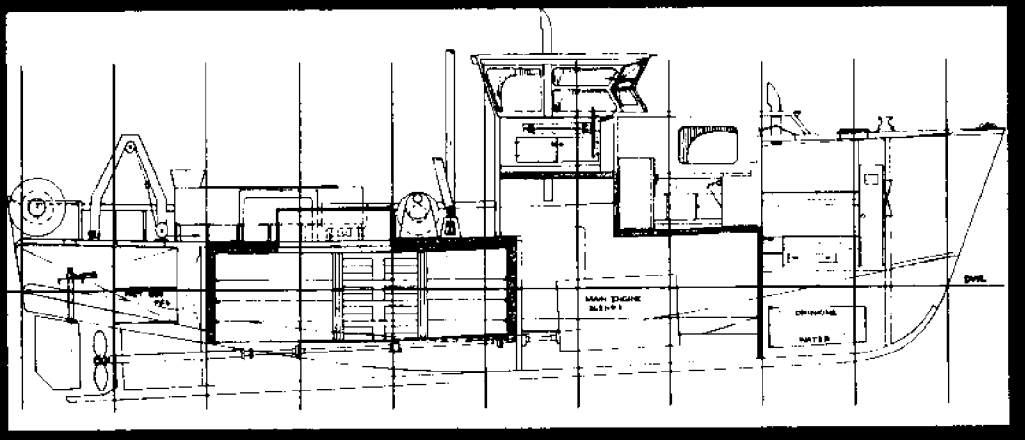

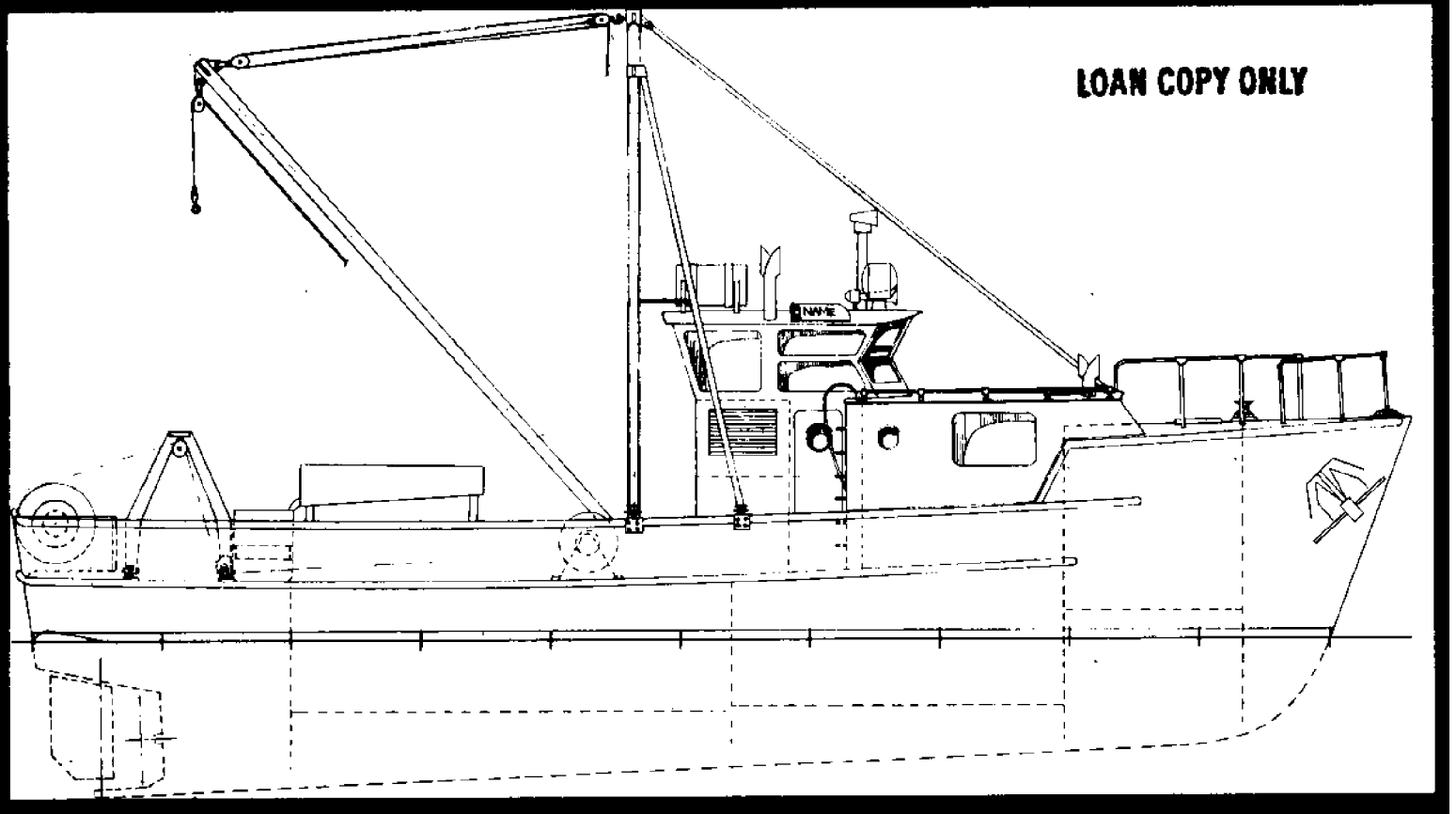

THE COMMERCIAL FISHERIES OF MAINE

An Outline Text
Prepared for a
Seminar
for
Financial Personnel

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Ira C. Darling Center Reference No. 74-34

Preface

THE COMMERCIAL FISHERIES OF MAINE was written by Cyrus Hamlin and John R. Ordway, of Ocean Research Corporation, for use as a text book in a seminar they conducted for Maine financial personnel.

The concept for the seminar originally developed during conversations between the authors and Halsey Smith, Director of the Center for Research and Advanced Study of the University of Maine in Portland. The seminar was sponsored by the Casco Bank and Trust Company, and was attended by representatives of that bank, Maine National Bank, Canal National Bank, all of Portland, Depositors Trust Company, Rockland, and the Merrill Trust Company, Bangor.

Many people, too many to be named, contributed information and advice in the preparation of the text. Some are associated with Maine's Department of Sea and Shore Fisheries*, or the National Marine Fisheries Service of the U.S. Department of Commerce; others are individuals in the fishing industry or related fields. A little of the credit for whatever this volume accomplishes must rest with each one of them.

Only through the capable typing and other help of Ms. Donna Sabaka and Sherrill Brittain was the text ready for each of the weekly sessions.

*Changed in 1973 to Department of Marine Resources

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THE COMMERCIAL FISHERIES OF MAINE

SESSION I

Introduction to the Fisheries

I. The Major Fisheries of Maine

History:

Fishing was Maine's first industry - beginning in the sixteenth century.

The early lust for gold and copper was soon transferred to fish.

Captain John Smith was one of the first exploiters, operating fishing fleets from Monhegan Island during the summer months.

Eventually stations were established on the mainland as well as on islands. (The largest was on Richmond's Island off Cape Elizabeth.)

Fishermen were on shares in the 17th century: a third for the vessel, a third for supplies, a third for the crew.

Bounties (subsidies) were used after Independence as a spur to the fishing industry. In the 1780's a bounty of five cents per quintal (equals 112 pounds) of fish was used to revitalize the fishing fleets after the Revolutionary War.

In the early 1790's the bounty on catch was replaced with a bounty proportional to the tonnage of the vessel, but the vessel had to meet certain performance requirements.

A common lay (share) system in the late 1700's - early 1800's: owner furnished one fifth of all supplies and took one fifth of the catch; crew paid four fifths of supplies and received four fifths of value of catch in proportion to amount of fish each one caught.

In the period 1820-26, Maine produced about one fifth of the total U.S. fish tonnage, and had over half the total number of fishing establishments on the Atlantic Seaboard.

Until the mid-1800's all fishing was done with hand lines over the side of the vessel. At that time dory fishing was introduced, in which two men handlined from each of several dories carried by the vessel. Shortly thereafter the more efficient trawl-lining, now called longlining, was devised and largely replaced handlining. Seining was introduced at the same time for catching schooling fish such as mackerel and menhaden.

The beam trawl came to the U.S. from Europe in the early 1900's. It required powered vessels, originally steam but after World War II exclusively diesel. This development, coupled with the availability of manufactured ice, permitted the landing of fresh fish and inaugurated the modern fishery as we know it today.

Technological developments since World War II have wrought major changes in the fishing industry, but it is still based largely on the trawl and the seine, fished by diesel-powered vessels.

Tastes in fish have changed drastically over the years. Some of the changes are listed below:

Haddock - virtually a trash fish until the invention of finnan haddie in the 1870's and the inception of the fresh fish industry.

Mackerel - in the early days a staple food fish, usually salted; appeal was lost during its recent absence and now in little demand.

Pollock - in the early fisheries one of the staple fish, then until recently a disdained fish; now achieving stature as an inexpensive but excellent substitute for haddock.

On Figure 1 are graphed curves of the total Maine landings, and total value for the period 1880 to 1970.

Table I presents general information on the major species of marine organisms landed in Maine. The species are arranged in descending order of their landed value. Although it is the final added value before consumption or export out of Maine which is the real economic indicator of importance to Maine, this added value is not easy to obtain because of weight loss in processing, different processing of the same resource, etc.

Figure 2 is a graph of the landings in pounds by month of selected species for the years 1969 and 1971. The fact that the peaks do not line up with each other suggest the desireability of versatile fishing craft able to exploit the most profitable resource of the moment.

Figure 3 indicates the distribution along the Maine coast by counties of the fish landings. The bars represent the value in dollars and values for the principal species. The total landings of all species are given.

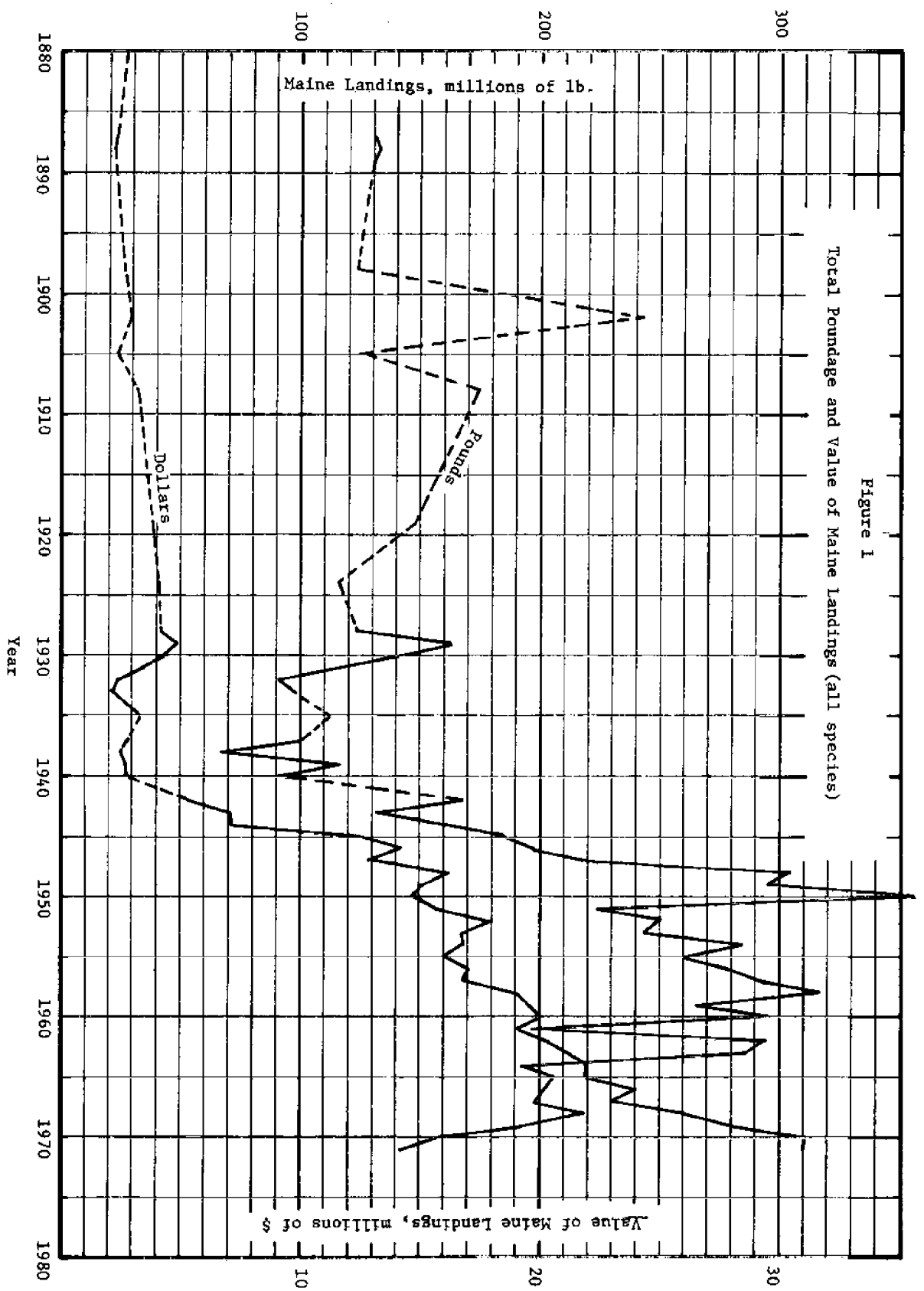


Figure 1

Total Poundage and Value of Maine Landings (all species)

Table I
MAJOR MAINE FISH SPECIES

Source: In general, Bigelow & Schroeder "Fishes of the Gulf of Maine"
OCEAN RESEARCH CORP., KENNEBUNK, MAINE

1. COMMON NAME	American Lobster	Northern Shrimp	Clams	Ocean Perch (Redfish)	Blood & Sand Worms	Sea Herring	Scallops	Whiting (Silver Hake)	TOTAL
2. LATIN NAME	Homarus americanus	Pandalus borealis	Mya arenaria	Sebastes marinus	Glycera dibranchiata Nereis virens	Clupea harengus	Pecten magellanicus	Merluccius bilinearis	
3. DESCRIPTION	Bottom dwelling crustacean	Bottom dwelling & swimming crustacean	Bottom dwelling bi-valve mollusk	Pelagic & bottom dwelling finfish up to 1¾ pounds.	Bottom dwelling bait worms.	Schooling pelagic finfish up to 1½ lb.	Ocean bottom dwelling mollusk	Pelagic and bottom swimming finfish up to 5 lb.	
4. RANGE	Labrador to North Carolina	North of 40 N. Lat. around the world	Labrador to North Carolina	No. Atlantic, N.J. to Arctic	Bl., St. Lawrence-Fla. Sa., Newfoundland-Va.	Both sides of N. Atlantic	Labrador to New Jersey	N. American Cont. Shelf, Nfld. to N. Carolina	
5. HABITAT	Inshore lobsters: generally rocky bottom to 80 fm. Offshore lobsters: edge of Cont. Shelf to 300 or more fm.	Generally found on mud bottom from 5 - 100 fm., depending on season. Bottom dwellers during day; some rise at night.	North of Cape Cod - intertidal protected zone in sand silt, clays, and mixtures	Distributed through water column 1-350 fm. but generally close to bottom. Rocky or mud bottom equal to or less than 35 degrees.	Blood - intertidal to 1,400'. Sand - intertidal to 530'. Found in sand and silt substrates, under rocks, marsh thatch.	Appearances are sporadic. Young herring move inshore spring & summer. Large herring stay generally offshore. Esp. plentiful E. Maine coast.	Inshore and offshore, such as Georges Bank. Prefer hard bottom.	Appear along coast from spring through fall. Concentrated in SW Gulf of Maine. Temp. - 38 degrees.	
6. HABITS	Will eat most anything, including other lobsters. Shell shed (moulted) to allow growth. Females lay 3,000-75,00 eggs.	Sex reversal, i.e., start as males, then become female. Live offshore in warm months - migrate in to spawn in cold months.	Adults sedentary - filter feeder. Spawn May-Nov.	Food generally of crustaceans. Do not migrate extensively. Females incubate 25,000 - 40,000 eggs internally each year.	Blood - live near surface in sediments. Sand - live below 8" in sediment near low water. Spring & early summer spawning when majority die.	Plankton feeder. Heavily preyed on by many fish. Spawn 20,000-40,000 eggs on non-mud bottom in 3-30 fm.	Capable of motion above the bottom in short spurts by water jet from its siphon.	Voracious eaters, prey on smaller fish. Do not school, but often swim together. Spawn in summer along entire coastal zone.	
7. AGE TO MATURITY, YEARS	5±	4	3-6	10±	3±	(sardine size) 1-2	6±	3+	
8. MAJOR FISHING SEASON	May-December	January-April	March-September	All year	Spring to late fall when flats ice-free	June -November	Legal in Maine waters Nov. 1 - April 15	June-August	
9. HOW PROCESSED	Inshore sold live. Offshore generally canned or frozen.	Whole, whole frozen, peeled & frozen, canned.	In the shell, and shucked fresh.	Filleted and frozen.	Live, packed in rock weed in cardboard cartons for shipment.	Canned as sardines, Frozen for lobster bait.	Adductor muscle shucked out and packed for fresh or frozen sales	Frozen headless, dressed.	
10. MAJOR MARKETS	Gourmet dining places in USA	Northern Europe and N.E. USA	North Atlantic & New England states	East and Midwest (replacing declining carp supply)	Sport fishing bait during season - L.I. Sound-Chesapeake Bay	Sardines USA Bait - Maine	Eastern USA	South and Midwest	
11. LANDINGS, LB. - 1971	17,558,000 lbs.	18,419,000 lbs.	5,256,800 meats	46,630,000 lbs.	1,561,000 lbs.	28,571,000 lbs.	387,000 lbs.	9,900,000 lbs.	142,684,000
12. LANDED VALUE, $ - 1971	$17,481,000	$3,671,000	$2,702,000	$2,347,000	$2,056,000	$687,000	$504,000	$480,000	$31,069,000
13. LANDED PRICE PER LB., $ - 1971	$0.995	$0.155	$0.514	$0.050	$1.317	$0.024	$1.302	$0.048	$0.217
14. WHOLESALE PRICE/LB., $ - 1971	$1.63			Frozen fillets $0.369				Frozen headless, dressed - $.27	
15. % VALUE-TOTAL ME. LDGS. - 1971	56.11%	11.78%	8.67%	7.53%	6.60%	2.2%	1.62%	1.54%	100%

Figure 4 (page 9) is a map of a portion of the Northwest Atlantic Ocean showing the principal areas fished by the entire New England Fleet. Indicated are the ICNAF divisions and some of the major grounds. Except for the ocean perch fleet, which fishes the Gulf of St. Lawrence and the inner grounds (3 and 5), Maine fishing fleets generally operate within 50 miles of the coast.

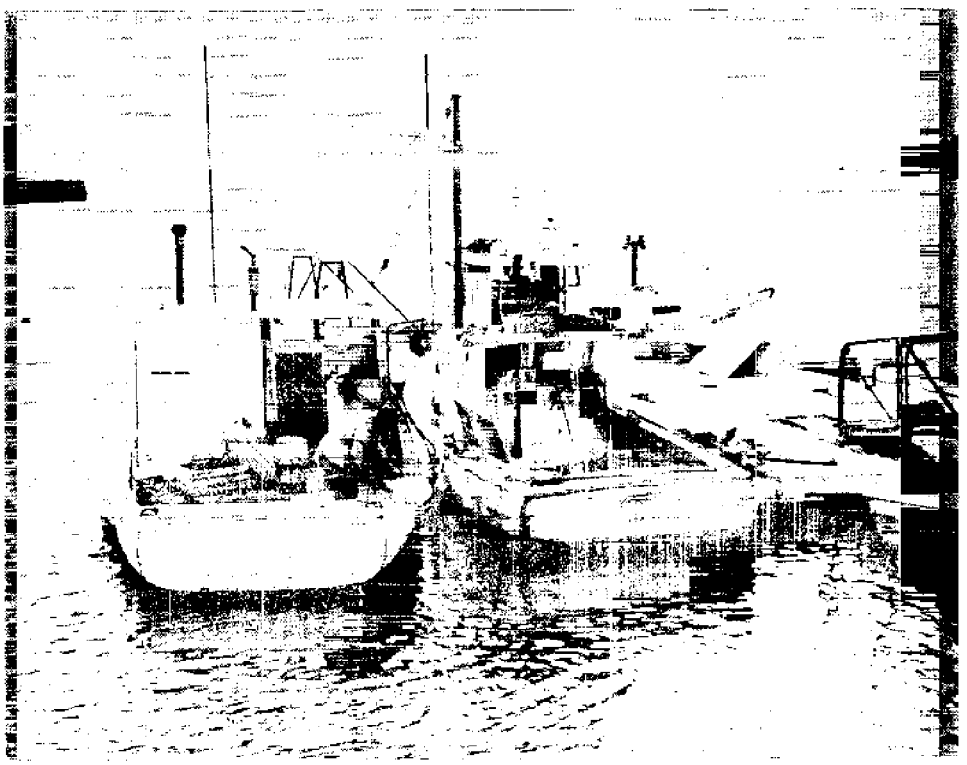


Figure 2
Maine Landings, millions of lb.
Of Selected Species by Calendar Month
1971 Landings – – – –
1969 Landings ——

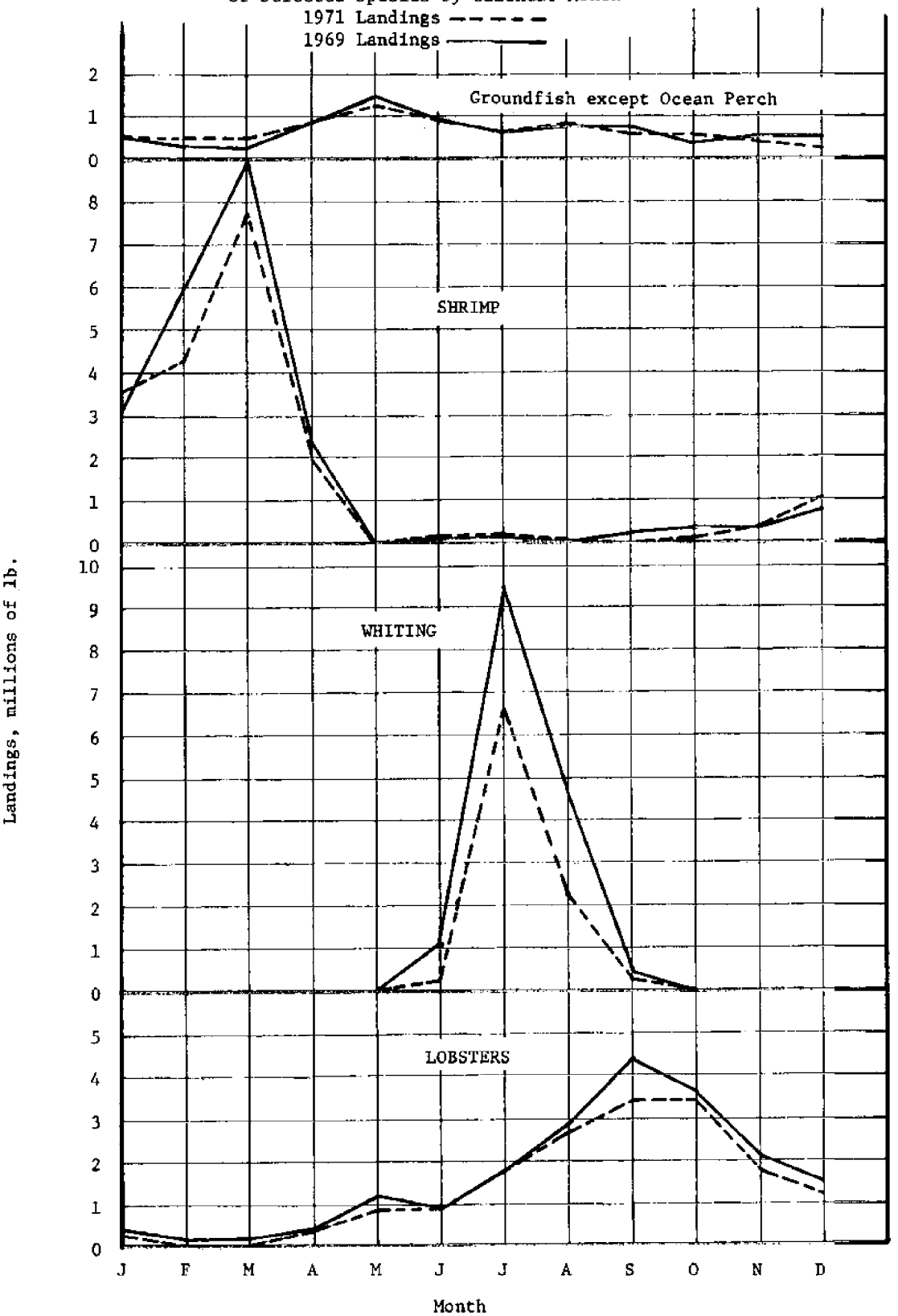


Figure 3

Dollar Value of Maine Landings of Selected Species by County, 1971

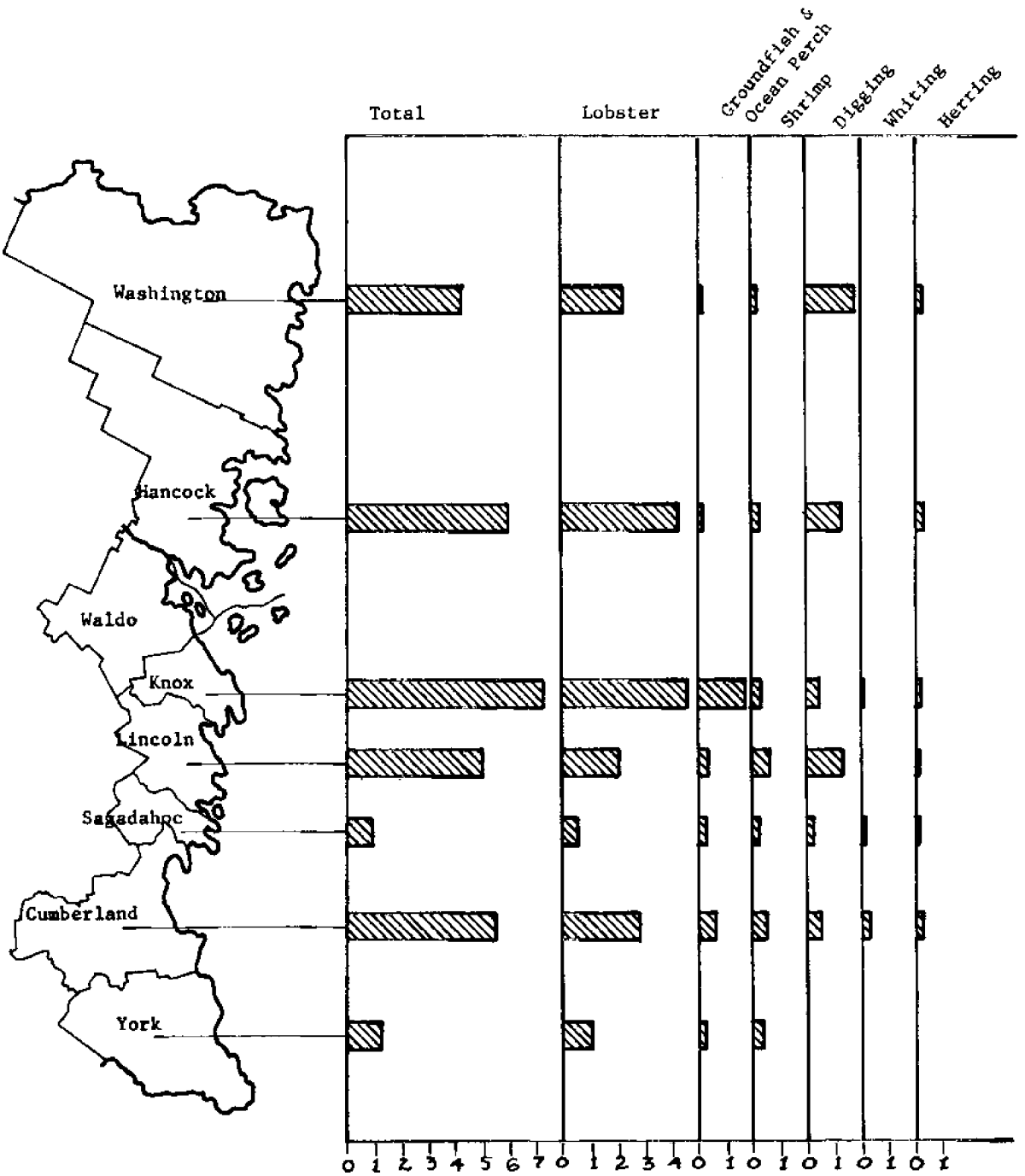


Figure 4

Principal Grounds Fished by the New England Fleet
Showing Principal Banks and ICNAF* Area Designations.

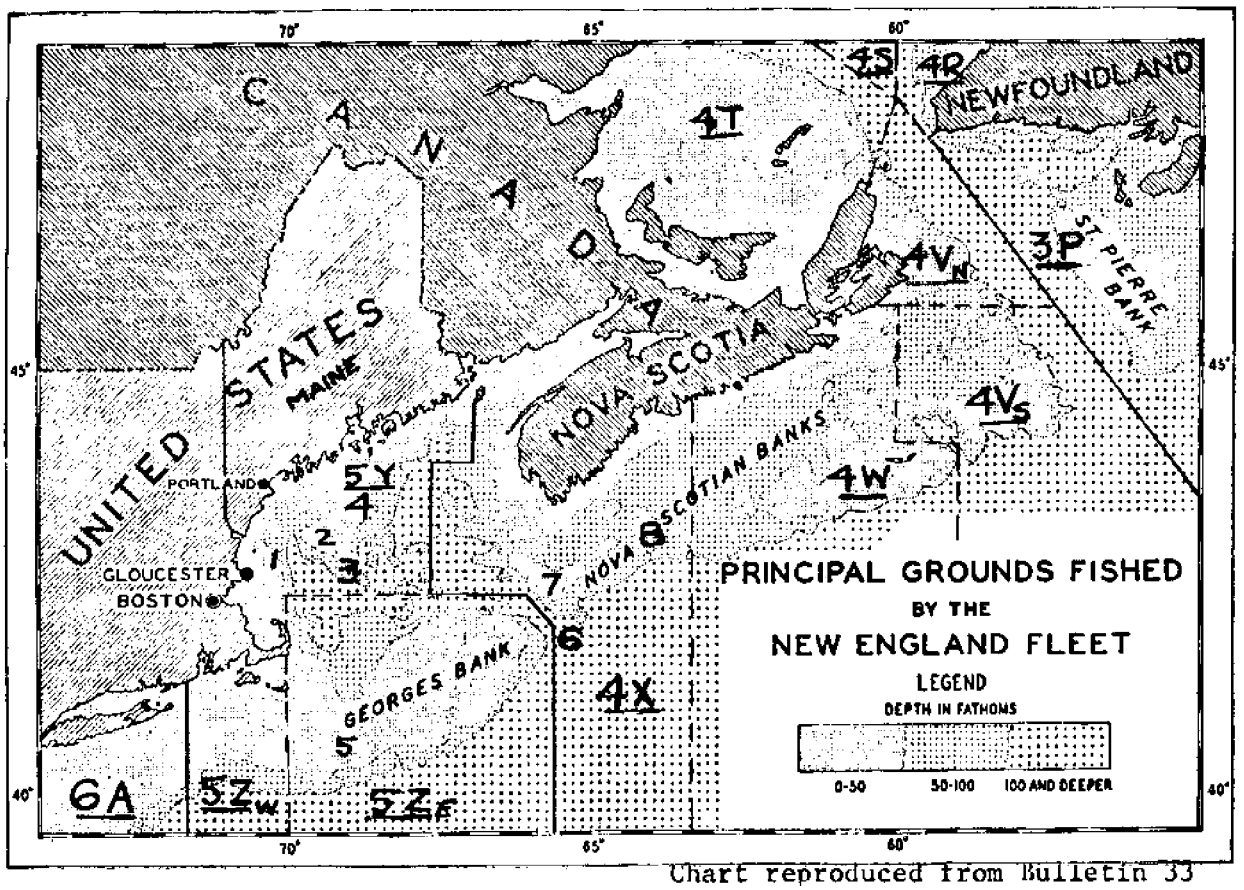


Chart reproduced from Bulletin 33
U.S. Fish and Wildlife Service

1. Jeffreys Bank
2. Platts Bank
3. Fpennies Ledge
4. Jeffreys Bank
5. Great South Channel
6. Northeast Channel
7. Browns Bank
8. Le Haves Bank

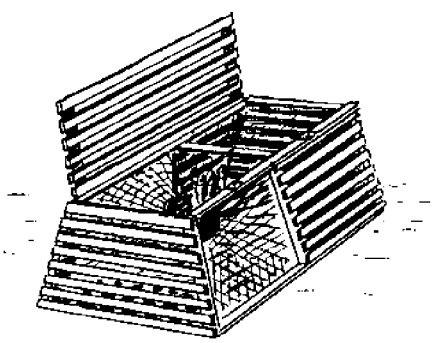
*ICNAF = International Commission for the Northwest Atlantic Fisheries. For statistical and management purposes, ICNAF has divided the Northwest Atlantic into zones, as 4x.

II. An Overview of the Harvesting, Transporting, Processing, Storage, Distribution and Marketing System.

Harvesting

Pots or Traps

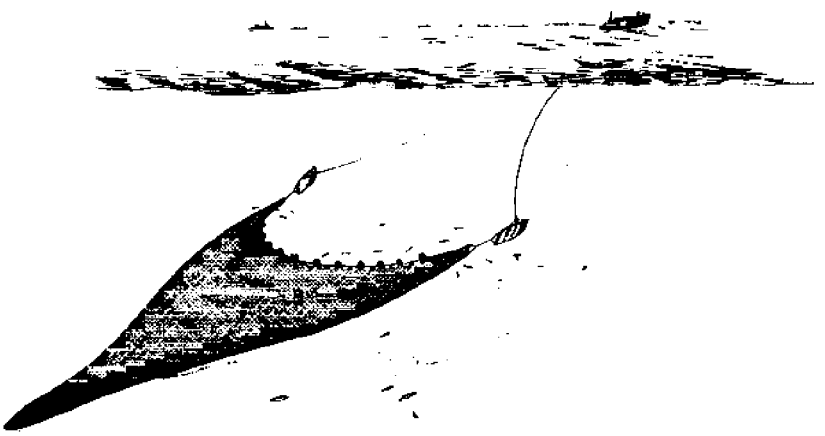
Pots or traps are rigid devices of various designs and dimensions used to entrap fish or shellfish. Their catching principal is based on luring the animals through one or more conical funnels to prevent escape. Pots are circular, rectangular, or semi-cylindrical; in other parts of the world other shapes are used. Several types of materials (wire and fiber netting, wood, and plastic) are used in their construction. Pots are generally baited and are fished as single units with a separate buoy line or several attached to one longline.



Otter or Bottom Trawl

The otter trawl is a device for catching bottom fish. It is constructed of twine webbing so that when fully assembled and rigged it will take the shape of a huge funnel while towed along the bottom of the ocean. Floats and weights are utilized in keeping the mouth of the net open.

To spread the mouth so that it will cover the largest possible area, each wing is fastened to an "otter" board or trawl "door". Each door is fitted with chains for attaching it to a towing cable from the trawling vessel. The resistance of the water to the forward motion of the boards, as they are towed at different angles, forces them to pull in opposite directions and thus keep the mouth of the net open. The "otter" boards are attached at some distance from the tips of the wings. A similar arrangement with different doors is used for midwater trawling, i.e., between bottom and surface.

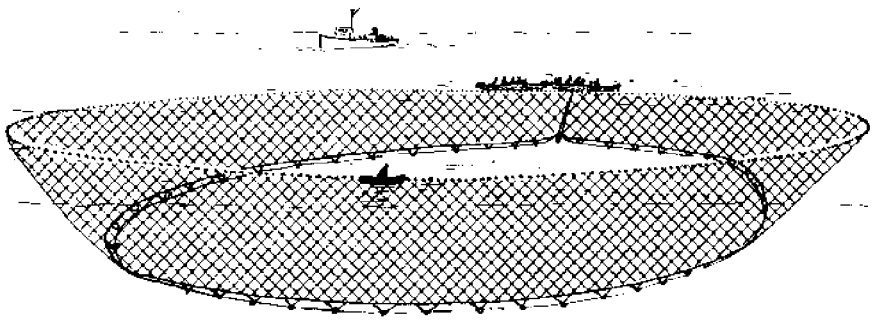


Purse Seine

A purse seine is an encircling type of gear designed to catch species that run in schools near the surface of the water such as anchovies, mackerel, menhaden, sardines, and tuna, although in some fisheries the seine net is used to fish the whole water column from surface to bottom.

The net is actually a long wall of webbing without a prominent bunt (bag). The top edge is floated by a series of corks (the cork line) and the bottom edge is weighted with a number of leads (the

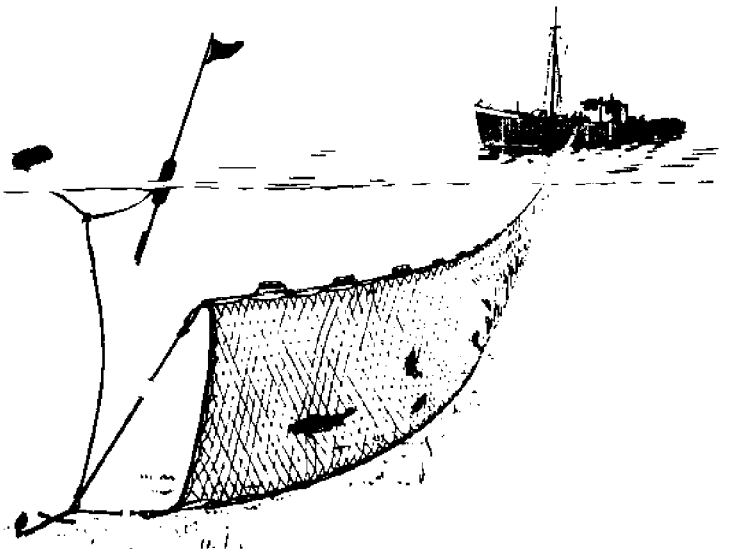
lead line). The essential feature of this net is the pursing by closing the draw string which is threaded through a series of rings along the bottom of the net below the lead line. Capture is effected by surrounding the school, pursing the bottom line so that the lead line is bunched or puckered, and concentrating the catch in the landing piece or small bag. The catch is removed by use of a brailer (a large scoop net on a long pole) or by a fish pump.



Gill Net

A gill net is an upright fence of netting in which the fish are caught in the meshes of the net. Fish, of a size for which the net is designed, swimming into the net can pass only part way through a single mesh. When it struggles to free itself, the twine slips behind the gill cover and prevents the fish from escaping. The fish is thus "gilled" and can neither go forward nor back. Various sizes of mesh are used depending on the species and size of the fish

to be caught. Gill nets can be suspended at the surface, in midwater, or close to the bottom by controlling the number of buoy lines and the size and number of floats on the top of the cork line and weights on the lead line. The net may be operated as stationary or moveable gear.



Processing and Storage

Processing can be described as the changes which are made to a resource between the time it is landed aboard the vessel and the time it is ready for distribution to either the consumer, wholesaler, or retailer. For some species a certain amount of the processing is carried out aboard the vessel; in the extreme case, on one of the large foreign factory ships all processing operations are performed on board and thus the ships are in fact floating processing plants.

The previous material and illustrations courtesy of Bureau of Commercial Fisheries (now National Marine Fisheries Service). Circular 109, Commercial Fishing Gear of the United States.

Rather than describe all the processing alternatives, the following questions may be illustrative:

How is the product sold - alive or dead?

If dead, in what condition - fresh or preserved?

If fresh, in what condition - whole or filleted?

If preserved, in what condition?

How is the product to be preserved - frozen or canned?

If frozen, is the product mixed with other products (cakes, sticks, etc.) or by itself (fillets, shrimp, etc.)?

If canned, is the product packed in sauce (mustard, oil, brine) or by itself?

Is the product cooked before preservation?

Is the product landed at the processing plant as caught or is it processed on board?

If processed - how (headed and gutted, filleted, etc.)?

If necessary, how is the product preserved from spoilage aboard the vessel?

Typical examples of the varying degrees of processing complexity are:

The lobster, for which the entire processing operation usually consists of pegging the crusher claw and storing in a pound for sale alive to the consumer.

Groundfish, which may be headed and gutted and stored in ice aboard the catching vessel, filleted, dipped in batter, and frozen at the processing plant, and shipped to still another processing plant for final packaging as a frozen convenience dinner. In some circumstances products are

imported from other states and foreign countries for processing by Maine plants, and many products are exported both nationally and internationally. In 1969 the total value of products processed in Maine was $47,675,000.

There are large holdings of processed products in various storage plants. The effect of these holdings is to smooth out the price variations which would otherwise occur in species which have a highly seasonal harvesting period. The following is a listing of cold storage holdings at 21 New England plants (5 are located in Maine) as of January 6, 1973:

5,477,000 pounds of frozen cod blocks
95,000 pounds of frozen flounder and sole blocks
3,532,000 pounds of frozen ocean perch fillets
10,111,000 pounds of frozen fish sticks and portions
202,000 pounds of frozen scallop meats

Transportation

The commercial fishing industry of Maine employs all the transportation elements; road, rail, sea, and air. Selection of the principal mode is dependent upon product requirements, unit price, density, and destination. For example, in 1970 Maine lobster landings accounted for 60% of total U.S. landings; because these are sold alive and are a high value item, refrigerated air transport is sometimes employed for long distance movements. Canned sardines, however, can move from origin to destination by a slower and less environmentally controlled transport mode. As an example of the diversity of fishery transportation activity, the following is a partial list of fishery products entering Maine during

the first week of January, 1973.

3,400 pounds of fresh cod by truck from Canada

442,000 pounds fresh herring by truck from Canada

31,400 pounds fresh cod blocks by truck from Canada

44,200 pounds frozen cod fillets by truck from Canada

19,60C pounds canned crab meat by truck from Canada

272,000 pounds live lobsters by truck and ferry from Canada

48,600 pounds canned sardines by rail from Canada

55,400 pounds canned sardines by rail from Canada

For the year 1969, over 1.7 billion pounds of fishery goods worth $700,000,000 were imported nationally for human consumption.

Marketing

Marketing of fishery products is a highly diverse operation ranging from the sale of fresh lobsters and shrimp by individuals on the roadside to the sophisticated advertising and packaging techniques employed by major producers of convenience foods. In addition to existing markets both the National Marine Fisheries Service and the Maine Department of Marine Resources are expending considerable effort in developing new markets nationally and internationally. The U.S. per capita consumption of fish and shellfish is rising slowly; in 1969 it averaged 11.1 pounds of fish eaten per person per year. However, this consumption is considerably below that of the other developed countries.

III. Fishing vessels, gear, and techniques presently employed, or which can be employed, in Maine.

Fishing Vessels

The types of fishing boats in common use on the Maine coast are as follows:

Class	Approx. Size Range Length Over All	Species Fished
Lobster Boats	up to 45'	Lobster, crabs, shrimp
Draggers & Trawlers	35' - 140'	Groundfish, shrimp. scallops
Seiners	35' - 65'	Herring
Gill Netters	40' - 50'	Groundfish
Sardine Carriers	50' - 85'	Transport sardines to packing plants

Older vessels have been shown statistically to be, on the average, less efficient producers of fish and are the most subject to loss or breakdown. Figure 5 is a histogram showing the distribution by age of Maine fishing vessels over 5 net tons. In examining the histogram, assume an efficient life of 20 to 25 years.

Similar data are not available for the lobstering fleet most of which are under 5 net tons. Lobster boats are estimated to be much younger - perhaps averaging 10 to 12 years.

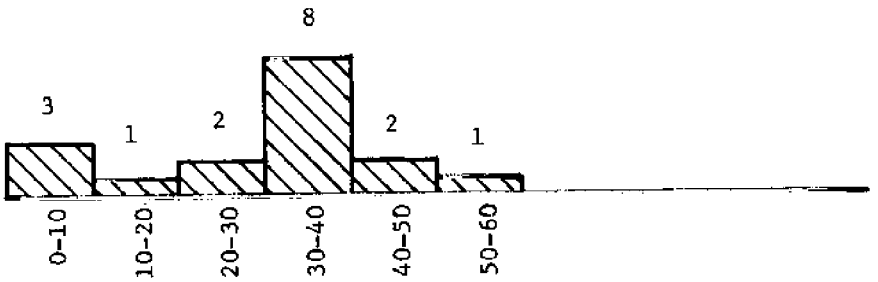
Figure 6 illustrates one of the reasons older vessels don't do as well on the average as new ones. The distribution of the points indicates quite clearly that the newer vessels have greater horsepower and hence are able to steam at higher speed and handle their gear faster.

Table II presents an approximate means of quickly evaluating the various ship and boat building materials. Wood is still probably

Figure 5
Maine Commercial Fishing Vessels Over 5 Tons
Within 10 Year Age Groups

17 Vessels with Register Length Greater than 70'

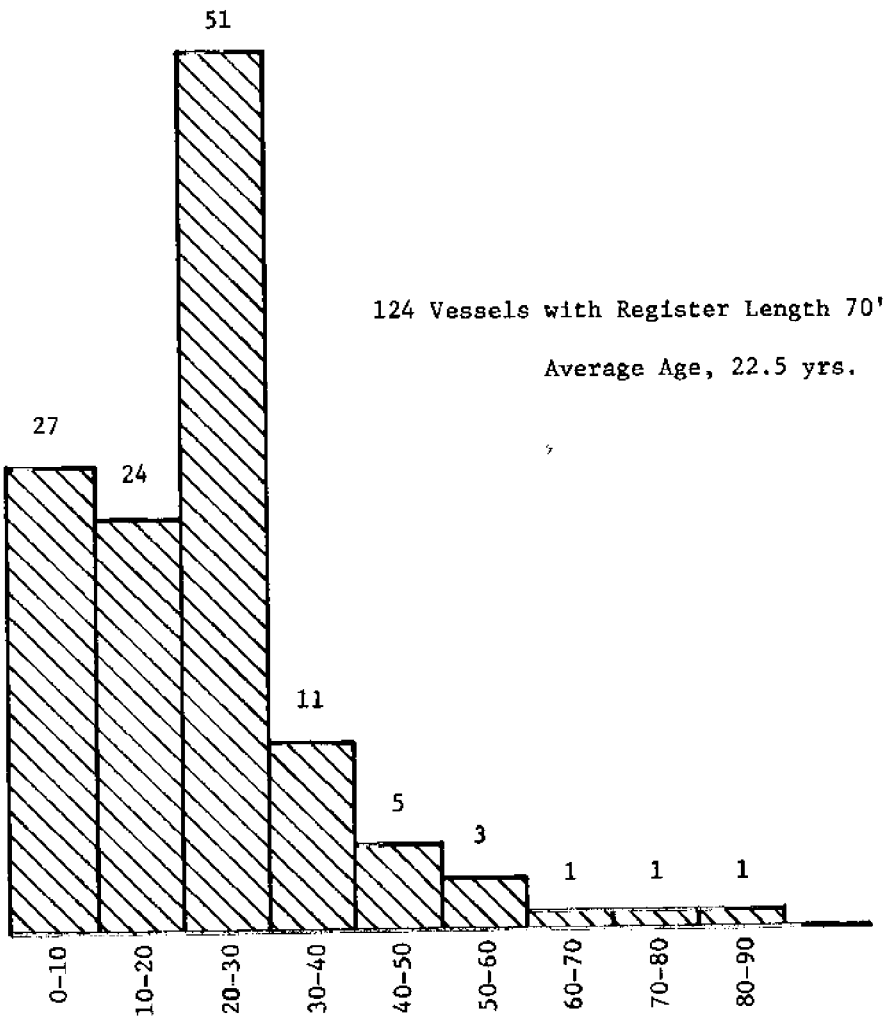
Average Age, 33.0 yrs.



Age Classes, Years

124 Vessels with Register Length 70' and Less

Average Age, 22.5 yrs.



Age Classes, Years

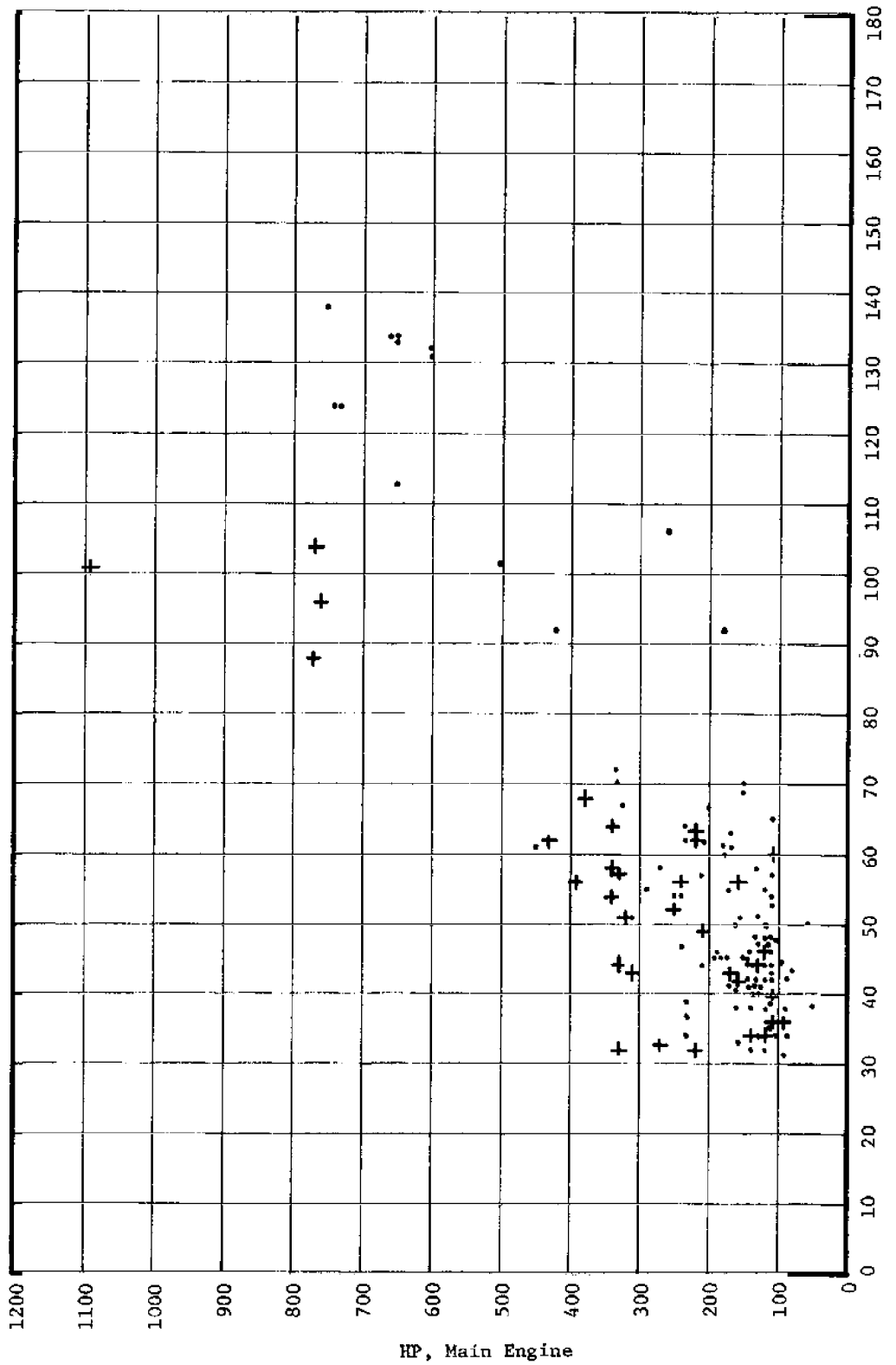


Figure 6
Main Engine Horsepower versus Registered Length for Newer and Older Fishing Craft
Vessels built 1963 and after +
Vessels built prior to 1963 •

the most popular material in Maine, with fiberglass coming on strong up to 40' LOA and steel in larger sizes.

Table II

Approximate Evaluation
Various Boat and Ship Building Materials

Material / Cost Element	Wood		Plywood with FRP	Fiberglass (FRP)	Steel	Alum.	Ferro-Cement
	Bent Frame	Sawn Frame					
Normal size range	20-75	60-100	15-75	15-72	40-	15-	30-60
Rel. const. cost for equal hold size	100	103	100	113	107	111	106
Rel. maintenance cost	100	100	70	50	100	30	90
Rel. insurance rate	100	100	98	98	91	88	100
Depreciation period	20	20	23	20	20	25	*
Used in Maine?	YES	YES	NO	UP TO 40'	YES	NO	NO

*The newness of ferrocement construction does not permit a useful prediction of vessel life. It is expected to be at least equal to wood and fiberglass, i.e., 20 years.

Vessel Associated Problems

Any problem arising on a vessel can be said to decrease its efficiency, whether it is a catastrophe leading to total loss, or a minor malfunction delaying departure an hour or two.

Table III lists the major elements in which problems can arise. The possible consequences of failures are two-fold: loss of revenue and cost of correction.

To sum up: the ideal fishing vessel is an integrated system in which each element is selected in relation to the entire system and for maximum reliability and efficiency. The farther the system departs from the ideal, the less effective it will be.

Axiom: a fishing vessel can only produce revenue when its gear is actually fishing.

Fishing Systems

Although there is infinite variety in fishing systems the world over, all those in Maine (except hand digging) include the major elements shown in Figure 7.

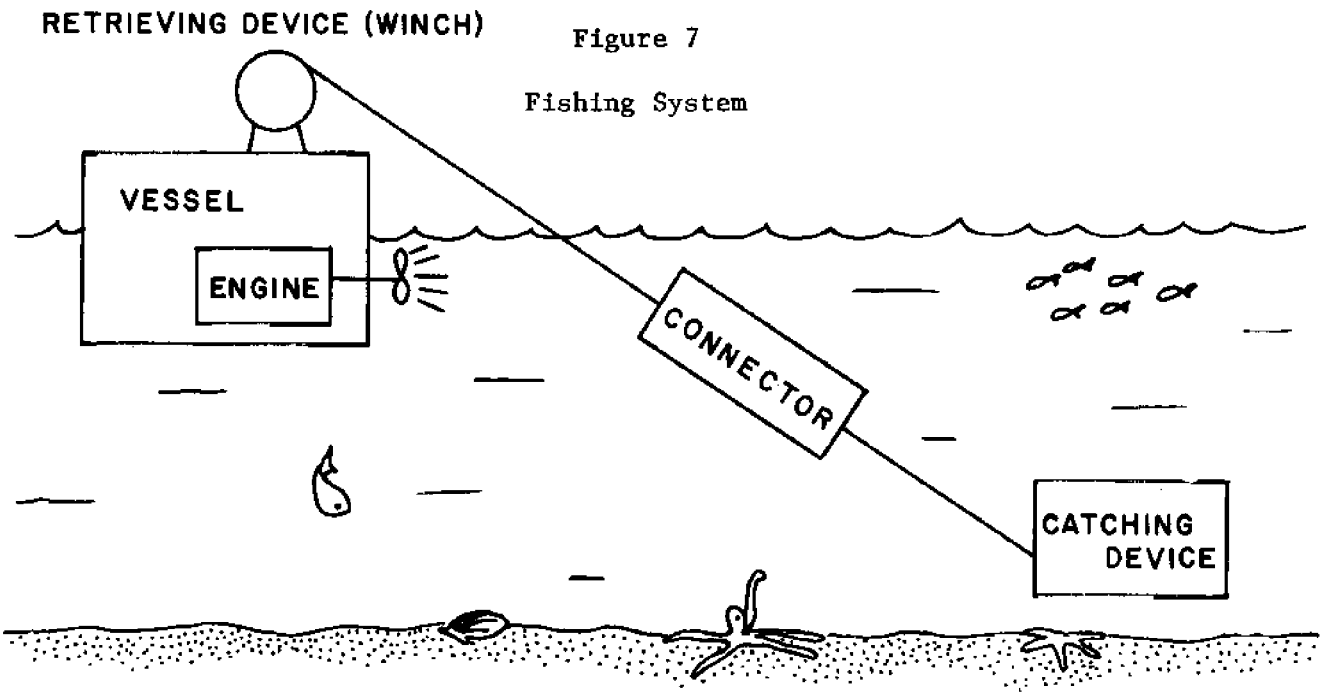


Figure 7

Fishing System

Table III

Review of Potential Fishing Operation Failures

Element which Fails	Possible Consequences	Possible Causes
Vessel structure	Sinking or curtailment of fishing	Poor design and/or construction, old age, poor navigating
Machinery	Curtailment of fishing or loss of efficiency	Inadequate maintenance, old age, poor selection
Instruments	Unable to navigate, unable to find fish	Inadequate maintenance, old age, poor selection
Gear (winches, etc.)	Inability or loss of efficiency in handling gear	Inadequate maintenance, old age, poor selection
Crew	Injury or sickness may require return to port, or loss of efficiency	Poor crew selection, lack of safety measures, vessel too small for conditions
Administration	May delay vessel departure, create financial problems, or have inefficient catch-selling abilities	Inadequate shoreside personnel and skills

Vessel: Covered previously

Engine: Figure 6 is a plot of engine horsepower against registered length (not LOA), for craft over 5 net tons. Note that newer vessels on the average have more powerful engines. All vessels shown may be assumed to have diesel power.

Winch: Must be large enough; too small means too slow a hauling speed and/or too light a lifting capacity. Generally directly driven from main engine, but the use of hydraulic power is increasing, sometimes with a separate prime mover.

Connector: Generally wire or fiber rope (solid connection in case of clam dredge or moss rake).

Catching Device: Range from tea cups to submarines. In Maine, however, the following will be found:

Pots or traps -

Lobster: Inshore - almost exlusively of wood construction. May be set singly or in trawls using fiber rope connector. Offshore - because of maximum size limitation, offshore lobsters are not landed in Maine.

Shrimp: Similar in size to lobster trap, but generally of steel. Use increasing - can be fished on bottom too rough for trawls.

Crabs (Jonah): Usually caught as incidental catch to lobster; occasionally fished specifically in lobster-type traps.

Trawls, bottom - Usually fished from one boat (side or stern dragger) with doors to keep mouth spread open. Practice of towing one large net with two small boats and no doors is increasing and appears to be more efficient. Wire connecting

trawl to winch (called warps) are given scope of 2 to 3 times water depth. Mesh size for groundfish controlled by ICNAF. Used for catching groundfish (cod, haddock, flounder, ocean perch, whiting, etc.) shrimp, and offshore lobsters (out of Massachusetts and Rhode Island).

Trawls, midwater - towed the same way as the bottom trawl, but with different door design. Vertical position determined by amount of warp out and speed of towing vessel(s). Use generally limited off Maine to catching herring.

Seines - Purse seine is dropped from vessel to form vertical circular wall about a school of fish, then pursed into bag shape. Retrieved by hydraulic, rubber covered block. Use limited to catching herring, but has also been used off New England for catching menhaden and schooling tuna.

Variations on purse seine:

Weirs - netting ("twine") hung on stakes in labyrinth pattern to entrap schools of sardine herring swimming along the shore.

Stop seine - Seines set to close off a cove in which sardine herring have schooled.

Scottish (or Danish) seine - A net similar to a trawl shot onto the bottom, then hauled toward a vessel anchored some distance away. Used for bottom fish.

Gill nets - May be floating or anchored; generally the latter off Maine. A size-selective catching device depending on mesh size. Retrieved by hydraulic hauler. Used for fish of many species

such as haddock and cod swimming up off the bottom (but not for flatfish like flounder).

Fishing Operations

Consists of: getting to the grounds; finding fish; operating the catching gear; processing and stowing the catch; returning to port.

Getting to and from Grounds - The only real variable is steaming speed, limited to about 10 knots except in a few non-Maine fisheries.

Finding Fish - Depends on knowledge of the species habits (from study and from past records) and the proper instrumentation properly used. The aim is to find the heaviest concentration of fish.

Processing and Stowing - Depends on species caught (lobsters and redfish are stowed whole; cod and haddock dressed; and shrimp may be cooked). Sanitation standards are generally low on Maine fishing vessels, yet variable quality of product is one of the major inhibitors of increasing per capita consumption of fish. Fish are normally stowed in bulk in the hold with sufficient ice to preserve them. Preferable alternatives are: stowing fish in clean plastic or metal boxes and using mechanical refrigeration instead of ice.

Considerations in vessel selection: The basic aim is high return on investment (ROI). Size, power, gear, electronics, must all be matched for optimum performance. Other things being equal, the vessel which keeps its gear fishing the most hours per year will return the highest ROI. Factors leading to high fishing hours per year:

Reliability (no broken trips) - depends on a first quality vessel and a capable maintenance routine.

Comfort (so crew enjoys living and working on the vessel) - important are vessel size relative to trip length, comfortable motion, dry decks, and living amenities.

Versatility (ability to change over readily from one fishery to another) - stern trawler configuration preferred.

Selection of captain (ability to find fish and work the gear).

Status of Fisheries in United States Relative to Other Countries

Tuna Fishery - U.S. a world leader through technology. Other countries are now copying.

Southern Shrimp Fishery - U.S. beginning to be technologically advanced; small refrigerated semi-factory vessels. United States vessels now being purchased by under developed countries.

North Pacific Fisheries (crabs, shrimp, salmon, halibut, other finfish) - In some areas quite highly developed.

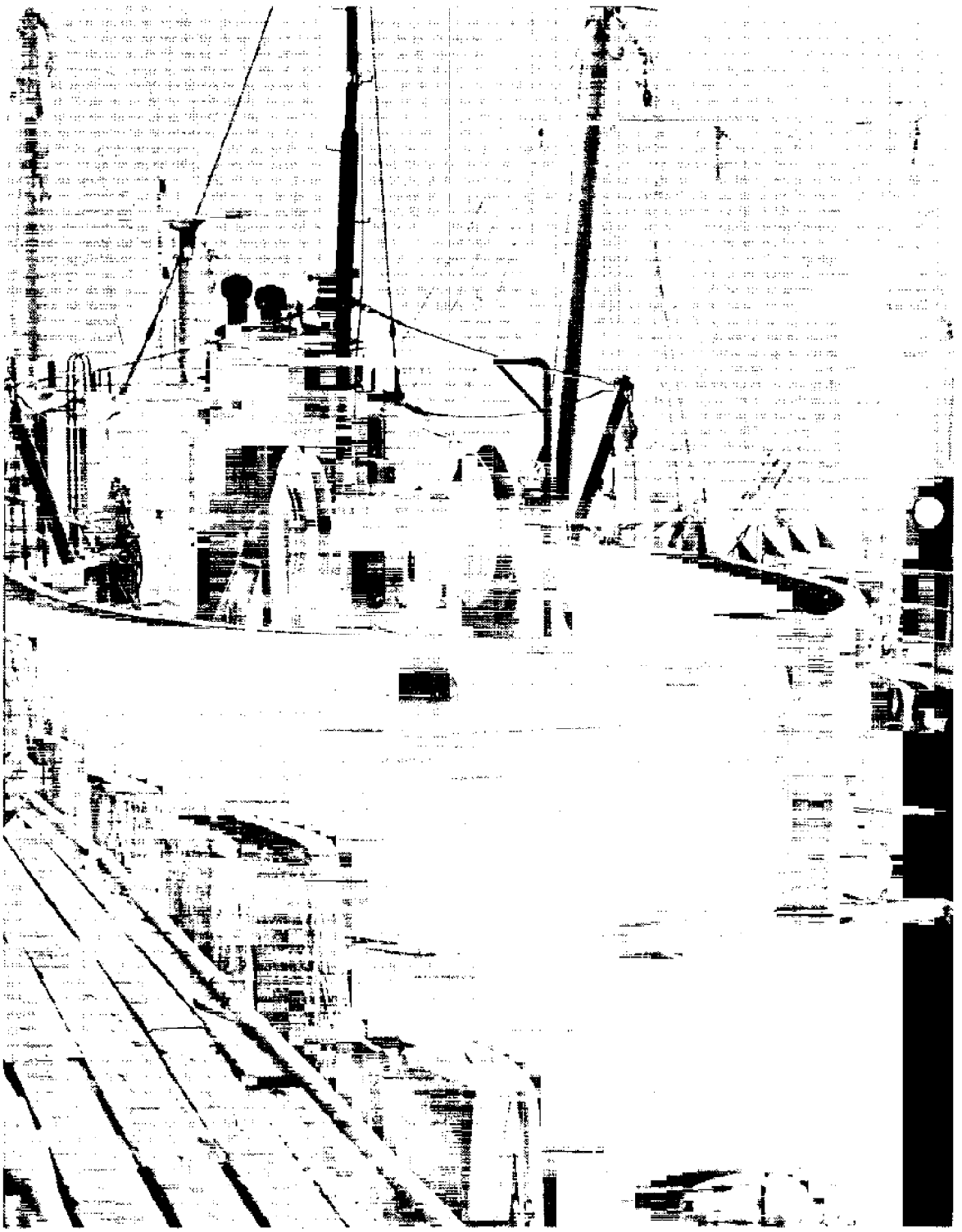
New England Fisheries - The poorest by comparison; suffer from foreign fishing and obsolete equipment. Isolated areas show excellent growth.

Maine - About the same as the New England statement. Foreign vessels tend to be more highly developed than Maine vessels. Size not necessarily a criterion of efficiency or fishing power.

Foreign tactics:

Often sail in fleets of sizable vessels. Sometimes fleet consists of mothership (factory ship) with small catcher vessels.

Pulse fishing - clean off a ground quickly, then leave it to build back up before fishing it again.



IV. Legalities and Restrictions

At the international level, the United States is a member of the International Convention for the Northwest Atlantic Fisheries, ICNAF. This body established quotas of various species which can be harvested within the ICNAF convention area.

The following quotas, in metric tons, affecting U.S. landed species are in effect for this area: (1 metric ton almost identical with 1 U.S. Long Ton). (1972)

Haddock - The total catch is limited to 19,000 tons with a closed season from April to June.

Cod - National Quotas: USA - 20,650 tons
Canada - 22,500 tons
Other - 52,500 tons

Yellowtail Flounder - National Quotas: USA - 24,000 tons
Canada - 35,500 tons
Other - 16,400 tons

Whiting - National Quotas: USA - 34,500 tons
Other - 118,500 tons

Red Hake - National Quotas: USA - 15,000 tons
Other - 25,000 tons

Herring - Quotas presently being negotiated

On the federal level there are at present relatively few direct restrictions on the harvesting segments of Maine's fishing industry. Fishing vessels are not required to be operated by licensed crews nor to be inspected annually. They do, however, fall under the Merchant Marine Act of 1792 and therefore cannot be built in foreign yards if over 5 net tons. Crewmen are afforded the same legal rights of protection as merchant marine crewmen. Fishing vessels, if over 5 gross tons, may be documented and as such become vessels of the United States, in which case any legal proceeding against a vessel must take place at

the federal, not state level. Processing plants which are engaged in interstate shipment of goods may request inspection by the Food and Drug Administration (FDA) on either a continuous or intermittent basis; however, it is not presently a requirement.

There are four areas in which federal legislation either has been recently enacted or is pending: mandatory vessel and plant inspection for sanitation, vessel and plant sewage and waste treatment systems, safety standards for fishing vessels, and FDA restrictions on the sale of fishery products with unacceptable contaminant levels. If all of these programs are passed and implemented strictly, the impact on the fishing industry will be sweeping, resulting in higher quality products, obtained and processed in a safer fashion and with less adverse impact on the environment than at present. Offsetting these desireable social features are the economic costs, estimated by the National Marine Fisheries Service to be approximately $4,000 per fishing vessel and $60,000 per processing plant.

At the state level the following license requirements and restrictions are in effect: (1972)

A commercial fishing license has a cost of $10 per operator or crewman if a resident (1 year) of Maine and a cost of $100 for operator and 2 crewmen if non-residents.

A lobster and crab fishing license has a 3 year residency requirement (1 year for honorably discharged veterans).

Specie	Minimum Allowable Size	Closed Season	Other Restrictions
Herring	4½" overall		No use of artificial light to attract except in York Co. and Sheepscot Bay
Quahog Clams	2" diameter		Using only hand power device except in Hancock County
Scallops	3" diameter	15 April - 31 October	Certain exluded territories
Lobster	3 3/16" from rear of eye socket to rear end of body shell. Maximum allowable size is 5"	From June 1 to August 31, no fishing from 4PM Saturday to ½ hr. before sunrise Monday; from June 1 to Oct. 31 no fishing from ½ hr. after senset until ½ hr. before sunrise	No egg bearing females can be in possession. Only pots permitted. No more than 3 traps/ trawl in York Co. and part of Saco Bay

Otter trawling is prohibited from midnight Friday to midnight Saturday during June, July and August, throughout the state, and from May 1 to December 15 both otter and beam trawling are prohibited in Washington County territorial waters.

From Cape Small south to Cape Elizabeth it is prohibited to use an otter trawl with a footrope greater than 70' and/or a headrope greater than 50' or to trawl using a vessel having a register length in excess of 65' during June, July and August. Purse seining is prohibited from April 10 to October 15 in the territorial waters of Washington County.

V. Social and Economic Impact of Fisheries on Maine

Social Impact

Historical influences:

Ability and willingness to exist in the hard, dangerous life in old-time sailing craft.

Necessity of improving and making do with materials at hand.

Demands of a rough environment which must be met by the vessels and men.

Occupational influences:

Great sense of independence and self-reliance developed from working alone or in small groups in a frequently unfriendly world.

Necessity of living close to nature to 1) make the forces of nature do one's bidding, and 2) outwit the marine prey.

Self-interest rightly understood expressed in an eagerness to help each other in adversity.

Variability of income.

How are these influences expressed in the present-day fisherman?

He tends to be:

Independent and self-reliant.

Sometimes is vociferous, but usually is quiet spoken.

Very able boatman.

Scornful of how much help he can expect from science and technology.

A hard worker under frequently uncomfortable and difficult conditions.

Unavoidably the coastal communities inherited much of the same qualities as the fishermen.

Future influences are already being felt - for good? for bad? Some of these influences and their results are listed below:

Increased mechanization—→ easing of the fisherman's lot—→ softer, less resolute individual?

The modern tendency to bigness—→ pressure to give up the independent role—→ become cogs in vertically integrated fishing enterprises?

Increased pressure on existing resources—→ reduced return per unit of effort—→ resolving the problem by accepting, even originating, controls as required, or slowly fade away?

Competition in domestic and foreign markets from sophisticated, well organized industries—→ force an up-grading of Maine's fishing equipment and techniques—→ accept the challenge and seek harvesting and marketing methods for presently under-utilized resources?

Economic Impact

The estimated total direct contribution to Maine's economy of the 1970 fishing industry (non-manufactured and manufactured products, and direct retail sales) is estimated to be $160,000,000. The secondary impact (fishing gear, fuel, boat-building, maintenance and repair,

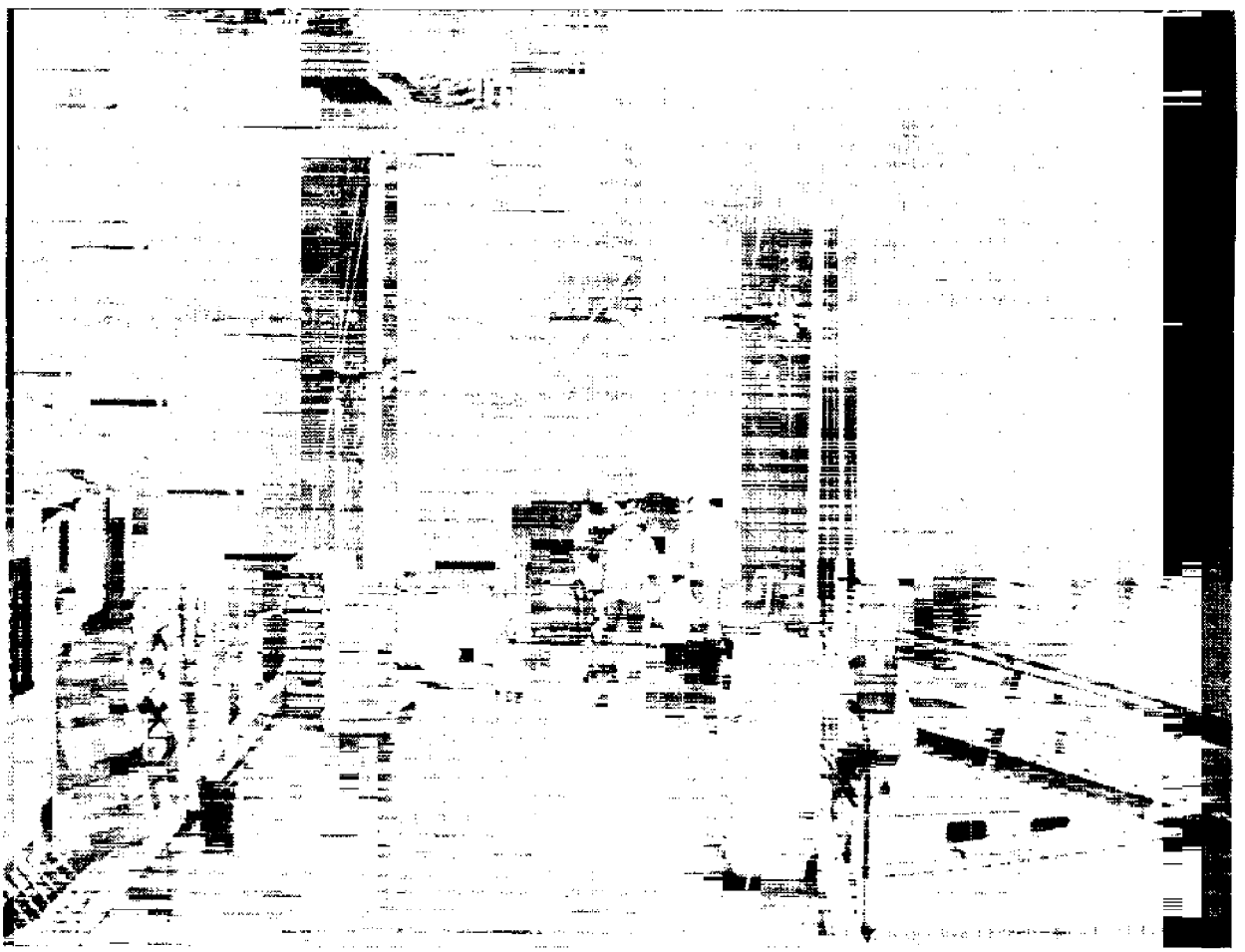
financing) is not known.

There is an authoritative estimate that the impact could be doubled through the following measures:

Development of more efficient harvesting methods.

Improvement in quality control.

Instigation of sensible resource management practices.



THE COMMERCIAL FISHERIES OF MAINE

SESSION II

Fishery Economics

I. How the fishing vessel sells the catch.

There is no fixed system in New England of selling a fishing vessel's catch. Every port appears to have its own customs and practices, and even in the same port there are often wide variations. The major methods are described below.

At auction - The catch of each vessel is auctioned off, generally by species, after the vessel is alongside but before it is unloaded.

This system of sale is used only in Massachusetts ports. However, the Boston auction prices are used in establishing ex-vessel prices in the Portland area.

By prior arrangement - In this method of disposing of the catch, the fisherman has a formal or tacit agreement to sell his catch to a particular buyer. The price may be variable, as when tied to Boston prices, or may be fixed for a finite period of time. This is common practice in Maine fisheries.

Out for bids - The fishing vessel owner, either directly or through an agent (such as a cooperative manager), canvasses all possible buyers before the vessel lands and sells the catch to the highest bidder. This is probably the most effective method if the selling agent is a good one and if there are several buyers to bid against each other.

A major problem in selling the catch is the variability of the size of catch, leading to a glut or famine situation. A short-term price variability factor of two is not unusual at the ex-vessel level, while wholesale price variability is small and of relatively low frequency.

II. Types of crew payments.

A "lay" or share system of crew payment is used throughout Maine with the exception of some 2-man lobster boat operations where the crewman is paid an agreed upon daily wage. While there are various different types of lay systems the principles are essentially the same; a division into specific shares of the cash receipts, or "stocks", for each trip, one part going to the crew, the other to the vessel and owner.

A lay system in common use is the so-called "broken 40" lay. Under this system deductions are made from the total cash received for the catch (known as gross stock) to yield the "net stock". Other costs are deducted from the gross crew share to give the net crew share, which is the amount divided among the crew (including captain).

Unit price for each species times pounds of each species = Gross Stock.

Gross stock less cost of [fuel + ice + welfare fund (if any) + bonus for mate and engineer + lumper (unloading)] = Net Stock.

Sixty percent times Net Stock = Gross Crew Share.

Cross Crew Share less cost of [groceries + cook (if any) + Cookers for shrimp (if any)] = Net Crew Share.

Net Crew Share/number of crewmen = Crew Share per man.

The remaining 40% of the net stock goes to the owner as owner's gross earnings. Out of these come captain's bonus (10% of remaining 40% or 4% of Net Stock), vessel and gear maintenance and repair costs, depreciation, hull and crew insurance, social security and unemployment, legal and professional service, interest and investment, and profit and taxes. Variations on the 60/40 lay include systems under which percentages are changed; for instance the Gross Crew Share may be 55% of the Net Stock. A wage plus bonus method in limited use provides for a modest regular wage plus a share of the catch.

Table IV indicates as percentages of the total receipts the stock distribution for a group of 28 New England side trawlers.

Table IV

Distribution of Total Stock Averages for 28 N.E. Side Trawlers

	Expenses	Lowliner	Highliner	Average
1.	Trip Expenses	21.2%	14.5%	17.9%
2.	Net Crew Share	46.5%	47.4%	46.9%
3.	Captain's Commission	3.3%	3.8%	3.6%
4.	Maintenance & Repair	8.0%	7.0%	7.5%
5.	Insurance	6.7%	5.3%	6.0%
6.	Payroll Taxes	1.7%	2.3%	2.0%
7.	Miscellaneous	3.0%	2.1%	2.5%
8.	Interest	1.5%	1.3%	1.4%
9.	Depreciation	7.8%	4.8%	6.3%
10.	Gear & Supplies	5.1%	5.2%	5.1%
	Total Receipts	$87,272	$86,366	$86,819
	Annual Income per Crewman	6,998	8,900	7,830
	Profit before taxes	-4,188	5,605	708

Source: "New England Trawlermen Struggle to Survive" by B. Noetzel, Vol. 34, No. 9-10 of Marine Fisheries Review, NMFS.

An arrangement is sometimes made guaranteeing a certain minimum payment to the crew for each trip; this is known as a "broker". Normally a vessel which conducts fishing operations for a planned number of days for a trip will be able to obtain a large enough catch to surpass the amount of the brokers. However, if the trip must be cut short because of machinery, gear, or hull failure, or weather or other reasons, it then becomes known as a "broken trip"; nevertheless, the crew will receive the minimum payment, or broker, regardless of how few fish were caught.

III. Vessel and Gear Expenses - Capital and Operating.

Capital costs - Except possibly for a shore facility or truck, the fishing vessel and gear represent virtually the entire capital expense of the fisherman.

Cost of fishing vessels vary according to weight. The cost per unit weight is fairly constant for vessels of the same specifications, although there is a slight decline as vessels become larger.

To estimate cost roughly, multiply length on the water (LWL), by Beam (B), by Depth (D), to arrive at a cubic number (N_{LWL}), representing the cubic feet in a box which will contain the vessel; this is a reasonably good measure of weight (displacement) for craft of a given building material, type of gear, horesepower, etc. To find the estimated completed cost, the cubic number is multiplied by a cost in dollars for each cubic foot in the box, ($C_{\$}$); the value of $C_{\$}$ can be derived from previous construction. For steel fishing vessels in the 100' range of length, the value of $C_{\$}$ will be about \$19 to \$21* (1973). Variability

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*These prices are for modern, completely rigged vessels, ready to fish.

in builders' quotes will depend upon their need for work, their experience with the type, the quality of work they do, and of course, inflation (from 1939 through the late sixties, the inflation rate averaged out at 6%). Table II, page 20, will help in estimating costs for craft of other construction.

As to depreciation, the Internal Revenue Service (IRS) is of little help, saying, "Due consideration shall be given in each segment of the industry and in each geographical location to the relevant economic, climactic and other factors which determine depreciable life." (IRS Publication No. 456 (7-62), July, 1962). The Boston Federal Reserve Bank (Bell, 1966) uses the following in a study of the New England fishing industry:

Depreciation Rates

	Estimated Life	Rate
Hull	25 years	4%
Engine and Equipment	10 years	10%
Total (components weighted equally)		7%

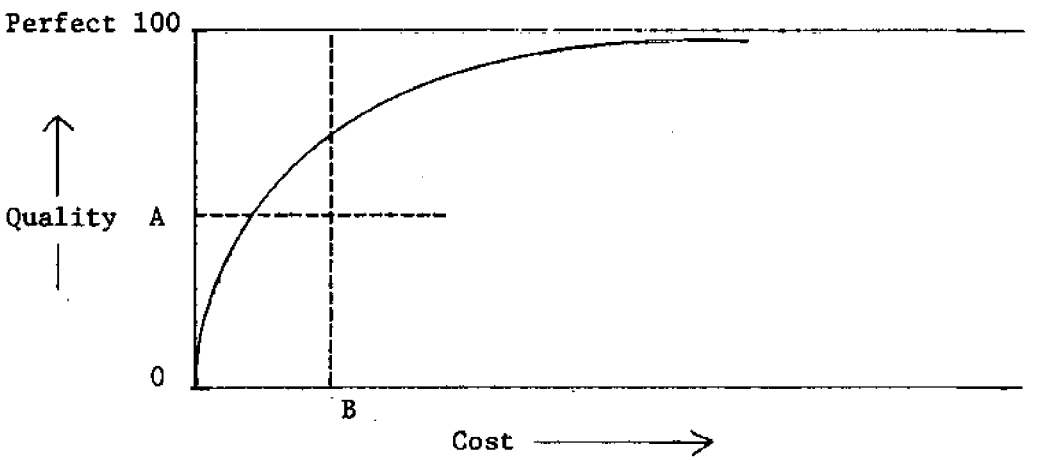
Care must be taken that the quality of the vessel and its outfit are optimum for the intended use. In general it can be said that Maine craft are too low on the quality scale. Procurement of a vessel should begin by defining the functional requirements of each element, then searching for the least expensive means of meeting these requirements.

Figure 8 is a schematic graph of the relationship of quality to cost. A quality below some level, A, will be unprofitable in almost any circumstance; unfortunately many Maine fishing vessels are probably

below this threshold value. In the other direction, to exceed some cost, B, will be merely providing unnecessary frills which have little or no effect on fishing efficiency.

Figure 8

Schematic Relationship of Vessel Cost to Quality



Operating Costs: As in capital costs, operating costs are also a function of vessel size, and are hence related to vessel construction cost. (Replacement cost for the current year is used instead of original construction cost to equalize out the effects of inflation.) John Proskie (Economics Branch, Department of Fisheries and Forestry, Ottawa, Canada) provides us with perhaps the best continuing statistical record of a fishing industry in his annual "Costs and Earnings of Selected Fishing Enterprises - Atlantic Provinces". (More recently, the Branch of Economics Research, NMFS, and various Sea Grant Projects are providing this same information for U.S. fishing vessels.)

Proskie has four main categories of recurring costs: maintenance and repair, fixed charges, operating expenses, and depreciation. Table V following gives the results of a compilation of these costs for 1967,

covering ten steel stern and side trawlers from 82' LOA to 154' LOA. The values are given as average percentages of replacement cost (original construction cost adjusted to 1967).

Table V

Overall Cost of Ownership
Average for 10 Steel Vessels, In Percent of Replacement Cost

	Avg.	High	Low
Maintenance and Repair	5.0%	7.0	2.3
Fixed Charges	3.0	4.	0.1
Depreciation (from Federal Reserve figures)	7.0	7.0	7.0
Operating expenses (exclusion of labor)	5.1	7.3	3.4
-Total cost of ownership (% of replacement)	20.1%		

Reference to Table II, page 20, will permit approximate estimates for craft of other construction.

In planning the purchase of a fishing vessel, it is obvious from the above that the initial cost is a major factor in achieving profitability. Increasingly in the developed countries, systems engineering is being applied to the design of fishing vessels, their machinery, gear, and crew, as a single system, with each subsystem (hull subsystem, propulsion subsystem, catching subsystem, etc.) designed with relation to all the other subsystems. In this fashion the ends sought by the vessel owner may best be met. In fisheries the desired end may be to maximize return on investment in the vessel, or it may be to provide an integrated industry with maximum raw material on a particular schedule and in a specified condition.

The systems approach can also be beneficial in matters of maintenance and repair. By laying out a carefully scheduled program of maintenance and replacement, costs of repair may be diminished, and revenue lost through broken trips should be virtually eliminated.

To sum up then, planning for a fishing enterprise based on a vessel should include the following elements:

1. Careful systems planning of the vessel and its gear - to minimize initial and operating costs and to maximize fishing effectiveness, and;

2. A carefully designed program for short and long term maintenance and replacement measures.

IV. Federal and State Programs affecting Fishermen - Economic and Technical.

Economic Assistance

NOAA/NMFS (NMFS, National Marine Fisheries Service, a part of NOAA, the National Oceanic and Atmospheric Administration). Administrates the following five financial support programs at a national level:

(Note that all figures refer to all U.S. commercial fisheries, not only those of New England or Maine.)

1. Fisheries Loan Fund (authorized by the Fish and Wildlife Act of 1956, as amended), which provides direct loans for financing or refinancing of cost of purchasing, construction, equipping, maintaining, repairing, or operating commercial fishing vessels or gear. The basic purpose of this program is to upgrade commercial fishing vessels and gear by providing reasonable financial assistance not otherwise available to commercial fishermen. Loan approvals are based on the following general criteria: (1) need for the loan; (2) unavailability of reasonable credit;

(3) statutorily authorized purpose; (4) loan repayment reasonably assured; (5) lack of economic injury to efficient vessel operators already in the fishery; and (6) upgrading applicant's vessel or gear, and/or improving his ability to operate efficiently and profitably. The following is a summary of the program to 1973:

- $20 million authorized for the revolving Fisheries Loan Fund; $13 million actually appropriated to date.
- $34 million in loans were approved during the life of the program (1956-71).
- 1,372 loans have been made, average per loan $25,000.
- 82 percent of loans have gone to five major fisheries - tuna, Pacific crab, Atlantic and Gulf shrimp, Pacific salmon, Atlantic groundfish.
- Outstanding loans now about $10 million.
- 53 percent of applications have been approved (1,372 out of 2,569)
- 40 percent of loans have included refinancing existing debt, 29 percent for financing used vessel purchase, 20 percent for repairs, replacement of equipment or rebuilding of vessels, 11 percent for new vessels, vessel conversion, and operating costs.
- Losses during life of program have been about 2 percent of total loan value.

2. Fishing Vessel Mortgage Loan and Insurance Program (authorized in 1960 by amendments to Title XI of the Merchant Marine Act of 1936), which provides government guarantees for the repayment of private credit extended to fishermen for the purpose of constructing, reconstructing, or reconditioning fishing vessels of five net tons or over. Vessel owners

arrange for loans through private credit institutions with no Federal funds involved. The repayment premiums are in the amount of one half of one percent of the loan outstanding.

The basic purpose of this program is to contribute toward improving the technical efficiency of U.S. fishing vessels through stimulating interest in the private credit market for financing fishing vessel construction, or reconstruction, at terms favorable to the fishing industry. The program has been designed to help proven successful operators to maintain technological efficiency. It is not designed, nor does it operate, as a "soft" credit mechanism. Generally, those who qualify for mortgage and loan insurance are among the most successful operators in any given fleet. The following is a summary of the program to date:

- Program has $25 million in guarantee authority; currently outstanding balances total $18 million.
- Since 1960, 237 applications for approximately $30 million have been approved.
- Premium collections have been in excess of $800 thousand; losses have amounted to $13 thousand.
- Over 80 percent (by value) of guarantees have been made in tuna and Atlantic and Gulf shrimp fisheries (16 guarantees in tuna fishery, and 148 in shrimp fishery).
- 84 percent of applications approved (237 out of 282).
- Not a soft program, only those with at least 25 percent equity capital have qualified. Project must be economically sound.
- In 1969, applications were not accepted for vessels to fish for yellowfin tuna in the Inter-American Tropical Tuna Commission (IATTC)

area (which was determined to have enough vessels to harvest the quota).

3. Vessel Construction Differential Subsidy Program (authorized by P.L. 86-516 in 1960), which provides fishermen with a subsidy to offset the differential between the higher purchase cost of U.S. built vessels and comparable vessels built abroad. U.S. fishermen must by law use only U.S. built vessels to land catches at U.S. ports. The handicap of high vessel purchase costs has affected particularly the New England fisheries, where U.S. fishermen compete actively with foreign fleets for catches and for markets, and original authority for this program effectively restricted coverage to the groundfish fleets of New England. Subsequent amendments extended coverage to other fleets. The most recent amendments extend the Act through fiscal year 1972 and authorize appropriations of $20 million per year for fiscal 1970 through 1972. However, no appropriations have been requested against that authority, and the program will be allowed to terminate with the expiration of the legislation on June 30, 1973. Since 1960, 45 vessels have been constructed with subsidies totaling over $20 million. About $10 million has been used in construction of tuna seiners. Vessels for New England fleets have used $7 million.

4. Capital Construction Fund (authorized by Section 21 of the Merchant Marine Act of 1970, P.L. 91-469), which provided a tax deferral system to assist in accruing reserves (private nontaxable funds) for replacement of old vessels. Contracts between fishermen and the Secretary of Commerce are effected to establish capital construction funds with vessel earnings, vessel depreciation cash flow, capital gains from vessel sales, casualty proceeds, and the earnings of the funds themselves.

Withdrawals are to be for acquiring, constructing, or reconstructing fishing vessels, or paying the principal indebtedness incurred for those purposes. The following is a summary of the program to date:

- Details of program are currently being worked out with IRS.
- 143 contracts have now been established for 1970.
- Some 70 new applications for 1971 are currently being processed.
- Tax benefits under this program are generally effective only in profitable fisheries. Vessel owners in depressed fisheries are not likely to benefit greatly from this program.
- Contracts effected for 1970 (143) involved 400 vessels now owned, 192 vessels to be acquired, and 39 vessels to be reconstructed.

5. Fishermen's Protective Fund (authorized by amendment in 1968, P.L. 90482, to the Fishermen's Protective Act), which provides a form of insurance to reimburse U.S. fishing vessel operators for certain losses and costs incurred as a result of seizures by foreign countries on the basis of jurisdictional claims not recognized by the United States. Under this matching-fund insurance program, fees are collected from vessel owners to cover at least administrative costs plus 33 1/3 percent of claims paid. The government makes up the balance. The following is a summary of the program to date:

- The program covers losses due to damage, confiscation, or destruction of vessel or gear, dockage fees, the market value of fish or shellfish spoiled or confiscated, and 50 percent of gross income lost as a result of seizure or detention.
- 213 vessels are participating in the program.
- 31 claims of $337,703 have been paid.

- 32 claims are pending.[1]

6. Farm Credit System - Under Farm Credit Act of 1971, short and intermediate term loans are available to fisheries. The two key parts of this systemare the Production Credit Association, PCA, and the Bank for Cooperatives. Exactly what the impact or extent of this Act will be is not yet clear; it is understood that the PCA in Auburn, Maine, recently processed a loan for the construction of a 40' fishing vessel. The period of the loan was less than 7 years at a rate of 7½% for 80% of the vessel cost.

7. SBA (Small Business Administration) - This agency has several relevant programs which could be utilized by commercial fishermen. Because of the high pressure for direct and guaranteed loans on this agency the financial assistance that can be provided is limited; however, this is one potential lending source.

8. MIBA (Maine Industrial Building Authority) - Although the MIBA has never financed a fishing venture, there is no statutory restriction against doing so. This agency can guarantee loans (of up to 20 years term and up to 80% of the total amount) to Local Development Corporations, (LDC's). The MIBA charges 1% of the loans for administrative costs. This is in addition to the bank or other lender interest rates. The MIBA constitutes an avenue of vessel financing which has been un-utilized up to the present.

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[1]Section taken from Background Information, U.S. Department of Commerce Request for Proposal "For the Evaluation of Financial Assistance Programs for NOAA/NMFS", dated July 21, 1972.

Technical, Advisory and Direct Assistance

At the federal and state levels there are several programs aimed at accomplishing pure and applied research and providing direct advisory service to commercial fishermen. The following is a highly abreviated compilation of governmental programs aimed at providing assistance to fishermen:

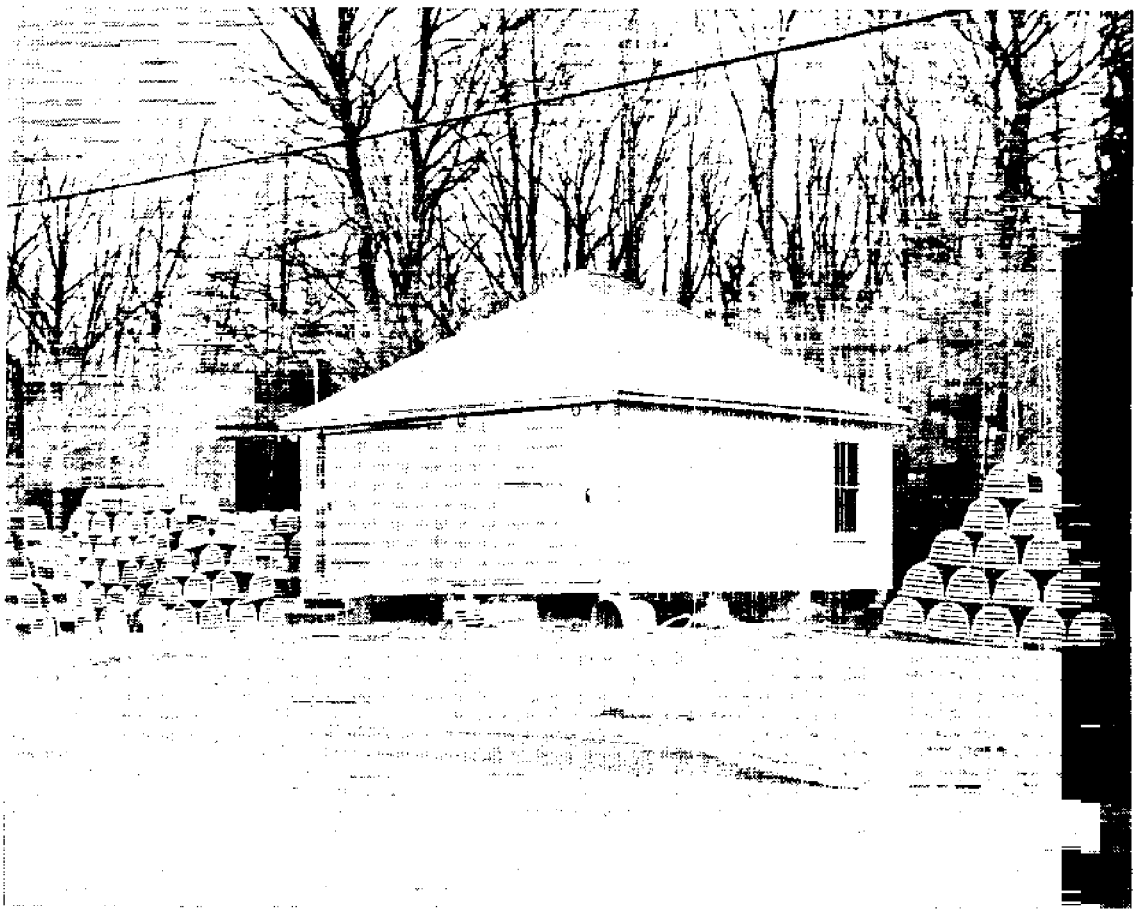
1. National Marine Fisheries Service (NMFS) - gathers actual fisheries landings data from dealers; has extension agents who can provide advisory information; makes exploratory cruises to gather resource information; performs basic gear research; makes economic, social and biologic investigations; gathers data and publishes documentation on regional, national and international levels, and is the prime federal agency concerned with U.S. commerical fishing interests.

2. State of Maine Department of Marine Resources - performs functions similar to that of the NMFS but with a state orientation and dealing with problems of concern to the state.

3. Office of Sea Grant, NOAA - provides funds primarily to educational institutions to perform basic and applied research in the marine area. The University of Maine Cooperative Extension Service has recently initiated a Marine Advisory Service assisting fishermen.

4. Food and Drug Administration, Environmental Protection Agency, Office of Safety and Health Administration, and the United States Coast Guard are regulatory agencies which also are involved with research in areas of concern to them. These agencies are expected to have a major impact on the capital requirements of the fishing industry during the next 2-4 years. The Coast Guard has the additional responsibility of providng Search and Rescue facilities, maintaining buoy and long range navigational

systems, making surveillance flights and enforcing national laws and international agreements.



Lobsters

Factors Affecting the Profitability of the Lobster Fishery

The American lobster (Homarus americanus) is a cold-blooded marine animal that belongs to a group of animals known as crustaceans - so called because of their hard but jointed and flexible "crust" or shell. The European lobster (Homarus vulgaris) is a close relative to Homarus americanus.

The body of a lobster is divided into two main regions, the head/thorax and the jointed abdomen, or tail. Covering the head/thorax is a rigid shell called the carapace; it is the length of the carapace which is commonly used as the size measure. The lobster has five pairs of legs, the first of which are large claws, one heavier (the "crusher") than the other (the "pincer").

The American lobster occurs from North Carolina to Labrador, but the greatest concentrations are along the Maine coast, around the southern tip of Nova Scotia, and around Prince Edward Island. In recent years sizable trawl and pot lobster fisheries have been built on an offshore population inhabiting the edge of the Continental Shelf and the upper part of the slope in the Georges Bank area.

Lobster growth requires periodic shedding of the shell; the frequency of shedding is high for the young, reducing to once or twice a year at maturity. At each molt, the length increases about 15%, the weight about 50%.

Lobsters grow and mature at different rates depending on water temperature; the colder the water, the slower the growth. Some mature when 7" long overall (about 3/4 lb.), others not until 12" long (2 lb. or more). Females lay 3000 to 75,000 eggs, and spawn approximately every 2 to 2½ years. Lobsters reach legal size (3 3/16" carapace length) in Maine in about five years.

I. Resource size, variations, limitations

Every renewable resource has a characteristic known as its maximum sustainable yield (MSY); the greatest tonnage of the resource which can be harvested on a continual basis.

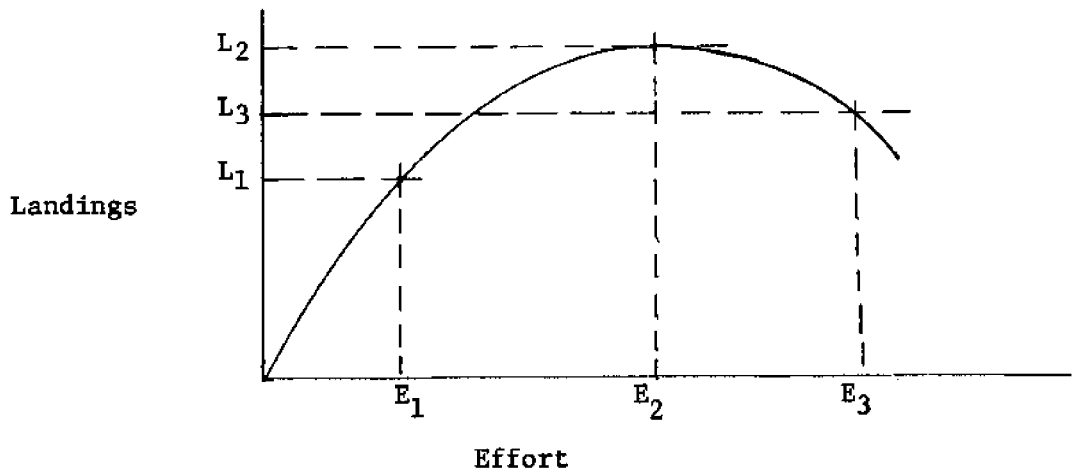
In a stable population (one whose size remains unchanged in time despite harvesting pressure) the number of young entering the population exactly supplies replacement for the losses from that population due to natural mortality and harvesting.

The problem of evaluating the many biological and environmental inter- and intra-relationships in a marine resource is complex and compounded by the extreme difficulty of making accurate observations and measurements.

In general terms the following typical relationships between landings and harvesting effort apply:

Figure 9

Landings Vs. Harvesting Effort



A fishery which is yielding landings of L_1 for an effort of E_1 is said to be underfished; one which has L_3 landings for effort E_3 is overfished; one which produces L_2 with an effort of E_2 is producing at the maximum sustainable yield (MSY). Note that a reduction in effort from E_3 to E_2 can accomplish an increase in landings from L_3 to L_2; this can be explained by the fact that a greater portion of the mature population is allowed to survive past the first breeding season.

Statistical studies show that the lobster mortality rate in the first year of legal size is 90% to 95%, of which 5% to 15% is natural, the rest by harvesting. This effectively eliminates most females before they reach egg-bearing age.

By increasing the minimum allowable carapace length from 3 3/16 inches to 3½ inches (and hence the number of lobsters which grow to sexual maturity before capture is permitted), it has been estimated that an increase of 18% in total annual landed poundage would eventually occur.

Robert Dow of the Maine Department of Marine Resources has been principally responsible for noting the correlation between sea water temperature and both birth rates and resource activity in lobster as well as other resources. Although the relationship of lobster landings to effort (in terms of number of lobster pots fished annually) is as shown in Figure 9, Dow feels that long term sea water temperature trends also have a significant effect on landings; (this has been demonstrated conclusively by Flowers, 1972, U.R.I.)

II. Methods of harvesting and holding lobsters

General considerations in handling lobsters

1. Rough handling - may cause loss of one or more claws, and, especially when shells are soft, needlessly high mortality.
2. Air temperature and humidity - should neither be cold enough to freeze animals, nor warm and dry enough to dry out the gills.
3. Water temperature - generally speaking, the lower the water temperature, the better the lobsters will hold.
4. Lobsters require sufficient water flow to provide oxygen for respiration (rate of oxygen consumption doubles at 60 degrees F over that at 40 degrees F), but too much air can be fatal.
5. Diseases - most serious is Gaffkaemia, a virulent disease of the blood, fatal to lobsters, harmless to man. Commonly enters lobster through bleeding wounds. Shell disease, caused by bacteria attacking the shell; widespread but only a few lobsters heavily infected. Fatal to lobsters, apparently harmless to man. Disease does not exist naturally in Maine waters; all cases traced to imported animals. Parasites infest the digestive tract and the shell

surface; none apparently harm the lobster or are harmful to man.

6. Lobsters are cannabalistic.
7. Annual loss of harvested lobsters through mishandling and disease is estimated to be 10%.

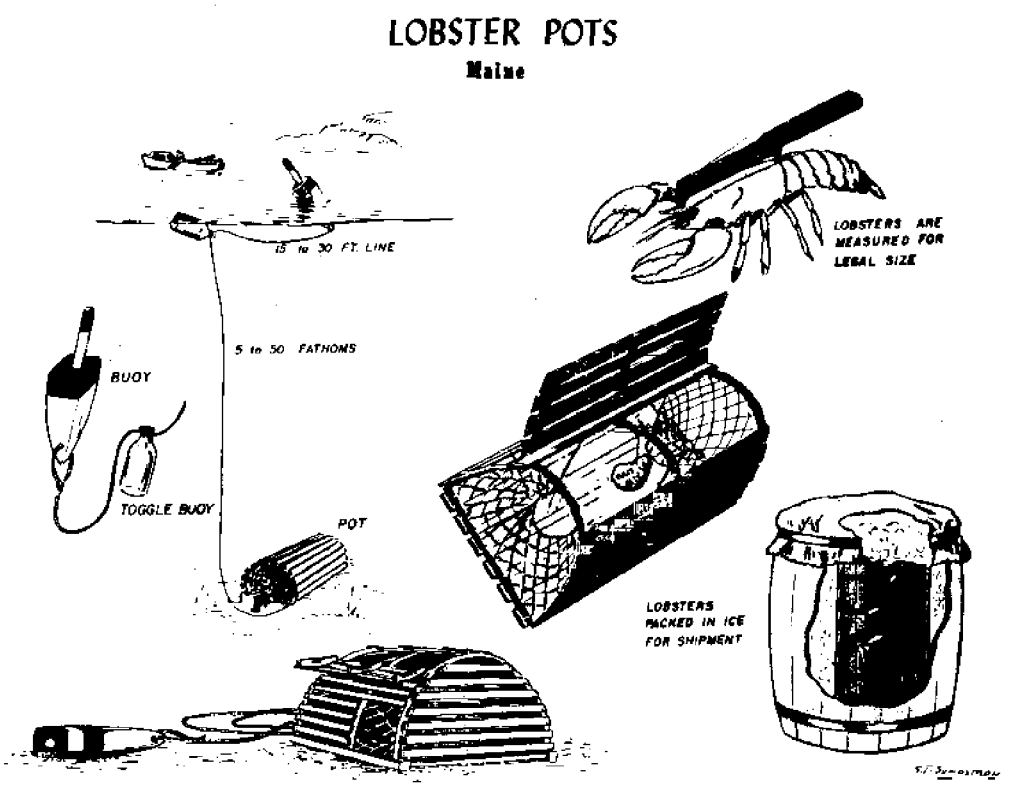
Harvesting

There are two major populations of lobsters: inshore, found in water from 5 to 80 fathoms or so, and offshore, found along the outer portion of the Continental Shelf and in the canyons, to depths of 300-400 fathoms. These populations are physiologically separate, and there is evidence that they are also geographically separate. Since the offshore lobsters include a high proportion over the 5" maximum size allowed in Maine waters, they cannot be landed here and hence will not be discussed.

Inshore lobsters are by law caught only by traps or pots, defined as "A stationary device set on the ocean bottom and commonly used along the Maine coast for catching lobsters." These are generally of wood, although experimentation has been done with metal and plastic pots. The traps are baited with fresh or frozen herring, or with fish or shellfish scraps. Figure 10 illustrates the type of trap "commonly used" and the method of rigging the pot warp and buoy.

An assembled trap costs approximately $10.00, and the normal rigging another $6.00 per trap. A boat will fish anywhere from 200 to 1600 or more traps. The larger numbers are fished by two-man boats and the traps are set in "line trawls", i.e., several traps attached to a "main line" on the bottom, buoyed at both ends. Especially in deep water, this system greatly reduces handling time required per trap.

Figure 10



The boats used in the lobster fishery fall within the groups listed below.

Size, LOA	Power
14' to 18'	Oar
16' to 22'	Outboard motor
20' to 32'	Inboard gasoline power
28' to 45'	Inboard diesel power

The smaller boats fish a smaller number of traps closer inshore than the larger boats. Virtually all boats with inboard power and some with outboard power have some type of powered hauler to bring the trap from the bottom to the rail. The present trend is almost exclusively to hydraulic haulers. A depth sounder, and a CB radio and/or a VHF marine radio

telephone, are considered necessary accessories. Larger boats frequently have radar to make it possible to fish during poor visibility.

Holding

Once the lobsters are landed on the boat and at least the crusher claw pegged or banded, they are stowed for best protection from the elements. In winter this means in a temperature above freezing; in summer as cool and moist an atmosphere as possible.

When landed, unless demand calls for immediate shipment, the lobsters are held for future sale by one of the four methods described below:

Crates: Wooden boxes holding approximately 100 pounds of lobsters. These are hitched together in the water for short term storage, and shipment is made in the boxes.

Cars: Open-work floating wooden enclosures, divided into pens about 4' to 6' square, each pen divided into layers by open wooden trays to prevent crushing of the lobsters. Cars, singly or in groups, are used for longer term storage (usually waiting for a favorable market) of up to 300,000 pounds or more of lobsters.

Tanks: Tanks installed on shore with pumped water for circulation and replacement. More costly but more convenient than other storage methods.

Pounds: Storage in dammed up coves or artificial enclosures built off from a beach. These utilize the natural flushing action of the tides, can hold lobsters for up to 6 months, and have capacities of 1,000,000 pounds of more. Lobsters are retrieved by nets, traps, or scuba divers.

III. Effort expended by Maine lobstermen

Pot fishing for lobsters depends on bait (either artificial or natural) attracting the lobster into the pot. Since the attractive properties of the bait dissipate with time in the water, the lobsters will be less likely to enter a pot which has been immersed for several days than one which has just been freshly baited. Figure 11 shows the average number of lobsters caught in a year by 100 traps for different numbers of days set. This curve is based on an average of 1968-1970 data. On a seasonal basis there are variations due to changes in water temperatures, and during the mating season. In general terms the catch/pot/day during the August to November period is about 3 times the catch/pot/day during the December to March period.

Figure 11

Average Number of Lobsters Caught per Year in Hauling 100 Traps

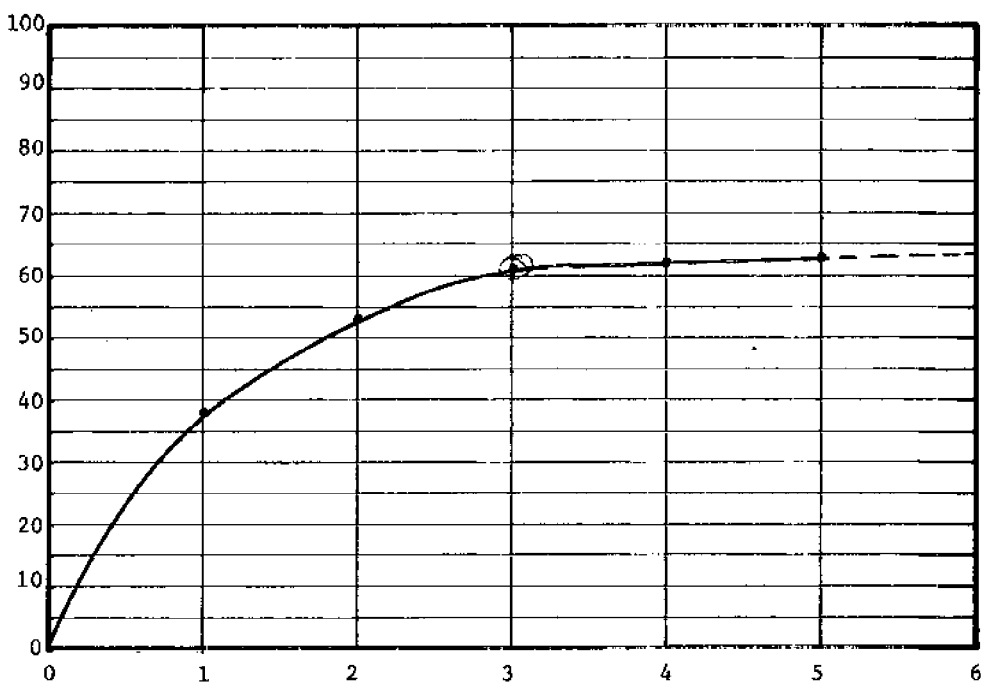
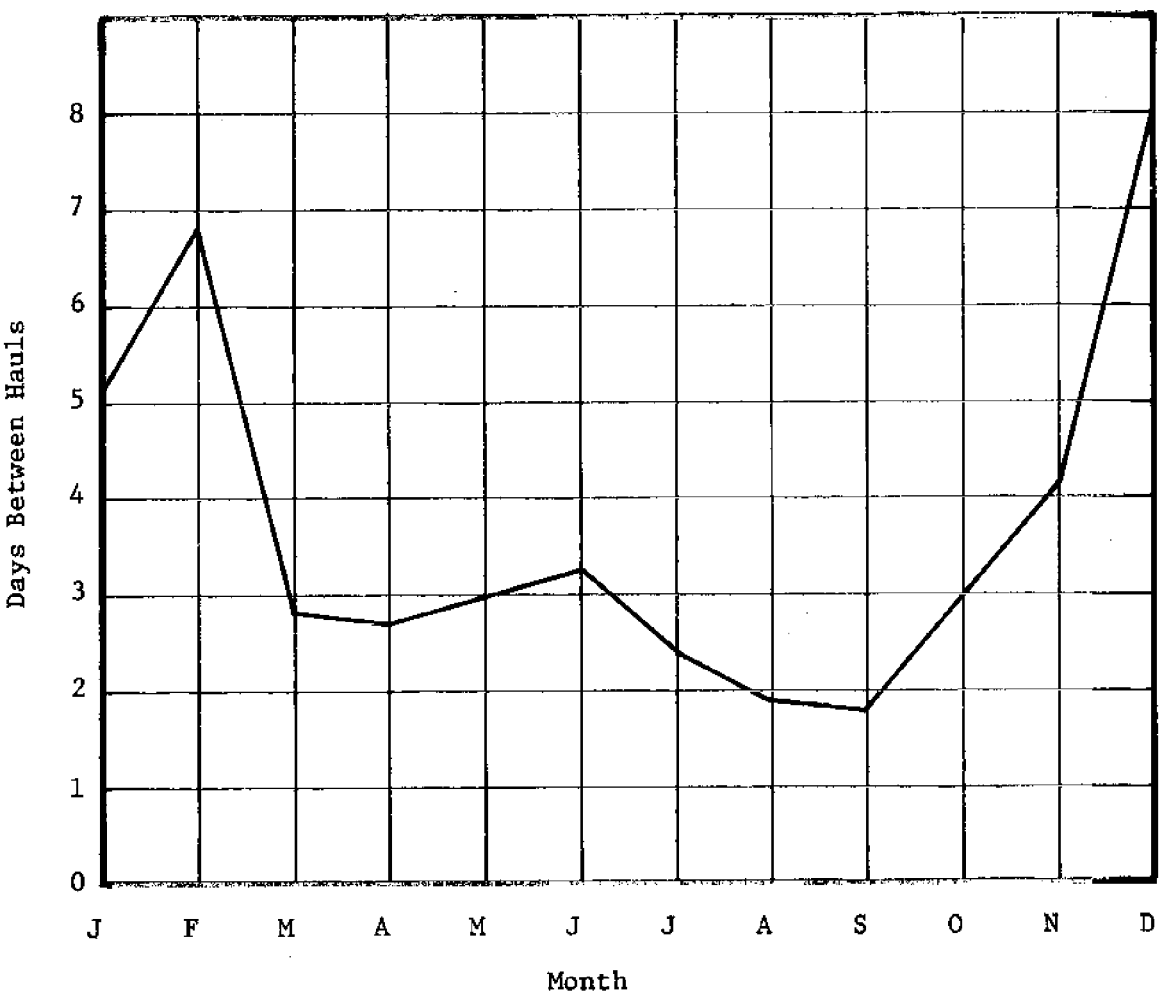


Figure 12 shows the average number of days between pot hauls for the 1968-1970 period by month. Lobster fishermen have been increasing their effort in two ways; by increasing the number of days between hauls from 2.10 in 1968 to 2.65 in 1970 and by increasing the total number of traps from 741,000 to 893,000 in the same three year period. In 1968 lobster boats fished from 15 to 1200 traps per boat with a mean of 219; in 1970 this figure had increased to a range of from 25 to 1400 traps per boat with a mean of 252, an increase of 15%.

Figure 12

Average Number of Days Between Pot Hauls
for the 1968-70 Period by Month



IV. Landings - amount, value, fluctuations

Lobster landings show considerable variation over the years, as indicated in Figure 13. Although the variation from year to year rarely exceeds 20% and is most often 5% to 10%, the long term variation can be considerable, as for instance the threefold increase between 1940 and 1960. One might assume that this simply represented the advent of the fast motor boat and power hauling equipment, but a search further back in history shows the same size catch by the rowing and sailing fleet in 1889 as in the peak year of 1957.

It is interesting to see what, if any, effect these landing variations have upon the lobstermen's economy. Despite the fairly momentous fluctuation in landings since World War II, the total landed value has ascended consistently at an average rate of 5%, as shown by the curve.

This illustrates a situation where the maximum economic yield appears to have taken precedence over the biological maximum sustainable yield. In other words, the lobstermen have been making more and more money despite a steady decline in landings over the past ten or twelve years.

The drop in landings since 1960 would suggest that the Maine lobster resource is being overfished. This opinion seems to be supported by the steady growth in landings for the other New England states as represented by the increasing divergence between the curve of Maine landings and the curve of total New England landings.

It may be that the upward trend of the value curve has reached a ceiling. The fact that the value didn't rise between 1970 and 1971, and that during the past years there was growing resistance to the high price of lobsters (restaurants removing them from their menus, for instance)

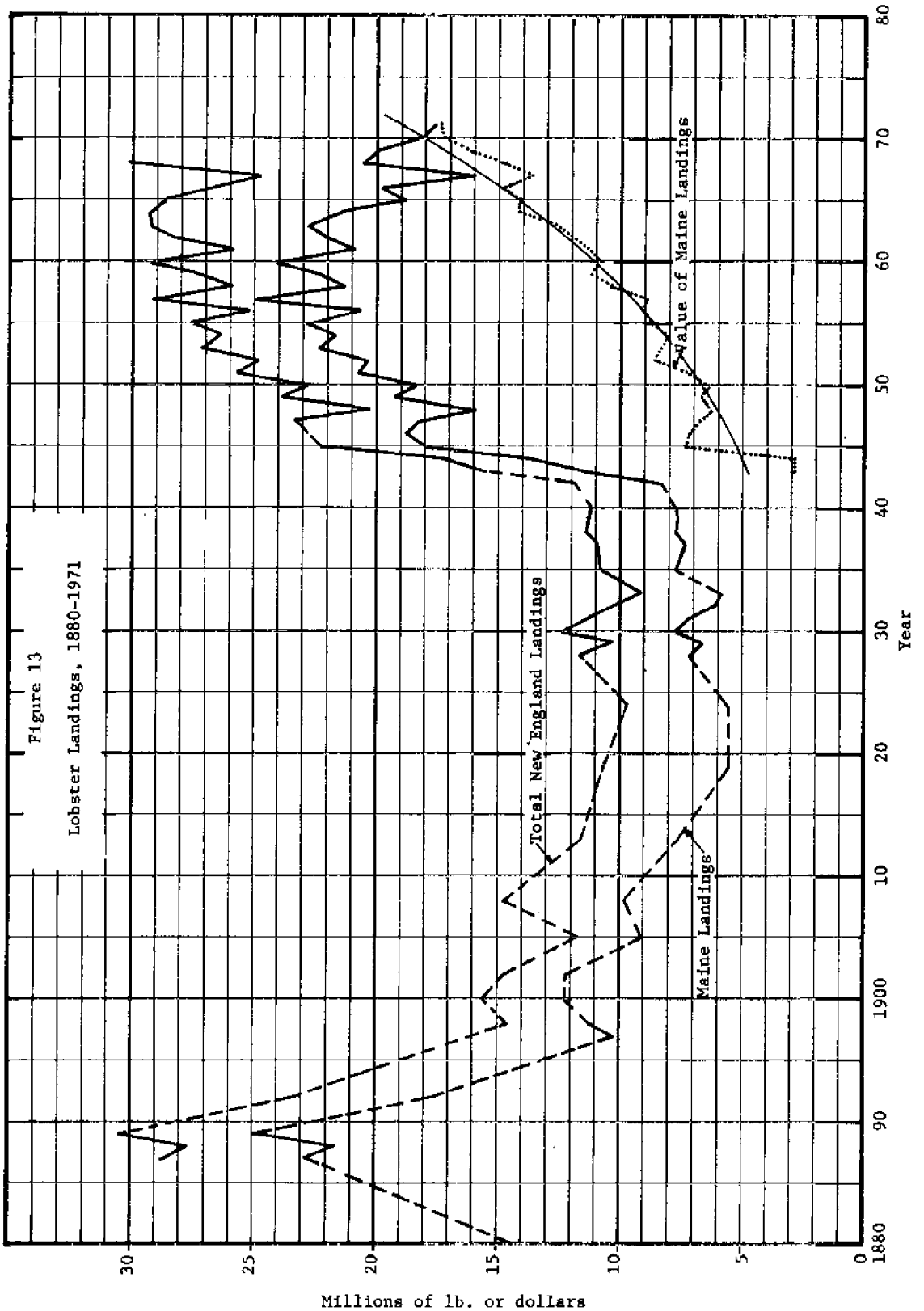


Figure 13
Lobster Landings, 1880-1971
Value of Maine Landings
Total New England Landings
Maine Landings
Millions of lb. or dollars
Year
0
5
10
15
20
25
30
1880
90
1900
10
20
30
40
50
60
70
80

suggests that this is indeed the case and that a further drop in landings may no longer support the upward course of the value curve.

Should this occur, the only recourse of the lobster industry will be to cooperate in measures designed to permit the lobster population to rebuild itself, and maintain itself at a fairly consistent yield approaching the estimated 22,000,000 pounds MSY. Some of these measures may be:

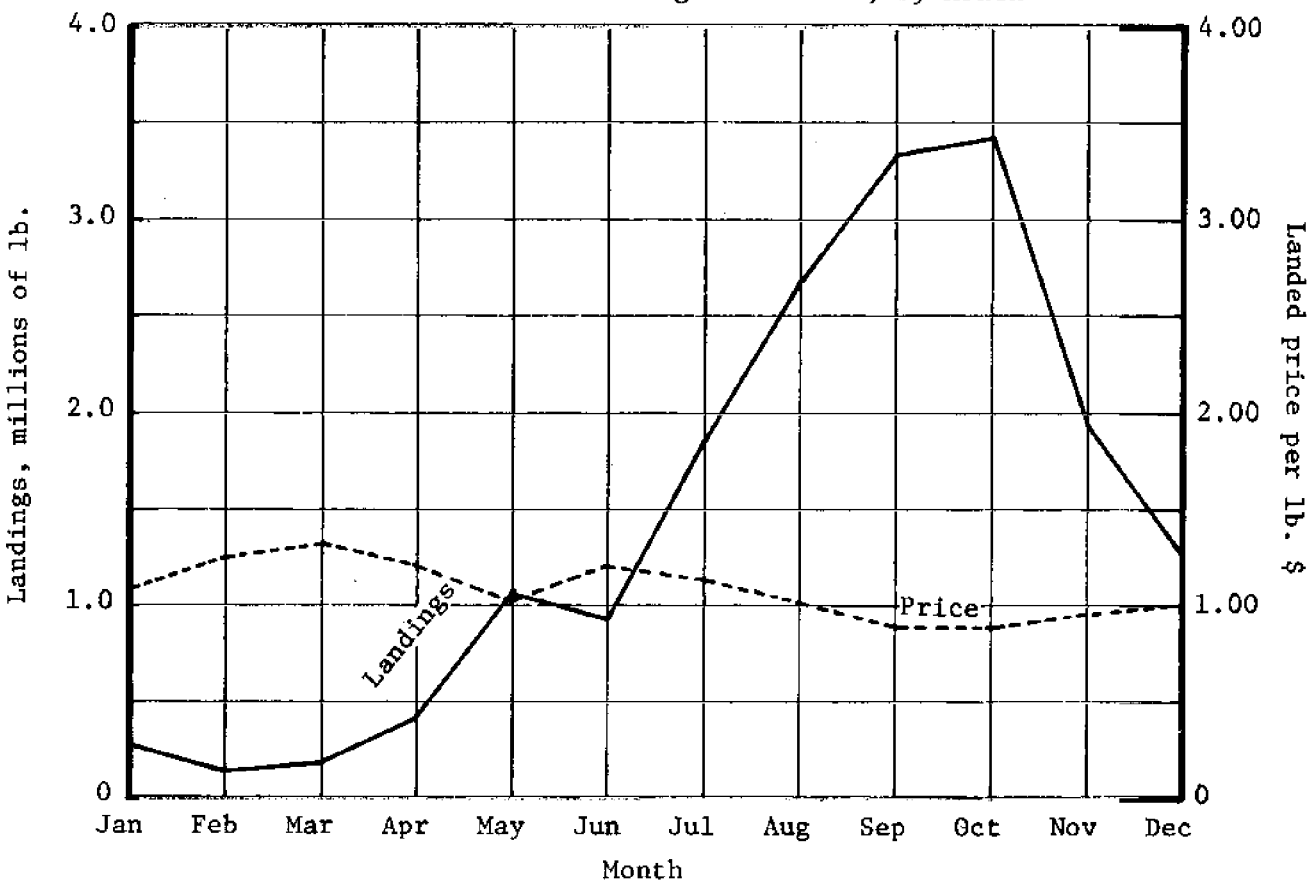
1. Limited entry into the fishery (limit on licenses).
2. Limit on number of traps per boat.
3. Quota system (total landings limited so as not to deplete the resource).
4. Closed season.
5. Adjustment of the minimum size requirement to allow more females to spawn before capture.

V. Economics

Because the majority of lobster landed in Maine is sold fresh, (only a quarter million pounds are processed annually) and because there is a great demand for this resource, the landings and the price per lb. received by the lobsterman from day to day are very closely coupled; during a month in which large quantities of lobster are landed the lobsterman receives a relatively low unit price; conversely for a month in which relatively few lobsters are landed the ex-vessel price rises. Figure 14 illustrates this relationship for 1971.

Figure 14

1971 Maine Lobster Landings and Price, by Month



The Maine lobster fishery has been traditionally operated by individuals and is less well defined statistically than some other Maine fisheries. However, it is possible to state that a lobsterman's gross stock in any given month is a function of:

Number of traps fished.

Number of days between hauls.

Average pounds of legal lobster captures per trap haul.

Average unit price.

Each of these quantities varies on a monthly basis.

The variable trip expenses for a given month are a function of:

Number of traps fished.

Number of days fished.

Distance to grounds.

Cost of bait.

Each of these quantities also varies throughout the year.

By entering appropriate values into the following relationships, the annual gross stock can be estimated:

Total number of traps set

1. Number traps hauled per day times average number of days between trips = average number of days between hauls of each trap.
2. From Figure 11 find the average catch per trap haul for the number of days between hauls.
3. Catch per trap haul times number of traps hauled per day times number of days fished per month = catch per month.
4. Catch per month times price per pound = gross stock per month.
5. Summation for number of months fished per year = annual gross stock.

During January, February, and March the relative inactivity of the lobster necessitates setting a large number of traps, each of which should be allowed a longer time between hauls in order to achieve a monthly catch comparable to a summer monthly catch. However, it is during the January through March period that extremely adverse weather conditions are most likely to cause extensive gear damage. This period could be called one of minimum gain and potentially maximum loss and therefore fishing activity is curtailed despite the relatively high unit price prevailing during those three months.

The recent trend in lobster boats is to install larger engines for propulsion than in the past; the usual reason given for this is that it will enable a boat of a given size to reach the grounds and return faster, and will thus permit hauling a greater number of traps within the limited number of hours when hauling is legal. To a certain extent this is true. However, taking into consideration the fact that an increase from 100 hp to 300 hp will increase the speed of a 35 foot lobster boat from approximately 13 knots to approximately 19 knots while tripling the initial machinery cost and complexity as well as fuel and maintenance costs should induce the lobster boat owner to consider quite carefully his selection of the size of the main engine, i.e., define the function of the engine in the optimum lobster harvesting system.

THE COMMERCIAL FISHERIES OF MAINE

SESSION III

General Discussion of Trawl Fishing

I. General principles - Trawling (sometimes called "dragging" when applied to smaller vessels) involves towing through the water a cone-shaped net in which the fish are trapped. The net, or "trawl" is towed large end first, and its effective size is increased by an extension, or "wing", on each side. The mouth generally is spread by means of "doors", flat planes attached by wires to the wings. When being towed, the doors are in a roughly upright position and at such an angle to the direction of motion that the hydrodynamic forces extend the width of the net.

The basic elements of the trawling system are the trawl itself and the propulsion engine of the vessel towing it. Other elements of the trawling system are indicated in Figure 15, which also identifies their dependence on the net/engine system.

The effectiveness of the trawl system is largely a function of the amount of water strained through it. There are other considerations involved, such as the ability of the fish to escape capture by out-swimming or avoiding the trawl, but other things being equal, the trawl will catch in proportion to its mouth area and the speed with which it is towed. Multiplying these two factors together gives the amount of water strained through the trawl.

II. Gear elements - The essential elements of the trawl gear are shown in Figure 16 and described below:

Figure 15

Block Diagram
Trawl Fishing System

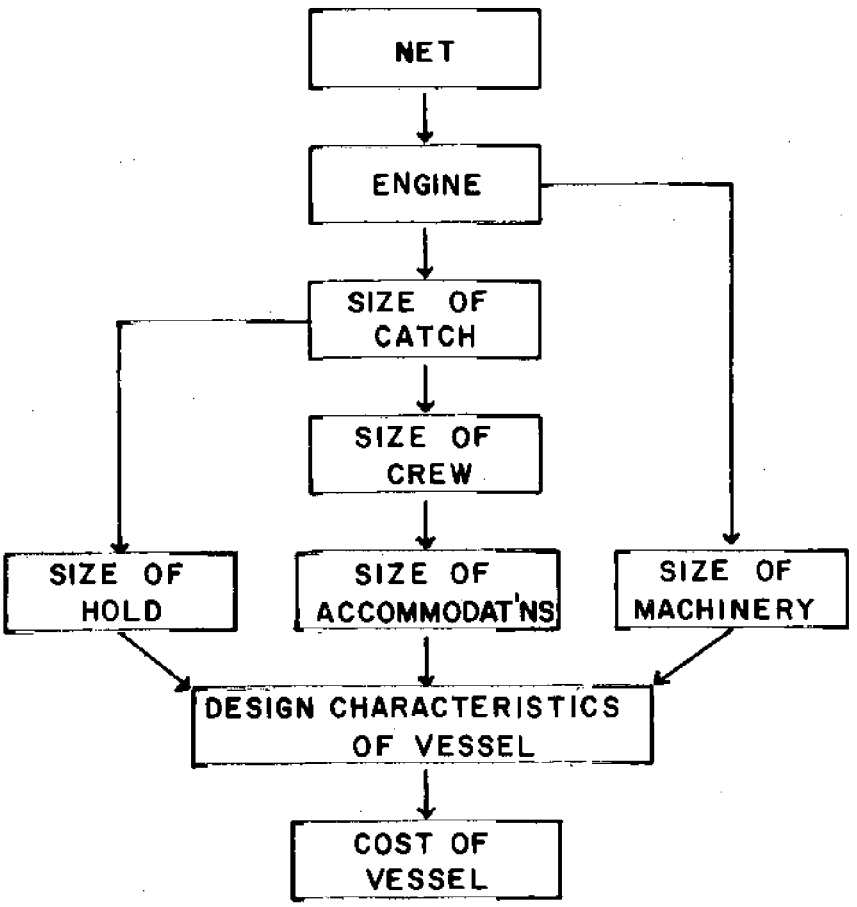
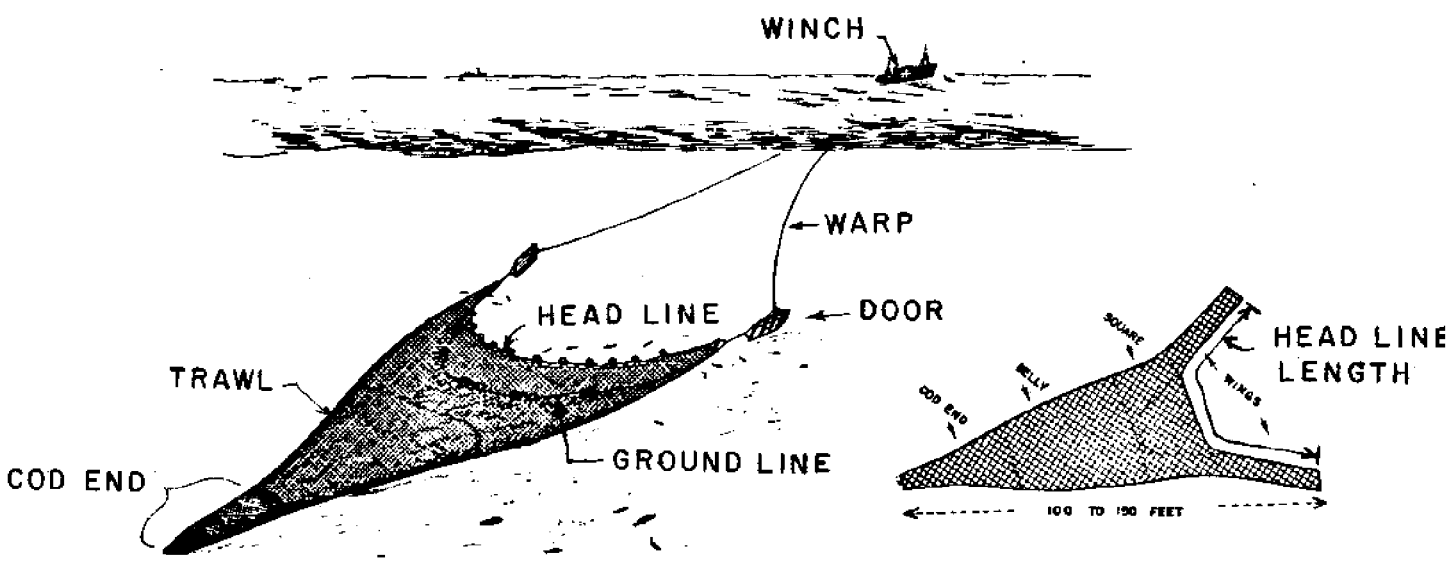


Figure 16

ATLANTIC OTTER TRAWL



Net - Made of synthetic netting. Mesh limited by ICNAF to 4½ inches minimum (1972) to permit young fish to escape capture. Ground line is weighted and sometimes has rollers; head line has floats to hold the mouth open. Net size usually given in terms of head line length. Fish are swept into the cod end, which is then lifted up and emptied onto the deck.

Doors - Generally of wood with steel fittings and a heavy steel wearing shoe on the bottom edge. The deeper the water fished, the heavier the doors. An important factor in successful fishing is the proper arrangement of the various attachments to the doors so as to give the best net shape.

Warps - Wire ropes leading from the doors to the winch. Generally let out so as to have a scope of about 3:1, i.e., the ratio of length of warp to depth of water.

Deck equipment - The winch is the most important item on the deck. The warps lead from the doors through the blocks hung from two gallows frames or a gantry to drums on the winch. Winches are usually mechanically driven from the main engine, but hydraulic operation is more flexible and rapidly becoming popular. A winch and its power source must be large enough to easily handle the trawl.

III. Types of trawls - The major types of trawls are:

Bottom trawl - Designed so the doors dig into the bottom, thus bringing the ground line close to the bottom to limit the escape of fish. Used for all bottom fish, shrimp, and lobster.

Midwater trawl - Similar to the bottom trawl, but generally much larger and with different doors. The midwater trawl is "flown" between the surface

and the bottom, according to where instruments indicate the presence of fish. The altitude of the trawl is adjusted by varying the amount of warp out and by altering vessel speed.

Beam trawl - The mouth of the trawl is held open, not by doors, but by a beam generally from 24' to 60' in length. Tows more easily and is easier to handle. Successfully used in Alaska and the North Sea, and on an experimental basis in Maine.

IV. Operations - Once the first requirement is met (finding the fish) trawling commences. The net is "shot", followed by the doors; when everything looks right in the water, warp is eased out to give the proper scope for the depth of water, and the tow begins. After towing for a period determined by the skipper (generally from 2-3 hours), the winch is manned and "hauling back" commences. When the doors reach the gallows frames, they are "hooked up", and hauling continued until the net is close aboard. The cod end is lifted up above the deck and the fish dumped. The net is shot again immediately (if it doesn't require repair).

Side trawling - Both gallows frames on the same side, warps towed from one quarter, and the net hauled over the side. Disadvantages: working deck is forward and hence exposed, vessel tows slightly crabwise, steering is poor, vessel lacks versatility.

Stern trawling - Gallows (or gantry) at stern, towing done from stern, handling done over stern or side. Advantages: working deck aft, hence more sheltered, towing done from point which allows good steering, vessel is very versatile.

Pair trawling - Two relatively low-powered boats tow a trawl without doors. Requires close cooperation and teamwork. Allows small boats to

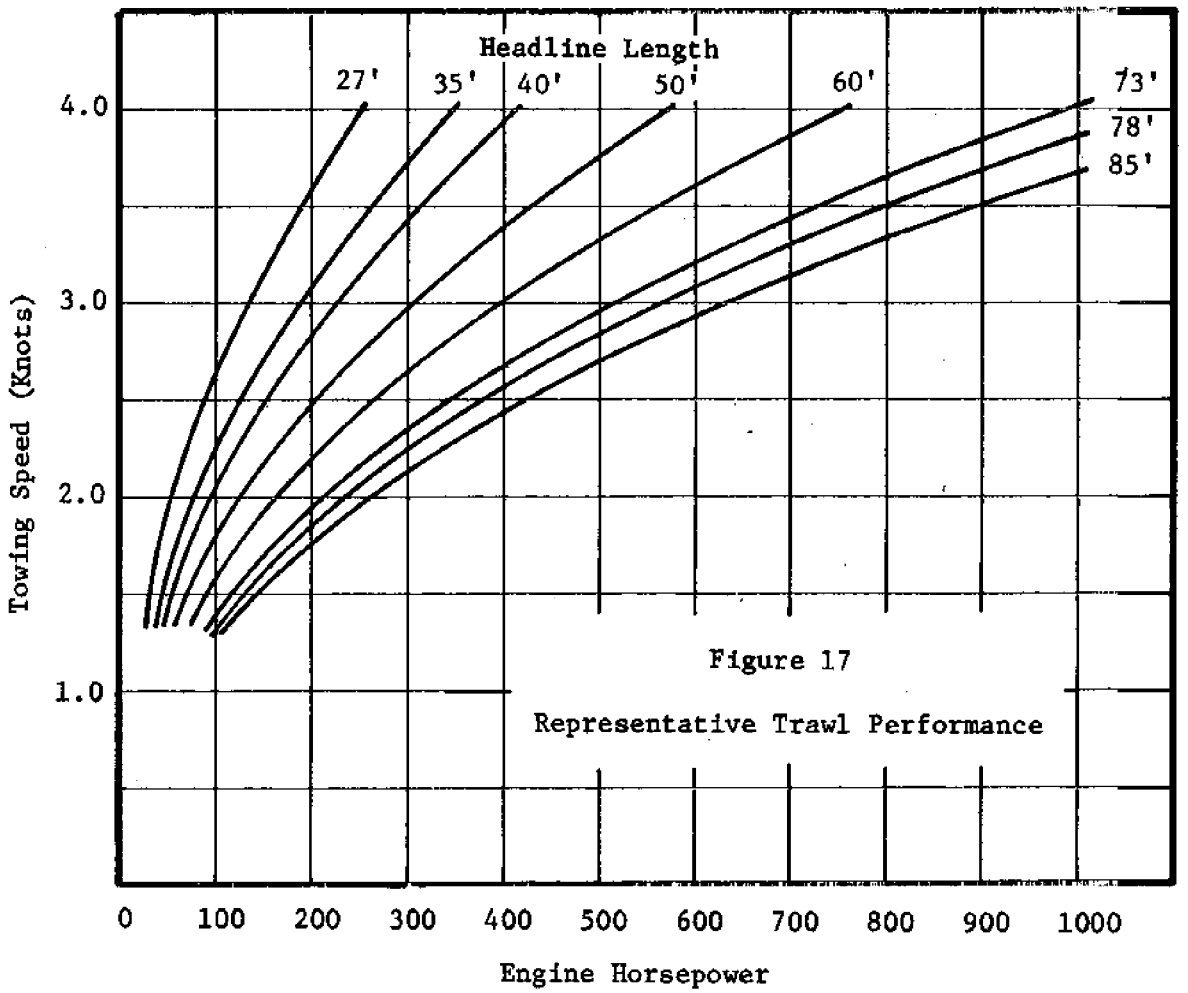


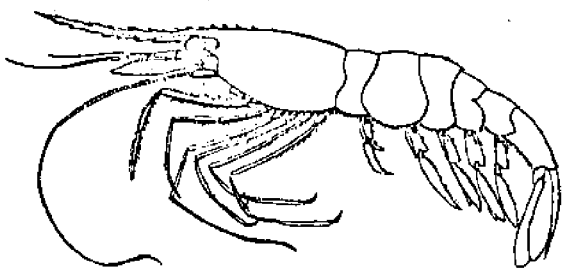
Figure 17

Representative Trawl Performance

Note that catching ability is proportional to the mouth area which is proportional to the headline squared. For instance, at the same towing speed a 60' net will catch approximately 4 times as much as a 30' net because $\frac{60^2}{30} = \frac{3600}{900} = 4$.

make excellent catches.

Figure 17 shows how towing speed varies with engine horsepower and net size. From the chart it can be seen that a large net towed slowly is better than a small net towed fast, assuming that fish escape is the same for both nets. For instance, at 300 HP, a 27' net will tow at 4 knots whereas an 85' net, three times as wide, will cause only a ½ reduction in speed.



Shrimp

I. Resource - The shrimp landed in Maine are Pandalus borealis, also known as Northern Shrimp. Their extreme range is from 42 degrees N. lat. to 98 degrees N. lat., and they frequent all the seas around the top of the earth. There is an extensive U.S. fishery off the coast of Alaska as well as the Gulf of Maine fishery off Maine and Massachusetts. Annual world landings (1962) were 63,000 tons.

P. borealis is a crustacean, like the lobster but considerably smaller (averaging about 50 per pound when mature). It is migratory, spawning inshore along the midcoast area of Maine. The young animals move offshore (generally to the Jeffrey's Ledge area) for their second and third years. During this period the shrimp, which begin life as males, become oviparous females and in their fourth year migrate inshore to spawn. It

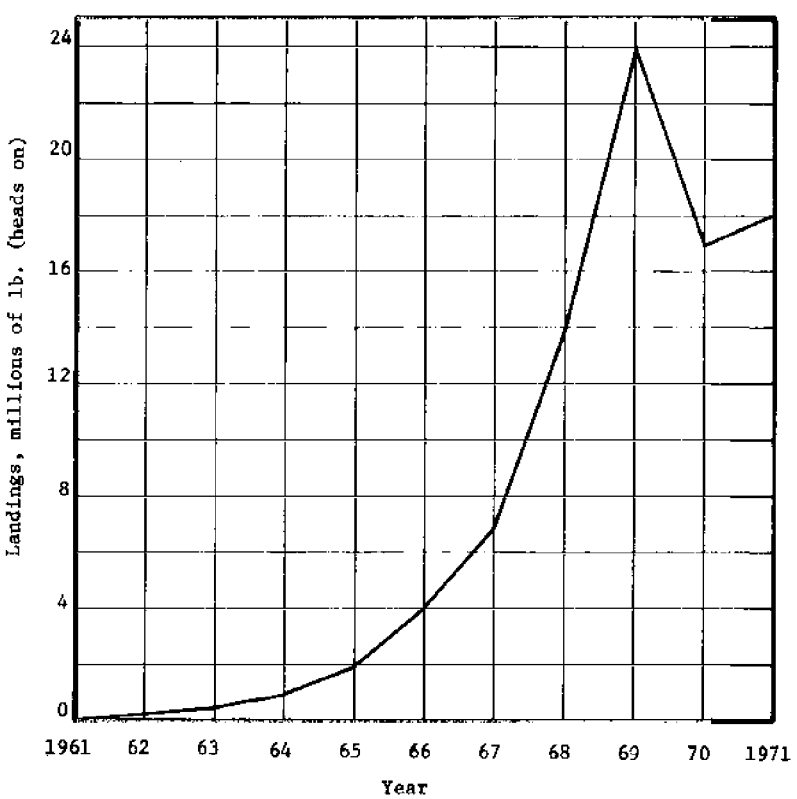
is mostly these egg-bearing shrimp which are caught by Maine's shrimp fleet.

To varying degrees shrimp also migrate vertically towards the surface at night, so shrimp fishermen invariably operate in the daylight hours when the density of shrimp close to the bottom is greatest.

The shrimp resource has shown great variability in size, probably, as Robert Dow of the Department of Marine Resources theorizes, because this is the lower limit of their range and they are thus more likely to encounter unfriendly environmental conditions. Figure 18 illustrates the rapid increase in shrimp population (at least as reflected by landings) in recent years. Long range weather predictions suggest that the resource will remain at a commercial level for the rest of this century.

Figure 18

Maine Shrimp Landings, 1961-1971



A problem of potential seriousness is that Massachusetts fishermen are increasingly exploiting the resource in the summer when it is on Jeffrey's Ledge. This raises the possibility of the shrimp being overfished before they can return to Maine waters. It is claimed that the summer shrimp are not of good quality.

II. Harvesting - Generally Gulf of Maine shrimp are caught by trawling, using a conventional otter trawl with doors. At least one experiment has been made using a beam trawl; although encouraging, the fisherman was unable to complete the test. One fisherman fishes in the southern style, towing two smaller trawls, a boom in each side.

A recent innovation is the harvesting of shrimp with metal traps, similar to lobster traps. Yields appear to be satisfactory and the traps can be fished on rocky bottom inaccessible to trawls. A conflict is sure to arise when both types of gear are used on the same ground.

The migration of shrimp into sheltered inshore waters has made it possible for small lobster boats to engage in the fishery in the winter months when lobstering falls off. Figure 2, page 7, clearly shows the seasonal nature of the shrimp fishery.

Shrimp prefer a muddy bottom, presumably for food reasons, and one of the skills of the captain is to keep his gear on mud. The shrimp, as they migrate inshore, tend to follow gullies in the bottom. Although the catch rate per hour that the trawl is on bottom ranges on the average from 300 pounds to 500 pounds, much higher rates are sometimes attained. In one instance a 50 minute tow produced 9,000 pounds of shrimp.

Catches per day at sea reflect the importance of horsepower, as shown in Table VI.

Table VI

Shrimp Landings per Day at Sea - Fleet of Portland - Nov. 1969 - Feb. 1970

Main Engine HP	"Best" Boat	Average	"Worst" Boat
		Thousands of lbs.	
100-150	2.8	1.55	.8
151-200	3.7	2.12	.5
251 and over	6.1	3.45	2.0

III. Processing and Marketing - The opening up of a European market for Maine shrimp (as a result of the failure of the European resource) has had profound effects on the industry, in terms of quality and price.

Prior to that time, a U.S. market was developing, but slowly. The shrimp for this market were landed in bulk from the catching vessels; held two or three days at iced temperatures (this "aging" resulted in separation of the meat from the shell for easier peeling), then peeled by hand and packed in containers for sale fresh or frozen.

The European market demanded a different product. The shrimp were to be cooked in brine (on board or on shore, and sometimes with a red dye added) within 8 hours of catching; then frozen and shipped to Europe. This resulted in a considerably firmer product (the U.S. market termed it "rubbery") with what many feel is a superior flavor. Nevertheless, there seems little enthusiasm for the whole cooked northern shrimp in the U.S.

The European market established high quality demands which are being reflected throughout the industry. An additional trend is towards increased mechanization of the processing phase. The development of peeling, deveining, and cleaning equipment able to economically handle

the small P. borealis has helped in both quality and cost. The nitrogen blast tunnel is another development which could lead to a profitable, high quality frozen shrimp industry. For the 1970-1971 season, the processed shrimp were divided among the following processing methods by weight:

Whole cooked	80%
Cooked peeled	16%
Raw peeled	4%

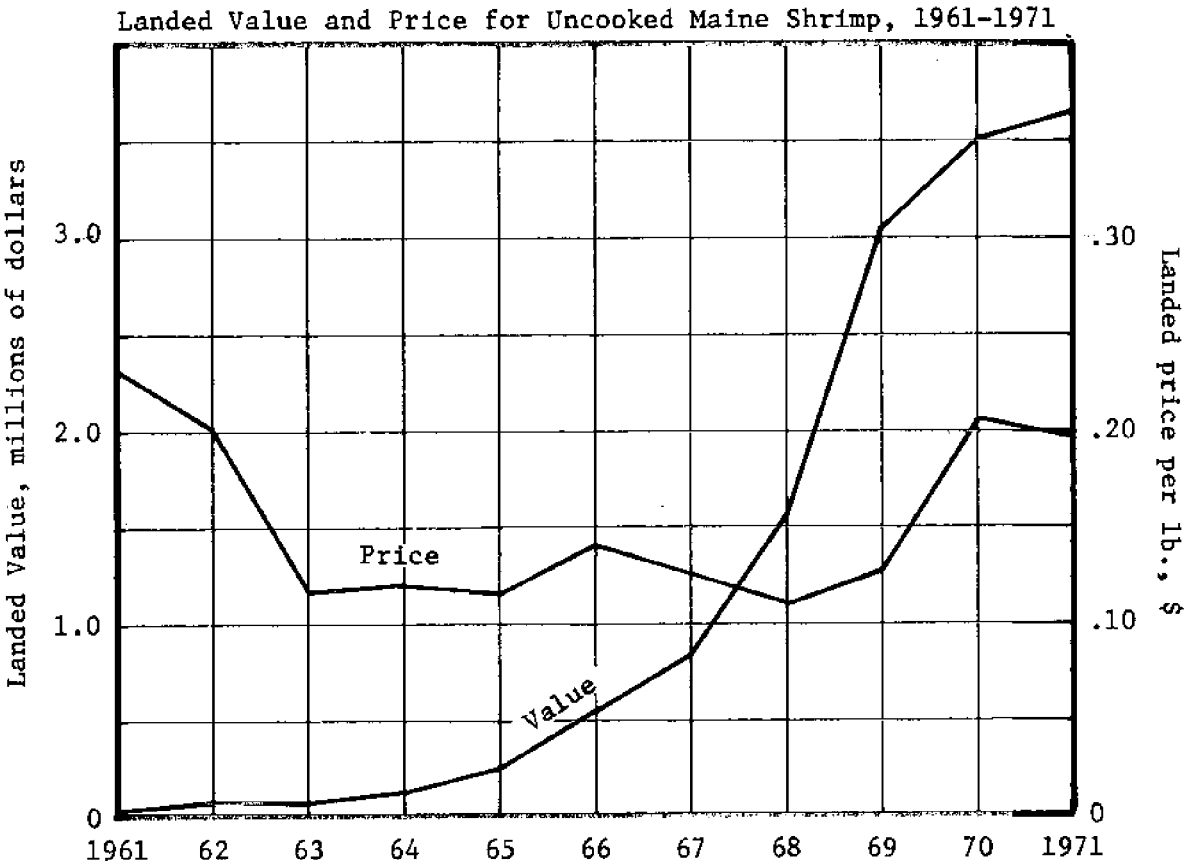
An estimated 90% were exported to Europe.

IV. Economics - The advent of the northern shrimp in commercial numbers has given Maine's dragger fleet a real shot in the arm. Several vessels, some quite modern and sophisticated, have been built or bought for the fishery. The highliners have paid their crews well (in one instance sharing $16,000 per man for the years work), although whether the prevailing lay system has permitted an equal prosperity for the owner is not known.

The ex-vessel price paid for the shrimp has held up well. That shown on Figure 19 is for uncooked shrimp; if cooking is done on board, the price will be 7¢ to 8¢ higher. (Cooking at sea is now losing popularity with the processors because of poor attention to quality control during the cooking process.) By contrast to the 11¢ to 20¢ paid to the Maine shrimper, the Alaska ex-vessel price has been only 4¢ per pound.

The multiplier for estimating the retail value of shrimp relative to the total landed value is approximately 2.8 to 3.0. On that basis, the increase in value of the 1971 Maine shrimp landings between the sea bottom and the consumer is an estimated $10,500,000 - exclusive of shipping costs.

Figure 19



Groundfish

The species of groundfish which are of primary importance to Maine are: cod, haddock, hake, pollock and whiting; not included is ocean perch which will follow the discussion of groundfish.

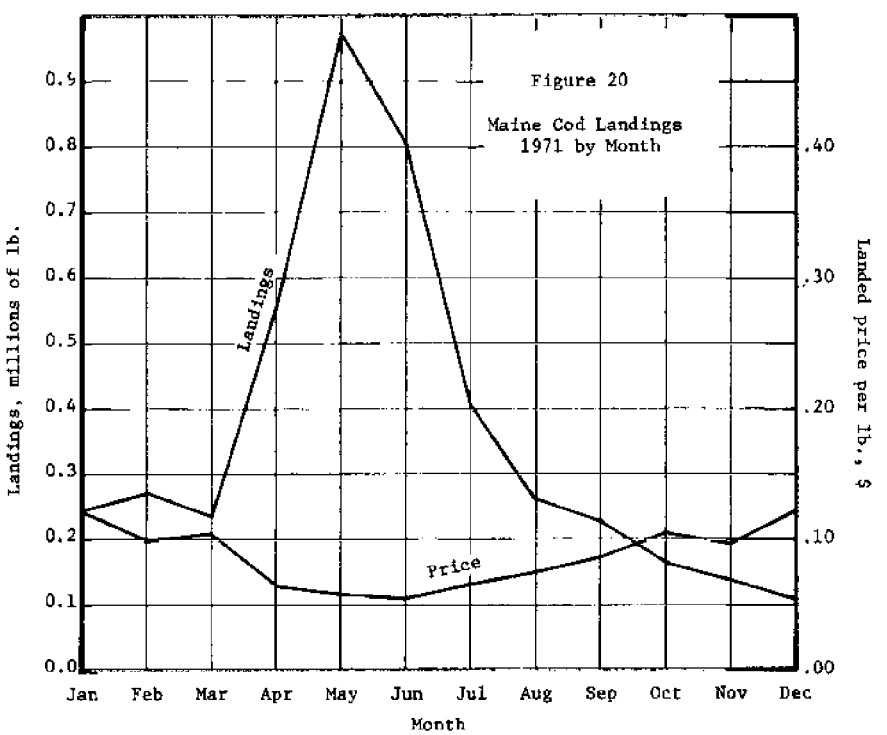
Cod spawns from March to May. It usually takes about 5 years to mature, when it can produce an average of 1 million eggs a year. A large inshore cod averages 35 pounds, although weights of over 200 pounds have been recorded. They tend generally to move inshore in winter months and offshore to cooler water during the summer months feeding prinicpally on

mollusks and small fish including herring, young haddock, and even young cod. Their principle enemy is the spiny dogfish.

Bottom trawling accounted for 70% of the 1971 Maine cod landings of 4,379,550 pounds, gill nets 19.4% and the remainder were caught by hand and long lines. Once landed on deck the heads and entrails are removed ("headed and gutted") and the catch held on ice ("iced down") until landing.

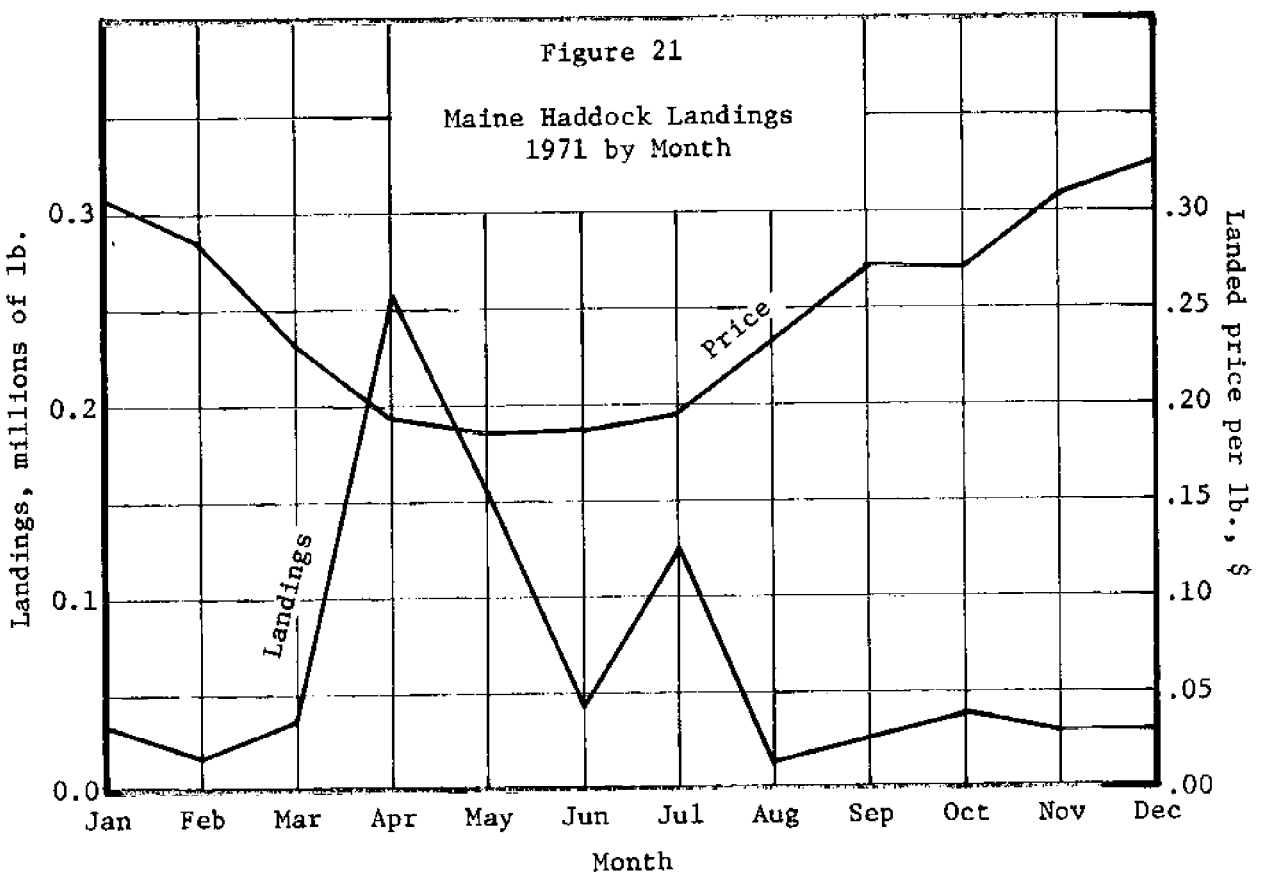
Cod is used in a variety of ways; it may be sold dried, as fresh or frozen fillets or used alone or in conjunction with other fish to form the basis for sticks, portions, or convenience foods such as "Fish 'n Chips" and frozen dinners.

Figure 20 illustrates the monthly variations of landings of cod in Maine, and the ex-vessel prices for 1971. Note the inverse relationship between price and landings, one of the important uncertainties facing the fisherman in planning his operations.



Haddock is a smaller fish than cod, weighing from 1 1/8 - 4 3/4 pounds with the largest fish recorded at 37 pounds. They reach maturity in 3 to 4 years after spawning which occurs during a brief period between the latter part of January to early April; an average size female may hatch 200,000 eggs. They are found infrequently in water colder than 35 degrees F or warmer than 52 degrees F. Figure 21 illustrates the monthly variation of landing and ex-vessel unit prices for 1971.

Bottom trawling accounted for 93.1% of the 1971 Maine haddock landings of 820,767 pounds, gill nets 4.3% and the remainder were caught by hand and long lines. These fish are also headed and gutted when caught, and iced down until they are landed. These high value fish are filleted ashore and marketed in both the fresh and frozen form.



Hake is a species of much less commercial importance to Maine than cod or haddock. First spawning at an age of 3 years, it grows to an average weight of 7 - 8 pounds. In general they have a tendency to move inshore during the autumn. Of the 1971 Maine landings of 1,971,997 pounds 42.7% were taken by hand or long line, 48.3% by bottom trawl, and the remaining 9% by gill nets. After heading and gutting aboard the vessel a small portion of the annual catch is sold as fresh fillets while it appears that the remainder is used for industrial feeds.

Pollock range from the surface to the bottom, feeding on many species of young and small fish, and grow to a weight range of from 4 - 15 pounds. By the age of 5, all female have spawned at least once. In 1971, trawling accounted for 75.3% of the Maine landings of 890,000 pounds with the remainder being caught by gill nets. Headed and gutted aboard, it is filleted ashore and is being marketed primarily in a frozen and breaded form. It is hoped that this species will eventually find consumer acceptance as a replacement for haddock.

Whiting, although it has a low ex-vessel value ($.048 per pound in 1971), is caught in large enough quantities to be attractive to the fishermen and has a fairly high wholesale price ($.27 per pound, frozen headless and dressed). These small fish become mature at 2 years (length 9¼ - 11 inches) and of commercially important size at 3 years. It feeds on the young of nearly all fish found within the Gulf of Maine, including other whiting.

In 1971, Maine whiting landings of 9,900,355 pounds were harvested by bottom trawl; once aboard these fish are iced and brought ashore still whole. There they are headed and skinned, and sold either fresh or frozen.

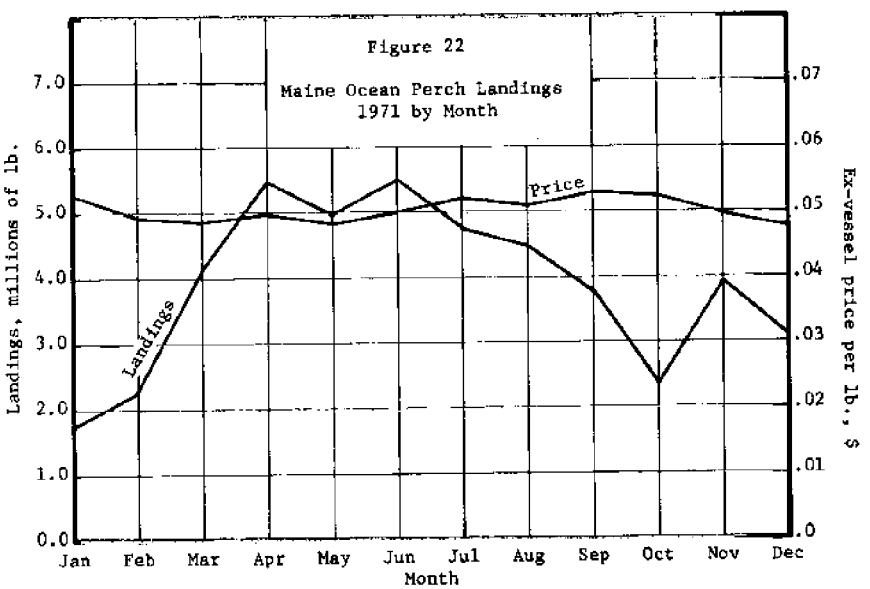
Ocean Perch

The fishery for ocean perch is Maine's only true distant water fishery, with vessels from Maine fishing for this species along the coast of Nova Scotia, Cape Breton Island, and into the Gulf of St. Lawrence. The ocean perch (common name - redfish; proper Latin name - Sebastes marinus) is a very slow growing fish. It does not mature until an age of 8 or 9 years and becomes commercially important only after about 10 years. Compounding this species sensitivity to over fishing caused by its slow maturation rate, is the fact that each female produces only between 25,000 - 40,000 young a year. They bear their young alive, not as eggs, and hence incur a lower initial mortality rate. They feed on a variety of crustaceans, small mollusks and fish and in turn are the prey of cod, halibut, and older redfish. The 1971 Maine catch of 46,629,942 pounds was caught by bottom trawl; experiments with high opening bottom trawls and midwater trawls indicate that they may also be successfully employed.

Because of the relatively large distances to certain redfish grounds (1,400 nautical miles round trip to the mid Gulf of St. Lawrence and return) the fact that sea conditions may be much more adverse than for inshore fisheries, and the fact that large quantities of this low-value fish must be landed each trip to make the trip economical, the typical redfish vessel is much larger (90' - 140' long) than a typical Maine inshore dragger. The crews on these boats stand a two watch system; one half of the crew operates the vessel for 12 hours while the other half rests, enabling fishing to be carried out continuously once the vessel is on the grounds. Trips of 17 days in length are not uncommon, nor are trip catches in excess

of 200,000 pounds for the larger boats. The catch is not processed aboard the vessel, but is held whole on ice until it is off-loaded at the processing plant.

To the best of our knowledge, all vessels which regularly operate in this fishery are owned by the processing companies; therefore, it may be said that this fishery in Maine is at least partially vertically integrated.* To what extent the processors control the transportation distribution and marketing system is not known. The company control of the boats and the fact that there are fairly large quantities of frozen ocean perch fillets in cold storage plants tend to produce a remarkably constant ex-vessel unit price throughout the year, as indicated in Figure 22. Presently the fillets are marketed either frozen (skin on) or breaded; the 1971 wholesale price for the former was $.369 per pound. A market for fresh fillets appears to be growing.



*"Vertical Integration" referes to an industry structure characterized by firms which perform the sequence of operations from raw resource extraction to final retailing; versus an industry structure characterized by firms which perform a single stage of process at a large scale for a large segment of industry.

Herring

Herring are a relatively small fish, reaching the length most desired for sardine canning of 7½ - 8 inches by the age of 2 years, and having a fully grown size of about 17 inches. The majority spawn first at an age of 4 years and produce an average of 30,000 eggs. Herring feed primarily upon plankton and pelagic shrimp and are fed upon by all the predaceous fish in the Gulf. In addition to these enemies, herring are also prone to wholesale destruction on the beaches by storms, water pollution and by becoming stranded on tidal flats.

The 1971 Maine landings of sea herring were 28,571,370 pounds; this is approximately 8,000,000 pounds less than 1970. However, it is understood that the 1972 catch is an improvement over 1971. The technology of harvesting this species has changed significantly in the brief period following the introduction of purse seining, as shown by Table VII.

Table VII

Percent of Annual Catch Harvested by:

	Purse Seine	Stop Seine	Weir	Other
1965	16.6	60.9	20.6	1.9
1969	63.7	18.8	15.0	2.5
1971	73.7	24.9	1.4	0

Other methods presently in use in other states and countries include one- and two-boat midwater trawling.

Once caught, the fish are loaded aboard a sardine carrier where they are salted down or held in brine and taken to the processing plant. One disadvantage of both the purse seining and midwater trawling methods is that if the intestinal tract and stomach of the fish are full, "feedey",

they must be dumped overboard; whereas those caught in stop seines and weirs can be held until they have voided themselves.

While the landed value of herring in 1969 was only $967,657 the processed value (primary wholesale) for that year was $11,511,902 including fresh herring that was imported.

Other Finfish

Alewife - 1971 landings - 2,000,000 pounds valued at $45,000. This fish is similar in size and appearance to the herring. An "anadromous" fish, i.e., one which lives in the sea until 3 or 4 years old, then returns in the spring to a fresh water stream to spawn. The alewife is considered an excellent food fish, fresh or salted. Nearly all the catch is made in the lower reaches of streams, with weirs, dip nets, or seines. Many communities lease the fishing rights to the highest bidder.

Bluefin Tuna - 1971 landings - 136,000 pounds valued at $13,000. A large fish (weighing as much as 1,200 pounds or more) of the mackerel family (sometimes called "horse mackerel"). The tuna is an "oceanic wanderer", traveling in small schools of up to 30 - 40 fish, and likes warm water, so only appears off Maine in late spring and summer. A 650 pound fish is about 14 years old. The bluefin is the basis for a considerable sport fishing industry, but most commercial fishing is done by harpoon. There is little demand in Maine for fresh tuna, although it is an excellent food fish having dark colored meat. (The West Coast tuna industry has conditioned us to accept only white tuna meat.) There is heavy demand, and premium prices paid in Japan if the fish are handled and processed precisely as they specify from the moment of catching.

Flounder

Flounder - 1971 landings - 1,300,00 pounds valued at $126,000. The flounders and soles (including the halibut) are unique in that, although beginning life as a normal two-sided fish, they gradually tip over so as to have a top and bottom, with both eyes on top. There are many varieties, but only gray sole, blackback and dab have appreciable landings in Maine. Flounder are occasionally trawled for in shallow bays, but most often are landed by Maine trawlers as incidental catch.

Mackerel - 1971 landings - 220,000 pounds valued at $14,000. (Compare these landings with 4,000,000 pounds in 1950, 31,700,000 pounds in 1880 and approximately 70,000,000 pounds in 1931.) A schooling fish, originally caught with hook and line, but since the 1870's generally fished with purse seine. Mackerel are "pelagic" (of the open sea) and migratory, appearing from spring to autumn in the western part of the Gulf of Maine. It is an excellent food fish, but does not keep well because of a high oil content.

Smelt - 1971 landings - 780,000 pounds valued at $18,460. A small (generally 7 - 9 inches) anadromous fish found close to shore and in estuaries. Normally caught with dip nets in streams when spawning or through ice in lakes by handline.

Industrial Fish - 1971 landings - 131,000 pounds valued at $2,705. This classification covers several varieties of fish not used for human food, but for oil, fish meal, animal food, etc. These low valued fish are landed in quantity in Rhode Island (51,000,000 pounds in 1969) and Massachusetts (19,000,000 pounds in 1969).

THE COMMERCIAL FISHERIES OF MAINE

SESSION IV

Digging Fisheries

I. Clams

The fishery for soft-shell clams is an important contributor to the marine economy of Maine, ranking third behind lobster and shrimp in value of landings; Figure 23 shows Maine's landings since 1915. Known as "long-necked", "soft", or "steamer", the Mya arenaria can reach a length of 5 to 6 inches if unharvested. It inhabits the intertidal zone, the shell lying buried with only the tip of the siphon exposed at the surface. When alarmed, the clam rapidly withdraws the siphon creating a vertical spurt of water and identifying its location to the clam digger.

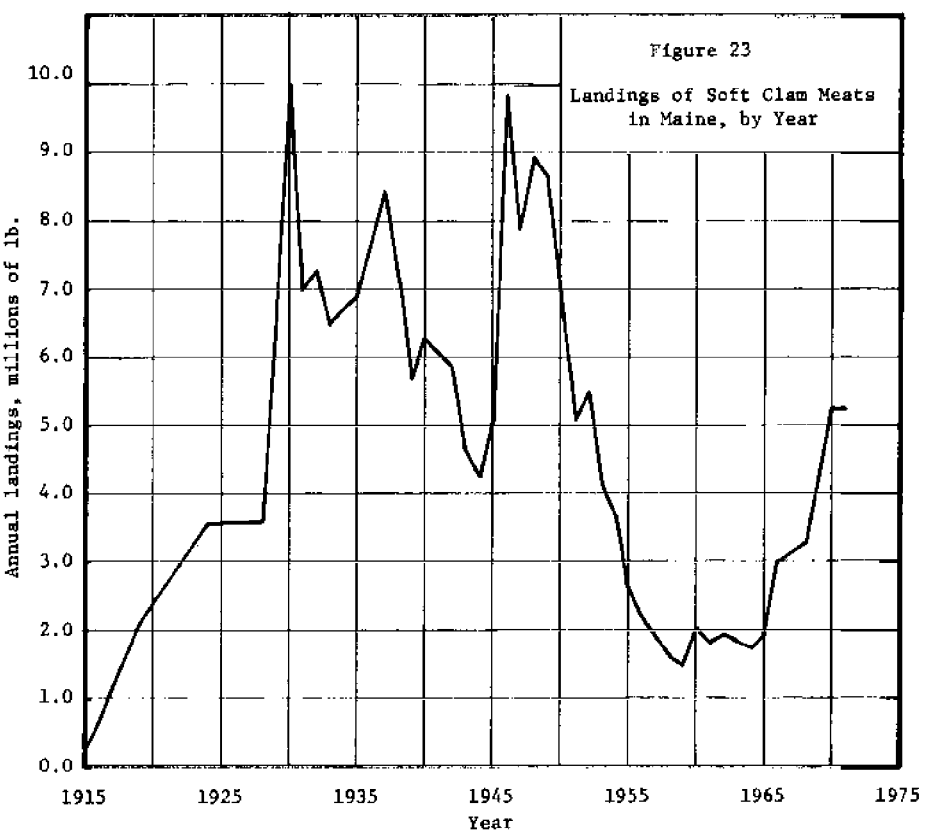


Figure 23

Landings of Soft Clam Meats in Maine, by Year

The clam feeds by filtering microscopic plants from the sea water through its siphon (filter feeder). Like other relatively immobile shellfish it is quite susceptible to environmental damage, i.e., oil and waste pollution. Clams which have been exposed to waste-polluted water can cleanse themselves by being placed in a clean environment for a period of time. This process is known as depuration. One difficulty that can arise is that filter feeders are accumulators of paralytic shellfish poison (PSP), a toxin produced by microspcopic plants (dinoflagellates). Although not normally a problem, these single-celled plants occasionally bloom explosively causing the so-called "Red Tide."[1] The filter feeders eat these plant cells and can contain a sufficient quantity of the toxin to cause illness or death to anything eating the affected mollusks. The toxin may remain for several months and there is no known method of detoxification.

At the present time all soft-shell clam harvesting in Maine is done by individuals using a hoe. In some other states a hydraulically powered dredge is used; this device uses a jet of high pressure water to free the clam and a conveyor to bring it to the surface. The Department of Marine Resources has recently started experimentation with one of these dredges to see if this type of equipment should be used in Maine and how to regulate its use.

The clams are usually sold whole or fried. The 1971 unit price ranged from $.46 to $.60 per pound of meat to the digger, with most landings occuring from April to September.

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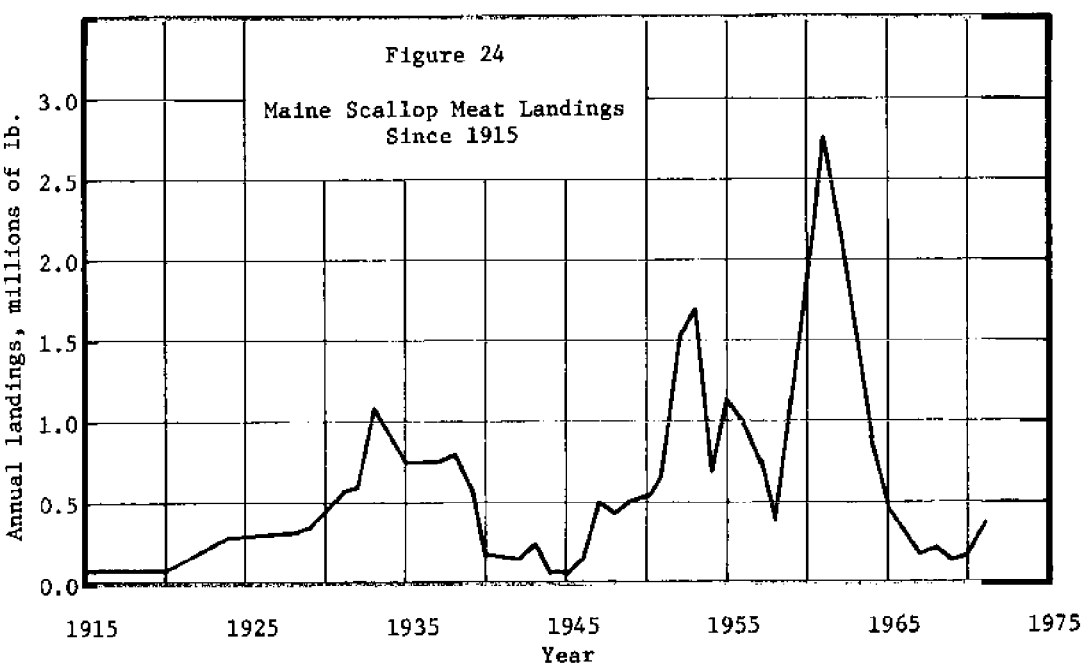
[1]State and Federal agencies continually monitor for Red Tide, and prohibit harvesting and sale of affected shellfish when it appears.

This resource has an extremely high ratio of primary wholesale value to landed value. It has been estimated that if sold as steamers, the price charged per serving is nearly 30 times the landed value and for fried clams this factor is nearly 15. If fully developed, the primary wholesale value of this resource would exceed that of lobster by approximately $30,000,000 and would account for over one half of Maine's potential primary wholesale value of fishing products.

II. Sea Scallops

The sea scallop, or giant scallop, reaching a length of six to seven inches, is found in deep water from Newfoundland to New Jersey. Unlike the clam, the scallop is not a burrower, but instead lives in small depressions on firm sandy bottom. The scallop can propel itself by rapidly opening and closing its shell, progressing through the water in a series of jumps. The muscle used to accomplish this is the adductor; this is the only part of the scallop eaten in the U.S., but in Europe the whole animal is eaten. Like the clam, the scallop is a filter feeder and



can accumulate PSP toxin; however, the toxin does not concentrate in the adductor muscle.

Scallops are harvested by boats towing scallop dredges. Conceptually similar to a small beam trawl, the scallop dredge has a very short "cod end" made of steel rings (the "bag") to withstand abrasion on rough bottom and has a sharpened steel bar in place of the footrope of a normal trawl to frighten and lift the scallops into the bag.

Scallops are generally harvested from November through April by vessels making one day trips. "Shucking", the removal of the adductor muscle, is done aboard and the waste thrown overboard. Although the ex-vessel price of the scallop meat is high, $1.30 per pound in 1971, the landings have declined precipitously from a 1961 high of 3,700,000 pounds of meats to the 1971 landings of 387,000 pounds as indicated in Figure 24; however, the preliminary data for 1972 indicate landings of over 900,000 pounds.

III. Worms

Blood and sand worms are dug by hand on exposed mud flats, principally during the spring and summer. Having an average 1971 unit price of $1.32 per pound, this high value resource is very popular for use as bait by sport fishermen. If the sub-tidal stocks of worms were to be exploited by permitting use of powered harvesting devices, it has been estimated that the primary wholesale value of this resource would be in excess of $9,000,000.

IV. Mussels

The most common variety of this shellfish is the blue mussel. This thin-shelled creature attaches itself by thin fibers to rocks, pilings, or other solid substrata in the inter-tidal zone. Although this resource is

readily harvested by hand, and brought a price in 1972 of $.24 per pound of meat, it has not found widespread consumer acceptance in the U.S. Possibly because of the rich flavor and yellowish meat, and because many of the mussels growing naturally in Maine have a tendency to form pearls. These pearls having no commercial value can make the physical process of eating the mussel meat difficult. In Europe where mussels are found naturally and are also cultured on ropes suspended from rafts, they are highly prized as both a source of protein and a delicacy. However, in Maine only 200,000 pounds of meats were harvested in 1972, with the majority of the landings occurring in March, April, May, June and December.

Under-utilized Resources

Much of the available marine biomass is not being utilized. Although with little or no appeal to the present U.S. market it could be possible to develop domestic markets for some of these under-utilized species, and other species could be exported to countries in which they are already popular.

Past practice has been for foreign capital to penetrate as deeply into the processing industry for export as possible. By exporting a raw material rather than a finished product, Maine is deprived of some of the income available from sales to those countries.

I. Mussels

The 1972 landings of mussel meats in Maine were approximately 200,000 pounds. While no specific estimates are available for an annual production potential of this resource for Maine, the United Nations has estimated the coastal region from the Chesepeake Bay to Maine could produce in excess of 200,000,000 pounds per year. If Maine were responsible for 15% of this production, at its present value this resource could have a landed value to Maine of over $7,000,000, and using a multiplier of 10 (the multiplier for clams ranges for 15-30), a primary wholesale value of over $70,000,000. To achieve this production of high quality mussels, cultivation would be required, but once accomplished this highly nutritious resource could be sold fresh, froze, fried, or canned. Mussels are cultivated in large quantities in Italy, Spain, and the Philippines.

II. Spiny Dogfish

This resource is not landed presently in Maine and is regarded as a nuisance. It has been estimated that the North Atlantic area (New York -

Maine) could support an annual harvest of 400,000,000 pounds. Assuming 15% of this amount could be landed in Maine at the ex-vessel price of $.05 per pound (although prices of up to $2.00 per pound have been reported in Germany) the annual landed value of this resource would then be $3,000,000. Used widely throughout England as the fish in "Fish 'n Chips", it seems likely that given sufficient marketing attention this resource could find consumer acceptance as a frozen convenience food.

III. Squid

The total recorded Maine landings of squid in 1971 was 290 pounds. Although some ports with sizable Mediterranean ethnic populations have regular landings of this resource at fairly high unit prices ($.183 per pound in Rhode Island in 1971), only an insignificant percentage of the estimated standing crop of 700,000,000 pounds in coastal waters from New York to Maine is being harvested by fishermen from the U.S. Ironically the Japanese caught approximately 26,000,000 pounds off New York from December 1971 to mid-February 1972. Since the squid, Lologis, migrates inshore during the summer months and offshore during the winter months, this fishery would seem to complement the shrimp fishery. The squid can be harvested by bottom trawl although midwater trawling is a much more effective technique; once landed it can be prepared in a variety of ways and sold either by itself or mixed with other seafood products. If Maine could land 15% of the potential annual landings (we estimate 43% of the standing crop) with an ex-vessel price of $.18 per pound, this fishery could have an annual landed value to Maine of over $6,000,000.

IV. Eels and Elvers

Although there is a small domestic market for this resource, its

principal value is as an export product. Eels which can be harvested by pot or spear bring up to $8.00 per pound in Sweden, and elvers (young eels) which abound in Maine streams and rivers and which could presumably be caught by pots or stop seines, bring up to $50.00 per pound in Japan when in demand.

V. Sea Urchin Roe

In 1971, approximately 50,000 pounds of sea urchins were landed in Maine at an average unit price of $.08 per pound. The eggs (roe) of this resource bring $4.00 per pound in Japan. This Maine resource has been described by experienced Japanese chefs as being of "excellent quality".

VI. Skate

While skate can be harvested by conventional bottom trawl, only a small portion of the over 600,000,000 pounds of standing crop (New York - Maine coast) is harvested. No landings were reported in 1971 for Maine. If 40% of the standing crop could be harvested annually, and if Maine could account for 15% of this at an ex-vessel price of $.07 per pound (1971 Rhode Island price) the potential of this fishery would be over $2,500,000 annually. The fact that skate sells for $1.00 per pound in England indicates a strong export potential for this product. Each skate wing will produce two excellent fillets, which can be prepared exactly like fish fillets.

Aquaculture

I. General Remarks

As with any new technology, definitions tend to be blurry and to vary from place to place. For the purposes of this text, aquaculture will be defined as, "The introduction of Man's agency into the growth cycle of renewable fresh and salt water resources to increase production, improve quality, and simplify harvesting, processing, and marketing." "Resource management" is sometimes used in a concurrent sense; it might be better to confine this term to Man's agencies external to the resource, i.e., laws, gear and vessel limitations, closed seasons, etc.

Aquaculture is carried out at various levels of effort. Minimum effort may be exemplified by the practice of dumping oyster shells back on natural oyster beds to provide cultch on which future generations of oysters might spawn. Intermediate effort is the selective breeding of anadromous salmon to increase growth rate and reduce maturation time, the improvement of spawning conditions, and the introduction of salmon into new rivers. At the upper end of the effort scale are the salmon and trout farms in which the fish are cultured throughout the entire life cycle under carefully controlled conditions which include disease monitoring, control of water temperature and quality, carefully designed diets, and limited control of the surrounding environment. All levels of effort have their advantages and disadvantages, with no level deserving more attention than another.

II. Aquaculture - Past and Present

Despite the newness of the word aquaculture, the skill itself is an old one. Four thousand years ago fish were being raised in China and oysters

in Japan, and 600 years ago the French were fertilizing trout eggs. The history of aquaculture in the United States is just about 100 years old, beginning with the rearing in hatcheries of anadromous and lake fish.

Despite its ancient beginnings, the intelligent culturing of marine organisms by man lags far behind his other efforts at supplying his needs. Where agriculture, for instance, has been a major contributor to the world's food supply for perhaps 5,000 years, aquaculture has, except in a few limited instances, been practiced for less than 100 years.

Nevertheless, the culture of marine resources is now beginning to produce good returns in many parts of the world and may do the same for Maine. Existing aquaculture opeations indicate 1) that it is a practical means of augmenting man's supply of food and other fishery needs, 2) that the yield per unit of area can be remarkably high, and 3) that when properly planned and managed, an aquaculture operation can be profitable. Aquaculture is practiced on a commercial scale in Japan (oysters, shrimp, tuna), Australia (oysters), Philippines (oysters, mussels), U.S./Canada (oysters, trout, salmon, pond catfish), Norway (salmon and trout), England (plaice), France (oysters), Spain (mussels), and Italy (mussels). The Food and Agriculture Organization (FAO) of the United Nations estimates that in the Chinese Peoples Republic in 1959, 35% of a fish consumption of over 5,000,000 tons was cultured (BCF Foreign Fisheries Leaflet 104). In addition to commercial operations, there is intensive research in many parts of the world into the culture of all types of renewable marine resources, including finfish, marine mammals, mollusks, crustacea, and marine plants.

III. Maine's Suitability for Aquaculture

Arguments for aquaculture in Maine include the following:

1. The Maine coast is heavily indented, with large areas of protected coves and bays.

2. The water is generally fairly deep.

3. The tides (ranging from 20' or more in the east to 9' in the west) will be invaluable for circulating food and, probably more important, for flushing out the quantities of metabolic waste resulting from intensive cultivation of animals.

4. The coastal plain is still relatively lightly settled and sparsely industrialized, reducing both the cost of aquaculture facilities and the danger of destructive pollution.

5. The coastal region of Maine has a long seafaring and fishing tradition, and virtually every part of the coast has some background in harvesting and processing seafoods.

6. Aquaculture within Maine's territorial waters will provide Maine with a source of renewable marine resources over which it will have very powerful control.

Disadvantages for aquaculture in Maine include the following:

1. Climate - the cold water limits species and slows the growth rate, and winter ice requires special provisions to protect in-water facilities.

2. The standards of handling many of Maine's marine resources are much too lax, leading to variable quality, many disappointed consumers, and loss of demand.

3. It is unlikely that large-scale aquaculture enterprises can be

achieved in Maine in the foreseeable future. If large size is a measure of viability, this may be a drawback.

The overall conclusion can only be that the advantages of aquaculture outweight the drawbacks, and that there is definitely a major place for aquaculture in Maine's future.

IV. Likely Candidates

A major question in establishing an aquaculture industry is what type of organism should be cultured. The prime considerations will be: 1) whether a market exists or can be readily developed for the product, 2) whether the proposed location of the enterprise is suitable for raising the organism, and 3) whether the costs of production plus a reasonable profit will allow offering the product at a price acceptable to the consumer.

The suitability of various organisms for aquaculture in New England was discussed at a conference held in 1970 at the University of New Hampshire. The most likely candidates identified are listed below:

Highly favorable	
Bay Scallop	*Aequipecten irradians*
Mussel	*Mytilus edulis*
Trout	*Salmo gairdnerii*
Salmon	*Salmo salar*
Favorable	
Oyster	*Crassostrea virginica*
Quahog	*Mercenaria mercenaria*
Freshwater Prawn	*Machrobrachium rosenbergii*

This list of candidates must be considered a rough cut, and is surely

subject to revision as research is continued, and particularly as aquaculture expertise and technology advance. Recent work in lobster culture, for instance, is bringing lobster production costs steadily closer to the break-even point.

Currently in Maine there are two salmon-rearing enterprises in the early stages of commercial production. The University of Maine Marine Research Laboratory at Walpole is assisting those interested in the raising of oysters and mussels.

V. Legal and Social Aspects

The legal status of inshore waters is tangled. The intertidal zone is the interface between land and marine legal regimes, and is where the shoreside property owner meets the mariner. These two confrontations are aggravated by the haphazard growth of a body of law ruling the interface, a body of law which is rapidly becoming anachronistic. The effect is to render uncertain the proprietorship of the water and bottom areas which are necessary for fish culture.

If aquaculture is to become a healthy member of Maine's economy, it must enjoy the same reasonable protection under law which other commercial enterprises take for granted. Maine can do little in international waters to protect its fishing industry. It can and should, however, take constructive and affirmative action to establish within the State's territorial limits the laws and regulations which are needed to provide a healthy atmosphere for aquaculture; while at the same time protecting existing beneficial marine activities and the general environment.

From the social point of view, a well-designed and managed aquaculture industry will provide steady year-round employment compatible with the

traditions of the area and its residents. Inevitably there will be conflicts between aquaculture and other interests; these can and must be resolved to minimize negative affects so that the greater good of the coastal community and the State are served.

VI. Economics

Aquaculture cannot be considered a get-rich-quick scheme. The planning, experimental preparation, pilot program, full scale initiation, and refinement of a commercially viable operation are all time and money consuming, but yet must be carried out fully to avoid catastrophic mistakes. An estimate of the time required from its inception for an aquaculture venture to reach consistent commercial production is at least five years, and might take as much as eight to ten years. These times are based on culturing a species with which there is considerable body of knowledge. To develop an industry based on a totally new species would double the time.

The economic viability of an aquaculture project will depend upon many variables; each project must therefore be worked out individually. For salmon or trout rearing in a highly sophisticated closed system, it was estimated that to be profitable, the gross revenue must equal capital cost. In the case of the "Sea Pool Farm" in Nova Scotia, their criteria for validity called for a minimum $3,000,000 investment in the farm and a production of 3,000,000 pounds at $1.00 per pound. Another expert has stated that a minimum investment for this type of venture was $1,000,000.

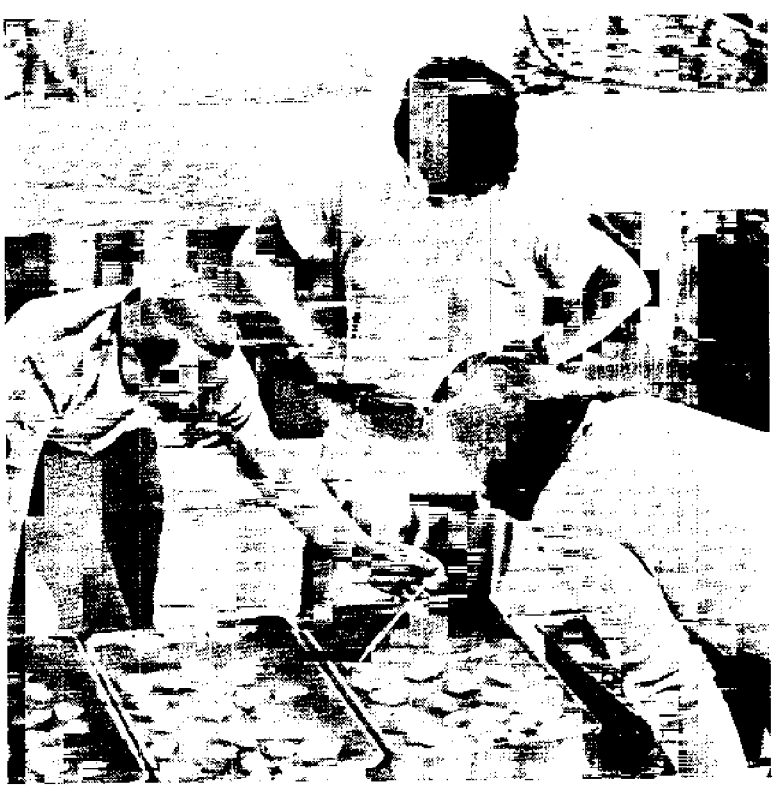
The figures cited above were given at the 1970 University of New Hampshire conference, and refer to fully controlled, highly sophisticated projects. For Maine it is probably much wiser to explore the lower levels

of aquaculture, utilizing existing land configuration and indigenous species as much as possible in order to reduce experimental time and capital investment. Hopefully, the legal inhibitions on this type of operation will be removed and experimental work by public and private agencies can be accelerated.

VII. Potential for Maine

What can we expect from aquaculture in a generation or two? There is evidence that aquaculture can increase the supply of marine organisms for Maine interests by a factor of ten. On this basis, the primary wholesale value of these products could mean $1,600,000,000 to the State's economy.

The conclusions to be drawn are that aquaculture will become a major industry in Maine, that it will increase the value of the marine resources industry many times, and that all encouragement should be given to it to develop wisely and profitably.



APPENDIX

BANK FINANCING OF FISHING VESSELS

SOME LEGAL ASPECTS

By Benjamin Thompson, Esquire*

The following is a discussion of some of the legal requirements for obtaining loans for vessels. The paper was given by Mr. Thompson to the bankers seminar for which this book was originally prepared. The discussion is included here because it is felt that the information it contains is little known, yet can be of great value to all those involved in the lending or borrowing of money for which a documented vessel is collateral.

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I. Loans to Existing Vessels - Necessary Documentation

A. CG-1330 - Certificate of Ownership. This can be purchased from the Documentation Officer for $1.00 and shows, among other things, the name and address of the owner of the vessel and any recorded liens which are outstanding.

Note: Maritime liens are secret liens and most liens need not be recorded to be valid. As a matter of fact, they cannot be recorded unless a preferred mortgage is first recorded.

B. The original operating document. This is akin to the registration of an automobile and contains most of the necessary data to make out a preferred mortgage. It also has a section on the back where preferred mortgages have to be endorsed and will give the banker a clue whether the vessel has any recorded encumbrances against it.

C. Survey. The survey should be done by a surveyor who is qualified not only in fishing vessel construction but who has a good idea of fishing vessel evaluation. Unfortunately, the value of a fishing boat once it becomes mired in economic woes and gets in the Marshal's hands, shrinks drastically. There are few surveyors in this area who possess the necessary professional qualifications on construction and who also have a fair idea of the going value of a fishing vessel and what its value might be, if the mortgage has to be foreclosed and the vessel sold by the Marshal.

D. The note. Probably your usual bank form of note can be used as long as it has a definite maturity date.

E. First Preferred Mortgage - CG-1348. This should be prepared in quadruplicate original, stating the interest of the mortgagor with acknowledgement from a qualified public official and must be recorded in the Documentation Office and endorsed on the vessel's operating document before it is valid. On large complicated loans, a special form of First Preferred Mortgage which can only be drawn by an attorney should be used.

F. Affidavit of Good Faith - CG-5940-2. This is a sworn statement that the mortgage is not being given to defraud, hinder or delay creditors.

G. Designation of Home Port - CG-1919. This designates the home port of the vessel.

H. Citizenship Affidavit for Mortgagor - MA-4557. This is for a corporation and MA-4558 is for an individual. The gist of these documents is that an individual cannot own an American flag vessel unless he is either a born or naturalized United States citizen. This is also true for a corporation unless the great majority of its stock is owned by American citizens.

I. Citizenship Affidavit for Mortgagee - Ma-4557. This is a similar one to the requirement for ownership. You should remember, however, that only the President, Secretary or Treasurer of a bank can sign this citizenship affidavit without a special vote, which needs to be filed with the Documentation Office.

J. Master's and Owner's Oath (Individual CG-1258 and Corporation CG-1259). This document on one side gives data like the service, horsepower,

name of the owner, rig, usual type of business. On the other side is the Master's Oath, again reflecting that the Master is a citizen of the U.S.

K. Notice of First Preferred Mortgage. This is simply a form, usually printed on a card, which should be kept in the pilot-house of the vessel at all times while the mortgage is outstanding. This calls attention of third parties to the fact that the vessel is under a First Preferred Mortgage, under a certain date, given to a certain bank or other entity.

L. CG-5949-14. This is a certificate put out for corporations requiring information concerning citizenship, a listing of the Directors and requiring an excerpt from the by-laws as to what constitutes a quorum of the directors.

I. Loans to existing vessels being sold when the new owner is applying for financing.

The same documentation as set forth above where ownership is not changed would be necessary and in addition the following documents:

A. Bill of Sale. There are various forms for various tonnages of vessels. In general, it is important to remember that a whole interest must be conveyed; the bill of sale must be completed in duplicate original; all signatures must be witnessed and the proper form of acknowledgement must be made.

B. Designation of Home Port - CG-1919. Where the home port is being

changed it is important as early as possible in the loan negotiations to notify the Documentation Officer where the vessel is then enrolled and to forward the abstract of title to the new Documentation Officer since it sometimes requires several weeks to accomplish this.

III. Vessels Under Construction

A first preferred mortgage can only be placed on a vessel which has been completed and is documented in the proper Documentation Office of the Department of Transportation. Therefore, in the event a bank is requested to finance a fishing vessel under construction, it seems practical to take the following steps:

A. The bank should review the construction contract to make sure, if possible, that the owner and the bank would have the right to come into the yard in the event of financial trouble on the part of the yard and hire someone to complete the vessel. An alternative would be to have the right to remove the vessel to another yard for completion. This is usually a question of leverage and many yards would not allow such a provision in the contract.

B. Another consideration is a clause that title to the vessel as it is constructed and to all the gear and equipment ordered for the vessel in the yard rests with the purchaser. This is good as far as bankruptcy or insolvency problems go, but you should consult your attorney as to its effect on the state sales tax particularly for non-residents.

C. The bank should take a security agreement under the UCC in the appropriate form. The protection of this agreement would presumably cease as soon as the vessel is completed and documented and at this point a first preferred mortgage should be placed on the vessel. The protection afforded by the UCC to some extent will depend on the wording of the contract and it is very necessary that this be discussed with your attorney.

IV. Insurance

Insurance is of prime importance to a bank, since tort liens such as claims for personal injury and salvage occurring after a first preferred mortgage is made and recorded, come ahead of it in priority.

A. Hull Insurance. Hull insurance is necessary in the event the vessel sinks or sustains hull damage.

B. P. & I. Insurance. "P. & I." means protection and indemnity and covers a multitude of things including but not limited to: personal injuries, salvage claims, etc.

C. Longshoremen's Rider. This may be necessary if the fishing vessel is unloaded by "lumpers", who may be hired by the owner of the vessel, the crew of the vessel or the fish company where the fish are landed.

D. When a bank makes a commitment on a fishing vessel one of the conditions should be that adequate full marine insurance coverage is procurable. It is at this time that it is very difficult to get any

P. & I. insurance on commercial fishing vessels and if the vessel is not of fairly recent construction, which is the exception rather than the rule, it is exceedingly expensive as well as difficult to get hull insurance.

V. Conclusion

Bank financing of commercial fishing vessels is very complicated and is completely unlike any other form of real estate or chattel financing. I would recommend that in every case where the loan is of any significant amount, and where the prime security is a first preferred mortgage on a fishing vessel, each bank consult its lawyer.