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Implementation of the Fishery Conservation and Management Act of 1976 affords opportunities for fishery expansion and economic development in the Oregon otter trawl fishery. The changes stimulated by the Act should occur, according to social science theorists, by the diffusion of innovations from innovative fishermen to less innovative fishermen, with the innovations including those in electronics and gear; and changes in target species and fishing strategy.

Theoretical expectations were, for the most part, supported by the field data gathered on the fishery. Most importantly the investigation revealed a high correlation between innovativeness and high earnings; high earnings could not be explained sufficiently by the effort or experience of the fisherman.

Some significant differences were encountered between theoretical predictions and the practice of the fishery. Contrary to the theoretical notion that innovators are unusual individuals marginally or imperfectly

integrated into their system, innovators in the Oregon otter trawl fishery are well-liked, sought out for advice and central to the system.

Further, competition, tax incentives and port environment were found to be major factors influencing the adoption of innovations. These factors are not presented in the theoretical literature.

"Pushing for the Highline": The Diffusion of Innovations in the Oregon Otter Trawl Fishery

by

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Some of these guys are willing to settle for whatever they can get. You see 'em out there fishin' just like grandpa. Not me, I'm going to stay on top of what's going on. I'm going to keep pushing for the highline.

Newport Fisherman, 1978

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CHAPTER ONE

INTRODUCTION

The Problem

This thesis explores how the Oregon otter trawl fishery changes. Theories which affirm that change occurs through the diffusion of innovations are tested against data gathered about the fishery. The channels of diffusion within the fishery are investigated and the individuals involved in the diffusion process are profiled.

This type of research is important because although fishery development efforts are common at this time, contemporary theories of change have not been applied to a commercial fishery. This investigation may therefore illuminate the dynamics of change within a fishery sub-culture and bring us closer to a more generally applicable theory of culture change. In the short run, moreover, a study of the mechanisms of change within the otter trawl fishery could be helpful in fishery development efforts such as outlined in several fishery development schemes which are currently being implemented within Oregon coast fisheries.

Of the fishery development efforts which currently effect the Oregon otter trawl fishery, by far the most important of these is the Fishery Conservation and Management Act (PL 94-265). This law extends United States jurisdiction over fisheries to 200 miles offshore and provides a set of mechanisms and guidelines for conservation and management of marine fisheries. This law has already had significant effects on the fisheries of Oregon.

The Fishery Conservation and Management Act provides the opportunity for the Oregon otter trawl fishery to expand into new fisheries, e.g., Pacific whiting, and for growth in existing fisheries, e.g., Dover sole and various species of rockfish. Participation in these fisheries will require equipment modifications to some extent or, in the instance of the Pacific whiting fishery, major gear and fishing strategy changes. The practices necessary to participate in these new fisheries will be transmitted from fisherman to fisherman.

Innovations are diffused through the interaction of individuals. Members of the Oregon otter trawl fishery, like any group of individuals, have a systematic manner of interaction. Knowledge of how innovations are communicated within the fishery could be invaluable in accomplishing changes more quickly and efficiently. Hostility and aggravation between agencies and members of the fishery might also be mitigated.

Review of the Literature

Because technology is the key to fishermen's adaptation to their environment, it would seem an obvious area of research. But it has not been studied with any rigor even in some of the standard studies of fishing communities (Andersen and Wadel 1972; Poggie and Gersuny 1974; Acheson 1975). Goodlad's (1972) work within the Shetland herring fishery is one of a few investigations of technological change in a fishery.[1] Other publications dealing with fishing technology have originated from outside the social sciences. These explain or introduce a fishing technology (e.g., Brandt 1964; Garner 1967; Hjul 1972; Browning 1974); record the history of the fishery (e.g., Harry 1956; Andrews 1959); or analyze the fishery from a biological standpoint (e.g., Harry 1956; Magill and Erho 1963; Ketchen and Forrester 1966; Forrester et al. 1978). Literature on the social dynamics of fishing technology is scant, and is nonexistent for the west coast of the United States.

Literature of the diffusion of innovations, however, is extensive. This research developed initially in the fields of anthropology, sociology, rural sociology and medical sociology (and later in education and marketing). Katz (1963:13) points out:

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[1] Acheson is currently involved in investigations similar to this thesis on the coast of Maine (Acheson 1978).

> Ironically it seems as if diffusion research in the various research traditions can be said to have been independently invented! Indeed, diffusion researchers in the several traditions which we have examined scarcely know of each other's existence.

The themes developed in the composite findings of all such research are strikingly similar, and are applicable to this inquiry.

The Setting

The nearly 300-mile coastline of Oregon is generally rugged, interrupted occasionally by estuaries and headlands. The low mountains of the Coast Range lie immediately inland with only a few peaks above 3,000 feet. For the most part the range is covered with a sometimes impenetrable temperate rainforest. The configuration of the ocean floor off Oregon tends to be flat. It has fewer obstructions than many coastlines and, conducive to good trawling, has produced thousands of square miles of fishing grounds.

The largest of the many otter trawl ports along the coast include Astoria, Newport and Charleston. Most of the harbors along the coast are bar harbors and in the past many boats were lost attempting to enter them in bad weather. At present most of these harbors have been modified by channeling and jetty construction to enhance their safety. Although bar crossings are still dangerous in bad weather it is no longer necessary to have "vessels staunch enough to ride out the blows" waiting for the bar to clear (Pacific Fisherman, March 1914:18).

Oregon coast weather has not changed since the early days of the otter trawl fishery--it is not extremely stormy, nor always clear and calm:

> Gales are of rare occurrence during the summer, yet the coast winds, blowing constantly from northwest, keeps up a boisterous sea and strong currents. During the fall and winter southeasterly gales are frequent (Pacific Fisherman, March 1914:18).

The otter trawl fisheries include 30-40 species, including flounder, sole, ocean perch, lingcod, rockfish and shrimp (Table 1). These fish are present in waters from several fathoms to over 700 fathoms. A significant portion of the catch is taken from outside twelve miles (Forrester 1978).

Establishment of the Oregon Otter Trawl Fishery

John N. Cobb addressed the Pacific Fisheries Society Convention in San Francisco in 1915, concerning the status of Pacific Coast fisheries. Under the heading of "miscellaneous fisheries," Cobb discussed the presence of "several species of delicious deep sea sole": various species of rockfish, black cod and scallops. He then predicted that:

> In the course of time one of the favorite resorts of our fishermen will be an extensive plateau off [the] northern Oregon Coast, upon which many of the present neglected species abound, and upon which otter and beam trawls could be worked easily (Cobb 1916:56).

Although he was correct, the presence of the deep sea species he mentions were well-known among fishermen years before his speech.

Scientific Name	English common name (INPFC preference first)
Codfishes	
Merluccius productus	Pacific hake
Microgadus proximus	tomcod
Theragra chalcogramma	Pacific pollock, walleye pollock, whiting, pollock
Gadus macrocephalus	Pacific cod, true cod
Rockfishes	
Scorpaenidae	rockfishes
Sebastes alutus	Pacific ocean perch
Sebastes brevispinis	silvergray rockfish
Sebastes flavidus	yellowtail rockfish
Sebastes goodei	chilipepper
Sebastes miniatus	vermilion rockfish
Sebastes paucispinis	speckled rockfish
Sebastes pinniger	canary rockfish
Sebastes ruberrimus	yelloweye rockfish
Greenlings	
Ophiodon elongatus	lingcod
Sablefishes	
Anoplopoma fimbria	blackcod, sablefish
Flatfishes	
Hippoglossoides elassodon	flathead sole
Hippoglossoides robustus	flathead sole
Hippoglossus stenolepis	Pacific halibut, halibut
Lepidopsetta bilineata	rock sole
Limanda aspera	yellowfin sole
Atheresthes evermanni	northern arrowtooth flounder
Atheresthes stomias	turbot, arrowtooth flounder
Eopsetta jordani	petrale sole
Microstomus pacificus	Dover sole
Parophrys vetulus	English dole, lemon sole
Shrimps	
Pandalus borealis	pink shrimp
Pandalus goniurus	pink shrimp
Pandalus jordani	pink shrimp
Pandalus platyceros	prawn

Table 1. Scientific and Common Names of Fish Species (from Forrester et al. 1978).

As early as 1884, for example, there had already been several attempts to establish a trawl fishery off Oregon. The word attempt is important during the early period of the Oregon fishery's history, as these efforts inevitably failed. Market fluctuations offered a less than stable financial atmosphere and therefore stifled most innovative behavior. The situation changed in the late 1930s when several markets established themselves and became profitable. Though market fluctuations continued to plague fishermen, they were not drastic enough to cause total failure of the fishery as had occurred earlier in its history. Markets stabilized further during the 1940s and 1950s, offering an environment conducive to long term investments such as innovative devices.

Euroamericans first took groundfish off western Canada with hook and line during the mid-1800s. These catches, consisting of various flatfish, lingcod and rockfish, were marketed in Victoria, British Columbia (Forrester et al. 1978). Then, in 1876, commercial trawling began in San Francisco Bay. In the early days, two sailboats were used to tow a single paranzella net. "The technique was judged so successful by competing fishermen, that the net had to be guarded at night for fear it would be burned" (Forrester et al. 1978:8). Later, sailpower was replaced by steam.

The small 36-foot schooner Carrie B. Lake initiated the Oregon-Washington trawl fishery in 1884 using a beam trawl just outside the

Columbia River. The venture was short-lived however, as the vessel and crew were lost at sea. Attempts at trawling were made in 1887, but these failed when the fish could not be marketed promptly. Late in 1888, the steam schooner George H. Chance fished a beam trawl off the central Oregon coast, but lack of markets again closed the fishery (Pacific Fisherman, March 1914:18).

Little activity in the trawl fishery is recorded outside San Francisco until 1903 when plans were being made to fish for halibut with otter trawl gear off the Queen Charlotte Islands (Pacific Fisherman, June 1903). Three years later, Richard Obee introduced the "Patent Beamless Trawl" known now as the otter trawl, to Seattle fishermen (Pacific Fisherman, August 1906). The gear was not accepted in that area, and in 1908 Obee and two partners began fishing otter trawl gear on the Evie outside the Columbia River (Pacific Fisherman, July 1908).

In 1912 the Oregon Coast Fishing Company opened a fish processing plant at Bay City, Oregon. But when the company boat, Vida, was hit by a heavy storm on its first trip the damaged vessel was withdrawn and the fishery abandoned (Pacific Fisherman, March 1914). Even so, early in May of 1915, the Union Fish Company of Bay City outfitted the steam tug George R. Vosburg with a beam trawl and "sent her out on the Oregon off-shore banks" (Pacific Fisherman, July 1915:28). Although the catch was good, the lack of a market and the absence of cold storage facilities forced the company to move the vessel to Astoria where it continued to fish (Pacific Fisherman, July 1915).

The early trawl fisheries were small-scale and were conducted close to ports of delivery. Markets were limited because of the small coastal population and the difficulty in transporting fish east of the mountains. The most stable trawl fishery for many years was based on the San Francisco market (Forrester et al. 1978).

During World War I there was a demand in the United States for protein to replace the quantities of meat which were being shipped overseas, and so interest in groundfish was renewed. The United States government implemented a vigorous "eat more fish and save meat" campaign between 1917 and 1918. But problems associated with transporting the catch to market, and a scarcity of otter trawl gear, limited the fishery's ability to exploit the potential market (Forrester et al. 1978).

Following the short-lived wartime demand, a lack of markets again plagued trawlers, and annual production declined to a level where it would remain for twenty years. The steam trawler Dauntless was forced to discontinue fishing in 1919 because Seattle dealers were only slightly interested in groundfish.

> In fact the last two catches brought in . . . consisting chiefly of deep sea sole, could not be disposed of to fresh fish dealers and consequently had to be sold to the reduction plant (Pacific Fisherman, September 1919:26).

A similar circumstance thwarted the Seaboard Fishing and Navigation Company of Seattle. It remodeled the U. S. torpedo boat Ace for otter trawling but the boat, valued at $125,000, suspended operation early in 1920 because of a lack of markets (Pacific Fisherman, September 1919; May 1920).

Slowly the situation improved and by the mid-1920s several boats were successfully trawling outside Puget Sound. They were joined by the Zarembo and the Warren H in the early 1930s (Pacific Fisherman, April 1935). At this point the fishery took hold and began to expand. The trawler E. L. Smith was used by Coast Fisheries of Reedsport in 1934 (Pacific Fisherman, September 1934); then two San Francisco trawlers, International No. 2 and No. 6, began fishing out of Astoria in 1937. These ships were soon joined by two more San Francisco based trawlers the Catherine Paladini and the Hugo Paladini (Pacific Fisherman, May 1937). In the same year the Roy Chase Fish Company began operating at Reedsport, Oregon, planning to fillet the catch of their company-owned boats, the Waseca and the Queen (Pacific Fisherman, May 1937).

Trawling out of Coos Bay was initiated late in 1938 when the Albacore and the Rogue were "apparently operating on a profitable basis" (Pacific Fisherman, January 1939:42). Several otter trawlers began delivering sole at Newport in 1940 (Harry 1956) and the boats delivering bottomfish at Astoria had increased to twenty vessels (Harry 1956).

The outbreak of World War II led to the rapid expansion of production in nearly all fisheries. Meat supplies were once again diverted to the armed forces, and market demand within the United States for fish protein increased dramatically. Technological advances in fish handling, freezing and packaging had largely solved the problem of delivering fish to distant markets (Forrester et al. 1978). Near the height of the wartime fishery, 1945, 26 million pounds of bottomfish were delivered to Oregon ports (Harry 1956). The fishery also benefitted from wartime developments in electronics which were easily adapted to uses within the fishery.

Fish livers, a rich source of vitamin A, were also in great demand. The livers of the various species of shark, dogfish and soupfin contained the highest concentration of vitamin A and were thus the prime target of trawler nets. The United States landings of all sharks rose from less than 550 tons in 1936 to 26,400 tons in 1944 (Forrester et al. 1978:12). According to a retired Astoria fisherman, the price of livers in Astoria rose from seven cents a pound to, at times, two dollars a pound. He added that when the price for livers was high, valuable food fish were livered and discarded at sea.

The wartime economy created a demand for fish among mink ranchers in Oregon. Mink were normally fed red meat, but during the war the ranchers sought inexpensive fillet scrap and unmarketable fish (Jones and Harry 1961).

By 1948 wartime markets had dwindled and landings had returned to prewar levels. Catches were severely restricted in some ports. Another setback occurred when synthetic vitamin A became available and foreign imports of fish livers collapsed the shark fishery (Harry 1956). Fortunately, the demand for mink food was still high and grew as the fillet market declined.

> A sharp decline in the fillet market fishery in 1953, with little recovery in the following years, caused the demand for fillet scrap to exceed the supply. As a result, an extensive fishery developed for whole fish for mink food (Jones and Harry 1961:14).

Many trawlers were fishing part-time for mink food and those who had lost their fillet market fished exclusively for that market. A plant with freezing and storage facilities was opened at Astoria in 1951 by the Oregon Fur Producers Association, a consumer's cooperative aimed at centralizing and stabilizing the supply of fish and fillet carcasses. A similar operation began at Newport two years later (Jones 1958). Whole fish landed for mink food rose from two million pounds in 1950 to over fourteen million pounds in 1956. This was two million pounds in excess of the commercial fillet market landings for that year (Jones and Harry 1961). Fillets began to gain popularity as food in the late 1950s, and the market has continued to expand.

Commercially adequate quantities of shrimp were located off the Oregon coast by the Oregon Fish Commission in the early 1950s (Pruter and Harry 1952). This fishery began expanding late in the decade and is still growing, with record landings in 1976-1977 and 1978. This boom in the shrimp fishery is attracting many new boats to the Oregon fishery.

Throughout the history of the Oregon otter trawl fishery occasional market ventures which showed some promise of profit sparked fishery expansion and the utilization of innovative practices. Up to the 1930s these innovative practices were most pronounced in gear changes (from beam to otter trawl), greater towing power (from sail to steam to internal combustion engines) and greater efficiency in vessel design (from sailboats to steam tugs to vessels designed for fishing). During this early history of the otter trawl fishery these markets inevitably failed and forced many boats into other fisheries or into retirement, thus stifling innovative behavior.

In the late 1930s this pattern changed. At that time markets stabilized sufficiently to offer a livelihood to fishermen on a continuous basis. Though market fluctuations continue to make a fisherman's life uncomfortable from time to time, there is enough market stability for many fishermen to feel that the fishery's future is reasonably secure. This is an atmosphere where devices and practices which increase landings become an important consideration.

The fishery continues to experience market changes. Many fishermen and fisheries biologists believe the shrimp fishery will soon begin to decline because of overfishing. At the same time, PL 94-265 will open new fisheries, most importantly that of Pacific whiting. The future is uncertain, but one fisherman put it this way: "There's going to be a lot of new boats around here and a lot of them are going to go belly-up, but I'll be around for awhile."[2]

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[2] Quotes from Oregon fishermen are derived from the investigator's field notes or interview data (1978-1979), unless otherwise noted.

CHAPTER TWO

"BEHIND THE SHOVEL": TRAWLING TOOLS

You just can't go out and be a dragger. It takes experience--you've got to put in some time behind the shovel.

Brookings Fisherman, 1978

Life at sea is one of constant motion--a motion which fatigues the newcomer, lulls the experienced. It's a life of smells, a combination of seawater and diesel fuel, of fish slime on the carpet and in the bunks, and the slight stench of the fathometer as it burns a record of the bottom.

It is mostly work. Before dawn to after dark work. Behind the shovel or behind the helm work. It's routine but not monotonous. It's sometimes exciting, sometimes adventurous, always a little different each trip.[3]

A trawl is any manner of pulling a net through water. The term trawl originates from the operation of the net rather than any peculiarity of the net itself (Scofield 1948). In its most common form, it fishes on the bottom, or within a few feet of the bottom, in the habitat of the various flatfishes, shrimp, cod, and rockfish (Browning

[3]Italicized passages are based on excerpts from the investigator's field notes, 1978-1979.

1974). Three types of trawls have been used in Oregon waters: the otter trawl (the only trawl in use in Oregon today), the beam trawl, and the paranzella trawl (Figure 1).

The paranzella, according to Scofield (1948:46), developed from a "beach seine or bag net." This method was introduced in California waters in 1887 by Italian fishermen, and for many years was the only method of trawling in California. It continued to be used into the 1940s. The paranzella appeared on the Oregon banks during brief forays by San Francisco based trawlers, but this fishery was never established in Oregon. The bag-shaped paranzella net is towed by two vessels running parallel to each other to keep the mouth of the net open. The depth the net fishes can be varied by the speed of the vessels (Browning 1974).[4]

The beam trawl, in contrast to the paranzella net, is towed by a single vessel (Figure 1). The mouth of the trawl is held open by a rigid horizontal beam rather than by lines between two vessels. The use of a beam severely limits the size of the trawl "because of the obvious difficulty of dealing with a spar up to 40 feet in length on the rolling, pitching deck of a small dragger" (Browning 1974:124). Although the beam trawl has not been used in the Oregon fisheries since the late 1930s, it is currently being used in the shrimp fishery

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[4]A modification of the paranzella net is still being used by Spanish trawlers on the Georges Bank and other western Atlantic grounds. The Spanish "pareja" trawlers have refined paranzella fishing into a peculiar art and have kept the rather primitive form of trawling alive (Browning 1974).

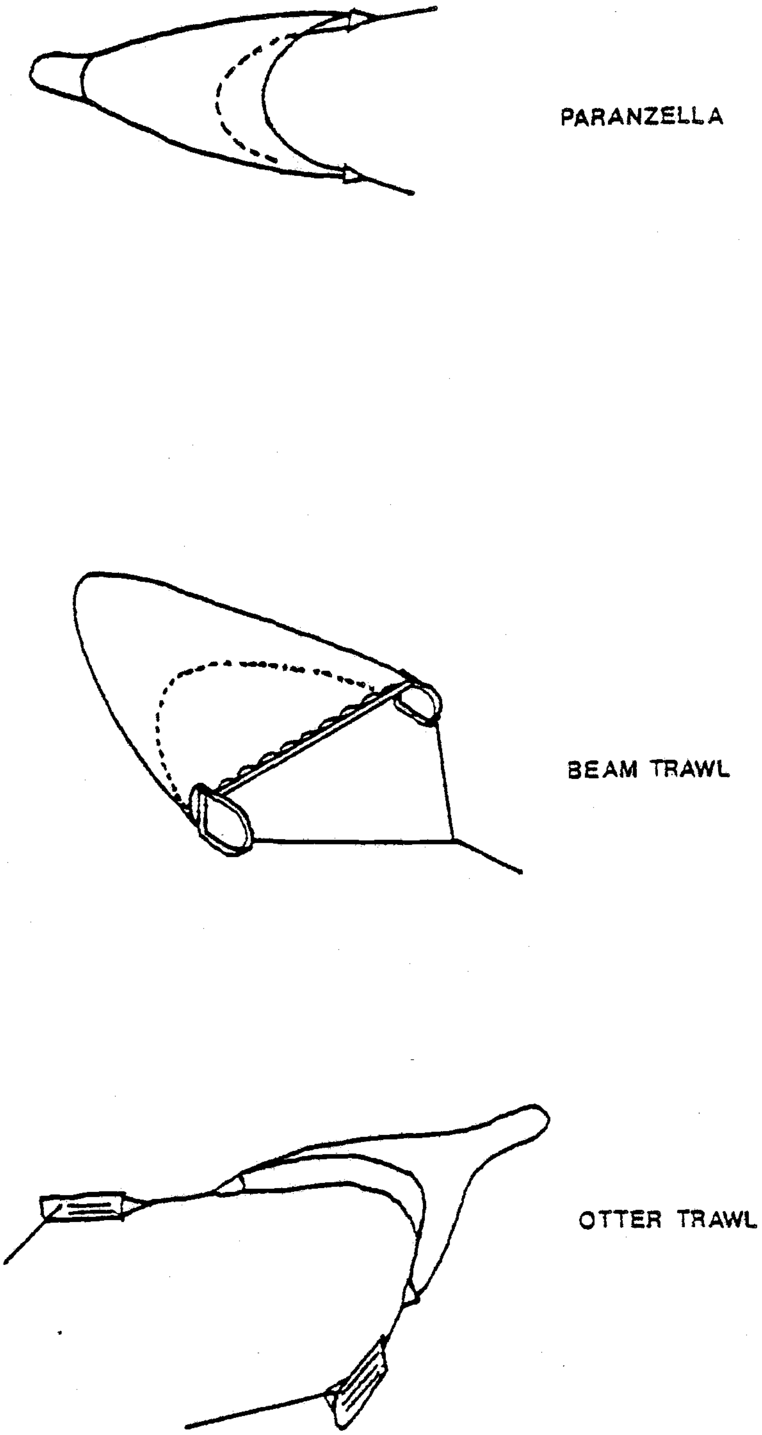

Figure 1. Paranzella trawl, beam trawl and otter trawl.

of southeast Alaska and Kodiak (Browning 1974).

The otter trawl is the most efficient and widely used trawl in the North American fisheries. United States Commissioner of Fisheries H. M. Smith commented in 1915 on the otter trawl:

> The trawl net or 'otter trawl,' is a huge net dragged over the bottom, its mouth being held agape by boards that tend to flare outward as the contrivance is pulled along. When it is considered that the mouth of such a net may be as much as 100 or 120 feet wide one realizes that a whole school of fish might be taken in at a gulp (Pacific Fisherman 1915:19).

The otter trawl was first used by the British about 1860 to exploit fish species of the North Atlantic. However, trawling at this time was

> a 'rough game'; the pay was low and the hardships were most severe, especially during the winter months. Loss of life was heavy . . . and many a weather bitten fisherman preferred to subsist on short rations ashore rather than ship out on a deep sea trawler (Andrews 1959:120).

Browning (1974:125) recounts the origin of the term otter trawl and the operation of the gear (Figure 2).

> The otter trawl is named after the otter gear of the world's navies, the gear used to tow paravanes to support the cables by which mine-sweepers cut mines loose from their anchor cables.
>
> In place of the paravane, the otter trawl uses two foils called otter boards (or doors) attached by bridles to the wings of the trawl. The otter boards hold the trawl mouth open horizontally because water pressure on them under tow tends to move them diagonally away from the vessel's heading.

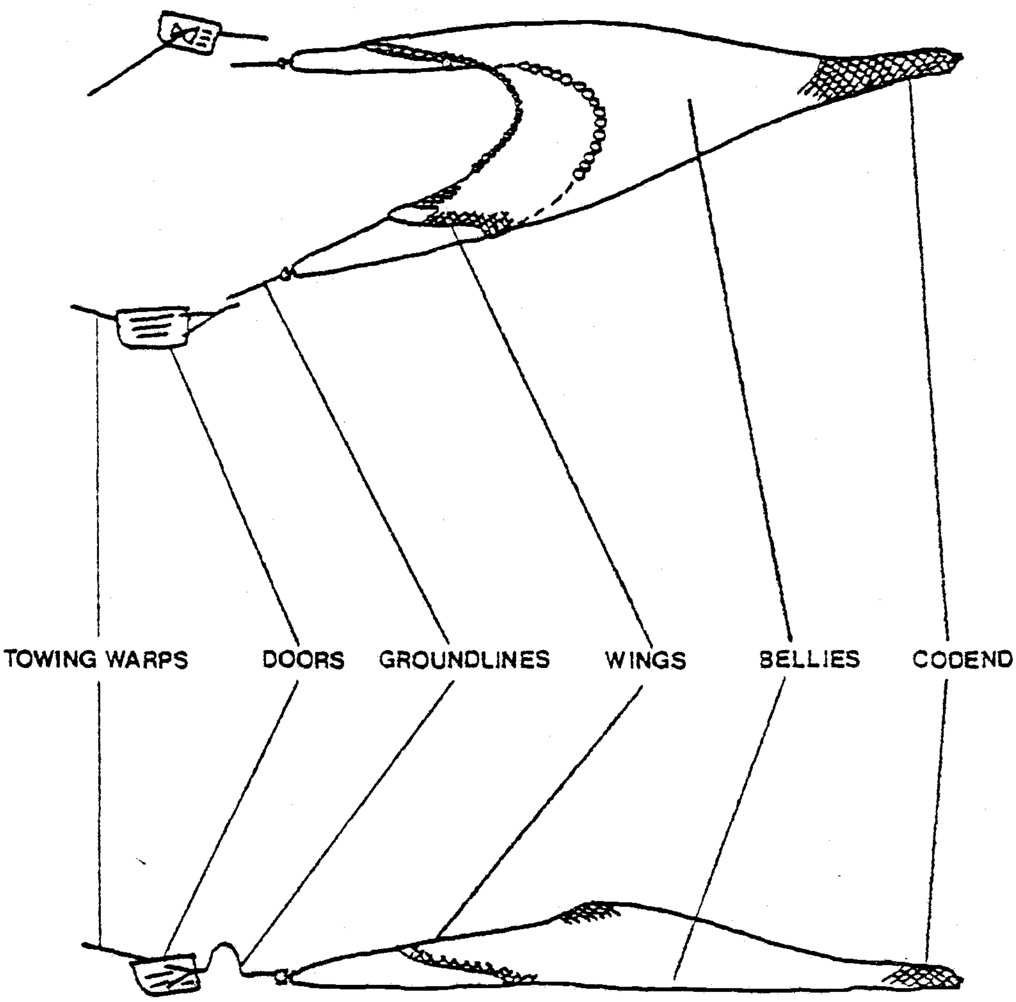

Figure 2. The otter trawl.

> The mouth of the trawl is kept open vertically by a varying number of floats of aluminum, glass, cork, or synthetic seized to the headrope and by a lead line at the foot rope.

The early otter trawls operated with the doors secured directly to the wings of the net. Later, the doors were set at varying distances ahead of the wings connected to them by ground lines; this is the widely used Vigneron-Dahl trawling method. This method affords a greater spread of the mouth of the net and herds the fish toward it (Browning 1974).

The Mandy K seemed to be almost vertical at times, first the bow in the air then straight down into the trough, water spraying up over the house. "The bar is like a goddamn roller coaster this morning, it's gonna be real bumpy out today."

Outside the bar, four hours running until we fish. The crew catches some sleep. Bud, as always, keeps an eye on the boat, takes us where the fish are. A good skipper can always go where the fish are. A good skipper keeps a mental record of all the possible grounds for each day of the year. On an August 25th he can remember where the good tows were on August 25th's of the years before.

The engine slows. Two men stand at the stern on each side of the net reel. The boat moves ahead slowly. The reel whirs as the net is turned off into the water. Hands prevent it from snagging. Next, the groundlines covered in old hydraulic hoses roll off the reel. The reel stops, each man clips his groundlines to the doors. The winches slacken the warps and the doors follow the net.

"How deep!"

"100!"

Loose strands on the warps indicating ten fathoms of cable race off the winches, over the deck, through blocks in the stern and into the water.

"Call 'em!"

"10, 20 . . 40 . . 60 . . 90, 100, all right . . . we're fishin'."

Carl bumps the hatchway as he steps into the house. The Mandy K rolls. A cigarette hangs from his mouth. The first tow is always the best for the crew, nothing to do for two and a half hours. As they sleep, Bud watches the paper machine, alright; checks the loran, calculates "mikes" per hour, adjusts the speed as the net fills with fish; scans the chart, unlocks the autopilot, turns the wheel slightly and re-locks the autopilot. He repeats this over and over until the end of the tow.

There are three methods of handling otter trawl gear that have been used on the Oregon coast. The earliest method was side trawling. These vessels set, tow, and land the net off the side (usually starboard). Blocks secured to a pair of heavy A-frame gallows handle the warps, doors and net (Scofield 1948; Browning 1974). Operating this gear is awkward, the net must be strapped aboard in sections by the boom until the codend can be hoisted over the rail. This "strapping procedure is time-consuming and dangerous with the net and floats swaying overhead subject to every influence of wind and sea" (Browning 1974).

Double-rigging, a common practice on shrimp vessels, has some similarities to side trawling. These vessels will tow a net on each side of the boat attached to heavy outriggers. Net strapping is accomplished through the side trawl procedure.

A second and still popular method is drum trawling. This method uses a large reel mounted in the stern onto which the groundlines and net are rolled (Figure 3). Setting and hauling the gear is much easier and less dangerous with the use of a net reel; only the codend need be strapped over the side. Getting the codend over to the starboard can be a tricky maneuver in inclement weather. The boat must take a turn so sharp that the vessel seemingly pivots on the codend. Once the codend is alongside, the weight of the packed codend leans the vessel to starboard and waves can break over the deck in a heavy sea.

The engine slows, the hydraulic power squeaks on. The crew staggers out the hatchway. As the winches spin, Walt and Carl wind the warps across the spool with a bar. The doors appear and are hung in place. The net reel hauls in the groundlines, they are pushed and pulled by hand until they are laid neatly across the drum. The fingers of Carl's gloves get caught and the reel has to be unwound slightly to free it. He does this twice.

The wings and body of the net roll onto the reel. The Mandy K turns hard to starboard and the codend floats to the side. A wire from the boom is attached to it. The block on the boom strains, too heavy, have to split it. Another wire chokes off the rear section of the codend and lifts it. The rest of the catch slips forward in the net,

Figure 3. Drum trawler

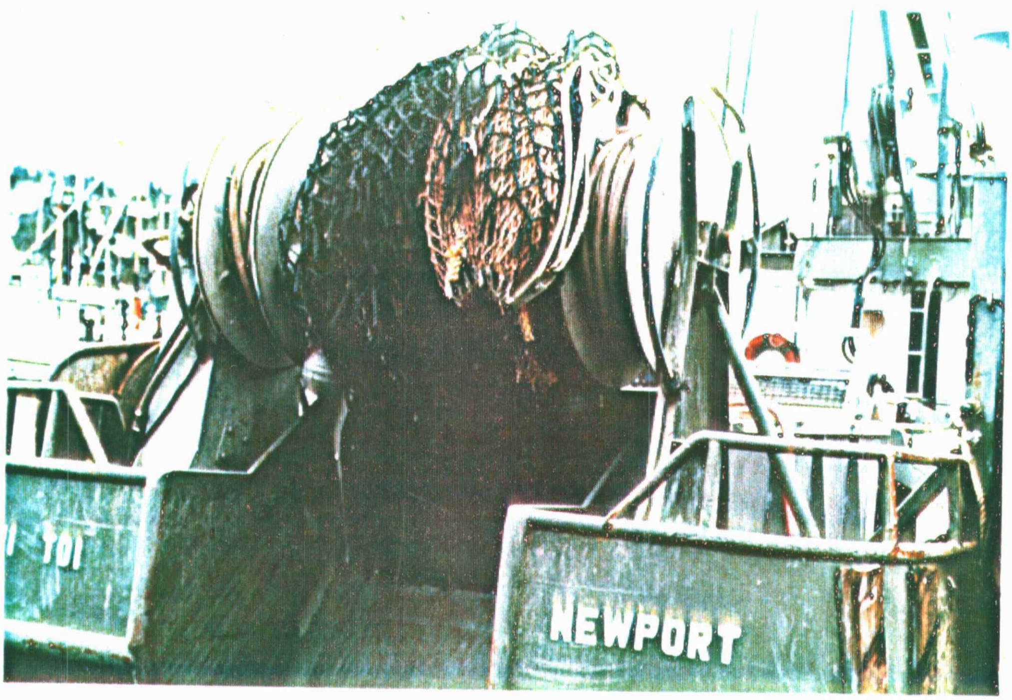

Figure 4. Drum trawler with stern ramp

out of the way. The block strains, slips a bit; "have to get that fixed someday." Water surges through the scuppers. This is a dangerous operation on a big sea. A deck can be swamped, deckhands lost. The codend hangs over the deck. Walt tugs the pucker-string. Again. Goddamnit. It pops; its load slips to the deck.

The wire is removed from the codend and it is tossed back into the water. A few shakes on the net by the boom and the codend is full and strapped aboard again. When the net is empty it is rolled onto the net reel.

There are too many skates, maybe 200 pounds "and no market for the goddamn things."

"Not a bad tow, though; think we'll try just to the west."

The newest method of gear handling on the Oregon coast is stern trawling. This method uses a ramp or spill-way in the stern of the vessel through which the net is set and hauled. The net is handled by winches and blocks from a gantry rather than a boom used on other trawlers.

A combination drum trawler with a stern ramp has been in use in the Oregon fisheries for about seven years. The vessels are set up in the same manner as the drum trawler with the addition of a stern ramp (Figure 4). The net can be hauled through the ramp and the codend hoisted from under the net reel, alleviating the danger of strapping the net over the side or turning the vessel into the weather. The trawl may be towed by a variety of large and small vessels. Oregon coast trawlers range in size from a 30 foot, 65 horsepower, navy surplus lifeboat to vessels in the neighborhood of 100 feet, with over 800 horsepower. The most common Oregon coast trawler today is between 50 and 70 feet long and 200 to 400 horsepower.

Various types of vessels have been used for trawling off Oregon. The oldest type, still used by many trawlers, is the schooner (Figure 5). Schooners were best adapted to side trawling as the gallows were easily mounted fore and aft and the net could be handled in the waist. Most schooners are old longline vessels, and many date to the 1920s. The oldest, the Jenny F. Decker, was built in 1901 and converted from halibut longlining to trawling in the early 1950s.

The house on a schooner is positioned to the rear and makes it slightly awkward to adapt them to drum trawling, but virtually all the schooner type vessels in the trawler fleet have made this conversion.

A vessel better suited to drum trawling, and used extensively in Oregon, is the conventional, house forward type. These vessels range from wooden purse seiners (Figure 6), to Gulf shrimpers (Figure 7), to modern whaleback designs (Figure 8). The open back deck on these boats make handling of the gear simpler and the change to an innovation, such as a stern ramp, is easier on these vessels.

A recent addition to the Oregon fleet is the modern stern trawler (Figure 9). These boats are large, powerful, and expensive. On many the engines are mounted in the stern for optimum performance and to provide extra hold space. The gear is handled by blocks and winches mounted to gantries aft and amidships. These boats are aimed at the mid-water hake fishery. However, most of these vessels are constructed so

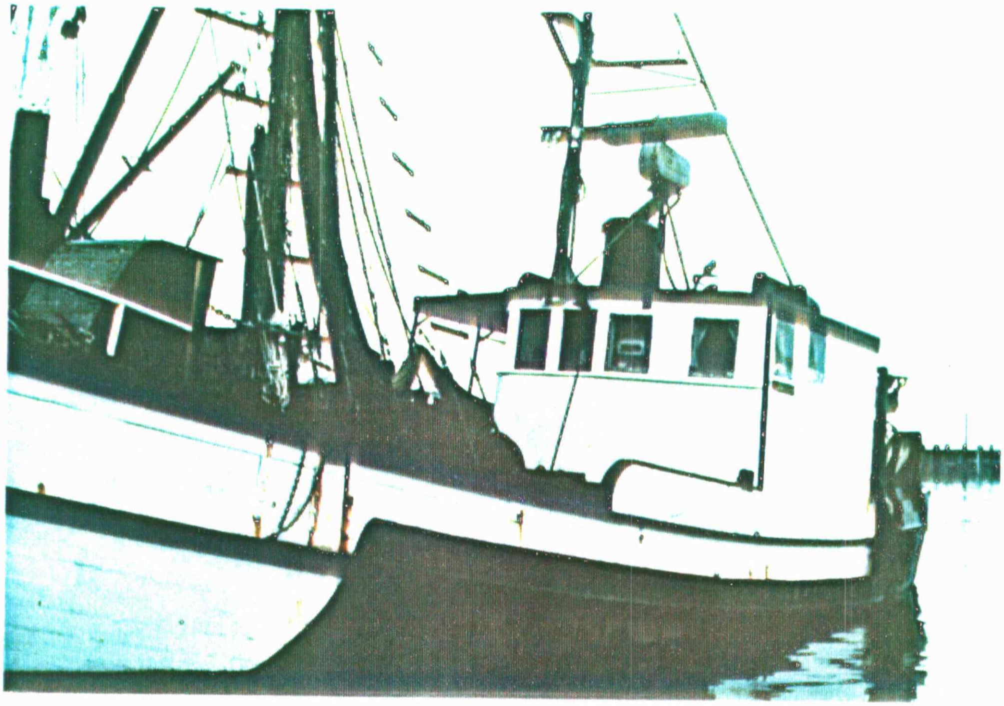

Figure 5. Schooner - trawler

Figure 6. Purse seiner

Figure 7. Gulf shrimper

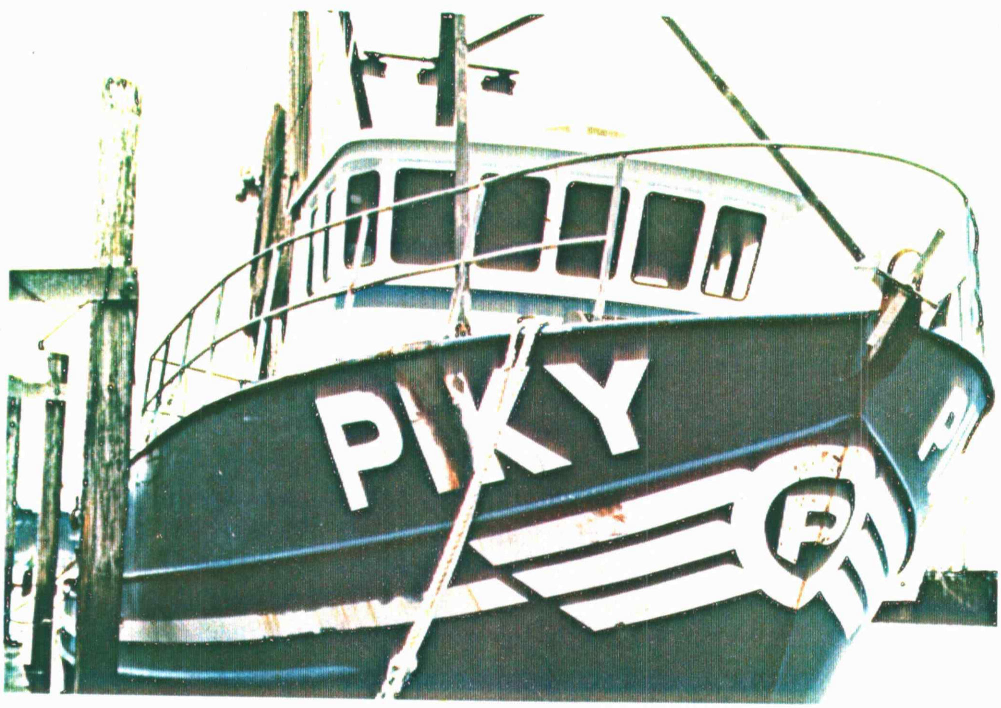

Figure 8. Whaleback

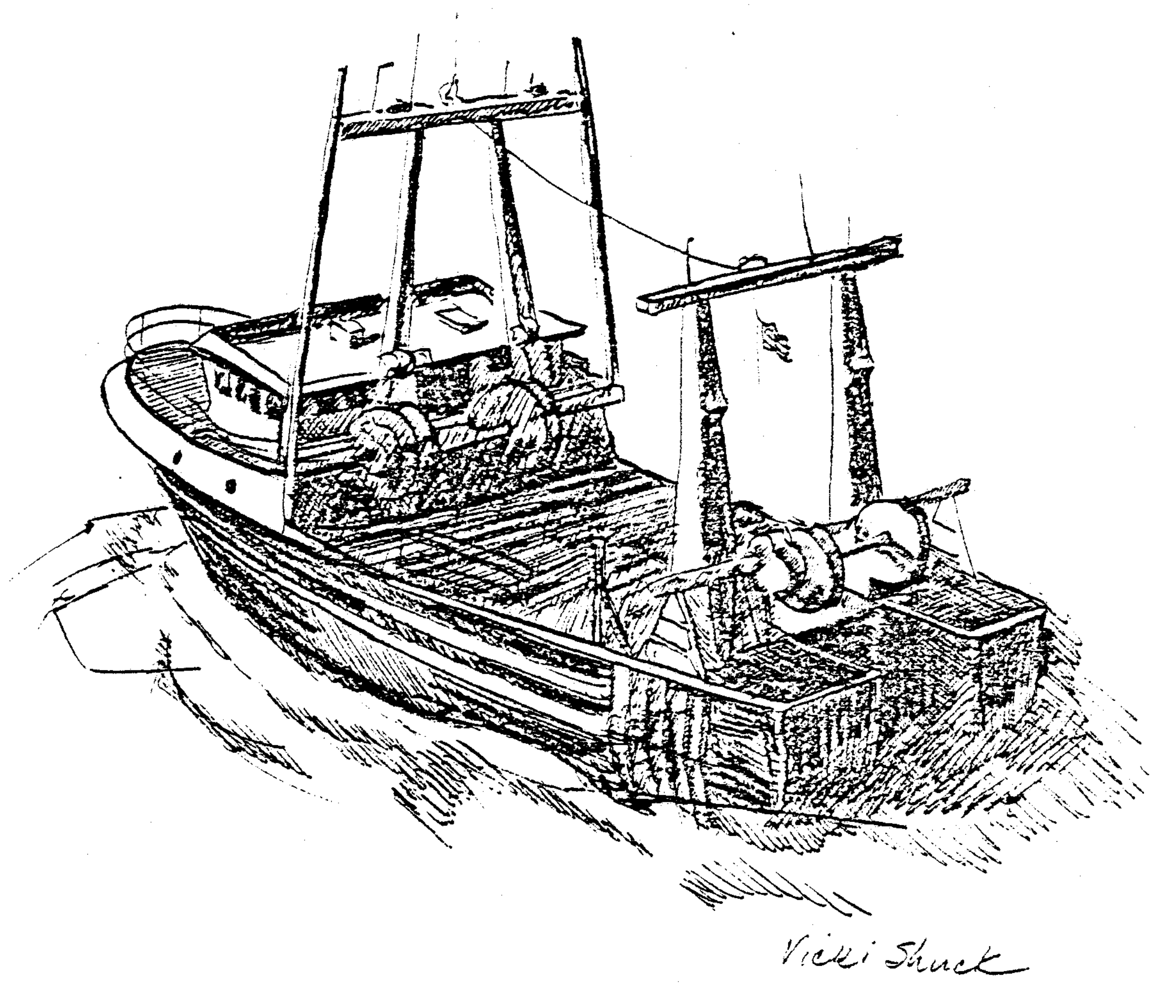

Figure 9. Modern stern trawler.

that the gear can be changed quickly to the various bottom fisheries. The stern trawlers are sophisticated vessels and will probably sound the death knell for traditional Oregon coast trawling.

During the second tow the catch from the first is sorted by species and what the packers will buy. The largest trash fish are the first to go, skates are tossed over the side with an easy motion of the spike. Crabs scurry about, claws erect. Almost everything is dead, suffocated, brought up too fast. Many fish are not marketable, a lot goes overboard.

Down to market fish now, the bins are full. Dover go here, rex there, petrale there, English there, everything else over there. Ice picks move keepers to the right bins move those too small over the side. The seagulls gorge themselves.

The hatch screeches as it slides from the hold. Shovels full of petrale slide down the wooden ramp positioned to direct them into the correct stall. The sound of shovel and ice ring from within. The ramp moves to the next stall.

"Dover now!"

The Mandy K rocks in the swells. Fish in the bins shift with the roll. Walt, standing in slippery product, tips backwards toward the rail. Regaining his balance, his eyes twinkle, "almost bought it that time."

The deck clear, the catch iced, the crew stretches in their bunks, booted feet hanging off the edges; open a fresh pack of Camels, half an hour left on this tow.

The tow is over. Silently to the back deck, each knows what to do. Another good tow, we've covered the area though, time to move.

Oregon coast trawlers have always had their standard gear, such as nets, winches, compass, but within the last 35 years many electronic devices have been added to the trawler's list of basics for success. This equipment assists in navigation, communication, and the location of fish populations. The devices may cost thousands of dollars, but most fishermen will not fish without them.

The basic array of electronic gear found on trawlers includes one or more fathometers, a loran, an autopilot, several two-way radios of various frequencies, and perhaps radar. Fathometers are of many types ranging from digital to "paper machines" which record depth and bottom configuration on paper. The latter types may be used to locate fish which appear as a distinct grey haze on the paper.

The loran is a navigational device which sends and receives signals to and from onshore beacons and computes the position of the vessel within a thousand foot radius. The older A-lorans are currently being phased out by the United States government in favor of the more accurate C-loran--the Coast Guard has switched its signal beacons to the C-loran signal and has plans to eventually close down the A-loran signal. Loran is also used to pinpoint the location of fishing grounds.

The autopilot or "iron mike" holds a vessel to a determined course and may prevent the fatigue associated with holding a course by hand. This may be especially useful on long runs or during tows, or on a heavy sea.

Two-way radios, which were unheard of on fishing boats until the 1940s, are now part of the way of life for trawlers. Beyond their value for emergencies and in providing entertainment, they serve as the medium for a fisherman to communicate the position of fishing grounds to members of his clique group and as a source of information on new developments (technological, social, political) in the fishery. The citizen's band and VHF frequencies are most commonly used.

Radar is in general use on trawlers. It is beneficial in navigating channels and running at sea when visibility is poor. And because it offers the capability of fishing in situations of poor visibility, the number of days one can fish is increased.

Many devices being used to scan bottom configuration are useful, including sonar. Sonar permits a trawler to fish close to reefs and rockpiles and avoid damaging his net or hanging up in rocky areas. A plotter which can be used in conjunction with the C-loran is also gaining popularity. The plotter will actually record a course taken on a tow, for example, so that it can be duplicated at another time. Some plotters are designed to direct the autopilot to steer a predetermined course.

Further, there are scale expanders used with fathometers to give a more detailed image of the bottom; mono-scopes which make more peripheral soundings than sonar; and net sounders which locate the depth and position of a net (used in mid-water trawling); and so on. Whereas a trawler used to fish by intuition and feel, he may now prospect for and take fish using the electronic senses of his vessel.

After a short run to a new area the net is set. This tow will be short, it's getting late, everyone is tired. The codend comes aboard in one haul this time. The deck lights go on, it's getting misty. An hour and a half behind the shovel and it's 10:00.

"Sandwiches tonight, too tired to fix anything else." Leaning in the hatchway, Walt smiles, fish slime in his beard.

The engine is shut down, always a relief. The sea can be heard now. The conversation is muffled with mouthfuls of bread and tunafish.

"Well, I wouldn't mind crabbin' in Alaska. I put in a season off California. Can think of worst ways to make a livin'."

"Did you run into ol' __________ when you were down there?"

"Who?"

"I heard they ran him out of Crescent City, won't let him tie . . . ."

"Oh, you mean __________. Yeah, that sonovabitch. He used to steal out of everyone's pots. Yeah, they won't let him in Crescent City anymore."

"Sounds like a good way to lose more than moorage."

Yawns are frequent. Bud heads for his bunk, he's been awake all day and will be the first awake in the morning.

The radios stay on all night, to get warning of bad weather or emergencies. A man from another boat fell overboard in the night. Reports from boats searching for him woke us occasionally.

Long before sunrise the V-12 Cummins diesel turns over.

"Five o'clock boys, rise and shine. Another day another dollar!"

CHAPTER THREE

"A COMPASS, A SOUNDING LEAD, AND A NET THAT ROTTED: DIFFERENTIAL ADOPTION, CURVES AND CATEGORIES

Forty-odd years ago when I started fishin' all we had was a compass, a sounding lead, and a net that rotted. Nowadays, they've got electronics that'll tell you where you are, how deep the water is below you and nets that instead of worrying about bathin' 'em and dryin' 'em, you just wait for them to wear out or get torn up 'cause that's the only way you'll get rid of them.

Retired Astoria Fisherman, 1978

The changes from compasses to lorans, from sounding leads to fathometers, and from cotton to synthetic nets, are but a few examples of the innovations that have been introduced and adopted by Oregon otter trawlers since the 1930s. Though the trawler's basic methods have not changed radically, their tools have been changed by new materials, new designs and electronics. Each of these changes followed a process of diffusion from innovative fishermen to adoption by other fishermen.

Research Procedures

How is it that an anthropologist is studying fishermen?

Well, anthropologists study people and fishermen are people.

Huh, we've never had a biologist like you out here before.

The approach of this thesis is primarily ethnographic, thus the data are derived from field investigations. These data are supplemented by a search of the historic literature pertaining to the Oregon otter trawl fishery. The data from these combined sources are analyzed in light of the theoretical literature on the diffusion of innovations.

The historic literature includes sources pertaining to the development of fishing technology (e.g., nets, gear, vessels) worldwide and in Oregon waters. Information detailing the introduction and diffusion of this technology was gathered from several sources, most importantly, various issues of Pacific Fisherman, a long-published journal devoted to the Pacific coast fishing industry. In addition, Harry's (1956) biological analysis of the Oregon otter trawl fishery provided data on the dates of introduction and vessel installation of several technological innovations. Oral histories, gathered during field investigations, proved to be an important source of information on the diffusion of specific innovations.

Do you remember who installed the first loran in Astoria?

Yes, it was, ahh, Viekko Rampannan.

Tell me about him what kind of man was he?

He was a good man. . . a good operator.

Did he experiment alot?

Oh yeah, he was always foolin' with something new or an idea of his own.

What did other fishermen think of him?

We liked him, all of us. He had some good ideas and he shared his advice.

I spent nine months involved in field investigations, beginning in late June of 1978. One month was devoted to developing rapport with informants and conducting preliminary, open-ended interviews in trawl ports along the Oregon coast including Astoria, Garibaldi, Newport, Winchester Bay, Charleston and Brookings. Six weeks were spent on board several draggers and shrimpers as a participant observer and conducting open-ended interviews. During this period I attempted to absorb all the literature did not provide about the technology of the fishery and its operation.

With the coming of autumn, interviews became more specific as to the questions asked and port focus. These interviews were conducted primarily in Astoria, Newport and Charleston, sites of the largest concentrations of otter trawlers. An average of two days per week were spent interviewing for six and one half months. Many of these interviews were with key informants who were contacted on several occasions. Informants included working and retired fishermen, marine extension agents, fishing gear suppliers, fishery biologists, net fabricators, marine electronics suppliers and other individuals connected with the fishery.

As a result of the field investigations and the literature search some definite conclusions were reached as to how innovations diffuse in the Oregon otter trawl fishery, what factors influence the rate of adoption, and what the characteristics are of the individuals involved in the diffusion process. In order to validate the ethnographic data, a questionnaire was administered by telephone which focused on the diffusion of innovations and demographic data (Appendix A). The sample was 62 Oregon shrimpers and draggers from a population of 213. Respondent names were selected from the 1978 Oregon Otter Trawl Commission boat roster. The roster is organized by vessel name arranged alphabetically. This list was followed by letter until the sample included 30% of the population.

> *Hello, this is Garry Stephenson from Oregon State University. I'm involved in a Sea Grant project part of which deals with how new ideas spread through the fishery. I wonder if I could ask you a few . . . .*

Figures 10 and 11 show the gross earnings for the fiscal year 1977-78 for each boat in the survey and the entire otter trawl fleet. Note that the survey (Figure 10) in comparison to the fleet (Figure 11), has fewer cases in the low income categories. The survey is biased toward higher income fishermen. There are important factors which account for this.

First, fishermen are a very mobile population. It is not possible to contact every person listed on a roster by telephone; people move, are not home, have no telephone et cetera. Liao and Stevens (1972) encountered a similar problem investigating the characteristics of Oregon fishermen. They were able to obtain only 71% of their intended sample size.

Telephone calls were made to 89 boat names; 62 respondents completed the questionnaire. This is approximately a 70% return, very close to the response Liao and Stevens report.

Of the 27 persons who did not respond to the questionnaire, 16 showed no telephone number listing; seven did not answer their phones (attempts

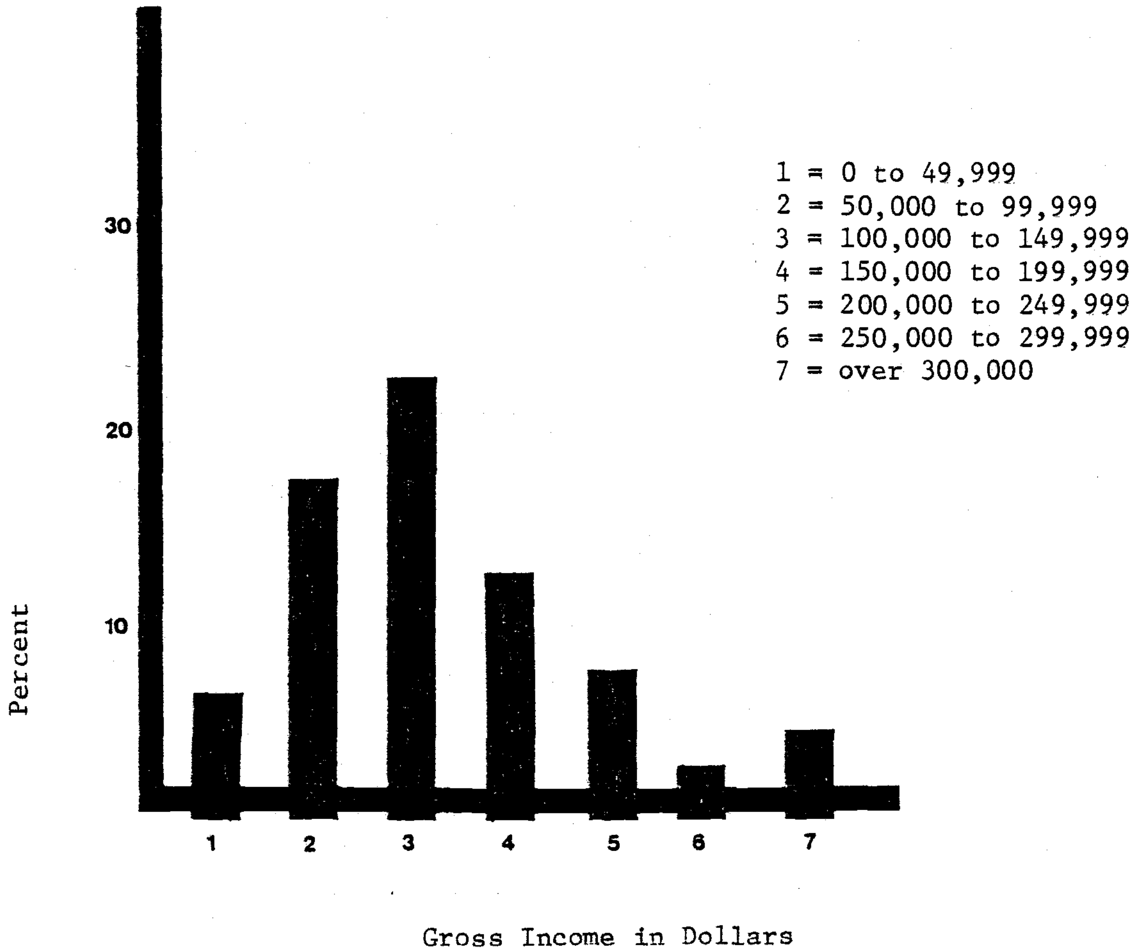

Figure 10. Distribution of gross earnings in the sample for fiscal year 1977-78, N=62 (Data from Oregon Otter Trawl Commission).

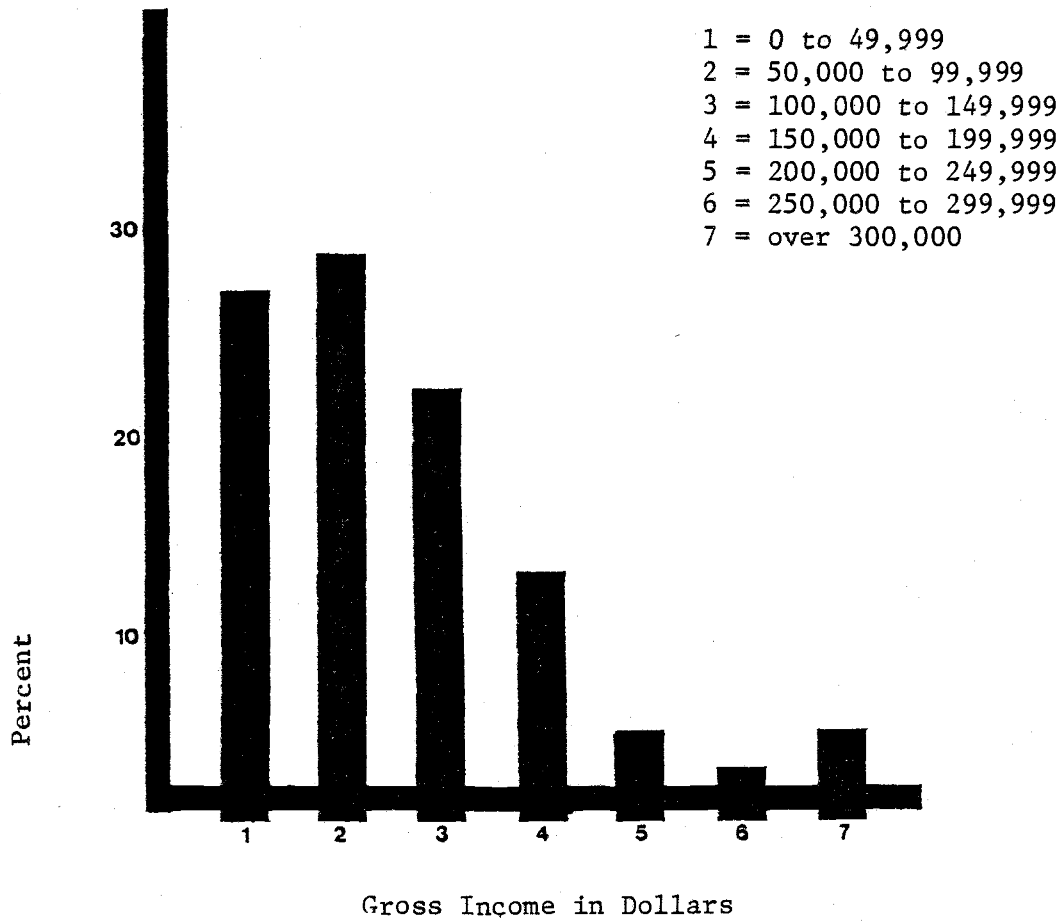

Figure 11. Distribution of gross earnings in the fleet for fiscal year 1977-78, N=213 (Data from Oregon Otter Trawl Commission).

to contact these persons were made on several occasions); and four had moved into an out-of-state fishery for the season according to family members. It is very possible that the low income group under-represented in the sample is included among the persons who could not be contacted.

In the chapters which follow, the theoretical literature on the diffusion of innovations is evaluated with data gathered on the Oregon otter trawl fishery. Utilizing historic and survey data, this chapter investigates categories of adopters of innovations. Chapter Four employs ethnographic and survey data to outline the characteristics of the individuals involved in the innovation diffusion process. Chapter Five also uses ethnographic and survey data to investigate the factors which influence the adoption of innovations and the rate at which they are adopted. Historic, ethnographic and survey data are then integrated in Chapter Six to describe the process of diffusion of innovations in the Oregon otter trawl fishery.

Differential Adoption: Curves and Categories

A subject discussed at length and even debated at times by social scientists is the pattern of adoption of innovations. All theorists and researchers would agree that the response to an innovation by a group of people is typically differential. Some people adopt the innovation quickly, some later, and some, perhaps, do not adopt the innovation at all (cf. Barnett 1953; Ryan 1969; Hagen 1972).

Rural sociologists have found individuals take widely varying lengths of time to adopt an innovation. Some Ohio farmers reported adopting 2,4-D weed spray within one year of when they became aware of its existence. Others took up to nine years to adopt the herbicide (Rogers 1961).

The pattern of adoption of innovations over time has been a focus of diffusion research (particularly in rural sociology) since the late 1930s. Many researchers have developed an "adoption curve" by plotting the number of individuals, or the cumulated percent of a population, adopting an innovation over time. In their classic study Ryan and Gross (1943) report a cumulative S-curve in the adoption of innovations. Lionberger (1960:80) uses the S-curve as an explanation of innovation adoption.

> Ordinarily, adoptions are very slow at first. After an initial slow start, they increase at an increasing rate until approximately half of the potential adopters have accepted the change. After this, acceptance continues, but at a decreasing rate. A curve . . . may be obtained by graphically plotting the number of persons accepting a specific change against a scale of successive years with those accepting in all previous years successively added in. This gives the characteristic S or <u>growth</u> curve.

But Perry and others (1967) demonstrated that the adoption curve more closely resembles a J-curve--innovations in their studies initially were adopted at a rapid rate. They contend that perhaps "innovation is rapidly becoming a norm": therefore, an S-curve may no longer be applied in agriculture (Perry et al. 1967:222).

Many researchers (cf. Pemberton 1936; North Regional 1952; Rogers 1958, 1971; Rogers and Beal 1958; Bohlen 1961) prefer to plot the curve simply by the number of individuals adopting an innovation within a specific time period. This method reveals a normal curve which conveys the same information as the S-shaped curve, that is, a small number of individuals adopt an innovation early and serve as the left tail of the curve. They are followed by a larger number of later adopters who are followed by the majority of adopters. Those lagging well behind in the adoption process are few and form the right tail of the normal curve.

Mindful of these theoretical expectations let us examine the adoption curve for a post World War II innovation in the Oregon otter trawl fishery. Harry's (1956) biological analysis of the Oregon otter trawl fishery records the dates of introduction and boat installation of several innovations of the late 1940s and early 1950s. One of these innovations was the fathometer. The fathometer was one of the first wartime developments in electronics to be utilized by Oregon trawlers. It was introduced into the Oregon fishery in 1940 by the vessel Flint. The following year three more vessels adopted the device. World War II caused a shortage in supply, after which fathometers were adopted at an increasing rate. Finally, the adoption rate diminished as most of the fishery had adopted the innovation. By plotting the number of installations of fathometers on vessels by the year of installation a normal curve is revealed (Figure 12). This supports the theoretical notion that a normal curve (or an S-shaped curve when the data are plotted on a cumulative basis) reflects the adoption process--early adoption by a few individuals, growth, then decline as later adopters accept the innovation. A close examination of the adoption curves for seven innovations that Harry (1956) recorded shows the innovations were not always introduced by the same individuals (Appendix B). In some instances the innovator of a device had a history of late adoption behavior. To

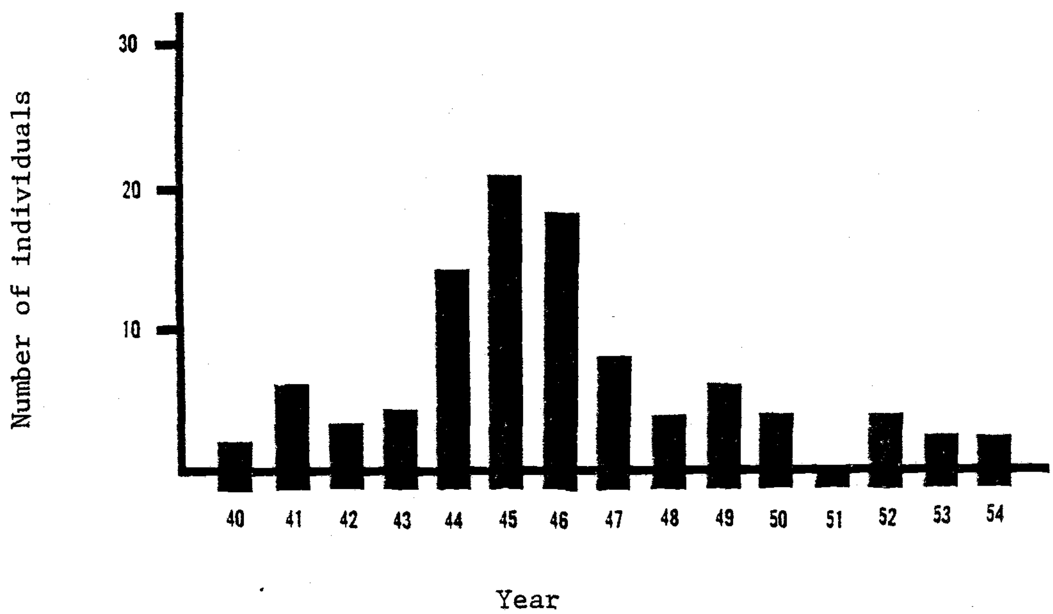

Figure 12. Adoption curve of the fathometer (from Harry 1956).

further analyze the diffusion process in later chapters it will be necessary to isolate specific adopter categories, particularly the innovator. But if we delineate adopter levels based upon one innovation, as is the common practice among rural sociologists, we run the risk of labeling someone as an innovator who rarely innovates. As a solution to this problem a sample of 62 present-day members of the Oregon otter trawl fishery were surveyed by telephone and their degree of innovativeness evaluated on three dimensions determined from the ethnographic data: 1) whether they had any of several specific innovations which have been recently introduced to the fishery on their vessel (C-loran plotter, sonar, stern ramp); 2) how innovative several specific devices on their vessel are (fathometer, net, radar); and 3) what their attitude toward innovations is (what they would do with extra money, how they feel innovations contribute to earning a living). These scores were summed and divided into eight intervals reflecting the degree of innovativeness. When these data are plotted by number of individuals and degree of innovativeness, a distribution results (Figure 13). This distribution for Oregon otter trawlers indicates a small group of innovative fishermen, a large group of fishermen who are less innovative and a small group of fishermen who are the least innovative of the fishery.

Various titles have been used to identify individuals as to their innovative behavior. For example, in 1952 the North Central Regional Rural Sociology Subcommittee identified adopter levels as innovators, community adoption leaders, local adoption leaders and late adopters. Later analysis of adopter distributions led rural sociologists to categorize farmers on the basis of the time they take to adopt new practices.

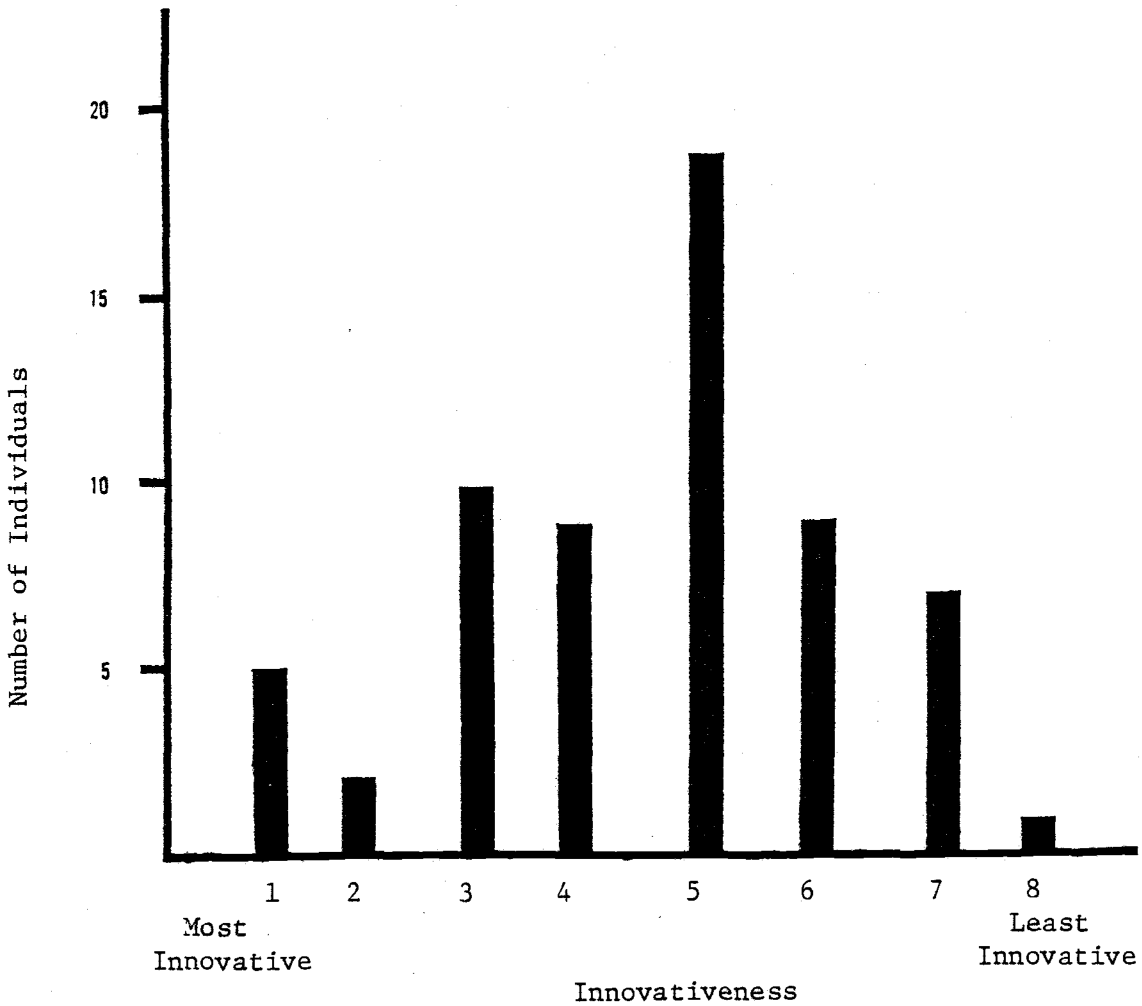

Figure 13. Distribution of innovativeness and adopter categories in the Oregon otter trawl fishery. for 1978 from telephone survey, N=62.

Using this method farmers have been categorized as innovators, early adopters, early majority, late majority and laggards (Rogers 1958; Bohlen 1961; Rogers and Shoemaker 1971).

Rogers (1958) created his categorization of adopters by determining the mean of the adoption curve,[5] and using the standard deviation to represent an adopter category, subtracted the standard deviation to the mean three times to represent the innovator, two times for the early adopter, and once for early majority categories, then added the standard deviation from the mean once to represent the late majority and twice to represent laggard adopter categories (Figure 14).

Roger's (1958) method for dividing up the innovativeness distribution was applied to data from the survey of the Oregon otter trawl fishery (Figure 15). The vertical dashed lines in Figure 15 show the categories of adopters. For group comparisons in Chapters Four and Five, the innovator and early adopter categories have been consolidated into one "innovative" category.

In summary, the process of adoption of innovations in the Oregon otter trawl fishery when plotted reveals a normal curve. Adopter categories in the fishery are delineated by applying Roger's standard deviation from the mean formula to this curve.

[5] Presser (1969) has criticized the use of the normal curve to determine adopter categories because "there is no sound theoretical basis for awarding adopter categories to proportions or percentages of the population. It is a matter of convenience . . . ." He does admit its general use would standardize data (Presser 1969:513).

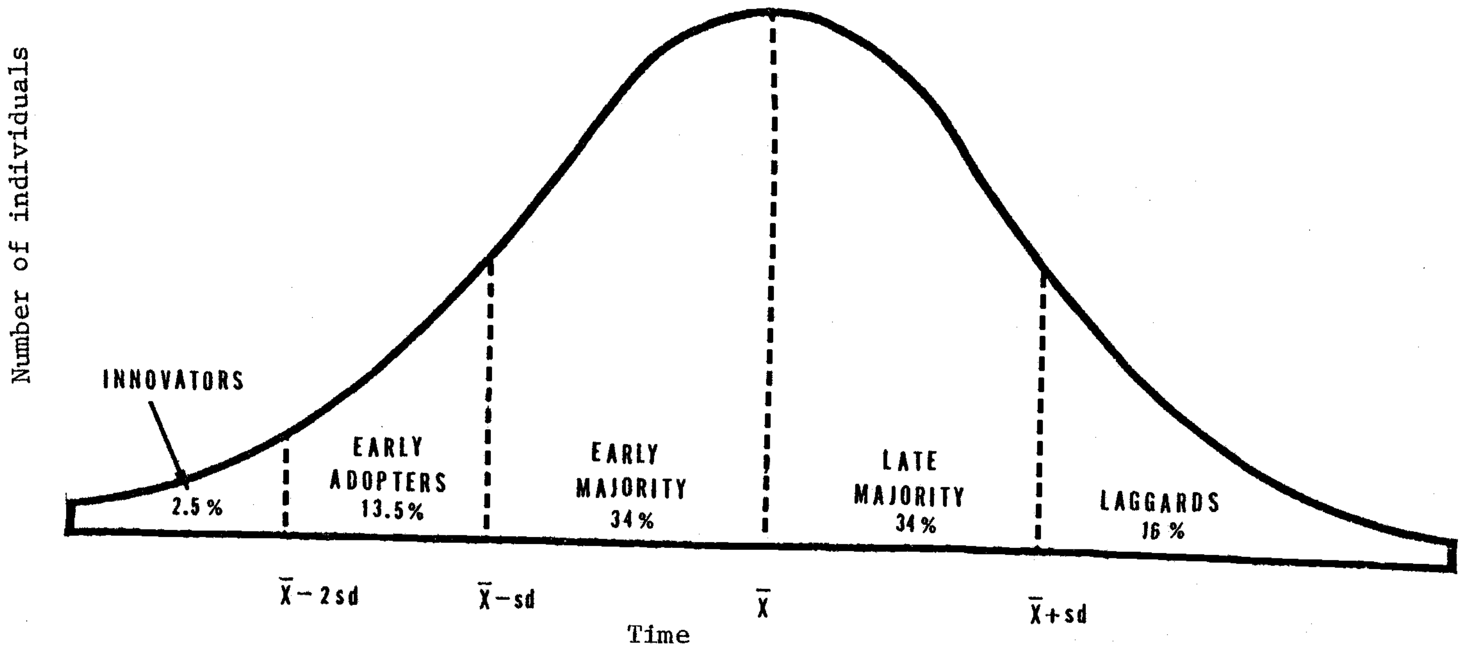

Figure 14. Categorization of adopters based on standard deviation from the mean (after Rogers and Shoemaker 1971).

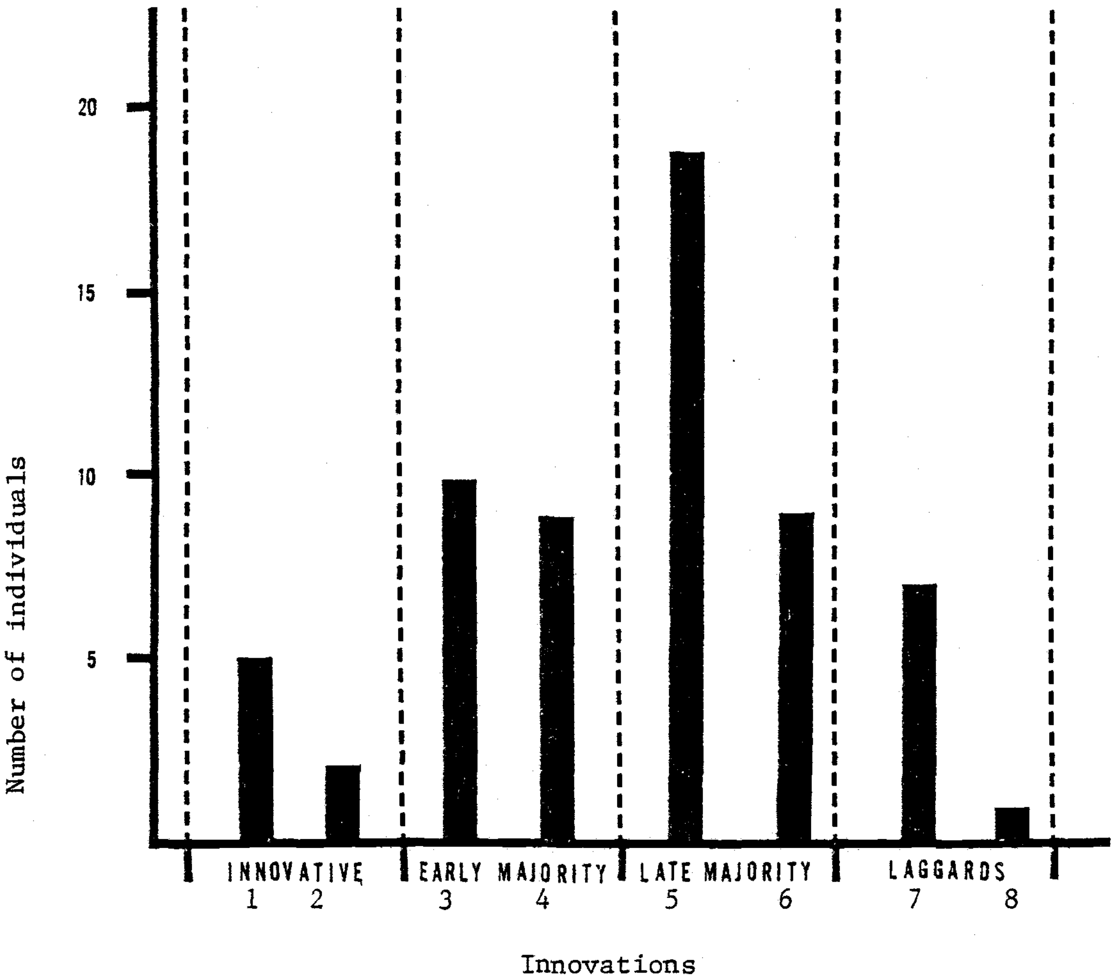

Figure 15. Distribution of innovativeness and adopter categories in the Oregon otter trawl fishery for 1978 from telephone survey, N=62. Innovative category combines Roger's (1958) innovator and early adopter categories.

CHAPTER FOUR

"OR A GUY FISHES LIKE A CRAZY MAN": CHARACTERISTICS OF THE PEOPLE INVOLVED

There are three ways of looking at it, either a guy is so strapped he can't make the payments on his boat let 'lone improve it; or a guy figures out what he needs to pay his bills, keep things running and stash a little away at the end of each season; or a guy fishes like a crazy man.

Charleston Fisherman, 1978

The previous chapter demonstrates the existence of general categories of otter trawlers based on their adoption behavior. The data thus support much of the theoretical literature, which also suggest that there are differences not only in adoption behavior between the categories of adopters, but in other behavior as well. This chapter investigates the characteristics of the different adopter categories of Oregon otter trawlers.

There is a marked difference between "innovators" and those who adopt innovations later in the cycle. The diffusion literature finds that usually innovators are unusual individuals, sometimes even marginally or imperfectly integrated into their community. Typically, these people repeatedly develop or adopt innovations despite the fact that they may be ostracized or set apart in their community. Only after the innovation is established and/or proved to be obviously profitable will it be accepted by the remainder of the community. A few people will adopt innovations only after everyone else, if they adopt them at all (cf. Barnett 1953; Merton 1959; Ryan 1969; Rogers and Burdge 1972).

Rural sociologists have demonstrated a continuum in age from innovator to laggard, with innovators being the youngest (Lionberger 1960). The survey data show no appreciable difference in the average age of each adopter category; all fall between 42 and 45 years of age. The distribution of age groups within each adopter category is interesting. All laggards are between 35 and 50 years old while the ages of the innovative are split: under 40 years old or over 50 years old. Although some of the more youthful members of the otter trawl fishery are innovative, many of the older members are innovative as well. In fact, of all the adopter categories the highest percentage of individuals over 50 years old exists among the innovative. Among the innovative 33% are over 50 years old compared to 20% for the early majority, 23% for the late majority and 0% for the laggards. Age, then, is not an important factor when considering innovativeness in the otter trawl fishery.

Coleman (1957) found innovators were more cosmopolitan; that is, innovators get outside their community and travel farther than later adopters. Innovative fishermen in the Oregon trawl fishery, according to the survey data, are no more travelled than other adopter categories. However, when innovative fishermen do travel, according to field data, it is often to see an innovation in practice or to attend workshops related to the trawl fishery. Later adopters do not show this behavior. Still, even though their motives for travel differ, it is difficult to call innovative fishermen more cosmopolitan than later adopters.

Examining the activity of fishermen in formal organizations we find that no one adopter category has a higher percentage of members in fishermen's organizations nor higher attendence of meetings than any other adopter category. The field data indicate the position of the innovative fisherman in an organization is usually higher than later adopters, in that they may hold the important positions such as a seat on the board of directors or council membership.

The sources of information on an innovation are important and change during the adoption process. Ryan and Gross (1943) found that during the first years following the introduction of hybrid corn seed, the media, including salesmen, radio advertising and farm journals, accounted for 70% of the information sources for the innovation. Later, as the innovation diffused, neighbors became the major source of information, accounting for more than 60%. Neighbors were also considered the most influential in deciding whether to adopt the seed.

Adopter categories also differ as to their source of information on innovations (Ryan and Gross 1943). This is true for members of the Oregon otter trawl fishery. Note in Table 2 that for innovative fishermen the primary source of information on an innovation is through various journals and publications. They do not depend on nor do they consult the "grapevine" for information on innovations. Conversely, the later adopter categories only rarely consult journals and depend to a large extent on the grapevine as a primary source of information on innovations.

Innovative fishermen as shown in Table 3 have among the highest gross earnings for landings of fish and shrimp.[6]

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[6] The data are based on the gross earning of each vessel. The income categories were determined by adding or subtracting the standard deviation from the mean.

TABLE 2. Sources of Information on Innovations of the Adopter Categories

Source	Innovative	Early Majority	Late Majority	Laggard	
Journals, Publications	83%	31%	17%	13%	
Other (including extension service, travel, and invention)	17	25	13	13	
Word of Mouth	0	31	69	56	
No Response	0	13	1	18	
N	6	16	24	16	62

Chi square = 15.3, $p<.01$, df = 6

TABLE 3. Degree of Innovativeness and Gross Income

Gross Earnings 1978	Innovative	Early Majority	Late Majority	Laggard	
>190,217	33%	31%	13%	0	
123,572-190,216	67	31	20	19	
56,925-123,571	0	38	58	50	
<56,924	0	0	8	31	
N	6	16	24	16	62

Chi square = 22.6, $p<.005$, df = 9

Note: The data are based on the gross earnings of each vessel for fiscal year 1978. The income categories were determined by adding or subtracting the standard deviation from the mean. Mean = 123,571; standard deviation = 66,646.

The data also show the less innovative a fisherman is, the lower his gross earnings are. This is in line with Lionberger's (1960) contention that the innovative have higher incomes than later adopters, and Coleman's (1957) evidence that the innovative have the largest operations of all the adopter categories. Some members of the early and late majority have landings as high as innovative fishermen but of importance is that in all instances the innovative have incomes above the mean (Table 3).

Of special interest then, is why do the most innovative fishermen have gross incomes higher than other fishermen? Does the fishing effort or the experience of the innovative fisherman account for his ability to land large quantities of fish and, therefore, have a high gross income? Examining the number of days per year an individual spends fishing, no relationship is indicated between the effort of an individual and his innovativeness (chi square=8.1, $p>.41$, df=8). The data show that innovative fishermen spend an average of 160 days per year fishing while the early majority, late majority and laggards spend 175, 140 and 130 days fishing per year, respectively. The high income of innovative fishermen is not accounted for by their effort.

The number of years fishing experience an individual has would seem to be an important factor in his ability to land many fish and, thus, have a high income but the data show that innovative fishermen are neither the most experienced nor the least experienced fishermen (chi square= 28.7, $p>.09$, df=20). Innovative fishermen average 22 years fishing experience while the early majority, late majority and laggard fishermen average 28, 23 and 20 years experience, respectively.

Innovative fishermen might be expected to be more experienced in the otter trawl fishery--more familiar with gear and fishing grounds--and would have an edge over fishermen with less experience as otter trawlers. The survey data, however, do not support this (chi square=28.7, p>.09, df=20). Over 66% of the innovative fishermen have spent less than five years in the otter trawl fishery. Nearly 50% of the fishery has between 6 and 15 years experience trawling. The number of years experience in the otter trawl fishery does not account for the ability of the innovator to land large quantities of fish and therefore have a high gross income.

The success of the innovative fisherman does not rely on his effort, his experience as a fisherman or his experience in the otter trawl fishery. Innovativeness is the strongest factor related to high gross income and high landings. The key to the relationship between innovativeness and highlining then, may be concealed in the fishing strategy of the individual, and will be investigated further in the chapters which follow.

CHAPTER FIVE

"YOU'VE GOT TO KEEP YOUR EYES AND EARS OPEN TO STAY AHEAD OF THE BOSS": FACTORS INFLUENCING THE ADOPTION OF INNOVATIONS

> *You just take a look down at the boat basin, you won't see any old fishermen, the competition is too stiff for them to keep up. You've got to keep your eyes and ears open to stay ahead of the boss.*
>
> *Newport Fishermen, 1978*

Innovative behavior is not something inherent in an individual. Innovative behavior is the result of an individual's reactions to his environment. The manner in which an individual contends with factors in his environment reveals something of how innovative behavior operates.

Rogers (1971) tells us that acceptance of an innovation depends on the relative advantage of the innovation over that which it would supercede. This seems only common sense but it enters the realm of the individual's perception of advantage. The perception of the advantage of an innovation is the sum of several social and economic factors.

The complexity of an innovation has a bearing on its rate of adoption (Bohlen 1961). A good example here is the introduction of the loran to Astoria fishermen. Following World War II, the only lorans available to fishermen were government surplus from air force bombers. These early lorans were in three pieces; a sender, a receiver, and a generating device--all were large and cumbersome. According to informants, the advantage of the loran over established navigation methods was recognized by most fishermen but adoption was slow at first because they had to learn how to operate them.

It is generally accepted that innovations in technology are likely to be more readily accepted if they can be related to existing cultural patterns (cf. Linton 1936; Barnett 1953; Meade 1955). Congruence, then, occurs when an innovation is related somehow to an accepted practice. Brandner and Straus (1959) concluded that hybrid sorghum was adopted at a dramatic rate where it was congruent with hybird corn, much more rapidly than in areas where it was simply more profitable. Thus, if the ice has been broken by the adoption of an innovation, innovations which are similar will be more readily accepted. The ready acceptance of the loran probably has something to do with the general acceptance of the direction finder, an electrical device helpful in navigation. The current acceptance of electronic devices in fishing was probably eased by the adoption of the fathometer, loran, and radio during the late 1940s and early 1950s.

Rural sociologists tell us that divisible innovations--innovations that can be tried out on a small scale to minimize risks--are more likely to be adopted (Bohlen 1961). There are, however, few innovations in fishing which are divisible. A net, a C-loran plotter, or even a set of doors cannot be added to a boat a little at a time. The purchase of most innovations in the fishing industry is very expensive and almost always an all or nothing transaction. There is, consequently, considerable financial risk involved in adopting something which has not positively proven itself to be profitable. This risk is alleviated to some extent through trial purchases made available by some manufacturers, but these are usually restricted to electronics or items which will not become "dirty," so would seldom apply to a net or heavy machinery. Some informants report that at times certain innovative items are shared between friends so a party who has not yet adopted the innovation may test it for himself. This practice does not seem to be widespread and is usually limited to devices which can be easily transferred from boat to boat, e.g., doors, nets, minor electronic devices or small deck equipment.

Innovations which produce readily observable results are adopted more rapidly than those whose results are not easily observed (Bohlen 1961). This is an important factor in the Oregon otter trawl fishery. All boats in the sample have a standard array of electronic devices, i.e., two-way radio, fathometer, A-loran and radar. The difference between fishing with and without these items is dramatic--navigational and fish finding capabilities are found to increase considerably when a fathometer or loran, for instance, are used as opposed to fishing without them. However, the difference between fishing with or without a sonar is, for some fishermen, negligible and not worth the cost. Others feel that because sonar spots snags, it increases landings by permitting fishing in areas potentially dangerous for gear. These types of innovations then, have benefits which are not dramatic and whose acceptance is dampened. Others have readily observable benefits and are well-accepted. Related factors are innovations which require large expenditures and so are not accepted as rapidly, and those with a high rate of return have a high rate of acceptance (Bohlen 1961).

Innovations which are perceived to have a high margin of return tend to be adopted more rapidly than innovations which yield a low margin of return on investment. Innovations which yield relatively immediate returns will be adopted more rapidly than those which are long term. Also, innovations which require large expenditures will be adopted slower because of "internal capital rationing" (Bohlen 1961).

Griliches (1957:355) feels that economic factors are most important in the adoption of an innovation. He concluded that about 60% of the variation in the rate of adoption of hybrid corn was based on profitability. Concerning the possible sociological factors he feels:

> In the long run, and cross-sectionally, these variables tend to cancel themselves out, leaving the economic variables as the major determinants of the pattern of technological change.

Havens and Rogers (1961) contend that profitability as the major factor in adoption of innovations does not hold up on a year-to-year basis. "Profitability, as any other item of information about an innovation, must be diffused" (Havens and Rogers 1961:414). They felt the "interaction effect"--the process through which individuals in a social system who have adopted an innovation influence those who have not yet adopted--is the major factor influencing adoption of innovations (Havens and Rogers 1961:411).

> It is our contention that once an innovation has fulfilled the minimum considerations of profitability, it is largely the amount of <u>interaction</u> between individuals who have and have not adopted . . . . The main result of interaction with individuals who have already adopted is to decrease the subjective uncertainty associated

> with adoption of the innovation (Havens and Rogers 1961:410).

The importance of interaction is supported by the classic hybrid corn study of Ryan and Gross (1943: 40).

> There is no doubt but that the behavior of one individual in an interacting population affects the behavior of his fellows. Thus the demonstrated success of hybrid seed on a few farms offers a changed situation to those who have not been so experimental. The very fact of acceptance by one or more farmers offers new stimulus to the remaining ones. The decision to adopt the new practice is a product not only of the operator's position in respect to some pre-existing conditions, but also of the influence and incentives brought to bear.

As shown in the previous chapter (Table 2), the primary source of information on innovations for later adopter categories is the grapevine or interaction with other fishermen. For most innovative fishermen, contact with knowledgeable persons within and without the Oregon fishery is their secondary source.

An important medium for this interaction is the clique group. According to Lionberger (1954), informal group and kin group members are very likely to influence one another to adopt the same innovations. This influence may be subtle, through informal discussions of new developments, or somewhat coercive. An example of the latter comes from an Astoria fishermen who related that during the late 1940s and early 1950s, the group of men he fished with began to adopt the loran. The informant felt he could do very well with his fathometer and direction finder, but as members of his group began to communicate "hot" fishing areas by loran bearings, he was compelled to adopt the new device in order to continue to fish with them.

Competition between members of a system for the target resource (and for their own livelihood), is something not mentioned in the literature. Competition is an important influence in most otter trawl ports in Oregon. Many fishermen are forced to adopt innovations to at least stay astride of other members of the fishery in landings and income. During my fieldwork, several informants told me the reason for the addition of a particular innovation was "competition put it on the boat."

Related to the influence of competition is that of the port environment. Many fishermen recognized that the three major otter trawl ports--Astoria, Newport, and Charleston--were ranked as to their innovative atmosphere. Newport is the most innovative, followed by Charleston; Astoria is the least innovative. The ranking obtained from the survey data show that Newport not only has the most innovative fishermen, but the fewest laggard fishermen (Table 4). By contrast, Astoria has the fewest innovative fishermen and the most laggard fishermen. Some informants feel Newport has the most innovative atmosphere because it is the most competitive port in Oregon and fishermen pay closer attention to the landings and practices of one another. Fishermen take pride in their port fleet and, as one informant from Newport related, "if you go down in the basin and look around you'll see a pretty impressive fleet. Most boats are well kept and pretty well advanced in gear and whatnot."

TABLE 4. Distribution of Innovativeness by Port

Degree of Innovativeness	Newport	Charleston	Astoria	Other
Innovative	20%	8%	8%	0%
Early Majority	30	22	17	60
Late Majority	35	48	17	40
Laggards	15	22	58	0
N	20	23	12	7

Another factor influencing the adoption of innovations not discussed in the literature is the influence of tax incentives on making boat improvements. Fishermen may deduct a large percentage of any improvement from their income taxes and, when one is deciding how to invest extra money, this is a consideration. When one informant was asked if he would invest extra money on shore or in his boat, he responded, "Uncle Sam will take it away from me if I buy land; I'd put it in the boat."

A fisherman once told me he felt that as a whole the shrimp fishermen were more innovative than the drag or bottom fishermen. I investigated this notion using the survey data. When the two fisheries are compared as to their innovativeness the bottom fishery dominates in the most innovative group; 14% of the bottom fishermen were innovative whereas only 7% of the shrimp fishery fell into this category. However, in the early majority category the reverse is true; 29% of the shrimp fishery were members of this category compared to 13% for the bottom fishery. Further, 40% of the bottom fishery were laggards in contrast to only 20% for the shrimp fishery. The implication is that though the bottom fishery has the highest percentage of innovative fishermen the balance of the group falls into the late majority and laggard categories (these two categories account for over 70% of the bottom fishery). On the other hand, the highest percentage of shrimp fishermen fall into the early and late majority categories (these two groups account for over 70% of the shrimp fishery). Consequently there are considerably more moderately innovative fishermen in the shrimp fishery than in the bottom fishery. As a factor influencing the adoption of innovations these moderately innovative fishermen act as follows: though interaction with very innovative fishermen is rare due to their smaller population; the possibility of mooring next to and interacting with one of these moderately innovative shrimpers is good. This offers greater visibility of an innovation and allows for additional interaction between an adopter and a non-adopter of an innovation. Thus, this special group may accelerate the diffusion of innovations.

In summary, many factors influence the adoption of innovations in the Oregon otter trawl fishery. Many of these, such as complexity, congruence, observability of results, expense, rate of return on investment, interaction between individuals and clique groups are cited in the literature and active in the otter trawl fishery. The divisibility of an innovation as cited in the literature does not apply to the otter trawl fishery. Not considered in the literature were the importance of competition between members of the fishery for the resource, the competitive and innovative atmosphere of a port, and the existence of a large population of moderately innovative fishermen influencing the adoption rate of innovations in the otter trawl fishery.

CHAPTER SIX

PUTTING FLESH ON EMPIRICAL BONES: HOW THE FISHERY WORKS AS A SYSTEM

I'd be happy to take you out and let you work on the back deck for a couple of trips. Do you get sick?

Newport Fisherman, 1978

This chapter integrates the data from the three previous chapters with ethnographic data from fieldwork in an attempt to replicate on paper the diffusion of innovation in a dynamic fishery.

How is an Innovation Diffused?

As noted previously, the most innovative fishermen are usually the first to adopt or develop an innovation, therefore, the diffusion of innovations begins here. In actuality it begins earlier than the adoption of an innovation by the innovator--when the individual first becomes aware of it. The data demonstrates that the sources of information on innovations are different for innovative fishermen than for later adopters. The sources utilized by the innovative fishermen are more expert and include publications from the United States, Canada and Europe; contact with marine extension agents; correspondence with knowledgeable individuals in many parts of the world, especially Canada and Europe; and contact with other innovative fishermen in the Oregon otter trawl fishery.

In line with other trawler informants, the process of adoption for the innovative is similar to the five steps outlined by Bohlen (1961) of awareness, information, evaluation, trial and adoption. There seems to be wide acceptance of the stages of the adoption process (cf. Beal et al. 1957; Beal and Bohlen 1957; Copp et al. 1958) as presented by Bohlen (1961:269-270):

> 1. Awareness. [At] this . . . stage . . . the individual knows of the existence of an idea or practice, but lacks details concerning its intrinsic nature and use. Awareness may begin as an involuntary act or as serendipitous behavior.
>
> 2. Information. [At] this . . . stage . . . the individual becomes interested in the idea. He seeks further basic information of a general nature regarding it. He wants to know why and how it works, how much it costs, and how it compares with other ideas or practices purported to perform the same or similar functions. He is concerned with knowing the conditions of use and the resources necessary to get optimum benefits from its use.
>
> 3. Evaluation. [At] this . . . stage . . . the individual takes the knowledge he has about the idea and weighs the alternatives in terms of his own use. He considers his own resources of land, labor, capital, and management ability and decides whether or not he has the necessary resources to adopt the idea. He also evaluates the idea in terms of the available alternatives and of his over-all goal structure. He considers whether or not the adoption of the idea will help him maximize his goals and objectives. If he thinks it will, in most cases, he makes the decision to give the idea or practice a physical trial.
>
> 4. Trial. At this stage the individual has the empirical experience of observing the idea in use. The trial stage is characteristically one of small scale use by the potential adopter or his observation of use under conditions which simulate those of his own situation. At this stage the individual is

> concerned with the specifics of application and use; the mechanics and actions relating to how to use the idea.
>
> 5. Adoption. At this stage the individual uses the idea on a full-scale basis in his operations and is satisfied with it. He is no longer trying to decide whether or not the idea is good for him in his operation into which he has incorporated it.

These stages are not passed through in an irrevocable manner, but are portrayed in stages for heuristic purposes only (Bohlen 1961).

The innovative fisherman will read about or have communicated to him through correspondence from contacts or his clique group information on the new device or practice. Inquiries are made of manufacturers for more information. The information is studied, and the costs in capital and lost time weighed against estimated profit for a given innovation. Friends (clique group members or other innovative fishermen) are consulted for possible connections in other areas of the country who might have used or currently are using the innovation. In many instances the innovative fisherman will travel, sometimes great distances, to see the innovation in operation. If the decision is made to try the innovation, it is purchased and evaluated. Adjustments are made to the innovation, if needed and/or possible, and adoption of the innovation is considered.

For later adopters the sources of information are not as broad as those of the innovative. Though many later adopters may consult publications or extension agents, the primary source of information on an innovation is the grapevine, and this begins where the adoption process for the innovator ends--with the introduction of an innovation into the fishery. The media for this interaction is the two-way radio (at sea), the boat basin coffee shop, and sometimes a local tavern. Developments are continually discussed through these media. There is a great reliance on observation. According to one informant, "if you spend three hours under the unloading hoist and a guy down the way spends eight hours, you're going to ask him what he's doing, and if he's using a new net or electronics you're going to try it." In more competitive ports the landings of other fishermen are watched and those who are doing well are questioned or observed. One informant said, "you use binoculars to watch other boats if you can't get them on the radio."

The later adopter then, spends less time reading and more time watching and talking. And because the profitability of an innovation is demonstrated by the time a later adopter considers it, fewer risks are taken. Risk-taking, and hence innovative behavior, is a problem to the fishermen whose financial resources are limited--they may be relegated to "coming up through the ranks." Some of the most innovative fishermen are in a strong financial position and can afford to "put their neck on the chopping block," as one informant related, and absorb the losses associated with experimenting.

Integration of the System

Innovations are diffused through contact between fishermen on several levels. Considering the nature of the transmission of ideas, more than one individual is necessary for an innovation to be diffused. The most basic interaction dimension in the otter trawl fishery is the clique group. Most clique groups are made up of from two to five individuals usually of the same adopter category, who fish together and watch out for one another's interests. These groups may be loosely organized, or closed and tightly organized--a clique in the true sense. The benefit of these groups is obvious in that they provide each other security and protection on an ocean which can get very big at times. But a more important benefit, for this study, is the increased fish finding capabilities of the group when operating as a unit. The rationale is simply that several boats have a better chance of locating a productive fishing area than does one boat. The information on these hot spots is shared with other group members, usually through some kind of code to exclude non-members from the information. One informant said,

> With each of us knowing about where the other was we would talk over the radio after each tow. The code we'd use was to talk about making trips to cities and the size of the city meant how big the tow was. So if I said "I'm going to Seaside on Thursday," it meant the tow was small. If I said, "I'm going to Portland," it meant the tow was big and they'd better find me. If the tow was no good we said so 'cause if a bunch of other fishermen wanted to come tow that area they were welcome to.

As previously mentioned, clique groups are a source of information on and an influence to adopt innovations. Along with the fish hunting activities of clique groups, a lot of talk goes on between members, and much of this concerns the latest developments in the fishery.

The system becomes broader when we consider interaction at the innovator group level--these are loose, informal groups of adopters formed around an innovative fisherman. The innovative individual can be the local highliner of the port, an innovator from a nearby port, or an innovative person known throughout the fishery. The most common group is the local port group and usually includes various adopters who are acquainted with one of the port's highliners. These innovative highliners are well respected, considered knowledgeable, and are well integrated into the system. They are sought out by their group for advice on problems as well as innovations. Their advice and their contacts are valued.

On one occasion during field work I was in a tavern owned by one of the local highliners; it was a place where fishermen gathered to socialize and discuss fishing. On this particular evening the innovative highliner was sitting at the bar with fishermen and friends to either side when a young man (early 30s?) came in and was greeted cordially by the highliner. The young man was having difficulties getting his net to fish and the highliner openly offered several possible solutions to the problem and gave the young man the names of other fishermen to contact if he had more trouble. Informants indicate that this is normal behavior within these groups. It needs to be stressed that these groups consist of very loosely organized adopters who identify and consult with a particular innovative fisherman. Membership in these groups is open and probably fluctuates: the members probably would not consider themselves a member of "so-and-so's" innovator group and probably are not aware of its extent.

Coffee shop groups are broad, loosely organized groups of fishermen who become acquainted through early morning breakfasts and "coffee klatching" at the local boat basin cafe. Here, information is shared on who is doing well, how he is doing it, what someone has heard or experienced about a new development or practice, as well as fishing politics, the marketing association, and world news. Interaction within the coffee shop group is lively; it is a primary stem of the grapevine. Innovative fishermen usually do not participate in these groups, as their sources of information lie elsewhere.

The radio group is the broadest, most loosely organized level of interaction in the otter trawl fishery. Information transmitted between all levels and members of the system is the primary channel for diffusion of innovations between ports. Competition continues, clique groups play hide and seek with hot spots over the radio, and prospecting fishermen try to keep secret the results of their explorations. But many informal conversations go beyond discussions of the weather, and serve to keep otter trawlers abreast of new ideas in the fishery.

The channels for communication of innovations then, are numerous and members of the fishery take full advantage of them. The social structure of the otter trawl fishery is such that it allows, and is perhaps based on, the flow of information.

CHAPTER SEVEN

"NO MATTER WHAT HAPPENS I'LL JUST KEEP FISHIN'": CONCLUSIONS

> *Yeah, I'll talk to you but I won't ever hear about what you're doin' again and it sure as hell won't have an effect on me; no matter what happens I'll just keep fishin' and the harder they make it for me to fish, the harder I'm gonna fish.*
>
> *Charleston Fisherman, 1978*

Findings

Throughout the preceding chapters, the theoretical literature pertaining to the diffusion of innovations has been compared to the data related to the diffusion of innovations in the Oregon otter trawl fishery. A reexamination of the results of each chapter's inquiry leads to the conclusion that the diffusion of innovation in this fishery follows the pattern presented in the literature. As the diffusion literature has been tested empirically, especially by rural sociologists, these results should be considered reliable. However, there are some differences between the theoretical expectations and the findings of this research. These differences fall into two categories: (1) theoretical expectations of the literature not present in the Oregon otter trawl fishery, and (2) factors encountered in the otter trawl fishery not present in the theoretical literature.

Two points of theoretical expectations not present in the otter trawl fishery come from the studies of rural sociologists. Lionberger (1961) correlated age and innovativeness among farmers (finding innovators were most often younger). In the Oregon otter trawl fishery the most innovative were distributed between 31 and 55 years of age, with 33% of the innovative being over 50 years of age.

The second point is the divisibility of an innovation as a factor in the rate of adoption of an innovation. Most innovative practices are divisible for farmers; hybrid corn can be planted an acre at a time until its profitability is determined; the same holds true for fertilizer and insecticides. This is certainly not true in the otter trawl fishery. Experimentation with or adoption of an innovation often requires a large expenditure of capital, and there is always the risk of failure even for the later adopters.

According to several theorists (Barnett 1953; Merton 1959; Ryan 1969; Rogers and Burdge 1972), the most innovative individuals occupy a special place in a social system. The most innovative are seen as unusual individuals, sometimes even marginally or imperfectly integrated into their system. In the Oregon otter trawl fishery, the most innovative fishermen are well respected, admired, and central to their social system. They are not considered strange or outsiders by fellow fishermen. Though the greater part of the fishery does not attempt to emulate the innovative, most fishermen do realize their value.

Factors which influence the adoption of innovations in the otter trawl fishery but are not discussed in the literature include

(1) the tax incentives for boat improvements lessen the risk of failure to some degree; (2) competition for a target resource influences the adoption of innovation in that competition exerts pressure on an individual to constantly upgrade and increase the efficiency of his boat; and (3) the attitude of the fishermen in a specific port toward innovation as an important factor influencing their adoption. This innovative atmosphere is probably a combination of competition, innovative example setting, and pride in the quality of a port's fleet.

The theoretical literature cites the role of kin and informal groups (clique groups) in influencing the adoption of innovations. Rural sociologists have mentioned the role of neighbors as sources of information on innovations, but stop short of delineating any other specific groups which influence or act as channels of communication for the adoption of innovations. Investigation in the Oregon otter trawl fishery showed that several groups act as mechanisms of influence. The delineation of these groups--the innovator group, coffee shop group, and radio group--reveals more of the specific mechanics of the innovation transmission than has been explored by previous investigations (cf. Barnett 1953; Lionberger 1960; Bohlen 1961; Ryan 1969; Rogers 1971; Hagen 1972).

Evaluation: What All This Means

The significance of these data are that they can be utilized in evaluating development or management schemes for the Oregon otter trawl fishery. The fishery is not stagnant. It is dynamic and developing, and will continue to develop without strong outside intervention. The data indicate members of the Oregon otter trawl fishery are not in the dark about the opportunities available to them; they do not need "experts" to develop their fishery. Oregon otter trawlers respond well to directed change and to the opportunities made available through legislated fishery expansion and protection designs. Timely examples of these are the directed change to the sole use of the C-loran, and the development of the Pacific whiting fishery, made possible through the Fishery Conservation and Management Act. The survey data show that as of January 1979, over 66% of the otter trawl fishery had adopted the C-loran. This is a high rate of adoption when one considers the program to promote the change was implemented just two years ago.

The opportunity to expand into the Pacific whiting fishery was seized upon by innovative Oregon trawlers very soon after PL 94-265 became active. Within one year of its enactment, there was one boat taking whiting by mid-water trawl. This vessel's landings were so impressive that several other fishermen contracted to have boats built for the whiting fishery. When Oregon otter trawlers were asked what they would do if they had an unspecified amount of extra money, nearly 13% responded that they were building or would build a new boat and enter the whiting fishery. An additional 10% said they would change gear, increase horsepower, or buy sophisticated electronics to upgrade their present boat and enter the hake fishery. Twenty-three percent of the fishery then, is responding favorably to the new fishery. There are presently five boats ready or expected to be ready to participate in the 1979 hake season. This addition the second year after introduction demonstrates the pace at which Oregon otter trawlers take advantage of opportunities.

One of the purposes of the Fishery Conservation and Management Act is "to encourage the development of fisheries which are currently underutilized or not utilized by United States fishermen . . ." (United States Government 1976). It appears this goal is being met in Oregon without the overt influence of federal agencies. Accordingly, it seems that fishery development programs should be aimed at developing a structure to encourage change, e.g., to develop markets for under utilized fish species, of which trawlers can avail themselves, and allow the fishery to continue to expand and develop by its own methods. This is repeated again and again throughout the history of the otter trawl fishery; when markets are available the fishery innovates and expands. Innovative strategies and technology are of no use when there is nowhere to sell the product.

One may assume from the presented data that highly innovative behavior is good or desirable, while less innovative behavior is less desirable. This is not at all the case. Everyone cannot be, nor does everyone want to be, the most innovative fisherman in Oregon. The degree of innovative behavior of an individual is not necessarily a function of intelligence or laziness. Innovative behavior is the consequence of an individual's adaptation to the system in which he lives and works. One might say that the most innovative fishermen are ambitious concerning the fishery, and are willing to exploit the resource to a maximum level to derive a maximum return. To these individuals, fishing practices and technology are not only their work but their recreation also. To most fishermen however, fishing is not an obsession, it is a way of making a good living. These fishermen have reached a balance between satisfying their needs and expending effort. The late adopting Astoria fisherman, criticized by his more innovative cohorts to the south, still earns enough money to support his household in a comfortable manner, and is able to spend time with his family or in pursuits other than researching the latest developments in the fishery. The situation is best summed up by the head quote from Chapter Four:

> There are three ways of looking at it; either a guy is so strapped he can't make the payments on his boat let 'lone improve it; or a guy figures out what he needs to pay his bills, keep things running and stash a little away at the end of each season; or a guy fishes like a crazy man.

References Cited

Acheson, James
1975 The Lobster Fiefs: Economic and Ecological Effects of Territoriality in the Maine Lobster Industry. Human Ecology 3:183-207.

Andersen, Raoul and Cato Wadel, editors
1972 North Atlantic Fishermen. Newfoundland Social and Economic Papers No. 5. Memorial University of Newfoundland.

Andrews, Ralph W. and A. K. Larssen
1959 Fish and Ships. Superior, Seattle.

Barnett, Homer G.
1953 Innovation: The Basis of Culture Change. McGraw-Hill, New York.

Beal, George, Everett Rogers and Joe Bohlen
1957 Validity of the Concept of Stages in the Adoption Process. Rural Sociology 22:166-168.

Bohlen, Joe
1961 The Adoption and Diffusion of Ideas in Agriculture. Our Changing Rural Society: Perspectives and Trends. James H. Copp, editor, Iowa State University Press.

Brandner, Lowell and Murray Straus
1959 Congruence versus Profitability in the Diffusion of Hybrid Sorghum. Rural Sociology 24:381-383.

Brandt, Andres von
1964 Fish Catching Method of the World. Fishing News, London.

Browning, Robert
1974 Fisheries of the North Pacific. Alaska Northwest, Anchorage.

Cobb, John N.
1916 Oceanward Trend of Our Northwest Fisheries. In Transactions of the Pacific Fisheries Society. Pacific Fisheries Society, Seattle.

Coleman, James
1957 The Diffusion of an Innovation Among Physicians. Sociometry 20:253-270.

Copp, James H., Maurice Sill and Emory Brown
1958 The Function of Information Sources in the Farm Practice Adoption Process. Rural Sociology 23:146-157.

Fanning, Patricia
1979 "Persons Who Fish" Fry Federal Agency for Renaming Them. Wall Street Journal, February 13:14.

Forrester, C. R., A. J. Beardsley and Y. Takahashi
1978 Groundfish, Shrimp, and Herring Fisheries in the Bering Sea and Northeast Pacific--Historical Catch Statistics Through 1970. International North Pacific Fisheries Commission Bulletin Number 37. Vancouver, British Columbia.

Garner, John
1967 Modern Deep Sea Trawling Gear. Fishing News, London.

Goodlad, Alexander C.
1972 Old and Trusted, New and Unknown: Technological Confrontation in the Shetland Herring Fishery. In North Atlantic Fishermen, Andersen and Wadel, editors. Newfoundland Social and Economic Papers No. 5. Memorial University of Newfoundland.

Griliches, Zvi
1960 Congruence versus Profitability: A False Dichotomy. Rural Sociology 25:354-356.

Hagen, Everett
1972 On the Theory of Social Change. Dorsey, Homewood, Illinois.

Harry, George Yost
1956 Analysis and History of the Oregon Otter-Trawl Fishery. Unpublished PhD dissertation, University of Washington, Seattle.

Havens, A. Eugene and Everett M. Rogers
1961 Adoption of Hybrid Corn: Profitability and the Interaction Effect. Rural Sociology 26:409-414.

Hjul, Peter, editor
1972 The Stern Trawler. Fishing News, London.

Jones, Walter Guy
1958 The Mink Food Fishery of Oregon in 1953 and 1954. Unpublished Masters thesis, Oregon State University, Corvallis.

Jones, Walter G. and George Y. Harry
1961 The Oregon Trawl Fishery for Mink Food, 1948-1957. Research Briefs. Fish Commission of Oregon 8(1):14-30.

Katz, Elihu, Martin L. Levin and Herbert Hamilton
1963 Traditions of Research on the Diffusion of Innovations. Amer. Soc. Rev. 28:237-253.

Ketchen, K. S. and C. R. Forrester
1966 Population dynamics of the petrale sole, Eopsetta jordani, in waters off Western Canada. Bulletin of the Fisheries Resources Board, Canada 153-195.

Liao, David S. and Joe B. Stevens
1975 Oregon's Commercial Fishermen: Characteristics, Profits, and Incomes in 1972. Oregon State University Sea Grant College Program, Corvallis.

Linton, Ralph
1936 Study of Man. Appleton-Century, New York.

Lionberger, Herbert
1960 Adoption of New Ideas and Practices. Iowa State University, Ames.

Magill, A. R. and M. Erho
1963 The development and status of the pink shrimp fishery of Washington and Oregon. Bulletin of the Pacific Marine Fisheries Commission 6:61-80.

Meade, Margaret
1955 Cultural Patterns and Technical Change. American Library, New York.

Merton, Robert
1968 Social Theory and Social Structure. Free Press, New York.

Nie, Norman, C. Hadlai Hull, Jean Jenkins, Karin Steinbrenner, Dale H. Bent
1975 Statistical Package for the Social Sciences. McGraw-Hill, New York.

North Central Regional Rural Sociology Subcommittee
1952 How Farm People Accept New Ideas. Iowa Agricultural Extension Service, Ames.

Pacific Fisherman
1903 June 1(1). Seattle.

1906 August 5(2). Seattle.

1908 July 6(3). Seattle.

1914 March 7(3). Seattle.

1915 July 7(7). Seattle.

1919 September 27(1). Seattle.

1920 May 28(5). Seattle.

1934 September 32(1). Seattle.

1935 April 33(1). Seattle.

1937 May 35(1). Seattle.

1939 January 37(1). Seattle.

Pemberton, Earl
1936 The Curve of Culture Diffusion Rate. Am. Soc. Rev., August.

Perry, Astor, Gene A. Sullivan, Robert J. Dolan and C. Paul Marsh
1967 The Adoption Process: S Curve or J Curve? Rural Sociology 32:220-222, June.

Poggie, John J. and Carl Gersuny
1974 Fishermen of Galilee: The Human Ecology of a New England Coastal Community. University of Rhode Island Marine Bulletin Series, No. 17. Kingston, Rhode Island.

Presser, H. A.
1969 Measuring Innovativeness Rather than Adoption. Rural Sociology 34:510-527, December.

Pruter, Alonzo T. and George Y. Harry
1952 Results of preliminary shrimp explorations of the Oregon coast. Fish Commission of Oregon. Research Briefs 4(1): 12-24.

Rogers, Everett M.
1958 Categorizing the adopters of Agricultural Practices. Rural Sociology 23:345-354.

1961 The Adoption Period. Rural Sociology 26:72-82.

Rogers, Everett M. and George Beal
1958 The Importance of Personal Influences in the Adoption of Technological Changes. Social Forces 36:329-335.

Rogers, Everett M. and R. Burdge
1972 Social Change in Rural Societies. Prentice Hall, Englewood Cliffs.

Rogers, Everett M. and F. Floyd Shoemaker
1971 Communication of Innovations--a cross-cultural approach. Free Press, New York.

Ryan, Bryce F.
1969 Social and Cultural Change. Ronald Press, New York.

Ryan, Bryce and Neal C. Gross
1943 The Diffusion of Hybrid Seed Corn in Two Iowa Communities. Rural Sociology 8:15-24.

Scofield, W. L.
1948 Trawling Gear in California. California Department of Fish and Game, Fish Bulletin No. 72.

U. S. Government
1976 Public Law 94-265. Government Printing Office, Washington D. C.

Glossary

back deck	The deck area behind the house. An area of great activity.
beach	The shore.
behind the shovel	Refers to actual shoveling of fish into the hold; however, usually a generalized term referring to the work done on the back deck.
belly, bellies	The lower mid-section of an otter-trawl net.
big set	The VHF radio or the marine radio telephone.
blocks	A system of cables and pulleys powered by a winch, used to lift the net into the deck of the boat.
bobbins	Round metal or rubber rollers attached to the foot-line of a net to make dragging easier.
body	The mid-section of an otter-trawl net.
boom	A crane-like affair on the deck of a vessel used to lift the net from the water.
chopper plate	A reinforced area on the doors for protection against damage due to rocks, and other obstructions.
clip	A metal closing device used on the puckering string or codline.
codend	Rear section of the net. The net's construction herds the fish to this point.
codline	Drawstring on the end of the codend which allows fish to be removed from the net.
crew	In general, persons who are employed by a trawler excluding the skipper; can also refer to a person with less experience than a deckhand.
deckhands, hands	A person who has more experience than a crew member.
doors	See otter-boards

double-rigged	A boat rigged to tow two nets, used by shrimpers.
drag	1. The term used to refer to an otter-trawl net. 2. To trawl, or the process of trawling.
drag boat, dragger	A type or term of reference for a boat in the otter-trawl fishery (see Note 2).
dragger, draggerman, otter-trawler	Terms used to describe members of the otter-trawl fishery (see Note 1, 2).
flapper	A small piece of netting fitted near the codend which acts as a non-return valve for fish.
flatfish	Species of fish flat in body, including the various soles and flounders.
flopper-stoppers	Stabilizers used on fishing boats to control their roll while at sea.
foc'sle	Sleeping quarters in the bow of the boat.
gallows	Structures which support the net reel.
gantry	A platform supported by towers on which winches, blocks, etc. are hung.
ground rope	A rope attached to the lower half of the mouth of the net, forming the lower lip of the net.
ground lines	The section of cable between the net and the doors.
hauling	The process of bringing the net onto the boat.
headline	A rope attached to the top of the mouth of the net, forming the upper lip of the net.
heaving in	Process of bringing the net onto the boat.
highliner	The fishermen in each port who catch the most fish (see Note 2).
house	Pilot house or helm.
iced, icing	The process of having ground ice put in the fish hold.
in house	The state of being finished with work for the day and retiring to the cabin or house.

in the round	A fish sold to a processor without being cleaned or headed.
iron mike or mike	The automatic pilot
keepers	Those fish or other marine animals which are of legal and marketable size.
landings	The term used to describe the volume of marketable fish delivered to a fish processor.
longline	A method of fishing with hook and line without poles; used to take halibut, among other species.
mickey mouse, or mouse	The citizen's band radio.
net reel	A large drum the net may be rolled on for storage and hauling.
otter boards, or doors	Steel or wooden rectangular shaped devices attached by cables to the wings of the net. They act as foils and spread open the mouth of the net as well as hold it to the bottom.
otter-trawl	A specialized type of trawl.
outriggers	Large structure which hold the stabilizers on most boats. Will hold the nets on a double-rigged boat.
paper machine	A recording fathometer.
picking, sorting	The process of separating marketable from unmarketable fish, and to separate marketable fish by species.
product	A synonym for fish, used in an economic sense.
puckering string	A drawstring on the codend which allows fish to be removed from the net.
rail	The "fence" enclosing the forward area of the deck.
roundfish	Species of fish round in body including lingcod, black cod, snapper and hake.

running	The process of moving the boat from one place to another.
schooner	Very old type of wooden vessel, many are converted from halibut fishers.
scuppers	Holes in the bulwarks enabling water to drain from the deck.
setting the net, or set	The process or state of the net being on the bottom and fishing.
shooting the net	The process of putting the net into the water.
shrimper	1. A boat in the otter trawl fishery which fishes mainly for shrimp. 2. The skipper of a shrimp boat (see Note 1, 2).
side trawler	A boat that tows the net off the side of the boat.
single-rigged	A boat rigged to tow one net.
skipper	The captain of the boat.
slime, slime sole	Name given to dover sole because its body is covered with a thick layer of mucous.
split	The process of opening the codend (via the puckering string) to facilitate removal of the fish.
splitting rings	Rings around the opening in the codend.
square, overhang	A section on the top of the mouth of the net which extends farther forward than the bottom of the mouth; helps reduce escape of fish.
stern trawler	A boat that tows and hauls the net off the stern.
strapping the net	Process of hauling the net aboard a vessel a section at a time by taking several "bites" with a wire.
trash	Unmarketable fish.

trawl	1. A method of fishing (trawling) where a net is towed through water. 2. The net used for trawling.
tow	1. A measurement of time or work: "We took four tows today." 2. The process of pulling the trawl through water.
waist	The middle deck area of a vessel.
warp	The cable connecting the doors to the winches.
western trawl	A box-type net.
winch	Mechanized drums which haul in cables attached to the nets.
wings	The forward extensions of an otter-trawl net.
wire	A cable.

Notes

1. A Word on Non-Sexist Terminology. The reader will note in this age of struggle toward sexual equality the term "fisherman" is used in this thesis. This is not a thoughtless act but one which was seriously considered by the investigator. I call three highly respected organizations to defend its use.

Recently, the National Marine Fisheries Service substituted the non-sexist term "fisher" for fisherman in its reports and correspondence. This move brought so many complaints from men and women involved in the fishing industry the agency requested special permission from the Commerce Department to return to the original term (Fanning 1979).

Terry Leitzell of the National Oceanic and Atmospheric Administration which oversees the fisheries service, had this comment on the controversy: "I felt we were playing around with something that was culturally and socially very important to the people affected" (Fanning 1979:11).

Judith Hokman, writing on behalf of 14 groups that make up the Pacific Coast Fishermen's Wives Coalition, continued:

> Whether a woman goes to sea and works on the back deck of a fishing boat, navigates, pilots, slaves in the galleys; or stays ashore and knits crab pots, ties fishing gear and raises future fishermen . . . she deserves to be called a fisherman--or a fisherman's wife. She desires no other title to be foisted upon her (Fanning 1979:11).

Finally, at the time of my fieldwork, there were no trawling vessels in Oregon operated by women. For these reasons, and because the aim of this thesis is to provide information on and hopefully to the benefit of the Oregon otter trawl fishery, I bow to the convictions of those who derive their livelihood from it.

2. Some Areas of Confusion. Some confusion may arise from the various terms referring to fishing vessels and the individuals who operate them. The terms utilized by members of the Oregon otter trawl fishery refer to a boat exploiting a certain fishery and the person who operates the boat are many times identical. The vessel which takes shrimp and the person who operates it are both "shrimpers." The distinction is made in the context of the conversation. A boat which exploits groundfish is a "dragger" or sometimes a "drag boat"; the person who operates it is also a dragger or, less commonly, a "draggerman." The thesis utilizes "trawler(s)" when referring to boats or members of the otter trawl fishery en masse. The term "trawlerman" is seldom if ever used on the Oregon coast.

There are probably other areas of problematic terminology in this thesis. Hopefully, they will be alleviated by the glossary. I feel it is best to use the language of the group under investigation, even if it results in some confusion, rather than separate this group further from the scientific community by invoking new terminology.

Appendix A

Sample Questionnaire

Date________________________________

How old are you?________________________________

How many days per year do you fish?________________________________

How long have you been a fisherman?________________________________

What port do you work out of?________________________________

Are any members of your family fishermen? y n ________________________________

What relationship?________________________________

Do they own their own boat? y n partners w/________________________________

____

How long have you been in the otter-trawl fishery?________________________________

Have you been in other fisheries? y n If so, which one(s)________________________________

____

If boat, WHAT improvements? New boat y n ______

Gear y n ______

Electronics y n ______

Remodel house y n ______ Other ______

Why would you make these improvements? ______

______

Where and when did you hear about them? ______

______

What types of fish do you generally take? sole ______ shrimp ______ / ______

______

Approximately what were your total landings for 1978? fish ______

shrimp ______

Was this an improvement over previous years? y n ______

If yes, to what do you owe this improvement? ______

______

If you have owned another boat previously, how was it different?

Hull-size ______ material ______ type ______ age ______

modifications ______

Horsepower ______ ______

Electronics-fathometer # ______ digital ______ paper ______

CB y n owp ______ VHF y n owp ______ autopilot y n owp ______

sonar y n ______ loran y n owp ______ loran C plotter y n owp ______

Gear-net(s) type ______ double-rigged ______

stern ramp y n owp ______ modification ______

auxiliary power ______

______

Appendix B

Categorization of the Post-War Otter Trawl Fleet on Seven Innovations

APPENDIX B. CATEGORIZATION OF THE POST-WAR OTTER TRAWL FLEET ON 7 INNOVATIONS

Fleet Units

radio	4 3 3 3 3 5 4 4 4 4 *4 4 1 3 3 4 3 3 3 3 3 4 3 3 3 3 3 4 1 2 2 3 3 2 4 2 5 4 3 5 3 4 3 1 2 2 3
fathometer	4 4 4 4 4 4 4 5 4 5 5 4 4 4 3 3 4 3 4 3 3 3 4 3 4 3 3 5 3 3 2 2 2 3 2 3 2 5 5 3 3 4 4 2 1 3 2 3
direction finder	4 4 4 4 4 4 * 5 4 4 4 5 4 4 4 4 *4 4 4 4 3 3 3 4 3 3 3 4 3 3 2 3 2 2 3 4 * 1 1 4 4 3 3 2 4 * 2
dandy-line	4 3 4 *3 4 3 4 3 4 4 4 3* *4 4 2 *3 *3 4 3 3 3 *4 4 3 2 4 *4 3 3 4 4* 4 2 1 2 2 2 2* 2
iron mike	4 3 4 4 3 4 4 4 * 4 3 4 4 3 3 3 4 3 3 3 *4 ** 3 3 2* 4 4 2* 2 2 *4 2 ** 3 4 2 2 2 2 ** 1
loran	3 3 4 1 3 4 3 4 1 3 * 3 4 3 * 3 4 1 1 3 *3 *3 *3 3 1 3 4 3* 3* 3 3 1 4 4 1 *3 3 * *** *
stabilizers	* 2* ** *2 ** 1 * *3 ** *3 *2 ** *3 2 ** 2* 3* 3* 2* 3* *2 ** 3 * ** *** *

1 Innovator

2 Early adopter

3 Early majority

4 Late majority

5 Laggard

* unknown date of installation

These data are taken from Harry's (1956) analysis of the Oregon otter trawl fishery. Each column represents one boat. An adoption curve was plotted for each innovation and adopter categories delineated using Roger's (1958) method.