



PACIFIC WHITING

RESOURCE AVAILABILITY, MARKET USE
and
ECONOMIC DEVELOPMENT POTENTIAL

Executive Summary of Reports on Pacific Whiting

Prepared by:
Oregon Coastal Zone Management Association, Inc.

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and
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MARCH 1991

**A REPORT TO THE 66TH OREGON LEGISLATIVE ASSEMBLY
1991 REGULAR SESSION**

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A TOW OF PACIFIC WHITING is brought aboard a factory ship for processing at sea.

Preface

The decade of change challenging Oregon's commercial fishing industry includes the potential for development of a new fishery that could generate \$86 million in income to coastal communities and up to \$114 million coastwide if catches of Pacific whiting were landed and processed onshore.

At the same time, the industry is also facing the loss of one of its most important and profitable fisheries, the catching of Pacific whiting for delivery to processing ships from foreign countries such as the U.S.S.R. and Japan. In 1990, the joint venture boats caught almost 400 million pounds of whiting for the foreign processing ships, earning \$22 million in revenue in the process and generating \$24 million in personal income for Oregon, Washington, and California communities—about \$16 million coming to Oregon coastal communities.

Both of these developments involve a small, two-pound dark gray, soft-textured fish, called Pacific whiting, or hake—the most abundant fish off the West Coast. More than half of the fish off the West Coast are whiting, making it the region's largest ocean biomass.

Responding to the direction provided by the 1989 Oregon Legislature to assure the development of a Pacific whiting fishery for Oregon shore-based production as part of the state's economy, a joint public and private investigative project was begun under the direction of the Oregon Coastal Zone Management Association, Inc. (OCZMA).

Resulting from that effort, this executive summary examines the feasibility of the development of a Pacific whiting fishery for Oregon. The legislative objectives were to assess resource supply and availability, plant locations, waste and by-product management, infrastructure requirements, financial operational structure, markets, planning and permitting, and technical assistance needs.

Funding for the project was provided by the Oregon Department of Agriculture, the Oregon Economic Development Department, and by Captain R. Barry Fisher, a Newport-based fisherman.

Acknowledgements

The information described within this executive summary was compiled primarily from background papers developed by researchers and consultants commissioned by the project to investigate the developmental issues described above. Those background papers are:

- Market Evaluation: Evaluation of Worldwide Whiting Resource Availability*,
Natural Resource Consultants (NRC)
- Market Investigation: Current Evaluation of Alaskan Pollock with Special Emphasis on Surimi and Analog Products*, Natural Resource Consultants
- Pacific Whiting Resource Supply, Socio-Economic Impact and Policy Analysis: Resource Availability, Cost Information, Income and Employment Impacts*,
Hans Radtke, Economist
- Market Investigation: Summary and Evaluation of Research on Pacific Whiting Productions*, William Jensen, Resource Valuations Inc.
- Oregon Community Impact Model*, William Jensen, Resource Valuations, Inc.
- Market Opportunities for Pacific Whiting*, Gilbert Sylvia, Oregon State University
Coastal Oregon Marine Experiment Station
- Infrastructure Requirements*, Ken Hilderbrand, Oregon State University,
Marine Advisory Program
- Land Use and Permitting Requirements*, Onno Husing, Planning Consultant

The project benefited from assistance by Dr. Gilbert Sylvia of the Coastal Oregon Marine Experiment Station and from the counsel of its steering and technical advisory committees:

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Highlights

PACIFIC WHITING Pacific whiting is the largest groundfish resource off the West Coast (excluding Alaska), with an allowable harvest of about 200,000 metric tons (about 440 million lbs.).

RESOURCE INCOME The Pacific whiting resource, depending on resource uses and allocation decisions, could generate up to \$86 million of income to coastal communities and add up to \$114 million of income to the state economy.

JOINT VENTURE FISHERY The Pacific whiting joint venture (JV) fishery between American harvesters and foreign processors that has been a source of income for the Oregon coast, will be discontinued in Oregon as of 1991. This will increase competition pressure on the other existing domestic groundfish fisheries and on the already fully-utilized shrimp fishery.

ALASKAN POLLOCK FISHERY The Alaskan pollock fishery is generally regarded as over-capitalized. As a result, large catcher-processors based in Alaska are expected to begin harvesting and processing Pacific whiting off the coast of Oregon during 1991.

WORLDWIDE RESOURCES As a result of reduced whitefish resources worldwide, advances in processing technology, and increased worldwide demand for fish, a substantially greater volume of Pacific whiting products can now be profitably processed by the U.S. industry and provide positive opportunities for the on-shore processing of Pacific whiting.

PRODUCT FORMS A variety of product forms may be profitably processed from the Pacific whiting resource including fillet products, minced products and surimi. Pacific whiting could also provide the resource base for production of other value-added products including battered and breaded fillets and portions.

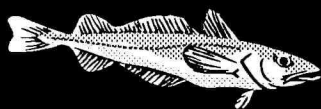
ANALOG PRODUCTION Secondary processing capability, such as analog production, may develop in Oregon for the production of surimi. The availability of fresh product could give Oregon a comparative advantage in analog production.

INFRASTRUCTURE The coastal infrastructure needed for seafood processing—water, waste disposal, cold storage—is generally adequate in Oregon for development of shore-based Pacific whiting processing to take place. Disposing with the resulting solid waste, however, may become a problem in some of the state's fishing communities.



PHOTO BY DIANE PLESCHNER

PACIFIC WHITING are released from the "window" of a midwater trawl net during a recent harvest.



PACIFIC WHITING

Introduction

Pacific whiting represents the largest groundfish resource found off the West Coast of North America. It is the only species currently harvested where there is significant difference between what can be caught, and the amount that is currently processed by U.S. fishing operations.

In 1989, U.S. fishermen harvested about 210,000 metric tons of Pacific whiting, but only about 4% of that harvest was processed in coastal fish plants. There is a significant opportunity for economic development in coastal communities if more of the whiting can be processed by these plants. Development of shore-side processing for whiting is also important to make up for reductions in other fisheries as their harvest levels approach maximum sustainable yield (MSY) over the next several years.

Several factors have combined to spell the end to the joint venture fishery. Research has shown that if whiting is handled properly during capture, processing and distribution, a quality product can be developed. Food

Pacific Whiting Migration Cycle

Pacific Whiting (*Merluccius productus*) is a cod-like species, ranging in size from about six inches and 0.07 lb. at one year of age to about 24 inches and about three pounds for females slightly over 13 years old.

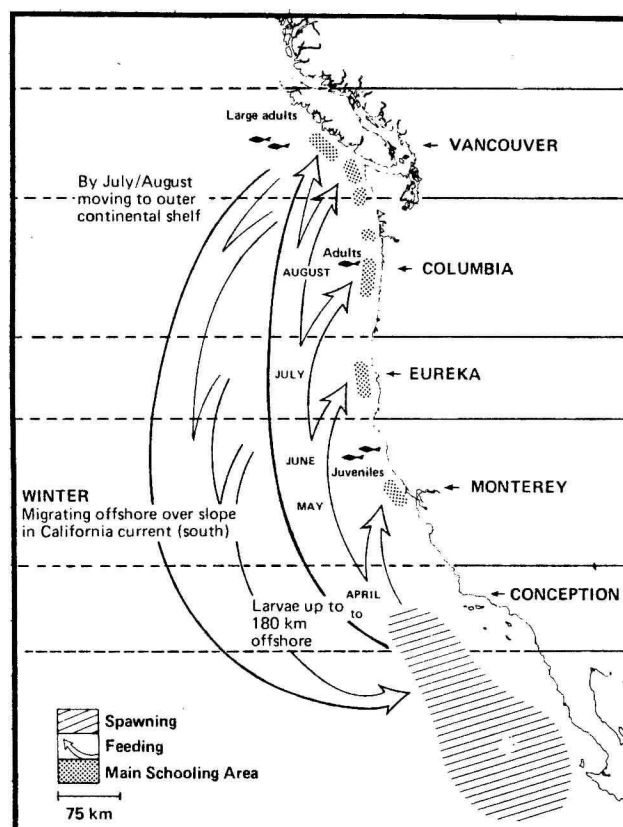
The average sizes of landed whiting vary from year to year as a result of growth and recruitment of stronger year classes of fish. Landings off the West Coast are 60% to 82% females (based on the 1977-1982 samples). Whiting caught in Puget Sound are somewhat smaller than coastal fish.

Pacific whiting disperse through the water column at dusk and remain near the surface at night. Fishing is carried on during daylight hours when whiting are densely concentrated at depths of 100 to 250 meters.

The map at right indicates the migratory cycling of the Pacific whiting. The coastal stock spawns off southern California/Baja California during the winter with adult fish migrating north in the spring and summer, then returning to their seasonal spawning grounds.

During the spring, schools off Oregon, Washington, and California are generally found over the continental slope but not over the shelf. In June, the fish begin to move shoreward to depths of 90 meters (50 fathoms) or less.

SOURCE: NATIONAL MARINE FISHERIES SERVICE



Distribution of North Pacific Whiting North America



THE NORTH PACIFIC WHITING RESOURCE is distributed from the Gulf of California to the Gulf of Alaska. It is most abundant between Baja, California, and southern British Columbia. The resource is distinguished by as many as four separate stocks including the large coastal outside stock. Separate and much smaller stocks are found off of southern Baja, California, in Puget Sound, and in Georges Strait. The inside stocks in Puget Sound and Georges Strait are fully exploited, but the last, big-volume stock off the West Coast of the U.S. is not yet fully utilized by the domestic fishing industry.

SOURCE: Natural Resources Consultants, *Evaluation of Worldwide Whiting Resource*

technologists have developed enzyme inhibitors which allow whiting to be made into surimi, a fish paste used to create products like artificial crab. The other major factor is the growth of an American factory processor fleet, capable of catching the fish and processing it on board, as the foreign processors have done.

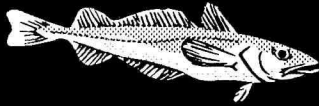
The fishing industry enters 1991 aware there will be no joint venture fishery. The 50 joint venture boats—35 of them based in Oregon ports—will have nothing to fish for at a time when other trawl fisheries are facing smaller quotas and greater restrictions. An unemployed joint venture fleet will send a destabilizing wave through the entire West Coast fishing industry. Operators will attempt to recoup the loss through other trawl and shrimp fisheries, which are already facing smaller quotas and more restrictions. For coastal ports, where commercial fishing brings in 27% of all total earned income, the loss of the fishery will adversely affect the total community.

The factory processors also create a dilemma for the shore-based plants, who have taken some tentative steps towards using the immense whiting resource. In 1989, Oregon coastal processors used about 800,000 pounds of whiting. By 1990, that amount had jumped to 5 million pounds, with more processors expressing interest

in the fishery. The needs of the shore-based plants and the factory processors are quite different. The plants need to make substantial investments in equipment to process large amounts of whiting onshore. They need the fish to be available to them over a long period of time to justify the economic expenditures. They are reluctant to make the investment if the bulk of the catch will be taken by the floating processors. There will be little contribution to Oregon coastal economies from the factory processors.

The whiting currently processed onshore contributes about \$4.8 million to the local coastal economies. The more whiting that can be processed onshore, the greater the economic benefits to the coastal communities and to the state of Oregon as a whole. If all of the whiting that is available in a normal year could be processed on-shore, the local economic gain would be \$86 million and \$114 million statewide.

The benefits from Oregon's resources should be derived by Oregonians, and its ocean fishery is no exception. To ensure that Oregon's fishing industry, Oregon's coastal communities, and the state as a whole, have the opportunity to derive the substantial benefits from that fishery, the state needs to continue to position itself and its local fishing industry for a growth in fishery allocation in 1992. The objective of the report is to encourage the contribution by the Pacific whiting fishery to that growth.



PACIFIC WHITING

Overview of Related Fish Resources

Worldwide Fish Harvest

The annual world commercial harvest of cods, hakes and haddocks, according to the 1987 United Nation's Food and Agricultural Organization (FAO) *Yearbook of Fisheries Statistics*, has been about 13.5 million metric tons or 30 billion pounds (a metric ton equaling about 2,200 lbs). See Table 1 below.

Alaskan pollock—including both the pollock off the coast of Alaska as well as in Asian waters—is the world's largest harvested fishery resource. Over the past several years, the world pollock catch constituted about 10% of the total world catch of all marine species. The Alaskan pollock harvest is over 50% of the total world harvest of cods, hakes and haddocks, and about 40% of the worldwide whitefish catch.

Whiting and Hake Resources

Whiting and hake are important whitefish resources. The hake and whiting resources of the world oceans represent a complex and somewhat confusing assemblage of species. They are found as members of the true cods (Family *Gadidae*), whittings or hakes (Family *Merluccidae*) and the grenadiers (Family *Macrouridae*), all of which are taxonomically positioned in the Order *Gadiformes*.

Table 1
Worldwide Fish Harvest

Cods, Haddocks, Hakes, etc.

<u>Year:</u>	<u>Metric Tons:</u>
1983:	12,600,000
1984:	12,300,000
1985:	12,500,000
1986:	13,600,000
1987:	13,700,000

Source: FAO *Yearbook of Fisheries Statistics*

Table 2
Total World Harvest

Hakes and Whittings

<u>Year:</u>	<u>Metric Tons:</u>
1982:	2,180,332
1983:	2,275,447
1984:	2,205,492
1985:	2,364,888
1986:	2,818,048
1987:	2,973,204

Source: FAO *Yearbook of Fisheries Statistics*

Total world harvests of hakes and whittings have expanded from 2.2 million metric tons in 1982 to almost 3 million metric tons in 1987. See Table 2 above. More than 72% of the 1987 harvest can be attributed to just five species with North Pacific whiting harvests in the northeast Pacific totaling 297,976 metric tons and 10% of the world harvest of hake and whiting. See Tables 3-A and 3-B following.

Table 3-A
Summary of Hake/Whiting Harvests and Potential Yields

Species	Distribution	Potential Average Yield*	1987 Harvest*	Parasite Problems
N. Pacific Whiting	Northeast Pacific	245,000	297,986	Yes
Silver Hake	Northwest Atlantic	175,000	77,975	Unknown
Red Hake	Northwest Atlantic	50,000- 100,000	2,626	Unknown
White Hake	Northwest Atlantic	<50,000	30,429	Unknown
European Hake	Northeast and East Central Atlantic, Mediterranean and Black Sea	150,000- 200,000	116,347	Unknown
Cape Hake	Southeast Atlantic	600,000- 700,000	444,348	Yes, can be severe
Argentine Hake	Southwest Atlantic	500,000	434,472	Minimal (<5%)
Chilean Hake	Southeast Pacific	125,000	64,286	High in Peru stock low elsewhere
Whiting	Northeast Atlantic, Baltic & Black Seas	200,000	150,791	Unknown
Blue Whiting	Northeast Atlantic	800,000	707,955	Yes, in organs
So. Blue Whiting	Southwest Atlantic, Southeast Pacific	1,000,000	103,777	Low
Southern Hake	Southeast Pacific	40,000	235,000	No
Patagonian Hake	Southwest Atlantic, Southeast Pacific	Unknown	110,993	Minimal
Hoki	Southeast Pacific, Southwest Pacific	225,000	194,274	Minimal
Patagonian Grenadier	Southwest Atlantic, Southeast Pacific	112,000	181,005	Unknown
Grand Grenadier	Southwest Atlantic, Southeast Pacific	Unknown	Unknown	Unknown

* Metric tons

Source: Natural Resource Consultants, *A Review and Analysis of Global Hake and Whiting Resources, Harvests, Products, and Markets*, 1990.

Table 3-B
Summary of Hake/Whiting Products and Markets

Species	Meat Quality	Principal Product Forms	Primary Markets
North Pacific Whiting	Pink color, lower than average quality	Frozen H&G ¹ , Surimi	Poland, EC ² , US
Silver Hake	High in winter, poor in summer	Fresh & frozen H&G	USSR, Canada US
Red Hake	Very soft and easily damaged	Fresh H&G	US, Canada
White Hake	White fillets	Fresh H&G, fillets	US, Canada
European Hake	White, top quality	Fresh H&G, fillets	Europe
Cape Hake	White flesh, bland to slightly sweet taste	Frozen H&G, skin-on or off fillets	Europe, primarily Spain
Argentine Hake	Small, bland, & white	Frozen H&G, fillets & fillet blocks	EC (H&G) US (blocks)
Chilean Hake	Tender, white, & flaky	Fish blocks, interleaved fillets	Europe & US
Whiting	Medium quality	Fresh	Europe
Blue Whiting	Soft (less firm than most species)	Minced fish blocks and fish meal	USSR and world fish meal market
Southern Blue Whiting	More firm than Blue whiting, but less white than other species	Fish blocks	EC, Eastern Europe, USSR
Patagonian Hake	Small, white, & bland fillet blocks	Frozen H&G,	Europe, US
Hoki	Whiter than Alaska pollock tastes similar to haddock	Surimi, H&G blocks	US, N. Zealand, Australia, Japan
Patagonian Grenadier	Unknown	Block	Eastern Europe
Grand Grenadier	White, bland, cod-like texture	Fillets, H&G blocks	US, Japan

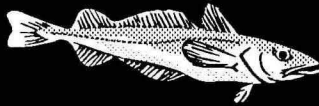
1 - Headed and gutted
2 - European Community

Source: Natural Resource Consultants, *A Review and Analysis of Global Hake and Whiting Resources, Harvests, Products, and Markets*, 1990.



PHOTO COURTESY OF OREGON SEA GRANT

SEA-GOING PROCESSOR VESSELS operate worldwide to meet the growing demand for whitefish.



PACIFIC WHITING

Markets

Major World Fish Market Forms

The three, major non-communist markets for groundfish in the world today are Japan, the European Community (EC), and the United States. Significant markets also exist in the Union of Soviet Socialist Republics (U.S.S.R.) and in eastern Europe. In the past, the latter have served primarily as markets of last resort for the hake and whiting harvested and processed by foreign nations. The consumption of groundfish in Japan utilizes species of North Pacific origin, a region of relatively low abundance for hake and whiting. As such, the role of Japan in the global hake and whiting market is currently far less important than its position within the world fish products or other groundfish markets might indicate.

Worldwide Whiting and Hake Product Forms

The primary markets for traditional hake products are in the U.S., in the U.S.S.R., and in the EC. The member-nations of that community—particularly Spain—dominate Western markets. The chief sources of this market originate off the coast of South Africa (Cape hakes), South America (Argentine hake), and in the Northeast Atlantic (European hake). Whiting usage varies considerably between the EC members. In Spain, Portugal, and Italy, whiting occupies well defined market niches whereas in other nations such as Germany and the United Kingdom, it serves primarily as a cod substitute.

The U.S. market primarily involves whiting blocks from Argentina and Uruguay. Limited amounts of White hake, Silver hake and North Pacific whiting are marketed in regional, largely ethnic markets. “Newer” species, such as hoki and southern hake (Antarctic Queen) have been attempting to establish a share of the U.S. market but have to date met with only mixed success.

The potential international markets for whiting are in eastern Europe, the U.S.S.R., Japan and China. The single most important factor affecting market expansion is the recent scientific breakthrough in the development of enzyme inhibitors used to prevent the proteolytic degradation of the fish once caught. Use of this additive allows whiting to be made into surimi, and creates the potential for new product forms. If whiting can be commercially harvested and processed, this resource may have a significant impact on the world markets for inexpensive cod-like substitutes.

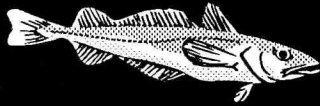


PHOTO COURTESY OF OREGON SEA GRANT
COLLECTING INFORMATION on Pacific whiting, the most abundant fish off the West Coast of North America.



PHOTO COURTESY OF OREGON SEA GRANT

PACIFIC WHITING, or hake, is a small, two-pound dark gray, soft-textured fish. More than half of the fish inhabiting the waters off the West Coast of North America are whiting, making it the region's largest ocean biomass.



PACIFIC WHITING

4

Trends in Whitefish-based Value-added Products

Worldwide Product Development

World production of whitefish exceeded 22 million metric tons in 1986, and is estimated to have exceeded 25 million metric tons in 1989. This level is only slightly greater than that available during the mid-1970s, and if it were not for the sharp upswing in Alaskan pollock production in the North Pacific region during the 1980s, whitefish production would have declined over this period.

The growth of whitefish-based value-added products such as surimi over the next decade will be based primarily on whitefish resulting in an increased competition for a relatively constant supply of whitefish. Some limited increase will occur in the catch of whitefish resulting from the harvest of hakes, flounders, Atlantic blue whiting, hoki and other species, and part of this may be used for surimi. Any major increase in the production of whitefish surimi would still depend upon raw material now being used for other whitefish commodities.

The Alaska Pollock Story

Most of the Alaskan pollock caught by U.S. fishermen has gone into surimi production. As the supply of whitefish products in the world changes, and as the methods of harvesting and processing the U.S. pollock supply evolves, shifts to other product forms may occur.

Before the U.S. expanded its jurisdictional boundaries to 200 miles in 1976, most of the pollock in the eastern Bering Sea was caught by Japanese, Soviet and Korean vessels. The U.S. harvest of pollock began slowly with the start of the joint venture fisheries in 1979. The harvest increased rapidly in 1982, as the number of joint venture operations mushroomed.

By the mid-1980s, American at-sea processing ships began processing pollock, and by 1989, the amount of pollock caught and delivered to U.S. processors had increased to about 800,000 metric tons. By 1990, all of the pollock caught in the 200-mile Exclusive Economic Zone (EEZ) established by the U.S. was caught and processed by U.S. fishermen and processors. In less than a decade, the fishery shifted from almost totally foreign to an all-American fishery.

Much Alaskan pollock is now processed in fillet and fillet blocks, and less of it is available to supply the demand for surimi. The potential U.S. capacity for surimi in 1991 has been estimated at 274,000 metric tons. A simplistic approach to estimating the actual production of Alaskan pollock surimi by the U.S. industry is to assume that it will be proportional to surimi capacity when compared to other commodities. Assuming this for 1991, leads to the conclusion that U.S. surimi production would be in the range of 177,000 metric tons.

The Japanese demand for high quality surimi is expected to remain at 225,000-230,000 metric tons for the foreseeable future. With the growth of analog products such as artificial crab, the U.S. demand for surimi could reach 44,000 metric tons in 1991. The combined demand for surimi could exceed U.S. production because of the limited amount of pollock available.

The harvest of pollock for 1970-1988 in the Eastern Bering Sea/Aleutian Islands is depicted by fishery in Figure 1 below, and projected for 1989. The Total Allowable Foreign Fishing is shown as "TALFF," the Joint Venture Production by "JVP", the Domestic Annual Production by "DAP." Figure 2, below, shows the harvest of pollock in the Gulf of Alaska, by fishery, for 1970-1988 and projected for 1989. TALFF is Total Allowable Foreign Fishing, JVP is Joint Venture Production, and DAP is Domestic Annual Production.

Figure 1
Pollock Harvest
 Eastern Bering Sea/Aleutian Islands

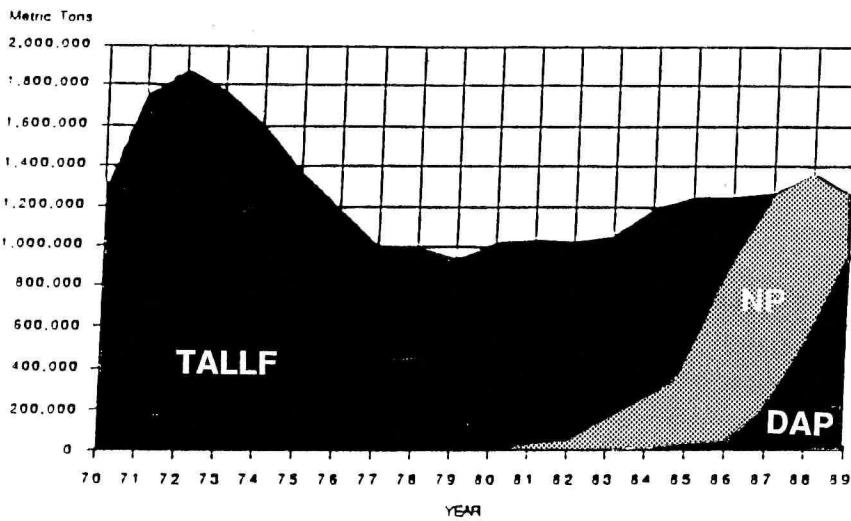
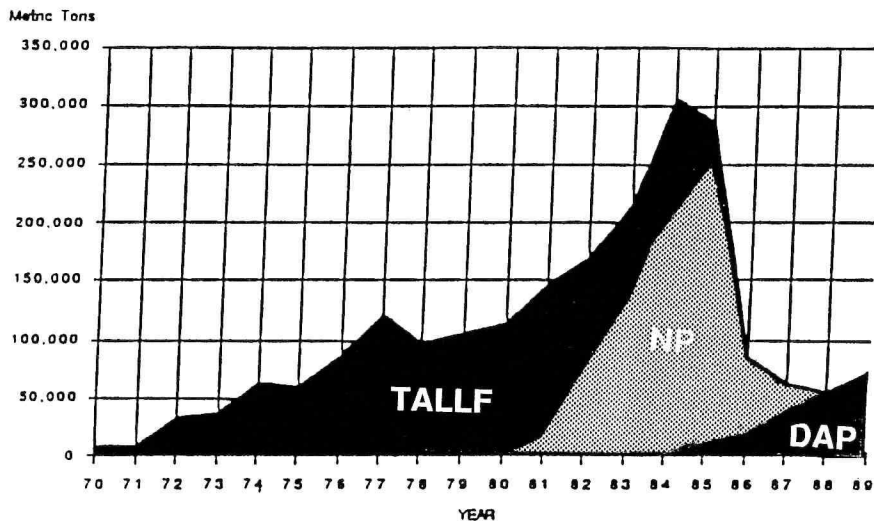
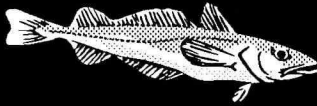


Figure 2
Pollock Harvest
 Gulf of Alaska



SOURCE: National Marine Fisheries Service, 1987-1990 Eastern Bering Sea/Aleutian Islands Resources Assessment Documents, PacFin Database, and Natural Resource Consultants projections.



PACIFIC WHITING

Pacific Whiting

Pacific whiting constitutes the largest West Coast biomass of groundfish. Equally significant, it remains the only species currently harvested where there is a large difference between the potential catch and the amount harvested and processed by U.S. fishermen.

Resource Availability

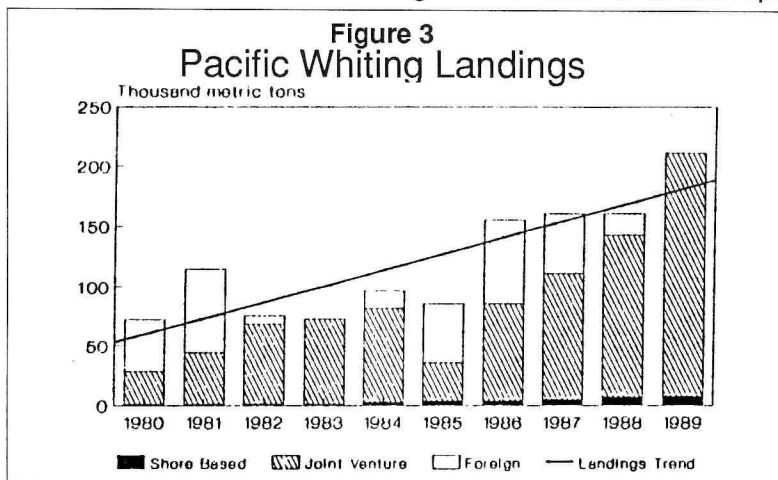
The Pacific whiting species occurs primarily in the area between Vancouver, Canada and Monterey, California. Two distinct stocks exist—a major stock found offshore and a much smaller breeding stock found in the Georgia Strait/Puget Sound area. The latter “inside stock” breeds in the Puget Sound and is harvested primarily during the winter months. The study focuses on the coastal stock, which is composed of a somewhat larger fish and is harvested during the summer. The coastal stock spawns off the California coast.

The tonnage of fish available in various West Coast groundfish fisheries is listed in Table 4 on the following page. Maximum sustainable yield (MSY) represents the estimated long term levels of harvest that can be taken without damaging the fishery. Acceptable biological catch (ABC) represents the current harvest levels set by management agencies.

Historical Harvest

The trend in Pacific whiting landings since 1980 is depicted in Figure 3 at left. In future years, the fish will be caught only by U.S. fishing vessels. Shore-side or at-sea processing will increase as whiting is more widely used by domestic processors. The slow growth trend in U.S. processing is depicted as the lower portion of each bar. The location of future U.S. whiting processing will depend on a variety of factors including resource availability and fishery management decisions in Alaska, as well as in the Pacific whiting fishery. Further changes in the fishery will involve redistribution of catch among processors rather than increased landings.

The 1990 whiting catch off the coast of the U.S. and Canada totaled 245,000 metric tons. The U.S. share was 196,000 metric tons. The total groundfish catch for all other species was 138,600 metric tons. Pacific whiting



SOURCE: PacFIN 1989 data preliminary

represents more than 50% of the total U.S. potential catch for West Coast groundfish (not including Alaskan groundfish or the Canadian share of the whiting). Currently, there is no sharing agreement between the U.S. and Canada on whiting, and the 1991 harvest is likely to be above the ABC, or acceptable biological catch.

The 1989 Pacific whiting landings listed on the following page in Table 4 include 203,578 metric tons of Pacific whiting processed by foreign factory ships operating in joint ventures with U.S. fishing vessels.

Table 4
Summary of West Coast Groundfish Stocks
Comparisons of MSY, ABC and Landings

(Metric Tons)

Species	MSY	1990 ABC ^a	1989 ABC	1989 Catch	1988 Catch ^b
Flatfish					
Dover Sole	24,400	27,900	27,900	18,775	18,002
English Sole	4,500	1,900	1,900	2,391	2,094
Petrale Sole	3,200	3,200	3,200	2,115	2,131
Remaining	>ABC ^c	7,700	1,645	6,499	2,711
Flatfish					
Rockfish					
Boccaccio	6,100	6,100	6,100	813	1,307
Chilipepper	2,300	3,600	3,600	576	1,194
Canary	3,500	3,500	3,500	2,220	1,699
Yellowtail	4,500	4,000	4,300	4,208	4,652
Other Sebastes	N/A	N/A	N/A	12,318	13,423
Remaining rock.	>ABC	14,000	14,000	1,736	9,889
Pac.Oc.Perch	2,500	0	0	1,454	803
Shortbelly	29,000	13,000	10,000	2	(Trace)
Widow	8,300	7,900	12,400	12,669	10,887
Unspecified	N/A	N/A	N/A	9,406	4,571
Thornyhead	N/A	N/A	N/A	7,864	5,592
Groundfish and Other Species					
Jack Mackerel	12,000	12,000	12,000	4	65
Lingcod	7,000	7,000	7,000	3,415	2,628
Pacific Cod	N/A	3,200	3,200	2,183	3,332
Pac. Whiting ^d	201,000	196,000	180,000	210,995	160,698
Sablefish	8,700	8,900	9,000	10,234	10,789
Others	>ABC	14,700	14,700	11	2,499

^{a/} 1990 ABCs and 1989 catch are preliminary estimates. ^{b/} Landings include PFMC Vancouver, Columbia, Eureka, and Monterey areas. ^{c/} >ABC indicates MSY is at least ABC. ^{d/} Pacific whiting MSY and ABC listed here are U.S. share of total U.S. and Canadian stock. "Catch includes domestic, joint venture, and (in 1988) foreign landings, but does not include Georgia Strait and Puget Sound landings.

Sources: PFMC *Status of the Pacific Coast Groundfish Fishery Through 1989 and Recommended Acceptable Biological Catches for 1990*. 1988 and 1989 whiting catch information is from PacFIN.

Table 5
Review of Past Market Research of Product Forms

Product Form	Major Use	Potential or Problems
Fish meal (also fish silage)	Source of food meal for poultry and animal formulations	Depends on price of soybeans; growth in aquaculture could be an increasing market
Fish protein concentrates	High-protein additives to food products	Potential for food additives if need for proteins is there; problems are with marketing and receiving payments from countries in need of protein additives
Headed and gutted	Traditional European markets and some ethnic U.S. markets	Market is limited unless one can be developed in the changing Eastern European market
Frozen blocks	Blocks made from processed fillets	Low yield of fillets, high labor costs and short "shelf life" of frozen product may hinder this development
Fillets (fresh and frozen)	Fresh and frozen for direct consumption	Soft flesh and perishability have caused some problems in marketing; because of technological advances the potential may be in secondary products
Prepared products	Prepared products in sauces, battered or breaded, and minced	May be potential for "take home" products in that preparation eliminates the enzyme problem
Canned	Human consumption or pet food	Product does not can well
Surimi	Minced for secondary product use	Enzyme inhibitors have been produced by U.S. and Japanese researchers; opens use of Pacific Whiting to the vast "surimi" market

SOURCE: William Jensen, *Market Investigation Summary and Evaluation of Research on Pacific Whiting Production*, Resource Valuation, Inc.

(In the joint venture fishery, U.S. vessels catch the fish and deliver them at-sea to foreign processor vessels.)

A significant amount of research has been completed on product forms from Pacific whiting. See Table 5 above. Minced fresh fish and surimi offers considerable potential for the utilization of Pacific whiting. In the U.S., surimi is used to make imitation crab meat, scallop and shrimp products. There are two requirements for the production of high quality surimi:

- Gel-forming capacity, which allows it to assume almost any desired texture;
- Long-term frozen storage stability, usually done with the addition of sugars such as cryoprotectants.

The development of enzyme inhibitors, which are used as soon as the fish is caught to retard the softening of the flesh, make these two characteristics possible with Pacific whiting.

Potential for the Oregon Coastal Economy

Major changes in the Alaskan pollock fisheries have led the owners of several U.S. factory ships to announce they will enter the West Coast whiting fishery in the spring of 1991. This decision has two major impacts:

Eliminated Fishery The abrupt elimination of the whiting joint venture fishery will leave 50 boats—35 of them based in Oregon ports—without a fishery. This will have a major impact

on the coastal communities, which depend on the revenues from the fishery. In 1990, the joint venture fishermen harvested about 170,000 metric tons of whiting with an ex-vessel value of more than \$22 million. This generated about \$24 million in personal income to the state of Oregon and about \$11 million to Washington. If the bulk of the whiting is harvested at-sea in the future rather than on land, there will be a major redistribution of these benefits.

Increased Pressure There will be increased pressure on other trawl and shrimp fisheries which are already facing smaller quotas and increased harvest restrictions.

Alternative Uses

The potential impact upon personal income resulting from various combinations of uses of the whiting resource at the state—depending on whether the landings occurred in Oregon, Washington or California—and local levels, are displayed on the facing page in Table 6 as seven alternative combinations of harvesting and processing the potential whiting quota of 200,000 metric tons in 1991. Headed-and-gutted and surimi are used as market forms in this analysis in order to display a range of alternative impacts. This analysis does not include all possible end-products such as fillets which might also be produced. The alternatives are as follows:

Alternative 1 The estimated use in 1990 is depicted as Alternative 1. The 180,000 metric tons total whiting harvest brings in an estimated \$30 million of coastal community level income and about \$41.6 million of state level income.

Alternative 2 For 1991, if the entire 200,000 metric tons were made available to be harvested and processed domestically on shore, such production could generate a total of more than \$86 million in coastal communities and a total of \$114 million to the Pacific Coast states. (It is highly doubtful that shoreside processors could utilize 164,000 metric tons of whiting for surimi in the short term, and this example is provided primarily for comparison with the income impacts of at-sea surimi production. It also indicates the potential for long-term growth in the onshore processing sector.)

Alternative 3 If the aforementioned 164,000 metric tons were harvested and processed on factory trawlers, a total of \$95.9 million could be generated at the state level, particularly in the Puget Sound area of Washington.

Alternative 4 This alternative displays the possibility of 36,000 metric tons for shoreside headed-and-gutted processing with the remaining 164,000 metric tons split equally between shoreside and offshore surimi production. A total of \$114 million of income is generated at the state level under this scenario.

Alternative 5 Alternative 5 shows the impact of the entire whiting harvest guideline/quota being harvested and processed by factory trawlers as surimi.

Alternative 6 This alternative shows the situation where the current onshore headed and gutted processing level is 7,500 metric tons and the remaining 192,500 metric tons is processed offshore.

Alternative 7 Alternative 7 shows the possible distribution of economic impact where 7,500 metric tons is processed onshore and the remainder of the 36,000 metric tons allocation is harvested by catcher vessels and processed by the JV/"mothership" combination.

The distribution of benefits changes substantially under the various alternatives. The most severe disruption of the recent pattern of economic benefits occurs if the at-sea processors take the entire quota. There is no indication that large factory processors are able to produce a quality product at any lower cost than can on-

Table 6
Pacific Whiting Harvesting Alternatives
 Potential Impact on Income in 1991 by Possible Combinations
 [\$000]

CATEGORY	ALTERNATIVES							
	No.1	No.2	No.3	No.4	No.5	No.6	No.7	
Onshore H&G	State	6,600	23,800	23,800	32,800		4,950	4,950
	Local	4,840	17,500	17,500	17,500		3,630	3,630
Onshore Surimi	State		90,200		45,100			
	Local		68,552		34,276			
Factory Trawl Surimi	State			72,100	36,050	88,000	84,700	72,100
	Local			69,634	34,817	84,920	81,735	69,634
Joint Venture (JV)	State	35,000						
	Local	26,000						
JV and Mothership	State						12,540	
	Local						11,913	
TOTALS	State	41,600	114,000	95,900	113,950	88,000	89,650	89,590
	Local	30,840	86,052	87,134	86,593	84,920	85,365	85,177

Explanatory Notes:

[Metric Tons]

- Alternative 1** = 10,000 Onshore Headed and Gutted and 170,000 JV
- Alternative 2** = 36,000 Onshore Headed and Gutted and 164,000 Shore Surimi
- Alternative 3** = 36,000 Onshore Headed and Gutted and 164,000 Factory Trawl
- Alternative 4** = 36,000 Onshore Headed and Gutted, 82,000 Shore Surimi, 82,000 Factory Trawl
- Alternative 5** = 200,000 Factory Trawl
- Alternative 6** = 7,500 Onshore Headed and Gutted and 192,500 Factory Trawl
- Alternative 7** = 7,500 Onshore Headed and Gutted, 164,000 Factory Trawl, 28,500 JV/Mothership

shore processing plants. On-shore processing plants face lower water, electricity and labor costs than do the large factory trawlers because they have to purify the water, generate electricity with diesel and house their workers. Each factory trawler may be able to process a greater quantity of product but not necessarily at a lower cost. There are indications that in Alaska the factory trawlers recovery in surimi production is 12-14% compared to 17-18% for onshore processors. This means that total product sold from a given amount of resource is higher for onshore processing than for offshore processing.

Harvest Allocation Mechanisms

As American factory processors begin to exploit the whiting resource, a substantial redistribution of income can be expected. There is the potential for major economic and social disruption of coastal communities that are dependent on the income generated by the revenues and expenditures of the whiting fleet. If the traditional whiting fleet does not have a resource for which to fish, the boats will attempt to recoup some portion of the annual \$300,000 to \$400,000 in average revenues per boat—totaling about \$20 million— they have lost.

They will do this by entering the other trawl and shrimp fisheries, which are facing smaller quotas and tighter restrictions. The disruption to the industry and the communities may well be more severe because it has been so abrupt. For a port such as Newport, Oregon, commercial fishing brings in some 27% of the total earned income, with the joint venture fleet making up a substantial portion of that total. The loss of this income will have an adverse effect on the entire community.

The Pacific Fishery Management Council (PFMC) has identified two primary issues involved in Pacific whiting allocation:

Protection and Provisions Protection of the existing onshore domestic whiting processing industry and provisions for future growth and development; and

Maintenance Maintenance of the benefits of the whiting resource fishery to traditional participants and coastal communities.

The Pacific Coastal Groundfish Fishery Management Plan, as amended by Amendment 4, authorizes the council to implement or modify management measures for social and economic reasons, including directly allocating any species among the current or prospective users of that resource.

Harvestors for shoreside processors have asked the PFMC for 36,000 metric tons of whiting in 1991. In November, 1990, the PFMC tentatively voted to provide the coastal plants with 36,000 metric tons, while the factory processors will be allowed to harvest up to 192,000 metric tons. If the PFMC ratifies this decision in March, 1991, future allocations may also be based on similar social and economic analysis. Substantial opposition to the council's decision is likely, however, from representatives of the factory processors.



PACIFIC WHITING

Market Opportunities

Status

Recent events have led most analysts to believe that a substantially greater volume of Pacific whiting could be profitably processed by the U.S. seafood industry. These events include global price increases for whiting and other groundfish species, expansion of whiting markets in Europe, shortages of other West Coast groundfish supplies relative to West Coast fishing capacity, and development of methods for counteracting parasite and texture-related quality problems.

Presently, the Pacific whiting fishery is operated primarily as a joint venture fishery involving American harvesters and foreign processing vessels from Poland, the Soviet Union, Korea, and Japan. The raw product is processed into fillets, headed-and-gutted (H&G) products, and surimi, and distributed to markets in Eastern Europe and Asia (fish meal is also produced from the wastes as a by-product). U.S. shore-based firms process approximately 6,000-10,000 metric tons annually which is less than 5% of the total allowable catch. Most of this product is processed into H&G which is positioned for sale to low-income ethnic households in the domestic retail market.

Past efforts by the U.S. industry to produce other Pacific whiting-based products such as fillets and breaded portions have been relatively unsuccessful. These failures have occurred despite research by seafood technologists demonstrating that if Pacific whiting is handled properly during capture, processing, and distribution, and if it is prepared and cooked in a manner which prevents the activation of protease enzymes, that a reasonable quality product could be developed comparable to other moderately priced whiting species. Preliminary analysis suggests that the industry's poor success has resulted from the adoption of production and marketing efforts too limited and too disorderly to effectively address product quality issues.

National Market Survey

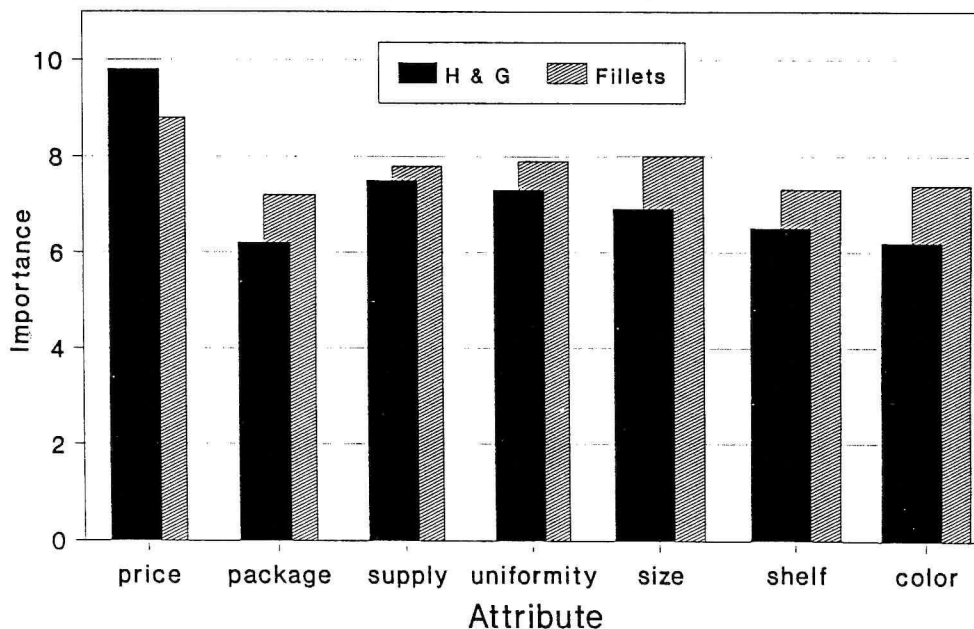
In order to explore the potential market opportunities for expanded domestic production of Pacific whiting, a national market survey was conducted of firms which handle whiting or handle product forms which could be processed from whiting. The survey objectives include developing marketing information on:

- Optimal product forms;
- Relative importance of product attributes;
- Effects of alternative contractual arrangements.

The survey results revealed that the industry is relatively confident that a wide variety of product forms could be profitably processed from Pacific whiting, but only if product quality is improved. There was consensus that, given the difficult issues related to product quality, a significant degree of cooperation, risk sharing, and marketing commitment would be essential among industry sectors. While the industry expects groundfish prices to increase during the next few years, they also believe there will be groundfish shortages. The industry also expects prices for whiting products to increase, but are uncertain as to whether there will be growth in supplies.

Profitable opportunities for expanding the production of H&G were considered limited. The domestic market for H&G is relatively specialized and margins are relatively low. High transportation costs for H&G product would limit opportunities in European markets. Fillets or minced products would provide better potential, but only if the product has at least a moderately firm texture and reasonably long shelf life. Examples from the survey results are summarized in Figures 4 and 5 below.

Figure 4
Relative Attribute Importance



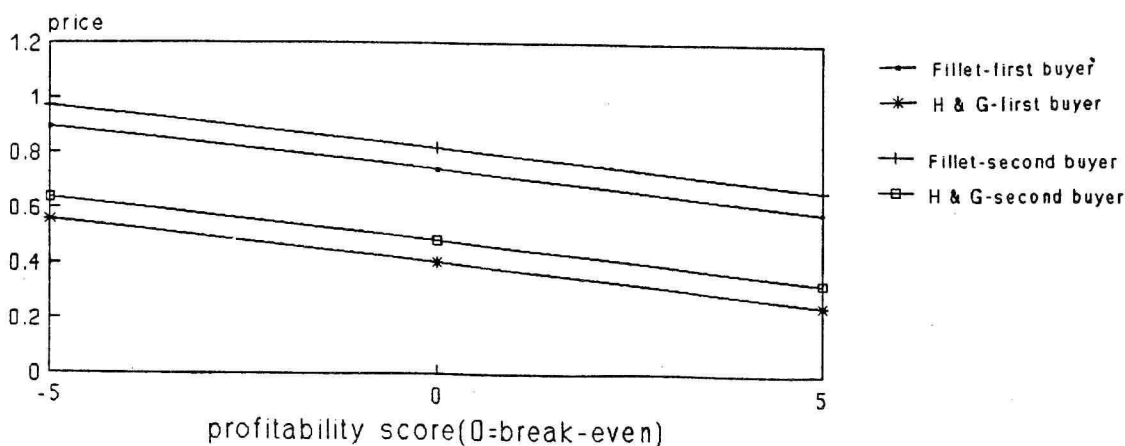
	Price	Packaging	Supply	Product Uniformity	Size	Shelflife	Color
H & G	9.8	6.2	7.5	7.3	6.9	6.5	6.2
Fillets	8.8	7.2	7.8	7.9	7.2	7.3	7.4

LSD_{.05} = 1.46

F = 9.21***

***($\alpha < .01$)

Figure 5
Relative Profitability of Moderate Quality Whiting



SOURCE: Gilbert Sylvia, *Market Opportunities for Pacific Whiting*, Oregon State University Coastal Oregon Marine Experiment Station

Figure 4 shows a comparison of the relative importance of some of the requisite market information for H&G and fillets. Price is shown to be significantly more important than other product attributes for the low priced “commodity” item known as H&G whiting. Conversely, for higher priced fillets, other attributes are as important as price in impacting decisions to purchase and distribute whiting products.

Figure 5 shows the relative profitability (+5 = highly profitable, 0 = breakeven, -5 = highly unprofitable) to primary and secondary buyers of purchasing a moderate quality Pacific whiting fillet or H&G. Buyer break-even prices of \$0.76 and \$0.85 per pound for fillets, and \$0.42 and \$0.51 per pound for H&G may be interpreted as an indicator of expected market price given a moderate level of product attributes. The price differentials between each market sector for each product form (approximately \$0.09 per pound for both fillets and H&G) may be interpreted as the margins or differences in purchase price between the distributors. Improving product attributes would result in an increase in market price; conversely reducing the level of product attributes would result in a decrease in price.

Prognosis

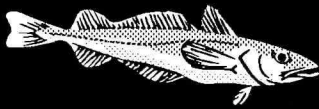
The opportunities for secondary processing into breaded products positioned for the food service and institutional markets is promising. With the rapid increase in cod and pollock prices, institutions including the military, school systems, prisons, and nursing homes are looking for reasonably priced substitute products. Breading may help improve product qualities and provides an opportunity for developing value-added products.

The U.S.-based surimi industry is expected to consolidate and become increasingly market oriented. Prices are expected to increase 10-30% within the next year as a result of the diversion of pollock away from surimi production and toward the more profitable fillet market. In addition, evidence from Japan indicates that Pacific whiting-based surimi is a relatively high priced product compatible in quality to the highest grades of surimi produced from Alaskan pollock. As a result, the potentials for a shore-based surimi facility as a secondary plant to produce surimi-based analogs looks promising if problems related to infrastructure—waste disposal and supply availability—can be solved.

Production of fresh rather than frozen surimi may provide a comparative advantage to shore-based plants relative to at-sea processors. Potential opportunities may be enhanced by inviting Japanese investors with experience in producing surimi from Pacific whiting, or by purchasing the rights to Pacific whiting-based surimi formulations. At least one Oregon firm will be producing significant amounts of surimi-based analog products within the next three years and is interested in securing supplies of high quality Pacific whiting.

For most primary and secondary product forms, a relatively large scale of operation and cooperation will be necessary in production, processing, and marketing. Besides supporting the necessary infrastructure, local and state governments will need to provide the support and incentives necessary to attract investment. Four key areas of support include:

- Encouraging the industry to control product quality and develop product standards;
- Solving waste disposal problems;
- Obtaining favorable shore-side allocation;
- Developing regulatory policies that would allow the industry to secure a level of raw product large and sustainable enough to justify long-term, large-scale investment.



PACIFIC WHITING

7

Infrastructure Requirements

The possible use of Pacific whiting in large scale surimi production was the focus of a West Coast Fisheries Development Foundation study conducted in 1988, titled *Pacific Whiting Surimi Production Feasibility Study*. The study used exhaustive source materials and drew heavily on previous research efforts in the handling and machine processing of whiting through the fillet stage. The conclusion drawn from the study was significant:

Both floating processor and shore-based production are not only technically feasible but have the potential for high rates of return under conservative operating assumptions.

Any shore-based Pacific whiting facility, however, will require substantial infrastructure support in the form of water and wastewater treatment capacity.

Water Requirements and Availability

Fresh potable water is an essential ingredient of virtually all food processing operations. Availability of potable water for fish processing varies widely from port to port along the Oregon Coast. Factors such as seasonal and hourly consumption can be limiting factors. However, communications with various municipalities and water districts produced opinions about availability of water in excess of current needs during the Pacific whiting season, from May through September. Although Florence—and perhaps Newport at times during dry years—do not presently have excess water supplies during the summer months, new resources and/or treatment facilities are being developed.

Solid Waste

Seafood solid waste production in Oregon is estimated to be about 40,000 to 50,000 tons in 1983, which is equal to about one-fifth the amount of waste which would be created by the entire harvest of whiting. A 150-ton per day whiting facility would produce from 52 to 112 tons per day of solid waste depending on the products produced.

Seafood waste disposal is currently a serious problem in certain localities and the addition of 52 to 112 tons of solid carcass waste would not be possible without undertaking costly disposal programs and investments. Alternatives for disposal or utilization of this waste include grinding and pumping to the estuary, fish meal, liquid fish products and composting.

Grinding and pumping solid waste to the estuary is possible in certain situations under a general Department of Environmental Quality (DEQ) permit held by the Oregon Department of Fish and Wildlife (ODFW). These discharges, monitored by ODFW, are permitted in an effort to introduce nutrients into the estuary in cases where there will be no damage from buildup of these materials. At this time, it seems likely that only sites on the main stem of the Columbia River would meet the criteria.

Disposal of whiting solid waste to existing fish meal facilities seems feasible in the Astoria/Warrenton area and from Coos Bay south to Brookings. Existing meal plants in Hammond and Charleston have surplus capacity although the economics of fish meal made from scrap changes frequently.

Liquid Waste

Screened, liquid seafood processing waste discharged into Oregon's estuaries is generally allowed under a DEQ permit. Most of Oregon's estuaries have a high enough flow to ensure that such discharges are not a problem if the discharge is piped into the channel reasonably near the ocean outlet. Upriver discharges would probably not be possible (e.g. Toledo, Oregon).

Cold Storage

Public warehouse gross freezer space in Oregon (as of October 1, 1990) was slightly over 62 million cubic feet, of which over 52 million cubic feet were usable for storage. Finding room for short-term storage for several 150 ton-per-day processing plants should not be a problem based on the assumption that the product would quickly be moved on to larger facilities in the Midwest and on the East Coast.

The feasibility of building public cold storage facilities on the Oregon Coast has been considered in two studies at the state and local levels. The results of each study indicate that at the time of the study, 1979 and 1989 respectively, the demand for coastal cold storage did not justify the investment. Transport to most U.S. markets would be mostly through the greater Portland area and cold storage at that point is the most practical.

Permit Requirements

Two major types of problems face an applicant who applies for a permit to establish and operate a Pacific whiting plant: (1) land use; and, (2) water and air pollution.

Under Goal 16 of the Oregon Statewide Planning Goals, Oregon's estuaries are subdivided into "overall estuary classifications" such as:

Natural Estuaries where the least amount of estuary alteration is permitted;

Conservation Estuaries is an intermediate category where some recreational uses and other commercial uses are permitted on a limited scale;

Development Estuaries where the most intensive water-dependent marine industrial activity is allowed.

Goal 16 further requires Estuary Plans delineate "Management Units" within estuaries. These management units are the equivalent of traditional zoning land use classifications and spell out where within a particular estuary different land uses are permitted.

It should be noted that Oregon's estuary plans are the outcome of years of intense effort on the part of many Oregonians. These plans provide a blueprint for future development and resource protection/enhancement in Oregon's estuaries. Therefore, every effort should be made to work within the estuary plans. Any effort to "open up" an estuary plan by trying to create a new development management unit or to expand existing development management units will meet with formidable opposition.

Under the Clean Water Act and the Oregon Revised Statutes, the National Pollution Discharge Elimination System (NPDES) permit system is administered in the context of water quality standards. Under Oregon and federal law, NPDES permits can be granted only if these discharges do not conflict with these water quality standards.

Due to the marked physical differences among Oregon's river basins (enumerated under OAR 340-41-202 through 962), applicants for an NPDES permit need to evaluate these different river basin standards before

Table 7
Summary of Infrastructure Criteria

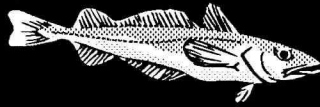
Area	Water	Liquid Waste	Solid Waste	Cold Storage
Astoria	Yes	River discharge	Grind & pump meal plant	Local, Portland
Warrenton/ Hammond	Yes	River discharge	Grind & pump, meal plant	Local, Portland
Garibaldi/Tillamook	N/A	Needs study	Will be a problem	Portland
Newport	Yes	Needs study	Will be a problem	Portland
Toledo	Yes	Probably not	Will be a problem	Portland
Florence	No	Needs study	Will be a problem	Portland
Umpqua	N/A	Needs study	Will be a problem	Portland
Coos Bay, Charleston/ Brookings	Yes	Needs study	Meal plant	Portland
	Yes	Needs study	California markets	Portland, or California

Source: Ken Hilderbrand, *Infrastructure Requirements*, Oregon State University Marine Advisory Program

they select a site for a whiting plant. These different standards may preclude the consideration of a whiting processing plant for certain sections of river basins.

Clearly, because large rivers and estuaries can assimilate wastes without affecting water quality more readily than smaller ones, it is more difficult and costly to structure an NPDES permit application for smaller rivers. Therefore, as a general rule, the larger the river and the estuary, the more likely an applicant is to receive an NPDES permit to operate a whiting plant. In addition, since the overall flow of water in rivers is greatest at their mouth, an application for an NPDES permit is more likely to receive an approval if the facility is proposed for the lower portion of a river rather than its upper reaches.

A determination by the Department of Environmental Quality as to which technology is needed will be dictated by the waste stream itself and the receiving environment. If, for some reason, an applicant needs to locate a plant in a small estuary, more intense levels of water treatment will be required. Conversely, proposals for plant siting beside larger estuaries with greater flushing capacity will involve less treatment. Local representatives of the Oregon Department of Economic Development may be contacted for assistance in moving any prospective development project through Oregon's "permitting" process.



PACIFIC WHITING

Glossary

ABC: Acceptable Biological Catch, represents the current harvest levels guidelines set by the regulatory management agencies.

Analog: Surimi-based fish products produced with minced fish (i.e. surimi); the main market has been Japan where such products are called "Kamaboko".

Factory Processors: Term referring to large, sea-going vessels outfitted to process catches on the open ocean; most were built in the last decade mainly to harvest pollock resources off Alaska; operators have requested a Pacific whiting allocation from the PFMC.

Groundfish: A fish managed by the PFMC, including such fish as cods, flounders and whiting.

H&G: Headed and gutted processed product.

JV: Pacific Joint Venture fishery between American harvesters and foreign processors

MSY: Maximum Sustainable Yield; represents the estimated long term level of harvest that can be taken without damaging the fishery.

MT: Metric ton; equivalent to 2,207 pounds.

OCZMA: Oregon Coastal Zone Management Association, Inc.—a voluntary organization of coastal counties, cities, ports, and soil and water conservation districts.

Over-capitalization: Investment in harvesting and processing potential has expanded very rapidly in the Alaska pollock fishery. Estimates are that the capacity to harvest this resource is 50% higher than needed to harvest the resource.

Pacific whiting (*Merluccius productus*): A small, two pound dark gray, soft-textured fish (also called hake); most abundant fish off the West Coast.

PFMC: Pacific Fishery Management Council, established by the Magnuson Fishery Conservation and Management Act passed by U.S. Congress in 1976; the council sets limits, rules and regulation concerning fish harvest between the 3-mile and 200-mile offshore area.

Pollock: Pollock is a huge fishery resource of about 3 billion pounds annual harvest, located off Alaskan shores.

Surimi: A highly refined form of minced fish meat. Used in a variety of imitation fish products, such as imitation crab, scallops and shrimp.

TAC: Total Allowable Catch—a quota or guideline of harvest set by management agencies.

Whitefish: Any one of a variety of white-fleshed fish.