ANALYSIS OF THE DISTRIBUTION SYSTEM FOR NORTHWEST-ORIGINATED FRESH AND FROZEN SALMON

Volume II

by

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File Manuscript No. 95-2

September 1971

U.S. NATIONAL MARINE FISHERIES SERVICE
ECONOMIC RESEARCH LABORATORY

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Research Contract No. 14-17-0007-991
with the U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Washington, D.C.

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The United States Government assumes no responsibility as to the accuracy or usefulness of the information contained herein.

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Chapter V

CHANNEL PROCESSES

In the preceding chapters the distribution system has been described as a set of independent entities having interdependent relationships. The basis of these links is the series of activities which must be performed between the time of catch and the final display in the retail counter. This chapter is concerned with the task of describing the nature and sequence of these activities, both to extend the description of the channel process and to provide a foundation for the cost and profitability analysis and the simulation model to follow.

The key to the organization of the channel is the specific configuration of these activities. In a vertically competitive market, specific channel processes would tend to be located so as to maximize the aggregate efficiency of the channel. We have noted, however, that there are few activities which are specifically bound to any one stage. It is therefore necessary to establish the sequence and choice of activities which take place within the channel. Although process activities are customarily located and organized at specific stages, it is not unusual to find them shifted either backward or forward in the channel. The most important factor in a process description of the salmon distribution channel is, therefore, not the identification of functions occurring within individual enterprises but the order in which the specific processes occur.

The two types of channel processes, exchange and physical processing, often occur within the same enterprise. The processor, for example, occupies a pivotal position in the buying and selling of salmon, while at the same time he is responsible for a major share of the physical processing decisions. There are, however, differences which can be observed between the two. The exchange channel often has more stages than the physical distribution channel. The reasons lie not only in the speculative nature of the exchange process but also in the constraints on excessive physical handling and the limitations of available facilities. Decisions in the one area are interdependent with those in the other, and for this reason the most logical manner in which to describe channel processes appears to be through the structure of the customary channel organization.

I. Fishermen

The starting point in the market channel naturally begins with the fishermen.[1] The location of fishing activity determines, in part, the way in which the fish are caught, which in turn determines the location in the channel of the initial process of eviscerating the fish. There are four principal methods of catching salmon: trolling, gill-netting, seining, and trapping. Trolling is the only form of salmon fishing permitted off the Oregon and Washington coasts. Gill-netting is permitted only in the Columbia,

[1] This section relies as a basic reference on Homer E. Gregory and Kathleen Barnes, North Pacific Fisheries (New York: American Council, Institute of Pacific Relations, 1939), p. 19-27.

Puget Sound, and northward. However, the only species which can be caught by hook are chinook and coho, which dominate the fresh and frozen salmon markets. The other three species must be netted or seined. In Puget Sound and northward, the use of gill nets and purse seines is widespread. Fish traps, potentially the most effective form of catching salmon, formerly were in restricted use, but at present are banned. For the most part the dominant species caught by gill net and troll are the chinook and coho.

The method of the catch determines the initial processing. Troll fishermen will clean the salmon they catch almost immediately, so that the normal condition in which these fish are brought to the receiving station is a dressed, head-on condition. On the other hand, gill-netted and purse-seined salmon are turned over "in the round," meaning that the cleaning must be done almost immediately elsewhere in the channel.

Troll Fishermen

Trolling is largely a small boat operation with the exception of a few tuna vessels participating in salmon fishing in their own off-season. The economic limits on the size of salmon boats are determined by the number of lines which a single troll boat can handle at one time. On the other hand, the distance to the fishing grounds encourages larger size in order to increase the amount of time available at the fishing grounds. This is limited in turn by the ability of the fishermen to keep the catch in a fresh condition. Some larger boats have cold storage tanks capable of maintaining the fish in a reasonably fresh condition for several days. Small boats, however, do not have this capacity and hence will be forced to return to shore on a one- or two-day round trip time schedule.

Troll fishermen perform four functions:

1. Catching
2. Cleaning
3. Storing
4. Transporting

Catching techniques do not appear to vary significantly among troll fishermen. Cleaning techniques are also presumed to be reasonably uniform, although some processors report that they have to re-clean the fish after receiving them. The cleaning operation is necessitated by the rapid deterioration of uncleaned fish, which can be arrested by storage at cold temperatures. Storage is limited by the size of the vessel and the equipment available on the vessel. Some vessels will be equipped with storage tanks of cold water maintained at a temperature barely above freezing. Smaller boats are merely equipped to carry the fish in the hold in a dry condition. The degree of freshness, as one of the major dimensions of fish quality, affects the price offered in the market. Transportation from the fishing grounds to the dock is normally provided by the fisherman himself, which limits his productive time at sea and also his distance from his receiving station.

Gill-Netters

As this practice is restricted in Oregon and Washington to a few areas with protected waters, the Columbia and Puget Sound, it has encouraged the use of small boats. The erratic nature of the season, dictated by the conservation policies of the Fish Commissions of Oregon and Washington, has encouraged activity by large numbers of fishermen who must stay in close proximity to the water to await announcement of openings in the fishing season. Because of the short time in which these seasons are open, or when the salmon are running up the river in large volume, transportation time to and from the fishing grounds becomes valuable. This has encouraged the use of tenders to go out to the boats and transfer the loads and issue receipts on the spot. In the Columbia River area at least, fish are transferred one-at-a-time by means of a pew, which probably works reasonably well because of the small scale of most gill-net operations. Gill-netters do not clean their fish, and this function is then shifted to a processing station. Thus the gill-netter performs two or sometimes three functions:

1. Catching
2. Storing
3. Transporting

Seining

With the introduction of the diesel engine into the fishing industry, purse seining became a highly productive way to catch salmon. Gregory and Barnes reported that seining (using a floating net which is drawn tightly around the catch), is used extensively in both Puget Sound and Southeastern Alaska, although Alaskan regulations limit the size of the purse seine vessel to 50 feet.[2] However a study reported by Rounsfell and Kelez[3] indicated that efficiency in catching chum, coho, and pink salmon increased with the size of the vessel. Because of the large size of the catch of these vessels, several receiving stations in Alaska and the Puget Sound have provided tenders to travel to the fishing grounds and pick up the fish on the spot. Again the fish are cleaned at the processor's plant.

Other forms of catching fish, notably beach-seining (without vessels), traps, and fish wheels, were not mentioned by respondents in our survey. They do not appear to be important at present for species normally sold in the fresh or frozen markets.

Pricing

This discussion of pricing will be confined largely to cohos and chinook salmon as they are the dominant species in the fresh and frozen markets. We should distinguish between two levels of pricing activity--the determination of the market price and the actual price-making practices by individual fishermen and buyers. The bargaining pattern is dominated both by the industry structure and the geographic orientation of the industry.

The structural aspects of price making at the landing stage have been described in Chapter III. Four factors have influenced the price

[2] Cited in Gregory and Barnes, p. 24.

[3] *Op. cit.*, p. 25.

level for salmon: an erratic supply, an oligopsonistic buyer structure, increasing demands from overseas markets, and efforts at collective bargaining by the fishermen. The result has been a repeating pattern of price increases over each season, and a trend, in the longer view, to increasing yields from season to season.

Price formation under these conditions controls supply by attracting new fishermen into the market. High prices increase the expected value of the rate of return, recognizing the erratic nature of supply. However, prices appear to be more stable than the quantities which are landed. Because most of the costs of the fishing vessel are independent of the size of the specific catch, the risks fall on the individual fishermen. The number of vessel trips undertaken can then be described as a function of the price offered and the probability of a sufficiently large catch. The commitment of a vessel need not be irrevocable if other species, such as tuna or albacore, are available. The number of trips for the purpose of catching salmon is the only other variable which can be adjusted. Therefore the price mechanism can adjust supply only imperfectly, varying fishing activity somewhat but not the supply of fish itself.

Because of the structure of the industry at the fishermen's level, comprised of many small boat operators, we would expect fishermen to be frequently undercapitalized and interested in lengthening their time at sea in order to increase revenues. A natural concomitant is a limited form of non-price competition through "boat accounts," in which some of the large processors may advance money to finance part of the fisherman's operation. This form of competition may also include facilities available for fuel and ice and off-hours unloading as a convenience for the fishermen. This has created patterns of loyalty by fishermen to specific firms, and also price differentials paid by firms which do not offer these advantages. Differentials as high as five to ten cents per pound were reported by processors who lacked these facilities.

There appears to be little active price searching by fishermen simply because of the time involved when they are running with loads. From the buyers' comments, fishermen appear to be aware of price differences at different stations; however there appears to be little switching from buyer to buyer during the course of the season.

II. Receiving Stations

Receiving stations perform four functional tasks in the distribution channel. They serve in the following ways:

1) as the point of purchase of fish from the fisherman, i.e., the point of transfer of ownership from the fisherman to other stages in the channel,

2) as the point of physical transfer from ship-to-shore,

3) as an accumulation point for inventory from individual fishermen to consolidate into larger units for transportation to the processor, and

4) as a point where repackaging and re-icing takes place in preparation for movement.

Receiving stations have a varied role in the transfer of title. Some are owned by the processor, others are independent or have a quasi-dependent relationship to the processor. Integration of processor and receiving stations is almost universal in California, but is only partial in Oregon, Washington, and Alaska. The buying relationship in an integrated operation is essentially that of a wholly-owned agent of the processor, who takes all of the risk of supply availability and nonperformance (such as failure to ice or to ship within reasonable periods).

A quasi-integrated relationship takes place when the buyer at the independently-owned receiving station acts as agent for the processor, even to the point of issuing payment with checks drawn on the processor. Under a slightly different arrangement, the processor offers a floor price with an agreement with the receiving station that all fish not sold at a higher price will go to the contracting processor at the lower price. The independent relationship describes stations which take possession and then search for buyers.

Most stations operate with some arrangement for interdependence with a processor or established working arrangements with one or two processors. Because of the highly perishable nature of fresh fish there is little time to search the market extensively for a better price; in addition, receiving stations are geographically restricted in their choice of buyers.

Receiving stations can be rudimentary, such as a simple barge to which vessels come, or more elaborate with an investment in scales and ice-making machines. It can also be an annex to a processor's own facilities. A typical physical operation of a shore-based receiving station involves a sequence of steps which carry the fish from the vessel to the transportation vehicle for movement to the processor.

1) Unloading the fishing vessel. When the vessel is alongside the dock, a crane with 500-pound "dump box" is lowered into the hold. It is then loaded by hand, hoisted up to the dock, and dumped onto a platform for sorting. There may be an intermediate movement involving transfer from the dump box into another container for movement to a protected area, but this is not always necessary. Unloading usually takes place in the afternoon, after return of the vessels.

2) Sorting and grading. Fish are examined for size, species, and defects, such as belly burn. Some receiving station operators have stated that fish are still sold at a uniform price to the processor, which indicates that the risk of the quality level and hence revenue loss is absorbed not at the receiving station but at the processor level.

3) Weighing. Fish are weighed and the weight is recorded.

4) Box and ice. Fish are loaded into containers. Ice will be added or not as a function of the time and distance to destination. Containers have predominantly been of three types:

a. wood "fish boxes" carrying 150-200 pounds. These are the traditional container in the industry and are designed for use in manual loading operations.

b. wood or woodfibre "tote boxes" of 500 pounds capacity, which were introduced to permit handling by forklift.

c. "wet-locks" which are fibreboard cartons, sealed against moisture.

From our survey it was observed that the fish box was used most frequently, although tote boxes were becoming more common as the forklift becomes more widely used.

5) Storing. Some receiving stations will then place the fish in a cooler--a semi-refrigerated storage area--or a cool room. Others will merely stack fish in any convenient area.

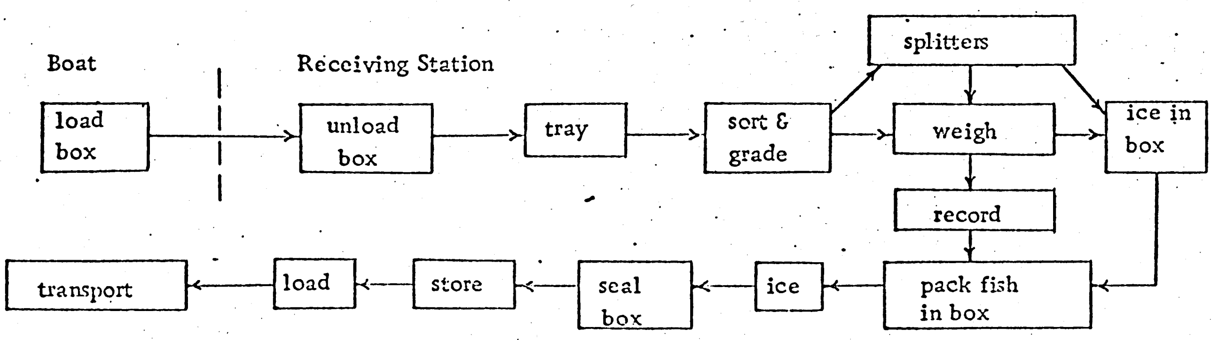
6) Loading and shipping. Loading and shipping are normally done in the evening. Transportation can be a part of the receiving station's activity with the use of its own trucks, it can be performed by the processing stage, transportation can be performed by a third party, the independently owned carrier, either contract or common. The choice of private or public carriage appears to be determined by the availability of public transportation. If capacity is

constrained, thereby limiting the ability of the carrier to handle peak loads, or if schedules are poor or non-existent, private transportation often appears to be the only alternative. The choice of which party furnishes the private transportation is related to the degree of autonomy of the receiving station. The station without transportation becomes highly dependent on the willingness of processors to perform the pick-up function, and therefore has foreclosed alternatives.

The entire process may be seen on the flow chart below:

Figure 5-1

Receiving Station Processing



One variation in the physical processing sequence is the use of tender vessels in lieu of a shore-based processing station. The tender is used most often where seining and gill-netting are common, the Columbia, Puget Sound, and Alaska. There are probably slight variations in tender operation. Their primary purpose is to accumulate quantities of fish, store them and transport them from the fishing grounds, freeing the fishing vessels for more directly productive activities.

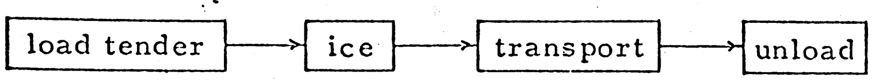
The physical functions of tender operation are:

1. Loading
2. Icing
3. Transporting
4. Unloading

In one case the transfer from a gill-net boat to a tender was described as taking place one fish at a time, with the use of a pew. However, this would not always be practical because of the quantities involved in seining operations. The process can be seen on this flow chart:

Figure 5-2

Tender Processing



When a tender is used, the grading, sorting, and repacking operations are shifted either to a receiving station or directly to a processor where the tender is based. As a rule tenders are owned by processors as a means of gaining control of a share of the supply.

Prices for the services of receiving stations are indicated by the differences between selling prices by the fishermen and prices paid to the processing stations. In fact, even independent receiving stations will normally describe their charges as an "add-on" to the landed price. The price differential also becomes an approximate indicator of the cost of the services which are provided. One independent receiving station reported that it charged its processor customer four cents per pound added on to his purchase price for all services except that of delivery to his plant, which was an additional four cents. Because of the ownership and geographic constraints there appears to be little active search for higher margins. Operators apparently sense that this would be futile, believing that margins are competitive. The freedom with which price information circulates through the industry would serve as a means of validating this position.

III. The Processor

The processor is the major point of physical transformation of the fish. Processors, however, do more than manufacture; they serve several functions, often combining different stages in the channel. Processor location is dictated by the location of fisheries, and the distance in time from the market dictates whether the processor is able to offer fresh fish or whether his activities are confined to frozen fish and other techniques of preservation.

Processors operate under several different functional forms, depending first on whether the firm is operating for its own account or merely processing for another channel member, and second on the functions which are determined by the processor's market role. At least six different combinations can be observed among processors:

1. processor only, but with ownership of fish
2. processor only, without ownership of the fish
3. processing and brokerage functions combined
4. processor and wholesaler combined with ownership
5. processor, wholesaler, and receiving station combined
6. processor, wholesaler, receiving station, and retailer combined

In addition there are firms which are designated as "processors," incorporating ownership of the firm but subcontracting the processing function. The actual form is determined by a combination of circumstances: the geographic location, the presence or absence of complementary activities by other firms, and, in addition, managerial perception of alternatives. If freezing facilities are installed for one species it becomes relatively easy to use them for another. A wholesaler, for example, may become involved in freezing salmon in order to utilize otherwise idle facilities although he may decide later to withdraw from this activity. Similarly, firms will operate simultaneously with different functions for different levels in the market. A processor may operate as a wholesaler at the same time that he is selling to other wholesalers, to retail customers, or through brokers to wholesalers in different markets. While the major portion of processing activity is oriented toward the manufacture and sale of fish products, the fluid character of market channels has permitted the annexation and combining of several differing levels of activity.

As a general statement, processors have tended to be oriented to markets more extensive than the regions in which they are located, a reflection of the product volume of the large processors. The resulting decentralization of markets has provided stability in the salmon market which otherwise would not be present.

The physical processes appear to be uniform among processors, given the choice of end products. We will describe processes related to three end products: fresh fish processing, freezing, and mild-curing. Other processes such as smoking, pickling, and drying are far less important to the industry as a whole and will not be included here.

Fresh Processing

There are four main steps in processing of fresh salmon:

1. unloading
2. grading and inspecting
3. storing
4. cleaning

1. Unloading. This step merely involves movement from the truck to an inspection table. Depending on the manner in which the fish are shipped, they will be handled as a unit or repackaged.

Frequently there is a delay requiring storage before the next step, grading and sorting.

2. Sorting and grading. Although frequently this is done at the receiving station, processors will also sort and grade as a protection against misclassification and damage-in-transit. Additional grading by weight may also take place at this time.

3. Storage. This is a multi-stage function occurring between activities to allow time for work scheduling.

4. Cleaning. Cleaning depends on the manner in which the fish were caught, i.e., whether troll caught, netted, or seined. Unless the processor is concerned with the quality of the cleaning of the troll caught salmon, this process will be by-passed; in all other cases it will be included here. The timing of the cleaning operation is critical and for this reason is located as early in the channel process sequence as possible.

Removal of the head normally occurs at this stage, but may be deferred, depending on the customary practice in the final market. Obviously there are economic reasons for removing heads early because of reduced weight for freezing and movement. However, one processor-wholesaler stated that for his trade he preferred to leave the heads on because the meat cutters with whom he deals expect to see salmon in this form.

After this stage the fish may go into any of three product forms:

1. fresh, in which case the product may be ready to go to market, although it may also be filleted or steaked,

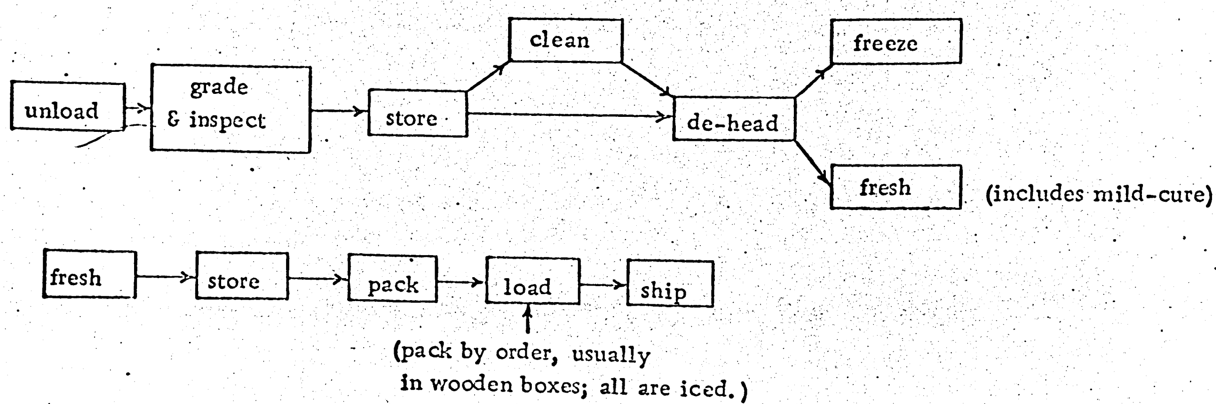
2. frozen, where the fish may be offered either dressed as a whole fish or in steaks or fillets, or stored for canning or mild-curing,

3. mild-curing, where the fish is brine-cured to be offered in this form, smoked, or otherwise processed.

The flow of the fresh process stages may be seen in this flow chart:

Figure 5-3

Fresh Salmon Processing



At this stage, fish are packed for shipment. This is done by placing them either in fish boxes or wet-locks. Icing is used both here and at all other storage points. The fish are now ready to be shipped.

Freezing

Freezing involves three additional steps:

1) Sharp freezing, where fish are frozen individually by being placed on racks and in a freezing room,

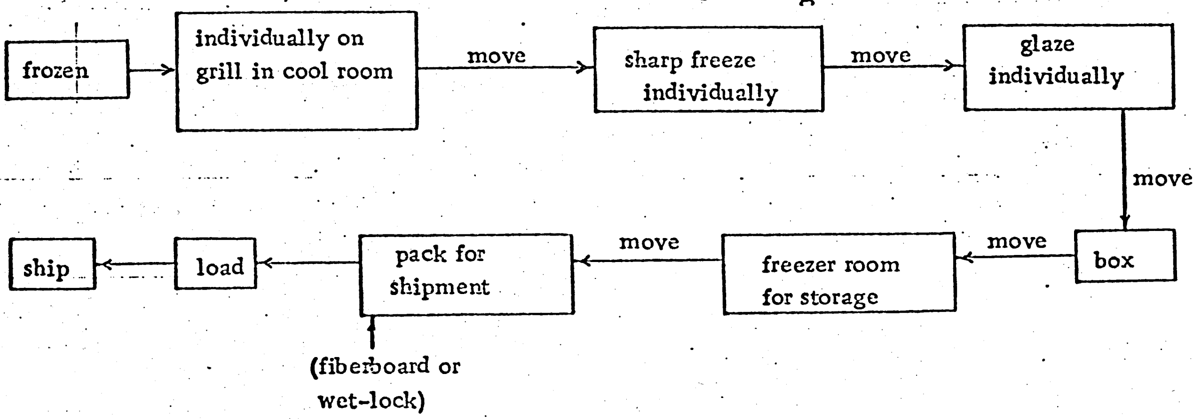
2) Glazing, in which fish are dipped repeatedly into a super-cooled tank of water, building a coat of ice completely around the fish, and

3) Storage. Fish are then held in a cold room until they are shipped. Holding in storage requires periodic reglazing, indicating that the holding costs of frozen salmon inventory are the combined costs of additional processing activity plus the cost of physical reprocessing.

The stages are seen in the following flow chart:

Figure 5-4

Frozen Salmon Processing



Several processors will steak salmon for the institutional market. This can be processed by freezing individual portions, referred to as IQF--Individual Quick Frozen portions, or by using a band-saw to cut frozen whole fish.

Mild-Curing

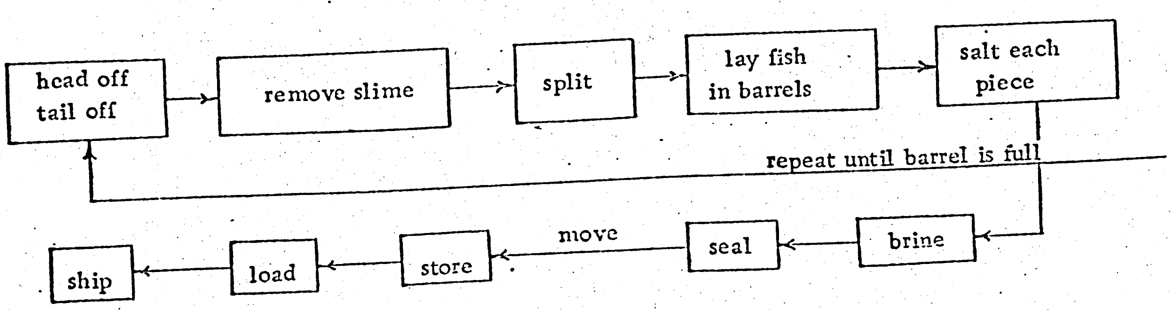
This process involves several steps beyond the preparation of fresh fish. In order to balance workloads, it may also include withdrawal from frozen stock. Fish are selected at the inspection station and identified by size as "splitters." These are normally large chinook and coho salmon, although occasionally other fish are used. Fish selected as splitters arrive at the process station to be prepared, loaded into the tierce, a large wood barrel of 870 pounds net capacity, and cured. Loading itself involves:

1) Removal of slime
2) Splitting of fish
3) Laying in barrel
4) Salting

Fish are accumulated in the tierce until the barrel is filled; it is then filled with brine and sealed. Curing takes place when the brine solution covers the fish. The barrel is then ready to ship. The process can be seen in the flow chart below:

Figure 5-5

Mild-Cure Processing



Pricing

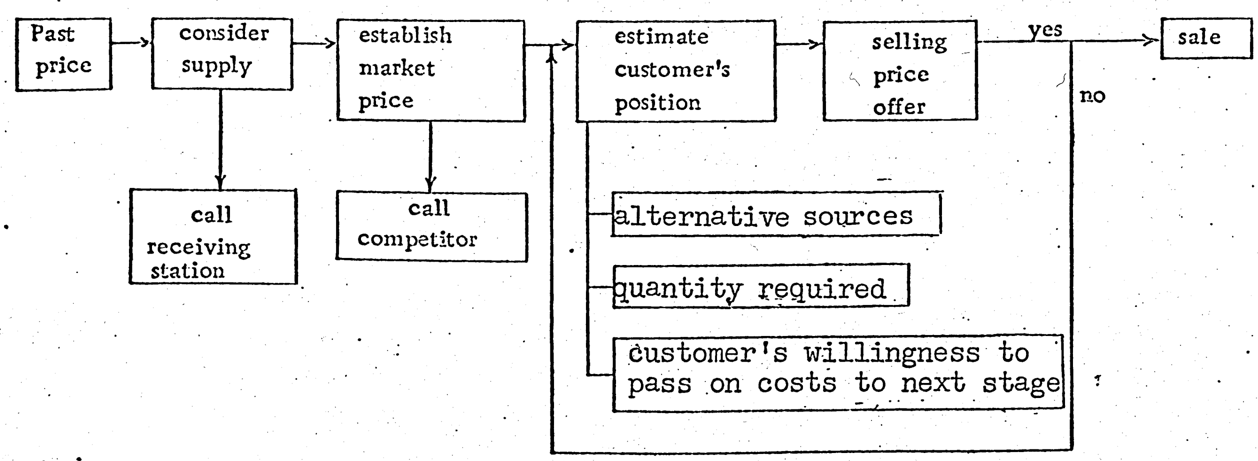
As a guide to pricing, processors speak in terms of a "target margin" pricing objective. In general this comes out as a statement of a desirable gross margin of 25 percent. However, most describe gross margins in a range of 15 to 18 percent. The difficulty with margin pricing in this situation is that no salmon processors are single-product firms. Salmon pricing covers two major and one minor product forms for two species; it must also take into account processors' orientation to all species native to their region. The only apparent options in product line exhibited by processors is whether to include shellfish within their product offerings. The target margin, therefore, becomes a general guide to pricing within which there is considerable room for variation in pricing for individual product forms.

The actual process of price determination is obscure, at least when stated as a series of rational, clearly defined procedural steps. One characteristic of pricing in this industry is that price information is freely available. The Market News Service publishes price data for Seattle and several Alaskan locations, although these data appear to be useful only in the immediate area. Dealers further away rely on trade sources. In general they appear to incorporate some estimates of supply into their calculation. Demand is far more stable than supply and therefore supply fluctuation will influence price more than will demand.

A tentative model of a processor's price behavior might follow this flow pattern:

Figure 5-6

Processor Price-Making Process



Processors recalling past prices will then seek to modify that price by new supply and price information. They will estimate the volume of current supply entering the market by checking with their receiving station and other sources of information. They will then confirm their impressions of price by checking the market, including both competitors and customers. They will estimate their customer's position in the market, specifically his alternative sources of supply, his requirements, and his willingness to pass on his costs, i.e., his customer's position. This results in a selling price offer. If it is accepted it becomes a sale, otherwise it requries re-estimating individual customer positions.

While models of the behavior of the firm have traditionally described business activities in terms of profit maximization, there has been recent movement toward the recognition of more limited objectives, under the heading of "satisficing."[4] The behavior of both processors and buyers in the salmon market would follow a course such as this; the burdens of searching the market fall more heavily on the processor because of the pressure of inventory holdings. Because of the perishability of the product and the potential cost of acquiring additional information, these firms follow limited search routines until reasonable bargains are made. The term "reasonable" incorporates in this case a minimum offer and acceptance price, and the absorption of risks by either side that prices which are potentially more favorable would be forthcoming.

In frozen markets there appear to be characteristic seasonal demand patterns determined by Lent or other specific periods of high fish consumption. These are modified by demands from other markets such as competition for supply from overseas markets and possibly by large inventories created by the size of the previous year's run.

Size and quality also affect price, with large fish bringing higher prices per pound. One processor described his size pricing policies as designed to earn profits on large and medium salmon. Small salmon, i.e., under seven pounds, were priced to clear the market and were generally unprofitable.

[4]Cyert, Richard M., and James G. March, A Behavioral Theory of the Firm (New York: Prentice-Hall, 1963).

Two factors characterize price making under these conditions. Price decisions in the fresh market at least tend to be short run, a response to supply conditions of the moment. Price making tends to be supply oriented, a condition brought on by the relative scarcity of salmon in comparison to what appears to be a secularly increasing demand for salmon products.

One of the most difficult decisions that a processor must make is the form in which he should attempt to sell his product. The production activity is assumed to be determined by relative prices in the market, although there is a consistent comment from many processors that they will try to take care of basic requirements of their present customers first. During the middle of the summer salmon run it must be decided how much to set aside in the frozen (future) market as opposed to the fresh market. The decision involves considerable risk for the processor because of the erratic nature of supply. A decision to freeze for an off-season market, i.e., to speculate, based on a small indicated supply in July and August may be unprofitable if a heavy fall run develops; conversely, if too little is frozen, sales are lost which would otherwise prove rewarding. However, as we have noted in Chapter IV, the decision is not predictable on the basis of published aggregate market data, and therefore must be explained by unidentified factors relating to the individual firm.

In recent years the continual upward trend of prices has tended to reduce the uncertainty of this decision. Processors have indicated that European buyers have become so concerned about securing adequate supplies of the product that they have been willing to make long-term forward commitments for frozen salmon, to be paid at the current market price when the product is shipped. Price increases can thus be passed on to their customers.

One aspect of marketing frozen salmon in geographically separated markets has been the necessity of supplying local stocks of inventory to meet short lead time requirements of major chain stores. This has resulted in the reported holding of large frozen inventories in the Midwest and Atlantic states. While we have noted in Chapter IV the presence of holdings of chinook for further processing, interviews indicated stocks which are also held in private warehouses to serve the large retail chain stores. This could not be confirmed from published data; however, it appears plausible given the oligopsonistic power of the large buyers. Presumably the cost of stockholding is either charged to the chain or passed on by the chain in its own pricing.

IV. Wholesalers

The wholesalers are oriented principally to local markets. In the exchange creation channel they serve as buying agents for their client customers: institutions, retail chains, and specialty food stores. Where the processor is a specialist in local supplies of sea food, the wholesaler in his buying role offers wider variety, which becomes part of his marketing strategy.

Functional combinations of wholesaling can be as varied as those of processing, including, as previously mentioned, combined wholesaling and processing. In addition, it is common to see specialist wholesalers without other activities appended, and in some cases in the Northwest it is not uncommon to see combined wholesaler-retail operations.

Some wholesalers will specialize, serving only the hotel-restaurant-club (i.e., the institutional) market. Others will serve primarily the retail chain market. The choice of customer segment dictates the type of fish product that these firms will offer.

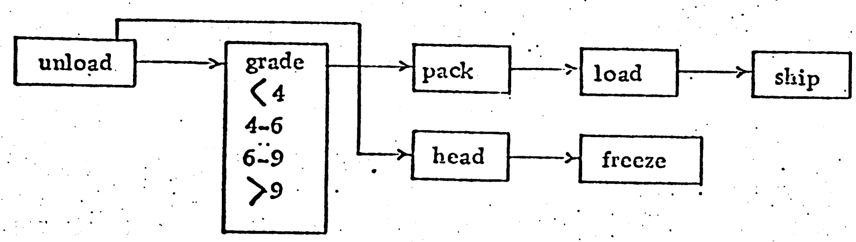
The functions of the wholesaler, therefore, include the role of buying agent. In addition they include several physical distribution functions related to receiving, sorting into outgoing orders, providing a rolling inventory for customers, and delivery. One air carrier reported that in the Chicago area the fresh fish wholesalers also pick up shipments at the carrier's terminal. Local conditions obviously have a strong influence on which functions are included within a specific wholesaler's activities. Wholesalers in metropolitan areas tend to emphasize variety within their assortment, although there is some tendency to specialize by quality range and the type of client.

Enumeration of the physical processing activities of typical wholesalers includes:

1) unloading
2) inspecting and grading
3) order-processing
4) loading
5) delivery

Figure 5-7a

Wholesaler Processing



(This is the range for Coho; there are also three grades for Chinook)

Order accommodation becomes an important part of a wholesaler's operation, because as a rule he deals with more customers than do the processors. In fact, this becomes an important weapon in competition for chain store business, where the chain buyer in effect shifts part of his administrative burden onto the wholesaler.

Wholesalers as well as processors may take speculative positions in frozen salmon, although this has been more common in the Northwest where wholesalers are closer to the source of supply. One processor commented that in periods of short supply he found many firms trying to hold inventories in speculation against price increases over the off-season. Presumably these would include wholesaler accounts.

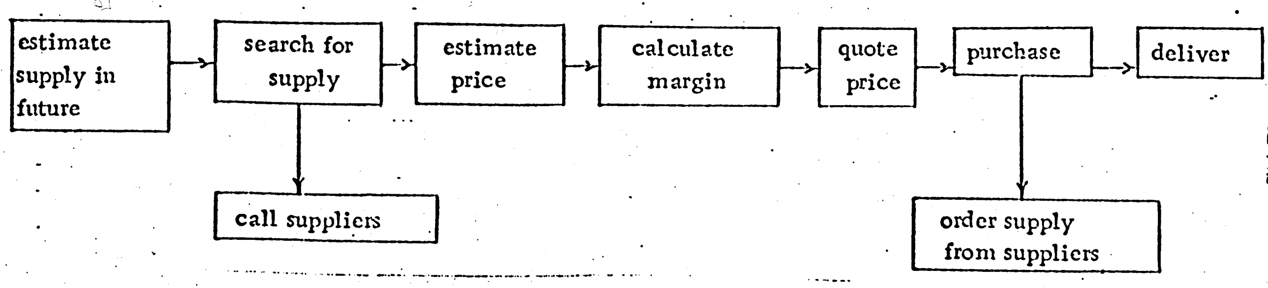
Marketing strategies of wholesalers differ markedly from those of processors. In both cases there is an effort to pass costs forward into the final market. However, the wholesaler meets pressures from his retail clients, particularly from chain stores where buyers tend to be price-conscious. While the institutional wholesaler may be more concerned about providing levels of quality and quantities of his products to his clients, the supermarket wholesaler is directly concerned about prices and quality levels to specific retail price objectives.

Up to this point the channel is concerned with passing its costs forward, and the channel beyond this point is concerned with competition for the consumer's expenditures. The wholesaler must resolve this pressure by rejecting high priced items for these customers, searching out lower-priced items as alternatives. The role of the wholesaler is, then, to search among his suppliers for items which he can offer as "bargain items" to his customers. The remainder of his offering is sold by the stores as a convenience to consumers, but without volume.

Pricing under these circumstances is not precise. The wholesaler is trying to maintain his gross margin but he does this through his product searching activities. The purchase of specials requires not only a low price, but also an advertising allowance of normally two to three cents per pound. In general, wholesalers will attempt to achieve a 15 percent gross margin including transportation costs to the customer. Therefore, a total price per pound at this stage would be P + (16 to .18P) 1.15, where P is the wholesaler's purchase price.

One major problem of wholesaling under these conditions is that of planning sales with the retail customer under conditions where one to two weeks lead time is required. Anticipating quantities and prices for fresh products can be particularly difficult under erratic supply conditions. The process is described in Figure 5-7b below.

Figure 5-7b
Wholesale Processing



Competition in the wholesale seafood business is described by respondents as extremely intense, which is heightened by the tendency of large chains to buy direct, reducing the potential market for the independent wholesalers. There is also a significant threat of potential competition among wholesalers, even though it may not be manifested directly in a high degree of account switching.

Retailing

Retail outlets for salmon take several different forms: restaurants, chain stores, delicatessens, specialty seafood stores. Demand for salmon can be expected to follow the demand for seafood products generally, strongest in areas with distinct ethnic enclaves. Demand for salmon appears to be strongest in major cities along the West Coast, Chicago, and the North Atlantic states, embracing the metropolitan areas of Boston, New York City and Philadelphia. In this study we have had access only to stores on the West Coast, principally in the Northwest. Neither the restaurant or delicatessen markets were studied. Therefore the observations below relate principally to retail stores in the Northwest.

Marketing to specialty seafood stores differs markedly from marketing to chains. The specialty store is concerned with variety. Customers may come in looking for bargain prices, but more likely they are motivated by taste. The retail chain store, on the other hand, tends, with some exceptions, to be oriented toward low price. Seafoods compete with each other and with meat and poultry. As a result there are distinct differences in marketing practice between the two types of operations. The first deals with products for which price may be secondary; therefore it provides a market for higher price species such as chinook salmon. While supermarkets have been known to offer chinook as a specialty, particularly in the spring, it is unusual. Supermarket buying has tended to favor coho salmon over the season. Supermarkets will however vary in assortment even within the same chain, depending on the clientele and the interests of the store manager. The seafood specialty store as an institution is declining in importance, and the restaurant trade is becoming the major retail market for chinook salmon.

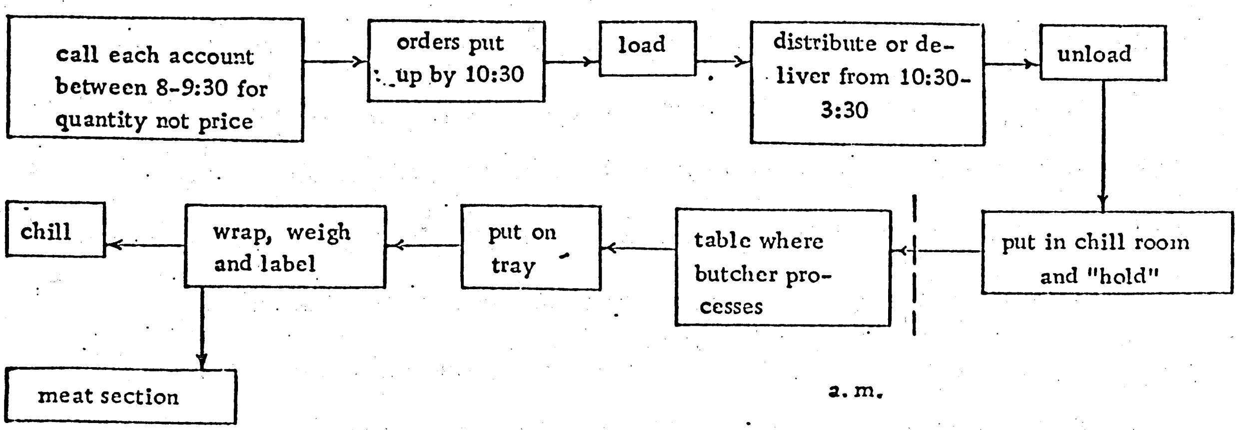
Physical processing at the retail level involves several stages:

1) receiving and storing in the store chill room
2) processing--meat cutter prepares for the counter
3) wrapping, weighing, and labeling
4) displaying in the meat section

The process of interaction and processing between wholesaler and retailer is described in this flow chart:

Figure 5-8

Retail Salmon Processing



Fresh fish is almost always prepared in the store, although one wholesaler prepackages fresh salmon steaks for a major Seattle chain. Frozen salmon can be prepared for sale at the processor, wholesaler, or at the retailer location. One processor has suggested that it may soon become attractive even to prepare the frozen display tray at the processor, to be delivered to the store ready to place in the counter. One of the major problems facing the fresh fish market is the decline in the role of the meat cutter. If the packaging function in meat processing is transferred to the packer, the meat cutter's role in retailing will tend to disappear. Fish volume at most supermarkets is a small portion of total sales, and it may be difficult to market fresh fish through this channel without the continued presence of retail meat cutters.

Pricing

Supermarkets and retail stores generally aim at gross margins of from 20 to 30 percent. One major chain buyer says that he aims for a target margin of 28 percent. The National Commission on Food Marketing study shows an average margin in the meat department of 22 percent. The necessity to earn adequate margins, combined with rising salmon prices in recent years have made chain fish buyers skeptical about the willingness of consumers to continue to buy salmon at the same rate as before. One buyer stated that he saw a psychological barrier of $1.00 per pound at retail. However, supermarkets were soon offering silver salmon at prices as high as $1.19 per pound.

Buying practices of large chains appear to vary considerably in the services they require from vendors. Some require local inventories of frozen salmon available to supply their local stores. Others will request shipments directly to their warehouse. There is no standard rule whether retailers will or will not maintain frozen inventories.

Brokerage

The role of the broker has declined in recent years. Traditionally brokers have not taken title to inventory, but have played a role arranging sales between buyers and sellers. They have tended to be oriented to local markets, so that a typical channel might involve direct contact with a processor on one side and a wholesaler or chain on the other. For this service, the broker normally charges five percent or five cents per pound, whichever is lower. When two brokers are involved, such as a broker in Seattle arranging a sale through one in Europe, the commission is usually divided. There is some speculation in the industry that the broker's importance is returning because of the trend to increases in frozen fish volume, but this is not borne out as yet by the figures. One broker commented that the commission rates were not sufficient to generate desired profits and as a result he was forced to take positions, to gain profits from speculation.

Transportation

In this study the costs of transportation service have been treated as given, without attempting to describe specific transportation processes such as terminal and line-haul operations. Prices for common carrier services can be found in published tariffs with minimal searching. For the exempt carriers, the market price determination would appear to be less certain. These carriers will sometimes quote prices directly to the shipper through a representing employee or agent, and in other circumstances will negotiate through a broker. How much searching activity takes place on the part of the shipper who buys the service is not known. The searching which does take place seems to be as much to ascertain the availability of service as the price.

Summary

In this chapter we have described the exchange and physical process in the salmon distribution channel. In some cases the level of detail has been explicit as these processes were observed at first hand; in others this description has been based on narration by the respondents. As far as we could determine in the course of the study, there was little reason, aside from time constraints or the requirements of specific sequences of activity, why specific processes tended to be located at one stage of the channel rather than another. Nevertheless, the association between process activities and specific stages in the channel is strong, resulting in a specialization of activity by individual firms. Looking at the channel processes as a whole, there appears to be a repetition of specific steps at several stages, specifically referring to handling inspecting, and grading operation. However to reduce the numbers of these steps will require industry consensus in two areas: the physical handling system configuration and standardized grading. While other changes might also be made, it will require extensive study of alternative configurations of the system.

This discussion is intended to provide an essentially qualitative base, to which must be added the cost, revenue, and profitability data of the succeeding chapter. These will be the building block for the simulation model in the chapters which follow.

Chapter VI

COSTS AND RETURNS

In previous chapters we have examined the market structure of the distribution channel and the processes involved. In this chapter, we wish to summarize the results of an investigation into the costs and rates of return of member firms within the channel. These will be examined by individual stage, and then aggregated in order to analyze the channel as a unit.

Sources of Data

Information for this investigation was drawn from a number of sources: direct interviews, financial statements of cooperating firms, direct observation and published studies. Information from direct interviews is based both on response to the interview questionnaire (see Appendix F-1) and further probing through in-depth discussion with the management of selected firms. A few firms permitted us to make direct observations, and the most extensive data on processing plant operation is based on observing specific production processes. By stage the sources were as follows:

1. Boat operators The summary of boat operation cost and rate of return data utilizes two studies: one of Oregon boat operations made by Dr. Fred Smith of the Department of Agricultural Economics at Oregon State University, and a similar study by Blake A. Campbell of the Canadian Department of Fisheries and Forestry, Vancouver, British Columbia.

2. Receiving Stations All information is based on interviews with four receiving stations in Oregon and Washington.

3. Processors Data on processors is based on direct inverview using the questionnaire form with 32 processor firms, supplemented with more extensive discussion with several of the larger firms in the sample. A few firms furnished us with financial and cost statements, and one firm permitted us to make direct cost studies of its operations.

4. Wholesalers Data presented here is derived from interviews with 34 large wholesalers in addition to published studies of accounting records of fish and meat wholesalers' activities.

5. Retailers Although we have included the financial statement of one seafood retailer in this study, the major share of salmon sales are not made by these firms but over the meat counters of supermarkets. The most important information presented here is based on information from the survey covering 14 retailers selling both meat and fish products. This is supplemented by published information on supermarket meat department operation.

Problems of Cost Allocation

One of the most difficult problems in ascertaining both costs and rates of return is that of determining the relevant costs and investments. Most firms in this industry handle several different species of fish, if for no other reason than to offset the seasonal production characteristics of individual species. In addition, a major portion of these firms will produce both fresh and frozen, and possibly even canned product forms of the same species. Many of the costs are joint among products, in that investment to process one species will inevitably lead to the capacity to handle others, and in a strict economic sense these costs are not assignable, but are jointly incurred.

These multi-product firms, however, must recover all costs including indivisible overheads as well as return on capital, and therefore have sought to allocate costs in order to provide data for measuring the profitability of their operations. The directly incurred costs for a given species or product form are clearly recognizable on a conceptual basis although the physical problems in measurement may present difficulties. Direct costs would include, for example, the purchase costs of salmon, freight charges, direct labor and material used in processing and packing. Other costs, however, such as building rent, utilities and clerical staff are not assignable except on arbitrary bases, which present neither accuracy in their description nor usefulness for decision-making purposes. In an industry in which the volume to be processed can be considered to be stochastically determined, allocation can only be made after the fact, because the volume over which the allocation is to be made is almost completely unknown before the beginning of the season. This is of little help to the manager of the firm concerned, because he needs some way to measure his performance at the time, either in controlling costs, establishing buying and selling prices and planning future operations. In the studies of the industry which follow, we have noted that firms have practiced three different methods of allocation:

1. Allocation by volume of production: This method, usually calculated on a basis of weight handled, distributes the unassignable costs according to the weight of the product, without regard to the potential revenue from each unit of product. It, therefore, provides little guidance either in the choice of products for processing or for pricing decisions. Acceptance or rejection of a particular strategy based on the "costs" thus derived may lead to completely erroneous decisions.

2. Allocation by revenue: This method distributes costs according to the proportionate share of product revenue. It has the advantage of reflecting market prices, although after the fact, and hence, profitability of individual products. However, it also has the disadvantage of assigning the highest unit costs to the product with the highest unit earnings. There is little logic in so doing other than that the pricing policy of the firm permits it.

3. Allocation by direct cost: This method will distribute overhead cost by product according to the proportions in which the direct costs are incurred. This method is intuitively more satisfactory, in that higher direct costs such as labor should lead to higher administrative costs, and some planning of direct cost outlays in advance of a season is a necessary part of the operation. However, there is no guarantee

that each unit of direct costs incurs a proportionate share of the unassignable costs, or that overhead costs respond to changes in output in the same way as direct costs.

Much of the data which follows is based on cost allocation, because the data was originally presented in this form. However, wherever possible, we have endeavored to identify the direct costs as well as total allocated costs.

One alternative which does not introduce the possible distortions of allocation procedures is the contribution margin approach. This is a simple concept:

Contribution margin = Net revenues - Direct Costs.

The difference is a contribution toward both overhead and profit. It has the advantage of following the economists' precept of establishing marginal cost as the minimum basis for pricing and output decisions, allowing that direct costs in accounting procedures are analogous to the marginal costs of the economic model of the firm.

The contribution margin has an advantage over allocation methods because it introduces no problems of distortion from allocation, and therefore, should provide a more precise measure of actual profitability. A firm using the contribution margin approach would seek to maximize the excess of revenue from all products over direct cost, the portion of the margin in excess of overhead costs being the profit earned. It does not provide advance guidance for planning or price-making, but realistically neither do allocation methods. Only a few firms in our investigation were using the contribution margin approach to cost measurement, and these were sufficiently conscious of the proprietary value of the use of this system to wish to avoid disclosing the details of their system.

Further discussion of the contribution margin in distribution costing will follow in dealing with total channel costs. At this stage it is sufficient to recognize the potential value of this approach in opening cost analysis to more accurate evaluation and presenting more realistic alternatives for decision-making.

I. Cost and Returns by Stage

In this section the data is presented on both costs and returns by stage in the distribution channel. The sources of information have been taken from interviews and financial statements of cooperating firms as well as direct observation, plus published studies of comparable data. In utilizing these data, we have found an almost complete lack of detail in cost and financial statements. For example, most firms have made no use at all of budgeting procedures, and hence could not supply any of the cost information desirable either for this study, or even for effective managerial control. Only two firms reported that they were using internal cost reporting systems. As a result, most data was reported to us impressionistically, with wide unexplainable variances between firms. With the exception of one firm which provided a statement to us with sufficient detail to calculate unit costs, financial statements from the industry showed only cost and and revenue information in aggregate form, without sufficient detail to identify costs associated with particular species, let alone product forms.

Management under these conditions would appear to be extremely difficult. The quality of the information available might permit firms to look backward to establish the history of the preceding season, but it does not permit rational planning for the future or even to control operations while they are in process. Managers may prefer to consider all costs as fixed for a particular season, but this philosophy permits them no intervention to control their costs as they occur.

A. Boat Operators

Data on salmon boat operators is based on two sources: the extensive research of Dr. Fred Smith, Marine Extension Economist at Oregon State University in cooperation with salmon boat operators within the state, and that of Blake A. Campbell, Chief of the Fisheries Research Division, Canadian Department of Fisheries and Forestry. Data from these two sources is summarized in Tables 6-1 and 6-2, and typical calculations from each study are reproduced in Tables 6-3 and 6-4.

According to their findings, in Table 6-2, the highest profitability vessels as measured by return on investment are the Port Orford (Oregon) 32 foot troll boat, and the 35 foot British Columbia gill-netter. Caution

Table 6-1

Salmon Boat Operator Annual Returns by Size of Vessel - West Coast U.S.

	A-1 Astoria Gillnet Vessel 28'	A-2 Port Orford Troll Vessel 32'	A-3 Brookings Troll Vessel 40'	A-4 Bodega Bay Troll Vessel 48'	A-5 Eureka Vessel 50'	A-6 Westport Vessel 52'
Gross Returns	$ 8,210	$23,900	$38,800	$37,945	$64,050	$60,500
Direct Exp.	4,626	11,487	19,911	19,398	36,940	29,030
Contribution Margin	3,584	12,413	18,889	18,547	27,110	31,470
Less Other Expenses	4,893	10,258	20,688	34,389	40,265	32,805
Net Returns	$(1,309	$ 2,155	$(1,799)	$(15,842)	$(13,155)	$(1,335)
Contribution Margin Percent of Sales	44%	52%	49%	49%	42%	52%
Break Even Price Per Pound (spring, summer)	$1.05	$.26	$.77	$2.00	$3,27	$1.13

Source: Research of Dr. Fred Smith, Department of Agricultural Economics, Oregon State University.

Table 6-2

Summary, Costs and Returns, Selected Pacific Northwest Fishing Boat Operators 1969

	Net Returns[1]	%Return to Investment[2]	Return to Operator[3]
35 foot B.C. Gillnetter	$4326	37.2%	$8826
40 foot B.C. Troller	3700	16.2	6300
32 foot B.C. Gillnetter	2177	27.7	5177
32 foot Port Orford Troller & Crabber	2155	26.9	8614
36 foot B.C. Troller	1400	14.0	2400
34 foot B.C. Troller	700	14.0	900
30 foot B.C. Gillnetter	217	11.0	1717
28 foot Astoria Gillnetter	-1309	-4.4	1154
52 foot Westport Troller & Crabber	-1335	6.6	16815
40 foot Brookings Troller & Crabber	-1799	4.5	9841
(a)$30,000 Gross B.C. Salmon Seiner	-4102	-1.8	-276
(a)$20,000 Gross B.C. Salmon Seiner	-5595	-6.4	-3044
(a)$10,000 Gross B.C. Salmon Seiner	-6800	-12.2	-5386
(a)48 foot Bodega Bay Troller & Crabber	-14733	-10.9	-4150
TOTALS	$20,998	8.7%	$48,888

(a) Converted to U.S. dollars at 93% of Canadian dollars.

[1]Gross returns less all costs including opportunity costs of interest on investment and owner's salary.

[2]Return is based upon gross returns less all costs except interest on investment.

[3]Return is based upon gross returns less all costs except opportunity cost of owner's salary.

Source: Research of Dr. Fred Smith, Department of Agricultural Economics, Oregon State University, Corvallis, Oregon, and Canadian Department of Fisheries, Vancouver, B.C.

should be used in comparing costs and returns, because these returns are influenced not only by vessel design, but by practices at each port, such as the "lay system" under which crews share in the gross returns. However, even taking these differences into account, the most efficient vessels would appear to be smaller in size. This leads to tentative conclusions about industry structure, at least under the conditions found in Oregon and British Columbia, that it is most efficient when organized in small operating units. The ease of entry referred to in Chapter III,[5] coupled with the economies of small scale would tend to preserve a highly competitive market structure among fishermen.

Returns are affected both by the random nature of the supply of fish and the desired utilization of the boats. The general tendency toward low returns shown here may indicate that prices during the study period were too low because of the presence of a large supply relative to the demand. Further, comments often heard within the industry point out the part-time nature of fishing as an occupation, where the out-of-pocket cash returns in the majority of cases are only sufficient to cover limited opportunity cost valuations of either their investment or their time. However, in Table 6-1, we have calculated the contribution margin as a percent of sales, and this helps to explain the persistence of fishermen in this occupation. The perceived potential profits may be substantial when the contribution margin is approximately

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[5] III, p. 72.

half of operating revenue. The average return for full average cost of 8.7 percent may not be an important factor in deciding whether to continue with fishing, although when they are compared to bank interest charges which prevailed at the time of the study, 9 percent, these earnings would appear to be inadequate.

In the Canadian study, Campbell notes:

> "The return to capital in the salmon seine industry is very low, ranging from a negative eight percent for vessels producing $10,000 of salmon, to three percent for vessels with gross returns of $30,000. Salmon gillnet and troll vessels produced returns of ranging from $56 per week for vessels producing $5,000 of salmon (trolling) to $353 per vessel per week with a gross return of $15,000 (gillnetting)." 6

Out-of-pocket or variable expense of operating the Oregon-based Port Orford troll vessel in salmon fishing is approximately $3,507 for salmon[7] or $501 per ton of salmon. The relatively low cost of operation enables boat operators to enter the industry easily, contributing to a condition of low earnings.

Earnings presumably could be increased by restriction of entry through limiting the total number of fishermen by license, as is done in British Columbia. The increased rates of return would add stability within this sector of the industry and create a climate for encouragement of investment in newer and more efficient equipment.

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6 Campbell, Robert A. Chief, Economics Branch, Office of Director, Pacific Region, Department of Fisheries and Forestry, Returns from Fishing Vessels 1966, 1967 and 1968, Ottawa, Queen's Printer, 1969, p. 57.

7 Taken from Table 6-3 as follows: Total salmon cost for the season less the operator's share equals the presumed out-of-pocket cost, or $5,586-$2,079 = $3,507.

Table 6-3

OREGON STATE UNIVERSITY
Marine Economics Data Sheet
32 Foot Port Orford Troll and Crab Vessel[1/]

Vessel Description: 32 feet by 11 feet, 3 ton capacity, 130 HP diesel engine, electronics[2/], 6 hydraulic pullers, crab pot block and 200 crab pots.

Expected Production and Prices: 30 tons crab at $540/ton ($.27/lb) and 7 tons salmon at $1100/ton ($.55/lb).

	Crab[3/]		Salmon[3/]		
Production Costs	Per Season	Per Ton	Per Season	Per Ton	Crab and Salmon Season Total
Gear Repairs	$2010	$ 67	$ 798	$114	$2808
Vessel Repairs	660	22	546	78	1206
Transportation	840	28	154	22	994
Bait	750	25	49	7	799
Fuel	270	9	231	33	501
Galley	150	5	140	20	290
Miscellaneous	60	2	49	7	109
Crewshare					
20% of Gross Returns	3240	108			3240
20% of Gross Returns			1540	220	1540
Operator's Share (27%)	4380	146	2079	297	6459
Total Production	12360	412	5586	798	17946
Annual Costs					
Interest on Investment (9%)					1080
Interest on Operating Capital (1/2 of 10%)					782
Depreciation					550
Utilities					500
Insurance (hull)					450
Dock Maintenance					240
Moorage					75
Licenses					57
Property Tax[4/]					13
Miscellaneous[5/]					52
Total Annual	2070	69	1729	247	3799
Summary					
Production & Annual Costs	14430	481	7315	1045	21745
Gross Returns	16200	540	7700	1100	23900
Gross Returns Less Production	3840	128	2114	302	5954
Net Return (Gross Returns Less All Costs)	1770	59	385	55	2155
Return to Investment (Net Return Plus 9% of $12,000)					3235 (26.96%)
Return to Operator (Net Return Plus 27% of Gross)					8614

Continued on next page

Table 6-3 Continued

Price and/or Production to Break Even, All Other Prices and Production as Above[6/]

	Crab	Salmon
Break Even Price (¢/lb)	20.20	25.96
Break Even Production (Tons)	22.45	3.30

1/ Developed by selected Port Orford fishermen in cooperation with the Oregon State University Marine Advisory Program. This data is representative of an above average vessel, as described, for this port. April, 1969.

2/ Costs are allocated to crab and salmon on the basis of time expended except where more direct allocation is possible.

3/ Loran, fathometer, 2 radios and automatic pilot.

4/ $31 per $1000 valuation x 4% of $10,500.

5/ Skiff, accounting, legal fees, etc.

6/ For example, when crab is $.27/lb with 30 ton production and salmon is $.55/lb, net return will be zero with 3.3 tons salmon production.

Source: Dr. Fred Smith, Marine Economist, Oregon State University.

Table 6-4

British Columbia Department of Fisheries and Forestry
Marine Economics Data Sheet
35 Foot B. C. Salmon Gillnet Vessel[1]

Vessel Description:

Expected Production and Prices:

Production Costs	
Hull, Engine and Electronic Equipment Repair	$ 950
Gear Repair	900
Fuel & Lubrication	600
Food	500
Miscellaneous	775
Operator Share (30%)[2]	4500
Total Production	8225
Annual Costs	
Interest on Investment (7%)	1001
Depreciation	1073
Insurance	250
Wharfage and Slip Charges	125
Total Annual	2449
Summary	
Production and Annual Costs	10674
Gross Return	15000
Gross Returns less Production Costs	6775
Net Return	4326
Return to Capital (Net Return plus 7% of $14,300)	5327 (37.2%)
Return to Operator (Net Returns plus Operator Share)	8826

[1] Basic data taken from "Returns From Fishing Vessels in British Columbia" Department of Fisheries and Forestry, 1155 Robson Street, Vancouver 5, B. C.

[2] Considered to be a fair return to operator for his labor.

B. Receiving Stations

As most receiving stations are either owned by or act in an agency relationship with processors, the sources of information on independent stations were necessarily limited. Further, facilities for these operations varied from dockside shack to the use of barge-buying scows to the integration of receiving into processing plant operations.

Average costs for operating these stations were estimated to range from 3 to 4 cents per pound of salmon, covering the functions of receiving, boxing, and icing fish. A buying scow in the Newport, Oregon harbor acted as a floating receiving station and agent for shore-based stations, charging approximately 3 cents per pound. When stations are owned by processors, they have generally been treated as a fixed cost for the season rather than as a cost which varies with the volume of fish.

Freight from the receiving station to the processing plant must also be included, and will vary with the location. An average cost of 1.5 cents per pound was suggested as a typical freight charge, which raises the cost of receiving the fish and supplying to the processor's door to a range of 4.5 to 5.5 cents per pound. Part of this could be saved by processing plants located where fish could be purchased directly from the boat operators.

C. Processors

The physical operations in salmon processing plants were previously described in Chapter V.[8] Based on this description, and direct time and cost studies within one plant, a model was developed which identifies the direct labor cost-volume relationships involved in processing operations, providing estimates of plant costs based on the size of the throughput volume, and the products being processed. In addition, financial statements from two other plants were obtained to provide some basis for comparison. These data have been augmented by interviews with other processing plant managers.

Salmon Processing Plant Study

The following model was developed through direct observation of a processing plant operating in the Puget Sound Area. The model thus developed shows observed standard times and the standard costs which were developed for various plant operations as measured during our investigation in the summer of 1969. Because this plant specializes in salmon only, the allocation problems of cost assignment to several species could be avoided. While canning facilities were also included in the plant equipment, the canning line was not in operation during the period of our study, and overhead applicable to canning operations was separated from that applied to fresh and frozen salmon.

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A flow chart for processing fresh and frozen coho and chinook salmon is shown in Figure 6-1, which also identifies the direct and overhead costs of this operation. The data presented here indicates that fresh coho is more expensive to process on a unit weight basis than fresh chinook. The difference lies in the relative sizes of the two species; chinook are larger than coho, while labor costs (and time) are approximately equal per fish.

The basis of direct labor costs, labor time (in man-minutes per pound) is shown in Figure 6-2 (a). These standard times are developed from stop watch observation, both directly and by study of films taken of the operation. The standard times reflect consistent (average) performance at each stage after elimination of extreme observed values. Time units were measured in man-minutes. For example, the total processing time for fresh coho salmon would be denoted as 0.2506 man-minutes per pound of fish, weight indicating the dressed weight after processing. Processing time was divided as follows:

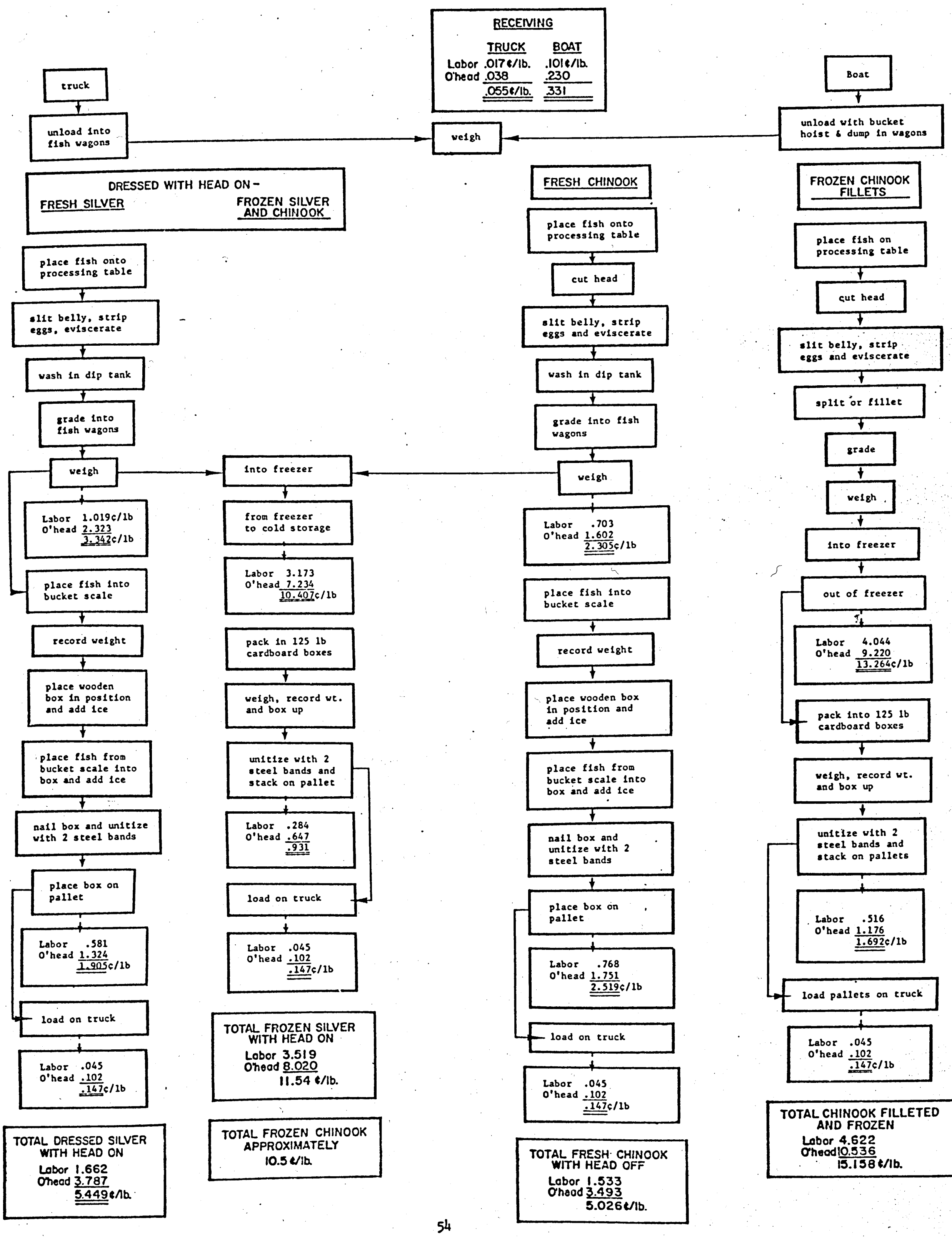
Receiving fish	.0026	minutes	per	pound
Processing fish	.1580	"	"	"
Packing fish	.0900	"	"	"
Total time other than shipping	.2506	"	"	"
Shipping	.0700	"	"	"
Total time fresh coho	.2576	"	"	"

indicating that slightly more than one-quarter minute is involved in processing each pound of fresh coho (silver) salmon through the plant.

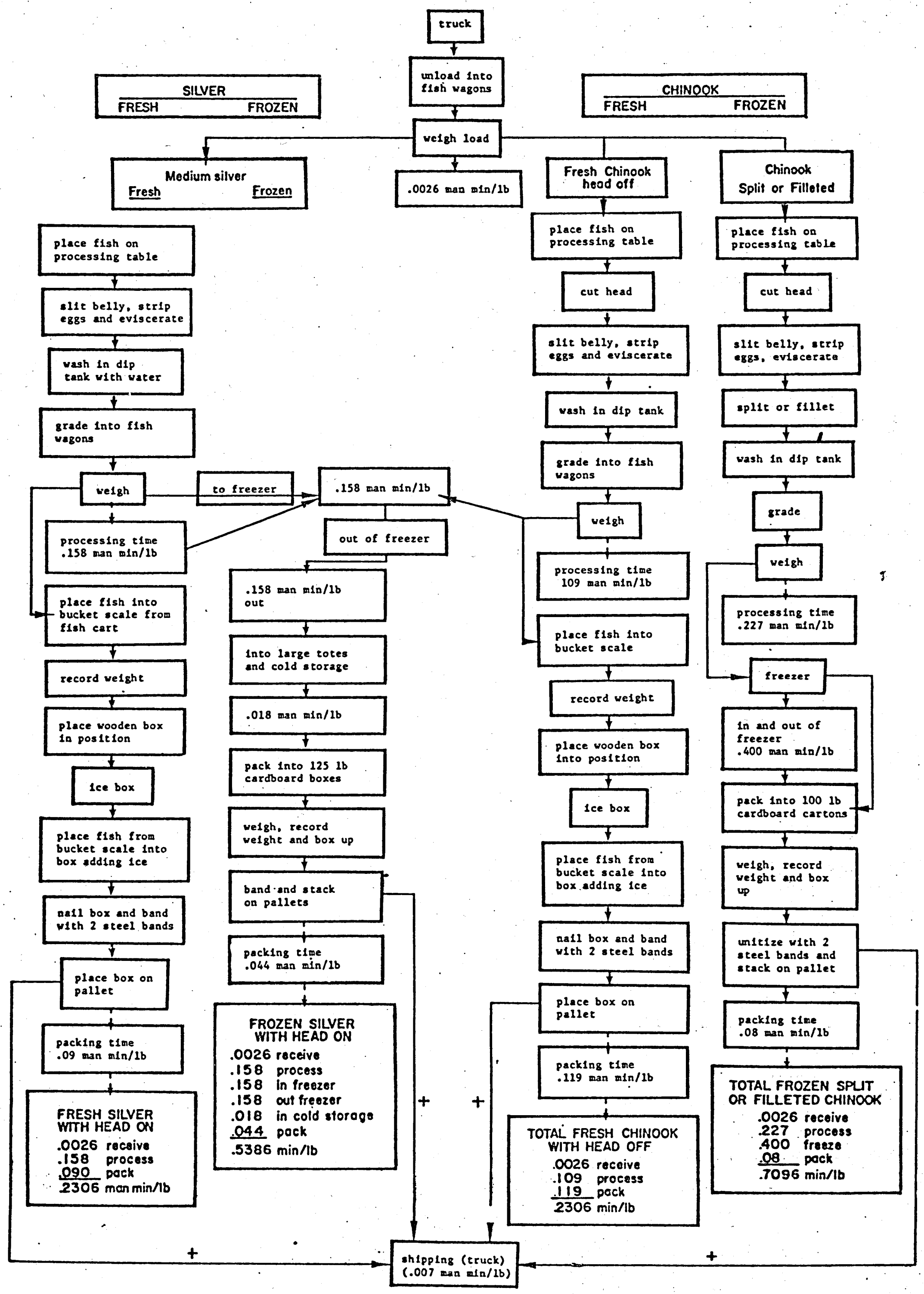
Actual average labor costs used in this study were $3.87 per man-hour, or 6.45 cents per man-minute. The procedure in developing costs was to calculate direct labor costs by multiplying the standard time by 6.45 cents. Overhead and other unidentified direct costs were calculated by multiplying the direct labor cost by 2.28 which then indicated total overhead cost of 14.71 cents per man-minute and total plant cost of 21.16 cents per man-minute. This is based on an overall average ratio calculated for this specific plant.

Processing information for other species is shown on the succeeding charts. Figure 6-2 (a) indicates the process steps and times for fresh medium coho, frozen medium coho (head on), fresh chinook with head off and frozen split or filleted chinook salmon. Figure 6-2 (b) indicates standard times for fresh chinook (medium) with head off, and Figure 6-2 (c) shows time standards for chinook, split and frozen. Data on frozen chinook shown at the bottom of Figure 6-1 were estimated, as this product was not being processed at the plant while the study was in progress. The data is recapitulated in Table 6-5 which identifies the costs and time standards for each function for each product, with additional detail provided in Tables 6-6 and 6-7.

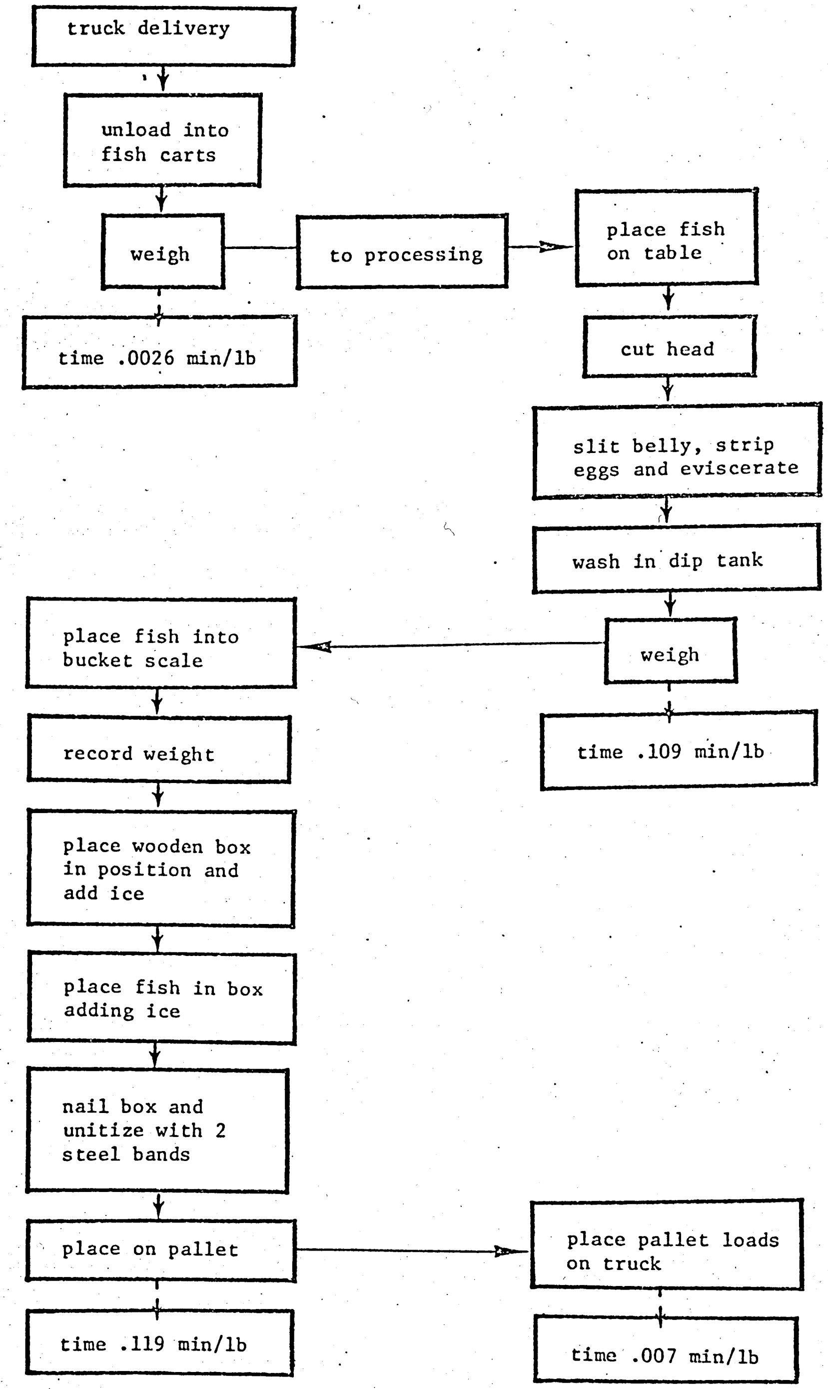
SALMON PROCESSING COST MODEL I
BASED UPON TIME STANDARDS
STANDARD COST PER POUND--FOUR PRODUCTS
FIGURE 6—1



SALMON PROCESSING COST MODEL II (a)
BASED UPON TIME STANDARDS
FOUR PRODUCTS
RECAP OF STANDARD TIMES
FIGURE 6—2 (a)



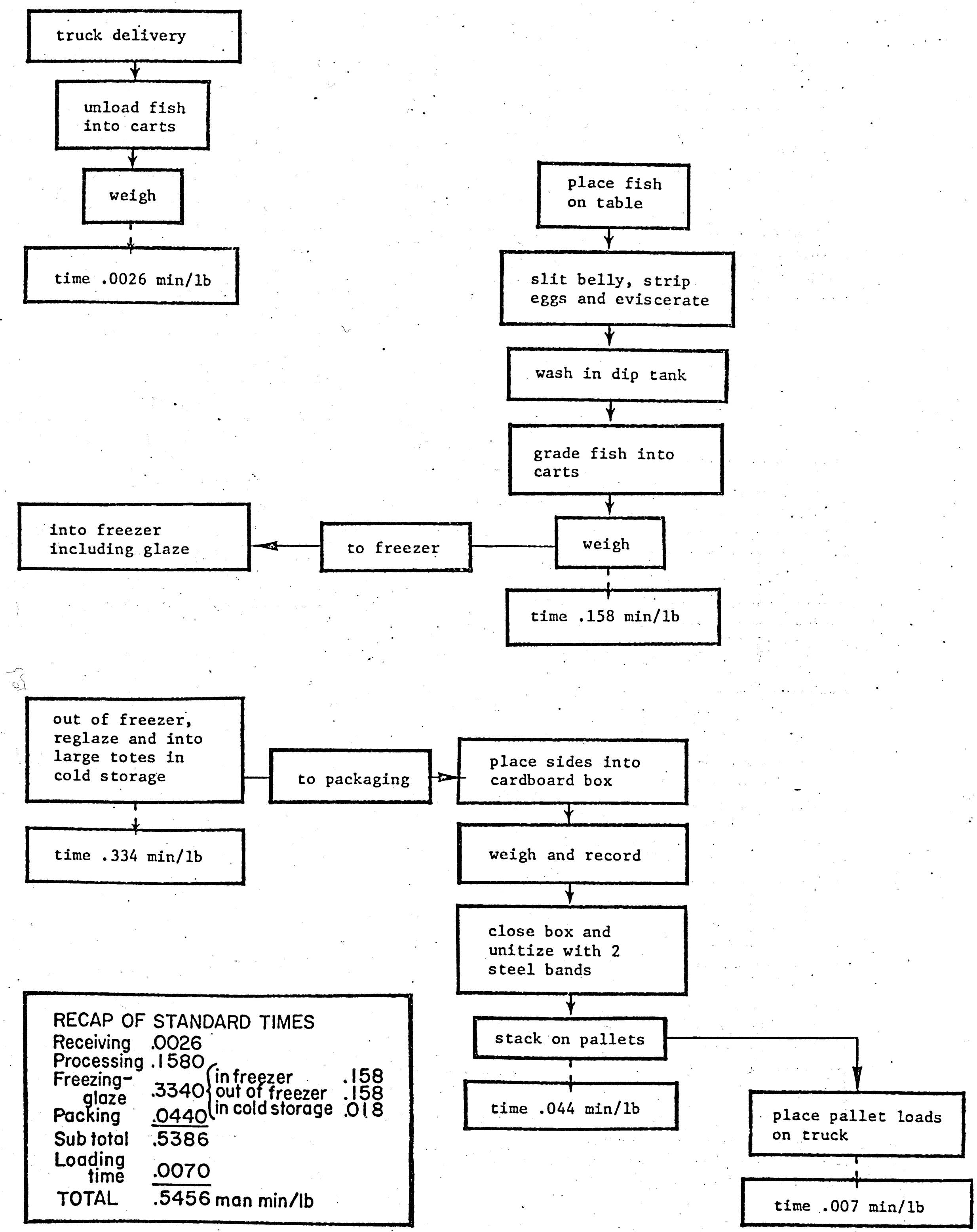
SALMON PROCESSING COST MODEL II (b)
BASED UPON A TIME STANDARD
FRESH CHINOOK WITH HEAD OFF
FIGURE 6—2 (b)



RECAP OF STANDARD TIMES

Receiving	.0026 (truck)
Processing	.1090
Packing	.1190
Subtotal	.2306
Loading time	.0070
TOTAL	.2376 man min/lb

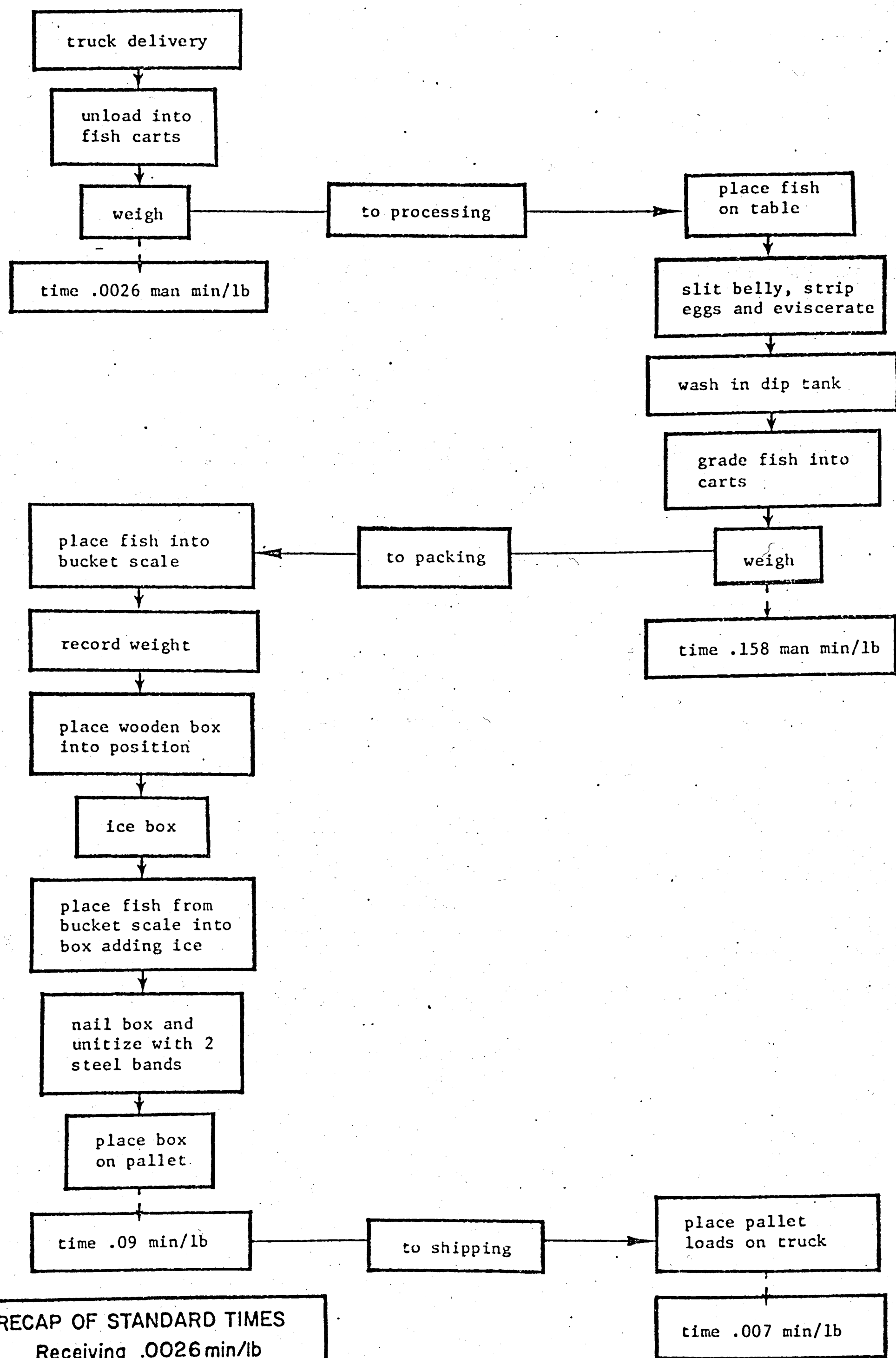
SALMON PROCESSING COST MODEL II (c)
BASED UPON TIME STANDARDS
FROZEN MEDIUM SILVER WITH HEAD ON
FIGURE 6—2 (c)



RECAP OF STANDARD TIMES

Receiving	.0026		
Processing	.1580		
Freezing-glaze	.3340	in freezer	.158
		out of freezer	.158
		in cold storage	.018
Packing	.0440		
Sub total	.5386		
Loading time	.0070		
TOTAL	.5456 man min/lb		

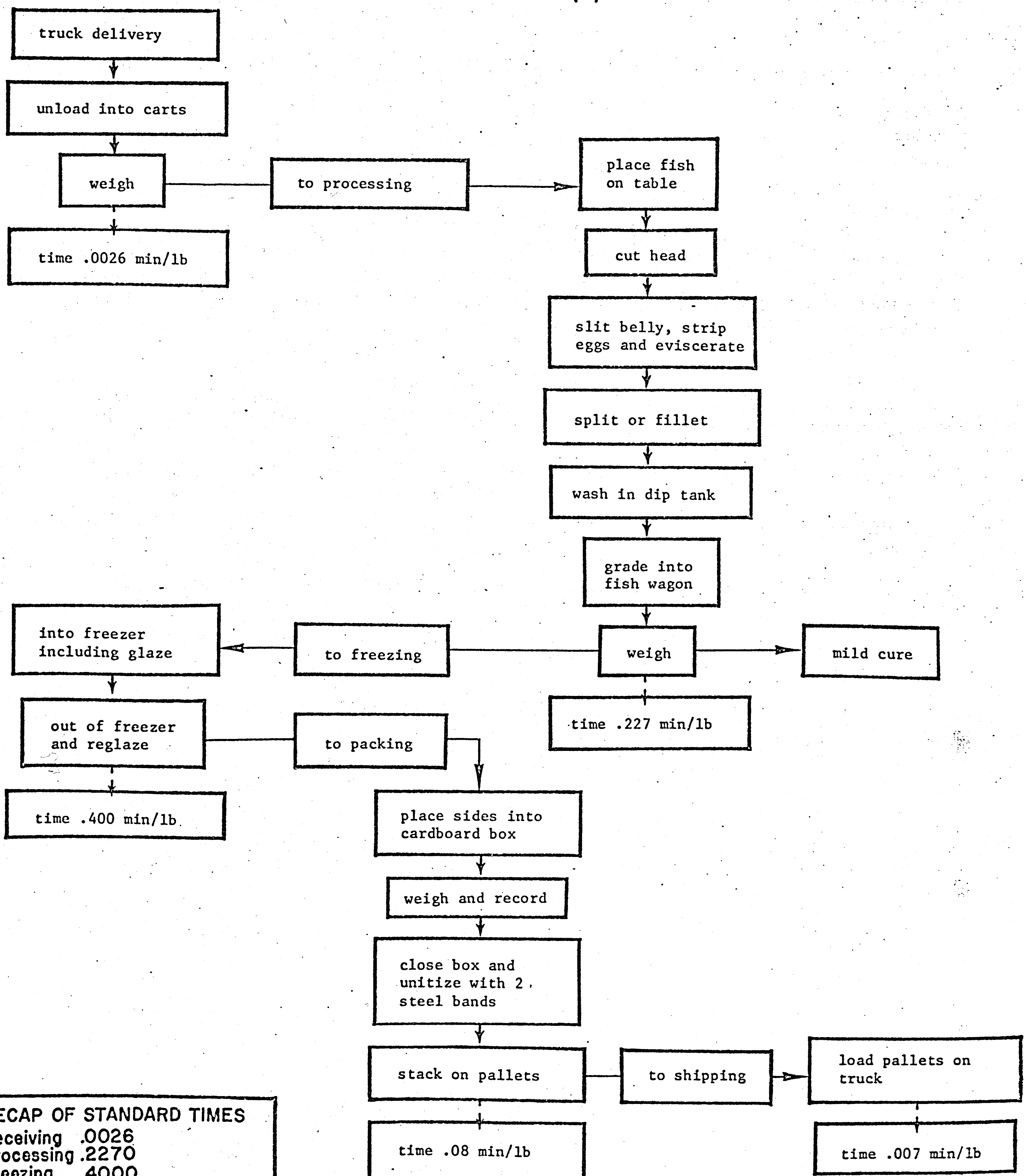
SALMON PROCESSING COST MODEL II (d)
BASED UPON TIME STANDARDS
FRESH MEDIUM SILVER
DRESSED WITH HEAD ON
FIGURE 6—2 (d)



RECAP OF STANDARD TIMES

Receiving	.0026 min/lb
Processing	.1580
Packing	.0900
Subtotal	.2506
Loading time	.0070
TOTAL	.2576 man min/lb

SALMON PROCESSING COST MODEL II (e)
BASED UPON A TIME STANDARD
CHINOOK, SPLIT AND FROZEN
FIGURE 6—2 (e)



RECAP OF STANDARD TIMES

Receiving	.0026
Processing	.2270
Freezing	.4000
Packing	.0800
Sub total	.7096
Loading time	.0070
TOTAL	.7166 man min/lb

Table 6-5

Summary of Times and Costs at Various Stages by Species and Operations

	Total Cost ¢/lb	Time min/lb	Labor Cost ¢/lb	Applied Overhead Per Pound
Receiving:				
Truck	.0550	.0026	.017	.038
Boat	.331	.0156	.101	.230
Processing:				
Fresh, medium silver w/head on (from round)	3.342	.158	1.019	2.323
Frozen, medium silver w/head on " "	10.407	.492	3.173	7.234
Fresh Chinook w/head on " "	2.305	.109	.703	1.602
Frozen Chinook, split or filleted " "	13.264	.627	4.044	9.220
Small silver, cannery butchered " "	5.818	.275	1.774	4.044
Packing:				
Fresh, medium silver w/head on	1.905	.09	.581	1.324
Frozen, medium silver w/head on	.931	.044	.284	.647
Fresh Chinook w/head off	2.519	.119	.768	1.751
Frozen Chinook, fillets	1.692	.08	.516	1.176
Loading:				
Truck	.147	.007	.045	.102

Table 6-6

Salmon Processing Model
Standard Times
Man Minutes Per Pound

Operations	Fresh Medium Silver Dressed With Head On	Frozen Medium Silver with Head On	Fresh Chinook with Head Off	Chinook Filleted & Frozen
1. Unload and Receive-				
Truck	.0026	.0026	.0026	.0026
Boat	.0156	.0156	.0156	.0156
2. Processing - Butchering, wash, grade, weigh	.1580	.1580	.1090	.2270
3. Cold Storage - Freezing or glaze (in and out)	--	.3340	--	.4000
4. Packing	.0900	.0440	.1190	.0800
5. Load	.0070	.0070	.0070	.0070
Total Man Minutes per Pound -				
Truck	.2576	.5456	.2376	.7166
Boat	.2706	.5586	.2506	.7296

Table 6-7

Salmon Processing Model
Standard Costs in Cents per Pound

	Fresh Medium Silver Dressed With Head on	Frozen Medium Silver Dressed With Head on	Fresh Chinook with Head Off	Chinook Filleted & Frozen
1. Unload and Receive -				
Truck	.055¢	.055¢	.055¢	.055¢
Boat	.331¢	.331¢	.331¢	.331¢
2. Processing	3.342¢	3.342¢	2.305¢	4.244¢
3. Cold Storage - Freezing or glazing (in and out)	--	7.065¢	--	9.020¢
4. Packing	1.905¢	.931¢	2.519¢	1.692¢
5. Load	.147¢	.147¢	.147¢	.147¢
Total Cost -				
Truck	5.449¢	11.540¢	5.026¢	15.158¢
Boat	5.725¢	11.816¢	5.302¢	15.434¢

Cost Estimating Equations

On the basis of the above process time and cost models, we developed estimating equations to identify the cost-throughput relationships for the following products.

1. Fresh medium coho, dressed, head on:
   - a. Direct labor cost: 1.63 x W* (in cents)
   - b. Total plant cost: 5.45 x W " "
2. Frozen medium coho, dressed, head on:
   - a. Direct labor cost: 3.52 x W " "
   - b. Total plant cost: 11.54 x W " "
3. Frozen medium chinook, dressed, head on: (estimated)
   - a. Direct labor cost: 3.20 x W " "
   - b. Total plant cost: 10.50 x W " "
4. Fresh medium chinook, dressed, head off:
   - a. Direct labor cost: 1.53 x W " "
   - b. Total plant cost: 5.03 x W " "
5. Chinook, large, filleted and frozen:
   - a. Direct labor cost: 4.62 x W " "
   - b. Total plant cost: 15.16 x W " "

* W - dressed weight per fish (in pounds)

Similarly, equations could be developed to identify costs for each species, whether in fresh or frozen product form. Direct material costs might be more difficult to measure unless careful records are kept. We would estimate these from other sources as about $0.01 per pound. Similarly, the purchase tax on fish which is paid either directly or indirectly by the processor is about $0.01 per pound. Therefore, a direct cost can be estimated by adding approximately 2 cents per pound to the direct labor cost shown here.

This approach and possibly the equations could be applied directly by other plants operating under similar circumstances to the one studied here. While we have used 6.45 cents per man-minute for direct labor cost, or 21.16 cents per man-minute for total plant cost, this could be altered without difficulty to revise the standard costs for other plants.

Other Plant Operations

For comparison, we have included a statement of standard processing costs for the year 1969. The corresponding financial statement however was not furnished:

Table 6-8

Standard Processing Time for Salmon Processor
1969 Season

			Per Pound
Cost of fish (from buying stations adjusted for shrinkage)		*	$0.605
Processing costs ---			
Freight	$0.010		
Dockage (service boats)	0.005		
Freeze	0.025		
Warehouse Operation	0.025		
Packaging Expense	0.015		
Supplies	0.005		
State Tax	0.015		
Total processing (Direct Cost)			0.100
	Total cost of sales		$0.705

	Per Pound
Average selling price was	$0.750
Less average cost of sales	0.705
Gross margin (available for overhead and profit)	$0.045

* Cost of fish purchased directly from boat operators was $0.045 per pound less or $0.56.

Source: Operating Cost Statement of Processor

While this processor reports average processing costs of $0.10 per pound, there is no way to identify the costs of fresh or frozen product individually without further information. This however does fall close to the $0.1154 cost developed in the model for total plant cost on medium frozen coho, and some of the variation might be explainable on the basis of the product mix.

Overhead for this processor was $24,000 per month, or $800 per day, based on 300 days per year of plant operation. During the peak of the season, approximately 16,000 pounds of salmon were processed per day. Allocating this overhead by species, and recognizing that salmon accounted for 20 percent of total sales, $160 per day could be charged against salmon production. At the annual volume involved, this was estimated by the manager to be $0.01 per pound. However, as we have noted before, the uncertainty of the total volume of the salmon run made any <u>a priori</u> allocation impractical. One alternative would involve distribution of this overhead in proportion to the direct costs, which would make Table 6-8 directly comparable to the data from the model. Nevertheless, this would still suffer from the difficulties of allocation methods in general.

Another financial statement by a different salmon processor provides a cost division by source for the month of August 1969.

Table 6-9

Production Cost of Fresh and Frozen Salmon

(total pounds 25,980)	total	Per pound
Sales	$21,166	$0.8110
Fish cost	17,159	0.6600
Fish tax	268	.0103
Fish procurement	1,106	.0425
Labor	276	.0105
Payroll taxes	51	.0019
Total direct cost	$18,860	$0.7252
Gross profit	$ 2,306	$0.0858
Gross profit percentage 10.9%		
Overhead expenses (allocated on basis of direct cost ratio of salmon to total direct cost.)	$ 1,097	$0.0422
Net income	$ 1,209	$0.0436

The costs of processing fresh and frozen salmon during this period were $0.0652 for direct processing, excluding the purchase cost of salmon, and $0.0422 for overhead, for a total processing cost of $0.1074 per pound, which compares to the costs calculated in the model of $0.1154 for medium coho frozen, head on.

In comparison, this processor also provided costs of canning salmon, based on his own operations earlier in the 1969 season. The data are shown in Table 6-10.

Table 6-10

Production Costs of Canning Salmon

	Cost per Pound
Labor	$0.060
Cans	0.060
Cartons and Labels	0.005
Total Direct Expense	$0.125
Manufacturing Overhead	$0.013
Total Expenses	$0.138

Source: Processor's Financial Statement

Assuming that costs developed in the model to be approximately comparable with the fresh and frozen salmon costs of this processor, we are then able to make the following comparison, assuming that all costs are applicable to medium coho salmon:

Product Form	Direct Labor	Material	Total Direct	Total Cost
Fresh	$.017	$.020	$.04	$.0645
Frozen	.035	.020	.07	.1254
Canned	.060	.065	.125	.138

The value of this comparison is that while total allocated costs for canned versus frozen salmon show little difference, much of the real distinction is submerged in the allocation. Recognizing that the relevant costs for the product decision are the direct costs, it is apparent that the direct costs of canning are more than three times those of fresh salmon and almost twice those of frozen salmon; the major difference between direct and total costs appears to lie in the volume basis for allocation. A market decision based on these alternatives should then be based on net unit revenues compared to these unit costs, i.e. the contribution margin. These may not be mutually exclusive decisions. Several processors spoke of the necessity to maintain stocks in their traditional product markets in order to satisfy customers, irrespective of the relative returns. This however can only be a short-run production cost. The usefulness of the processing cost model lies in the added precision that it gives to estimation of direct labor costs. It is sufficiently flexible to be adapted to the specific product and wage rates of individual plants. By using direct labor costs as a guide, it establishes a measure of control and plant performance, and provides the basis for cost information for product choice decisions and production planning.

Rates of Return for Processors

The two principal measures of profitability for a firm are profit margin and rate of return. The problem in measuring returns to fish processors is that with several different species of fish or products the problems of allocation make precise determination of profits difficult. On the basis of the contribution margin, it is possible to compare different species or product forms. However the rate of return, and even net profit margins, can only be determined when all of the products which are part of the allocation are considered as an entity, then to be compared on the basis of a common investment base.

The relative profitability of salmon compared to other species is indicated in the experience of one large Northwest processor over a 3-year period:

Table 6-11

Comparative Margins on Salmon Versus Other Species
For Northwest Processor
$/pound

	1966		1967		1968	
	All Species	Salmon	All Species	Salmon	All Species	Salmon
Sales	$.70	$.58	$.78	$.60	$.94	$.77
Purchases	.57	.39	.60	.39	.75	.41
Gross Margin	$.13	$.19	$.18	$.21	$.19	$.36
Margin Percent	18.5%	32.7%	23.0%	35.4%	20.2%	46.7%

Source: Records of Processor

While salmon processing is tied to the processing of other species by the necessity to share joint facility investment and to incur joint overhead costs, its advantages in generating large margins are clearly evident. Salmon thus becomes a major element in the product choice strategies of most Northwest fish processors, earning more than proportionate contribution to overhead and profits.

Several firms have attempted to measure rate of return by species. The normal procedure which these firms follow is to allocate both overhead costs and investment on a basis of physical volume, revenue or direct costs. The reported results are shown in Tables 6-12 and 6-13, which describe rates of return for two different firms.

Table 6-12

Fresh and Frozen Salmon Rates of Return
Compared to Other Species, 1969
Large Salmon Processor

	Fresh & Frozen Salmon Total	Other Species Total
Total Investment	$4,701,000	$6,192,000
Total Pounds Sold	13,175,459	19,675,000
Total Sales	9,488,080	10,620,200
Variable Expense	7,735,897	8,704,188
Contribution	1,752,183	1,916,012
Contribution Percent of Sales		
Fixed Expenses	1,047,095	1,188,042
Net Return	705,088	727,970
Net Return -		
Per Sales Dollar	7.4%	6.8%
Per Pound	5.4¢	3.7¢
On Investment	15%	11.7%

Table 6-13

Comparative Returns for Salmon Processor

1967-1968

	1967	1968
Return for total operations on total assets	2.8%	3.1%
Return for total operations on net assets	9.5	7.6
Return for all species, fresh and frozen on net assets	NA	5.0
Return for salmon on total assets	13.9	12.9

Source: Financial Statement of Salmon Processor

While this type of calculation may provide a rank ordering of returns by species, it cannot provide a true measure of returns unless all species are processed simultaneously, and there are no economies of scale in any production process. For example, a firm that processes both salmon and crab, with one species following the other and using the same facility without special investment, would incur the same investment if it chose only one or the other. To allocate the investment base in effect is to deflate falsely the investment base and hence to raise the rate of return. The resulting number may be useful as an internal control providing its limitations are established. It does not provide any guidance as to the true rate of return, which can only be measured for the enterprise as a whole. The relevant calculations therefore are the rates of return for the firm, and contribution margin for the individual species or product form.

Even the rate of return problem for the firm is not free from distortion. The investment base for many processing plants is sufficiently old that it has in many cases been fully depreciated, and further was built in a period of lower construction costs. Returns to processors do not reflect the prospects facing a new entrant to the industry, which would appear to be lower. Establishing the rate of return will require more extensive research than can be done here, but it will be necessary in order to evaluate fairly the current health of the industry.

D. Wholesalers

Cost and returns data on wholesalers is derived both from financial statements of a few cooperating firms, supplemented by additional comments in interviews, and from published sources, principally Annual Financial Statements 1969 published by Robert J. Morris Associates.

In Table 6-14, data from these two different sources are presented for comparison:

Table 6-14

Costs and Returns from Fish Wholesaling

A. Sample of Three Pacific Coast Firms, 1969

Firm:	A	B	C
Size of firm: Total net fixed investment	Under $100,000	$1 - 2 mm	$1 - 2 mm
Sales:	Under $100,000	$1 - 2 mm	more than $2mm
Sales:	100.0%	100.0%	100.0%
Cost of goods sold	70.0	85.7	82.5
Gross Profits	30.0%	14.3%	17.5%
Other expenses	33.0	11.8	24.0
Net profit before tax	(3.0)%	2.5%	3.5%
Return on investment	(12)%	4.18%	4.14%

Average of three: 5.7%

Source: Survey data

B. National Sample of Fish Wholesalers:

Size of Firm: Total assets	Under $250,000	$250,000 and less than $1mm	$1mm and less than $10mm	Total sample
Net Sales:	100.0%	100.0%	100.0%	100.0%
Cost of Sales	81.2	83.6	82.8	83.0
Gross Profit	18.8	16.4	17.2	17.0
All other expense net	16.6	14.4	14.7	14.7
Profit before tax	2.2	2.0	2.5	2.3
Return on investment	12.4%	4.3%	6.5%	7.1%

Source: Annual Financial Comparisons, 1969 (Robert Morris Associates, Philadelphia, 1969), P. 132.

The firms included within our own sample appear to perform in a manner consistent with the national averages for fish wholesaling, with the exception of firm A. Margins tend to be between 16 and 19 percent. Other firms surveyed reported a range from 10 to 30 percent of total sales. Operating expenses for firms B and C tend to be lower than those reported nationally, but profits are also lower. Firm A is a small inland wholesaler whose data reflect the small scale of operation as well as some peculiarly local factors which tend to make overhead expenses high. Net margins varied for the two firm sample between 2.5 and 3.5 percent, and in the larger survey, from 3 to 9 percent. It should be noted that in our survey there appears to be little pattern to the size of either gross margins or the returns. In the national data, if the groups are relatively homogenous, then there appear to be some higher returns to larger scale.

Detailed cost studies of wholesale operations were difficult to obtain. Further, the functions of wholesalers varied from local suppliers within an urban area to those that served large geographic areas. The organization of wholesalers also varied. Some employed driver-salesmen, others used separate salesmen. Data from the Robert Morris survey of fish wholesalers presents a broad categorization of expenses incurred as follows:

Table 6-15

Costs of Fish Wholesalers
of Asset Size Between $250 and less than $1 mm
1968

Net Sales:	100.0%
Cost of goods	80.8
Gross Profit	19.2
Selling and Delivery Expense	4.0
Officers' Salaries	2.6
All other general Administrative Exp.	8.7
All other expense net	1.5
Profit before tax	2.4

Source: Annual Financial Comparisons, 1969 (Robert Morris Associates, Philadelphia, 1969), P. 304.

This can be compared to the experience of a West Coast wholesaler with an extensive delivery route operation:

Table 6-16

Delivery and Selling Expense for West Coast Wholesaler
1968

Sales	100.0%
Selling Expenses including commissions advertising, telephone, bad debt reserve and miscellaneous expense	0.83%
Delivery	
Supervision	0.83%
Labor	3.75
Vehicle Operation	1.60
Other	0.32
Total delivery expense	6.50%

Source: Financial Statement of a Fish Wholesaler.

The wholesaler's primary tasks are buying for his client customers the retail stores, sorting and icing fish in his plant as he fills orders and then delivering the product to the customer stores, restaurants, and institutions. From the fragmentary evidence above, it appears that of the selling and delivery expense, delivery is the most expensive single activity which a wholesaler performs. Yet it appears from our observation that many wholesalers exercise extremely little control over this area of their operation. Even inventory control over drivers appears to be non-existent in several operations we observed.

The closest comparable class of business activity to fish wholesaling is that of meat wholesaling. Data for meat wholesalers of a comparable size is shown in Table 6-17, which indicates that these firms operate with much lower margins: 8.4 versus 17.0 percent, and yet earn higher returns, 7.8 versus 7.1 percent.

Table 6-17

Costs and Returns of Meat Wholesalers
(% of Sales)

Firm Size (Assets)	Less than $250,000	$250,000 and Less than $1mm	$1mm and Less than $10mm	All Sizes
Net Sales	100.0%	100.0%	100.0%	100.0%
Cost of Sales	85.6	89.9	92.6	91.6
Gross Profit	14.4	10.1	7.4	8.4
All Other Expense	13.0	8.9	6.2	7.0
Profit before Tax	1.4	1.2	1.3	1.3
% Profit before Tax to total Assets	10.0%	6.9%	7.8%	7.8%

Source: Annual Financial Comparisons, 1969 (Robert Morris Associates, Philadelphia, 1969), P. 137.

The rates of return in fish wholesaling would suggest that these firms will eventually disappear, because of their unprofitability. In Chapter III[9] examination of data on wholesaling for these two classes indicated that for sales per employee and sales per square foot of warehouse space the productivity of meat wholesalers was more than double that of fish wholesalers. Coupled with the high risk of spoilage in fish inventory, this points out some obvious causes for differences in profit rates.

Fish wholesalers are gradually being displaced by both direct buying practices of chains and also by diversified frozen food distributors, who are absorbing the higher volume categories of fish wholesaling. While there are tendencies toward concentration in many lines of wholesale activity, this appears to be particularly true in fish wholesaling. Small wholesalers by their own admission are declining rapidly in number and it would appear that in the long run only the largest will survive.

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Table 6-18

Fish Retailer

	1968
Sales	$141,100
Cost of Sales	115,700
Gross Profit	25,400
Less Operating Expenses	
Salaries	13,248
Rent	484
Utilities	2,905
Advertising	116
Office Supplies	458
Oper. Supplies	--
Repairs and Maintenance	407
Interest	125
Taxes and License	1,061
Payroll Taxes	678
Insurance	583
Legal and Acc't.	275
Delivery and Pickup	1,199
Travel and Enter.	2,000
Janitor	--
Depreciation Exp.	3,000
PUC	115
Laundry	140
Unclassified	--
Total Operating Expense	26,794
Net Income	(1,394) (1%)

Table 6-19

Meat Markets
Average Annual Volume $50,000-100,000
Percent of Total Sales

Sales		100.00%
Cost of sales		78.73
Gross profit		21.27%
Wage expense	7.32	
Operating supplies	1.27	
Repair expense	.24	
Advertising	.64	
Car and delivery	.40	
Bad debts	.02	
Administrative and legal	.20	
Miscellaneous expense	.32	
TOTAL Controllable		10.41%
Contribution to fixed and profit		10.86
Fixed expenses -		
Rent	1.30%	
Utilities	1.07	
Insurance	.37	
Taxes and licenses	.48	
Interest	.09	
Depreciation	.70	
TOTAL FIXED expense		4.01%
Net Income		6.85%

Source: The National Cash Register Company, Dayton, Ohio, "Expenses in Retail Businesses", 1969, p. 78.

E. Retailing

Data on salmon retailing is also difficult to obtain, but possibly for different reasons. Seafood contributes a small fraction of total supermarket sales, and salmon is obviously an even smaller fraction of the total. While specialist seafood retailing might provide a basis for establishing the costs of retailing of salmon, the number of specialty seafood retailers is small and declining. In fact most of the remaining dealers had added other lines such as poultry. Table 6-18 is a typical income statement which was obtained from a small seafood dealer, and this one showed a negative return.

Most salmon which reaches the housewife is sold through the meat department of supermarkets. While the differences in returns in wholesaling indicate differences in handling of meat and seafood, the retail costs of handling for the two classes should be close enough to use data for meat departments in general as a basis for establishing seafood costs. Data for meat departments of supermarkets was taken from a study by the National Cash Register Company[10] and is shown in Table 6-19. The direct (controllable) costs were 10.4 percent of sales, the fixed expenses were 4.0 percent for a total cost of 14.42

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[10] National Cash Register Company, Inc., Expenses in Retail Business, 1969 (Dayton, Ohio, 1969), p. 78.

percent. The gross margin in this study was 21.27 percent, which is slightly less than the gross margin of 24.6 percent reported as a typical performance for meat departments for 1968 by the Supermarket Institute.[11]

Interviews with fish buying officers of retail chains on the West Coast tended to support these figures. One large chain reported that handling costs for seafood tended to be about 15 percent of sales. Some buyers spoke of a 25 percent profit margin as being desirable, but realistically, that seafood margins fell in a range close to 20 percent. One supermarket chain of 12 stores reported markups of 24 to 30 percent on salmon. Handling costs were 15 percent of sales and included the following steps:

a. heading and trimming of the fish

b. cutting into steaks

c. wrapping and arranging in display container

d. selling to customer

This particular chain sold about 75 percent of the salmon processed as steaks and chunks, the remainder being sold as sides or whole for baking.

In a general context of supermarket operations, the marketing of fish only makes a small contribution to total sales and profits. Yet the market is affected by the buying power which the supermarkets are

[11] The Supermarket Industry Speaks 1969, (Chicago, Illinois: Supermarket Institute, 1969), p. 11.

capable of bringing to the wholesalers and increasingly direct to the processors themselves. Elsewhere we have pointed to the concentration of buying power in the hands of a few organizations in grocery retailing.[12] However, profit margins or rates of return do not appear to be unduly large. Data for a sample of 164 supermarkets in 1968 indicated gross margins of 19.4 percent, net profit margins before tax of 1.9 percent and returns before taxes on total assets of 9.6 percent.[13] The curb to monopoly profits must come from within the supermarket industry itself, with large chains in competition with each other. The pressures to reduce buying costs are manifest in salmon distribution in the elimination of wholesaling and in the efforts to secure supplies for specific price levels such as the hesitancy of chain buyers in 1969 to offer salmon at more than one dollar per pound.

II. Channel Costs and the Contribution Margin

How much does the distribution of salmon cost the consumer? The subject of distribution costs in the American economy has been subject to many investigations over the years.[14] Yet the system must be repeatedly defended against the critics who raise the issue whether the price of distribution is too high.

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12 III, pp. 89-99.

13 Annual Financial Comparisons, op. cit. P. 199.

14 Dewhurst, Frederick J., Stewart, P. W., and Field, L., Does Distribution Cost Too Much? (New York: The Twentieth Century Fund, 1939) and Cox, R., Goodman, C. S., and Fichtandler, T. C., Distribution in a High Level Economy (Englewood Cliffs, New Jersey, Prentice-Hall, 1965).

At this point we are in a position to examine the total costs of moving salmon through the channel. Several ways can be suggested to measure distribution costs: as a series of prices including the addition of profits and costs from preceding stages; as a series of margins which are the net differences between prices at succeeding stages, and which then identifies the average price for distribution services provided, and as a series of directly identifiable direct costs involving only the actual processing and movement of a specific product to market. This last is actually a cumulative contribution margin, in which the average margins which are customarily considered to be distribution costs are then divided into the direct costs and the unassignable margins between final revenues and the sum of the direct costs.

Channel costing actually involves a conflict in two directions. At each stage of the channel, the firm is faced with horizontal allocations across products and markets, in which managements will seek to maximize the net contribution of their product line to firm overhead and profit. At the same time, there is a series of bargaining relationships between firms at each stage, in which prices are potentially free to vary from the marginal cost (analogously the direct cost) of the seller to the maximum price which the next stage will offer. If there is a dominant firm at either end of the channel, the net margins should be concentrated there.

In the salmon industry, we have examined the costs and margins on the basis of individual stages. In order to discuss the total cost and margin for movement through the channel, the typical distribution costs of a channel in the Northwest are summarized involving fishermen, receiving station, freight to the processor, processor, wholesaler, and retailer. This particular case will consider only local delivery from processor to wholesaler such as the channel for the Seattle Metropolitan area, in order to avoid unnecessary complications. The channel costs are shown in Table 6-20. The data used here have been selected from the information gathered for this study.

The allocation problem of the individual firm now becomes that of the channel. How does the 64 percent of the costs which are not assignable become allocated to each stage? The answer lies in the price behavior of the channel as the size of the contribution margin is determined by the difference between revenue and direct costs. Pricing in a vertical relationship is dependent on bargaining between channel stages, and is directly influenced by the relative strengths of the two sides. In a competitive market, pricing must reflect the collective supply offerings of firms at one stage and the collective demands of the firms at the succeeding stage. However, in imperfect

Table 6-20

Collective Approaches to the Distribution Cost
For Salmon in the Northwest
data in cents/pound

Channel Member	Price at Input	Gross Margin	Direct Cost
Fisherman[1]	0	0	40
Receiving Station[2]	55	3	2.5
Freight to Processor[3]	58	2	1.5
Processor[4]	60	9	4
Wholesaler[5]	69	9	8
Retailer[6]	78	21	0
Consumer	99	0	0

Total Margin..................44 cents
Direct Cost of Movement through Channel......16 cents
(Without fisherman's direct production cost)

1. Fisherman - based on estimated costs of Port Orford 32' troller in Table 6-3.
2. Receiving station - based on interview data, production costs estimated.
3. Freight - average figure quoted by one processor.
4. Processor - based on cost study, includes:

Labor	$0.013
Selling cost	.0003
Processing Mat'l.	.010
Fish Tax	.010
Total	$.046

5. Wholesaler - based on interview data from one wholesaler, includes:

Labor	$.050
Trucks	.015
Other	.015
	$.080

6. Retailer - No information available. However if there are no charges, there must still be opportunity costs in relation to a substitute item such as other fish, poultry or meat.

Note: The above calculations do not include return on investment or opportunity cost for owners in alternate employments.

The results of summing the gross margins and the direct costs show:

Sales price	99	cents	100.0%
Total margin in distribution	44	"	44.3
Total Direct Costs	16	"	16.2
Physical Processing costs	9	"	9.1
Direct physical processing costs	4	"	4.0
Distribution only costs	35	"	35.3
Direct distribution costs	12	"	12.1
Unassignable costs	28	"	28.2
Unassignable costs as a percent of total margin			63.6

competition, the influence of market structure must be transformed into variations from a competitive norm. Thus cost allocation becomes a result not of supply factors alone such as production volume, or direct costs incurred but also of demand, reflecting monopolistic or its counterpart, monopsonistic conditions in the market place.

The managerial problem is therefore how to cover overhead costs when dealing with such a fluid situation. The only guideline is to search out opportunities which maximize the total net difference between revenues and costs, which in turn requires only three types of information: direct costs, volumes, and prices.

The problem of margins is larger than the above example would suggest. Transportation has been treated as given. Yet the direct cost can be substantially lower than the total cost, depending on whether the movement is a forehaul or backhaul, and whether other shipments move with the fish. Further, it would seem logical that most fixed price services involved in distribution incorporate some degree of allocation, and that this margin in effect is negotiable through the price system.

<u>Management Practice in Salmon Distribution</u>

One major indicator of managerial efficiency is the amount and quality of information available to managers to enable them to make better decisions. In general, this appears to be low at every level of the industry. Decisions appear, in the case of most firms in our survey, to be based on intuition and poor, out-dated information. The lack of specific data on salmon processing and distribution from industry for this study is indicative of more than a desire to maintain proprietary secrets. Reliable accounting information for managerial decision-making is simply not available to most of the firms that need it. The lack of direct costing procedures is particularly noticeable among processors, who could utilize this information to select product forms for processing. The widespread misallocation of resources in the industry evidenced by inefficient production organization and weak controls on outside delivery operations, supports an impression of a lack of concern with cost control.

Many firms in the survey appeared to be more oriented toward their supply than to their markets. There appears to be a reluctance on the part of management in this traditional industry to experiment with new species and product forms. Despite the narrow resource base, irregularity of supply and the seasonal nature of salmon, the smaller firms and most of the larger ones have been reluctant to diversify. Only a handful of companies have demonstrated an ability to respond to new market opportunities and to recognize the futility of maintaining the older patterns with poor profit trends.

Directions for Research

The difficulties in providing answers to the essential questions of costs and returns point to several areas in which research is absolutely necessary to an evaluation of the industry. There is an almost complete lack of information available on the costs of process and distribution functions. The cost study of processing operations provides the only basis for identifying these costs that we have encountered for this industry. Therefore, an important direction for future research is to extend cost studies to other parts of the distribution channel, to build a more comprehensive set of data which can serve as a reference for potential changes in production and distribution.

A second failing of the data that was encountered in the industry is the difficulty in establishing realistic rates of return. The problems of jointness in capacity and overheads present extreme difficulties in measuring returns on individual product lines. In addition, we have observed a decline in investment in this industry reflected in the age of plant and equipment. If returns are based on net depreciated values of buildings which have survived several generations, and which were built at much lower construction costs, the returns then appear to be overstated. A second research need is, therefore, to study the measurement of rates of return, and possibly to establish the earnings capability of firms if they were to enter the industry today.

Studying cost and financial statements of these firms cannot help but indicate the quality of management and the information tools with which they must work. The need for cost acquisition and analysis is apparent in this industry in almost every operation being evaluated. A third research need which this chapter demonstrates is that of establishing cost and financial reporting systems which will be of immediate use to managers, and planning their implementation in order to achieve higher quality of management within the industry.

Concommitant with improved cost information, the industry also needs better market information. The geographic problems of remote supply areas and distant markets must be overcome if the market for salmon and other species is to become more efficient, and if the returns from individual firms are to be improved. Without adequate information, the bargaining position of the suppliers becomes weak compared to that of the buyers, while the allocation of fish resources to the market becomes wasteful because the market cannot seek out the highest-return alternatives.

A fourth research area, therefore, is the need to establish better market information systems, to link markets to each other more effectively, and also to improve the ability of managers to plan their returns from the supply they have on hand or anticipate, both in selling activities and in estimating contribution margins for production.

For many firms the quality of management is low. However, it is difficult to foresee any wholesale improvement of management in this industry without also improving the quality of information with which they work. The conditions under which decisions must be made are difficult, being unable to predict supply accurately, and hence being unable to plan workloads, being forced to commit sales of products which have not been purchased, and facing large areas of their operation where costs cannot be realistically or usefully assigned. For many of the smaller firms in this industry to survive, the need for research in these areas is readily apparent, research not only into solutions of the problems themselves but also in implementation of the findings into actual practice.

Summary

The objective of this chapter has been to measure the costs and returns of firms engaged in salmon distribution. The basic sources of information have been direct observation of processing and distribution operations, interviews, financial statements of cooperating firms, and comparative data from published sources. Despite the number of sources, we have found little data that is specifically relevant to the salmon industry. This stems from both a low level of information within the industry, and the joint production characteristics of the industry. Nevertheless, estimates were made of costs and returns at each stage in the channel and for the channel itself.

1. Fishermen tend to earn low or negative returns. However, the direct costs have tended to be about half of total revenues earned, indicating why fishermen tend to return to this activity from season to season.

2. No estimate of profitability was made for receiving stations, as most are tied contractually or by ownership to processors. Average costs were estimated to be between 3 and 4 cents per pound.

3. Processor earnings have been generally low, based on the financial statements available. However they would appear to earn more on salmon than on other species. One firm reported earnings

for 1968 of 3.1 percent on total assets, or 12.9 percent on assets devoted to salmon, based on allocation of the investment base. Measurement of the direct labor, total direct and total plant costs for typical salmon products showed for medium coho salmon, the following costs in cents per pound:

	Direct Labor	Total Direct	Total
Fresh	$.017	$.04	$.0645
Frozen	.0352	.07	.1254
Canned	.060	.125	.138

4. Returns for wholesalers were 5.7 percent in our sample, and 7.1 percent based on published data for a national sample. Margins in the study sample were 14 and 17 percent, while the national data indicated an average of 17 percent. Net returns in the survey sample ranged from 2.5 to 3.5 percent.

5. Retailing of salmon takes place largely through the meat departments of supermarkets rather than through specialist seafood stores, which are declining rapidly. Meat department margins for salmon appear to be about 20 percent, although retail chain buyers refer to target margins of 25 to 30 percent. Retail supermarkets earn returns of about 10 percent on investment, based on published data.

The two most profitable stages in the channel are the processors and the retailers. Neither processors nor supermarkets appear to be earning extraordinary profits. Exertion of market power in the channel would appear to be stemming from the competition which supermarket chains face from each other in dealing with the consumer. This in turn faces the power of the processor in his capacity to sell to alternative markets. The increases in concentration at the processor level and the relatively high margin returns in salmon lead to a conclusion that market power is increasing at that level in response to that of the large retail chains.

6. Total costs for operation of the channel appear to be about 44 percent of the total retail price for the end product for a channel confined to a local market area. Of this, the directly assignable costs of moving salmon to market were $.16, with the difference of $.28 being the unassignable overhead costs. Overhead costs are the major share of total channel costs, and the allocation of this overhead is accomplished through the vertical price structure. Therefore average margins become a reflection of prices charged rather than the reverse, where prices are set at levels which will cover costs.

7. Management practice in a large number of firms is disappointingly poor, with little effort either to control costs or to innovate into new areas. This is evidenced by the lack of relevant data which managers

have to work with. In this study we have presented a cost model based on study of direct labor time and costs for processing of salmon, which provides an initial basis on which to collect data. While this model was developed with the cooperation of one firm, because of the invariability of the salmon processing technology, it should also be applicable to other firms as well.

8. More than presenting factual data, this chapter points to the necessity for further study of cost and returns of this industry. Specifically, there are four areas which need closer examination:

a. the need for more comprehensive data on the processing and distribution costs of the industry.

b. the need to establish more accurate estimates of rates of return for firms within the industry.

c. the need to develop cost and financial reporting systems for better control.

d. the need for better marketing information in order to make better decisions for product planning and marketing.

This summary has presented some estimated costs and returns. However, the most important finding of this chapter is the lack of reliable information. It is difficult to understand how management can be improved without a massive upgrading of the information available.

Chapter VII

THE COMPUTER SIMULATION MODEL

The initial step in development of a simulation model is to determine the purpose of the model and establish workable objectives. For the model under development here, the primary objective is usefulness; the model must be realistic, and capable of application to real world problems. Development of a model of this type involves balancing several potentially uncomplementary characteristics such as: Complexity and elegance, user knowledge requirements, and compatibility with readily available data. Naylor *et al*. state that "In order to be useful a scientific model must necessarily embody elements of two conflicting attributes--realism and simplicity. On the one hand the model should serve as a reasonably close approximation to the real system and incorporate most of the important aspects of the system. On the other hand, the model must not be so complex that it is impossible to understand and manipulate."[15] The salmon distribution model was developed under the constraints imposed by these two conflicting alternatives.

With usefulness as the primary objective, the characteristics that make a model useful must be isolated. For the model to be

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[15] Naylor, Thomas H., *et al*., *Computer Simulation Techniques*, John Wiley & Sons, Inc., New York; 1966, p. 10.

useful and beneficial, rather than just an academic curiosity, it must meet some important need of potential users, and not entail excessive difficulty or cost in the process. With potential users not clearly identified, it was difficult to determine current and future problems for application; however, characteristics giving the model general predictibility of system entities under varying economic and physical conditions seemed desirable. Several guidelines were established to avoid excessive difficulty and cost. First, the model should not require excessive amounts of computer time to run; second, input data should as nearly as possible approximate that which is available in the present day world, so as not to require a major effort to compile, and third, the output should be in a recognizable and usable form.

Direct involvement of potential users during the development of a model of this type is highly desirable, since it greatly reduces both the problems of implementation and the risk that the model will be impractical or fail to meet user requirements. It also makes the model less strange and frightening, and reduces the learning time required when the model is delivered. Direct user involvement did not appear to be possible during the development of this model.

Two rough rules of thumb often applied to simulation projects of this type are: (1) Half of the effort of development of the model goes into implementation, and (2) problems of implementation are directly proportional to the complexity of the model. With these and the lack of user involvement in mind, a necessary guideline seemed to be "keep it simple."

Philosophy of the Model

The model developed is a non-optimizing, deterministic model of the pricing and distribution of fresh salmon. It can be loosely described as an information generator. It makes possible the generation of prices and volumes of salmon sold to each of several markets (one being frozen inventory), under predetermined conditions of catch volume, cost, prices, and demands. In addition it computes the total accumulation of frozen inventory during the season.

It is written in FORTRAN, for operation in batch mode from either punched cards or teletype terminal on a CDC 3300 computer.

Some serious consideration was required in deciding what part of the industry should be described. Two alternatives to be considered were macro versus micro; that is, should the model attempt to characterize the entire industry, or the behavior of a single, hypothetical firm. The decision was made that a macro-economic model would prove more useful. It appeared desirable to produce the model which would serve the greatest number of people, or the greatest portion of the industry. Since the structure and functions of firms varies so widely within the industry, to model for example the physical processing function, though interesting, would probably serve only a few firms. On the other hand, information on prices, volumes, and destinations of the catch (the distribution flow mechanism) seemed to be of far more general interest and therefore more appropriate, at least as a starting point.

Presumably, an information generating model, utilizing actual or forecast volumes or demands, could predict such things as volumes flowing to each market area, retail prices at a given market at some future point in time or the effect on the system of changes in distribution parameters. Such information could be appropriately published to the fishing, shipping, and retail marketing industries.

More detailed, specific models could be developed later, if desired, as follow-on projects. This might, in fact, be accomplished in conjunction with a continuing effort to operate and update the basic model.

One important characteristic identified in the original proposal and kept in mind throughout the development process was a degree of generality sufficient to permit application of the basic model to other seafood products, and possibly to products of other types without a major re-design. This basic distribution model can be readily adapted to simulate the distribution system in any industry with the following attributes:

1. Highly seasonal supply
2. Volume limited only by available supply
3. Sold either in fresh or frozen state
4. Highly perishable

5. Speculation is practiced in frozen inventory, in that inventories are accumulated during peak supply periods, for sale when the supply of the fresh product dwindles.

Logic of the Model

A number of assumptions are necessary as a starting point in model development. Analyzing the information collected in the earlier phases of this study led to the following assumptions.

First, the entire industry is dependent upon the amount of salmon caught; supply controls how much will be sold, and the market is capable of absorbing any volume of catch without greatly changing the price.

The price paid to fishermen is agreed upon in advance of the start of the season, and is independent of the volume caught. The price increases slightly during the season as buyers compete for fish but there is not a major change.

Catch occurs during a relatively short season, and as a function of time, can be approximated by a trapezoidal curve. This curve could be created by the user, by inputing five parameters and to vary the volume, "other things being equal," would require changing only one parameter. The season could be made longer or shorter by changing two parameters, and the entire season could be manipulated or moved through time by variation of four parameters.

Internal structure or logic of the model assumes that the price paid the fishermen and the required markup to sell in various market areas can be determined, and the demand characteristic of various markets are known. It is assumed that six relatively independent products exist, determined by species and size, and offered to six distinct market areas, each with its own costs and demand characteristics. The market price initially offered is determined by the price paid to the fishermen, plus the markup for processing and distribution associated with each market area. Demands are compared with available supply, and if total demand exceeds supply, offering prices are increased to the point where available supply will satisfy demand, with the priority for allocation among markets being profitability.

Six distinct markets were conceptualized in the model, each with its own characteristics of distribution costs and demand functions. The inventory of frozen product was considered as a seventh market, with characteristics as described above. Reference to the seventh market in the model always relates to the inventory of frozen salmon. The seven markets are listed in Table 7-1.

As the season progresses and the catch volume increases toward its peak, prices are driven down, until they reach the minimum at which the system can operate profitably. Processors place a floor under their selling prices, at which they begin freezing the excess, thus holding the effective supply equal to the demand at the price in question.

Table 7-1

Product Markets

Market Number	Description
1	Local market (minimal distribution costs)
2	Non-local, in-state markets (utilizes common carrier)
3	California markets (increased complexity of distribution)
4	Midwest region (transportation range 1,000-2,000 miles)
5	East Coast (transportation beyond 2,000 miles)
6	Export market (transportation includes air and water)
7	Frozen product inventory

In the course of this project, two similar models were developed. The first, or original model, simulated the distribution of fresh salmon only, and ran for a 40 week season. Late in the study it became possible and desirable to develop a second generation model, similar in concept to the original, but considering also the distribution of frozen salmon. This second model required a 52-week season in order to replicate an entire year of operation.

The first model assumed that frozen salmon has no effect on the distribution of the fresh product, while the second model is based on the hypothesis that fresh and frozen salmon compete on an equal basis pricewise for consumer demand. Each of these hypotheses is of value, as will be described later.

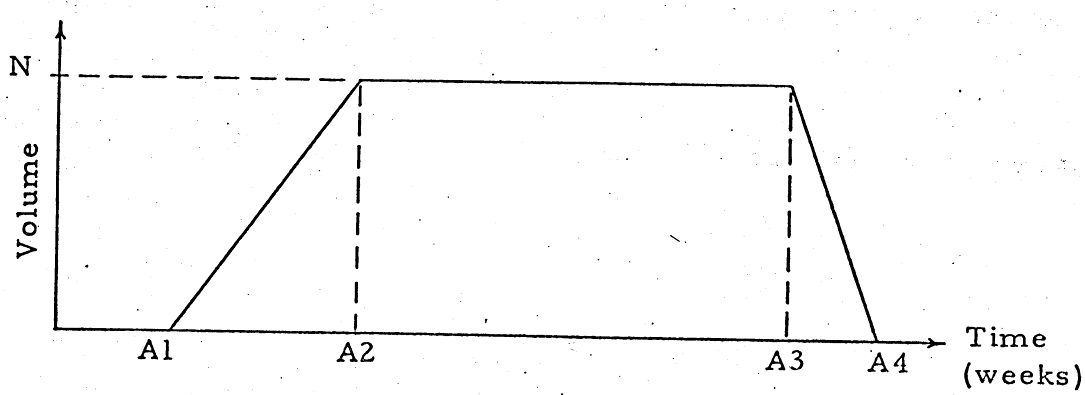
The models determine the volume of each product shipped to each market area during each week of the season, the retail price, and the value of retail sales (price x volume).

In addition, the first model is capable of computing total volume by week, by product, or by market area, the amount of frozen inventory accumulated, and the total catch for the year.

The models consider six categories of fish (chinook and coho, large, medium, and small), and the distribution system is simulated on an annual basis. Catch for any (each) category is computed from a set of five parameters: (1) the magnitude of peak (volume) weekly catch; (2) the week in which catch begins; (3) the week when volume reaches a plateau at peak volume; (4) the week in which catch begins to decline; and (5) the week in which catch again reaches zero. The curve, as shown in Figure 7-1, is assumed linear between these four points. The parameters CMAX, A1, A2, A3, A4, for each category are read in, and can be adjusted as necessary before running the model.

Figure 7-1

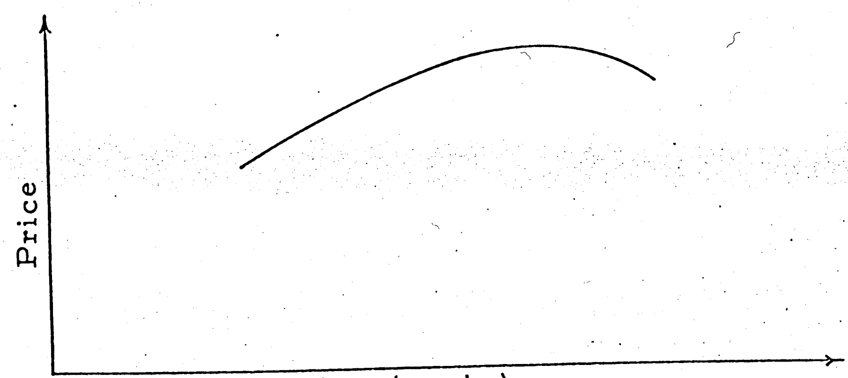
Catch Distribution Function



Next, a price (at the receiving station) for each category is computed, with the price paid to the fishermen being chiefly a function of time, varying over the season. The characteristic shape of this curve is shown in Figure 7-2.

Figure 7-2

Landed Price Function



This curve can be approximated by establishing three points; the two end points of the curve and the peak value. From these can be computed the necessary parameters, B1, B2, and B3, for use in the formula

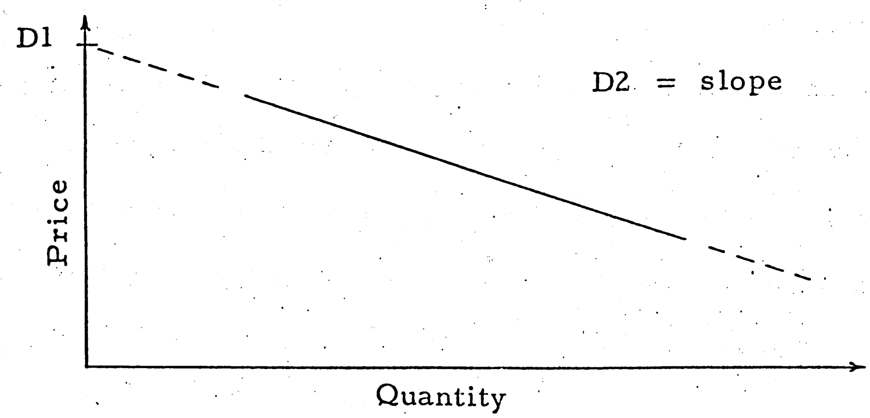
$$P = B1 + B2t - B3t^2$$

where t = time (week of the season).

Another important element is the demand for each category of fish in each of six market areas. We have assumed that demand (as a function of price) is essentially linear over the range of prices which is of interest, and therefore is fully defined by any two points, or by one point and the slope of the line as shown in Figure 7-3.

Figure 7-3

Market Demand Function



The decision model for freezing is based on the assumption that if demand at base price is less than catch, demand will be satisfied at that base price and the balance of the catch will be frozen rather than sold at a loss. If demand exceeds catch, then the price will be forced upward until demand equals catch. Interactive fresh and frozen product markets are introduced in the second model by supplementing supply with frozen salmon at some point sufficiently above base price to cover freezing and storage costs until frozen inventories are depleted.

In summary, the market place portion of the model requires parameters for thirty-six demand curves, covering six categories of salmon and six market areas. The validity of the model will be examined in Chapter VIII by testing the output of the model against historical data.

Appendices D-1 and D-2 to this chapter contain logic diagrams of the first model in flow chart form, and a listing of the entire FORTRAN program is provided in Appendix D-3. Appendices D-5 and D-6 pertain to the second model, with a block diagram and computer program respectively.

Parameters

For ease in experimentation, 127 parameter values are read by the program from data cards. These vector parameters are identified in Table 7-3 and a sample set is shown in Appendix E-1 to Volume II. Each experiment to be run would merely require a new set of data cards reflecting the revised parameter values; Chapter VIII presents the rationale for values selected in model validation.

Parameters CMAX, A1, A2, A3, and A4 describe the time distribution of catch and can be determined by analysis of corresponding catch data.

B1, B2, and B3 generate the time distribution of landed prices paid to fishermen; this distribution is typically of the form shown in Figure 7-2, and the relevant range of values can be observed in historical data sources. The elements of D1 and D2 describe, in slope-intercept form, demand values for salmon in the various markets. Determination of price elasticities is beyond the scope of this study; the values estimated and used for model validation can be seen by observing lines eight to twelve and sixteen to twenty-one of Appendix E-1 to Volume II. For experimentation, values would either be estimated, or imputed from careful analysis of price-quantity relationships in the selected market areas. Parameter E is intended to reflect the total channel markup for each market and is assumed to be constant for fresh product categories. Total channel markup includes handling, processing, storing, transporting, profit, and all other identifiable distribution costs. Values for this parameter would be determined by analysis of the above named channel cost components.

While the use of demand schedules as parameters in the simulation are analytically more interesting, these are obviously difficult to derive. As one alternative, it is possible to make a relatively minor revison of the model to substitute single point estimates of price-quantity relationships, such as the data which might be forthcoming from market surveys. In this way the model would operate with more realistic information requirements. The operating process of market allocation would behave as follows:

1. If supply equals the total of quantities demanded, the model could merely distribute according to market requirements.

2. If supply were less than total demand, the model could then distribute product according to some predetermined decision-rule. One rule might be to maximize total revenue minus cost; in which case the model would search among markets for the highest prices first, compare costs and select first the one with the highest net difference, assigning in turn quantities to markets with the next highest returns until the supply is consumed. Constraints such as minimal quantities required for markets regardless of prices could also be incorporated.

3. In the case where supply might exceed demand, the model would follow the identical procedure above. However the excess supply would have to be disposed of as either fresh or frozen product offered at a lower price, through the device of a hypothetical demand schedule which might create interactions with the previous allocation procedure, shipped to other markets not identified in the model, or transformed into other product forms where they do not compete directly with the allocated product.

Output Option

Several output options have been built into the first model in order to allow the user to obtain information in sufficient detail, but without at the same time burdening him with unnecessary paper or more information than he can use.

The user specifies which output options he desires by preparation of a header card as the first item of input data. The header card is simply a row of seven digits, either 1 or 0, indicating a yes or no answer to seven questions, as shown in Table 7-2. No output options are provided in the second model, however a header card (blank if desired) must be used. This was done to make possible the use of the same data deck with either model.

Table 7-2

Output Options
Output Header (1 = Yes; 0 = No)

Card Column Number	Output Option
1	Are total volumes by species desired?
2	Are total volumes by market area desired?
3	Are totals by week desired?
4	Are weekly totals of each variety to each market desired?

Table 7-2 Continued

Card Column Number	Output Option
5	Is total frozen inventory accumulation desired?
6	Is frozen inventory desired at the end of each week?
7	Is a printout of volumes, retail prices and dollar value of retail sales, by species by week, desired for each market area?

Input Data

Following the output option header card, the data used by the model to generate catch volumes, prices, and demands must be provided. This requires 21 lines (cards) of data, as shown in Table 7-3. A sample of a complete data file is provided in Appendix D-4 of this chapter.

Table 7-3
Data File

Data Card	Parameter Name	Format	Information Content
1	CMAX	6I5	Max catch (weekly) for category
2	A1	"	Time (wk. no.) catch leaves zero
3	A2	"	Time (wk. no.) catch reaches CMAX
4	A3	"	Time (wk. no.) catch leaves CMAX
5	A4	"	Time (wk. no.) catch reaches zero
6	B1	6F5.2	Initial landing price per lb.
7-12	D1	"	Zero demand price per lb.
13	B2	6F10.5	Price increase, F(t)
14	B3	"	Change in price trend, $f(t^2)$
15-20	D2	"	Slope of demand curve, F (price)
21	E	7F5.2	Value added, for market area (price markup, per lb.)

The Second Model

The original model assumes no competition between fresh and frozen product, and thus is unable to show the behavior of the system when these products interact. This assumption is fairly accurate since, particularly in the domestic market, fresh salmon is able to undersell frozen during the catching season, and frozen does not enter the market until shortages of fresh cause prices to rise sufficiently to cover the costs of freezing and holding frozen inventory. However, in situations such as the European market, the lower shipping costs of delivering frozen salmon by ship rather than air permits frozen to compete freely with fresh, and perhaps even drive fresh salmon from the market. This makes development of the second model highly desirable.

The second model assumes, in contrast to the first, that fresh and frozen salmon compete for markets on an equal basis; which form will be sold in a given market at any time depends solely upon which can be delivered at lower cost.

The initial price for fresh fish was determined by the price paid to fishermen at landing time, and prices moved upward from this level depending upon normal markups and demand pressure. A similar procedure is used in the model for frozen prices. The initial price is based on the average cost of the frozen inventory, which is the price paid to fishermen (or the competitive price, if higher) plus the cost of freezing.

The price at which fresh salmon is retailed on any market is equal to the price of fish at point of origin, plus a markup peculiar to the market area. This markup includes shipping cost, handling, profit, etc. In the same manner, in the second model, frozen salmon is offered at average cost (at origin) plus a markup peculiar to the market. Since differing transportation and handling costs are possible with frozen, markup may be different, particularly in the case of export of fresh by air and frozen by sea. For this reason, it may be possible for fresh to drive frozen from some markets and not from others.

In the model, each market area compares prices of fresh and frozen, and selects the least costly, demand is then determined on a basis of minimum price available, and demands for both fresh and frozen are totaled for all areas.

In order not to deplete the inventory of frozen product before the next season, frozen sales are not permitted to exceed an amount equal to the inventory on-hand divided by the number of weeks left before the beginning of the next catching season. If the demand for frozen exceeds this limit, the price of frozen is raised, and markets again are surveyed to determine which choice is cheaper, and new demands determined.

Since part of the cost of frozen inventory is a holding or storage cost, the total cost of frozen inventory must be raised weekly by the weekly holding cost per pound, multiplied by the amount of inventory on hand.

Summary

Along with the primary objective of value as a predictive device it was the intent of the model builder to make the model as compatible with generally available information as possible in order to minimize the compiling effort required prior to running. Imperfect knowledge of total user requirements and unknown trends in future data forms may have limited the achievement of these dual objectives, however if the model proves useful to a degree which makes the preparation of input data a large and costly clerical task, a new generation of model, tailored to user information sources could be developed. The output option might also require revision after some operating experience is gained. Redesign of the model, if desired, would be based on feedback from users after sufficient experience with the original model to permit evaluation of its strengths and shortcomings, and clearer definition of the function which the model will perform.

Chapter VIII

RUNNING THE MODEL

This chapter describes validation of the fresh salmon distribution model and provides users with an understanding of how to use it for experimentation. Examples of input parameters, and how these parameters may be modified to simulate various hypothetical or real world situations are shown, as well as results of several runs with a series of parameters. While the first model is emphasized, the procedures are generally applicable to both.

The model has been written in FORTRAN, and designed primarily for batch processing, using punched cards; however, it has also been run from a teletype terminal, using the Oregon State University time-sharing system. When extensive output listings are desired, use of the teletype for output is not recommended, due to the slow teletype print speed and the narrow page width. It was possible with the Oregon State system to run the model from a teletype terminal and transfer the output to the line printer. When available, this method provides speed, efficiency, and flexibility.

Running the model requires two types of preparation: (1) Selection of the appropriate or desired output option; and (2) Providing appropriate input parameters. Decriptions of the output option and header card have been included in Chapter VII and require no additional explanation. Input parameters, on the other hand, require further explanation.

Input parameters fall into four categories with regard to their function in the model. Functional classifications are: (1) Catch volume parameters; (2) Landing price parameters; (3) Demand parameters; and (4) Markup parameters. Each of these categories will be explained in detail below. Table 8-1 shows the parameter format contained in various cards of input data, in the order of their occurrence.

Catch parameters are contained in the first five cards of the data deck, with peak weekly volumes on the first card, and time parameters on the next four cards. There are six elements of data on each of these cards, corresponding to the six categories of salmon considered by the model.

Parameters for prices paid to fishermen are placed on cards six, thirteen, and fourteen, with card six containing the most important of these parameters, the prices at the start of the season. Card thirteen shows the average weekly price increase during the season, and card fourteen shows the weekly decrease in rate of price rise over the season. If one price over the entire season is desired, these parameters may be set equal to zero, or blank cards may be inserted.

Demand parameters are contained in two blocks of six cards each, cards 7-12 and 15-20. The first block of six cards reflects D1, the hypothetical price (per pound) at which demand would be zero. This is the point at which the extended demand curve would intersect the vertical (price) axis. The second block of parameters describes the slope of the demand curve, the increase in volume associated with decrease in price.

In each of the two blocks of data described, each of the six cards contain parameters for one of the six market areas.

The final card of data contains the markup or value added in price per pound between landing of the fish and the particular retail market. There are seven parameters on this card, with the seventh being the value added in the freezing process. This seventh parameter is used in determining the value or cost of frozen inventory.

Table 8-1

Input Data Specifications

Card #	Parameter	Format Spec.
1	CMAX	6I5
2	A1	"
3	A2	"
4	A3	"
5	A4	"
6	B1	6F5.2
7-12	D1	"
13	B2	6F10.5
14	B3	"
15-20	D2	"
21	E	7F5.2

In order to test the model's operation and validity, a file of test data must be used. For preliminary runs absolute accuracy was not essential, and a very minimal effort was devoted to compilation of data. On the other hand, a fair approximation of the real world was needed, in order to provide both a realistic test of the model and to determine whether the model would be useful if only approximate data were available. The preparation of the initial run data is described below. The data set used in the initial run is listed in Appendix E-1 of this chapter.

Real World Data

Landed prices of large, medium, and small coho of 82, 65, and 53 cents at the start of the season were used for the initial runs, and April 1 was considered to be the approximate beginning of the salmon fishing season. For the simulation, the season was assumed to start, volume-wise, in the second week for small and medium coho, and the third week for large.

Markup, the parameter E, for the local market was set at 44 cents based on cost and profit data derived from interviews, and markup for other markets was increased proportionally to distance. From available data, Chicago prices appear typically to be 23-24 cents above Seattle prices. Thus, markup for Chicago is put at 68 cents, and New York the same.

Chinooks appear to typically run about 35 percent higher in price than coho. Accordingly, chinook prices were pegged at about 4/3 coho prices, lacking readily available coho data, for the start of the season.

The total U.S. chinook catch in 1965 was 27,086 K lbs, with the typical chinook season running from April through October, approximately 27 weeks. This makes the average weekly catch around one million pounds (1,000 K lb). The peak catch is probably somewhat above this (perhaps 1,500 K lb), which must be distributed among large, medium, and small. The exact shape of the curve is not defined from the above, but is probably less critical than correct total volume. Arbitrarily, peaks were set at 400 K lb for small, 500 K for medium, and 600 K for large chinook. Assuming the season is later for larger fish, this trend was injected into dates of catch curves.

Appraisal of 1965 data indicates that the U.S. coho catch was 32,886 K lb, and the typical coho seasons run from May to September, or perhaps 20 weeks, for an average weekly catch of 1,600 K lbs. Lacking more precise information one might arbitrarily say that the peak catch was 2,100 K lb, evenly divided among large, medium, and small, or that the peak values of each were 700 K lbs.

Results of the initial run, using the above approximations as test data, are shown in Tables 8-2 and 8-3.

Table 8-2

Production Volume from Initial Run (1000 pounds)

Species	Frozen	Fresh	Total Catch
Coho	3,269	20,418	23,687
Chinook	23,991	0	23,991
Total	27,260	20,418	47,678

Table 8-3

Fresh Salmon Distribution from Initial Run

Market	1000 Pounds
1. Local	3,966
2. In State	8,492
3. West Coast	1,518
4. Midwest	2,262
5. East	4,180
6. Export	0
Total	20,418

Using 1966 data as a base year for model comparison, the totals shown in Table 8-4 were calculated.

Table 8-4

Actual Domestic Consumption and Export for 1966 (1000 pounds)

Product Type	U.S. Production	Imports	U.S. Consumption	Export
Fresh	26,046	1,769	25,385	2,430
Frozen	15,703	6,532	4,815	17,420
Totals		50,050		50,050

Comparing Table 8-4 with 8-2 shows that total volumes achieved in the initial run were not in great disagreement with those of the actual 1966 catch. The model showed that most of the coho catch was sold fresh and that all chinook was frozen. While this is not precisely correct, it appears sufficiently close to the real situation to be of no concern at this time, and no doubt can be corrected by closer examination and correction of input parameters. A more interesting consideration, at least initially, was the fact that the model indicated no fresh export, although some fresh salmon is actually exported; this suggested adjustment of input parameters.

As an example of how the model may be made to simulate different real world situations consider the following: On the initial run, fresh salmon exports in the model were zero. However, actual data indicate that some export does occur. This suggests that either the foreign demand used in the model or the costs of shipment overseas is unrealistic. Let us assume the latter to be the case, since neither is known exactly. In the second run the assumed export markup for fresh salmon was lowered from ninety-four to eighty-nine cents. Successive runs were made at eighty-four and seventy-nine cents. The results of these runs are shown in Appendix E-2 and summarized in Table 8-5 below.

Table 8-5

Summary of Effects of Export Markup on Distribution

Market \ Export Markup	Distribution Volume (1000 Pounds) .94	.89	.84	.79
1	3,966	3,966	3,865	3,799
2	8,492	8,492	8,406	8,348
3	1,518	1,518	1,458	1,418
4	2,267	2,267	2,247	2,237
5	4,180	4,180	4,150	4,130
6	0	26	149	494
Total Fresh	20,418	20,444	20,275	20,426
Frozen Coho	3,269	3,243	3,412	3,261

As expected, foreign demand was not price sensitive and export volume was still too low. A change in demand curves was thus indicated. It is possible to increase demand at a given price by: (1) increasing maximum price, thus shifting the demand curve; or (2) decreasing the slope of the demand curve (dP/dQ).

Additional runs were made with the export markup held constant at eighty-four cents and increasing the "zero demand" price-parameters by an additional five cents per pound on each successive run. The results of these runs are contained in Appendix E-3 and summarized in Table 8-6 below.

Table 8-6

Distribution Volumes for Varying Export Demand Curves

Market	Volume in 1000 Pounds			
	Initial Run	Run 2	Run 3	Run 4
1	3,865	3,551	3,324	3,087
2	8,406	8,140	7,951	7,749
3	1,458	1,293	1,189	1,102
4	2,247	2,200	2,163	2,100
5	4,150	4,064	4,003	3,893
6	149	918	1,844	2,885
Total Fresh	20,275	20,166	20,474	20,816
Frozen Coho	3,412	3,521	3,213	2,871

As may be seen, the model responded with increasing exports of fresh salmon as the foreign demand was increased. Since both demand curves and markups for various markets can be varied independently, it is possible to replicate with reasonable accuracy any real world distribution situation.

Model number two, which included the interaction of the fresh and frozen product markets, performed as expected in the test runs. After a sufficient time lag to produce and ship the frozen product to the more distant markets, the lower transportation costs allowed it to compete effectively against the fresh product and gain a market share. This tended to force the market price of the fresh product downward in order to compete. As time continued through the year the frozen product continued to encroach on the fresh markets and at the end of the fishing season, when fresh fish were no longer available, the frozen inventories supplied the entire worldwide demand.

Only sufficient summary data on the fresh model have been included in this chapter to demonstrate that the model does perform in the desired manner. The output options provide for extensive amounts of printout on quantities and values with considerable detail; however, without extensive refinement of the data inputs to the model, these figures are of little value as quantitative measures.

Running the Second Model

Since the second model is a variation of the first, the primary change being the introduction of interacting fresh and frozen product markets, it was considered desirable that the same data deck be compatible with either model. The second therefore requires only the addition of one data card to the original data deck. This card contains the markup associated with sale of frozen salmon in each of the six market areas. Following this on the same card is the weekly cost of holding frozen inventory.

The second model does not include the variety of output options contained in the first model. For this reason no header card information is required. In order to make the decks completely interchangeable however, provision has been made for the second model to allow the header card to be present, but to ignore it. If a deck without the header card is to be used with the second model, a blank card should be inserted in its place so that the total card count remains unchanged.

It must be remembered that a final card is required for the second model which need not be present in the distribution model for fresh product only. Since this card is the last one in the data deck it may be included in both model's data decks without special provision. In summary, a single data deck can be used interchangeably with either model.

Summary

Two computer models describing the distribution of fresh and frozen salmon are now complete and ready to apply to this system or others with similar characteristics, as described in Chapter VII. The model selected for use will be determined by the user's interest in the system, either as the interaction of two competing products, or as a single fresh product with a separate slightly transformed inventory. The more than one hundred parameters that can easily be varied lead to an extensive array of experimental situations that could be performed in order to illuminate the characteristics of the system and predict the results of variations in exogenous or endogenous factors. Chapter IX will summarize the results to this point and outline several recommendations for further use of the simulation models.

Chapter IX

SUMMARY AND CONCLUSIONS

The primary objectives of this study were: to describe the distribution system of fresh and frozen salmon landed in the Pacific Northwest, investigate costs and returns in this industry, and develop a computer simulation model which would provide insight into the dynamics of the system and be useful as a predictive device.

Most of the emphasis during the study was placed on those activities which occur between the arrival of the fish at the receiving station, where the catch is first transferred to shore, and the final delivery of an edible product to the consumer. The product forms were limited to fresh and frozen coho and chinook salmon, and although the western regions of Canada produce considerable quantities of these products, primary emphasis was placed upon United States production. The distribution channel was identified as consisting of receiving stations, processors, wholesalers, brokers, and an assortment of retail outlets including such forms as restaurants. Two principal data sources were used in the study: secondary data gleaned from various government and industry sources, and primary data from a direct survey by personal interview with selected organizations representing all of the functions in the distribution channel.

Distribution Channels

Production methods were found to be basically two types: trolling from fishing boats, and gill-netting in selected areas. Production quantities appear to be cyclical and rather erratic, however the West Coast season begins about April first in the southern regions and slowly moves northward culminating with the gill-netting seasons as the fish move into the rivers towards the spawning grounds. British Columbia and Alaska produce almost three-fourths of the total West Coast production of coho and chinook, with British Columbia providing almost one-half of the total.

Production of fresh frozen salmon has followed a fairly stable trend, with little growth or decline, while the demand for salmon generally has been increasing. A shift in emphasis was observed toward more fresh and frozen product forms; in Canada, the change has been from fresh to more frozen production while in the United States fresh salmon has been increasing relative to total salmon production.

Worldwide patterns indicate a shift away from canned forms toward fresh or frozen products. Consumption of salmon is concentrated in six countries and the active fresh and frozen market seems even narrower than this. Export trends indicate increasing importance of foreign markets for fresh and frozen salmon produced in the United States.

Our research demonstrates that the market for fresh and frozen salmon is not confined to any one region but involves significant movements both to the eastern United States and overseas.

The market structure for salmon distribution is not clearly defined by the data in this study. It appears to be dominated by a group of fairly large processing firms with established positions in the markets which control supplies in excess of their own production capabilities. These firms sell to even more concentrated buyers in the American retail food distribution channels. Only the presence of large overseas markets acts in countervalence to the exercise of significant market power by buyers. That part of the channel which extends from the processor to the consuming public operates in a reasonably competitive fashion, however the oligopsonistic nature of the industry with respect to the fishing effort may give rise to certain imperfections. Further inquiry is recommended in the area of market structure analysis of the industry.

The physical distribution part of the salmon channel process constitutes a large share of the activities involved in distribution. The forms of transport which can be used and the markets served are determined by the product. The use of motor carriers has shown an increasing trend since 1961 relative to other forms of transport; most of this increase has been by private truck and carriers exempt from regulation under the agricultural exemption of The Motor Carrier Act of 1935. A recent trend observed was the increased use of air freight carriers for fresh salmon.

A major distribution problem observed in our study was the multiple handling of fish which takes place from receiver to retailer, partly due to the need for sorting and grading. Multiple handling can only be reduced by considering the distribution system as a whole, rather than as fragmented units, so that fish are sorted and boxed when caught and not rehandled. While salmon distribution in the Northwest displays the characteristics of a system, there is no visible effort at this time to manage the process as an integrated unit.

Costs and Rates of Return

In our investigation of costs and rates of return, a trend was observed of relatively higher rates of return on fresh and frozen salmon compared to other fishery products. However, overall returns of the industry including all species handled appear to be low compared to other industries.

Possible reasons for overall low rates of return were: inefficient processing methods, lack of marketing orientation, and inadequate cost accounting information.

From the observations of this study, managers of most fishery processing companies did not have such information available as budgets, standards, and contribution margins, which are needed for making decisions regarding various alternative uses for the product. The result seems to be generally one of inefficient management maintaining a labor intensive industry which has not aggressively reduced costs or improved rates of return in the industry. A cost model using standards was suggested as a way to improve information for decision-making.

A separate study is recommended to develop better information systems for the salmon industry and to distribute this to the industry in various ways.

Simulation Model

Two separate deterministic computer simulation models were developed to describe the distribution system. The first model is based on the assumption that only fresh salmon is offered to the final consumer, and excess supply above this level is frozen. Model number two assumes the interaction of these two product forms, actually competing for market share. Except for this basic conceptional difference the two models are identical and utilize a common data base. They operate on an annual cycle with the volume of landed salmon generated in the model as a function of time and prices paid to the fisherman following the typical seasonal variation noted in the study. Six discrete market areas are simulated, each with its own distribution costs and price-demand relationships, and six distinct products are traced through the complete distribution system. These products are conceived to be three size categories of each of the two species of fish under study. In the model which includes the interaction of frozen salmon in the marketplace, product variety is increased by the addition of the frozen form. The model is completely dynamic and constructed in general form so that more than one hundred parameters such as catch distributions, landed prices, distribution costs, market demands, etc., can be easily changed for experimentation. The model has been constructed and shown to simulate real world conditions; it is now ready for use as a device to further study the system.

The effort to prove or disprove the assumptions contained in the model demonstrated the paucity of interrelated data on the various markets, prices and products. A sufficient number of unknowns existed in any available data to make duplication of known information with the model a relatively easy task simply by variation of selected parameters. Stated differently, the model is capable of duplicating the real world, insofar as we have simultaneous information on the various parts of the distribution system. The model demonstrates firm cause-effect relationships not unlike those observed in the industry, and provides a means of inferring various unknown results from known or assumed situations. Since at present even gross estimation of these quantities is difficult to obtain, it appears that the model is capable of providing the industry with information which is not presently generally available. Better knowledge of this type of information would undoubtedly be a valuable aid to decision making, particularly in the case of small operators who do not have elaborate systems of their own. These conclusions lead to several recommendations for further development and use of the simulation model:

1. Refinement of parameter values is necessary so that absolute confidence is held in the values generated when the model is run. Price-quantity relationships need to be determined for the various market areas if distribution patterns are to be considered seriously. Channel markup costs must be isolated for individual markets, and more detailed landed catch data developed. Accurate knowledge of values such as these will allow meaningful experiments to be performed relating to the distribution system.

2. When correct parameter values have been determined, many useful experiments can be designed to predict system performance under varying conditions. Effects on distribution of such things as shifts in demand, changes in landed prices, changes in processing technology, or improved transportation methods could be predicted. The model could be used to predict the impact of various possible future events, such as major changes in yield, or revisions of governmental regulations or policies.

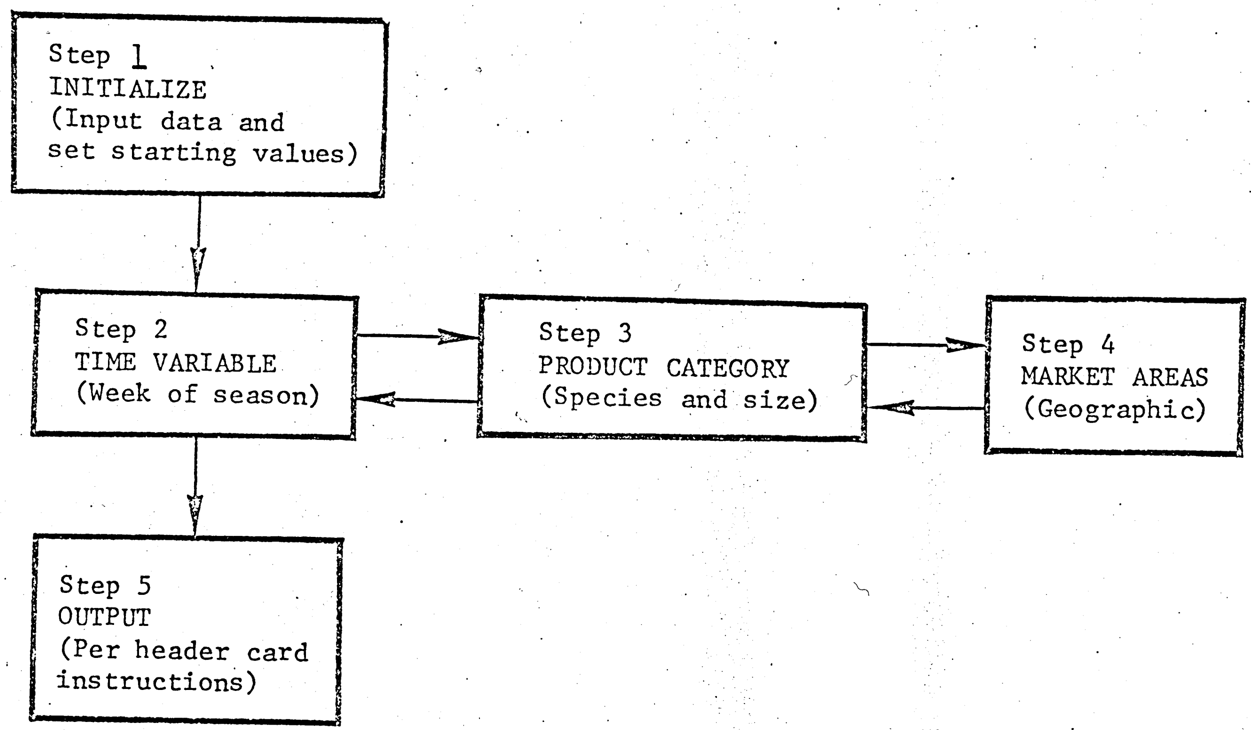
3. The model should be made available to students, firms, and research organizations interested in the economics of the salmon industry. The model could be used in conjunction with government or industry publications to forecast future trends, and to extend available statistical and economic information to the industry.

4. A period of use will no doubt point out weaknesses or desirable changes in the model which would lead to refinement and redesign. It may prove desirable to reduce the determinism of the model and introduce stochastic processes via Monte Carlo techniques. Feedback from users will be an essential factor in the process of improving the model as a predictive tool.

This study has accumulated considerable basic data on the salmon industry of the Northwest, and should be useful to other related studies regarding this important industry.

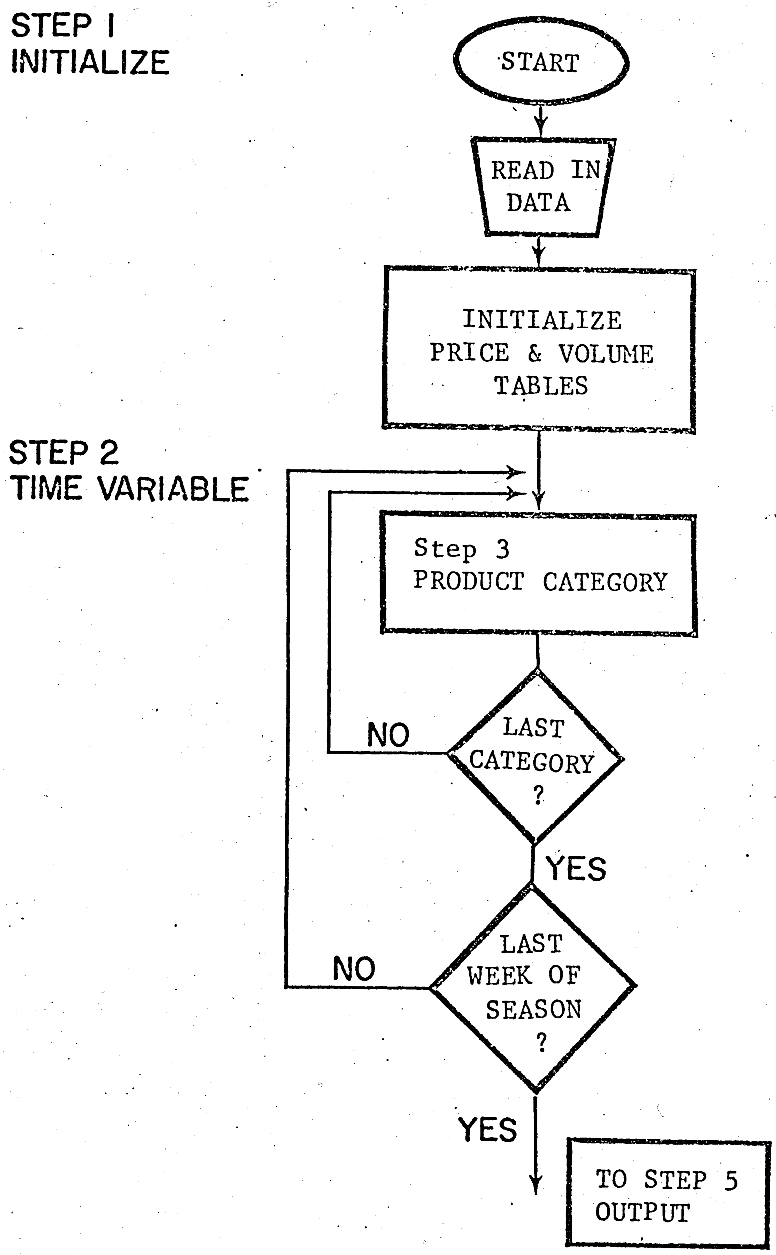
APPENDIX
(Volume II)

APPENDIX D-1
GROSS BLOCK DIAGRAM

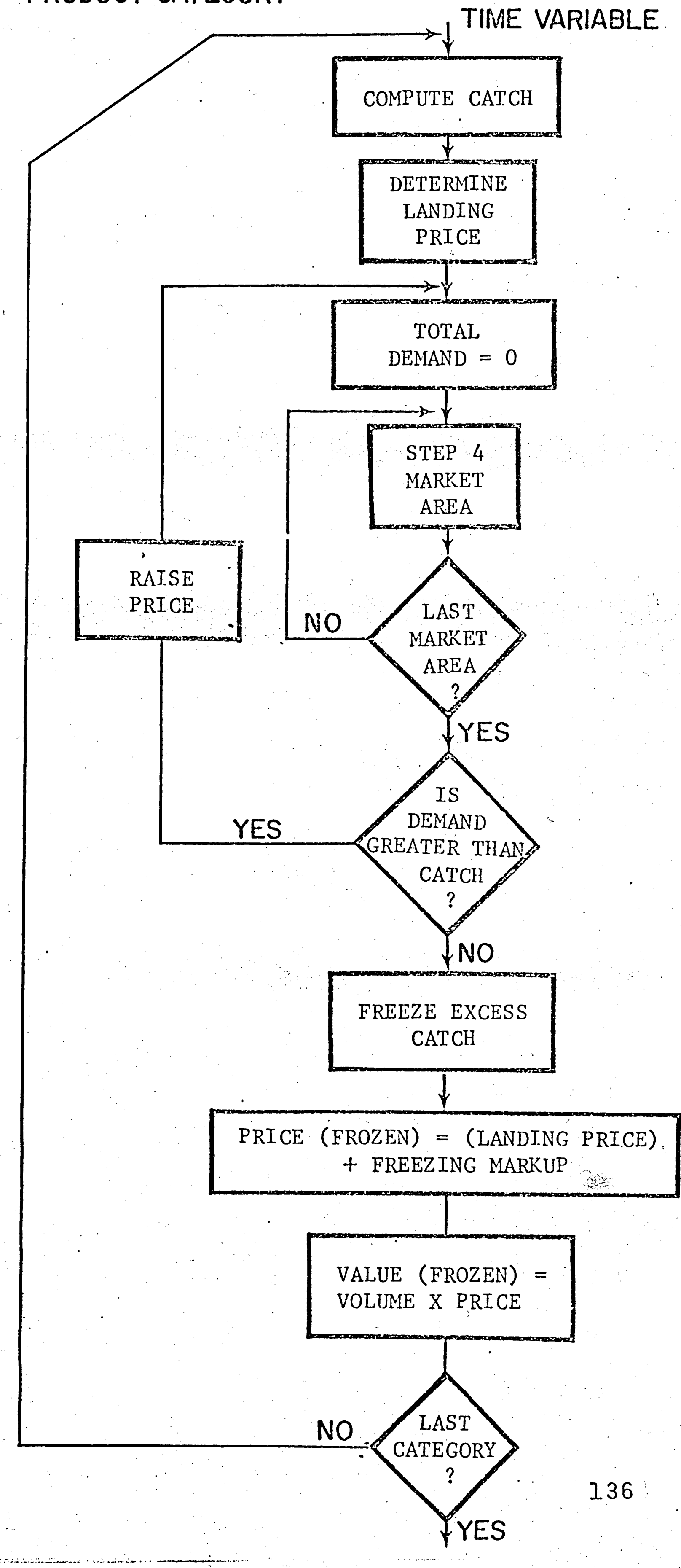


APPENDIX D-2

DETAILED BLOCK DIAGRAM

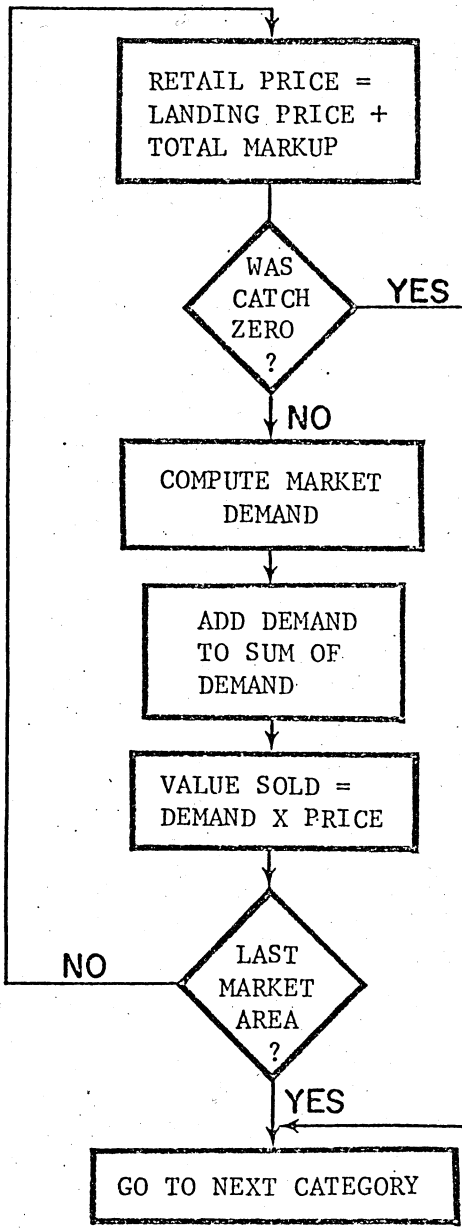


STEP 3
PRODUCT CATEGORY



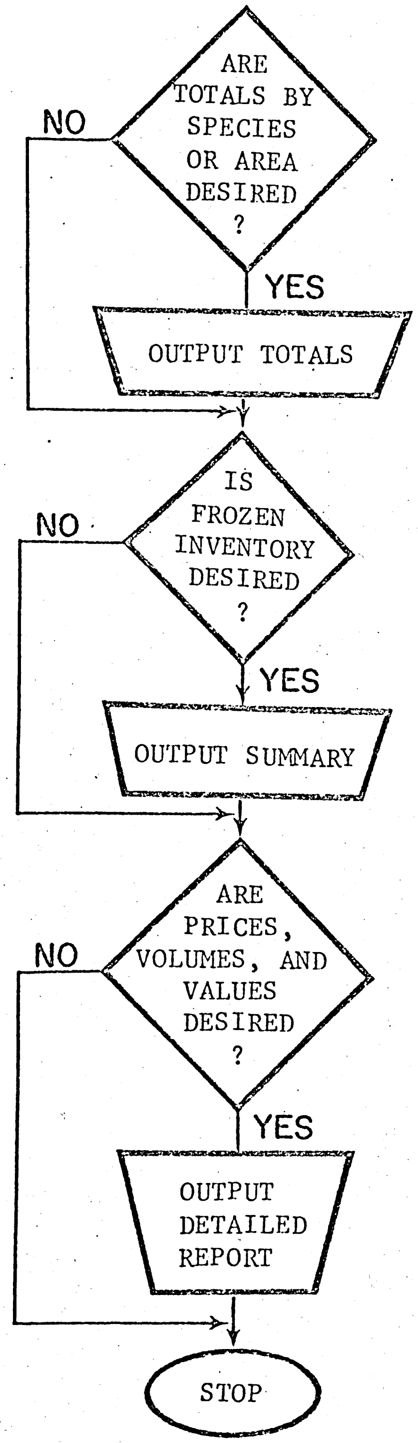
APPENDIX D-2 (Cont.)

STEP 4
MARKET AREA



APPENDIX D-2 (Cont.)

STEP 5
OUTPUT



Appendix D-3

Computer Program (First Model)

```
      PROGRAM FISHSIM
C GLOSSARY
C         A1(L)      WEEK CATCH OF TYPE L BEGINS
C         A2(L)      WEEK CATCH OF TYPE L LEVELS OFF
C         A3(L)      WEEK CATCH OF TYPE L BEGINS TO DECLINE
C         A4(L)      WEEK CATCH OF TYPE L REACHES ZERO
C         B1         LANDING PRICE, START OF SEASON
C         B2         PRICE TREND, OVER TIME, DP/DT
C         B3         CHANGE IN PRICE TREND, OVER TIME
C         C          MAXIMUM CATCH
C         CMAX       MAX CATCH OF SEASON FOR A CATEGORY
C         D1         PRICE AT WHICH DEMAND IS ZERO
C         D2         SLOPE OF DEMAND CURVE
C         DM         DEMAND
C         E(M)       TOTAL PRICE MARKUP,MARKET AREA (M)
C         FRZ        FROZEN
C         I          WEEK NUMBER
C         L          CATEGORY NUMBER
C         M          AREA NUMBER
C         N          CATCH
C         PR         PRICE(TWO DIMENSION)
C         PRI        PRICE (THREE DIMENSIONS)
C         SLS        SALES
C         VAL        VALUE (PRICE TIMES VOLUME)
C         IVOL       VOLUME DEMANDED
C         MT         SUM OF DEMANDS BY CATEGORY
C CATEGORIES,L, ARE AS FOLLOWS9
C         1          SMALL CHINOOK
C         2          MEDIUM CHINOOK
C         3          LARGE CHINOOK
C         4          SMALL COHO
C         5          MEDIUM COHO
C         6          LARGE COHO
C MARKET AREAS
C         1          LOCAL
C         2          IN STATE (OTHER THAN LOCAL)
C         3          WEST COAST (OTHER STATES)
C         4          MID WEST
C         5          EAST COAST
C         6          EXPORT
C         7          FROZEN
C PRICE MATRIX (I,L,M), VALUE MATRIX (I,L,M) AND VOLUME
      DIMENSION PRI (40,6,7), VAL(40,6,7), IVOL(40,6,7)
      DIMENSION A1(6),A2(6),A3(6),A4(6)
      DIMENSION B1(6),B2(6),B3(6)
      DIMENSION CMAX(6)
      DIMENSION E(7)
```

```
      DIMENSION PR(40,6)
      DIMENSION D1(6,6),D2(6,6)
      DIMENSION LIST (10)
      DIMENSION ISUM(6)
      INTEGER CMAX,A1,A2,A3,A4
C READ IN DATA
C READ IN DATA AS TO WHAT OUTPUT LISTINGS ARE DESIRED.
C HEADER CARD DATA IS A SERIES OF 1'S AND 0'S, INDICATING
C A YES OR NO DECISION ON EACH OF
C SEVERAL OUTPUT OPTIONS. YES=1) NO=0.
      READ 99,LIST
   99 FORMAT(10I1)
C READ IN ARRAYS CMAX,A1,A2,A3,A4, SIX ELEMENTS IN EACH
C IN I5 FORMAT, SIX ELEMENTS PER DATA CARD. (I.L. EACH
C ARRAY ON ONE CARD.)
      READ 50,CMAX,A1,A2,A3,A4
   50 FORMAT(6I5)
   51 FORMAT(6F5.2)
   52 FORMAT(6F10.5)
   53 FORMAT  (7F5.2)
C READ IN ARRAYS B1,D1, SIX ELEMENTS EACH IN F5.2 FORMAT
C ONE ARRAY PER CARD.
      READ 51,B1,D1
C READ IN ARRAYS B2,B3,D2, SIX ELEMENTS IN EACH, ONE ARRAY
C PER CARD IN F10.5 FORMAT
      READ 52,B2,B3,D2
      READ 53,E
C INITIALIZE MATRICES
      DO 40 I=1,40
      DO 40 L=1,6
      DO 40 M=1,7
      PRI(I,L,M)=0
      VAL(I,L,M)=0
   40 IVOL(I,L,M)=0
C OUTER LOOP (WEEKS)
      DO 10 I=1,40
C MIDDLE LOOP (CATEGORY) I.E. SPECIES AND SIZE).
      DO 20 L=1,6
C CALL CATCH WITH MAX (PEAK) CATCH FOR CATEGORY,WEEK
C NUMBER, AND CATCH CURVE POINTS
      CALL CATCH (CMAX(L),I, A1(L),A2(L),A3(L),A4(L),N)
C CALL PRICE,WITH PRICE PARAMETERS AND WEEK NUMBER) COMPUTE
C MINIMUM PRICE.
      CALL PRICE (B1(L),B2(L),B3(L), I,PR(I,L))
C INSIDE LOOP (MARKET AREA)
   21 MT=0
      DO 30 M=1,6
C RETAIL PRICE = LANDING PRICE + AREA MARKUP
      PRI(I,L,M) = PR(I,L) + E(M)
C IF THE CATCH WAS ZERO,SKIP OVER DEMAND COMPUTATIONS AND
C VALUE COMPUTATIONS.
```

```
      IF(N .EQ. 0) GO TO 33
C COMPUTE DEMAND FOR EACH AREA,M, AT PRICE PRI (I,L,M)
      CALL DEMAND (D1(L,M),D2(L,M),PRI(I,L,M),ID)
      IVOL (I,L,M) = ID
C SUM DEMANDS
      MT=MT+ID
C VALUE OF SALMON SOLD ON ANY MARKET IS PRODUCT OF PRICE
C AND VOLUME.
   30 VAL (I,L,M) = ID * PRI(I,L,M)
C IF DEMAND (SUM OF ALL AREAS) EXCEEDS AVAILABLE SUPPLY
C INCREASE PRICE. OTHERWISE,FILL DEMAND AT MINIMUM
C PRICE, AND FREEZE BALANCE TO AWAIT FAVORABLE PRICES.
      IF(MT .GT. N) GO TO 31
C FROZEN BECOMES THE SEVENTH MARKET FOR FRESH SALMON.
      IVOL(I,L,7)=N-MT
   33 PRI(I,L,7)=PR(I,L) + E(7)
      VAL(I,L,7)=IVOL(I,L,7)*PRI(I,L,7)
      GO TO 32
   31 PR(I,L)=PR(I,L)+.02
      GO TO 21
   32 CONTINUE
   20 CONTINUE
   10 CONTINUE
C PRINT OUT VARIOUS OUTPUT LISTINGS IN ACCORDANCE WITH
C READER CARD INSTRUCTIONS.
C IF EITHER TOTAL VOLUMES BY SPECIES OR TOTAL VOLUMES BY
C MARKET AREA ARE DESIRED, PRINT HEADINGS) IF NOT,
C SKIP THIS PORTION.
  101 FORMAT(1H1,'    TOTALS SHIPPED TO EACH MARKET AREA',/
     1 ' MARKET AREA',10X,'TOTAL CHINOOK',5X,'TOTAL COHO')
  102 FORMAT (1H0,I5,12X,I10,5X,I10)
  103 FORMAT (1H0,4X,'TOTALS FOR YR',I10,5X,I10)
  104 FORMAT(1H1,' WEEK       ',10X,'TOTAL CHINOOK',5X,'TOTAL COHO')
  105 FORMAT (1H0,4X,'TOTAL FRESH  ',I10,5X,I10)
      IF (LIST(1)+LIST(2) .EQ. 0) GO TO 108
      MCOHO=MCHIN=0
      PRINT 101
      DO 107 M=1,7
      JVOL=0
      DO 106 L-1,6
      DO 106 I-1,40
      JVOL=JVOL+IVOL (I,L,M)
      IF (L.EQ.3)JCOHO=JVOL
  106 IF (L.EQ.6)JCHIN=JVOL-JCOHO
      MCOHO=MCOHO+JCOHO
      MCHIN=MCHIN+JCHIN
      IF ( LIST(2) .EQ. 0) GO TO 107
      PRINT 102, M,JCOHO,JCHIN
      IF(M .EQ. 6) PRINT 105,MCOHO,MCHIN
  107 CONTINUE
      IF (LIST(1).EQ. 0) GO TO 108
      PRINT 103,MCOHO,MCHIN
  108 CONTINUE
      MCOHO=MCHIN=0
      PRINT 104
```

```
      DO 110 I=1,40
      JVOL=0
      DO 109 L=1,6
      DO 109 M=1,7
      JVOL=JVOL+IVOL (I,L,M)
      IF (L.EQ.3)JCOHO=JVOL
  109 IF (L.EQ.6)JCHIN=JVOL-JCOHO
      MCOHO=MCOHO+JCOHO
      MCHIN=MCHIN+JCHIN
      IF (LIST(3) .EQ. 0) GO TO 110
      PRINT 102, I,JCOHO,JCHIN
  110 CONTINUE
      IF ( LIST(1) .EQ. 0) GO TO 111
      PRINT 103,MCOHO,MCHIN
C IF WEEKLY TOTALS OF EACH VARIETY TO EACH MARKET ARE
C DESIRED, PRINT THEM) OTHERWISE, SKIP THIS SECTION.
  111 IF (LIST(4) .EQ. 0) TO TO 112
      DO 60 M=1,7
      PRINT 54,M
      DO 60 I=1,40
   60 PRINT 73,I,(IVOL(I,L,M),L=1,6)
   54 FORMAT (1H1,'MARKET AREA',I5,/ ' WEEK NO.',4X,'SML CHINOOK',4X,
     1'MED CHINOOK',4X,'LG  CHINOOK',4X,'SMALL COHO',4X,
     2'MEDIUM COHO',4X,'LARGE  COHO')
  112 IF (LIST(5)+LIST(6) .EQ.0) GO TO 77
C IF LISTINGS OF FROZEN INVENTORY ARE DESIRED, PRINT THEM)
C IF FROZEN INVENTORIES FOR EACH WEEK ARE NOT DESIRED,
C SKIP TO 76
      IF (LIST(6) .EQ. 0) GO TO 76
C IF NOT, SKIP THIS SECTION.
C RECORD FROZEN INVENTORY ACCUMULATION FOR EACH WEEK; AND
C TOTAL FOR YEAR
      PRINT 75
   75 FORMAT (1H1,'FROZEN INVENTORY',/'WEEK NO.',4X,'SML CHINOOK',4X,
     1'MED CHINOOK',4X,'LG  CHINOOK',4X,'SMALL COHO',4X,
     2'MEDIUM COHO',4X,'LARGE  COHO',4X,'WEEK TOTALS')
      DO 70 L=1,6
   70 LSUM=0
      DO 71 I=1,40
      LSUM=0
      DO 72 L=1,6
      LSUM=LSUM+ISUM(L)
   72 ISUM(L)=IVOL (I,L,7) + ISUM(L)
   71 PRINT 73,I,(ISUM(L),L=1,6),LSUM
   73 FORMAT (1H0,I5,7I15)
      JSUM=0
      DO 76 L=1,6
   76 JSUM=JSUM +ISUM(L)
C IF TOTAL FROZEN INVENTORY IS NOT DESIRED, SKIP TO
C 77.
```

```
      IF (LIST(5) .EQ. 0) GO TO 77
      PRINT 74,JSUM
   74 FORMAT(1H0,5X,'TOTAL FROZEN INVENTORY',3X,I10)
   77 CONTINUE
C PRINT OUT RESULTS, FOR EACH MARKET AREA
C IF DESIRED
      IF (LIST(7) .EQ. 0) GO TO 57
      DO 61 M=1,7
      PRINT 54,M
C PRINT VOLUMES, PRICES, AND VALUES FOR EACH WEEK AND CATEGORY
      DO 61 I=1,40
      PRINT 55,I,(IVOL(I,L,M),L=1,6)
      PRINT 56,(PRI(I,L,M),L=1,6)
   61 PRINT 56,(VAL(I,L,M),L=1,6)
   55 FORMAT (1H0,/1H0,I5,6I15)
   56 FORMAT (1H0,5X,6F15.2)
   57 END
      SUBROUTINE CATCH (C,I,A1,A2,A3,A4,N)
      INTEGER C,A1,A2,A3,A4
      IF (I .LT. A1) GO TO 1
      IF (I .LT.A2) GO TO 2
      IF (I .LT. A3) GO TO 3
      IF (I .LT. A4) TO TO 4
    1 N=0
      GO TO 5
    2 N=C*(I-A1)/A2+.5
      GO TO 5
    3 N=C
      GO TO 5
    4 N=C*(1.*(A4-I)/(A4-A3))+.5
    5 RETURN
      END
      SUBROUTINE DEMAND (D1,D2,P,ID)
      ID=(D1-P)/D2
      IF (ID .LT. 0) ID = 0
      RETURN
      END
      SUBROUTINE PRICE (B1,B2,B3,I,P)
      P=B1 + (B2*I) - (B3 * I * I)
      RETURN
      END
```

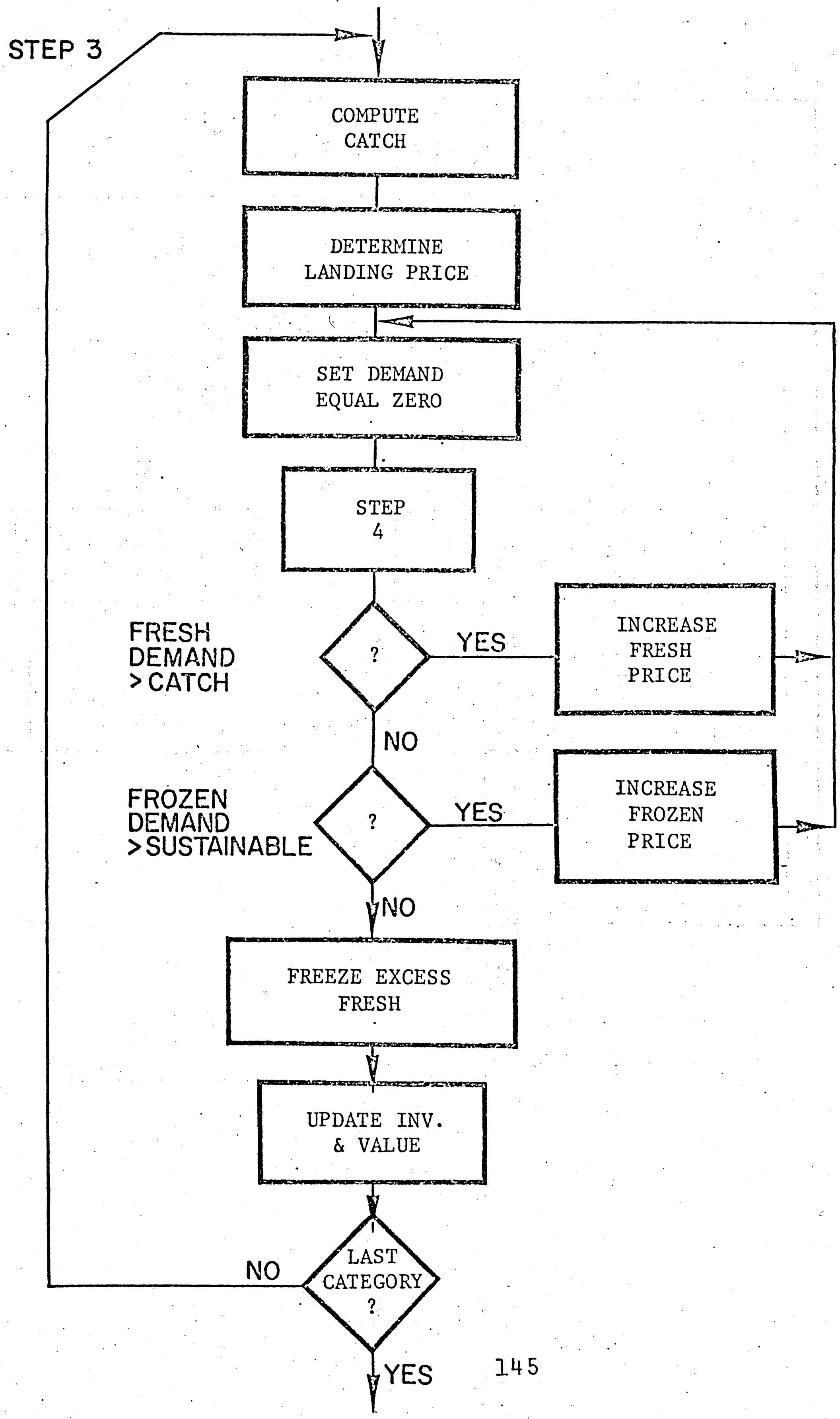
APPENDIX D-4

SAMPLE DATA

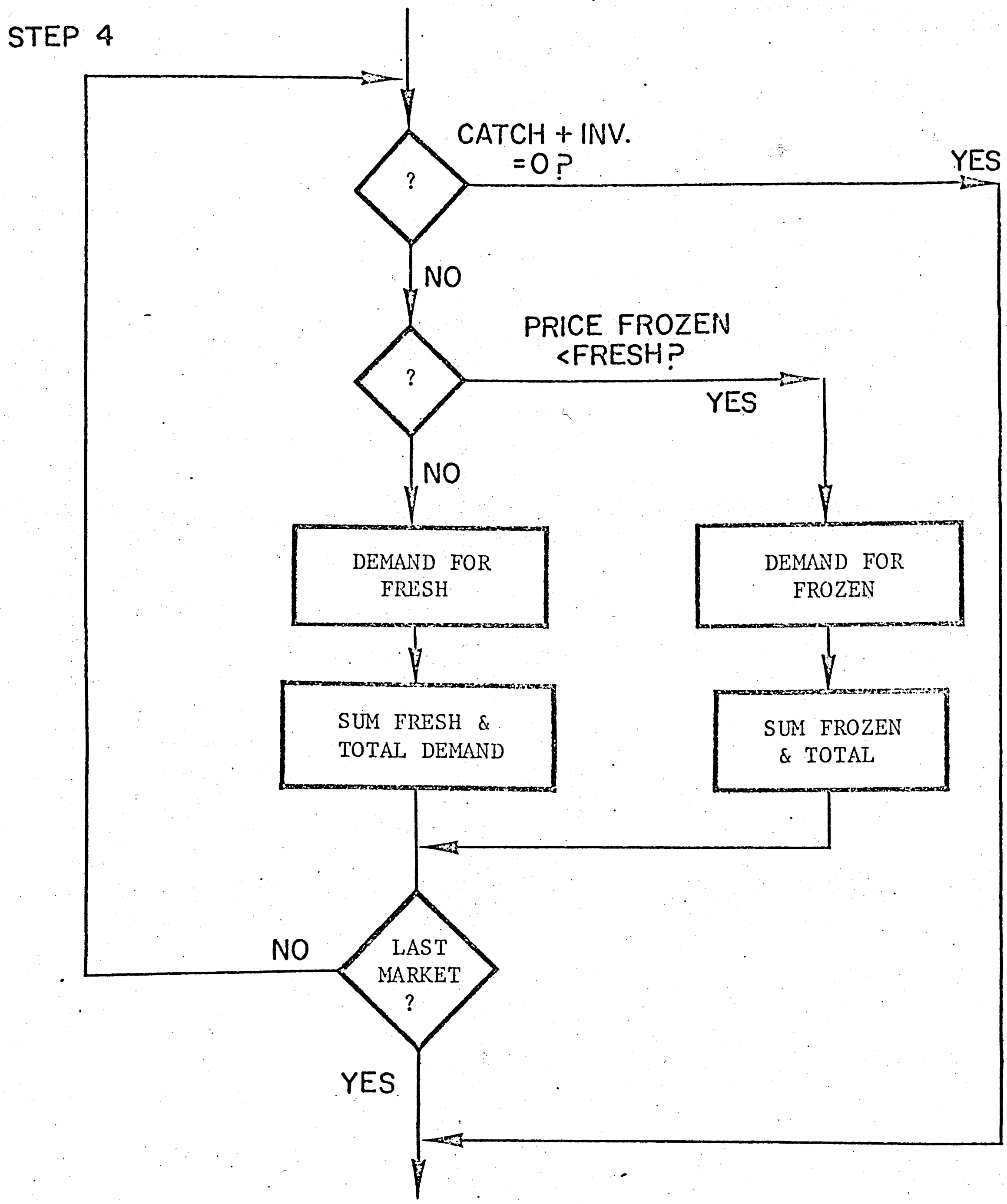
```
1111110000
  700   700   700   400   500   600
    5     6     6     2     2     3
   13    15    17    17    20    23
   19    21    23    24    27    30
   25    26    26    29    29    30
   72    88   109    53    65    82
  120   136   157   104   116   133
  125   139   161   108   121   139
  128   143   165   113   125   143
  140   155   180   115   129   147
  140   160   185   117   131   150
  160   180   200   120   135   155
       35          35          35         166         166         166
       14          14          14           5           5           5
     00400       00045       00500       00350       00350       00400
     00100       00200       00250       00300       00250       00200
     00100       00200       00250       00300       00250       00200
     0003        0003        00031       00040       00050       00060
     0004        00045       00042       00045       00060       00070
     00045       00053       00050       00045       00080       00100
   44    49    54    68    68    84    10
   39    40    44    47    49    45    01
```

APPENDIX D-5

DETAILED BLOCK DIAGRAM (Second Model)



APPENDIX D-5 (Continued)



Appendix D-6

Computer Program (Second Model)

```
      PROGRAM SALMON
C GLOSSARY
C          A1(L)      WEEK CATCH OF TYPE L BEGINS
C          A2(L)      WEEK CATCH OF TYPE L LEVELS OFF
C          A3(L)      WEEK CATCH OF TYPE L BEGINS TO DECLINE
C          A4(L)      WEEK CATCH OF TYPE L REACHES ZERO
C          B1         LANDING PRICE, START OF SEASON
C          B2         PRICE TREND, OVER TIME, DP/DT
C          B3         CHANGE IN PRICE TREND, OVER TIME
C          C          MAXIMUM CATCH
C          CMAX       MAX CATCH OF SEASON FOR A CATEGORY
C          D1         PRICE AT WHICH DEMAND IS ZERO
C          D2         SLOPE OF DEMAND CURVE
C          DM         DEMAND
C          E(M)       TOTAL PRICE MARKUP,MARKET AREA (M)
C          FRZ        FROZEN
C          I          WEEK NUMBER
C          L          CATEGORY NUMBER
C          M          AREA NUMBER
C          N          CATCH
C          PR         PRICE(TWO DIMENSIONS)
C          PRI        PRICE (THREE DIMENSIONS)
C          SLS        SALES
C          VAL        VALUE (PRICE TIMES VOLUME)
C          IVOL       VOLUME DEMANDED
C          MT         SUM OF DEMANDS BY CATEGORY
C CATEGORIES,L, ARE AS FOLLOWS9
C          1          SMALL CHINOOK
C          2          MEDIUM CHINOOK
C          3          LARGE CHINOOK
C          4          SMALL COHO
C          5          MEDIUM COHO
C          6          LARGE COHO
C MARKET AREAS
C          1          LOCAL
C          2          IN STATE (OTHER THAN LOCAL)
C          3          WEST COAST (OTHER STATES)
C          4          MID WEST
C          5          EAST COAST
C          6          EXPORT
C          7          FROZEN
C PRICE MATRIX (I,L,M), VALUE MATIRX (I,L,M) AND VOLUME
      DIMENSION PRI (52,6,7), VAL(52,6,7), IMH(52,6,7),IMZ(52,6,7)
      DIMENSION A1(6),A2(6),A3(6),A4(6)
      DIMENSION B1(6),B2(6),B3(6)
      DIMENSION CMAX(6),INV(6),TOTCOST(6),AVECOST(6)
      DIMENSION E(7),F(6),IH(6),IZ(6),IT(6)
```

```
      DIMENSION PR(52,6),IVOL(52,6,7)
      DIMENSION D1(6,6),D2(6,6)
      INTEGER C,A1,A2,A3,A4
C READ IN DATA
C READ IN ARRAYS CMAX,A1,A2,A3,A4, SIX ELEMENTS IN EACH
C IN I5 FORMAT, SIX ELEMENTS PER DATA CARD. (I.E. EACH
C ARRAY ON ONE CARD.)
      READ 49,NOTHING
   49 FORMAT(I5)
      READ 50,CMAX,A1,A2,A3,A4
   50 FORMAT(6I5)
   51 FORMAT(6F5.2)
   52 FORMAT(6F10.5)
   53 FORMAT (7F5.2)
C READ IN ARRAYS B1,D1, SIX ELEMENTS EACH IN F5.2 FORMAT
C ONE ARRAY PER CARD.
      READ 51,B1,D1
C READ IN ARRAYS B2,B3,D2, SIX ELEMENTS IN EACH, ONE ARRAY
C PER CARD IN F10.5 FORMAT
      READ 52,B2,B3,D2
      READ 53,E,F,S
C INITIALIZE MATRICES
      DO 40 I-1,52
      DO 40 L=1,6
      DO 40 M=1,7
      PRI(I,L,M)=0
      VAL(I,L,M)=0
   40 IVOL(I,L,M)=0
      DO 41 I=1,6
      INV(I)=TOTCOST(I)=IH(I)=IZ(I)=IT(I)=0
   41 AVECOST(I)=5.00
C OUTER LOOP (WEEKS)
      DO 10 I=1,52
C MIDDLE LOOP (CATEGORY) I.E. SPECIES AND SIZE).
      MXSL=0
      DO 20 L=1,6
C CALL CATCH WITH MAX (PEAK) CATCH FOR CATEGORY,WEEK
C NUMBER, AND CATCH CURVE POINTS
      CALL CATCH (CMAX(L),I, A1(L),A2(L),A3(L),A4(L),N)
C CALL PRICE,WITH PRICE PARAMETERS AND WEEK NUMBER) COMPUTE
C MINIMUM PRICE.
      CALL PRICE (B1(L),B2(L),B3(L), I,PR(I,L))
C IF THE CATCH WAS ZERO,SKIP OVER DEMAND COMPUTATIONS AND
C VALUE COMPUTATIONS.
      IF (N + INV(L) .EQ. 0) GO TO 20
C INSIDE LOOP (MARKET AREA)
      PRA=AVECOST(L)
      IF (INV(L) .GT. 0) AVECOST(L) =TOTCOST(L)/INV(L) +S
      MXSL=INV(L)/(52-I)
   21 MT=MZ=MH=0
      DO 30 M=1,6
C RETAIL PRICE = LANDING PRICE + AREA MARKUP
      PRI(I,L,M) = PR(I,L) + E(M)
      IF(PRI(I,L,M) .GT. PRA + F(M)) GO TO 34
```

```
C COMPUTE DEMAND FOR EACH AREA,M, AT PRICE PRI (I,L,M)
      CALL DEMAND (D1(L,M),D2(L,M),PRI(I,L,M),ID)
      MH=MH+ID
      MT=MT+ID
      IVOL(I,L,M)=ID
      IMH(I,L,M)=ID
      IMZ(I,L,M)=0
      GO TO 30
   34 PRI(I,L,M)=PRA + F(M)
      CALL DEMAND (D1(L,M),D2(L,M),PRI(I,L,M),ID)
      MZ=MZ + ID
      MT=MT+ID
      IVOL(I,L,M)=ID
      IMH(I,L,M)=0
      IMZ(I,L,M)=ID
C VALUE OF SALMON SOLD ON ANY MARKET IS PRODUCT OF PRICES
C AND VOLUME.
   30 VAL (I,L,M) = ID * PRI(I,L,M)
C IF DEMAND (SUM OF ALL AREAS) EXCEEDS AVAILABLE SUPPLY
C INCREASE PRICE
      IF (MH .GT. N) GO TO 31
      IF (MZ .GT. MXSL) GO TO 32
C FROZEN BECOMES THE SEVENTH MARKET FOR FRESH SALMON.
      IVOL(I,L,7)=N-MH
      PRI(I,L,7)=PR(I,L) + E(7)
      VAL(I,L,7)=IVOL(I,L,7)*PRI(I,L,7)
      INV(L)=INV(L)+N-MT
     3TOTCOST(L)=TOTCOST(L) + VAL (I,L,7) -MZ*AVECOST(L) + INV(L)*S
      IF(INV(L) .GT. 0) AVECOST(L) = TOTCOST(L)/INV(L)
      GO TO 20
   31 PR(I,L)=PR(I,L)+.05
      GO TO 21
   32 PRA=PRA + .05
      GO TO 21
   20 CONTINUE
      PRINT 100,I,(INV(L),L=1,6)
  100 FORMAT(1H0,'FROZEN INV.,WK',I5,6I10)
  101 FORMAT(1H0,'AVE.  COST    ',5X,6F10.2)
      PRINT 101,(AVECOST(L),L=1,6)
   10 CONTINUE
C PRINT OUT RESULTS, FOR EACH MARKET AREA
      DO 60 M=1,7
      PRINT 54,M
C PRINT VOLUMES,PRICES,AND VALUES FOR EACH WEEK AND CATEGORY
      DO 60 I=1,52
      PRINT 55,I,(IMH(I,L,M),L=1,6)
      PRINT 56,(IMZ(I,L,M),L=1,6)
      PRINT 57,(IVOL(I,L,M),L=1,6)
      PRINT 58,(PRI(I,L,M),L=1,6)
   60 PRINT 59,(VAL(I,L,M),L=1,6)
   54 FORMAT (1H1,'MARKET AREA',I5,/ ' WEEK NO.',14X,'SML CHINOOK',4X,
     1'MED CHINOOK',4X,'LG  CHINOOK',4X,'SMALL COHO',4X,
     2'MEDIUM COHO',4X,'LARGE   COHO')
```

```
55 FORMAT (1H0,/1H0,I3,2X,'FRESH',5X,6I15)
56 FORMAT (1H0,5X,'FROZEN',4X,6I15)
57 FORMAT (1H0,5X,'TOTAL',5X,6I15)
58 FORMAT (1H0,5X,'PRICE',5X,6F15.2)
59 FORMAT (1H0,5X,'VALUE',5X,6F15.2)
   END
   SUBROUTINE CATCH (C,I,A1,A2,A3,A4,N)
   INTEGER C,A1,A2,A3,A4
   IF (I .LT. A1) GO TO 1
   IF (I .LT.A2) GO TO 2
   IF (I .LT. A3) GO TO 3
   IF (I .LT. A4) GO TO 4
 1 N=0
   GO TO 5
 2 N=C*(I-A1)/A2+.5
   GO TO 5
 3 N=C
   GO TO 5
 4 N=C*(1.*(A4-I)/(A4-A3))+.5
 5 RETURN
   END
   SUBROUTINE DEMAND (D1,D2,P,ID)
   ID=(D1-P)/D2
   IF (ID .LT. 0) ID = 0
   RETURN
   END
   SUBROUTINE PRICE (B1,B2,B3,I,P)
   P=B1 + (B2*I) - (B3 * I * I)
   RETURN
   END
```

APPENDIX E-1

INITIAL RUN INPUT DATA*

Punch Card Column Numbers	5	10	15	20	25	30		40	50	60
Output Options	1111110000									
CMAX	700	700	700	400	500	600				
A1	5	6	6	2	2	3				
A2	13	15	17	17	20	23				
A3	19	21	23	24	27	30				
A4	25	26	26	29	29	30				
B1	72	88	109	53	65	82				
	104	108	112	100	103	106				
	109	113	117	120	108	111				
	112	116	120	108	111	114				
D1	140	145	150	132	138	144				
	136	143	150	133	139	145				
	134	142	150	129	136	143				
B2		350		350		350		166	166	166
B3		14		14		14		50	50	50
		00030		00030		00031		00040	00050	00060
		00040		00045		00042		00045	00060	00070
D2		00045		00053		00050		00045	00080	00100
		00400		00045		00500		00350	00380	00400
		00100		00200		00250		00300	00250	00200
		00350		00400		00050		00400	00450	00400
E	44	49	54	68	68	79	49			

*In general the columns correspond to species as follows:

Column No.	Specie
1	Small Chinook
6-10	Medium Chinook
11-15	Large Chinook
16-20	Small Coho
21-25	Medium Coho
26-30	Large Coho

APPENDIX E-2

RESULTS OF DECREASE IN EXPORT MARKUP PARAMETER

Market Area	Totals Shipped to Each Market Area E(6) = 94¢ Total Chinook	Total Coho
1 (Local)	0	3966
2 (In-state)	0	8492
3 (California)	0	1518
4 (Midwest)	0	2262
5 (East Coast)	0	4180
6 (Export)	0	0
Total Fresh	0	20418
7 (Frozen)	23991	3269
Totals for year	23991	23687

Market Area	Totals Shipped to Each Market Area E(6) = 89¢ Total Chinook	Total Coho
1 (Local)	0	3966
2 (In-state)	0	8492
3 (California)	0	1518
4 (Midwest)	0	2262
5 (East Coast)	0	4180
6 (Export)	0	26
Total Fresh	0	20444
7 (Frozen)	23991	3243
Totals for year	23991	23687

APPENDIX E-2 (CONTINUED)

Market Area	Totals Shipped to Each Market Area E(6) = 84¢ Total Chinook	Total Coho
1 (Local)	0	3865
2 (In-state)	0	8406
3 (California)	0	1458
4 (Midwest)	0	2247
5 (East Coast)	0	4150
6 (Export)	0	149
Total Fresh	0	20275
7 (Frozen)	23991	3412
Totals for year	23991	23687

Market Area	Totals Shipped to Each Market Area E(6) = 79¢ Total Chinook	Total Coho
1 (Local)	0	3799
2 (In-state)	0	8348
3 (California)	0	1418
4 (Midwest)	0	2237
5 (East Coast)	0	4130
6 (Export)	0	494
Total Fresh	0	20426
7 (Frozen)	23991	3261
Totals for year	23991	23687

APPENDIX E-3

RESULTS OF INCREASING EXPORT DEMAND PARAMETERS

Market Area	Totals Shipped to Each Market Area D1(6,1) = $1.34 Total Chinook	D1(6,4) = $1.29 Total Coho
1 (Local)	0	3551
2 (In-state)	0	8140
3 (California)	0	1293
4 (Midwest)	0	2200
5 (East Coast)	0	4064
6 (Export)	0	918
Total Fresh	0	20166
7 (Frozen)	23991	3521
Totals for year	23991	23687

Market Area	Totals Shipped to Each Market Area D1(6,1) = $1.39 Total Chinook	D1(6,4) = $1.34 Total Coho
1 (Local)	0	3324
2 (In-state)	0	7951
3 (California)	0	1189
4 (Midwest)	0	2163
5 (East Coast)	0	4003
6 (Export)	0	1844
Total Fresh	0	20474
7 (Frozen)	23991	3213
Totals for year	23991	23687

APPENDIX E-3 (CONTINUED)

Market Area	Totals Shipped to Each Market Area D1(6,1) = $1.44 Total Chinook	D1(6,4) = $1.39 Total Coho
1 (Local)	0	3087
2 (In-state)	0	7749
3 (California)	0	1102
4 (Midwest)	0	2100
5 (East Coast)	0	3893
6 (Export)	0	2885
Total Fresh	0	20816
7 (Frozen)	23991	2871
Totals for year	23991	23687

Appendix F-1

CONFIDENTIAL
INTERVIEW GUIDE

Firm name ______________________________
Address ______________________________
Principal officer ______________________________
Contact (if other than above) ______________________________
Type of business (e.g., processor (what type?), wholesaler, etc.)
Primary ______________ Secondary ______________
Principal products handled ______________________________
Principal functions for salmon ______________________________
Total volume of business (in lbs. and $) ______________ ______________
How much of total volume is salmon? ______________________________
How much is fresh salmon? ______________________________
How much is frozen salmon? ______________________________
Other? ______________________________
How do you decide on this? ______________________________
Number of employees ______________ Full time ______________
What is maximum during peak salmon season? ______________________________

Where does salmon come from that you process?
Locale: (name specific towns if possible) What is % of business by area?

______________ ______________ ______________

What are the major firms that supply you?
Name of firm ______________________________
Address ______________________________
Is there an individual we should contact? ______________________________
Function of firm in salmon channel:
What physical processing does he do in salmon channel?

____

What relationship is this firm to you (independent, subsidiary, etc.)?

____

What percent of your salmon business does he supply?

____

How are buying prices set? ______________________________
What information do you look for in setting selling price? ______________
What is current selling price? ______________________________
How do they arrive at margin to cover processing? ______________
Are brokers involved? ______________ How? ______________
______________________________ Who? ______________

Inbound transportation and outbound
Do you use your own trucks? ______________________________
If yes what does it cost?
Total Cost ______________
Per pick-up ______________
Per pound ______________

Can you supply details of operating cost?
Driver ________
Fuel ________
Maintenance ________
Depreciation ________
Refrig. ________
Other ________
Total mileage ________
Total Weight ________
How much backhaul traffic is involved?

Other transportation? ________
Do suppliers deliver? ________
If no what mode of transportation do you use?
Carrier ________
Type of service: (contract, common) ________
Rates or charges ________
Who pays transportation charges? ________

Average size of shipment ________
Range of size ________
Type of container ________
If reusable container, who owns ________
Are shipments iced? ________
Is refrigeration used in transit? ________

What is typical transit time from supplier? ________
At this point ask him to recapitulate entire time schedule from source to this firm ________
What range of transit time does firm normally experience ________ ________ or when is it nornmally delivered?
____
Are there any problems of carrier reliability? ________
What other problems do you encounter? ________
In what condition does fish arrive? (freshness, other) ________

In plant operation

What specific functions does your firm perform on salmon? (e.g., cleaning, icing, packing, loading, sorting, cutting, consumer packaging, canning, freezing, other?) ________
Describe explicit steps involved in processing fresh and frozen salmon.
____
Flow chart of internal processes:

What is total cost of operation for salmon? ________ Per pound? ________
What is gross margin? ________
What is net profit (after total cost)? ________

Can firm break costs down?
- By labor ______________
- Capital ______________
- Other ______________

Can firm develop costs of each function?
- Function name ______________
- Labor: Hrs. ______ Rate ______ $/Hr. ______ Total cost per season ______ Cost/lb. ______
- Capital cost: Total book value of equipment used ______ Hours used ______ Depreciation cost ______ Dep'n/hr. ______
- Other (specify, such as materials, outside services, etc.) ______________

What are interest charges on frozen salmon? ______________
- Physical holding costs ______________

What are overhead costs of business? (Ask if there were no fish coming in the door, what costs would be present to keep the doors open?) ______________

Does firm finance either supplier or customer? ______________
How much shrinkage? ______________
How much waste? ______________
What type of by-products? ______________

Outbound movement

Where do you ship: Region? Percentage to each region? Percentage fresh or frozen?
(e.g., NE US, Midwest, export, So. Calif., N. Calif, Wash., Down state Oregon, Portland area, Seattle area)

Who are your buyers?
- Name of buyer ______________
- Address ______________
- Type of business ______________
- Region served (describe market, e.g., Portland Suburban Stores) ______________
- What percentage of sales are they? ______________
- Fresh or frozen? ______________

How do you sell to customers?
- Outside salesmen ______________ Region ______
- Salesmen-drivers ______________ Region ______
- Call-in orders ______________ Region ______
- Brokers ______________ Region ______
- Other middlemen ______________ Region ______

Are there any particular reasons why you do it this way? ______
How are prices set in this market?
- Contract ______
- Bid ______
- Open list ______
- Cost plus margin ______

Outbound transportation

Do you use your own trucks? ____________

If yes what does it cost? ____________

Total cost ____________ Per delivery ____________

Per pound ____________

Can you supply details of operating cost?

- Driver ____________
- Fuel ____________
- Maintenance ____________
- Depreciation ____________
- Refrigeration ____________
- Other ____________
- Total mileage ____________
- Total weight ____________
- Is there any backhaul traffic? ____________
- If no do customers pick-up? ____________
- If no what other form of transportation do you use?
  - Carrier ____________
  - Type of service (contract, common) ____________
  - Rate or charges ____________
  - Who pays transportation charges ____________
  - Average size of shipment ____________
  - Range of size ____________
  - Type of container ____________
  - If reusable container, who owns? ____________
  - Are shipments iced? ____________
  - Is refrigeration used in transit? ____________
  - What is typical transit time to delivery? ____________
  - What range of transit time does firm normally experience, or when is fish normally delivered? ____________
  - Are there any problems of carrier reliability? ____________
  - What other problems do you encounter? ____________
  - What is the total transportation cost per year? ____________

For retail and wholesale operations only

How much inventory do you normally carry of salmon? ____________

Reasons for this level ____________

What types of salmon do you sell? (Fresh, smoked, etc.) ____________

What trend of sales have you encountered in market in last three years?

____

Do you do any processing in store (refer back to in-plant detail) ____________

How do you set retail price? ____________

Does supplier assist with display, or preparation for sale? ____________

Flow chart of position in market channel: