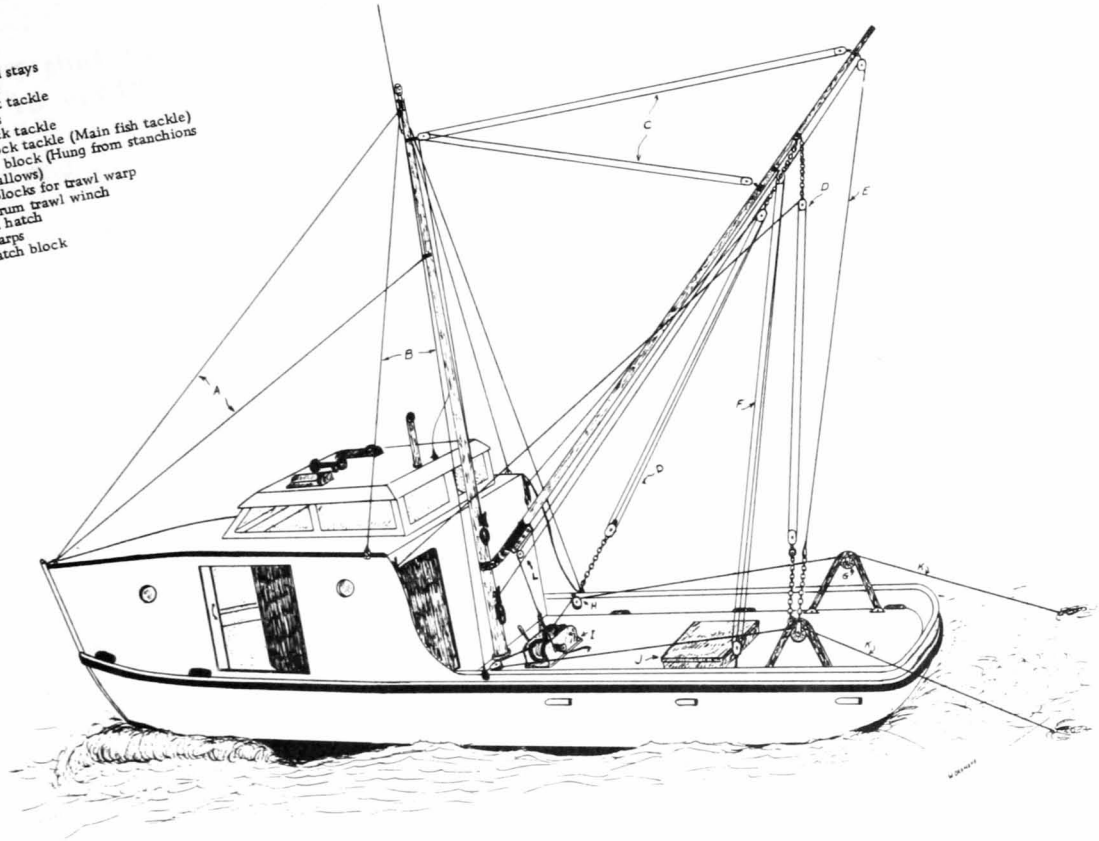

Figure 2.--Great Lakes gill-net tug converted to a trawler.

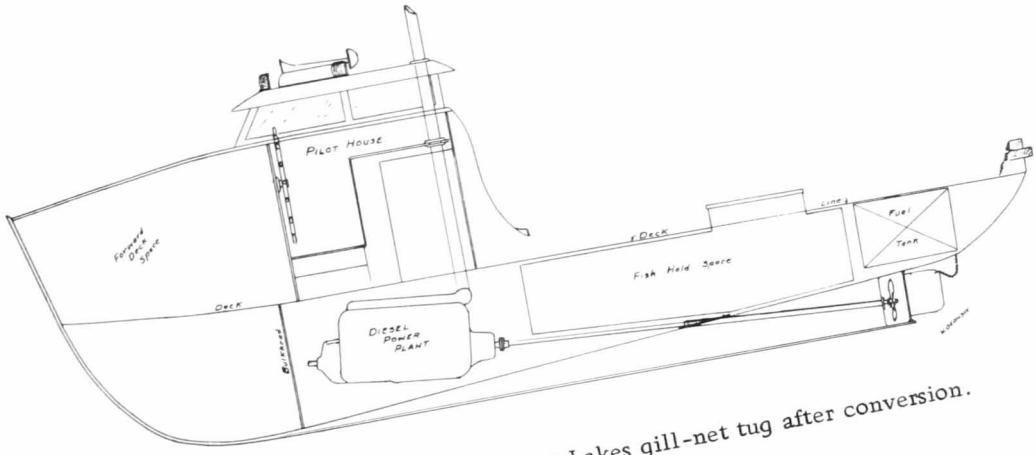

Figure 3.--Inboard profile: Great Lakes gill-net tug after conversion.

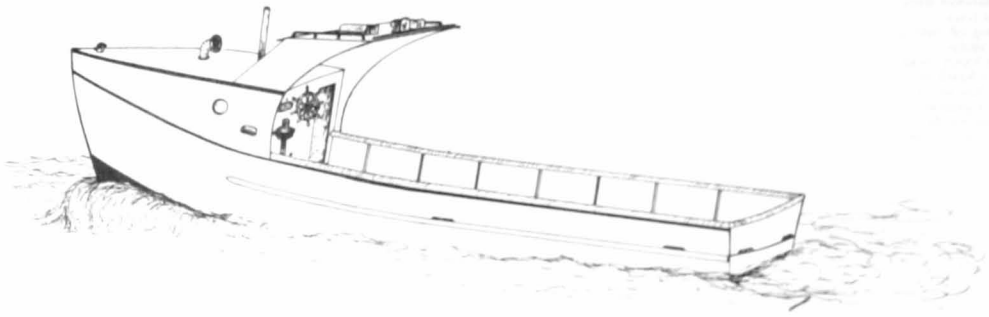

Figure 4.--Typical Great Lakes trap-net fishing vessel.

industrial trawling. The vessel owner may find it necessary to strengthen deck members before installing the mast and other deck gear. In some instances a considerable portion of the superstructure must be removed to permit these installations and efficient handling of trawl gear. A large carrying capacity for increased quantities of fish becomes necessary for profitable operation. A hold is desirable because the storage of large quantities of fish above deck results in a very tender and top-heavy vessel. Vessels should have a hold capacity for at least 20,000 pounds of fish plus adequate ice.

Often vessels change trim at sea because of fishing conditions. Furnishing adequate freeboard presents a difficult problem in the conversion of some Great Lakes vessels. Many were originally constructed with decks below or near the waterline entirely protected from weather and accumulation of a deckload of water through wave action. It is essential that decks do not trap water. Safety here rests on watertight structure, the ability of the vessel to quickly rid itself of a deckload of water through adequate scuppers or freeing ports, and good judgment of the skipper.

Propulsion Machinery

Unlike gill-net, trap-net, and pound-net operations trawling requires varying power under varying speeds and load conditions. To reduce operating and maintenance cost, simplicity of maintenance and construction, availability of service, and safety of operation should be considered. The engine selected should be provided with matched reduction gear and propeller designed for the intended vessel usage.

Horsepower requirements will vary with vessel size and hull design. If repowering becomes necessary, a reliable engine with a rating between 100-200 hp. should be installed. It is

suggested that prospective buyers contact engine manufacturers with respect to engine capabilities.

Winches and Deck Arrangements

Trawlers generally are equipped with two drums for spooling the towing warps. These may be double-drum combination winches placed amidships with the warps led to fairlead blocks on the rails and then aft to blocks hung on the quarter stanchions or gallows (fig. 2). Gypsy heads are usually built into this type of winch. In another arrangement, the drums are mounted just aft of the

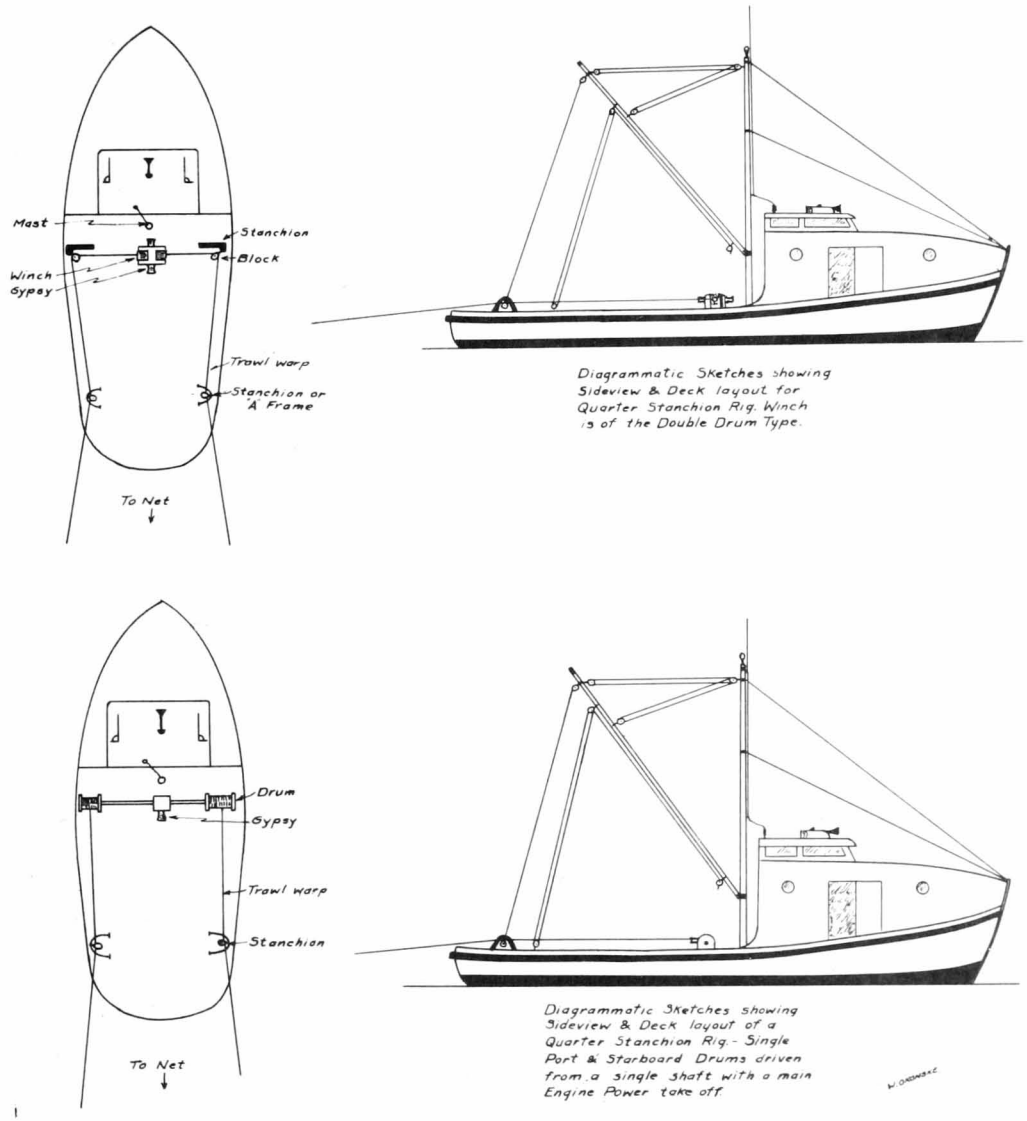

Figure 5. --Types of winch arrangements on trawlers.

mast--one drum near the starboard rail and the other near the port rail--with the towing warps leading directly aft to a block on the quarter stanchions. A gypsy head is located on a pedestal just aft of the mast. Power for operating these units generally comes from a power take-off from the main engine, but the drums may be driven by an auxiliary, hydraulic, or electric drive.

Stanchions or gallows are generally constructed of heavy duty 3- to 4-inch pipe and steel plate. Another type in common use is the single well-braced pillar. The stanchions serve as a frame for hanging the dandyline blocks and as the towing point. Figure 6 shows several types of stanchions in general use.

Mast and Boom

A stout mast must be rigged amidships behind the house. A common practice is to construct this of steel pipe, 6 to 8 inches in diameter, on which a heavy boom is hung. Two or three shroud lines of 1/2-inch rigging cable or 5/8-inch steel rods are secured at the top of the mast and are fastened to pad eyes on each rail with turnbuckles. Generally, from one to two forward stays are secured near the stem in like manner. The boom is supported by a topping lift, the specific arrangement of which may vary throughout the fleet. Boom vangs are rigged to prevent movement of the boom during operation.

The hoisting gear consists principally of a single tackle rigged near the end of the boom and a double tackle rigged a short distance below this. The running ends are then carried to the gypsy head, directly or though a lead snatch block.

TRAWLING GEAR

Towing Warps

The wire rope most commonly used is constructed of improved plow steel cable composed of 6 strands and a lubricated hemp center, with 19 wires to the strand. This gives a cable of great strength and toughness, but one still flexible enough to allow easy handling. The size of the cable used varies with the size and capacity of the winch. Usually it is of 3/8-inch to 5/8-inch diameter. The length of towing warp for each drum, generally adequate for most fishing operations in the Great Lakes, is three times the greatest expected fishing depth.

Briddle Arrangement

A hook-up called "dandyline gear" suitable for the Great Lakes is used extensively in the West Coast industrial-fish

STANCHION OR GALLOWS

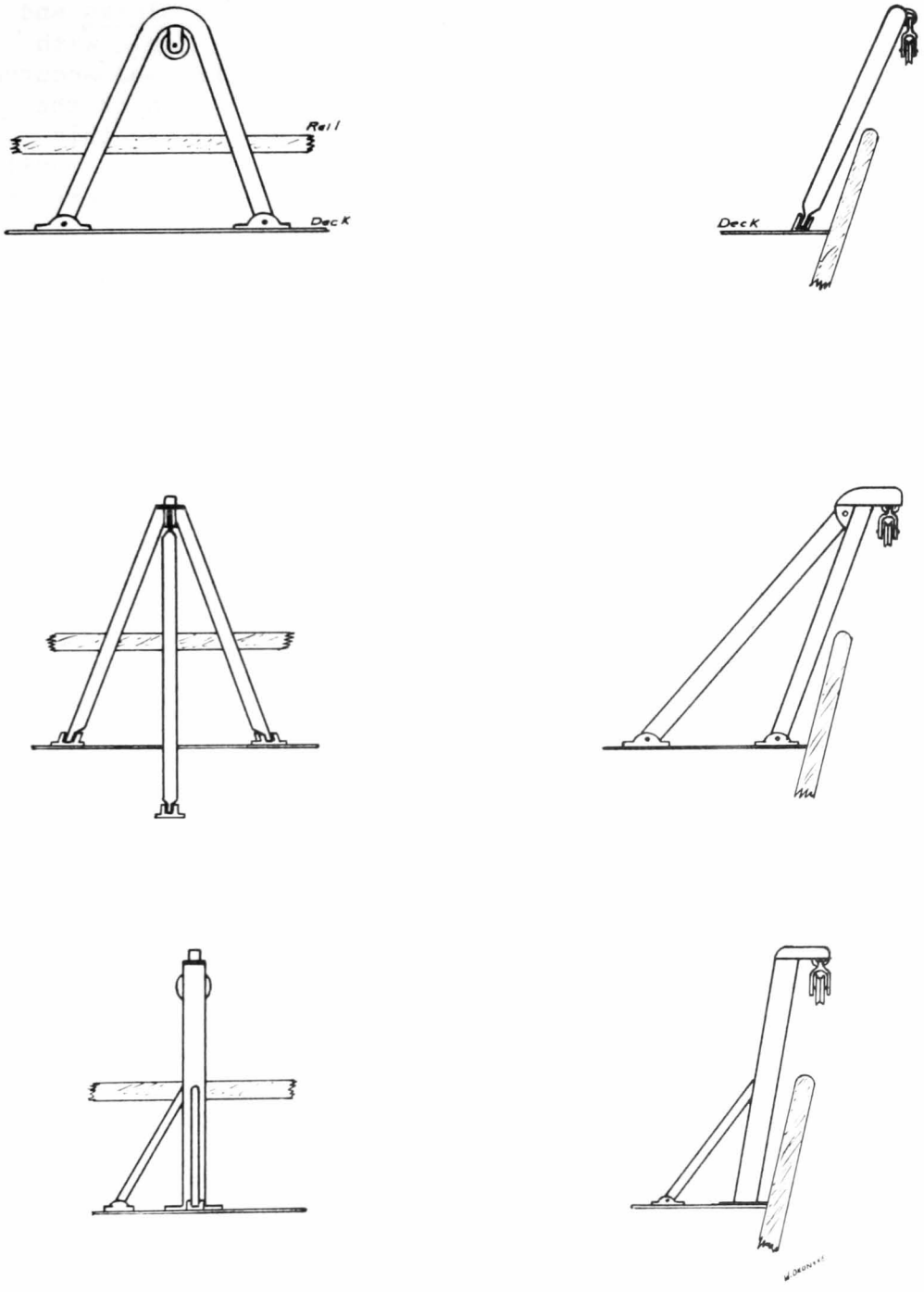

Figure 6.--Types of stanchions in general use.

fishery and elsewhere (fig. 7). It consists of bridle lines attached directly to the tow cables by special hooks, rings, and connecting links, which can readily pass through the blocks and fairlead rings. The doors are attached to the tow cable with special hooks in such a way that they may be unhooked and secured to the stanchions. This enables the operator to haul back the bridle lines with the winch. Other operators do not use this arrangement, but prefer to attach the net to the door with manila line. With rope bridle lines, however, the procedure of retrieving the trawl is more laborious.

BRIDLE ARRANGEMENT

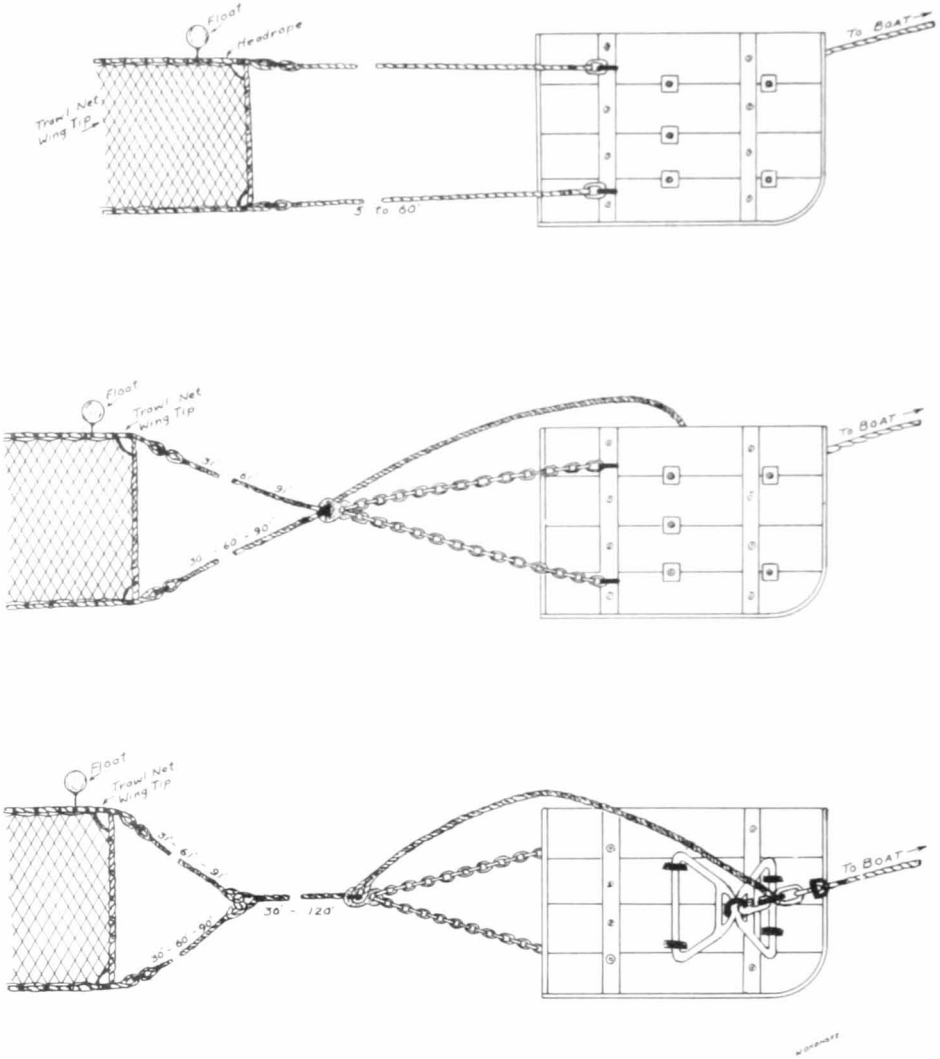

Figure 7. --Various hook-up methods.

Table 1.--Recommended sizes of trawling gear related to vessel power.

Horsepower	Trawl size	Trawl door size
60 - 90	33' - 42'	5'-6' x 36"
115 - 165	45' - 55'	7' 6" x 40"
170 - 200	60' - 75'	8'-9' x 48"

Nets and Doors

An advantage of the stern-set method of trawling is that a relatively small vessel can tow a large net, provided the vessel is adequately powered. Table 1 lists some recommended gear for vessels of varied power. It is suggested that vessel owners undertaking trawling operations for the first time purchase both trawls and doors from an experienced trawl maker. To date, no single net design has proved to be the outstanding producer. The design shown in figure 8 is one that has been used by several fishermen in the Great Lakes.

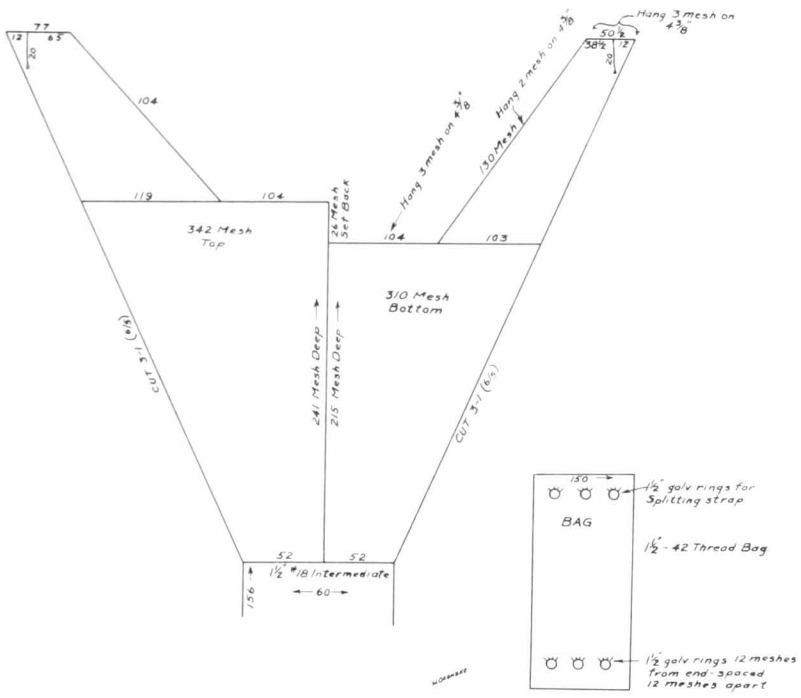

Figure 8.--Schematic design of 50-foot balloon fish trawl.

Table 2.--General specifications and cost estimates for trawl gear and equipment.

Equipment	Rating	Cost in dollars
Engine, Diesel	65-200 hp.	1,500 - 10,000
Reduction gear	Varies with engine and hull to 3:1	300 - 1,500
Propeller	Varies 32/28 to 50/36	50 - 800
Electronic gear	Depth recorder 0-100 fathoms or 0-300 feet	500 - 5,000
Rigging	Mast and boom complete with rigging	200 - 500
Fishing equipment:		
Winch	2 drums individual brakes and clutches. At least one gypsy head	300 - 2,000
Trawl stanchions (gallows)	2 required	100 - 500
Blocks	2-4 required, 4" x 6"-8", sheaves - hanging block	100 - 500
Cable	3/8" - 6 x 19 or 6 x 7, 3:1 depth ratio	250 - 1,000
Trawl doors	6' x 30" to 9" x 48"	150 - 400
Trawls	40' - 75' headrope, cotton or synthetic	200 - 750
Hardware	5/8" V-D rig and shackles, thimbles, etc.	50 - 100

Electronic Fish Detection

Since early in the 1940's, electronic echo sounders have played an important role in the development of many major fisheries. After World War II, recording echo sounders were adapted by almost all operators of medium and large vessels in the leading fishing countries. Most modern fishermen feel they are groping in the dark if deprived of this equipment.

Prompt location of fish concentrations may mean very profitable fishing operations. Many modern echo sounders are suitable for the detection of fish--schools or individuals--at depths up to several hundred fathoms provided the fish are distinctly above the bottom. Echo sounders also enable the skipper of a fishing boat to detect underwater obstacles which might otherwise entangle his gear and add to the operational cost in gear and fishing time. It behooves the prospective trawl fishermen to provide his vessels with a reliable echo sounder for use as a fish detector and as a navigational tool.

Cost of Conversion

The cost of converting available Great Lakes fishing vessels to suitable stern trawlers will vary between $2,000 and $25,000, depending on the type of hull conversion, materials and equipment used, and labor cost. The general specifications for trawling gear and equipment are listed in table 2. Table 3 gives an estimated range of costs for items necessary for the conversion.

Table 3.--Estimated range of costs for items involved in vessel conversion.

Item	Cost in dollars
Possible hull modification	100 - 4,000
Possible repowering	1,500 - 10,000
Mast and boom	150 - 500
Stays and other rigging	100 - 300
Winch	300 - 2,000
Towing blocks (2-4 required)	100 - 300
Two trawl gallows	100 - 500
Trawl cable	250 - 1,000
Set of trawl doors	150 - 400
Trawls	200 - 750
Hardward	50 - 100
Electronic equipment	500 - 5,800
Total	3,500 24,850

Many of the items listed may be fabricated by the vessel owner, or some of the items may be on hand and need not be purchased. Since such factors vary for each individual case, it is impossible to estimate the actual costs for all producers contemplating conversions to trawling. For accounting purposes, an arbitrary sum of $3,000 as the cost of conversion is used in this section.

Operating Costs

An attempt to calculate the average operating costs for one year has been made in table 4. Such items as vessel and engine depreciation are estimated. The rates which have been used in this report are based on a vessel with a value of $10,000 and an engine with a value of $2,000. These values may not provide a realistic method of determining costs, since many of the vessels on the Great Lakes have been fully depreciated. However, the estimates shown may serve as a guide for owners who are contemplating conversion.

Table 4.--Estimated average annual operating expenses for Great Lakes trawling vessels.

Item	Annual cost	
Vessel depreciation, 20 years	$ 500	
Engine depreciation, 5 years	400	
Electronic gear depreciation	200	
Trawl replacement, 2 per year	600	
Repair of gear, winches, etc.	150	
Fuel, oil, grease, etc.	1,200	
Insurance	250	
Sub-total		$ 3,300
Labor		
Fisherman, $15.00 per day, 200 days	$3,000	
Captain	5,000	
Sub-total		$ 8,000
Total operating costs		$11,300

As yet, insurance rates for trawling vessels in the Great Lakes are not standardized. Therefore, it will be necessary for the vessel owners to investigate the rates of several companies and determine which policies are adequate and have reasonable rates. The insurance costs, used in estimates here, are for total-loss insurance only. This type of insurance should be supplemented by protection-and-indemnity insurance if the coverage is to be adequate. The rates for adequate insurance vary from 4 to 12 percent of the value of the equipment insured. It may be possible to obtain insurance on a trip basis or for a limited period of the year.

The wages indicated in table 4 should not be considered as being set at the limits shown. They are based on the minimum pay for a trawling operation. It can be assumed that it will also be necessary to provide a bonus for the captain and fisherman if they are to put forth their best efforts and conduct overnight operations. Such a bonus should be based on a minimum catch per day and any production over the minimum would be shared by the crew. The minimum should be the volume needed to break even for the operations.

From the information shown in the table, it appears that a vessel will require an annual catch with a value of $11,300 to break even. In this study, considering the nature of the enterprise, an estimated return on the original investment of approximately 15 percent may be necessary to compensate the owner for his risk. To the capital expenditure for conversion must be added the cost of the vessel and engine. The total capital investment in the hypothetical vessel described here amounts to a minimum

of $15,000. Therefore, the income from this investment should be $2,250.

Combining the operating costs and the return on investment, it is shown that a gross income of $13,550 is necessary to maintain profitable operations. When this total is converted to pounds of fish, at 2 cents per pound, slightly over 675,000 pounds of fish must be produced each year. It is estimated that most vessels will operate about 200 days per year. Under these conditions, it will be necessary for the vessel to produce an average of 3,375 pounds per day. This volume appears to be rather low; however, it may be difficult to realize because of poor fishing on some days and gear failure on other days. It can be assumed that on some of the 200 fishing days the vessel will produce few, if any, fish.

To offset the lost days of fishing, it will be necessary to produce capacity loads of fish on the better fishing days. The vessel should have a safe carrying capacity of 20,000 pounds and should be capable of maintaining operations until the hold has been filled. This may often necessitate overnight trips.

If the vessel does not have facilities for overnight operations, its efficiency will be reduced. In terms of fish production, the hours of running time between the fishing grounds and the port are wasted. The efficient utilization of the vessel's carrying capacity cannot be obtained in single-day trips, and fuel and maintenance costs will be increased in relation to the production. Under such conditions, it is doubtful that a profitable operation is possible.

Marketing

The trawl fishery on the Great Lakes will be based on low-priced industrial fish. At present the fishery is limited by law to a few species which cannot be economically harvested by conventional fishing methods and are not important for recreational purposes--alewives, chubs, and smelt. In general these fish will be marketed as mink food, canned pet food, and possibly, fish soluables and fishmeal. The markets for mink food and pet food will absorb most of the production in the near future, and others may develop later.

It is probable that some of the smelt will be sold for human consumption and return a relatively high price per pound. In addition, 5 to 10 percent of the chubs should be suitable for smoking and, hence, demand a relatively high price. The remainder of the catch will be sold in large quantities at low prices.

The point where the catch will be landed is an important consideration in trawling for industrial fish. This type of fishery will not permit the traditional landing of catches at many small ports. The establishment of pet-food packers and fishmeal plants will be dependent upon the availability of large quantities of fish at a single port. The transportation of raw industrial fish by commercial carriers is not practical because of the high rates involved. If several vessels unload at one point, it will be possible for industrial users to establish docking and unloading facilities for the trawlers. Such facilities should include fish pumps for efficient unloading. Under such conditions, more time could be spent on the fishing grounds.

If the vessel owners do not land their catches at a central point, they will experience difficulty in disposing of the fish. In some areas mink ranchers will absorb part of the production. However, the ranchers will want the smelts and alewives separated from the chubs. This will force the vessel owners to sort the catch, a situation which is unprofitable unless a large and continuous supply of fish is available.

The price for industrial fish can be expected to decline when the production increases. Smelts, alewives, and chubs will not command a high price when several trawlers are able to produce large supplies. This will necessitate the efficient handling of the fish to obtain a profit.

The landing of the catches at a central point will provide the producers with an ideal opportunity to form cooperatives. Such organizations would result in savings on purchases of gear and supplies. In addition, a cooperative may provide for the marketing of catches. Some of the functions which could be performed by a large cooperative are the sorting of the catch, freezing and storing of fish, as well as reduced transportation rates through volume shipments of fish suitable for human consumption.

Before any effort is made to convert vessels to trawling, it is recommended that the owners spend some time on vessels which are trawling in the Lakes. In addition, it would be an advantage to obtain technical assistance. If this policy is followed, there will be a saving of time and money in converting the vessels.

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