

An Economic Analysis of  
**EXISTING MARKETS for**  
**COMMERCIAL FISH**  
from the Upper Midwest

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AN ECONOMIC ANALYSIS OF EXISTING MARKETING SYSTEMS FOR  
COMMERCIAL FISH FROM THE UPPER MIDWEST

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During the early settling of the United States, cattle were slaughtered for their hides and sheep were raised for their wool.<sup>1</sup> Fish comprised the greater share of the settler's protein diets. These consumption trends have changed considerably since that time. In recent periods per capita meat and poultry consumption in the United States greatly exceeded per capita fish consumption. In the 10-year period from 1955 through 1964, annual per capita consumption of meat increased from 163 to 175 pounds and per capita poultry consumption increased from 27 pounds to 40 pounds. During this same 10-year period, per capita consumption of fish remained at approximately 10.6 pounds.

Although total consumption of fish increased over this 10-year period, it can only be attributed to the increase in the population.<sup>2</sup> Domestic fishermen, on the other hand, did not supply much of this increase in total consumption. Most of the increase came from imports. Imports of edible fish have increased from 34 per cent of the total volume of fish consumed in the United States in 1955 to 50 per cent in 1964.<sup>3</sup>

An annual volume of 14 million pounds of commercial fish (nongame fish) has been estimated to be available for procurement from North Dakota waters. The estimate includes about 6,000,000 pounds of buffalofish, nearly 3,000,000 pounds of carp, 2,250,000 pounds of goldeye, and 3,000,000 pounds of miscellaneous fish, such as sheepshead, common sucker, carpsucker, bullheads, and catfish.<sup>4</sup>

Purpose of Study

The major objective of this study was to identify and analyze markets for North Dakota's commercial fish production. The specific objectives were:

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<sup>1</sup>Nash, Darrel A., "Demand For Fish and Fish Products with Special Reference to New England," Recent Developments and Research in Fisheries Economics, Edited by F. W. Bell and J. E. Hazleton, Oceana Publications, Inc., Dobbs Ferry, New York, 1967; pp. 31-32.

<sup>2</sup>Ibid.

<sup>3</sup>Ibid., p. 32.

<sup>4</sup>North Dakota State Game and Fish Department, Bismarck, North Dakota, 1966.

1. To identify and describe existing marketing systems for selected classes of fish
2. To provide a description of commercial fish processing and commercial fish wholesaling operations that presently exist in surrounding states
3. To determine the competitive position of North Dakota fisheries.

Objective number two was added after the study was under way because essential descriptive information on commercial fishing, commercial fish processing, and commercial fish wholesaling operations was not available. It was felt that these data were necessary for a complete understanding of the market potential for North Dakota's supply of commercial fish.

One of the original objectives of the study was to project utilization trends for commercially caught fish. This objective was eliminated because of lack of information on utilization trends for specific species of fish.

#### Procedure

Secondary data were obtained from the United States Bureau of Commercial Fisheries and from other governmental and nongovernmental sources. Personal interviews were conducted with commercial fishermen, commercial fish processors, and commercial fish wholesalers. A wide array of commercial fish wholesalers were interviewed, ranging from small town fish wholesalers to large wholesalers operating in a central market city.

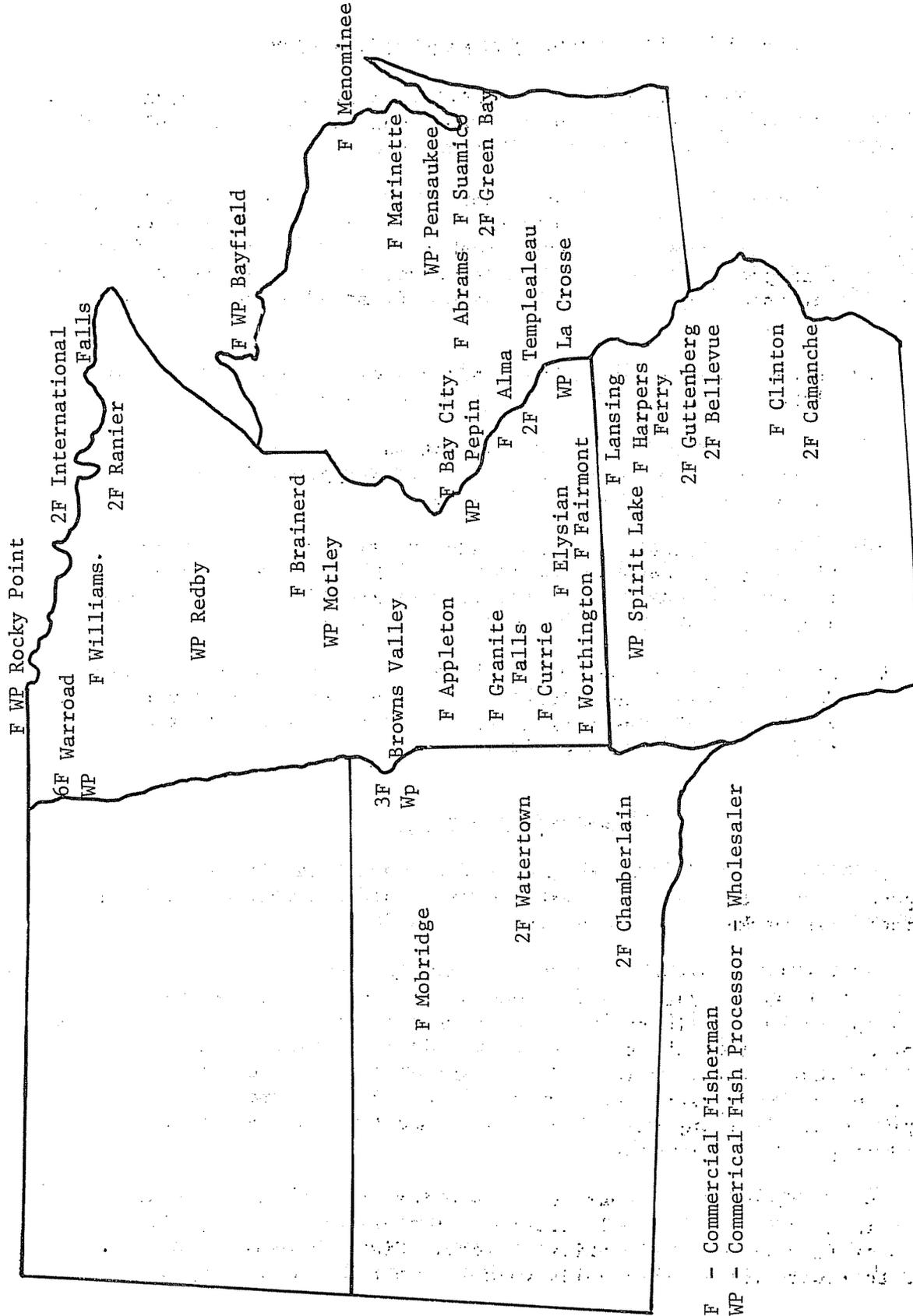
All primary and secondary data were collected, combined, and analyzed. Following the analysis, all seemingly relevant information was placed into the general thesis outline.

A statistical regression analysis was conducted on three different species of fish to find out which of the various market factors had the largest amount of influence on the price of species.<sup>5</sup> The regression analysis included data from five different states: Iowa, Minnesota, North Dakota, South Dakota, and Wisconsin.

The personal interviews obtained for the project were concentrated in the four-state area of Minnesota, South Dakota, Wisconsin, and Iowa. A geographical map was made of the location of each of the commercial fishermen and commercial fish processor-wholesalers interviewed for the study (Figure 1).

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<sup>5</sup>Regression techniques are statistical methods employed to test the relationship between the changes in the quantities of one variable called the dependent variable to changes in the quantities of one or more variables called independent variables where variables symbolize a set of values of specific activities.



F - Commercial Fisherman  
 WP - Commercial Fish Processor - Wholesaler

Figure 1. Location of commercial fisheries and commercial fish processor-wholesalers interviewed in South Dakota, Minnesota, Iowa, and Wisconsin, 1967.

## DESCRIPTION OF FRESH FISH MARKETING SYSTEMS

A large proportion of the commercial fish harvested by fishermen was sold on the fresh fish retail market or to a wholesaler. The wholesaler in turn resold the fish to a retail fresh fish outlet.

Fresh fish are those that have not been frozen solid but have been packed in ice for a short period of time (three to four days) to prevent spoiling. The fish can be delivered fresh to a retail store by a fishery or a wholesaler in just about any form, depending on the "keeping" qualities of the particular species of fish. The various forms of marketing fresh fish are:

1. In the round. The product goes directly from the producer without going through any form of processing.
2. Dressed or gutted. Some buffalofish and a very high percentage of the game fish caught in the Upper Midwest and Canada are shipped in this form.
3. Skinned and dressed. Bullheads usually are shipped in this form, although the form in which they are marketed is very dependent upon the climatic conditions during the season of the year that the fish are shipped.
4. Fillets. There appears to be quite a small market for this form of fresh fish, although it is increasing more every year, as most consumers do not want to bother with dressing, skinning, and scaling fish.

### Chicago Fish Markets

Chicago is considered the major fish marketing city in the United States. Fish price quotations from the Chicago market affect virtually all other major and minor fish markets throughout the United States.

A daily fish marketing report is compiled by the Bureau of Commercial Fisheries from data collected from wholesale fish markets in the Chicago area. The fish prices quoted in this report represent an average price for fish paid by all major fish wholesalers in the Chicago area. Wholesalers often pay a wide range of prices in a given day for the same quality fish. As a result, the price listings that appear in the daily market report may not be representative of any one particular transaction that might have taken place during a day of trading.

The quantity of each particular species of fish marketed in one day also is included in these daily reports. The daily catch reported for each species of fish is not necessarily correct. Fish wholesalers are not required to report their total daily volume of purchases if they do not choose

to do so. This provides wholesalers the opportunity to withhold information from the market in an effort to maintain a false market atmosphere concerning supply of specific species of fish during a given market day or week. They use this technique as a means of holding the price of fish up when the market becomes flooded. They do it to make retailers believe that fish are fairly scarce and thus are able to charge retailers more for the fish. A prominent fish wholesaler in Chicago stated that the main objective of these daily reports was to give fishermen and fish wholesalers a little idea of what was going on in the fish business.

A significant percentage (estimated 30 per cent) of commercial fish that was once channeled through the Chicago wholesale market is now marketed directly to large chain stores. These chain stores have facilities for removing the scales from the fish that they purchase and for preparing them for sale on the retail fresh fish market. This practice of shipping directly to chain stores from small town wholesalers and fishermen seems to be developing as a trend in the fish business. This change has caused the elimination of many of Chicago's wholesale and retail fish firms.

The few wholesale fish firms left in Chicago ship most of their fish in and out by truck. There seems to be no pattern during a given day when trucks will haul fresh fish into the market and when trucks will haul fresh fish out of the market to numerous points throughout the United States. Fresh fish arrive at the plant in various forms. Some are ready for immediate shipment directly to retail markets. Most fish require further processing, such as gutting, scaling, or heading, before they are packed for shipment to a retail market.

Each wholesale firm has cooling facilities for holding fresh fish. When the fish are brought into the plant, they usually are packed in ice and stacked in wooden boxes in a large cooler. After they are processed into a marketable form, they are packed in special boxes for shipping to a retail market outlet.

Sale of fresh fish from wholesale fish firms directly to individual customers on a retail basis generally is discouraged by the wholesaler because he is not organized to retail fish. The wholesaler is more concerned with dealing in large volumes of fish.

Although most of the fresh fish leaving the Chicago wholesale markets are shipped by truck, some are distributed in the Upper Midwest by railway express. Special shipments sometimes move by air transport to the east or west coast.

There are no daily price quotations posted by a fish wholesaler, as are found in a grain elevator or a livestock marketing center, because no two fishermen may get the same price for their fish (regardless of quality) during a given market day. Wholesalers base their prices paid on the number of pounds of fish offered by the individual fisherman during that particular day, the dependability and regularity of the fisherman throughout the year, demand

for the particular species of fish, as well as the quality of fish. The quantity of that particular species and quality that had already reached the market during that particular market day or week also is of major importance.

The law of supply and demand plays a large role in determining the price of fish. In the fish business, climatic conditions play a large role in determining the supply of fish that will be available for a given day or even a given week. When climatic conditions are unfavorable for commercial fishing operations in a certain area, the particular species of fish harvested becomes scarce. The price of that species is then bid up. The fact that fresh fish can be stored for only short periods before spoilage eliminates the possibility of building up a reserve supply of fish to take care of periods when supply becomes short.

### Local Fish Markets

Not all fish caught in a commercial fishing area reach wholesale markets, such as those existing in Chicago, New York, or St. Louis. A significant percentage of commercially harvested fish is marketed through local retail fish markets. There is a considerable variation in the size of these local retail fish marketing firms throughout the Upper Midwest. Most of the firms are proprietorships.

The volume of fish that each firm handles depends on the original purpose underlying the creation of the market. Some local retail fish markets are organized to market lots of fish too small to be shipped to a large wholesale market, such as Chicago or New York. Some are organized to supply tourist trade in an area where a particular species of fish is harvested. Others are organized by individual fishermen and are used as a means of diversifying their business enterprise. They usually operate on a part time basis, selling fresh or smoked fish in small backyard markets. There are also a few full time retailers of fresh fish and fish products (prepared fish).<sup>6</sup> These firms are organized to handle a wide variety of fish and generally do not limit their stock of fresh fish to the particular species caught in their area. They also ship in fish and shellfish from various parts of the United States and Canada. These firms sometimes have processing facilities to handle those fish that come in to the market directly from the producer.<sup>7</sup>

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<sup>6</sup>It is believed by some fresh fish retailers that much of the fresh fish that is sold in various retail market outlets is frozen before it is shipped, thawed by the retailer upon delivery, iced, and displayed and sold as fresh fish.

<sup>7</sup>A good example of a full time fish retailer is a particular fish retailer located in North Dakota. He receives his supply of marine products from three different geographical areas. His fresh fish, such as lake trout and pike, comes from Canada. His ocean fish, such as salmon and halibut, comes from Alaska via west coast wholesale fish distributors. The remainder of his marine products, such as oysters and shrimp, he receives from the east coast. He buys very little from the Chicago wholesale markets because he has closer wholesale markets from which to buy (namely, the Winnipeg markets).

Interviews with a few of these full time retailers indicated that the processed forms of fish in demand today are considerably different from those of five or six years ago. Consumers no longer demand fish that are not scaled and headed, but are willing to pay considerably more (per pound) for a fillet, even though the fillet may not possess the quality (taste) that fish marketed in the round possess.

Goldeye Market--Winnipeg, Manitoba

The wholesale market for goldeye<sup>8</sup> is for the most part located in Winnipeg, Manitoba, Canada. The demand for goldeye in the Winnipeg wholesale market had been largely satisfied by the harvest of the province of Manitoba. Recently the supply area has expanded to various states in the central part of the United States (Table 1). Price data on prices paid to fishermen were not available because records of these prices were not kept by the Canadian Department of Fisheries. Information available indicated that retail prices on the Winnipeg market ranged from \$1.80 to \$2.15 per pound.

TABLE 1. GOLDEYE MARKETED IN WINNIPEG FROM HARVESTS IN THE UNITED STATES AND CANADA, 1961 THROUGH AUGUST, 1967

Province of Origin	1961	1962	1963	1964	1965	1966 <sup>a</sup>	1967 <sup>a</sup>
Pounds of Fish							
Alberta	7,900	13,500	6,900	1,400	400	---	---
Manitoba	56,000	43,000	53,000	70,000	132,000	---	---
Ontario	24,000	34,000	20,000	28,000	19,000	---	---
State of Origin							
Minnesota	---	---	3,508	5,540	9,954	4,469	---
North Dakota	---	---	---	---	---	1,100	---
Iowa	---	---	---	---	---	39,870	37,610 <sup>b</sup>
Tennessee	---	---	---	---	---	---	28,190 <sup>b</sup>
South Dakota	---	---	---	---	---	---	11,783 <sup>b</sup>
Montana	---	---	---	---	---	---	41,213 <sup>b</sup>

<sup>a</sup>Canadian catch data were not available for the years 1966 and 1967.

<sup>b</sup>Pounds of fish caught from January 1 to September 1, 1967.

Source: Department of Fisheries, Central Region, Winnipeg, Manitoba, Canada.

<sup>8</sup>Also known as mooneye and toothed herring.

The major portion of the goldeye harvest sold in the Winnipeg wholesale market is dressed and needs little processing before it is smoked and sold on the retail market.<sup>9</sup> Each processor-wholesaler of goldeye has specialized markets for his product. Some retail outlets require 9 to 10 ounces of smoked goldeye, whereas others require a much larger finished product (12 or 13 ounces). Prices paid to fishermen on the wholesale market are very dependent on the quality and size of fish that the particular retail outlets are demanding during that particular week or month of the year. The major retail outlets for goldeye are restaurants and railroad dining cars.

In the early 1960's, the supply of goldeye decreased rapidly. This made it difficult for wholesalers of goldeye to maintain fringe markets and at the same time guarantee supply to major principal retail markets in the Winnipeg area. During the past two years, however, supply has exceeded the demand for goldeye. Wholesalers of smoked goldeye have been attempting to expand their retail market outlets because of optimism concerning the future supply of goldeye.

An estimated 400,000 pounds of goldeye was held in Winnipeg's cold storage warehouses in September, 1967. Because of this apparent sufficient supply, wholesalers were refusing to buy for the remainder of the year except at extremely low prices. The prices (summer, 1967) paid fishermen for 14 to 15 ounce goldeye (green weight)<sup>10</sup> ranged from 45 cents to 50 cents per pound. Goldeye harvested during the fall of 1967 were believed to have been sold by fishermen for as low as 17 cents per pound (dressed) to local wholesalers. The change in supply that occurred was small relative to the total supply of goldeye previously sold on the Winnipeg market.

It appears that a relatively small change in the quantity supplied caused a large proportionate change in price, since the retail market for goldeye in Winnipeg could not be expanded in the short run. This would also indicate, however, that a relatively small decline in the quantity marketed would cause a large increase in price.

In summary, the basic marketing system for fish is rather complex (Figure 2). It is not possible in this analysis to specifically identify the degree of activity that takes place at any given stage in the marketing process.

#### MARKET STRUCTURE OF COMMERCIAL FISH INDUSTRY

There are four basic market structure classifications of American capitalistic industries: (1) pure competition, (2) monopolistic competition,

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<sup>9</sup>Goldeye generally is sold in the retail market as a smoked fish.

<sup>10</sup>Green weight is defined as the weight of the gutted goldeye before smoking.

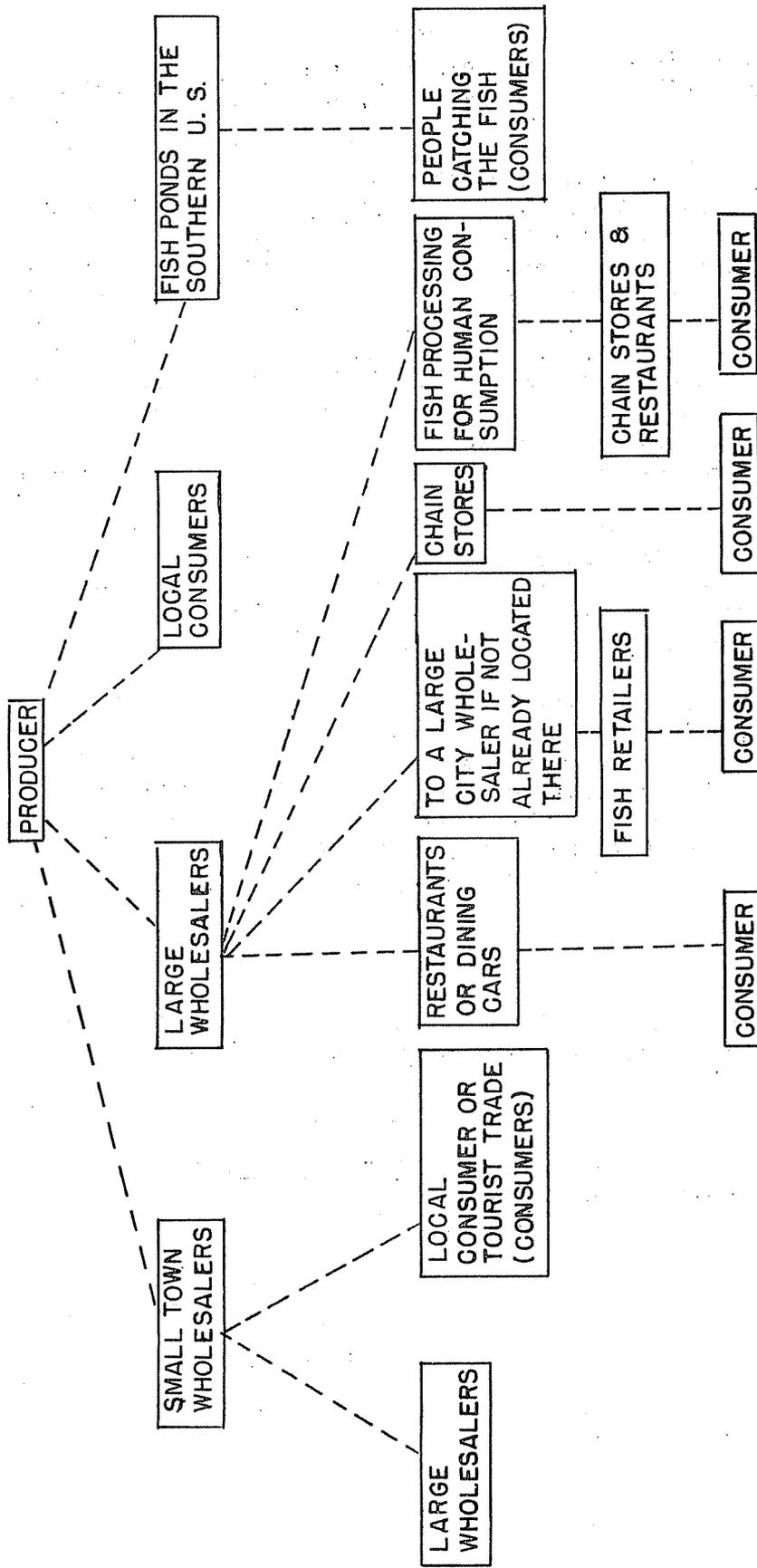


Figure 2. Breakdown of distribution channels for fish marketed for human consumption in the United States.

(3) oligopoly, and (4) monopoly.<sup>11</sup> This classification is considered from the seller's side of the market. Each basic structure has at least one characteristic that separates it from the other three market classifications.

The purely competitive industry contains a large number of sellers in the market, each of whom has no perceptible influence over another. A monopolistically competitive industry has many sellers working independently. Various degrees of minor product differentiation will exist, which in turn provides each seller with a small degree of market control. An oligopolistic industry is generally categorized as one which contains a small number of sellers. An oligopoly may also be an industry which is dominated by a few firms. This does not mean that there are only a few firms in the industry. There may be as many as 100 firms in the industry, but five or six large firms out of the 100 tend to control the industry. In the case of pure monopoly, one firm becomes the industry and in turn has complete control over the price of goods or services produced in the industry.

Market structure classifications can also be examined from the buyer's side of the market.<sup>12</sup> The characteristics which exist in the sellers' market structure classifications also hold true for the buyers' market structure classifications. The four buyer market structure classifications are pure competition, monopsonistic competition, oligopsony, and monopsony.

No existing industry fits perfectly into any one of these market structure classifications.<sup>13</sup> Generally an industry possesses characteristics of several or all of the four basic market structures. However, each industry possesses specific characteristics which enable classifying it into one of the four basic structures. The fish industry is no exception to this rule. The wholesale fish business exhibits the characteristics of an imperfect monopsony.

#### Monopsony

The word monopsony signifies one buyer.<sup>14</sup> There are five basic characteristics that define a perfect monopsony: (1) a sole buyer of a specific

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<sup>11</sup>McConnell, Campbell R., Economics: Principles, Problems, and Policies McGraw-Hill Book Company, Inc., New York, New York, 1963, pp. 394-98.

<sup>12</sup>Ibid., p. 398.

<sup>13</sup>Hall, A. Stuart, The Logic of Price Economics, University of Nebraska, Topic No. VI, p. 75.

<sup>14</sup>McConnell, op. cit., p. 394.

resource, (2) there are no other alternative markets for the individual sellers in the industry, (3) the buyer has considerable control over price, (4) the monopsonist has developed definite barriers to entry into the industry (they may be economies of size or other prohibiting factors), and (5) depending on the type of resource the monopsonist is purchasing, he may engage in extensive advertising and public relations activities (an example may be a local grain elevator that engages in public relations activities even though they are the only purchasers of grain in that area).

An imperfect or incomplete monopsony is an industry that does not fully exhibit all the characteristics of a pure or perfect monopsony. For example, if only two alternative markets existed for a certain resource and if a seller was located nearer one market than the other, the seller of the resource could not profitably sell in the more distant market. If the more distant market actively competed for the product by bidding the price up or absorbing the additional transportation costs, then the original buyer would no longer possess perfect monopsonistic power.

There appear to be situations of imperfect monopsony in the wholesale fish marketing industry. Located in the four-state area is a market which buys fish from a large number of fishermen. Each fishery lacks individual market power; that is, no single producer can control the supply of fresh fish. Entry into the fishing industry is almost completely free in terms of the total four-state area.<sup>15</sup> The potential real supply of harvested fish is greater than the demand.

There are three main characteristics of this particular firm that demonstrated its monopsonistic powers: (1) this wholesale buyer was economically alone in the industry. A few small buying firms do exist, but handle a very small part of the area's total production. The geographical advantage of this monopsonist can be illustrated by employing a hypothetical example of a fisherman which produces approximately 500,000 pounds of commercial fish (nongame fish) per year.<sup>16</sup> Prices received for the fish generally vary considerably from one week to another and from season to season. The estimated break-even price on production costs was three cents per pound. During the months of July and August (1967), the average price of the product at the nearest major market was about eight cents per pound. Assuming the fisherman could make contact with a buyer in that market and that the cost of shipping was three cents per pound, a profit above normal costs of two cents per pound could be obtained. In this case the monopsonistic firm would not be able to procure fish unless a competitive net price was offered.

During the months of April and May, the period of maximum harvest, this fisherman may be faced with the circumstance of having to sell to the monopsonistic firm. When the production of fish is high, the price of fish in the

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<sup>15</sup>Entry may not be free in a particular state.

<sup>16</sup>In this case, the situation is in reality more realistic than hypothetical.

nearest major market is usually depressed. The price depression occurs this time of the harvest year because the supply of the product is at a maximum. It is a simple matter of short-run supply greatly exceeding short-run demand. Seasons of high production often do not coincide with seasons of high demand. The fisherman is faced with the alternatives of either attempting to sell the harvest at the break-even price of three cents per pound or discontinuing the fishing operation until the market strengthens. In most instances the fisherman does not have alternatives. Market information is either not available or not accurate. The fisherman proceeds to harvest fish, only to discover ex post that a break-even price for his catch is not available. The fisherman is forced to sell to the firm that will offer a price that will cover the largest percentage of the fisherman's fixed costs of production without incurring any further variable costs of production. In this case there is generally only one firm that will buy the fisherman's fish and that is the monopsonistic large firm in his area.

This monopsonistic firm has numerous methods of disposing of the fish that it buys. The fish can be frozen until market demand expands. The fish can be processed into products that are in demand at that particular time or products that can be stored with a minimum amount of expense. The large wholesaler may have contracts with other firms located considerable distances from the point of harvest. These submarket firms are generally willing to pay the added transportation costs in order to maintain a guaranteed supply of a particular species of fish. This situation illustrated the definite lack of communication between the individual fisherman and the total markets. This situation may be due to one or both of the following factors: (1) absence of external economies by individual fisherman, e.g., inability to procure reasonable transportation and/or (2) inadequate or inaccurate market news information with regard to prices and quantities of fish being marketed. This situation may be diagrammed as shown in Figure 3.

(2) The pricing techniques used by the monopsonist provide distinct advantages. The firm does not post daily fish prices for various product grades of fish that it purchases. Instead, each fisherman bargains individually with the wholesaler until a price is arrived at. It appears that a wide range of prices are paid during a single day for the same quality product. This practice is known as discriminatory monopsony. Discriminatory monopsonistic price discrimination occurs when a buyer cuts prices as low as the traffic will bear while dealing with each seller individually (Figure 4). In most instances the fisherman is at a distinct disadvantage in the bargaining process, but in some cases the fisherman may have a storage pond to hold his fish in for an alternative market in which the fish could be disposed.

The fisherman selling quantity  $q_1$  will receive price  $p_1$  as a settlement price at the conclusion of the bargaining process. Fisherman  $q_2$  will receive price  $p_2$  after the same process without knowledge of the settlement price between the wholesaler and fisherman  $q_1$ . The wholesaler is not required now to offer fisherman  $q_1$  price  $p_2$  because: (1) fisherman  $q_1$  is not aware of price  $p_2$  and (2) there exists no alternative buyer. This process continues with each individual. The quantity of fish the producer has for sale would dictate the price he would receive for his catch (assuming identical quality of catches

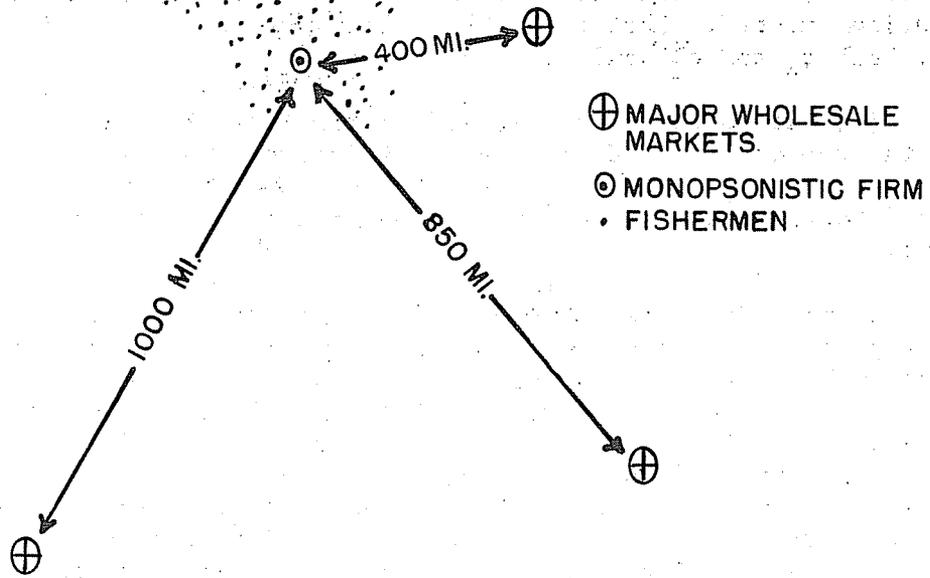


Figure 3. Diagram of the location situation in the wholesale fish marketing system.

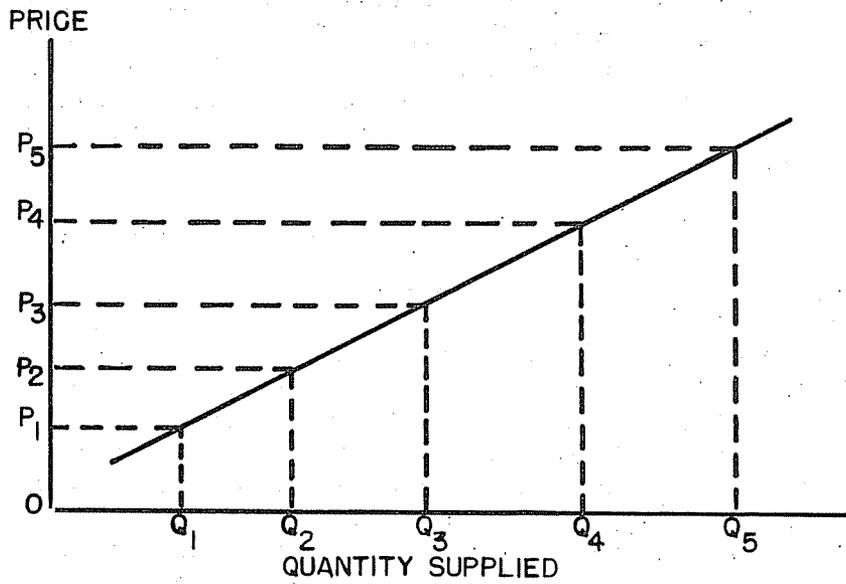


Figure 4. Discriminating monopoly.

and identical marketing dates). The results of this pricing system are simply that the buyer's total procurement costs are less than if a nondiscriminating situation existed. That is, each fisherman would receive identical prices, e.g., both  $q_1$  and  $q_2$  would receive price  $p_2$ .

(3) The large wholesaler will establish effective barriers of entry into the wholesaling and the fishing industry. In this case barriers of entry into the wholesale market also provide the monopsonist with monopoly powers. Several techniques are used by the monopsonist to keep other buyers out of the market.

A small firm operating as a buyer in a specific geographic marketing area may face intense competition with the much larger firm if the small firm offers to buy the area's produce at a much higher price. The fisherman in this area (assuming away loyalty) will take advantage of the hike in prices. The large firm will attempt one or both of two possible counter measures against the new entrant: (1) offer higher prices to fishermen and thereby preclude supply to the new firm, and (2) threaten the fishermen with refusal to buy their harvest once the new entrant has satisfied its capacity. This concept does not hold true for a period of very high supply (months of April and May), but the short range storage periods for fresh fish limit the periods of abundant supply to the short periods of increased catches. In either case the new entrant is not able to procure a consistent supply. The market remains static. The original firm can once again deal in a discriminatory manner with each fisherman.

Another advantage that the monopsonistic firm has is the ability to sell more than one species of fish as well as a number of different qualities of each particular species. New entrants generally do not have either the capacity, techniques, nor outlets to market a variety of fish. The new firm may be willing to offer a higher price for the fish in that area than would the large wholesaler dominating the area, but the large wholesaler (or monopsonistic firm) has a sufficiently large supply area to threaten to discontinue buying all other species of fish caught by fishermen if the total harvest is not marketed to the dominant firm.

The large buyer may also use capital availability to control supply. The wholesaler may finance all or part of the costs of entry into the fishing business. The capital necessary to purchase boats, motors, nets, trucks, cooling equipment, plant site and housing, and crates will be supplied by the wholesaler. The wholesaler establishes both personal and economic loyalty on the part of the individual fisherman. This practice provides the dominant wholesaler with three distinct advantages: (1) a new entrant into the wholesale or processing business would find it extremely difficult to obtain supply because the dominant wholesaler is large enough and diversified enough to control the destination of the fish produced, (2) the wholesaler can guarantee a continuous over-supply of fish by merely creating more fishermen than are necessary, and (3) the wholesaler can effectively discourage any cooperative activity on the part of the fisherman.

The degree to which monopsony exists in the wholesale fish industry cannot be exactly determined from the amount of research that was conducted. Evidence to fully document the conditions described above was not available without more time and legal authority. However, fishermen interviewed freely discussed the market in general forms that provided the basis for the above discussion. Many of them were quite frank about market conditions. A great deal of further research is necessary to thoroughly document and describe the market conduct in the wholesale commercial fish industry.

DESCRIPTION OF THE BUSINESS:  
FISHING, PROCESSING AND  
WHOLESALE

In the commercial fish industry, there are four basic functional levels through which fish and fish products are channeled. The four functions are: (1) harvesting,<sup>17</sup> (2) wholesaling, (3) processing, and (4) retailing. Fish would not necessarily proceed through all functional levels, that is, the wholesaling and/or processing levels may be bypassed.

The following discussion will be focused upon the socioeconomic characteristics of the first three functional levels. The analysis is derived from data obtained from randomly sampled fishermen (harvesting), wholesalers, and retailers located in Minnesota, Wisconsin, South Dakota, and Iowa. Because of the predominance in numbers of fishermen compared with other functions, more data were available from the harvesting or production point of view.

Commercial Fishery

Most of the fisheries surveyed are faced with conditions creating risks which are analogous to farming. A commercial fisherman is at the mercy of the weather. In some cases prevailing weather conditions will eliminate spawning seasons for years at a time. It is mandatory that the right kind of weather conditions prevail in order to harvest. During the spring, summer, and fall, high winds and rough waters often make it impossible for the fishermen to get on the water with small craft. Large nets of several varieties are difficult to handle in rough water. During the winter, snow storms and high winds prevent a fisherman from raising fish through holes in the ice.

The operating conditions of fisheries vary (Table 2). The average number of months that fishermen are active is higher in those states where

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<sup>17</sup>The harvesting or production function is normally referred to as the fishery. This term will hereinafter be employed when referring to fishermen or the harvesting facilities.

commercial fishing takes place during the winter than in those where most of the harvesting is during periods when waters are not covered with ice.

Commercial fisheries are not organized as corporations. Licenses and contracts cannot be legally obtained by a corporation in each of the states. Even if the corporate structure were possible, a fishery would have to have an annual gross income in the range of 150 to 200 thousand dollars in order to reap the benefits from the corporate tax plan. None of the fisheries surveyed has an annual gross income anywhere near this magnitude. Simple proprietorship seemed to be the most popular form of business framework among commercial fishermen. Where partnerships existed, each of the partners possessed a license or contract.

Two-thirds of the fishermen were licensed. Licensed fishermen generally fished large bodies of water, such as Lake of the Woods or the Oahe Reservoir. Contracts, on the other hand, are generally let by the state to operators for maintaining balance between game and nongame fish.

The average number of years that each individual interviewed had been in the fishery business was quite high. The overall average for all four states was 22.3 years. Entry into the industry is not high. There are two major reasons for this: (1) the investment in equipment was relatively high as compared with firms in other industries that are producing the same net return, and (2) the net income derived from most fishery operations was quite low. Wages paid labor in nearby communities are generally higher than income derived from commercial fishing (with little or no capital investment).

The overall average annual gross income of the 45 commercial fisheries interviewed was \$16,055. Although accurate average yearly production cost figures were not obtained from the fisheries, the estimated average net income of each fishery would be about 33 per cent of the gross income. Production costs are incurred from: (1) hired labor costs, (2) equipment depreciation, maintenance costs of equipment, and gasoline and oil costs, and (3) money paid to the State Game and Fish Department for each pound of fish that they catch.<sup>18</sup>

The amount of hired labor used in the average fishery in each state was in direct proportion to the average annual gross income earned (Tables 3 and 7). There were some exceptions to this in Wisconsin where operators were substituting capital for labor at a greater rate than in other states.

As would be expected, where labor was difficult to obtain, hourly wages were high. Where it appeared labor was easily available, labor rates were low. This would explain why capital substitution in Wisconsin is greater than in the other states.

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<sup>18</sup>Not required in all states.

TABLE 2. OPERATING CONDITIONS OF COMMERCIAL FISHERIES: MINNESOTA, WISCONSIN, SOUTH DAKOTA, AND IOWA, 1967.

State	Number of commercial fisheries interviewed	Average operating period (months/year)	Business framework			Average number of years in fishery business	Number licensed	Number with contract	Average number of years		Average annual gross income per fishery
			Proprietorship	Partnership	Other				License	Contract	
Minnesota	17	5.5	13	4	21.0	10	7	24.0	15.0	9,738	
Wisconsin	11	8.8	6	5	26.5	11	--	24.2	--	19,400	
South Dakota	8	10.0	6	2	12.5	--	8	--	12.5	30,155	
Iowa	9	8.3	7	2	29.3	9	--	29.3	--	4,925	
All States	45	8.1	32	13	22.3	30	15	25.8	13.8	16,055	

TABLE 3. BUSINESS CONDITIONS OF THE FISHERIES IN MINNESOTA, WISCONSIN, SOUTH DAKOTA, AND IOWA, 1966

State	Labor used in business		Have trouble getting help?	Wage rate		Plan to expand				
	Number of fisheries interviewed	Average number of full time men <sup>a</sup>		Yes	No	Full time Part Time		Yes	No	
						(\$/hr.)	(\$/hr.)			
Minnesota	17	.77	3.7	5	10	2.06	1.77	2	12	3
Wisconsin	11	.54	2.0	6	3	2.75	2.00	4	7	--
South Dakota	8	5.20	7.6	1	7	1.93	1.69	2	4	2
Iowa	9	--	.33	--	2	--	1.67	1	8	--
All States	45	1.40	3.3	12 <sup>c</sup>	22 <sup>c</sup>	2.18 <sup>d</sup>	1.78 <sup>e</sup>	9	31	5

<sup>a</sup>Fishing every day of the fishing season.  
<sup>b</sup>Only work during periods of high production.  
<sup>c</sup>The total Yes and No answers do not equal the number of fisheries interviewed because some fisheries do not require additional labor.  
<sup>d</sup>Twelve fisheries.  
<sup>e</sup>Twenty-two fisheries.

The high number of negative answers received from fishermen when each was asked whether he was planning to expand his operation could be partially explained by the unavailability of hired labor in certain areas. An exception was in Wisconsin, where a substitution of capital for labor was occurring. Of the 45 fishermen interviewed, nine were planning to expand, 31 had no plans of expanding, and five were undecided.

A variety of species of fish is caught in each state. The average wholesale price per pound<sup>19</sup> received by the fishermen interviewed was based on prices received from only those fishermen in the state who harvested that particular species of fish (Table 4).

The wholesale price of buffalofish, bullheads, and carp had a tendency to increase at harvesting points closer to the Chicago market (Table 4). This variation in price could be attributed to the decrease in transportation costs as the fish moved closer to the Chicago market. An exception was South Dakota. The wholesale prices paid to a small percentage (25 per cent) of the fishermen interviewed in that state were higher than average. They were selling buffalofish and carp in the gutted form, and as a result received a higher price per pound on the Chicago market.

A small percentage (20 per cent) of the fishermen interviewed in Wisconsin and Iowa was selling buffalofish and bullheads directly to wholesalers on the Chicago market, and therefore were receiving full wholesale market prices for their fish, but were also arranging for and paying for the costs of transporting them to market.

The transportation of commercially harvested fish was generally absorbed by the fisherman who harvested the fish. The price that he received from the buyer was the Chicago wholesale price less transportation and commission costs. Most of the fishermen in Iowa and two or three in Wisconsin, however, handled transportation arrangements for fish sold in the Chicago market. The harvest was generally handled by a specialized trucking firm which has specific weekly routes. Nearly all of the fish marketed were moved by motor carrier. A small percentage of the Minnesota harvest moves by rail. During the harvest period, fish are shipped about three times per week.

The largest percentage (estimated 70 per cent) of the fish were shipped to two states: Illinois and Iowa. There are large wholesale fish markets located in these two states (Chicago and Spirit Lake, respectively). The remainder of the fish was shipped to southern states. A large percentage (estimated 35 to 40 per cent) of the fish shipped to southern states was shipped live to be planted in fish ponds for public fishing.

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<sup>19</sup>Wholesale prices paid to fishermen are defined as Chicago wholesale market prices less transportation costs.

TABLE 4. AVERAGE FISH PRICES FISHERMEN RECEIVED FOR THEIR FISH IN MINNESOTA, WISCONSIN, SOUTH DAKOTA, AND IOWA, 1966<sup>a</sup>

State	Number of fish-eries inter-viewed	Ale-wives	Buffalo-fish	Bull-heads	Carp	Cat-fish <sup>b</sup>	Perch	Sheeps-head	Suck-ers	Fish used for mink feed	Fish used for fish meal (cattle feed)	(cents per pound)	
												Carp	Cat-fish <sup>b</sup>
Minnesota	17	--	7.9	8.0	2.6	--	10.5	4.5	--	3.5	--		
Wisconsin	11	.95	13.5	10.5	3.3	23.0	16.3	6.0	2.8	--	.80		
South Dakota	8	--	10.0	9.3	3.1	23.0	--	4.5	--	2.5	--		
Iowa	9	--	13.3	13.8	3.7	27.0	--	8.6	3.0	--	--		
All States	45	.95	10.8	10.3	3.1	25.3	12.4	7.0	2.8	3.3	.80		

<sup>a</sup>Chicago wholesale market price less transportation costs.

<sup>b</sup>All prices are for catfish sold in the round.

The average shipping cost ranged from 5.3 cents per pound from Minnesota to 2.5 cents per pound in Iowa. The difference in transportation costs can be attributed to distance from the wholesale market. Some fisheries incurred costs of processing prior to shipment. This cost ranged from one cent to one and one-third cents per pound (Table 5).

Commercial fish harvested in the Upper Midwest are sold for human consumption and for animal feeds. Fish consumed by humans are marketed in various forms: (1) in the round directly to a wholesaler or directly to a retail fish market, (2) in the round live to the south for replanting to be reharvested by the public, (3) gutted to a wholesale or retail market and resold to the consumer in the gutted form, and (4) smoked. The manner in which they are shipped of course depends highly on the demand.

Several fisheries sell at least part of their harvest for animal feeds (Table 6). Nearly all of that portion of the harvest sold for feed is further processed.

The bulk (estimated 75 per cent) of the fish caught by those fishermen that were interviewed went for human consumption. The largest share (estimated 85 per cent) of the fish marketed for human consumption was shipped in the round. The next most popular was the gutted form. A small percentage (about 10 per cent) of the fisheries sold fish directly to smokers who either retailed the processed product or sold smoked fish to retailers.

Those fish sold for human consumption shipped in the round and gutted reached the final consumer in many different forms. Most of the fisheries that were interviewed were uncertain as to the final form and destination. There were instances when fishermen knew the final destination of their fish because the wholesaler to whom they sold their fish marketed fish in only one or two forms. An example is Chicago's fresh fish markets where close to 100 per cent are marketed fresh or fresh frozen. On the other hand, markets, such as the one located in Spirit Lake, Iowa, have numerous outlets for these fish, such as (1) marketing fresh in the round or gutted form, (2) processing for fish sticks, (3) processing for pet foods, and (4) processing for cattle feed. As a result, only the market forms that the fishermen were reasonably sure that their fish were consumed in were recorded (Table 6).

The commercial fishing business at the present time appears to be very much like the business of farming where the capital investment is high and net return per dollar invested is very low.

Aside from market instability (discussed in Chapter IV), there is another factor that has an effect on the level of net income earned by fisheries. In a business where there is a high fixed investment ( or high fixed costs of production), the length of the operating season has a large effect on the

TABLE 5. TRANSPORTATION DATA FOR FISHERMEN IN MINNESOTA, WISCONSIN, SOUTH DAKOTA, AND IOWA, 1966

State	Number of fishermen contacted	Cost of Transportation		Average shipping and/or processing costs per pound (cents/ pound)	Average number of shipments per week during season <sup>a</sup>	Destination of fish shipments	Percentage of fish shipped by Truck Rail	
		Per cent of time paid by wholesaler	Per cent of time paid by fishermen					
Minnesota	17	82.4	17.6	5.3	--	2.0 (5 said it varies)	Illinois (Chicago) Nebraska Iowa Tennessee	89.7 10.3
Wisconsin	11	45.4	54.6	3.5	--	3.5 (9 said it varies)	Illinois (Chicago) Indiana Missouri Tennessee Iowa Nebraska	100.0 --

- continued -

TABLE 5. TRANSPORTATION DATA FOR FISHERMEN IN MINNESOTA, WISCONSIN, SOUTH DAKOTA, AND IOWA, 1966 (continued)

State	Number of fishermen contacted	Costs of transportation		Average shipping and/or processing costs per pound (cents/pound)	Average number of shipments per week during season <sup>a</sup>	Destination of fish shipments	Percentage of fish shipped by Truck	Percentage of fish shipped by Rail
		Per cent of time paid by wholesaler	Per cent of time paid by fishermen					
South Dakota	8	100.0	--	1.2	2.8	Iowa Illinois (Chicago) Ohio Missouri Kansas Tennessee	100.0	--
Iowa	9	22.2	77.8	1.3	2.9	Illinois (Chicago) Iowa	100.0	--
All States	45	64.4	35.6	1.2	2.8	Iowa, Tennessee, see, Missouri, Indiana, Nebraska, Ohio, Illinois (Chicago) Kansas	96.7	33.3

<sup>a</sup>Based on 26 respondents.

TABLE 6. KNOWN ALTERNATIVE USES MADE OF FISH SHIPPED BY FISHERMEN IN MINNESOTA, WISCONSIN, SOUTH DAKOTA, AND IOWA, 1967

State	Number of fishermen contacted	Fresh-Round									
		Buffalo-fish	Bull-heads	Cat-fish	Her-ring	Perch	Pick-erel	Sauger	Sheeps-head	Suck-ers	Wall-eyes
Minnesota	17	6	5	6	--	5	5	4	3	--	8
Wisconsin	11	2	2	7	1	1	--	--	3	4	--
South Dakota	8	5	5	4	--	--	--	--	1	--	--
Iowa	9	8	3	5	2	--	--	--	6	1	--
All States	45	21	15	22	5	1	6	4	13	5	8

- continued -

TABLE 6. KNOWN ALTERNATIVE USES MADE OF FISH SHIPPED BY FISHERMEN IN MINNESOTA, WISCONSIN, SOUTH DAKOTA, AND IOWA, 1967 (continued)

State	Number of fish-ermen contacted	Fresh-Gutted										
		Buffalo- heads	Bull- heads	Carp	Cat- fish	Perch	Pick- erel	Sauger	head	Stur- geon	Wall- eyes	White- fish
Minnesota	17	--	--	--	--	--	3	1	--	--	1	4
Wisconsin	11	1	--	2	--	1	--	--	1	--	--	--
South Dakota	8	2	3	2	1	--	--	--	--	--	--	--
Iowa	9	--	1	--	7	--	--	--	--	2	--	--
All States	45	3	4	4	8	1	3	1	1	2	1	4

- continued -

TABLE 6. KNOWN ALTERNATIVE USES MADE OF FISH SHIPPED BY FISHERMEN IN MINNESOTA, WISCONSIN, SOUTH DAKOTA, AND IOWA, 1967 (continued)

State	Number of fishermen contacted	Smoked			Animal Feeds			
		Buffalo-fish	Carp	Suckers	Hog feed	Cattle feed	Mink feed	Pet food
Minnesota	17	--	--	1	3	--	9	--
Wisconsin	11	2	3	--	--	3	--	--
South Dakota	8	3	5	--	--	3	--	--
Iowa	9	--	2	--	--	--	--	2
All States	45	5	10	1	3	6	9	2

MINNESOTA DEPARTMENT OF CONSERVATION  
 DIVISION OF FISHERIES  
 600 S. STATE ST. ST. PAUL, MINN. 55103  
 1967

TABLE 7. PRODUCTION DATA FOR FISHERIES IN MINNESOTA, WISCONSIN, SOUTH DAKOTA, AND IOWA, 1966

State	Number of fisheries inter-viewed	Cost and Revenue Items					Average annual gross income as a percentage of total capital investment in buildings and equipment	Average annual operating period (months)
		Average investment in buildings	Average investment in equipment	Average annual labor costs	Average investment in buildings and equipment	Average annual gross income		
Minnesota	17	\$2,497	\$14,097	\$4,416	\$16,594	\$ 9,738	58.7	5.5
Wisconsin	11	5,909	32,355	4,555	38,264	19,400	50.7	5.8
South Dakota	8	8,250	25,193	8,748	33,443	30,155	90.2	10.0
Iowa	9	3,133	5,167	0	8,300	4,925	59.3	8.3
All States	45	4,481	18,577	4,232	22,024	16,054	72.9	8.1

TABLE 8. BUSINESS STATISTICS ON 10 COMMERCIAL FISH PROCESSOR-WHOLESALEERS IN MINNESOTA, WISCONSIN, SOUTH DAKOTA, AND IOWA, 1966<sup>a</sup>

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Length of annual operating period:

- 7 - the year around
- 3 - five months

Business framework:

- 6 - corporate
- 1 - partnership
- 2 - proprietorship
- 1 - cooperative
- 39 years - average age of business<sup>b</sup>
- 3.5<sup>c</sup> - average number of full time employees<sup>d</sup>
- 16 - average number of part time employees<sup>e</sup>
- \$1.80/hour - average full time wage rate<sup>f</sup>
- \$1.48/hour - average part time wage rate<sup>g</sup>

Trouble getting help:

- 5 - No
- 4 - Yes

Plans to expand operation:

- 7 - No
  - 1 - Yes
  - \$42,000 - average investment in buildings<sup>h</sup>
  - \$40,143 - average investment in equipment<sup>i</sup>
  - \$22,833 - average annual labor costs<sup>j</sup>
  - \$216,875 - average annual gross income<sup>k</sup>
- 

<sup>a</sup>One from South Dakota, four from Wisconsin, one from Iowa, and four from Minnesota. Seven out of the 10 shipped at least a portion if not all of their fish to the Chicago wholesale fish market.

<sup>b</sup>Only two of the 10 firms had been in business less than 30 years.

<sup>c</sup>One large processor-wholesaler was eliminated from this figure because he had 85 full time employees and therefore was not at all representative of the average operator in the commercial fish processing and wholesaling industry.

<sup>d</sup>Eight respondents.

<sup>h</sup>Five respondents.

<sup>e</sup>Nine respondents.

<sup>i</sup>Seven respondents.

<sup>f</sup>Seven respondents.

<sup>j</sup>Seven respondents.

<sup>g</sup>Eight respondents.

<sup>k</sup>Four respondents.

normal profits<sup>20</sup> realized. In other words, the greater the total production for a given investment in buildings and equipment, the lower the average fixed costs per unit of production<sup>21</sup> will be for the producer (Table 7).

### Commercial Fish Processor-Wholesalers

This section of the analysis is based on the results of interviews with 10 commercial fish processor-wholesalers from Minnesota, Wisconsin, South Dakota, and Iowa.

Varying amounts of information were secured from each of the 10 commercial fish processor-wholesalers interviewed (Table 8). There were three main reasons for this: (1) the respondent often did not have enough time to do a complete job of filling out a questionnaire,<sup>22</sup> (2) four of the businesses were small operations and therefore did not have a large volume of information to contribute,<sup>23</sup> and (3) three of the operators were very reluctant to release any information for fear that the information would find its way back to a competitor.<sup>24</sup> As a result, the information received from the 10 processor-wholesalers interviewed is based on less than a 100 per cent response.

Various reasons were given for not expanding: (1) three firms could not secure a large enough volume of fish to fully utilize the existing plant capacity, (2) two firms saw very little future in the fish business in their area so were content to maintain the facilities they presently operated, and (3) the other three firms were having trouble obtaining help because they could not compete with wages paid by other industries in the surrounding area.

The varying methods in transportation and packaging among the 10 firms, along with the scattered information gathered in this area, made it impossible to compile any meaningful transportation and packaging costs incurred by the 10 firms.

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<sup>20</sup>Normal profits defined: The return on an investment that covers wages and salary payments to labor and interest and rental payments for capital and land, and also payments to the business or entrepreneur for any routine labor services, capital, or land he owns and supplies in operation of his own enterprise.

<sup>21</sup>A unit of production could represent a pound of fish or a ton of fish depending on which is most convenient.

<sup>22</sup>One in Wisconsin, one in Iowa, and one in Minnesota.

<sup>23</sup>One in South Dakota, one in Minnesota, and two in Wisconsin.

<sup>24</sup>One in Wisconsin and two in Minnesota.

### ANALYSIS OF PRICE VARIATIONS FOR BUFFALOFISH, CARP, AND BULLHEADS

There are many variables that may cause changes in the price of a good or service. The relative impact of each of the variables will be different. That is, particular variables will be of greater significance than other variables.

A multilinear stepwise regression model was used to perform the statistical analysis. Three dependent variables and 13 independent variables were used throughout the state and aggregate analysis and five independent variables in the quarterly analysis. The dependent variables used for the analysis were:

#### Dependent Variables<sup>25</sup>

$X_1$  = Price of buffalofish<sup>26</sup>

$X_1$  = Price of carp<sup>26</sup>

$X_1$  = Price of bullheads<sup>26</sup>

Some clarification should be made as to the order in which each of the above dependent variables appears in the regression equation. When the price of buffalofish was the dependent variable ( $X_1$ ), the price of carp ( $X_8$ ) and the price of bullheads ( $X_7$ ) appeared as independent variables. When the price of carp was the dependent variable, the price of buffalofish became  $X_8$  and the price of bullheads remained  $X_7$ . When the price of bullheads was  $X_1$ , the price of buffalofish remained  $X_8$  and the price of carp became  $X_7$ .

The analysis includes data for the 12-year period from 1954 through 1965. No specific tools other than simple logic were used to determine which independent variables to include in the analysis. The following independent variables were used in the analysis:

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<sup>25</sup>Dependent variable: A factor that is dependent upon the changes that take place in the independent variables. Independent variable: A factor whose change causes a change in the dependent variable. Variable: A quantity which may assume a succession of values which need not be distinct.

<sup>26</sup>Chicago Wholesale Fish Market Prices for Calendar Years 1954 through 1965, U. S. Department of Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries, Branch of Current Economic Analysis, Arlington, Virginia.

Independent Variables

- X<sub>2</sub> = Production of buffalofish<sup>27</sup>
- X<sub>3</sub> = Production of carp<sup>27</sup>
- X<sub>4</sub> = Production of bullheads<sup>27</sup>
- X<sub>5</sub> = Pounds of fish caught with a sein<sup>27</sup> ) Buffalofish, carp,  
) and bullheads,
- X<sub>6</sub> = Pounds of fish caught with a gillnet<sup>27</sup> ) respectively
- X<sub>7</sub> = Price of bullheads (or carp)<sup>28</sup>
- X<sub>8</sub> = Price of carp (or buffalofish)<sup>28</sup>
- X<sub>9</sub> = Price of beef<sup>29</sup>
- X<sub>10</sub> = Price of pork<sup>30</sup>
- X<sub>11</sub> = Price of chicken<sup>31</sup>
- X<sub>12</sub> = Number of fishermen operating (by state)<sup>29</sup>
- X<sub>13</sub> = Per capita disposable income (by state)<sup>32</sup>

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<sup>27</sup>Fishery Statistics of the United States, 1954 through 1965, (Mississippi River Fisheries), U. S. Department of Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries, Washington, D. C.

<sup>28</sup>Chicago Wholesale Fish Market Prices for Calendar Years 1954 through 1965, op. cit.

<sup>29</sup>Livestock and Meat Statistics, 1962, Bulletin No. 333, USDA, Economic Research Service, Washington, D. C., July, 1963; and Livestock and Meat Statistics, 1967: Supplement to 1966 Livestock Report, Bulletin No. 333, USDA, Economic Research Service, Washington, D. C., June, 1967.

<sup>30</sup>USDA, op. cit., pp. 283, 140.

<sup>31</sup>Poultry and Egg Situation, Selected Series for Poultry and Eggs through 1964, Bulletin No. 232, USDA, ERS, May, 1965.

<sup>32</sup>Calculated from per capita personal income figures and State and Federal income tax figures. Per capita personal income figures from the U. S. Bureau of the Census, Statistical Abstracts of the United States, 1956 through 1966, Washington, D. C., Federal income tax figures from Statistics of Income 1963 and 1965 Individual Income Tax Returns, U. S. Treasury Department, IRS, Washington, D. C., June, 1967. State income tax figures from Compendium of State Government Finances, Bureau of Census, 1954 through 1965.

$X_{14}$  = Consumer price index<sup>33</sup>

The values for variables  $X_9$  (price of beef),  $X_{10}$  (price of pork),  $X_{11}$  (price of chicken), and  $X_{14}$  (consumer price index) remain constant for the 17 equations of the regional and state analysis. The values of variables  $X_2$  (production of buffalofish),  $X_3$  (production of carp),  $X_4$  (production of bullheads),  $X_{12}$  (number of fishermen fishing in each state), and  $X_{13}$  (per capita disposable income in each state) vary from state to state in the individual state analysis, and in the regional analysis five-state totals were used for  $X_2$ ,  $X_3$ ,  $X_4$ , and  $X_{12}$ , and a five-state average was used for  $X_{13}$ . The values for variables  $X_5$  (pounds of a particular species seined) and  $X_6$  (pounds of a particular species gillnetted) varied within an individual state analysis depending on which price (price of carp, price of buffalofish, or price of bullheads) was used as the dependent variable. In the regional analysis, values for variables  $X_5$  and  $X_6$  were five-state totals of the pounds of each particular species seined and five-state totals of the pounds of each particular species gillnetted. Variables  $X_7$  (price of bullheads or carp) and  $X_8$  (price of carp or buffalofish) varied from equation to equation depending on which of the three prices (price of buffalofish, carp, or bullheads) was used as the dependent variable ( $X_1$ ) in the equation.

#### Regional Analysis (Five-State Area)

The prices of buffalofish, carp, and bullheads were all three used as both dependent and independent variables in obtaining the following function:

Equation 1 (Price of buffalofish =  $X_1$ ):

$$\begin{aligned} X_1 = & 1.99067 + 151685 \log X_4 + .360404 \log X_8 + .219742 \log X_9 \\ & \quad (.048122) \quad (.205260) \quad (.164843) \\ & + .190186 \log X_{13} - 1.35926 \log X_{14} \\ & \quad (.262592) \quad (.992917) \end{aligned}$$

$$R^2 = .812962$$

The only significant independent variable at the 95 per cent probability level in the above equation was  $X_4$  (production of bullheads). The relationship between  $X_1$  and  $X_4$  was positive, that is, as the production of bullheads increased, the price of buffalofish increased. It is interesting to note that the production of buffalofish did not serve as a significant variable.

The  $R^2$  values appearing at the end of each equation designate the percentage of variation in the dependent variable ( $X_1$ ) that has been due to

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<sup>33</sup>Economic Report to the President, President's Council of Economic Advisers, Government Printing Office, Washington, D. C., January, 1967.

per cent changes in the independent variables in the equation. The  $R^2$  value is in decimal form and not a straight percentage figure. For example, in Equation 1, approximately 81 per cent of the change in the price of buffalofish ( $X_1$ ) can be contributed to the per cent changes that have taken place in the independent variables in the equation ( $X_4$ ,  $X_8$ ,  $X_9$ ,  $X_{13}$ , and  $X_{14}$ ).

As the production of bullheads ( $X_4$ ) increased, the price of buffalofish ( $X_1$ ) increased. An explanation for this could be that in years when the production of bullheads was up (maybe because of a good spawning season in previous years), the price of buffalofish was up as a result of a decline in the production of buffalofish during those same years. There may be many reasons for such a situation existing.

In the next equation the price of carp was used as the dependent variable.

Equation 2 (Price of carp =  $X_1$ ):

$$X_1 = 1.01562 - .108077 \log X_2 + .353445 \log X_8 - .204894 \log X_{11}$$

(.041780)                      (.237210)                      (.073057)

$$R^2 = .751893$$

Variable  $X_{11}$  (the price of chicken) had the most influence on the dependent variable in the above equation, although variable  $X_2$  (production of buffalofish) entered the stepwise analysis first. Both  $X_2$  and  $X_{11}$  have a negative relationship with  $X_1$  (price of carp). As the production of buffalofish and price of chicken increase, the price of carp decreases.

The explanation for such a relationship may be because buffalofish is a close substitute for carp and therefore, as the production of buffalofish increased, the carp market would weaken and thus the price of carp would decrease. The same relationship exists with the price of chicken ( $X_{11}$ ) and the price of carp ( $X_1$ ); as the price of chicken increases, the price of carp decreases. There was no apparent explanation for this relationship other than possible inaccurate wholesale fish price data.

The third and final equation on the five-state analysis employs the price of bullheads as the dependent variable.

Equation 3 (Price of bullheads =  $X_1$ ):

$$X_1 = .846109 + .155849 \log X_2 + .404901 \log X_3 - .017347 \log X_6$$

(.040368)                      (.129782)                      (.006847)

$$R^2 = .840118$$

All three independent variables were significant at the 95 per cent level. Variable  $X_3$  (production of carp) was the first variable to enter the

stepwise analysis, but was not quite as significant as variable  $X_2$  (production of buffalofish). Both variables  $X_3$  and  $X_2$  have a positive relationship with the dependent variable  $X_1$  (price of bullheads).

As the production of carp ( $X_3$ ) increased, the price of bullheads ( $X_1$ ) increased. A hypothesis for this would be that in years where the carp population was high, the bullhead population was kept down, and, as a result, not many pounds of bullheads were marketed, thus keeping the price of bullheads down. The same explanation could be used for the relationship between the production of buffalofish to the price of bullheads as was used previously for carp, although the variation in hardness between bullheads and buffalofish is much smaller than the variation in hardness between carp and bullheads.

#### Quarterly Analysis (1960 through 1966)

A time series analysis such as the 12-year one discussed above often camouflages significant seasonal price-quantity relationship. As a result, the following quarterly analysis was conducted for the period 1960 through 1966. The analysis was conducted on Chicago wholesale fish market prices and marketings for that period.<sup>34</sup> The dependent variables were:

##### Dependent Variables

$X_1$  = Price of buffalofish<sup>34</sup>

$X_1$  = Price of carp<sup>34</sup>

$X_1$  = Price of bullheads<sup>34</sup>

Six independent variables were employed in the analysis:

##### Independent Variables

$X_2$  = Marketings of buffalofish<sup>34</sup>

$X_3$  = Marketings of carp

$X_4$  = Marketings of bullheads

$X_5$  = Price of carp (or buffalofish)<sup>34</sup>

$X_6$  = Price of bullheads (or buffalofish)<sup>34</sup>

<sup>34</sup>Albano, G. A., Receipts and Prices of Fresh and Frozen Fishery Products at Chicago, U. S. Department of the Interior, Bureau of Commercial Fisheries, Division of Resource Development, Market News Service, 565 North Washington Street, Chicago 6, Illinois, 1960 through 1966. Chicago wholesale market prices are averages of all qualities of each species analyzed by quarters. Marketings are total for quarterly periods on Chicago wholesale fish market.

The objective of the quarterly analysis was to seek out any price quantity relationships that may have existed on a seasonal basis.

Equation 4 (Price of buffalofish =  $X_1$ ):

$$X_1 = 1.73685 - .780215 \log X_2 + .918720 \log X_5 + .765824 \log X_6$$

(.169082)                      (.159446)                      (.176200)

$$R^2 = .693738$$

The price of carp ( $X_5$ ) was a highly significant variable in Equation 4. The marketings of buffalofish ( $X_2$ ) and the price of bullheads ( $X_6$ ) were also significant at the 95 per cent level.

As the price of buffalofish ( $X_1$ ) increases by 100 per cent, the price of carp ( $X_5$ ) increases by 92 per cent. If the price of buffalofish were 10 cents per pound, and increase of 10 cents would affect the price of carp such that if carp were at five cents per pound, the price would increase almost five cents per pound. The price of buffalofish ( $X_1$ ) and the marketings of buffalofish ( $X_2$ ) are negatively related. As marketings increase, price decreases. The price of carp is positively related to marketings of carp. Therefore, the price of buffalofish is the controlling variable on the Chicago market, i.e., price of carp responds to changes in price of buffalofish and provides impetus to fishermen to increase or decrease the harvesting of carp.

Equation 5 (Price of carp =  $X_1$ ):

$$X_1 = -.208814 + .245464 \log X_3 + .290271 \log X_5$$

(.054524)                      (.097415)

$$R^2 = .620137$$

The marketings of carp on the Chicago wholesale market ( $X_3$ ) were a highly significant variable in equations. The price of buffalofish ( $X_5$ ) was also significant at the 95 per cent level.

The positive relationship between the marketings of carp ( $X_3$ ) and the price of carp ( $X_1$ ) does not follow the logical relationship that the price of a commodity usually had with the supply of that commodity. In other words as the marketings of carp increase, the price of carp also increases. Two hypotheses can be made as explanations of this situation: (1) the supply function rather than the demand function is affecting the market; as price rises, fishermen begin to fish more and flood the market, dropping price. The magnitude of this drop in price would not show up in monthly averages unless weighted daily prices were used in compiling average monthly prices. (2) the price and marketing data appearing in the Bureau of Commercial Fisheries Chicago reports are not representative of true market transactions.

Equation 6 (Price of bullheads =  $X_1$ ):

$$X_1 = - .763220 + .632551 \log X_2 - .529384 \log X_5 + .575954 \log X_6$$

(.154447)                      (.184683)                      (.132568)

$$R^2 = .513890$$

The price of buffalofish on the Chicago market ( $X_6$ ) was the most significant independent variable in the equation. There was a positive relationship between the price of buffalofish ( $X_6$ ) and the price of bullheads ( $X_1$ ). The marketings of buffalofish ( $X_2$ ) and the price of carp ( $X_5$ ) were also significant at the 95 per cent level.

The total quarterly marketings of bullheads on the Chicago market are very low in relation to the marketings of buffalofish and carp. As a result, it appears that the Chicago market is not the central market for bullheads. This would account for the fact that the marketings of bullheads ( $X_4$ ) did not enter Equation 3 as a significant variable. Thus, the results of Equation 3 do not reflect the true picture as to what factors actually have an effect on the price of bullheads, but rather, probably show the price leadership of buffalofish on the Chicago wholesale market. The main market for bullheads would probably be in the south central part of the United States.

In equations (state, regional, or quarterly) where the price of buffalofish was used as the dependent variable ( $X_1$ ), the price of carp ( $X_3$ ) had a positive relationship with the price of buffalofish ( $X_1$ ); as the price of buffalofish increased, so did the price of carp. In these same equations (price of buffalofish =  $X_1$ ) the production or marketings of buffalofish ( $X_2$ ) had a negative relationship with the price of buffalofish ( $X_1$ ). As production (or marketings) of buffalofish ( $X_2$ ) increased, the price of buffalofish decreased. This is an expected normal price-quantity relationship. On the other hand, in equations where the price of carp was used as the dependent variable ( $X_1$ ), the production (or marketings) of carp ( $X_3$ ) was positively related to the price of carp ( $X_1$ ). As the production of carp increased, the price of carp also increased.

In other words, as buffalofish is the higher priced fish (and the fish that is the most in demand) of the two, it is used by the fisherman as a means of unloading the lower priced carp to the wholesaler for a fair or possibly break-even price. The price of buffalofish was a function of the quantity of buffalofish produced or marketed. ( $P_{bf} = f(Q_{bf})$ ).

#### ALTERNATIVE MARKETS FOR NORTH DAKOTA FISH AND THEIR COMPETITIVE POSITION IN THOSE MARKETS

An annual volume of 14 million pounds of commercial fish (nongame fish) has been estimated to be available for procurement from North Dakota

waters.<sup>35</sup> This 14 million-pound estimate was composed mainly of three species of high quality commercial fish, plus other miscellaneous varieties. The estimate includes about 6,000,000 pounds of buffalofish, nearly 3,000,000 pounds of carp, 2,250,000 pounds of goldeye, and 3,000,000 pounds of miscellaneous fish, such as sheepshead, common sucker, carpsucker, bullheads, and catfish.

As was mentioned previously, the wholesale market for buffalofish is stronger than the market for carp or other lower quality fish. Because of this, the price of buffalofish is about twice (or even in some cases three times) that of carp. Buffalofish would appear to be the most feasible of the two species (carp and buffalofish) to market. The estimated average price for buffalofish (of average grade) is about 14 cents per pound on the Chicago wholesale market.<sup>36</sup> The estimated average price for carp on the Chicago market is about 5.5 cents per pound.<sup>37</sup> As a result, if production and transportation costs were the same for the two species, it would be much more profitable to harvest buffalofish and sell them on the Chicago market than it would be carp. (Average price differential per pound between the two species would be about 8.5 cents per pound.)

The following are average production and transportation costs computed from data secured from two of the larger firms interviewed.<sup>38</sup> The fish shipped by these two firms were shipped in the gutted form; therefore, the average wholesale market price per pound that they sold at on the Chicago market was three or four cents per pound higher than those marketed in the nongutted form (Table 9).

The fishery profit was 3.5 cents per pound providing that all production cost estimates are correct. If a wholesaler had bought the fish from the fisherman (at 12 cents per pound) and sold them on the Chicago market, the profit would average one cent per pound. In both cases, if either the fisherman or the wholesaler can cut their costs of production, they could increase their profits. The wholesaler who handles the fish has a chance to make more than a 14-cent per pound profit by bargaining for a higher price on the Chicago wholesale market.

In the case of carp, the fisherman received three cents per pound at the fishery for a gutted fish ready to go to market. The production costs for carp (9.5 cents per pound) are identical to those of buffalofish, because the same type of equipment and the same amount of labor are used in producing

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<sup>35</sup>North Dakota State Game and Fish Department, Bismarck, North Dakota, 1966.

<sup>36</sup>Market form -- in the round.

<sup>37</sup>Ibid.

<sup>38</sup>Summer, 1967.

them. As a result, the gross return on a pound of carp doesn't even cover the fisherman's out-of-pocket costs of producing them. Most of the carp bought from these two fisheries go to a processing plant in Iowa, resulting in some profit. The only reason the fisherman hauls these carp into the fishery is because he has already incurred the costs of catching them and taking them out of the net, and in order to retrieve these costs he has to market them.

TABLE 9. ESTIMATED COSTS AND REVENUE FOR MARKETING GUTTED BUFFALOFISH, UPPER MISSISSIPPI STATES, 1967<sup>a</sup>

Item	Costs
	(cents per pound)
Costs: Harvesting <sup>b</sup>	5.0
Processing <sup>c</sup>	1.5
Transportation	4.0
Other <sup>d</sup>	<u>3.0</u>
Total	13.5
Revenue (Gross) Gutted	17.0
Revenue (Net) Gutted	3.5

<sup>a</sup>Does not include North Dakota data.

<sup>b</sup>Includes labor and harvesting equipment costs.

<sup>c</sup>Includes gutting, icing, and boxing.

<sup>d</sup>Capital and utility costs on fishery facilities and fees paid to State Fish and Game Department per pound of fish caught as well as other small miscellaneous costs such as a license or contract registration fee.

In the case where the production costs of harvesting buffalofish in North Dakota waters were the same as those incurred in harvesting buffalofish from South Dakota waters, and the same price was had for buffalofish out of North Dakota waters, it would be feasible and profitable to market buffalofish. It would not be feasible or profitable to market carp from North Dakota waters under the same circumstances because the wholesale market price for carp is too low.

The problems that enter into the marketing of either buffalofish or carp in North Dakota are: (1) can a high enough price be secured on the Chicago market to pay the costs of harvesting these fish, with a reasonable

amount of profit, and (2) can buffalofish and carp be harvested as cheaply in North Dakota as they are in South Dakota?

The main factor affecting the business of commercial fishing is risk, the risk of being able to secure a stable market outlet for the fish that are caught and the risk of getting a long enough fishing season to pay for the fixed costs of owning harvesting equipment. Generally, the more risk that can be taken out of a business, the more sound and attractive it becomes.

The monopsonistic framework of the wholesale fish industry makes it impossible for an individual fisherman to know at what price he will be able to market his fish. These monopsonistic actions appear to be taking place in both Iowa and Chicago where most of the buffalofish, carp, and bullheads from this region are marketed. As was mentioned previously, what makes it difficult for the individual fisherman is the fact that once he has caught his fish, he has to either sell them to the highest bidder, at a price which may be quite low, or dump them back into the water. The perishability of his product makes it impossible for him to hold his fish for over three or four days unless he has a pond that he can put them into and take them out of when the market goes up. If he sells his catch for a low price, he can at least cover some of his fixed costs of production. On the other hand, if he dumps them back into the water, he loses all of his fixed costs of production. A logical answer to the fisherman's marketing problem would seem to be a cooperative. In a situation such as this, a number of fishermen could pool their bargaining power and regulate the quantities of fish marketed in any one market day in an effort to obtain higher prices for their fish.

The idea of cooperatives looks good on paper, but they have been tried in the past and have failed. The two main factors that have been responsible for their failure are: (1) the independence of the individual fishermen has made it difficult for them to get organized and stay in operation, and (2) the cooperatives have taken in a relatively small percentage of the total amount of commercial fish being caught. As a result, the over-supply of fish that exists in the industry enables the wholesaler to completely cut off the supply of fish coming from the small areas where the cooperative exists. As a result, the cooperative fails to work and the fishermen are right back in the same place where they started. It would be difficult to say how large a single fishery cooperative would have to be before it would have significant bargaining power in order to remain functional. Further research would have to be conducted in this area before any reliable recommendations could be made.

The weather conditions in a fishing area also add to risk in a fishing operation. There is not too much a fisherman can do to decrease this type of risk other than try to minimize his capital investment in harvesting and processing equipment. By doing this, if an area proves to be unprofitable to fish because of prevailing weather conditions, he can pick up his equipment and move to another area without incurring much of a loss. This type of operation is often referred to by fishermen as a "poor boy" operation because of its low-fixed capital investment.

Bullheads, which are somewhat similar in price to buffalofish, do not appear very prominent on the Chicago wholesale market. The volume of bullheads marketed in Chicago is much smaller (10 per cent) than the total volume of bullheads harvested in the combined area of Minnesota, Iowa, Wisconsin, North Dakota, and South Dakota. It would seem logical that the market for bullheads would be at central markets in the central and south central region of the United States, since this is where the demand for bullheads is the strongest.

The other higher quality species of fish available for procurement from North Dakota waters is goldeye. The market for goldeye is, at present, located strictly in the Winnipeg area. The most practical means of marketing goldeye in Winnipeg, because of the limited size of the market, would be to arrange a contract to sell a specified volume of goldeye to a Winnipeg goldeye wholesaler. The present market price for goldeye on the Winnipeg market is very dependent on the size of goldeye marketed and the market outlook for the 1968 fishing season. In the case where a goldeye contract could be secured and where harvesting conditions in North Dakota waters were not unreasonable, the marketing of goldeye from North Dakota waters would be feasible.

#### SUMMARY

Commercial fish are marketed through numerous different marketing channels. The market route that each species of fish takes is dependent upon the demand that exists for that species at the time it is marketed. Some species are shipped directly from the producer to the retailer, whereas other species go from the producer to a processor or wholesaler and finally to a retailer. Practically all the wholesale fish markets studied were receiving an oversupply of fish.

The commercial fishing, commercial fish processing, and commercial fish wholesaling businesses appear to be quite unstable. The fisherman is very unsure of the catch he may get because of variation in weather conditions and variation in spawning seasons. More risk and uncertainty is added to the business by the unstable prices that he receives for his fish. The structure of the commercial fish business lends itself very well to the establishment of commercial fish wholesalers possessing monopsonistic characteristics. Lack of restrictions on buying practices in the fish industry gives wholesale fish firms freedom to carry on their business in the fashion that they find to be most profitable.

Wholesale market prices of the various species of commercial fish analyzed appear to be quite dependent in some way on supply. Variations in this relationship were brought about through changes in marketing practices, such as using the bargaining power of one species of fish as a tool in selling another less marketable species of fish.

The average capital investment that fisheries have invested in equipment is relatively high when considering the risk and uncertainty that they

face in the commercial fish business. Profits are very dependent on prevailing weather conditions and reliable market outlets for their fish. In many cases a "poor boy" operation seems to be the only way the fisherman can survive.

There is a great need for more and better reporting of fishery statistics. The largest improvements could be made by increasing the accuracy of the prices and quantities of fresh water fish marketed on major wholesale fish markets. Additional research is needed in the area of the pricing practices of wholesale fish buyers.