AN ABSTRACT OF THE THESIS OF

Jim V. Earley for the degree of Master of Science in Agricultural and Resource Economics presented on December 7, 1983.

Title: The Role of Selected Regulations on the Distribution of West Coast Groundfish

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Expanding groundfish production on the West Coast and in the United States in total, over the past decade, has increased competition in the groundfish market. During the same period, regulations have evolved to control production in the groundfish industry for the purpose of conserving the resource. Other regulations exist to control certain aspects of the market for groundfish. Such regulations are generally expected to have local impacts. However, little consideration is usually given to the impact regulations may have outside a local area. Indeed, since market competition has increased so significantly in this industry, the geographical distribution area has expanded considerably in recent years. Inter-regional impacts should be considered when regulations are established. The purpose of this research was to examine the impact selected regulations may have on markets for groundfish.

The hypothesis tested by this research is stated as the following: regulations intended to impact local regions have no

more than a local affect. Stated another way, regulatory authorities at state or regional levels generally intend to impose regulations that do not impact regions other than those under their jurisdiction. The test, then, is to determine if other regions are affected by "localized" regulations.

The regulations to be examined include restriction or alteration of production in a limited region and established intra-state transportation rates (for seafood) that limit competition in the state transportation market. Specifically, alternative distribution patterns were generated in response to postulated changes in: (1) the availability of groundfish in the Oregon region and (2) California intra-state transportation rates to reflect more competition in the seafood transportation market (lower rates).

The hypothesis was tested by estimating demand equations for groundfish, employing these in a spatial equilibrium model, and subjecting the results to a sensitivity analysis.

The hypothesis testing consists of four parts, each independently insufficient to reject the hypothesis. As a whole, however, the four parts should provide enough evidence (although not a statistical test) to reject the hypothesis. The results of the research indicate rejection of the hypothesis was acceptable. Indeed, several of the regions where no affect was expected in response to the postulated changes showed significant impacts.

This research was a pioneering attempt. The results are not conclusive, in part because of the absence of appropriate data.

However, the results were significant enough to indicate promising possibilities for future research. In fact, a major contribution of the work was to point out how this research technique can be improved by refining inputs to the model and increasing its complexity to reflect more of the available routes associated with different product forms, product transport techniques and different species.

The major result of the research was to indicate the need to consider impacts which extend beyond the local market in establishing regulations.

The Role of Selected Regulations on the Distribution of West Coast Groundfish

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Chapter I INTRODUCTION

Need for the Analysis

Expanding groundfish production on the West Coast and in the United States in total, over the past decade, has generated an interest in new markets and new methods of handling product. The industry has been responsive to increased groundfish landings by expanding its activities in both areas. One consequence has been increased competition in new and traditional markets for West Coast products.

Regulatory changes affecting business and fishing activity may have various impacts. Management decisions by agencies directly or indirectly associated with any part of the distribution network for seafood products will usually be translated through the system by interacting with other parts of the network.

Nevertheless, regulatory units often impose regulations under the assumption that resulting impacts will be felt locally and will have no impact outside the local area. For example, the 1982 Pacific Fishery Management Council's (PFMC) Groundfish Management Plan (page 4-1) states, in effect, that the PFMC groundfish plan would have little or no effect on the North Pacific Fishery Management Council's groundfish plan and presumably with other management councils' groundfish plans. Another regulatory agency, the California Public Utilities Commission (CPUC) also regulates part of the distribution network on a local basis. The presumption is that regulations (specifically tariffs, i.e., transportation rates set by the Commission) imposed by the CPUC have local or, at most, statewide impacts.

The purpose of this research is to examine the role of selected regulations on the distribution of West Coast groundfish and to indicate whether or not management decisions intended for one region have impacts on seemingly unrelated regions. To explore this issue requires an examination of the interdependence of geographical markets for groundfish.

Objective

The objective of this research is to test the null hypothesis that markets for groundfish are local or regional in scope and that insignificant inter-relatedness exists from region to region.

The procedures used to test the hypothesis are:

1. Develop a demand equation based on a national groundfish market with no distinction between regions.
2. Disaggregate the national groundfish demand equation into regional demand equations based on the demographic characteristics of population and income for each region and insert each of the derived regional demand relationships into a spatial equilibrium model. Generate the resulting distribution pattern and prices and compare with data collected on actual movements of groundfish.

3. Change the supply conditions according to the effect predicted to occur after the institution of various harvest restricting regulations and change the intrastate transportation rates within California to reflect the absence of CPUC imposed tariffs.
4. Compare the resulting simulated product flows and regional prices obtained under number 3 with those obtained under number 2.

The criteria for rejecting the hypothesis are based on a combination of all 4 test procedures and consist of:

1. Ability to specify a national groundfish demand relationship with theoretically consistent coefficients.
2. Replication of actual product movement as reported by a National Marine Fisheries Service (NMFS) survey for 1981 with those obtained using the estimated demand equations, actual supply conditions and actual transportation costs within the spatial equilibrium model. That is, data generated by the simulated market are compared with actual data for the year 1981. The closer the correspondence, the greater the confidence in the model as a simulator of conditions in the U.S. groundfish market.
3. Observation of significant impact on demand regions and alteration of product movement in regions not directly affected by assumed changes in supplies for the Oregon and California regions only. If the model generates

significant impacts on the non-West Coast markets. This could suggest that the market for West Coast groundfish has larger than regional dimensions. While no unbiased statistical test of the hypothesis is possible, results which suggest no, or very small, changes in non-West Coast markets in response to postulated changes in West Coast groundfish supplies could provide at least some support to the hypothesis.

The changes that are inserted into the spatial equilibrium analysis are the result of hypothetical responses that might occur when regulations are imposed which 1) reduce the landings of groundfish on the West Coast and 2) reduce the transportation rates for intrastate shipments in California.

To be more specific, the Pacific Fishery Management Council has indicated the need to reduce the harvest of certain species groups of groundfish within the Columbia region. Groundfish harvest in other regions on the West Coast have not exceeded recommended levels and so no reductions are planned for those regions. The total recommended level of reduction is around 15 thousand metric tons, ex-vessel weight. This translates into a processed weight (in fillet form) of about 11 million pounds. To investigate the impacts of these changes, three alternative assumptions are made about how reductions will affect groundfish supply. Under the first, it is assumed that there is a uniform reduction in supply over the year. That is, a reduction of 902 thousand pounds per month for 12 months.

Under the second scenario, it is assumed there is a reduction in supply of 1,804 thousand pounds per month for the last 6 months. Under the third scenario, there is a redistribution of harvest from Oregon to California of 1,804 thousand pounds per month for the last 6 months. Finally, attention is directed to examining the effects of changes in transportation costs. It is assumed that the harvest level is equivalent to the status quo situation, but that there is a reduction in intrastate transport rates in California which bring them in line with rates specified for interstate shipments of equivalent distance.

Description of the Groundfish Industry

Groundfish include most benthic and some pelagic species of fish harvested primarily by otter trawls, traps and sometimes by gillnet or hook and line (see Appendix, Figure 4, pg.). The major species groups include cod (Gadus morhua, G. macrocephalus) (both Pacific and Atlantic); flatfish; haddock (Melanogrammus aeglefinus); ocean perch (Sebastes marinus and S. alutus) (Atlantic and Pacific); rockfish (Sebastes sp. and Sebastolobus sp.); sea bass and snapper; and sablefish (Anaplopoma fimbria).

Commercial harvest of groundfish is primarily by trawl fisheries on the East, West and Gulf Coasts. Groundfish are also harvested incidental to the shrimp fishery in the Gulf and on the West Coast.

Most of the fish on the East Coast is sold through auctions at the time of delivery after harvest. On the West Coast, fish is sold based on negotiated prices at specified times of the year or when market conditions dictate re-negotiation. The difference in marketing technique at the ex-vessel level is due primarily to the size difference between the two fleets. The West Coast fleet, including Alaska, numbers less than 500 boats (Kramer, Chin and Mayo, Inc., 1982), while the East Coast fleet is considerably larger. Another difference involves fishing technique. On the East Coast, many of the boats return to port after each day of fishing, while West Coast boats may make trips lasting as long as 10 days or more.

The predominant market channel for the West Coast begins with a buying station, usually owned by a processor. Several processors sell to a wholesaler who then sells to retailers or institutions. In some cases the retailer may also function as a wholesaler and distribute product to several subsidiary retail outlets, restaurants, and/or institutions. On the West Coast, only four processors are large enough to act as wholesalers (personal communications, processors, 1983). Some of the smaller processors may attempt direct sales, but usually to the predominant market channel. Figure 1 is an illustration of this market channel.

Another intermediary, who may become involved in the market channel at almost any position, is the broker. The broker's function is to arrange markets; to act as the go-between for retailers, wholesalers or processors.

Product from the West Coast is sold primarily to the fresh fish market. According to Wang et al. (1978) East Coast distributors

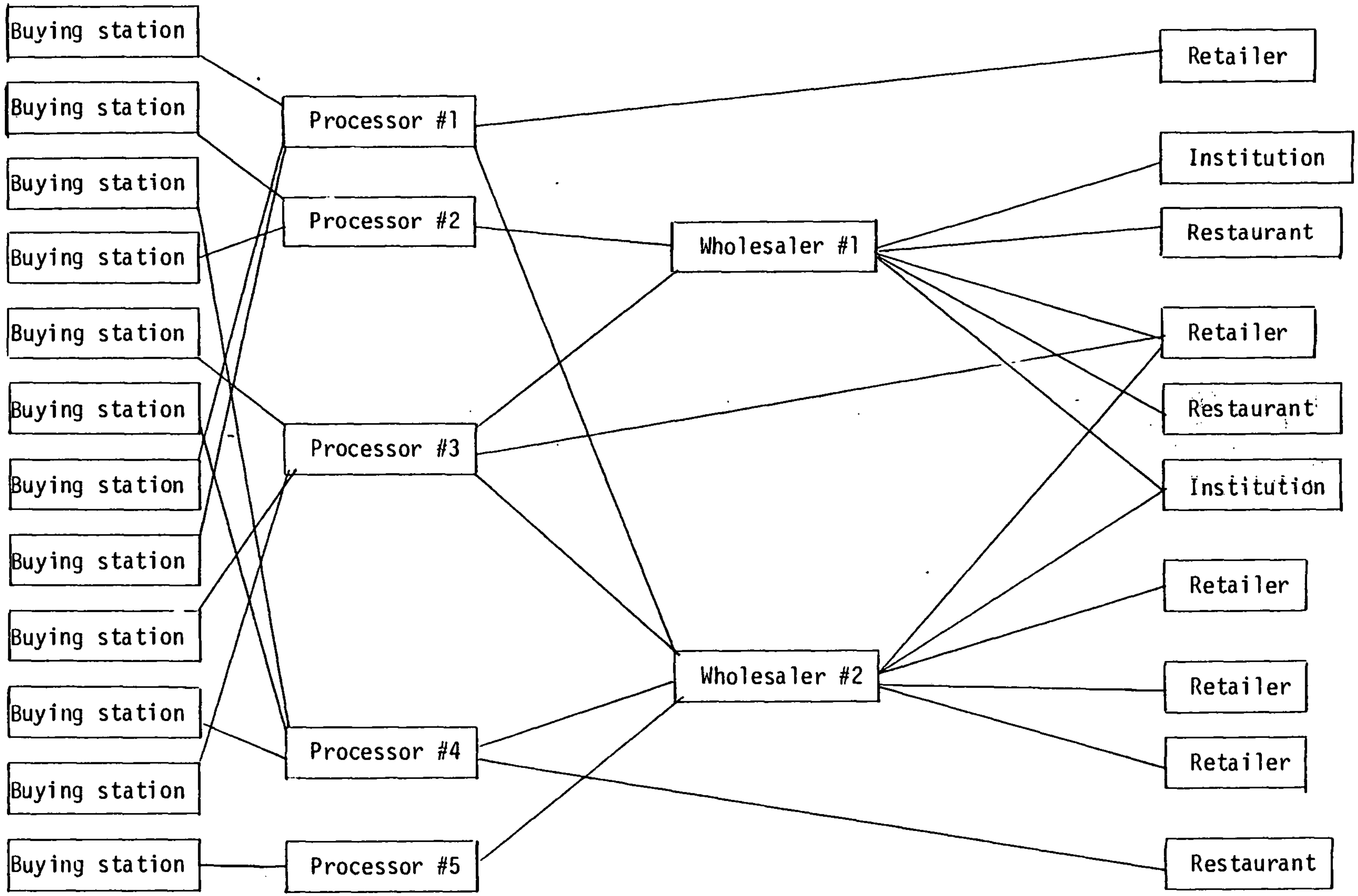

Figure 1. Illustration of Market Channels for Groundfish

also target the fresh market with domestically produced groundfish. Over 90 percent of the domestic landings of East Coast cod, haddock, ocean perch and flounder are sold in the fresh market.

Processors have attempted to compete in the frozen fish market with little success. The competition from imports of groundfish in the frozen market is very high and gaining entry into the market is difficult. Processors are also reluctant to freeze fish and place them in inventory when interest rates make financing that inventory expensive.

California landings of groundfish are dominated by flatfish, with very high volumes of Dover sole (Microstomus pacificus) making up as much as 50 percent of the total landings. Although flatfish, especially Dover sole, continue to make up a considerable share, Oregon and Washington landings of groundfish are dominated by rockfish. In fact, rockfish landings have contributed substantially to the overall increase in total landings observed for Oregon and Washington in the past four years.

Only recently (within the past 10 years) has the groundfish industry attempted to expand the distribution of West Coast groundfish. Up to this time, the traditional markets for Oregon, Washington and Northern California groundfish have been confined to major metropolitan centers in the West Coast states, primarily in California. Marketing efforts have been extended to Southern, Midwestern and Eastern areas of the U.S. In fact, West Coast production is becoming increasingly important to East Coast fresh fish markets due, in part, to increasing pressure on New England fish stocks and the ability of West Coast distributors to supply fillets during the winter, when New England landings are low (Kramer, Chin and Mayo, 1982).

The ability to ship product by air because of direct flights and more refrigerated cargo capacity (physical) has also contributed to expansion into non-traditional markets. One attendant development has been the ability of producers from other geographic regions to do the same, thus increasing competition in traditional markets. Several West Coast distributors indicate that competition in the Los Angeles market has increased so substantially that it is no longer the primary market area targeted by their firms. Many processors indicate that their primary market areas have shifted to the north, away from the Southern California area.

High quality imported frozen product sometimes competes directly with fresh product. Imported frozen cod, flounder and a few other species are thawed and sold as fresh fish or displayed in retail markets alongside fresh product (personal communications, processors, distributors, retail outlets, 1983).

West Coast groundfish generally competes with production from other regions, and with imported frozen product. Attributes which make West Coast production more desirable include availability and freshness. However, new technology is helping other sources of groundfish to overcome any advantage West Coast product may have and is making the market more uniform. Uniformity, here, implies that the groundfish market is changing from local or even regional to national. Distinction between geographic region and, indeed, between species is becoming less significant; at least, this appears to be the case. As indicated earlier it is the purpose of the present research to explore this issue.

Seafood Transportation

Although air freight has become more common recently, refrigerated vans continue to be the predominant mode of transport used by most processors and distributors. Most processors own or lease trucks for transporting product (usually unprocessed) from one location to another, within their company. When product is shipped to a customer, independent companies are used. The usual shipment size to one customer ranges from 1,000 to 5,000 pounds with shipments over 10,000 lbs. extremely rare (various personal communications, processors, 1983).

Most of the independent trucking companies contacted, who specialized in hauling fresh and frozen seafood, indicated they primarily handle less-than-truck load shipments and they do multiple pickups and multiple drops. These companies also indicated they generally consolidate shipments in an attempt to provide the least expensive and most timely service available.

Since interstate transport of fresh and frozen (uncooked) seafood is not regulated by the Interstate Commerce Commission, there are no prescribed tariffs for the trucking industry. Cost to the customer is based on whatever the market is willing to pay and charges are highly negotiable. Competition for certain routes is fairly heavy and there appears to be a high turnover in companies providing trucking service to the seafood industry.

Most states, with the exception of California, also exempt uncooked seafood from regulation. California prescribes tariffs for intrastate transport of seafood and has higher rates than most out-of-state companies provide. As a consequence to setting rates, California has relatively little competition in intrastate transport of seafood. In fact, two companies handle most of the shipments of product from producer to customer within California.

The Demand for Groundfish

An increased level of national competition in the groundfish market provides a rationale for aggregation of data across species and regions to estimate the demand for groundfish. Attempts to model demand at the individual species level have yielded unexpected results (to be discussed more completely in Chapter II), probably because of the high degree of substitutability associated with groundfish. Physical characteristics may be an underlying factor associated with this substitutability. When consumers purchase groundfish (especially in fillet form) they perceive the item as having certain attributes including, but not limited to, light color, flaky texture, mild taste, and (possibly) low fat content. Examination of individual products illustrates similarities across most groundfish species in these traits.

How do sellers perceive these substitutional relationships? When individual distributors were asked what effect a reduction in West Coast production would have on their business, all of them indicated they would get the product, that is, groundfish, from some other source (region). These other sources include: the East Coast and Alaska, along with imports from Canada, Norway, Iceland, Sweden, Germany, Denmark and New Zealand. The indication then is that distributors also perceive the similarity in species and are willing to exploit the substitutability in order to maintain a constant product flow to customers.

Thus it appears that, in recent years, the market for West Coast groundfish has become national in scope, expanding from its earlier regional orientation. The West Coast species compete across the country with species from other parts of the U.S. and from abroad. With this change in the nature of the market within which West Coast species compete, changes in various regulations (fisheries management, transportation, ...) may have different impacts than would be the case were these species sold only regionally.

Chapter II. LITERATURE REVIEW

Previous Work

Relatively little study has been devoted to seafood market channels. Schary et al. (1970) conducted a study on the distribution channels for fresh and frozen Pacific salmon which yielded some interesting insights concerning movement of West Coast produced salmon. For example, they helped to indicate amounts of salmon entering various markets and the importance of domestic and export markets. They also illustrated available market channels for West Coast salmon. Gillespie and Gregory (1971) produced a study dealing with the market channels for fresh finfish in the Texas seafood industry. The study was descriptive in nature and was intended to demonstrate the predominant market channels for the six dominant species landed by the Texas industry. Johnston et al. (1980) examined West Coast groundfish markets and the processing capacity of the West Coast industry. An important finding of this study was that capacity, measured in terms of output, depended on several factors, including price, markets and processing of other products. Both Johnston et al. (1980) and Gillespie and Gregory (1971) concluded the groundfish industry is not homogeneous. Processor size and technology differ, as do methods used to market product. An implication of this conclusion is that identification of supply and demand relationships becomes more difficult. However, several attempts have been made to accomplish this task.

In 1969, Nash presented a study using cross-sectional data for a one year period which analyzed the consumption of seafood in the United States. The survey was based on diaries of fish purchases kept by fifteen hundred households. The participants profiled U.S. population by geographic region, income groups, family size, occupation, age, race and religion. The intent was to provide the Bureau of Commercial Fisheries with a method to determine how various demographic and income characteristics influenced demand. The data also provided greater understanding of fish buying patterns in the United States.

Since 1969, a few other studies have been conducted. The National Marine Fisheries Service carried out similar studies (to Nash) in 1972-74 and in 1981. The results provide a better understanding of how consumption changed over time. Perry (1981) reported results of his econometric analysis of the 1972-1974 Consumer Expenditure Diary Survey. Capps (1982) also analyzed the 1972-1974 survey information using a different technique from Perry and reached similar conclusions. The results of the studies by Nash, Perry and Capps included a demand relationship with variables that described differences in consumer demand based on income levels, geographic region, race, ethnic background, location of geographic region, availability of seafood, religion, marital status, population density, and other similar factors. It was clear from their research, that each of the above factors has a definite impact on the demand for seafood. For example, families with low incomes tend to consume more seafood than do those with high incomes, but the type and species consumed were different. Also, people from the south tend to consume more seafood than those in the Mid. U.S., possibly due to availability of substitutes such as beef or pork and other characteristics. However, two factors that rendered those studies of limited use were the high degree of aggregation, (i.e., all seafood were aggregated together) and the difficulty of translating the coefficients of variables generated by using cross-sectional data into coefficients that would fit into a demand relationship based on time-series data. Nonetheless, the results of these studies helped in pointing out how the demand relationship for the present study could be specified.

Proctor and Associates (1980) under contract to the Pacific Fisheries Management Council during 1978, collected and presented sales information, including shipments, on several species, including West Coast groundfish. A similar study was conducted for 1981 by the National Marine Fisheries Service. The purpose of these two studies was to illustrate primary market channels for West Coast groundfish. The latter study by NMFS generated data on shipments of groundfish which were compared to the results of the spatial equilibrium analysis of the present study. The only problem with using these data was that they were fairly complete for the California regions, but included only 50 percent of the processors in Oregon and even less in Washington. In order to use the information it was necessary to extrapolate the data, which may introduce some bias if the population reporting was not representative of the population as a whole.

The most extensive survey to date was recently completed (1983) for the National Marine Fisheries Service. This study included information on U.S. demographics, household demographics of responses to attitudinal questions, species bought by region, species bought by month, and attitude summaries of consumers. However, the full study was not available at the time of execution of this research.

In addition to survey information, the Department of Commerce publishes statistics on regional fish prices in Operation Pricewatch, landings, inventories, imports and apparent consumption of fish products in the Food Fish Market Review and various other statistics, including landings, in publications such as the Fishery Market News. This availability of data has enabled researchers to conduct time series analysis of demand for groundfish on an aggregated basis.

Bockstael (1976) performed an analysis of the demand for several species of groundfish in both fresh and frozen form. Bockstael indicates, in her literature review, that there is a lack of a comprehensive model of the market for interrelated groundfish products incorporating the important elements of inventory and imports. Indeed, most groundfish demand analysis has dealt with ex vessel demand of single species using single equation analysis. Tsoa, Shrank and Roy (TSR) (1982) and Lin (1984) both indicate that this technique leads to serious simultaneous equations bias by not considering how both supply and demand interact to set price.

A finding by Bockstael which was supported by comments received during interviews[1/] conducted with brokers and wholesalers of seafood was that consumers differentiate very little between groundfish species, only slightly more between fresh and frozen products and differentiate seafood primarily at a level that separates broad classes, ie., salmon, halibut, other whitefish and crustaceans. The primary goal of Bockstael's demand analysis was to analyze the impact of imports on U.S. consumer prices. Her technique was to simultaneously estimate supply and demand functions of the principal producing and consuming nations. Excess supply and demand equations were then approximated as the difference between domestic supply and demand at world prices. As in most demand studies of fish, the domestic landings of product are assumed, at least in the short run, to be perfectly price-inelastic; that is, landings are assumed not to be affected by price, but determined solely by capital stocks, weather conditions and biological forces beyond human control (Bockstael 1976; Crutchfield and Zellner 1962; Cullen 1969; TSR 1982).

In the present study, the primary analytical tool is spatial equilibrium analysis, as discussed in Chapter III. Bockstael used log linear transformations of the variables and generated statistically significant results. Unfortunately, log linear

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1/ Interviews were conducted by Richard Johnston, Professor in Agricultural and Resource Economics at Oregon State University and the author during the course of this research.

estimates of demand and supply cannot be used with spatial equilibrium analysis because the functions intersect neither the price nor the quantity axes. Thus, Bockstael's findings are difficult to employ because there is no way to measure the area bounded by the intersection of supply and demand.

Another, more recent, demand study was conducted by Tsoa, Shrank and Roy (TSR). They attempted to estimate the elasticities of demand for various groundfish species without actually estimating demand. Rather, they estimated the parameters of a semi-reduced form single equation. TSR's paper made a significant contribution in technique because it was an attempt to remove a considerable amount of simultaneous equations bias, despite the absence of data on supply relationships. According to Lin (1984), the attempt by TSR was flawed by its failure to indicate estimates of import demand and supply, although TSR indicated that lack of necessary data was the reason for neglecting this portion of the model.

Despite some shortcomings, the model postulated is worth examining in some detail. By adapting the inventory adjustment-price expectations model developed by Nerlov, TSR were able to develop equations for a desired stock function, a partial inventories adjustment function, a supplier's adaptive expectations function, and a wholesale demand function. Solving the system simultaneously and performing the appropriate transformations, the authors were able to generate a semi-reduced form single equation. They then used data available from Food Fish Market Review and Outlook to estimate the parameters of this equation. Using real prices and income, TSR (1982) found that the estimated coefficients had unexpected signs. According to theory the expected sign for the price variable would be negative. TSR derived a positive sign for this variable. To overcome this difficulty, nominal prices were used and hypothesized signs were generated. The error in this approach was that it violated the homogeneity conditions, since the estimate neglects changes in price relative to other goods, (inflation) over time (Henderson and Quandt 1971). In fact, there seems to be a very high correlation between nominal price, the CPI and nominal income which could explain the fit they derived. A cursory review of the data used by TSR revealed a possible cause of their difficulty in deriving a price coefficient with the expected sign. In each of the time series of quantity consumed and the corresponding price for that same month for the individual species, there were several pairs where price increased when quantity increased and price decreased when quantity decreased. Comparing the same months that this occurred to observations in the other species it was clear that, often, when the quantity of one species decreased that of another increases, so that the expected price change would not occur or, in many cases, would be the opposite of expectation. This indicated a high degree of substitutability that overshadowed and in some cases altered the expected price quantity behavior. These problems render the empirical results by TSR of lesser value to the completion of the present study. The model described however, was of use and was employed, at least in part, in this analysis.

A Partial Spatial Equilibrium Model

As indicated above, several econometric studies have been conducted on the demand for groundfish products. No empirical analysis has been undertaken to examine factors which affect the distribution of groundfish. However, this issue has been addressed in examining the flow of other food products.

A recent analysis, after which this research was patterned, was conducted by Charbonneau and Marasco (1972). They constructed a spatial equilibrium analysis of the U.S. oyster market. Their purpose was to ascertain the effect changes in the cost of production would have on the distribution of product. Charbonneau and Marasco used an interregional competition model adapted from Takayama and Judge (1964) and Lee and Seaver (1971). Because a similar model is used in the present study, the work by Charbonneau and Marasco is reviewed here in some detail.

The model used estimated supply and demand for each region. Using a quadratic programming algorithm, they then generated estimates of shipments which would satisfy the requirement of demand for each region while simultaneously maximizing consumer surplus and minimizing transportation cost based on movement of product from supply sources to demand destinations. The resulting solution, then, should approximate that which would be generated under perfectly competitive conditions (see Samuelson, 1953).

The model included linear estimates of demand and supply where N spatially separate markets (or regions) were assumed and demand and supply functions for a single commodity in the i^{th} region were

Then if r_{ij} is negative (meaning the difference in price is greater than transportation cost) shipment may occur. Profit in a region induces a flow of product to that region until the movement eliminates that profit at the margin. Negative profit would cause a reduction in flow, until r_{ij} on the marginal unit shipped was ≥ 0. Charbonneau and Marasco expressed the equilibrium condition where profit is driven to zero in a region as:

$$r_{ij} \, X_{ij} = 0$$

The system of equations was solved by equating the two demand relationships and transferring price to the left hand side so that the general form appeared as:

$$\sum_{i=1}^{N} X_{ij} - \beta_j P_j = \alpha_j + \sum_{m=1}^{K_i} \delta_{jm} Z_m + U_j$$

and equating the supply equations such that:

$$\sum_{j=1}^{N} X_{ij} - \beta_i P_i = A_i + \sum_{m=1}^{K} C_{im} Z_m + V_i$$

These equations along with $r_{ij} = T_{ij} - (P_j - P_i)$ and $r_{ij} x_{ij}$ are included in a spatial simplex tableau which is solved for equilibrium values of price, consumption and shipments from region to region.

The actual model of demand was represented, for any region i,

$$Q_t^D = \beta_0 + \beta_1 P_t + \beta_2 Y_t + U_t$$

where Q_t^D is the wholesale quantity of oysters demanded in time t, P_t is the wholesale price in time t, and Y_t is total personal income in time t.

The actual model of supply was represented for region i by

$$Q_t^S = \alpha_0 + \alpha_1 (\sum Q_{t-1}^S) + \alpha_2 (M_t) + V_t$$

where Q_t^S is the quantity supplied in time t, $\sum_{j=1} Q_{t-1}^S$ is the one year lagged national supply of oysters, and M_t is the marketing margin, defined as wholesale price minus the landings price for oysters.

The regional price coefficients, projected supply and interregional transport costs were solved simultaneously. Once these values were derived, the cost of production was changed and the system was re-solved for new price, shipments and regional disappearance. This analysis of sensitivity to change was the activity of most interest and the technique selected for conducting the present research. The next chapter on methodology will describe how several of the techniques described in chapter II are adapted for use in this research.

Chapter III. CONCEPTUAL FRAMEWORK AND METHODOLOGY

The objective of this research is to determine if local regulations have greater than local impacts on the movement of groundfish in general and West Coast groundfish in particular. The technique chosen to accomplish this objective is spatial equilibrium analysis. The program used is one developed by McCarl et al. (1983) known as "SEBEND." (This program and the associated documentation will be available to other researchers in the form of an Agricultural Experiment Station bulletin available from Oregon State University.)

Users of spatial equilibrium models attempt to maximize an objective function containing supply and demand relationships, transportation rates and other constraining factors. The system of equations and costs is solved by satisfying market conditions in both supply and demand regions and minimizing the total cost of that product movement. Products flow from surplus supply regions to surplus demand regions when the price generated in the surplus demand region (P_D) exceeds the price in the surplus supply region (P_S) plus the cost of transportation (C_T). Product flows into a surplus demand region until P_D falls to a point where $P_D = P_S + C_T$. The expectation is that consumer and producer surplus will be maximized while transportation costs are minimized, thereby approximating a model of a competitive market.

The point where $P_D \geq P_S + C_T$ is an equilibrium condition for the spatial equilibrium model. The assumption from this is that, at equilibrium, prices from region to region can vary at most by the cost of transportation (including miscellaneous marketing costs). Use of such a model is justified on the grounds that the U.S. groundfish market is highly competitive. As indicated in Chapters I and II there is substantial degree of substitution among groundfish species from both domestic and foreign sources. The perfectly competitive model then appears to be an appropriate framework within which to examine product distribution.

The Model

To better illustrate, a simple graphic example is represented by Figure 2; an inter-regional trade model.

Graph 1 represents the supply and demand curves for a surplus supply region. Graph 2 represents the supply and demand curves for a surplus demand region. By comparing the two graphs, it is evident that equilibrium price P_D for excess demand is higher than the equilibrium price P_S for the excess supply market. If the price in the surplus supply market is greater than P_S, the market will be oversupplied and demand will be reduced. If the price in the surplus demand region is reduced, then excess demand will result when supply is reduced.

In Graph 3 the curve labelled "demand" is derived as the horizontal difference between the supply and demand in the surplus demand region, (ex. $q^1 - q^0 = \overline{OQ}_t$) for the excess demand market.

The supply curve is derived from the excess supply region and is the difference in quantity demanded and supplied at various

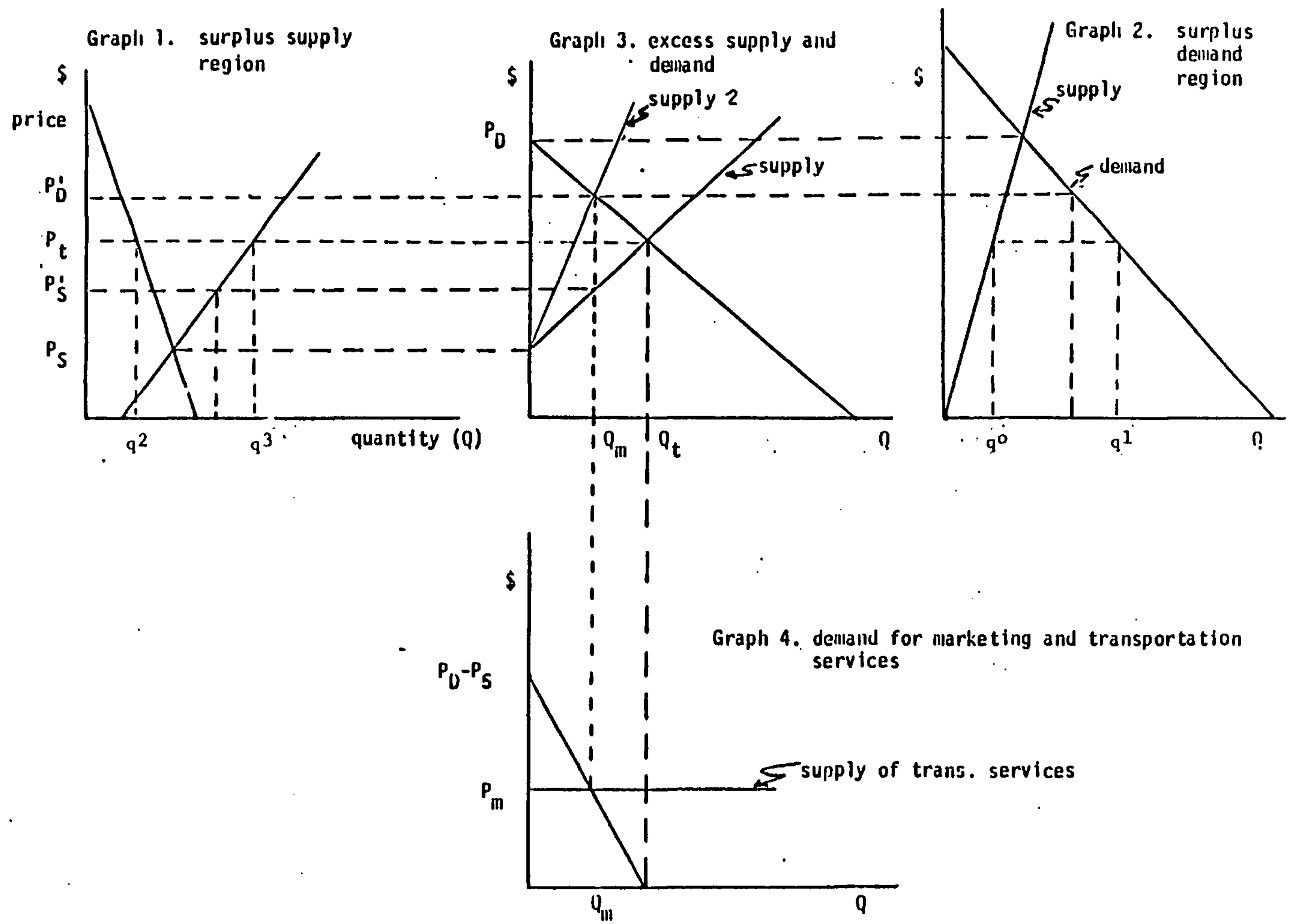

Figure 2. An Inter-Regional Trade Model

prices (ex. $\overline{OQ}_t = q_3 - q_2$).

In the fourth graph, the demand for marketing services (including the demand for transportation) is derived by looking at the differences between the demand and supply prices associated with the various quantities exchanged, i.e. the vertical differences between demand and supply in Graph 3. If marketing services had a zero cost, then the quantity of that service demanded would be Q_t. If marketing services cost more than $P_D - P_S$, there will be zero quantity demanded for that service (it costs more to market than is available to pay for the service).[2/]

In this illustration transportation and marketing costs have the effect of shifting the slope of the supply function in Graph 3 to the left so that the supply function intersects the demand function at P_D' (represented by supply 2).

Simplistically, considering Figure 2 to represent the entire market for a commodity, Graph 1 represents the total supply in the excess supply regions, Graph 2 represents total demand in the excess demand regions and Graph 3 represents total export supply and demand. Graph 4 represents the total demand and supply of marketing services.

P_S' is the price realized by the supplier, P_D' is the price realized by the demander and P_m, the difference between P_S' and P_D',

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2/ It is assumed here that the ratio between the quantity of product shipped between regions and the quantity of marketing required to ship is constant.

(See Map Pocket)

Figure 3. Graphic Representation of Changes in Demand from Scenario to Scenario Within One Region; The Northeast

is the portion of the price realized by the transporter. This should look very familiar to the equilibrium condition for spatial equilibrium where P_m is the same as the cost of transportation.

Within the spatial equilibrium framework, the area of the triangle $(P_S,0)$, (P_D,Q_m), $(P_D,0)$ is maximized by minimizing the sum of the supply cost for each of the product shipments while satisfying the condition that total quantity supplied equals total quantity demanded.

Because of unavailability of data, at the present time, this analysis relies on perfectly price inelastic supply curves. In the framework of Figure 2, the supply curves used in this research are represented by vertical lines intersecting the demand functions in Graphs 1 and 2 at P_S and P_D respectively.

Transportation Information and Transportation Routes

Transportation rates were collected directly from sources providing service to the industry or by an engineering approach. The engineering approach is described by Boles (1977). In general, the rates were fairly uniform and where cross checks of actual versus calculated rates were conducted, the two were similar. A primary difficulty in using spatial equilibrium models was that there were no clearly defined criteria to determine the magnitude and location of markets. Furthermore, for geographically large areas, it was necessary to select a representative transportation rate figure which would be appropriate for locations within the region. Thus, for each region a "center" was selected for use in estimating transportation rates.

Since all markets cannot be identified in the model, some aggregation must be done. This may introduce a certain amount of error; however, some indication of magnitude of the error may be obtained via sensitivity analysis (e.g., determining the changes in "optimum" distribution patterns associated with changes in assumed transportation rates). In this analysis the regions chosen were based on knowledge of product movement from the West Coast.[3/]

The chosen supply regions include: The East Coast, Alaska, an import region, the Bay Area, South (California), Northern California, the Oregon Coast and Washington. The demand regions include: the North Pacific region (centered in Seattle); Oregon (centered in Portland); Northern California (centered at San Francisco); Southern California (identified by Los Angeles and San Diego); the Southwest (associated with Denver, Colorado; Phoenix, Arizona; and Dallas, Texas); the Mid-U.S. (Chicago); the East Coast (New York) and the Southeast Coast (Atlanta). Transport rates are identified from each supply region to each demand region as outlined earlier. Here, it was assumed that unit transport rates were constant. In Figure 2 this is represented as a perfectly price-elastic supply curve for marketing services (Graph 4).

3/ Professor William Jensen at Lewis and Clark College (previously Executive Director of the West Coast Fisheries Development Foundation) was very helpful in this regard.

Supply and Demand Equations

The supply relationship consists of two components plus inventory. The first component is domestic production. It is argued that supply from domestic production is perfectly price inelastic. That is, price has little effect on the quantity supplied, at least in the short run. The essential constraint involves the fairly high fixed cost associated with the initial investment after deciding which fishery to enter. Once the decision to enter a particular fishery has been made it is better to stay with that fishery even when price fluctuates because of the high fixed cost associated with switching to a new fishery and revenues lost while taking time to switch. The short run scenario is examined because of the lack of a simple method for establishing a long run supply function, the extensive diversity among the groundfish fleet and because of the lack of data needed to estimate the supply function for each region. The short run scenario is also due to the imposition of harvest limits on the entire fleet. Once the harvest limit is reached, price has no effect on increasing landings. In this context then, it appears that factors which might influence supply domestically are beyond human control and involve such things as the weather and size of biological stocks. This appears reasonable in view of the decision to use monthly data in the analysis, permitting examination of intra-seasonal movement of both product and prices.[4/]

[4/] Suppliers to and from particular parts may be sensitive to prices, however. Further, research on this subject is appropriate.

The second component of supply is imports, where imports are a function of world landings, exchange rates, inventories, time of year, prices of substitutes, U.S. income and groundfish prices and prices and income in other countries. Due to the unavailability of monthly data it is not currently possible to estimate the import supply function. Therefore, it is assumed that the import supply of groundfish is perfectly price-inelastic. This assumption introduces error to the system. Reducing this error by greater data acquisition is recommended for future efforts. However, for the purposes of this research, a perfectly price inelastic supply function is probably adequate in view of the short run nature of the analysis.

Inventory figures are not included as input in the analysis, but are calculated implicitly within the model. That is, storage is permitted within the model at a unit cost assumed to be uniform for all locations.

Justification for monthly analysis is based on the fact that availability of product (or lack of availability) is a primary reason for changing suppliers or sources of product. Yearly analysis provides too much aggregation and reduces the influence of seasonal availability differences.

Estimation of the demand relationship is the next step in this analysis. It is postulated that demand is a relationship between the quantity of a commodity consumed and its price, the income of consumers, the prices of substitutes for that commodity, the prices of complementary goods and time of year. Other variables that could have an influence, as was pointed out in Chapter II, include race, marital status of household head, geographic location, population density (urbanization), household size, education level, occupation and others. (Capps, 1982, Perry 1981, Nash, 1969.) These factors are not included in this analysis because of lack of data and because they would make the spatial equilibrium analysis too cumbersome. The relationship between price and quantity, for a normal good is expected to be negative. That is, as price increases quantity decreases. Although the relationship between quantity and income and quantity and prices of substitutes may be variable, for the purposes of this analysis, the expected relationship is positive. That is, as income or prices of substitutes increase, the quantity of groundfish consumed is expected to increase.

Data

Ultimately, the availability of data is a constraining factor in the precision and adequacy of this analysis. Data from the Food Fish Market Review (1973-1982) were used to specify quantities of east coast production. West Coast and Alaska production figures were collected from the National Marine Fisheries Service Regional office in Seattle (Joe Terry, personal communications, 1983), the Pacific Fishery Management Council (Hank Wendler, personal communications, 1983), the Oregon Department of Fisheries and Wildlife (Chris Carter, personal communications, 1983), the Pacific Marine Fisheries Commission (PMFC, groundfish statistics, 1973-1982) and the California Department of Fish and Game (personal communications 1983). Ideally, consumption and price data in each of the regions would permit the generation of a demand relationship for each of the regions. At this time, however, acquisition of these data was not possible. Therefore, an attempt was made to estimate the regional demands by disaggregating a demand derived for the nation as a whole. Even data appropriate for deriving national demand were limited. Thus, the demand relationship used in this study was based on relatively few variables.

Theoretically, per capita quantity consumed nationally is assumed to be dependent on price of the product, per capita income, the price of substitutes, the time of year, and other factors. Quantity demanded was calculated by adding beginning inventories, imports and landings of the most predominant species of groundfish on both east and west coast, calculated on a fillet weight basis, and subtracting the ending inventories of those species. For this study, the species list included: cod (Atlantic and Pacific), haddock, flounder, ocean perch (Atlantic and Pacific), soles, rockfish, and sablefish.

The price used in this model was a weighted average price based on wholesale prices reported in the Food Fish Market Review (1972-1982). Wholesale prices for individual West Coast groundfish species were not available. Thus, the weighted price was biased through not including these prices. However, data available from Operation Price Watch, a report of monthly retail prices in 10 U.S. cities, collected by NMFS, were examined. Retail prices of individual West Coast species were found to be highly correlated with average retail prices for species reported in Food Fish Market Review (see Table 1).[5/] The low correlation of fresh rockfish fillets was due, in part, to a lack of observations for several of the months (only 66 observations out of 141 possible were present in the data series) and the missing observations were from several different points in the time series. The missing values were given a value of zero. When the missing observations were removed, the correlation increased to about .7. Here, it appears reasonable to assume, for purposes of the present analysis, that the calculated weighted average price, computed from the Food Fish Market Review data, can be used to approximate the price of groundfish, on a national basis.

Income and population data were collected for the U.S. from Survey of Current Business (1973-1983). The "consumer price index" (CPI) and "wholesale price index" (WPI) were also obtained from this publication.

According to George and King (1971), poultry has the highest cross price elasticity of demand with fish. It was therefore assumed that poultry is very substitutable with groundfish and, thus, the price of poultry was used in this research as the price of a substitute good. All prices and income are deflated by the CPI to

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[5/] Although no further analysis was conducted, there may be other explanations for the higher correlation, i.e., population increases, increases in the CPI and increases in income.

Table 1. Correlation between Prices of Various Species of Groundfish including Two Substitutes

	OPUS	COOFLUS	FLOUNUS	HADUS	TURBUS	FHADUS
OPUS	1.000000	.983623	.994783	.986973	.966563	.829627
COOFLUS	.983623	1.000000	.985573	.989592	.964824	.855968
FLOUNUS	.994783	.985573	1.000000	.994970	.977299	.840305
HADUS	.986973	.989592	.994970	1.000000	.978710	.850425
TURBUS	.966563	.964824	.977299	.978710	1.000000	.837724
FHADUS	.829627	.855968	.840305	.850425	.837724	1.000000
FFLOUN	.808529	.832494	.817295	.825630	.844948	.816621
FOPUS	.900852	.883284	.897839	.895272	.900565	.740225
FROKUS	.471974	.469252	.463376	.464124	.488311	.470800
SOLE	.946626	.926321	.944930	.932967	.929143	.823440
FCOO	.948552	.954360	.949630	.951905	.943126	.836874
CHICWH	.879823	.919709	.882142	.902147	.843096	.811042
CHICBR	.945991	.973014	.955063	.969033	.937930	.853471
	1	2	3	4	5	6

	FFLOUN	FOPUS	FROKUS	SOLE	FCOO	CHICKWH
OPUS	.808529	.900852	.471974	.946626	.948552	.879823
COOFLUS	.883284	.883284	.469252	.926321	.954360	.919709
FLOUNUS	.817295	.897839	.463376	.944930	.949630	.882142
HADUS	.825630	.895272	.464124	.932967	.951905	.902147
TURBUS	.844948	.900565	.488311	.929143	.943126	.842096
FHADUS	.816621	.740225	.470800	.823440	.836874	.811042
FFLOUN	1.000000	.753136	.358827	.787954	.817123	.757244
FOPUS	.753136	1.000000	.425880	.861595	.865136	.767443
FROKUS	.358827	.425880	1.000000	.498007	.484697	.383669
SOLE	.787954	.861595	.498007	1.000000	.916485	.830666
FCOD	.817123	.865136	.484697	.916485	1.000000	.870869
CHICWH	.757244	.767443	.383669	.830666	.870869	1.000000
CHICBR	.825800	.852121	.418780	.897874	.931737	.968624
	7	8	9	10	11	12

	CHICBR
OPUS	.945991
COOFLUS	.973014
FLOUNUS	.955063
HADUS	.969033
TURBUS	.937930
FHADUS	.853471
FFLOUN	.825800
FOPUS	.852121
FROKUS	.418780
SOLE	.897874
FCOO	.931737
CHICWH	.968624
CHICBR	1.000000
	13

OPUS is the 10 city average for frozen ocean perch fillets
COOFLUS is the 10 city average for frozen cod fillets
FLOUNUS is the 10 city average for frozen flounder fillets
HADUS is the 10 city average for frozen haddock fillets
TURBUS is the 10 city average for frozen turbot fillets
FHADUS is the 10 city average for fresh haddock fillets
FFLOUN is the 10 city average for fresh flounder fillets
FOPUS is the 10 city average for fresh ocean perch fillets
FROKUS is the 10 city average for fresh rock fish fillets
SOLE is the 10 city average for fresh sole fillets
FCOO is the 10 city average for fresh cod fillets
CHICWH is the 10 city average for whole chickens
CHICBR is the 10 city average for chicken breasts

remove any effect inflation may have had on price and to satisfy the conditions of homogeneity in demand functions (Henderson and Quandt, 1971).

Demand Equation for Groundfish

The demand equation was estimated using two stage least squares (2SLS). 2SLS was used to reduce some of the simultaneous equations bias generated by not including explicit supply functions in a system of equations to simultaneously estimate supply and demand (Hanushek and Jackson, 1977, Wonnacott and Wonnacott, 1979). The first structural equation was based on the theoretically formulated equation for demand:

$$ATC = f(RAP, RY, RPPC)$$

where

ATC is the per capita consumption;

RAP is the real weighted average price;

RY is the real income, and

RPPC is the real price of poultry.

The second structural equation was an implicit supply function expressed in the form of a demand for ending inventories by wholesalers of groundfish.

The function is expressed as:

$$EI = g(QS, RAP)$$

where

EI is the per capita ending inventory

QS is the per capita total product supplied

RAP is the real weighted average

an identity equation exists where

$$QS = ATC - EI$$

expressing the structural equations as:

$$ATC = \beta_0 + \beta_1 RAP + \beta_2 RY + \beta_3 RPPI,$$

$$EI = \gamma_0 + \gamma_1 RAP + \gamma_2 QS, \text{ and}$$

$$ATC = QS - EI$$

Then,

$$ATC = QS - (\gamma_0 + \gamma_1 RAP + \gamma_2 QS)$$

and since

$$ATC = \beta_0 + \beta_1 RAP + \beta_2 RY + \beta_3 RPPI$$

therefore,

$$QS - \gamma_0 - \gamma_1 RAP - \gamma_2 QS =$$

$$\beta_0 + \beta_1 RAP + \beta_2 RY + \beta_3 RPPI$$

from which it follows that

$$-(\gamma_1 RAP + \beta_1 RAP) =$$

$$-(1 - \gamma_2)QS + \gamma_0 + \beta_0 + \beta_2 RY + \beta_3 RPPI$$

thus,

$$RAP = -\frac{\gamma_0 + \beta_0}{\gamma_1 + \beta_1} + \frac{1 - \gamma_2}{\gamma_1 + \beta_1} QS - \frac{\beta_2}{\gamma_1 + \beta_1} RY - \frac{\beta_3}{\gamma_1 + \beta_1} RPPI$$

Let

$$\pi_0 = \frac{\gamma_0 + \beta_0}{\gamma_1 + \beta_1}, \quad \pi_1 = \frac{1 - \gamma_2}{\gamma_1 + \beta_1}, \quad \pi_2 = \frac{-\beta_2}{\gamma_1 + \beta_1},$$

$$\pi_3 = \frac{-\beta_3}{\gamma_1 + \beta_1}$$

The first stage reduced form equation is

$$RAP = \pi_0 + \pi_1 QS + \pi_2 RY + \pi_3 RPPI.$$

The second stage of the 2SLS system is to include the calculated value for RAP in the first structural equation:

$$ATC = \beta_0 + \beta_1 RAP + \beta_2 RY + \beta_3 RPPC + \beta_4 D_1 \dots + \beta_{14} D_{11}$$

where values of RAP in the first equation are generated by applying ordinary least squares regression to the reduced form equation.

Also included in this equation was a method to adjust for seasonality differences using monthly binary variables where

D_1 is equal to 1 for February and zero for the other 11 months

D_2 is equal to 1 for March and zero for the other 11 months and so on

January is represented by a zero for all 12 months and is included in the constant term, C or β_0.

The results of the regression are presented in Table 2.

Next, all of the variables except price were collapsed into the constant term by multiplying the coefficient of the variable by the average value for that variable. This generated 12 separate equations, one for each month containing only the dependent variable, constant term and the price variable.

These 12 equations were then disaggregated to represent the 8 demand regions by multiplying the constant term and price coefficient by the population for each region, thereby correlating per capita demands to total regional demands. A further adjustment in the constant was made to reflect differences between regions based on income. This manipulation yielded 96 separate demand equations representing the 8 regions and 12 months for the year 1981. This year was selected because data were available for comparison to results of the spatial equilibrium model.

Using the computer program provided by McCarl et al. (1983), the regional demands, transportation rates, and the supply of groundfish were then employed in the spatial equilibrium analysis. The program was then run to generate the optimal shipments from supply points to demand points. Also included in the model were

Table 2. Estimate of Regression Coefficients Where the Dependent Variable is ATC, the Per-Capita Consumption.

Right-Hand Variable	Estimated Coefficient	Standard Error	T-Statistic
C	.312383	.108341	2.88334
RAPF	-2.61911	.508784	-5.14779
RY	23.9419	3.60287	6.64522
RPPI	.431681	.807152E-01	5.34819
D1	.178565E-01	.901613E-02	1.98051
D2	.514483E-01	.898702E-02	5.72473
D3	.270942E-01	.929533E-02	2.91481
D4	.243464E-01	.928801E-02	2.62127
D5	.351652E-01	.905473E-02	3.88363
D6	.210814E-01	.901417E-02	2.33869
D7	.987098E-02	.895088E-02	1.10279
D8	.184356E-01	.905110E-02	2.03683
D9	.162874E-01	.906707E-02	1.79632
D10	-.162352E-01	.893993E-02	-1.81603
D11	-.210981E-01	.894239E-02	-2.35934

RAPF is the fitted price from the first stage, RY is the real income, RPPI is the real poultry price, and D1 through D11 are the monthly binary variables to adjust for seasonality.

arcs[6/] which allow storage of product at a cost of about .0015[7/] per pound per month. The results are displayed in Chapter IV.

The final two steps were to alter product availability from the West Coast and to alter intrastate transport costs in California. The changes in product availability were based on expectations of occurrence and limitations imposed by various regulations. Regulation changes by the PFMC receive particular attention.

[6/] The routes product can take from supply point to demand point.

[7/] All costs, rates and prices are 1981 values expressed in 1967 dollars, i.e., 1967 = 100, 1981 = 269.

Chapter IV. RESULTS

The results of the spatial equilibrium analysis are presented in Tables 3 through 17. Tables 3, 8, and 13 are the results of the initial input and are used as the results to which all other tables are compared. Tables 4, 9, and 14 are the results generated by the first change in input where a reduction in harvest in the Oregon region of 902,000 pounds per month for 12 months was made. Tables 5, 10, and 15 are the results generated by the second change in input where a reduction in harvest in the oregon region of 1.8 million pounds per month for the last 6 months was made. Tables 6, 11, and 16 are the results generated by the third change in input where harvest was redistributed from the Oregon region (a reduction of 1.8 million pounds per month for the last 6 months) to the California region (an increase of 902,000 pounds per month in each of the California regions for the last 6 months). Tables 7, 12 and 17 are results generated by the fourth change in input where reductions were made in the intrastate transport cost within California to reflect rates (equivalent) to interstate rates of similar distance.

Equilibrium Quantity and Price

The first set of results, as illustrated in Tables 3 through 7, are equilibrium quantities and prices for each of the five scenarios previously discussed. Quantities are expressed in 1000's of pounds and prices are 1981 values expressed in 1967 dollars. A comparison of the computer results with survey results is made in Chapter V,

Table 3. Equilibrium Quantity and Price Results Generated from the Initial Input

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
SEATTLE	QUANTITY	689.1	718.2	863.4	738.6	799.9	786.4	832.7	816.9	921.4	810.4	671.5	708.0	9356.6
	PRICE	.490	.490	.480	.490	.480	.490	.480	.480	.490	.480	.490	.480	
PORTLANO	Q	375.8	394.1	446.9	406.9	407.1	436.8	427.7	417.8	521.5	413.7	364.9	349.5	4962.6
	P	.490	.490	.490	.490	.490	.490	.490	.490	.490	.490	.490	.490	
BAY AREA	Q	2570.9	2665.3	3123.3	2730.9	2918.4	2885.7	3024.3	2973.2	3321.8	2952.4	2514.4	2621.5	34302.1
	P	.500	.500	.490	.500	.490	.500	.490	.490	.500	.490	.500	.490	
SOUTHERN CAL	Q	5395.3	5613.6	6675.4	5765.7	6201.7	6123.5	6446.7	6328.3	7132.1	6280.4	5264.8	5514.6	72742.1
	P	.510	.510	.500	.510	.500	.510	.500	.500	.510	.500	.510	.500	
SOUTHWEST	Q	793.6	1203.4	1589.3	1296.6	1298.9	1515.8	1448.9	1376.8	2133.8	1347.0	989.9	878.0	15862.1
	P	.560	.550	.550	.550	.550	.550	.550	.550	.550	.550	.550	.550	
NORTHEAST	Q	15448.1	16163.0	18227.5	16661.6	20971.0	20698.8	18909.4	17089.9	21141.5	16930.9	13587.1	12988.2	208816.8
	P	.520	.520	.520	.520	.490	.500	.510	.520	.520	.520	.530	.530	
MIO U.S.	Q	6115.1	6627.2	8104.1	6984.4	10288.8	10020.6	8665.7	7289.8	10189.9	7176.7	5809.6	5381.1	92652.9
	P	.530	.530	.530	.530	.500	.510	.520	.530	.530	.530	.530	.530	
SOUTHEAST	Q	3250.0	3875.9	5681.0	4311.2	8590.0	8181.7	6446.3	4685.3	8228.7	4547.3	2875.9	2352.4	53025.8
	P	.530	.530	.530	.530	.500	.510	.520	.530	.530	.530	.530	.530	

Quantities are expressed in 1000's of pounds.

Prices are 1981 values expressed in 1967 dollars.

Table 4. Equilibrium Quantity and Price Results Generated by the First Change; A Reduction of 902 Thousand Pounds per Month for 12 Months

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
SEATTLE	QUANTITY	619.5	709.5	854.7	730.0	791.2	777.8	763.2	808.3	912.9	801.8	662.9	638.5	9070.3
	PRICE	.502	.492	.482	.492	.482	.492	.492	.482	.492	.482	.492	.492	
PORTLAND	Q	330.9	388.5	441.3	401.3	401.6	431.3	422.1	412.2	515.9	408.2	359.3	344.0	4856.4
	P	.502	.492	.492	.492	.492	.492	.492	.492	.492	.492	.492	.492	
BAY AREA	Q	2358.8	2638.9	3097.0	2704.5	2892.0	2859.3	2812.1	2946.8	3295.4	2926.0	2488.1	2409.3	33428.2
	P	.512	.502	.492	.502	.492	.502	.502	.492	.502	.492	.502	.502	
SOUTHERN CAL	Q	4901.8	5552.2	6614.0	5704.3	6140.4	6062.1	5953.2	6267.0	7070.8	6219.0	5203.5	5021.1	70709.4
	P	.522	.512	.502	.512	.502	.512	.512	.502	.512	.502	.512	.512	
SOUTHWEST	Q	743.0	1162.7	1548.7	1256.0	1258.3	1475.2	1408.2	1336.1	2093.2	1306.4	949.3	837.4	15374.7
	P	.562	.552	.552	.552	.552	.552	.552	.552	.552	.552	.552	.552	
NORTHEAST	Q	15244.7	15959.6	18024.1	16458.2	20767.6	20495.4	18706.0	16886.5	20938.1	16727.5	13388.7	12784.8	206376.3
	P	.522	.522	.522	.522	.492	.502	.512	.522	.522	.522	.532	.532	
MID U.S.	Q	5959.1	6471.2	7949.1	6828.4	10132.8	9864.6	8509.7	7133.9	10033.9	7020.7	5653.6	5225.1	90780.9
	P	.532	.532	.532	.532	.502	.512	.522	.532	.532	.532	.532	.532	
SOUTHEAST	Q	3048.1	3674.0	5479.1	4109.3	8388.1	7979.8	6244.4	4483.4	8026.7	4345.4	2674.0	2150.5	60602.6
	P	.532	.532	.532	.532	.502	.512	.522	.532	.532	.532	.532	.532	

Quantities are expressed in 1000's of pounds.

Prices are 1981 values expressed in 1967 dollars.

Table 5. Equilibrium Quantity and Price Results Generated by the Second Change; A Reduction of 1.804 Million Pounds per Month in the Last 6 Months

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
SEATTLE	QUANTITY	683.0	712.1	857.3	732.5	793.8	780.3	765.7	750.0	854.5	743.5	604.6	701.9	8979.1
	PRICE	.491	.491	.481	.491	.481	.491	.491	.491	.501	.491	.501	.481	
PORTLAND	Q	371.8	390.2	443.0	402.9	403.2	432.9	423.7	413.8	478.2	409.8	321.6	345.6	4836.8
	P	.491	.491	.491	.491	.491	.491	.491	.491	.501	.491	.501	.491	
BAY AREA	Q	2552.3	2646.7	3104.7	2712.3	2899.8	2867.1	2819.9	2768.8	3117.4	2748.0	2310.0	2602.9	33149.8
	P	.501	.501	.491	.501	.491	.501	.501	.501	.511	.501	.511	.491	
SOUTHERN CAL	Q	5352.0	5570.3	6632.1	5722.4	6158.4	6080.2	5971.3	5852.9	6656.7	5804.9	4789.4	5471.3	70061.9
	P	.511	.511	.501	.511	.501	.511	.511	.511	.521	.511	.521	.501	
SOUTHWEST	Q	755.0	1174.7	1560.7	1268.0	1270.3	1487.3	1420.2	1348.1	1819.1	1318.3	675.1	849.4	14946.0
	P	.561	.551	.551	.551	.551	.551	.551	.551	.561	.551	.561	.551	
NORTHEAST	Q	15304.6	16019.5	18084.0	16518.1	20827.5	20555.3	18765.9	16946.4	20998.0	16787.4	13433.6	12844.7	207094.9
	P	.521	.521	.521	.521	.491	.501	.511	.521	.521	.521	.531	.531	
MID U.S.	Q	6005.1	6517.1	7994.1	6874.3	10178.7	9910.6	8555.6	7179.8	10079.8	7066.6	5699.6	5271.0	91332.2
	P	.531	.531	.531	.531	.501	.511	.521	.531	.531	.531	.531	.531	
SOUTHEAST	Q	3107.5	3733.4	5538.6	4168.7	8447.5	8039.3	6303.8	4542.8	8086.2	4404.8	2733.4	2210.0	61316.2
	P	.531	.531	.531	.531	.501	.511	.521	.531	.531	.531	.531	.531	

Quantities are expressed in 1000's of pounds.

Prices are 1981 values expressed in 1967 dollars.

Table 6. Equilibrium Quantity and Price Results Generated by the Third Change; Redistribution of Harvest from Oregon to California

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
SEATTLE	QUANTITY	690.5	719.6	864.8	740.0	801.3	787.8	773.2	757.5	922.8	811.8	672.9	709.4	9251.5
	PRICE	.490	.490	.480	.490	.480	.409	.409	.490	.490	.480	.490	.480	
PORTLAND	Q	376.7	395.0	447.8	407.8	408.0	437.7	428.6	418.7	522.4	414.6	365.8	350.4	4973.4
	P	.490	.490	.490	.490	.490	.490	.490	.490	.490	.490	.490	.490	
BAY AREA	Q	2575.2	2669.6	3127.6	2735.2	2922.6	2889.9	2842.7	2791.6	3326.0	2956.6	2518.7	2625.7	33981.4
	P	.500	.500	.490	.500	.490	.500	.500	.500	.500	.490	.500	.490	
SOUTHERN CAL	Q	5405.2	5623.4	6685.2	5775.5	6211.6	6133.4	6024.5	5906.0	7142.0	6290.2	5274.7	5524.5	71996.1
	P	.510	.510	.500	.510	.500	.510	.510	.510	.510	.500	.510	.500	
SOUTHWEST	Q	790.2	1209.9	1595.9	1303.2	1305.5	1522.3	1455.4	1383.3	2140.4	1353.5	996.4	884.6	15940.5
	P	.560	.550	.550	.550	.550	.550	.550	.550	.550	.550	.550	.550	
NORTHEAST	Q	15480.8	16195.7	18260.1	16694.2	21003.7	20731.5	18942.1	17122.6	21174.2	16963.6	13619.7	13020.9	209209.1
	P	.520	.520	.520	.520	.490	.500	.510	.520	.520	.520	.530	.530	
MID U.S.	Q	6140.2	6652.3	8129.2	7009.4	10313.8	10045.7	8690.7	7314.9	10214.9	7201.7	5834.7	5406.1	92953.8
	P	.530	.530	.530	.530	.500	.510	.520	.530	.530	.530	.530	.530	
SOUTHEAST	Q	3282.5	3908.4	5713.5	4343.6	8622.4	8214.2	6478.8	4717.8	8261.1	4579.8	2908.4	2384.9	63415.3
	P	.530	.530	.530	.530	.500	.510	.520	.530	.530	.530	.530	.530	

Quantities are expressed in 1000's of pounds.

Prices are 1981 values expressed in 1967 dollars.

Table 7. Equilibrium Quantity and Price Results Generated by the Fourth Change; A Reduction in Intra-State Transport Costs for California

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
SEATTLE	QUANTITY	660.3	628.6	751.8	627.1	831.8	818.4	747.4	722.9	827.4	594.7	455.8	679.3	8345.7
	PRICE	.495	.505	.498	.503	.475	.485	.494	.496	.506	.516	.526	.485	
PORTLAND	Q	317.9	297.0	374.9	295.6	427.8	418.2	372.6	357.1	421.5	274.5	186.3	331.0	4074.3
	P	.505	.515	.508	.518	.485	.495	.504	.506	.516	.526	.536	.495	
BAY AREA	Q	2483.2	2391.8	2782.8	2390.4	3015.9	2983.2	2763.9	2686.2	3034.8	2293.8	1855.9	2533.8	31215.7
	P	.505	.515	.508	.518	.485	.495	.504	.506	.516	.526	.536	.495	
SOUTHERN CAL	Q	5191.3	4977.4	5883.3	4973.7	6428.5	6350.3	5841.0	5660.9	6464.7	4748.7	3733.1	5310.6	65563.6
	P	.515	.525	.518	.528	.495	.505	.514	.516	.526	.536	.546	.505	
SOUTHWEST	Q	934.7	782.2	1351.1	722.3	1735.2	1660.0	1333.9	1221.0	1692.0	619.0	.0	1029.1	13136.4
	P	.555	.565	.558	.568	.535	.545	.554	.556	.566	.576	.585	.545	
NORTHEAST	Q	16204.5	15486.7	18467.1	15468.5	20290.3	20018.1	18334.0	17742.7	20361.6	14718.3	11374.5	16609.9	205076.1
	P	.515	.525	.518	.528	.495	.505	.514	.516	.526	.536	.546	.505	
MID U.S.	Q	7794.2	7207.4	9386.8	7168.2	10865.5	10597.4	9323.2	8889.4	10690.5	6578.5	4112.5	8159.0	100772.7
	P	.515	.525	.518	.528	.495	.505	.514	.516	.526	.536	.546	.505	
SOUTHEAST	Q	5423.5	4626.9	7341.4	4549.1	9336.6	8928.4	7297.5	6755.9	8876.8	3773.0	679.1	5948.4	73536.5
	P	.515	.525	.518	.528	.495	.505	.514	.516	.526	.536	.546	.505	

Quantities are expressed in 1000's of pounds.

Prices are 1981 values expressed in 1967 dollars.

Table 8. Product Flow as a Result of the Initial Input

To	From		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
TO SEATTLE	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	689.1	718.2	863.4	738.6	.0	688.5	828.9	816.9	340.8	.0	671.5	181.2	6537.1
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	799.9	99.0	3.8	.0	580.8	810.4	.0	526.8	2819.4
TO PORTLAND	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	375.8	394.1	448.9	406.9	407.1	436.8	427.7	417.8	521.5	413.7	354.9	349.5	4962.6
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO BAY AREA	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	.0	.0	.0	17.4	513.0	.0	.0	.0	2590.0	170.1	91.6	1217.0	4599.1
		NORTHERN CALIFORNIA	379.8	.0	.0	464.5	1246.9	204.7	.0	1038.3	731.8	.0	731.9	.0	4799.8
		OREGON COAST	2191.1	2665.3	3123.3	2249.0	1158.5	2691.0	3024.3	1934.9	.0	.0	1690.0	679.0	21395.5
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	2782.2	.0	726.5	3508.7
TO SOUTHERN CAL	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	954.0	631.0	640.0	2447.0	1028.0	.0	.0	3195.5	.0	4332.5	70.0	13298.0
		IMPORTS	5395.3	1611.6	3161.1	3312.0	1646.2	848.3	5905.7	4653.2	.0	832.4	.0	4531.9	31897.7
		BAY AREA SOUTH	.0	.0	.0	522.6	.0	.0	.0	.0	.0	.0	.0	.0	522.6
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	99.4	.0	.0	.0	.0	.0	99.4
		OREGON COAST	.0	.0	727.2	.0	2108.5	.0	442.7	1675.1	.0	5448.0	.0	.0	10401.5
		WASHINGTON (P.SOUND)	.0	3046.0	2156.0	1271.0	.0	4247.2	.0	.0	3936.6	.0	932.3	912.8	16521.9
TO SOUTHWEST	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	354.6	1203.4	196.3	1296.6	1298.9	890.8	1448.9	1376.8	2133.8	428.6	.0	878.0	11506.9
		BAY AREA SOUTH	429.0	.0	1391.0	.0	.0	825.0	.0	.0	.0	918.4	989.9	.0	4355.3
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO NORTHEAST	FROM	NORTHEAST	5063.2	7581.0	1770.1	18385.8	10194.9	10240.3	10975.9	4895.0	11491.9	315.9	7472.6	2811.5	89200.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	10384.9	8582.0	16457.4	275.8	10778.1	10458.5	7931.5	12194.9	9547.6	16615.0	6114.5	10176.6	119516.8
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO MID U.S.	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	6115.1	6627.2	8104.1	6984.4	10288.7	10020.6	8566.7	7289.8	10189.8	7176.7	5809.6	5181.1	92652.9
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO SOUTHEAST	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	3250.0	1875.9	5591.0	4311.2	8590.0	8181.7	5446.3	4585.3	8228.7	4547.3	2875.9	2352.4	63025.8
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

Quantities are expressed in 1000's of pounds.

Table 9. Product Flow as a Result of the First Change

To	From		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
TO SEATTLE	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	709.6	.0	273.6	791.2	777.8	763.2	.0	.0	.0	.0	.0	1315.4
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	619.6	.0	854.7	455.4	.0	.0	.0	808.3	912.8	801.8	662.9	638.5	5754.9
TO PORTLAND	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	330.9	388.5	441.3	401.3	401.6	431.3	422.1	412.2	515.9	408.2	359.3	344.0	4856.4
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO BAY AREA	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	.0	.0	.0	.0	527.0	575.6	.0	.0	.0	.0	106.7	1217.0	2425.3
		NORTHERN CALIFORNIA	1385.4	.0	798.3	935.2	.0	504.7	247.1	.0	2762.1	.0	1593.4	.0	8226.2
		OREGON COAST	973.4	2305.6	2298.6	1769.4	2365.0	1779.0	2565.0	2700.0	.0	.0	788.0	78.0	17611.0
		WASHINGTON (P.SOUND)	.0	332.3	.0	.0	.0	.0	.0	238.8	533.3	2926.0	.0	1114.3	5144.7
TO SOUTHERN CAL	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	241.0	.0	1344.0	640.0	2447.0	1028.0	722.0	1059.0	5300.0	.0	447.0	70.0	13298.0
		IMPORTS	3942.9	5552.2	2590.5	4249.7	3539.7	1459.1	5231.2	5208.0	.0	.0	2795.2	4517.9	19085.5
		BAY AREA SOUTH	.0	.0	.0	.0	153.7	.0	.0	.0	.0	2575.0	.0	.0	2728.7
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	3544.0	.0	.0	3544.0
		WASHINGTON (P.SOUND)	717.9	.0	2679.5	814.6	.0	3575.0	.0	.0	1770.8	.0	1951.3	433.2	11952.3
TO SOUTHWEST	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	469.7	1162.7	.0	1012.7	1258.3	1475.2	1408.2	1335.1	2093.2	.0	.0	837.4	11053.7
		BAY AREA SOUTH	273.3	.0	1548.7	243.4	.0	.0	.0	.0	.0	1305.4	949.3	.0	4321.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO NORTHEAST	FROM	NORTHEAST	3164.6	10919.7	441.8	15458.2	11486.5	10874.2	9699.5	4847.9	10891.9	.0	8200.0	2215.7	89200.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	12080.1	5039.9	17582.2	.0	9281.2	9621.3	9005.5	12038.7	10046.2	16727.5	5181.7	10569.1	117176.3
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO MID U.S.	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	5959.1	6471.2	7948.1	6828.4	10132.8	9864.6	8509.7	7133.9	10033.9	7020.7	5653.6	5225.1	91780.9
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO SOUTHEAST	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	3040.1	3574.0	5479.1	4109.3	8389.1	7979.8	6244.4	4483.4	8026.7	4345.4	2674.0	2150.5	60502.6
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

Quantities are expressed in 1000's of pounds.

Table 10. Product Flow as a Result of the Second Change

To	From	Origin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
TO SEATTLE	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	712.1	721.9	71.1	.0	.0	.0	.0	864.5	242.8	.0	507.4	3209.7
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	601.0	.0	135.5	651.4	793.8	780.3	765.7	750.0	.0	500.7	604.5	94.5	5769.5
TO PORTLAND	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	[illegible]	390.2	443.0	402.9	403.2	432.9	423.7	413.8	478.2	409.8	321.6	345.6	4815.8
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO BAY AREA	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	.0	.0	.0	463.3	513.0	.0	511.5	1158.8	.0	.0	1056.0	1217.0	4919.6
		NORTHERN CALIFORNIA	806.2	.0	.0	.0	2386.8	186.1	645.4	.0	3117.4	.0	1209.8	.0	8351.5
		OREGON COAST	1746.2	2646.7	3104.7	2249.0	.0	2681.0	1663.0	1610.0	.0	.0	44.3	123.7	15868.6
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	2748.0	.0	1262.1	4010.1
TO SOUTHERN CAL	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	241.0	713.0	631.0	640.0	1735.4	.0	.0	2163.9	6656.7	400.0	.0	117.0	13298.0
		IMPORTS	5111.0	1801.1	3462.3	3889.0	1156.0	3621.7	5971.3	3689.0	.0	3956.9	.0	4524.9	37181.3
		BAY AREA SOUTH	.0	.0	.0	583.8	.0	.0	.0	.0	.0	.0	.0	.0	583.8
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	691.1	518.3	.0	3267.0	.0	.0	.0	.0	1448.0	.0	.0	5924.4
		WASHINGTON (P.SOUND)	.0	2365.0	2020.5	609.6	.0	2458.6	.0	.0	.0	.0	4789.4	829.4	13072.4
TO SOUTHWEST	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	755.0	1174.7	245.8	1268.0	1270.3	1004.5	1420.2	1348.1	757.1	205.3	675.1	849.4	10973.4
		BAY AREA SOUTH	.0	.0	1314.9	.0	.0	482.7	.0	.0	1062.0	1113.0	.0	.0	3972.6
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO NORTHEAST	FROM	NORTHEAST	4783.2	7345.9	1724.7	16518.1	9280.0	12731.2	10516.9	3506.1	9721.1	2821.1	7761.7	2400.0	[illegible]
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	10521.4	8673.6	16359.3	.0	11547.5	7824.1	8149.0	13440.3	11276.9	13966.3	5591.9	10444.7	117994.9
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO MID U.S.	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	6005.1	6517.1	7994.1	6074.3	10178.7	9910.6	8555.6	7179.8	10079.8	7066.6	5699.6	5271.0	91312.2
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO SOUTHEAST	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	3107.5	3733.4	5538.6	4158.7	9447.5	8010.3	6103.8	4542.8	8085.2	4404.8	2733.4	2210.0	61316.2
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

Quantities are expressed in 1000's of pounds.

Table 11. Product Flow as a Result of the Third Change

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
TO SEATTLE	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	690.5	719.6	864.8	716.1	.0	797.8	773.2	753.3	922.8	50.4	672.9	27.8	6979.2
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	23.9	801.3	.0	.0	4.2	.0	761.4	.0	601.6	2272.3
TO PORTLAND	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	376.7	395.0	447.8	407.8	408.0	437.7	428.6	418.7	522.4	414.6	365.8	350.4	4973.4
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO BAY AREA	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	.0	.0	.0	.0	513.0	.0	1375.7	690.6	.0	.0	.0	1609.7	4189.0
		NORTHERN CALIFORNIA	825.5	.0	.0	486.2	1246.0	.0	.0	2101.0	1148.8	.0	2420.7	.0	8235.2
		OREGON COAST	1749.7	2669.6	3127.6	2249.0	.0	2889.9	1467.0	.0	.0	.0	90.0	78.0	14320.7
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	1163.7	.0	.0	.0	2177.2	2956.6	.0	938.1	7235.5
TO SOUTHERN CAL	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	954.0	631.0	640.0	.0	3475.0	722.0	.0	6185.3	.0	620.7	70.0	13298.0
		IMPORTS	5405.2	1621.4	2738.0	3888.4	3254.6	1311.3	727.7	5906.0	.0	1067.7	3847.0	4888.1	34655.4
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	2113.0	.0	.0	2113.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	1257.6	.0	.0	51.6	.0	.0	1309.2
		OREGON COAST	.0	.0	1160.2	.0	2957.0	101.1	.0	.0	.0	3058.0	.0	.0	7276.3
		WASHINGTON (P.SOUND)	.0	3048.0	2156.0	1247.1	.0	1246.0	3317.1	.0	956.7	.0	807.0	566.4	13344.2
TO SOUTHWEST	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	361.2	1209.9	202.9	763.2	1305.5	897.3	1455.4	.0	.0	1353.5	117.7	.0	7555.5
		BAY AREA SOUTH	429.0	.0	1393.0	540.0	.0	625.0	.0	1383.3	2140.4	.0	878.8	884.6	8274.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO NORTHEAST	FROM	NORTHEAST	5169.8	7687.6	1443.7	16498.9	11900.0	10800.0	5894.7	4861.3	9450.2	1556.3	11527.5	2400.0	89200.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	10311.0	8508.0	16816.4	195.3	9103.7	9931.5	13047.4	12261.3	11723.9	15397.3	2092.3	10620.9	120009.1
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO MID U.S.	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	6140.2	6652.3	8129.2	7009.4	10313.8	10045.7	8690.7	7314.9	10214.9	7201.7	5834.7	5406.1	92953.8
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO SOUTHEAST	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	3282.5	3908.4	5713.5	4343.6	8622.4	9214.2	6478.8	4717.7	8261.1	4579.8	2908.4	2384.9	63415.3
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

Quantities are expressed in 1000's of pounds.

Table 12. Product Flow as a Result of the Fourth Change

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
TO SEATTLE	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	660.3	628.6	751.8	627.1	831.8	818.4	747.4	722.9	827.4	594.7	455.8	679.3	8345.7
TO PORTLAND	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	297.0	374.9	218.7	427.8	.0	.0	.0	421.5	236.4	.0	.0	1976.2
		OREGON COAST	317.9	.0	.0	76.9	.0	418.2	372.6	.0	.0	38.1	186.3	331.0	1741.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	357.1	.0	.0	.0	.0	357.1
TO BAY AREA	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		BAY AREA SOUTH	155.2	.0	.0	218.3	.0	625.0	4.6	.0	437.8	.0	.0	675.9	2116.7
		NORTHERN CALIFORNIA	.0	970.0	625.1	.0	134.7	95.4	.0	1988.3	.0	.0	.0	.0	3811.6
		OREGON COAST	2328.1	1421.8	2157.7	2172.1	.0	2262.8	2759.3	.0	2597.0	2293.8	1855.9	.0	19848.5
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	2881.2	.0	.0	698.0	.0	.0	.0	1857.9	5437.0
TO SOUTHERN CAL	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	241.0	636.5	707.5	640.0	64.4	3410.6	.0	1148.8	5932.2	.0	.0	517.0	13298.0
		IMPORTS	3498.5	2581.9	1301.3	894.2	2262.4	.0	3381.5	.0	.0	1458.5	.0	.0	15378.3
		BAY AREA SOUTH	273.8	.0	1393.0	.0	834.7	.0	956.4	567.0	.0	.0	2793.2	541.1	7359.3
		NORTHERN CALIFORNIA	1178.0	.0	.0	1391.3	.0	2326.1	867.4	.0	.0	.0	939.9	3905.5	10608.3
		OREGON COAST	.0	.0	2481.5	.0	3267.0	.0	.0	3945.1	.0	165.9	.0	347.0	10207.5
		WASHINGTON (P.SOUND)	.0	1759.0	.0	2048.1	.0	613.6	635.6	.0	532.6	3123.3	.0	.0	8712.2
TO SOUTHWEST	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	934.7	782.2	1351.1	772.3	1735.2	1665.0	1333.9	1221.0	1692.0	619.0	.0	1029.1	13135.4
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO NORTHEAST	FROM	NORTHEAST	8355.3	8785.0	4247.7	12652.3	11890.1	10809.9	9270.1	4409.0	11420.9	.0	.0	7359.7	89200.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	7849.2	6701.7	14219.3	2816.3	8400.2	9208.2	9063.9	13333.7	8940.7	14718.3	11374.5	9250.2	115876.1
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO MID U.S.	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	7794.2	7207.4	9386.0	7168.2	10865.5	10597.4	9321.2	8899.4	10690.5	6578.5	4112.5	8159.0	100772.7
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TO SOUTHEAST	FROM	NORTHEAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		ALASKA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		IMPORTS	5423.5	4626.9	7341.4	4549.1	9136.6	8928.4	7297.6	6755.9	8876.8	3773.0	679.1	5948.4	73536.5
		BAY AREA SOUTH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		NORTHERN CALIFORNIA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		OREGON COAST	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
		WASHINGTON (P.SOUND)	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

Quantities are expressed in 1000's of pounds.

Table 13. Storage Quantities as a Result of the Initial Scenario

DEC TO JAN	NORTHEAST	.0000
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	422.2300
	OREGON COAST	.0000
	WASHINGTON	.0000
JAN TO FEB	NORTHEAST	1036.8449
	ALASKA	241.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	155.5621
	OREGON COAST	454.8861
	WASHINGTON	1344.0000
FEB TO MAR	NORTHEAST	1255.8339
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	729.0000
	NORTHERN CAL	310.2545
	OREGON COAST	227.5646
	WASHINGTON	.0000
MAR TO APR	NORTHEAST	7285.7661
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000
APR TO MAY	NORTHEAST	.0000
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000
MAY TO JUN	NORTHEAST	1705.1004
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	2913.1120
JUN TO JUL	NORTHEAST	2264.8007
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000
JUL TO AUG	NORTHEAST	788.9007
	ALASKA	722.0000
	IMPORTS	.0000
	BAY AREA SOUTH	961.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	1379.2471
AUG TO SEP	NORTHEAST	4093.8519
	ALASKA	1781.0000
	IMPORTS	.0000
	BAY AREA SOUTH	1528.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	3157.2471
SEP TO OCT	NORTHEAST	.0000
	ALASKA	3885.2471
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	2597.0000
	WASHINGTON	.0000
OCT TO NOV	NORTHEAST	3684.1292
	ALASKA	4285.4624
	IMPORTS	.0000
	BAY AREA SOUTH	24.4990
	NORTHERN CAL	761.2664
	OREGON COAST	.0000
	WASHINGTON	125.3433
NOV TO DEC	NORTHEAST	411.5492
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000

Quantities are expressed in 1000's of pounds.

Table 14. Storage Quantities as a Result of the First Change

DEC TO JAN	NORTHEAST	184.3098
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	609.0404
	OREGON COAST	.0000
	WASHINGTON	.0000
JAN TO FEB	NORTHEAST	3119.7474
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	155.7280
	NORTHERN CAL	70.7439
	OREGON COAST	770.6283
	WASHINGTON	6.5233
FEB TO MAR	NORTHEAST	.0000
	ALASKA	713.0000
	IMPORTS	.0000
	BAY AREA SOUTH	884.7280
	NORTHERN CAL	239.6525
	OREGON COAST	.0000
	WASHINGTON	1378.2062
MAR TO APR	NORTHEAST	7358.1724
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	422.3833
	WASHINGTON	.0000
APR TO MAY	NORTHEAST	.0000
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	296.6455
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000
MAY TO JUN	NORTHEAST	413.5356
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	128.9834
	NORTHERN CAL	461.1950
	OREGON COAST	.0000
	WASHINGTON	3713.0000
JUN TO JUL	NORTHEAST	339.3827
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	178.3983
	NORTHERN CAL	77.4129
	OREGON COAST	.0000
	WASHINGTON	1569.9643
JUL TO AUG	NORTHEAST	139.8122
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	1139.3983
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	2952.9643
AUG TO SEP	NORTHEAST	3491.9348
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	1706.3983
	NORTHERN CAL	1860.7669
	OREGON COAST	.0000
	WASHINGTON	3683.8518
SEP TO OCT	NORTHEAST	.0000
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	2768.3983
	NORTHERN CAL	176.8108
	OREGON COAST	1695.0000
	WASHINGTON	1826.9922
OCT TO NOV	NORTHEAST	4000.0000
	ALASKA	400.0000
	IMPORTS	1506.4394
	BAY AREA SOUTH	.0000
	NORTHERN CAL	943.6544
	OREGON COAST	.0000
	WASHINGTON	1817.2015
NOV TO DEC	NORTHEAST	.0000
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000

Quantities are expressed in 1000's of pounds.

Table 15. Storage Quantities as a Result of the Second Change

DEC TO JAN	NORTHEAST	.0000
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000
JAN TO FEB	NORTHEAST	1316.7982
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	429.0000
	NORTHERN CAL	.0000
	OREGON COAST	899.8300
	WASHINGTON	661.0274
FEB TO MAR	NORTHEAST	1770.8855
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	1158.0000
	NORTHERN CAL	164.7223
	OREGON COAST	.0000
	WASHINGTON	.0000
MAR TO APR	NORTHEAST	7846.2236
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	507.0900
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000
APR TO MAY	NORTHEAST	428.1635
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	1135.9764
	OREGON COAST	.0000
	WASHINGTON	.0000
MAY TO JUN	NORTHEAST	3048.1241
	ALASKA	711.6137
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	2919.2070
JUN TO JUL	NORTHEAST	1116.8808
	ALASKA	1739.6137
	IMPORTS	.0000
	BAY AREA SOUTH	142.2971
	NORTHERN CAL	711.0234
	OREGON COAST	.0000
	WASHINGTON	1112.3108
JUL TO AUG	NORTHEAST	.0000
	ALASKA	2461.6137
	IMPORTS	.0000
	BAY AREA SOUTH	591.7859
	NORTHERN CAL	996.9064
	OREGON COAST	.0000
	WASHINGTON	1729.5729
AUG TO SEP	NORTHEAST	4693.8773
	ALASKA	1356.7009
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	2856.0611
	OREGON COAST	.0000
	WASHINGTON	2757.5968
SEP TO OCT	NORTHEAST	2372.8198
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	597.0000
	WASHINGTON	4117.0000
OCT TO NOV	NORTHEAST	3551.7027
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	522.3974
	OREGON COAST	.0000
	WASHINGTON	4586.9606
NOV TO DEC	NORTHEAST	.0000
	ALASKA	47.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	45.7267
	WASHINGTON	.0000

Quantities are expressed in 1000's of pounds.

Table 16. Storage Quantities as a Result of the Third Change

DEC TO JAN	NORTHEAST	.0000
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	874.7724
	OREGON COAST	.0000
	WASHINGTON	.0000
JAN TO FEB	NORTHEAST	930.2340
	ALASKA	241.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	160.1323
	OREGON COAST	896.3337
	WASHINGTON	1344.0000
FEB TO MAR	NORTHEAST	1042.6121
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	792.0000
	NORTHERN CAL	312.5395
	OREGON COAST	664.7725
	WASHINGTON	.0000
MAR TO APR	NORTHEAST	73.901700
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000
APR TO MAY	NORTHEAST	.0000
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000
MAY TO JUN	NORTHEAST	.0000
	ALASKA	2446.9999
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	310.0100
	WASHINGTON	1748.0668
JUN TO JUL	NORTHEAST	.0000
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	104.4413
	OREGON COAST	.0000
	WASHINGTON	1934.0882
JUL TO AUG	NORTHEAST	3605.2855
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	585.2690
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000
AUG TO SEP	NORTHEAST	6943.9698
	ALASKA	1059.0000
	IMPORTS	.0000
	BAY AREA SOUTH	78.3657
	NORTHERN CAL	.0000
	OREGON COAST	1610.0000
	WASHINGTON	1773.8482
SEP TO OCT	NORTHEAST	4893.7333
	ALASKA	173.6781
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	2207.0000
	WASHINGTON	.0000
OCT TO NOV	NORTHEAST	7327.4628
	ALASKA	573.6781
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	1658.3730
	OREGON COAST	.0000
	WASHINGTON	.0000
NOV TO DEC	NORTHEAST	.0000
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	977.2271
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000

Quantities are expressed in 1000's of pounds.

Table 17. Storage Quantities as a Result of the Fourth Change

DEC TO JAN	NORTHEAST	3240.3072
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000
JAN TO FEB	NORTHEAST	985.0111
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	683.6598
FEB TO MAR	NORTHEAST	.0000
	ALASKA	76.4950
	IMPORTS	.0000
	BAY AREA SOUTH	729.0000
	NORTHERN CAL	.0000
	OREGON COAST	1016.2248
	WASHINGTON	.0000
MAR TO APR	NORTHEAST	3552.2591
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	1404.1727
APR TO MAY	NORTHEAST	.0000
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	321.7165
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000
MAY TO JUN	NORTHEAST	9.8827
	ALASKA	2382.5804
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	1091.5017
	OREGON COAST	.0000
	WASHINGTON	.0000
JUN TO JUL	NORTHEAST	.0000
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	.0000
	OREGON COAST	.0000
	WASHINGTON	.0000
JUL TO AUG	NORTHEAST	229.8900
	ALASKA	721.9999
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	487.5669
	OREGON COAST	335.0948
	WASHINGTON	.0000
AUG TO SEP	NORTHEAST	4020.8845
	ALASKA	632.1656
	IMPORTS	.0000
	BAY AREA SOUTH	.0000
	NORTHERN CAL	772.2711
	OREGON COAST	.0000
	WASHINGTON	.0000
SEP TO OCT	NORTHEAST	.0000
	ALASKA	.0000
	IMPORTS	.0000
	BAY AREA SOUTH	624.1821
	NORTHERN CAL	1944.7730
	OREGON COAST	.0000
	WASHINGTON	.0000
OCT TO NOV	NORTHEAST	4000.0000
	ALASKA	400.0000
	IMPORTS	2452.7832
	BAY AREA SOUTH	1737.1821
	NORTHERN CAL	2883.3699
	OREGON COAST	352.2076
	WASHINGTON	.0000
NOV TO DEC	NORTHEAST	8200.0000
	ALASKA	447.7078
	IMPORTS	1086.7078
	BAY AREA SOUTH	.0000
	NORTHERN CAL	2952.4536
	OREGON COAST	.0000
	WASHINGTON	351.1584

Quantities are expressed in 1000's of pounds.

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Figure 3 is a graphic representation of the comparison between each of the five scenarios for the Northweast region as an example. Table 20 in the appendix is a tabular comparison of all the demand region quantities and prices to aid the reader in comparing the changes in consumption brought about by changes in the inputs.

In all the scenarios, changes occurred in prices and quantities in response of either supply or transportation cost changes. When product was redistributed from Oregon harvest to California harvest, eastern markets experienced increases in shipments. In most months the Oregon, Washington and California regions also experienced slight increases except during peak demand months of late summer when quantities shipped actually decreased.

Major changes in some other scenarios also occurred where quantity shipped was relatively higher in the early and late months and lower in the summer months. Other observations of change can be noted and the tabular presentation of Table 20 should facilitate comparison.

Product Flow

The second set of results is the product flow generated by the spatial equilibrium analysis. Tables 8 through 12 illustrate the product flow activity that occurred as a result of the five different scenarios.

Again, using the Northeast as an example, significant changes were observed in product movement. In the initial results in Table

8, product was supplied to the Northeast from imports and from the Northeast region. Observe that every month has some supply from each of those sources. In Table 9, the supplies in various months were altered (some were increased, some decreased) with no real pattern to the changes. In fact, in April, the quantity supplied by imports went to zero and in October, the quantity supplied by the Northeast went to zero. Comparing Table 8 to Table 10, the changes in the Northeast region were less significant but still noticeable. Again, in April the quantity supplied by imports went to zero, but during October the quantity supplied by the Northeast increased by 2.5 million pounds.

The most noticeable change in the Northeast that occurred as a result of the last change in inputs, represented by Table 12, was the zero quantity supplied by the Northeast in October and November. Notice also that no zero quantities occurred in the supply from imports to the Northeast.

Another region in which flows were significantly impacted was the Southwest. In this region, the main sources of supply included the California region from the Bay area south, and imports. Again, the changes in flow that occurred followed no apparent pattern and many of the changes were significant alterations from the initial results.

Changes in flow of product also occurred in the Washington, Oregon, Bay area and Southern California regions. As an example, comparing Table 8 to Table 9, significant changes occurred in product movement to the Seattle region. In Table 8, the Northern

California region supplied the January quantity demanded while in Table 9 the January quantity demanded was supplied by the Washington region. Similar changes occurred in other months. In fact, the changes were so great that in total, the quantity supplied by Northern California to Seattle decreased from 6.5 million pounds to 3.3 million pounds while the quantity supplied from the Washington region increased from 2.8 million pounds to 5.75 million pounds. Similar changes were observed when tables 10 through 12 were compared to Table 8.

Many of the changes in product flow were the result of redistribution of product from one region to another. However, some of these changes were the result of another output from the model: storage from month to month.

Storage

Tables 13 through 17 illustrate storage patterns that occurred as a result of changes in the input from month to month occurred in the model when the future price exceeded the previous price plus the storage cost.

Although the changes in storage patterns appear random, they are the result of re-adjustment in price (see Tables 3 through 7 and Table 20) that occurred as a result of changes in the quantities available and costs associated with different routes. The important aspect of these tables to note is not so much the size of the change, but that change in storage patterns occurred at all.

Chapter V. CONCLUSIONS

The hypothesis stated in Chapter I was the basis for development of this conclusion section. The first step in testing the hypothesis was the derivation of a national demand relationship. The inadequacy of previous work by Tsoa, Shrank and Roy (1981) indicated that in order to generate theoretically consistent results a specification for demand had to be based on product groupings other than species by species. TSR's results were based on deriving a demand relationship based on individual species. In order to derive coefficients with theoretically correct signs, TSR had to use nominal prices. This violates basic demand theory homogeneity conditions. The approach used in this research was to recognize the high substitutability of various groundfish products and to aggregate them in the model specification. When Bockstael (1978) performed the same sort of aggregation, but on a regional basis, the linear relationship she derived did not provide a very good fit. She resorted to deriving demand using a log-linear form of equation with good results. However, in order to use the spatial equilibrium framework of the present study, it was necessary to specify linear demand equations. Thus, an attempt was made to estimate demand by aggregating regional quantities and species. Theoretically consistent results were generated. This in itself was not enough to reject the hypothesis of regional markets because the existence of a national demand does not mean regional demands do not exist. The next step was to disaggregate the national demand into various regional demands based on regional population and income characteristics and to insert those demand relationships into a spatial equilibrium model.

The results of product movement generated by the spatial equilibrium model appear to replicate the actual movement of product as reported by the National Marine Fisheries Service survey of primary market channels in 1981 with only slight discrepancies. This result tends to lend support to the validity of the national demand relationship and adds to the evidence for rejecting the hypothesis.

When status quo results of Table 8 were compared to survey results of the National Marine Fisheries Service (Table 21 in the appendix) some routes did not coincide, but the relationship was close enough for the spatial equilibrium model to be employed as a fair simulation of actual market conditions. Table 22 in the appendix compares the two results.

In some instances the model predicted 0 pounds product flow on some arcs while the survey results indicated some product flow. Several explanations for these discrepancies exist. One is that some product flow (as indicated by the survey) was not based on profitability, but rather on market development, i.e., a short-run loss for a long-run gain. Another explanation is that much of the product flow from the West Coast to the Southwest goes through California (Bay Area South). This could explain the 4 million plus pounds following this arc instead of moving from Oregon or Northern California directly to the Southwest.

The third test, altering the set of conditions as input to the algorithm, provided the best information used in helping to reject the hypothesis. For example, the first alteration, reducing product harvested in the Oregon region by a million pounds per month for 12 consecutive months, caused some interesting changes to occur nationally (see Chapter IV).

In order to fail to reject the hypothesis, the expectation would have been that no changes in product movement, demand or price would have occurred in regions such as the northeast. However, after comparing Tables illustrating the results of changes to the status quo results, it appears there was an effect.

Combining the results of the three procedures to test the hypothesis, it appears that the hypothesis can confidently be rejected although no statistical test could be undertaken. This suggests that regulations which appear to be confined to a local or regional scope may, in fact, impact other regions and possibly provide an outcome that is different from the expected.

Because of limitations introduced into the model, (i.e., fixed supplies) the explanatory and predictive capabilities of the model were below what they would be with a more complete data set. Future efforts to use spatial equilibrium as a management tool could be enhanced by refining the inputs to the model. Developing a set of supply functions to represent each of the supplying regions would be one of the first suggestions for increasing the accuracy of the estimates. Another suggestion is to refine the transport rates so that they reflect seasonal variation associated with changes in the demand for that service. A third suggestion is to develop a better formulation of the substitutional relationship so that the full capacity of the quadratic program used to generate product flows could be utilized. Once these refinements are made it would be possible to provide a more confident statement as to specific impacts associated with regulation changes. One possible test would be to determine if regulations designed to provide constant product availability are better for the industry than regulations that cause seasonal variation in availability.

It might also be possible to assess the welfare effects of regulation changes, at least as to how they affect the fishing industry. With this knowledge, a better understanding of regulation impacts could aid in formulating regulations that not only had biological goals, but economic as well.

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APPENDIX

Table 18. Quantities Available From Each of the Supply Regions by Month for 1981.

	Jan	Feb	Mar	Apr	May	Jun
Northeast	6100.0	7800.0	9100.0	11900.0	10800.0	9500.0
Alaska	241.0	713.0	631.0	640.0	2447.0	1028.0
Imports	25500.0	21900.0	33600.0	16300.0	32600.0	30400.0
Bay Area South	429.0	729.0	664.0	540.0	510.0	625.0
Northern California	1178.0	1267.0	1000.0	1610.0	1654.0	1330.0
Oregon Coast	2646.0	2438.0	3623.0	2249.9	3267.0	2681.0
Washington	1344.0	1704.0	2156.0	1271.0	3713.0	1432.0

	Jul	Aug	Sep	Oct	Nov	Dec	Total
Northeast	9500.0	8200.0	7400.0	4000.0	4200.0	2400.0	89200.0
Alaska	720.0	1059.0	5300.0	400.0	47.0	70.0	13298.0
Imports	30400.0	30200.0	30200.0	29600.0	14800.0	23300.0	318700.0
Bay Area South	961.0	567.0	1056.0	1113.0	1056.0	1217.0	9476.0
Northern California	1355.0	2273.0	1594.0	1175.0	1009.0	953.0	16398.0
Oregon Coast	3467.0	3610.0	2597.0	2851.0	1690.0	678.0	31797.0
Washington	1383.0	1778.0	1360.0	3718.0	807.0	2186.0	22852.0

Quantities are expressed in 1000's of pounds.

Table 19. Transport Rates Associated with Individual Routes.

TO SEATTLE	FROM NORTHEAST	.1000
	ALASKA	.1000
	IMPORTS	.0928
	BAY AREA SOUTH	.0260
	NORTHERN CALIFORNIA	.0185
	OREGON COAST	.0167
	WASHINGTON (P. SOUND)	.0074
TO PORTLAND	FROM NORTHEAST	.1000
	ALASKA	.1000
	IMPORTS	.0928
	BAY AREA SOUTH	.0223
	NORTHERN CALIFORNIA	.0150
	OREGON COAST	.0149
	WASHINGTON (P. SOUND)	.0149
TO BAY AREA	FROM NORTHEAST	.1000
	ALASKA	.1000
	IMPORTS	.0928
	BAY AREA SOUTH	.0200
	NORTHERN CALIFORNIA	.0250
	OREGON COAST	.0167
	WASHINGTON (P. SOUND)	.0186
TO SOUTHERN CAL	FROM NORTHEAST	.1000
	ALASKA	.0800
	IMPORTS	.0500
	BAY AREA SOUTH	.0350
	NORTHERN CALIFORNIA	.0390
	OREGON COAST	.0228
	WASHINGTON (P. SOUND)	.0230
TO SOUTHWEST	FROM NORTHEAST	.0900
	ALASKA	.1500
	IMPORTS	.0928
	BAY AREA SOUTH	.0743
	NORTHERN CALIFORNIA	.0817
	OREGON COAST	.0817
	WASHINGTON (P. SOUND)	.0930
TO NORTHEAST	FROM NORTHEAST	.0186
	ALASKA	.2000
	IMPORTS	.0500
	BAY AREA SOUTH	.1200
	NORTHERN CALIFORNIA	.1200
	OREGON COAST	.1200
	WASHINGTON (P. SOUND)	.1200
TO MID U.S.	FROM NORTHEAST	.0200
	ALASKA	.1800
	IMPORTS	.0500
	BAY AREA SOUTH	.1000
	NORTHERN CALIFORNIA	.1000
	OREGON COAST	.1000
	WASHINGTON (P. SOUND)	.1000
TO SOUTHEAST	FROM NORTHEAST	.0200
	ALASKA	.2000
	IMPORTS	.0500
	BAY AREA SOUTH	.1200
	NORTHERN CALIFORNIA	.1200
	OREGON COAST	.1200
	WASHINGTON (P. SOUND)	.1200

Table 20. Comparison of Results for each Scenario and each Demand Region.

SEATTLE

	SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIO 4		SCENARIO 5	
	Q	P	Q	P	Q	P	Q	P	Q	P
JANUARY	689.1	.490	619.6	.502	683.0	.491	690.5	.490	660.3	.495
FEBRUARY	718.2	.490	709.6	.492	712.1	.491	719.6	.490	628.6	.505
MARCH	863.4	.480	854.7	.482	857.3	.481	864.8	.480	751.8	.498
APRIL	738.6	.490	730.0	.492	732.5	.491	740.0	.490	627.1	.508
MAY	799.9	.480	791.2	.482	793.8	.481	801.3	.480	831.8	.475
JUNE	786.4	.490	777.8	.492	780.3	.491	787.8	.490	818.4	.485
JULY	832.7	.480	763.2	.492	765.7	.491	773.2	.490	747.4	.494
AUGUST	816.9	.480	808.3	.482	750.0	.491	757.5	.490	722.9	.496
SEPTEMBER	921.4	.490	912.8	.492	854.5	.501	922.8	.490	827.4	.506
OCTOBER	810.4	.480	801.8	.482	743.5	.491	811.8	.480	594.7	.516
NOVEMBER	671.5	.490	662.9	.492	604.6	.501	672.9	.490	455.8	.526
DECEMBER	708.0	.480	638.5	.492	701.9	.481	709.4	.480	679.3	.485

PORTLAND

	SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIO 4		SCENARIO 5	
	Q	P	Q	P	Q	P	Q	P	Q	P
JANUARY	375.8	.490	330.9	.502	371.8	.491	376.7	.490	317.9	.505
FEBRUARY	394.1	.490	388.5	.492	390.2	.491	395.0	.490	297.0	.515
MARCH	446.9	.490	441.3	.492	443.0	.491	447.8	.490	374.9	.508
APRIL	406.9	.490	401.3	.492	402.9	.491	407.8	.490	295.6	.518
MAY	407.1	.490	401.6	.492	403.2	.491	408.0	.490	427.8	.485
JUNE	436.8	.490	431.3	.492	432.9	.491	437.7	.490	418.2	.495
JULY	427.7	.490	422.1	.492	423.7	.491	428.6	.490	372.6	.504
AUGUST	417.8	.490	412.2	.492	413.8	.491	418.7	.490	357.1	.506
SEPTEMBER	521.5	.490	515.9	.492	478.2	.501	522.4	.490	421.5	.516
OCTOBER	413.7	.490	408.2	.492	409.8	.491	414.6	.490	274.5	.526
NOVEMBER	364.9	.490	359.3	.492	321.6	.501	365.8	.490	186.3	.536
DECEMBER	349.5	.490	344.0	.492	345.6	.491	350.4	.490	331.0	.495

BAY AREA

	SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIO 4		SCENARIO 5	
	Q	P	Q	P	Q	P	Q	P	Q	P
JANUARY	2570.9	.500	2358.8	.512	2552.3	.501	2575.2	.500	2483.2	.505
FEBRUARY	2665.3	.500	2638.9	.502	2646.7	.501	2669.6	.500	2391.8	.515
MARCH	3123.3	.490	3097.0	.492	3104.7	.491	3127.6	.490	2782.8	.508
APRIL	2730.9	.500	2704.5	.502	2712.3	.501	2735.2	.500	2390.4	.518
MAY	2918.4	.490	2892.0	.492	2899.8	.491	2922.6	.490	3015.9	.485
JUNE	2885.7	.500	2859.3	.502	2867.1	.501	2889.9	.500	2983.2	.495
JULY	3024.3	.490	2812.1	.502	2819.9	.501	2842.7	.500	2763.9	.504
AUGUST	2973.2	.490	2946.8	.492	2768.8	.501	2791.6	.500	2686.2	.506
SEPTEMBER	3321.8	.500	3295.4	.502	3117.4	.511	3326.0	.500	3034.8	.516
OCTOBER	2952.4	.490	2926.0	.492	2748.0	.501	2956.6	.490	2293.8	.526
NOVEMBER	2514.4	.500	2488.1	.502	2310.0	.511	2518.7	.500	1855.9	.536
DECEMBER	2621.5	.490	2409.3	.502	2602.9	.491	2625.7	.490	2533.8	.495

SOUTHERN CALIFORNIA

	SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIO 4		SCENARIO 5	
	Q	P	Q	P	Q	P	Q	P	Q	P
JANUARY	5395.3	.510	4901.8	.522	5352.0	.511	5405.2	.510	5191.3	.515
FEBRUARY	5613.6	.510	5552.2	.512	5570.3	.511	5623.4	.510	4977.4	.525
MARCH	6675.4	.500	6614.0	.502	6632.1	.501	6685.2	.500	5883.3	.518
APRIL	5765.7	.510	5704.3	.512	5722.4	.511	5775.5	.510	4973.7	.528
MAY	6201.7	.500	6140.4	.502	6158.4	.501	6211.6	.500	6428.5	.495
JUNE	6123.5	.510	6062.1	.512	6080.2	.511	6133.4	.510	6350.3	.505
JULY	6446.7	.500	5953.2	.512	5971.3	.511	6024.5	.510	5841.0	.514
AUGUST	6328.3	.500	6267.0	.502	5852.9	.511	5906.0	.510	5660.9	.516
SEPTEMBER	7132.1	.510	7070.8	.512	6656.7	.521	7142.0	.510	6464.7	.526
OCTOBER	6280.4	.500	6219.0	.502	5804.9	.511	6290.2	.500	4748.7	.536
NOVEMBER	5264.8	.510	5203.5	.512	4789.4	.521	5274.7	.510	3733.1	.546
DECEMBER	5314.6	.500	5021.1	.512	5471.3	.501	5524.5	.500	5310.6	.505

SOUTHWEST

	SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIO 4		SCENARIO 5	
	Q	P	Q	P	Q	P	Q	P	Q	P
JANUARY	783.6	.560	743.0	.562	755.0	.561	790.2	.560	934.7	.555
FEBRUARY	1203.4	.550	1162.7	.552	1174.7	.551	1209.9	.550	782.2	.565
MARCH	1589.3	.550	1548.7	.552	1560.7	.551	1595.9	.550	1351.1	.558
APRIL	1296.6	.550	1256.0	.552	1268.0	.551	1303.2	.550	772.3	.568
MAY	1298.9	.550	1258.3	.552	1270.3	.551	1305.5	.550	1735.2	.535
JUNE	1515.8	.550	1475.2	.552	1487.2	.551	1522.3	.550	1666.0	.545
JULY	1448.9	.550	1408.2	.552	1420.2	.551	1455.4	.550	1333.9	.554
AUGUST	1376.8	.550	1336.1	.552	1348.1	.551	1383.3	.550	1221.0	.556
SEPTEMBER	2133.8	.550	2093.2	.552	1819.1	.561	2140.4	.550	1692.0	.566
OCTOBER	1347.0	.550	1306.4	.552	1318.3	.551	1353.5	.550	619.0	.576
NOVEMBER	989.9	.550	949.3	.552	675.1	.561	996.4	.550	.0	.585
DECEMBER	878.0	.550	837.4	.552	849.4	.551	884.6	.550	1029.1	.545

NORTHEAST

	SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIO 4		SCENARIO 5	
	Q	P	Q	P	Q	P	Q	P	Q	P
JANUARY	15448.1	.520	15244.7	.522	15304.6	.521	15480.8	.520	16204.5	.515
FEBRUARY	16163.0	.520	15959.6	.522	16019.5	.521	16195.7	.520	15486.7	.525
MARCH	18227.5	.520	18024.1	.522	18084.0	.521	18260.1	.520	18467.1	.518
APRIL	16661.6	.520	16458.2	.522	16518.1	.521	16694.2	.520	15468.5	.528
MAY	20971.0	.490	20767.6	.492	20827.5	.491	21003.7	.490	20290.3	.495
JUNE	20698.8	.500	20495.4	.502	20555.3	.501	20731.5	.500	20018.1	.505
JULY	18909.4	.510	18706.0	.512	18765.9	.511	18942.1	.510	18334.0	.514
AUGUST	17089.9	.520	16886.5	.522	16946.4	.521	17122.6	.520	17742.7	.516
SEPTEMBER	21141.5	.520	20938.1	.522	20998.0	.521	21174.2	.520	20361.6	.526
OCTOBER	16930.9	.520	16727.5	.522	16787.4	.521	16963.6	.520	14718.3	.536
NOVEMBER	13587.1	.530	13383.7	.532	13443.6	.531	13619.7	.530	11374.5	.546
DECEMBER	12988.2	.530	12784.8	.532	12844.7	.531	13020.9	.530	16609.9	.505

MID U.S.

	SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIO 4		SCENARIO 5	
	Q	P	Q	P	Q	P	Q	P	Q	P
JANUARY	6115.1	.530	5959.1	.532	6005.1	.531	6140.2	.530	7794.2	.515
FEBRUARY	6627.2	.530	6471.2	.532	6517.1	.531	6652.3	.530	7207.4	.525
MARCH	8104.1	.530	7948.1	.532	7994.1	.531	8129.2	.530	9386.8	.518
APRIL	6984.4	.530	6828.4	.532	6874.3	.531	7009.4	.530	7168.2	.528
MAY	10288.8	.500	10132.8	.502	10178.7	.501	10313.8	.500	10865.5	.495
JUNE	10020.6	.510	9864.6	.512	9910.6	.511	10045.7	.510	10597.4	.505
JULY	8665.7	.520	8509.7	.522	8555.6	.521	8690.7	.520	9323.2	.514
AUGUST	7289.8	.530	7133.9	.532	7179.8	.531	7314.9	.530	8889.4	.516
SEPTEMBER	10189.9	.530	10033.9	.532	10079.8	.531	10214.9	.530	10690.5	.526
OCTOBER	7176.7	.530	7020.7	.532	7066.6	.531	7201.7	.530	6578.5	.536
NOVEMBER	5809.6	.530	5653.6	.532	5699.6	.531	5834.7	.530	4112.5	.546
DECEMBER	5381.1	.530	5225.1	.532	5271.0	.531	5406.1	.530	8159.0	.505

SOUTHEAST

	SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIO 4		SCENARIO 5	
	Q	P	Q	P	Q	P	Q	P	Q	P
JANUARY	3250.0	.530	3048.1	.532	3107.5	.531	3282.5	.530	5423.5	.515
FEBRUARY	3875.9	.530	3674.0	.532	3733.4	.531	3908.4	.530	4626.9	.525
MARCH	5681.0	.530	5479.1	.532	5538.6	.531	5713.5	.530	7341.4	.518
APRIL	4311.2	.530	4109.3	.532	4168.7	.531	4343.6	.530	4549.1	.528
MAY	8590.0	.500	8388.1	.502	8447.5	.501	8622.4	.500	9336.6	.495
JUNE	8181.7	.510	7979.8	.512	8039.3	.511	8214.2	.510	8928.4	.505
JULY	6446.3	.520	6244.4	.522	6303.8	.521	6478.8	.520	7297.5	.514
AUGUST	4685.3	.530	4483.4	.532	4542.8	.531	4717.8	.530	6755.9	.516
SEPTEMBER	8228.7	.530	8026.7	.532	8086.2	.531	8261.1	.530	8876.8	.526
OCTOBER	4547.3	.530	4345.4	.532	4404.8	.531	4579.8	.530	3773.0	.536
NOVEMBER	2875.9	.530	2674.0	.532	2733.4	.531	2908.4	.530	679.1	.546
DECEMBER	2352.4	.530	2150.5	.532	2210.0	.531	2384.9	.530	5948.4	.505

Table 21. Results of the N.M.F.S. 1981 Survey

TOTAL GROUNDFISH -- SUMMARY: LAND, SEA AIR

TO / FROM	Seattle	Other Washington	Portland	Other Oregon	San Francisco	Los Angeles San Diego	Other California	TOTAL
Oregon Washington	*388,000 **111,540	3,631,000 1,197,900	0	7,521,000 2,481,930	0	0	5,500,000 1,815,000	17,040,000 5,623,200
California Hawaii	1,778,000 568,740	5,993,000 1,977,690	0	14,160,000 4,672,800	14,238,000 4,698,540	457,000 150,810	5,797,000 15,113,000	82,423,000 27,199,590
Other U.S.	611,000 201,630	2,980,000 983,400	0	3,806,000 1,255,980	167,000 55,110	0	1,438,000 474,540	9,002,000 2,970,660
Foreign	1,114,000 367,620	808,000 266,640	0	470,000 155,100	0	0	6,858,000 2,263,140	9,250,000 3,052,500
TOTAL	3,891,000 1,284,030	13,412,000 4,425,960	0	25,957,000 8,565,810	14,405,000 4,753,650	457,000 150,810	59,593,000 19,665,690	117,715,000 38,659,500

* Values are expressed in round weight. ** Process weight.

Source: National Marine Fisheries Service 1981 Primary Market Channels.

Table 22. Comparison of Spatial Equilibrium and Survey Results

FROM / TO	Washington	Oregon	Northern California	Southern California
Oregon Washington	*1,309,000	2,482,000	1,815,000	2,481,930
	**2,819,000	0	11,499,000	0
California Hawaii	2,564,000	4,673,000	15,113,000	4,849,000
	20,031,000	31,796,000	4,897,000	5,121,000
Other U.S.	1,185,000	1,256,000	474,540	474,540
	0	0	0	4,355,000

* First row express the results of the survey.

** Second row express the results of the initial spatial equilibrium analysis.

All volumes are expressed in processed pounds.

Fishing with nets

Trawlers

A trawler is a fishing vessel that drags a funnel-shaped net ("trawl") through the water to harvest fish or shrimp. The net is wide at the mouth and tapers back to the narrow "cod" end that collects the catch. Trawls can be over 100 feet across the opening and 150 feet long.

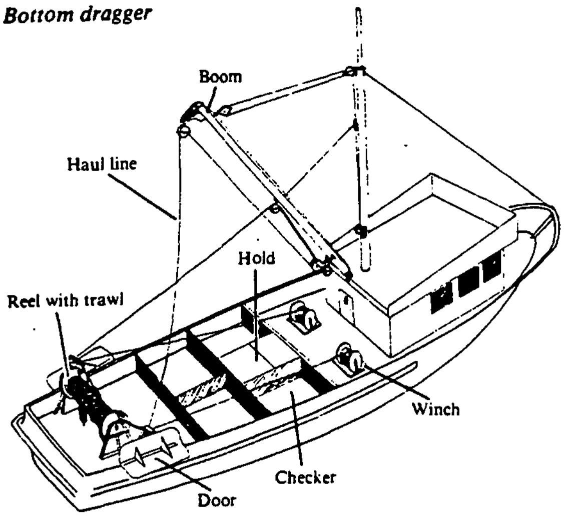
Trawl fishermen tow bottom and shrimp nets at 2 to 4 knots on or above the ocean floor. They might tow midwater nets faster to stay with the schooling fish they harvest.

A large, rectangular wooden or metal "trawl" door attached to each side ("wing") of the front of the net keeps the net spread open during the tow. Doors are flat, oval, or slightly V-shaped. A steel tow cable extends from each door to a winch just behind the pilot house.

Many of the newer trawlers have square sterns with inclined ramps; they are referred to as "stern trawlers." On these, nets are hauled aboard by winching them up the ramp. Trawlers without inclined ramps haul the nets over the side.

Bottom draggers and midwater trawlers work year-round while shrimpers are restricted to a seasonal fishery from April to mid-October.

Bottom dragger



Bottom trawl in operation

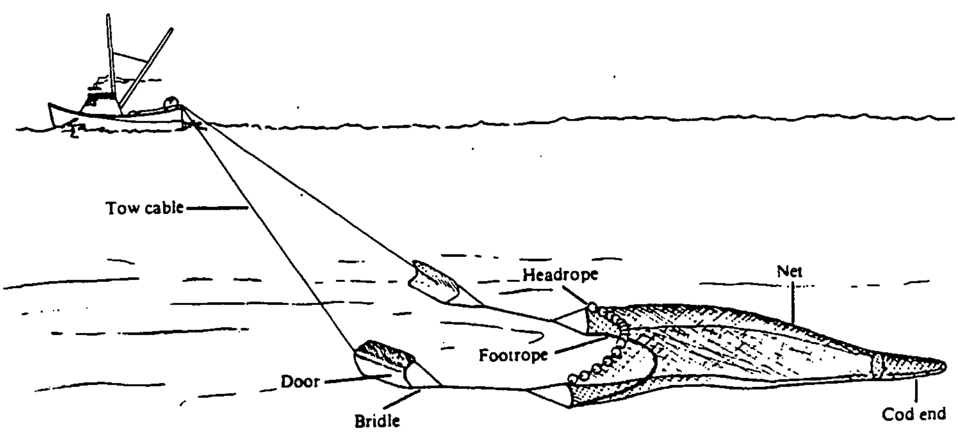


Figure 4. Description of Fishing Methods

Source: A Guide To Oregon's Commercial Fishing Vessels. Sea Grant Publication. SG68, 1981.

Bottom draggers tow a trawl along the ocean floor to catch bottomfish such as perch, rockfish, cod, flounder, blackcod, and sole. Most trawls are designed to catch particular groups of bottomfish.

The large mesh net (4½ to 5 inches) is kept on a stern-mounted reel. Doors are stored along the port and starboard rail near the reel. The crew sets the net off the stern by unwinding it from the reel into the water, cod end first, allowing the drag of the cod end in the water to unwind the net from the reel.

Then they place the doors in the water and release enough cable from the winches to position the net at the desired tow depth. Water pressure causes the doors to separate as they move along the ocean floor and thus pull the mouth of the net open horizontally. A combination of floats on the headrope, laced to the upper lip of the net, and a weighted footrope, laced to the lower lip of the net, holds the net mouth open vertically.

If it is to be towed over rough bottoms (as for rockfish), steel bobbins or rubber discs attached to the footrope help it ride over obstacles. Tow time lasts from 30 minutes to several hours. Depths range from 10 to 500 fathoms, at distances of from 1 to 40 miles offshore.

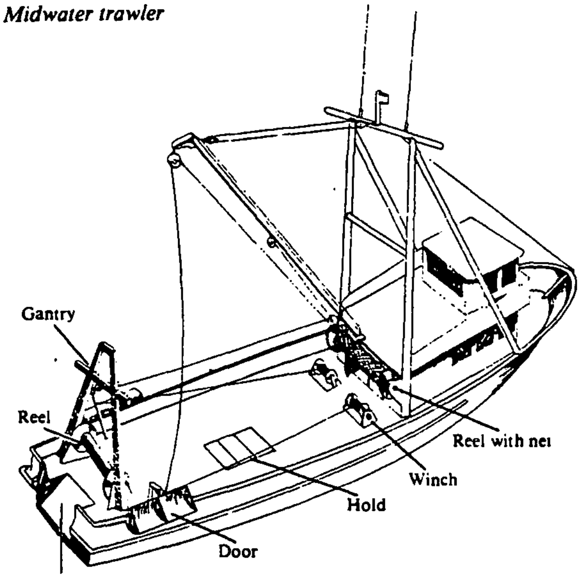
The crew hauls the net by winding in the cables with the winches until the doors are in place on the vessel and most of the net wound back onto the reel. On vessels without inclined ramps, they bring the cod end around to the downwind side of the stopped vessel and hoist it up and aboard by a haul line and block on an overhead boom. If the catch is so large that they cannot hoist the net without danger to vessel or gear, they must lift and empty it in sections ("splits").

Once the catch is aboard, they reset the net for another tow. Then they separate the fish by species into deck bins ("checkers") and ice or refrigerate them in the hold. One tow can bring up 30 tons of bottomfish. It is not unusual to have 60 tons of fish in the hold after a 4-day trip.

Shrimpers tow one or two small-meshed (1½-inch) nets just above the ocean floor for small, pink cocktail shrimp. Single-rigged shrimpers tow one net off the stern (as bottom draggers do), and this net is kept on a stern-mounted reel. Double-rigged shrimpers tow one net off each side of the vessel from large outriggers lowered to a 60° angle. In this case, nets are not kept on reels but folded on deck or hung from the boom while in port. Double-riggers, of course, have two sets of doors—one set for each net.

Chains ("tickler chains"), attached to the footrope, drag along the muddy bottom, stirring shrimp up and into the net.

Midwater trawler



Once onboard, shrimp are sorted from fish on a shallow table or run through a mechanical sorting machine. The machine or table and small mesh net distinguish a shrimper from a bottom dragger. You can identify double-riggers by their large outriggers, lack of reel, and two sets of doors.

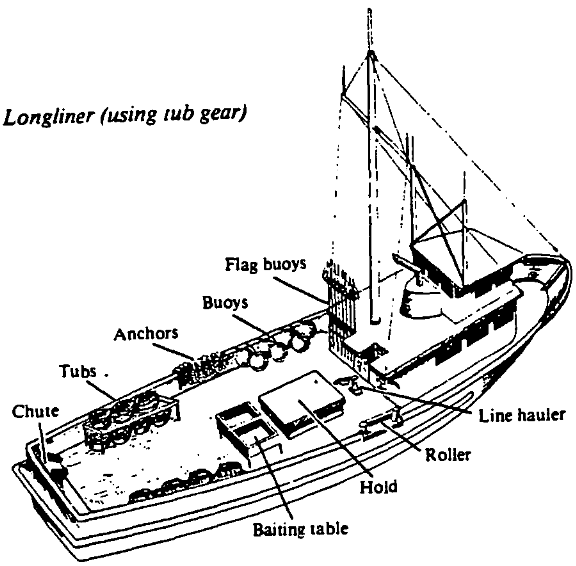
Shrimp are found in green or gray mud at depths of 80 to 150 fathoms.

Midwater trawlers tow a net off the stern from just above the sea floor to just below the surface. They harvest fish that move in schools such as Pacific whiting and rockfish. Sophisticated electronic equipment enables the skipper to both find and stay with fish. The net is towed a much shorter time than is the bottom or shrimp trawl—10 to 30 minutes— and may yield 50 tons of fish in one tow. Virtually all of these vessels are stern trawlers.

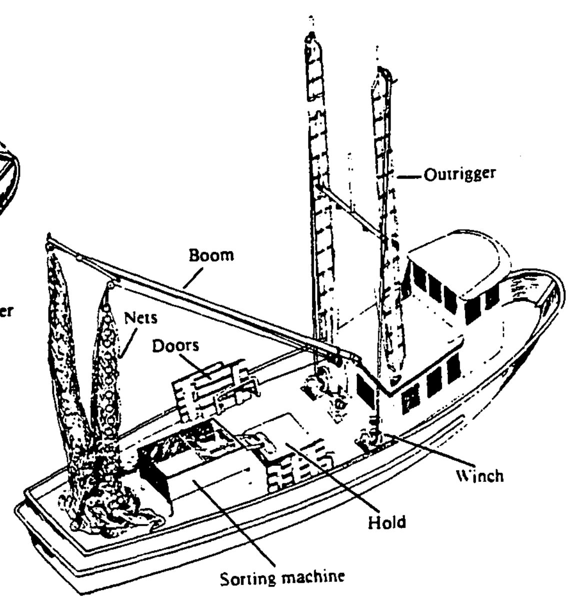
The vessels are rigged much like bottom draggers but use tall, concave metal doors; they frequently have more than one net reel onboard. An overhead A-frame or gantry on the stern holds one or two reels, and there may even be a third, located near the pilot house. Often, the other reels store bottom trawls, allowing the crew to quickly convert the vessel from midwater- to bottom-trawling. In this case, bottom trawl doors would also be carried onboard.

Figure 4. continued

Longliner (using tub gear)



Double-rigged shrimper



Halibut lines are set at 30 to 150 fathoms and soaked 6 to 12 bours before hauling. Blackcod longlines are fished at 100 to 400 fathoms and are hauled after only 4 to 6 bours because the soft-mouthed blackcod tend to wriggle free or be taken by predators. Blackcod may or may not be cleaned before icing, depending on the market. Halibut are always dressed at sea.

Blackcod are fished year-round, but tbe balibut season is limited by quotas and may only last a few days or weeks during the summer months.

Shrimp trawls in operation

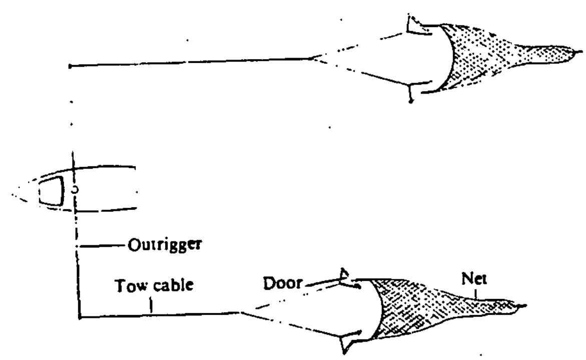
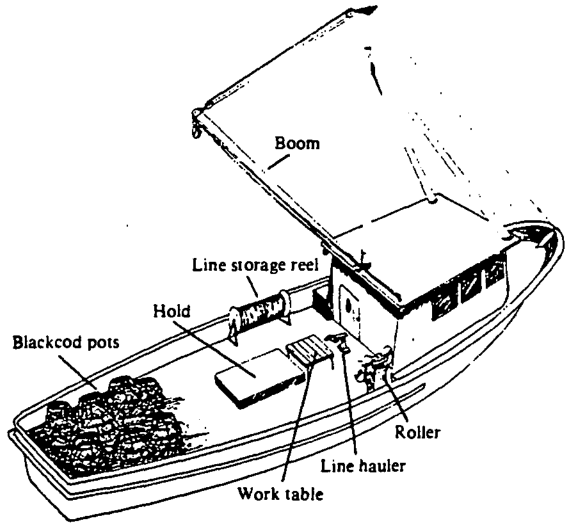
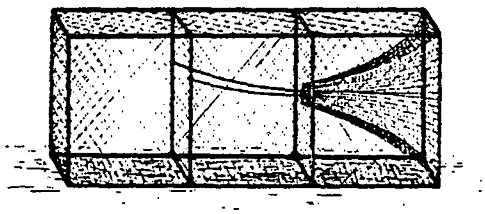


Figure 4. continued

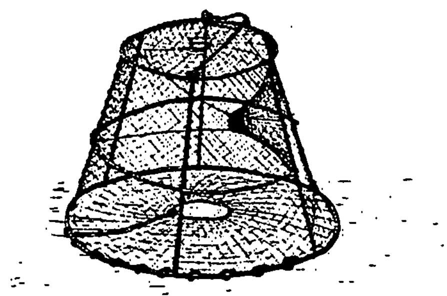
Longliner (using pots)



Rectangular blackcod pot



Basket-shaped blackcod pot



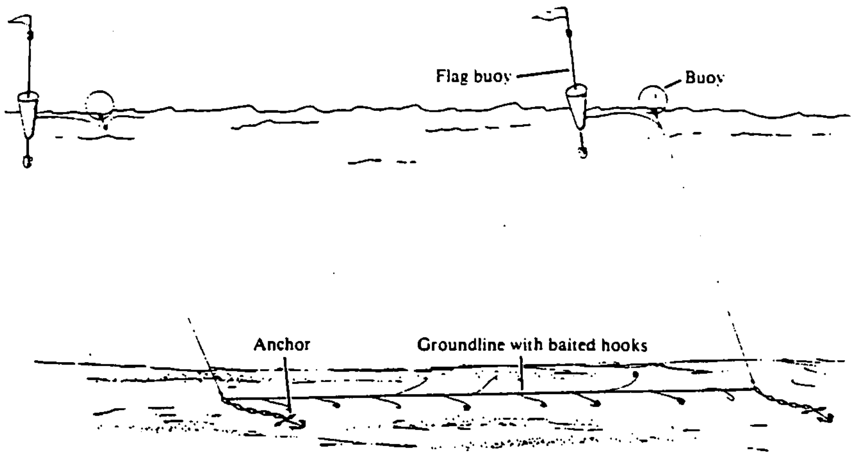
Blackcod pot fishing is selective for blackcod and is used as an alternative to the other methods of catching this species.

Vessels are usually 60 or more feet in length because of the deck space required to carry the large pots. Rectangular, basket-shaped, and cylindrical pots are in use. Basket-shaped pots have collapsible bottoms so more pots can be stacked on deck. Onboard gear includes a line hauler or hydraulic block like the crab block, an overhead hoist for lifting the heavy pots, and large buoys and flag poles. Reels are sometimes used to hold the groundline, or it is coiled on deck or in the hold.

Pots baited with squid or herring are run on a longline system with up to 50 pots attached to each line. Groundlines are set at depths of 200 to 400 fathoms and are weighted at each end by an anchor. Surface buoys and flagpoles mark the location of the lines.

Figure 4. continued

Set longline gear



Floating gillnet

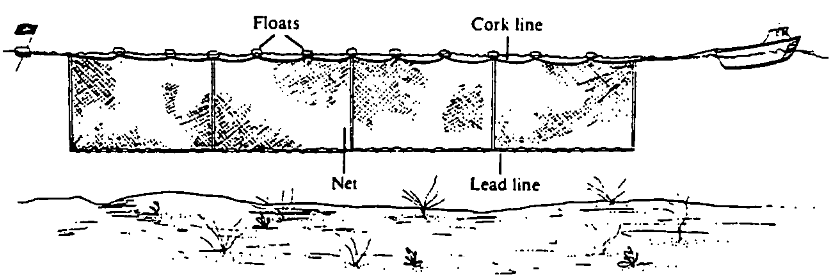


Figure 4. continued