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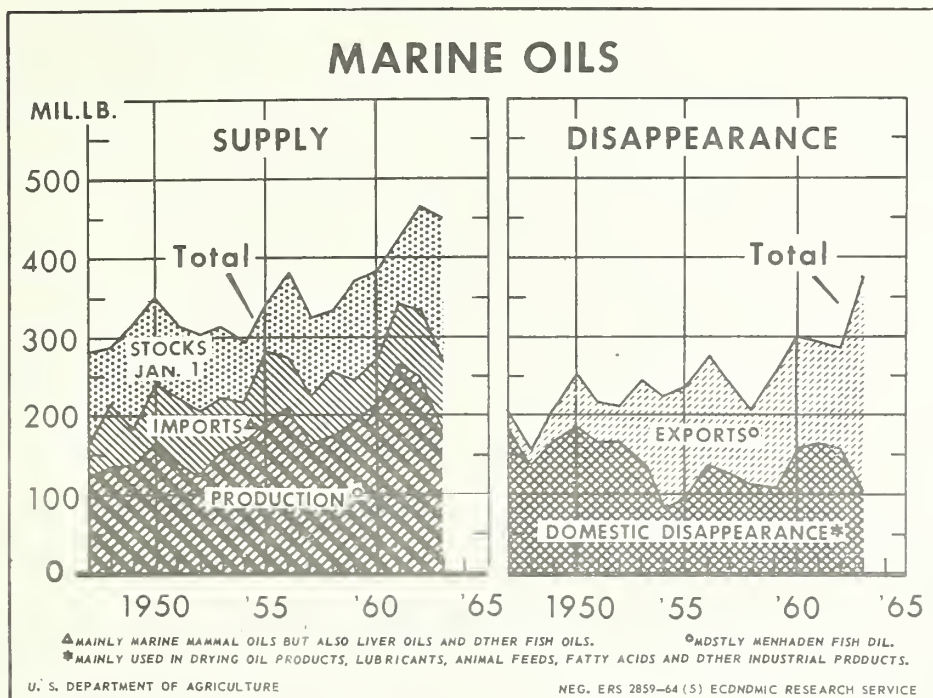
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RECENT TRENDS IN U. S. PRODUCTION, USE, AND PRICE OF MARINE OILS 1/

by
Stanley A. Gazelle



U. S. supplies of marine oils increased from a postwar low of 281 million pounds in 1947 to over 450 million in recent years, mainly due to an uptrend in production. Output dropped sharply in 1963 because of a poor fishing season for menhaden, the leading marine oil produced in the United States.

Marine oil exports have ex-

panded greatly in the postwar era, from 21 million pounds in 1947 to 274 million in 1963. Record U. S. exports in 1963 resulted from the sharp reduction in world output of marine oils and rising prices. Domestic disappearance, which has fluctuated considerably during this period, fell off sharply in 1963, apparently because of increased prices for menhaden oil. (See page 29).

Reprinted from the Fats and Oils Situation, FOS-223, June 1964, by the Economic and Statistical Analysis Division, Economic Research Service

RIAGENCY READING ROOM

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RECENT TRENDS IN U. S. PRODUCTION, USE,
AND PRICE OF MARINE OILS 1/

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Stanley A. Gazelle

Since World War II, supplies of marine oils in the United States have shown an irregular, upward trend, increasing from a postwar low of 261 million pounds in 1947 to over 450 million pounds in recent years. Though marine oils account for less than 3 percent of the total domestic production of fats and oils (including oil equivalent of oilseeds), they are important in both the domestic and foreign markets. In recent years, about 45 percent of the U. S. marine oils have gone into domestic consumption and the other 55 percent exported (table 21). Domestically, they are used in drying oil products, in lubricant production, in animal feeds, fatty acids, and for other industrial purposes. In these industries, they compete effectively with commodities of agricultural origin, such as soybean, linseed, castor, tung, and tall oils. Medicinal marine oils, such as cod liver oil, primarily are imported items and comprise only a small part of the entire industry.

Fish meal and fish solubles are other products produced jointly with oil from certain species of marine animals. They are important ingredients used in the livestock and poultry feeding industry. Fish meal supplies have increased since the end of World War II. In 1963, supplies totaled 675,000 tons compared with 209,000 in 1946. Annual domestic production of fish meal increased from around 200,000 tons in 1946 to around 320,000 in 1955. Output remained at a high level until 1963, when it dropped to 298,000 tons. Imports of fish meal in recent years have accounted for most of the annual increase in supplies. In 1963, around 375,000 tons were imported, compared with 8,000 tons in 1946. About 80 percent of the 1963 total came from Peru. 2/

Sources of Marine Oils

There are two major sources of marine oils. Body oils, the major marine oil group in the United States, are obtained mainly from whole fish and from fish waste resulting from canning, filleting, and dressing fish. Fish liver and viscera oils, the other group, are extracted from the internal organs and

1/ The term "marine oils" generally refers to oils derived from marine animal life. There are several distinct classes of marine oils, such as liver oils, marine mammal oils, and fish oils, produced from a wide variety of species. Since marine oil production in the United States is dominated by one species of fish--the menhaden--this paper analyzes the oils as a single group; class divisions are held to a minimum.

2/ A comprehensive analysis of the fish meal industry is contained in the Feed Situation, FdS-197, dated February 1963. Reprints may be obtained from the Division of Administrative Service, MOS, Agricultural Economics, USDA, Washington 25, D. C. Ask for ERS-112.

Table 21.--Marine oils: Supply, disposition, and utilization, 1912-1963

Year	Production		Supply		Disposition		Utilization									
	Men- haden	Total	Imports 2/	Stocks Jan. 1	Exports and shipments 3/	Domestic disap- pearance	Use in shorten- ing	Soup	Paint and varnish	Linoleum and oilcloth	Other drying oils 4/	Lubricant and similar oils	Animal feeds	Fatty acids	Other	Total
	mil. lb.	mil. lb.	mil. lb.	mil. lb.	mil. lb.	mil. lb.	mil. lb.	mil. lb.	mil. lb.	mil. lb.	mil. lb.	mil. lb.	mil. lb.	mil. lb.	mil. lb.	mil. lb.
1912	---	43	21	---	9	55	---	11	---	---	11	---	---	---	33	55
1913	---	3	17	---	9	11	---	---	---	---	2	---	---	---	9	11
1914	---	27	23	---	1	49	---	16	---	---	10	---	---	---	23	49
1915	---	10	20	---	30	29	---	---	---	---	6	---	---	---	23	29
1916	---	35	33	---	68	67	---	13	---	---	13	---	---	---	41	67
1917	---	31	40	---	71	70	---	13	---	---	14	---	---	---	43	70
1918	---	25	30	---	55	51	---	6	---	---	10	---	---	---	35	51
1919	---	38	19	---	57	49	---	8	---	---	10	---	---	---	31	49
1920	---	54	16	46	3	54	---	---	---	---	11	---	---	---	43	54
1921	48	60	24	61	1	99	---	38	---	---	20	---	---	---	41	99
1922	55	81	51	45	6	120	---	91	---	---	24	---	---	---	5	120
1923	58	88	56	50	2	146	---	74	---	---	29	---	---	---	43	146
1924	30	70	69	46	1	137	---	68	---	---	27	---	---	---	42	137
1925	47	101	85	47	1	175	---	99	---	---	35	---	---	---	41	175
1926	31	83	93	58	1	165	---	---	---	---	41	---	---	---	12	165
1927	31	82	134	67	1	190	---	135	---	---	38	---	---	---	17	190
1928	28	92	125	92	1	237	---	143	---	---	47	---	---	---	32	237
1929	25	116	139	5/71	1	220	---	134	---	---	44	---	---	---	27	220
1930	25	111	127	5/105	1	180	---	114	---	---	36	---	---	---	30	180
1931	15	65	144	5/163	2	223	---	127	12	15	---	---	---	---	49	223
1932	23	92	94	5/147	1	196	---	98	8	12	---	---	---	---	64	196
1933	26	134	97	5/142	6	283	---	97	9	13	---	---	---	---	95	283
1934	28	226	59	5/144	7	226	---	11	12	13	---	---	---	---	91	226
1935	31	240	79	195	3	320	---	138	19	14	---	---	---	---	120	320
1936	38	301	93	192	4	370	---	161	24	16	---	---	---	---	128	370
1937	30	270	123	214	2	389	---	21	28	17	---	---	---	---	133	389
1938	32	266	85	216	3	305	---	17	146	14	---	---	---	---	111	305
1939	46	271	87	259	16	357	---	167	26	17	---	---	---	---	126	357
1940	45	188	42	245	4	272	---	108	31	15	---	---	---	---	106	272
1941	47	220	36	199	3	282	---	76	41	15	---	---	---	---	113	282
1942	40	158	64	5/202	10	196	---	6	23	5	---	---	---	---	86	196
1943	44	175	133	219	74	233	---	45	27	1	---	---	---	---	141	233
1944	47	214	38	219	14	285	---	51	36	2	---	---	---	---	124	285
1945	65	186	37	231	34	301	---	114	43	6	---	---	---	---	126	301
1946	76	153	31	119	15	170	---	40	36	5	---	---	---	---	81	170
1947	66	128	35	118	21	185	---	43	34	5	---	---	---	---	95	185
1948	68	131	81	75	20	132	---	35	27	5	---	---	---	---	57	132
1949	64	136	46	134	40	167	---	10	15	4	---	---	---	---	131	167
1950	79	166	74	109	77	182	---	8	21	4	---	---	---	---	140	182
1951	97	140	84	5/90	51	166	---	2	32	2	---	---	---	---	135	166
1952	100	124	81	5/98	46	165	---	---	32	1	---	---	---	---	129	165
1953	138	155	69	94	108	135	---	7/	31	7/	---	---	---	---	102	135
1954	144	166	53	74	142	135	---	---	20	1	---	---	---	---	60	135
1955	164	151	50	64	143	96	---	---	13	---	21	---	---	---	62	96
1956	174	207	70	105	144	135	---	---	14	---	18	---	---	---	103	135
1957	122	165	60	103	120	129	---	---	11	---	21	---	---	---	97	129
1958	132	172	83	78	96	112	---	---	12	---	18	---	---	---	82	112
1959	160	195	50	126	147	109	---	---	3	8	10	---	---	---	27	109
1960	189	215	56	114	147	153	---	---	33	---	15	---	---	---	41	153
1961	243	266	77	84	126	168	---	---	2	---	10	---	---	---	17	168
1962	233	250	85	133	130	156	---	---	68	---	2	---	---	---	36	156
1963 10/	168	166	83	8/182	274	9/104	---	---	16	---	8	---	---	---	23	9/104
1964	165	165	83	8/163	274	9/104	---	---	16	---	8	---	---	---	23	9/104

1/ Includes Menhaden, tuna, and mackerel, herring, fish liver, sperm, whale and seal oils. 2/ Includes fish livers, vitamins and drugs derived from marine animals. 3/ Includes re-exports, fish livers, vitamins and drugs. In 1947 and 1948 includes some exports under voluntary relief programs. 4/ 1912-30 assumed to equal 20 percent of total domestic disappearance. 5/ Apparent stocks. 6/ Reported stocks minus stocks in bonded warehouses. 7/ Less than 500,000 pounds. 8/ Includes government stockpile. 9/ Factory consumption used for years in which factory consumption exceeds computed domestic disappearance. 10/ Preliminary.

trimmings of various fishes. Body oils are derived mainly from such species as menhaden, herring, alewife, salmon, tuna, mackerel, whales (including sperm oil), and other lesser known types. Body oils are used predominantly as drying oils in the surface coatings industry. Menhaden oil, for instance, is highly unsaturated; it has an iodine value (the index of the drying and polymerizing properties of oils) of 140 to 180.

The main source of liver and viscera oils is from codfish and certain species of the shark family, although the most commonly known is cod liver oil. Fish liver oils are rich in vitamins A and D and this is their chief value. The synthetic production of these vitamins has curtailed materially the demand for fish liver oils in recent years. Domestic output of liver and viscera oils, though quite substantial in the 1940's, today is very small, totaling about 200 thousand pounds in 1963 (table 22).

Menhaden Fish Oil is the Leading Marine Oil
in the United States

Menhaden fish are not used for human consumption mainly because they are too oily in taste and quite bony. Nevertheless, oil obtained from this fish has a significant impact upon the fats and oils economy of the United States. These high-oil content fish inhabit the coastal waters of the Atlantic Ocean from Nova Scotia to Brazil. They are caught commercially off the Atlantic and Gulf Coasts of the United States. In the fall, menhaden migrate from the North Atlantic southward. They average less than a foot in length and about two-thirds of a pound in weight.

Menhaden usually swim in large schools near the surface of the water and are caught primarily within 3 miles of the shoreline. The schools are located usually by airplanes working closely with large fishing ships. The fishing vessels, when approaching a school, release the purse boats which carry the net, or purse seine. After being caught, the menhaden are then pumped from the net into the large fishing ship. Many of these ships, especially in the Gulf, have refrigerated holds to preserve the quality of the fish. On arrival at the plant, the fish are pumped from the boats to the equipment where they are continuously cooked by pressurized steam and pressed. In processing or reduction, the entire fish is used. The economic value of menhaden lies in the important fish products of oil, meal and solubles. The total yield of the three averages about 40 percent of the weight of fish reduced.

Oil yield from menhaden averages around 9 percent, but the rate can vary widely, from less than 1 percent to nearly 50 percent. This rate varies seasonally as well as from year to year, depending upon the fishing grounds, the condition and age of the fish and many other factors. Yield of fish solubles averages around 8 percent. The recovery of meal is fairly constant at about 20 percent. Due to the high water content, yield of products from the fish processed is low when compared to yields from materials such as the vegetable oilseeds.

Oil production follows closely the annual fishing cycle and is a highly seasonal business. Production is heaviest during the summer months and tapers off sharply during the winter. Almost 90 percent of total oil output is produced

Table 22.--Marine oils: U. S. production by coasts, class and species, 1953-63

Coast, class and species	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963 *
	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.
Atlantic and Gulf Coasts											
Body oils:											
Menhaden	137.9	144.3	163.4	173.6	122.3	132.1	159.7	189.3	242.7	232.6	167.6
Alewife	---	---	---	.6	.8	.3	.3	.6	.1	.9	.3
Herring	1.5	1.7	.4	1.0	1.1	1.6	1.4	1.0	2/	2/	2/
Other 3/	2.7	3.4	4.4	3.9	6.2	7.1	5.5	3.6	5.6	3.1	3.2
Total	142.1	149.5	168.3	175.1	130.4	141.1	166.9	194.4	248.4	236.6	171.1
Liver and viscera oils:											
Cod	.9	1.2	1.2	2/ 1.4	2/ 1.4	2/ 1.4	2/ 1.4	2/ 1.4	2/ 1.4	2/ 1.4	2/ 1.4
Shark	2/	2/	2/	2/ .7	2/ .2	2/ .2	2/ .2	2/ .2	2/ .2	2/ .2	2/ .2
Other 5/	1/	.2	1/	.1	.9	.2	2/	2/	2/	2/	2/
Total	.9	1.4	1.2	2.2	1.2	.4	2/	2/	2/	2/	2/
Total oils, Atlantic and Gulf Coasts	143.0	150.9	169.5	181.3	131.5	141.5	166.9	194.4	248.4	236.6	171.1
Pacific Coast 6/											
Body oils:											
Herring	4.0	4.0	7.7	12.7	13.0	11.6	13.6	10.5	2/ 6.1	5.1	5.7
Tuna and mackerel	4.9	4.4	4.1	5.3	5.5	4.7	4.5	3.8	5.7	5.0	5.7
Whale (sperm and other)	---	---	---	---	3.3	3.2	3.9	3.3	3.5	2.6	2.1
Sardine (Pilchard)	.1	5.7	6.7	2.5	.7	5.6	1.4	1.2	.6	.2	1/
Salmon	1.6	1.4	1.1	.6	.4	.7	.3	.1	.1	.1	.6
Other 7/	2.3	1.9	1.5	4.7	2.2	2.3	1.5	1.6	1.2	.5	.4
Total	12.9	17.4	21.2	25.8	25.1	28.1	25.3	20.5	17.3	13.5	14.5
Liver and viscera oils:											
Shark	2/ .2	2/ .2	2/ .4	2/	2/	2/	2/ .2	2/ .2	2/ 4/	2/ 4/	2/ 4/
Other 8/	.5	2.3	.2	1/	1/	1/	2/ .1	2/ 1/	2/ .1	2/ 5/	2/ 4/
Total	.7	2.5	.5	1/	1/	1/	2/ .2	2/ .2	2/ .1	2/ 1/	2/ .2
Total oils, Pacific coast 6/	13.6	19.8	21.7	25.8	25.2	28.1	25.6	20.7	17.4	13.5	14.7
Total body oils, U. S.	155.1	166.8	189.4	204.9	155.5	169.2	192.3	214.9	265.8	250.1	185.6
Total liver and viscera oils, U. S.	1.6	3.9	1.7	2.2	1.2	.4	.2	.2	.1	1/	.2
Total oils, U. S.	156.6	170.7	191.1	207.1	156.6	169.5	192.5	215.1	265.8	250.1	185.8

1/ Less than 50,000 pounds. 2/ East and West Coast production combined. 3/ Includes groundfish and unclassified body oils. 4/ No longer shown separately. 5/ Includes tuna, burbot, flounder, hake, halibut, pollock, cod, swordfish, sea bass, whale and mixed liver oils. 6/ Includes Alaska, Hawaii, American Samoa and Puerto Rico. 7/ Includes anchovy, ocean perch, fur seal, bottomfish, halibut and unclassified body oils. 8/ Includes halibut, ratfish, sablefish, tuna, swordfish, ling cod, and mixed liver and viscera oils.

* Preliminary.

Totals computed from unrounded numbers. Data converted from gallons at 7.74 pounds per gallon for Atlantic and Gulf Coasts and 7.5 pounds per gallon for Pacific Coast for years 1953-61. Fish and Wildlife Service, USDI, used conversion factor of 7.5 pounds per gallon for all regions.

Compiled from official statistics of the Fish and Wildlife Service, U. S. Department of the Interior.

Table 23.--Wholesale prices of menhaden fish oil compared with prices of linseed, soybean, dehydrated castor, tung and oiticica oils, 1947-64

Year	Menhaden : oil, crude, tanks, f.o.b. Baltimore	Linseed : oil, raw, tank, carlots, Minne-apolis	Soybean : crude, tanks, f.o.b. Decatur	Dehy- drated : castor oil, tanks, southern mills	Tung oil, domestic : tanks, f.o.b. southern New York	Oiticica : oil, liquid, tanks, New York	Menhaden fish oil as percentage of:				
	Cents per lb.	Cents per lb.	Cents per lb.	Cents per lb.	Cents per lb.	Cents per lb.	Percent	Percent	Percent	Percent	Percent
1947	18.6	34.0	23.2	33.8	1/	4/26.8	55	80	55	---	69
1948	17.8	27.8	22.3	25.8	1/	20.7	64	80	69	---	86
1949	7.9	22.7	11.0	21.6	2/22.3	1/	35	72	37	35	---
1950	8.7	16.5	14.0	24.0	25.3	4/20.2	53	62	36	34	43
Average, 1947-50	13.2	25.2	17.6	26.2	3/23.8	3/22.6	52	75	50	3/35	3/66
1951	14.0	18.9	16.8	33.7	4/30.1	28.6	74	83	36	36	49
1952	7.2	15.9	11.0	34.0	4/38.0	23.9	45	65	21	19	30
1953	6.9	15.0	12.4	27.7	27.1	21.9	46	56	25	25	32
1954	7.8	14.6	13.3	21.8	23.6	16.5	53	59	36	33	47
1955	8.2	12.9	11.6	20.5	23.5	13.6	64	71	40	35	60
Average, 1951-55	8.8	15.5	13.0	28.5	30.3	20.9	57	68	31	29	42
1956	8.8	14.1	13.2	23.8	24.1	15.0	62	67	37	37	59
1957	8.9	13.6	12.2	28.2	22.6	17.2	65	73	32	39	52
1958	8.0	13.8	10.5	27.3	21.2	16.7	58	76	29	38	48
1959	7.4	13.1	9.0	25.1	22.0	19.9	56	82	29	34	37
1960	6.5	13.1	8.8	25.0	22.0	15.1	50	74	26	30	43
Average, 1956-60	7.2	13.5	10.7	25.9	22.4	16.8	59	74	31	35	47
1961	6.2	14.2	11.5	25.0	27.6	14.1	44	54	25	22	44
1962	4.6	14.2	9.0	25.1	36.9	16.9	32	51	18	12	27
1963	6.2	12.7	8.9	25.1	36.9	28.4	49	70	25	17	22
1964											
January	8.1	13.3	8.1	25.1	29.1	32.0	61	100	32	28	25
February	8.3	13.3	8.0	25.1	27.9	28.8	62	104	33	30	29
March	8.4	13.3	8.1	25.1	26.5	19.0	63	104	33	32	44
April	8.5	13.3	7.9	25.1	25.7	18.7	64	108	34	33	45

1/ Not reported. 2/ Average based on monthly prices beginning with April and for those months in which reported. 3/ For years shown.

4/ Average based on data for months reported.

between May and October. Last year, 32 plants produced 168 million pounds of menhaden oil, 90 percent of the entire U. S. production of all marine oils. Of this amount, 24 percent was produced along the North Atlantic Coast, 18 percent along the South Atlantic, and 58 percent along the Gulf (tables 24 and 25).

Marine Oil Production Concentrated Along the Atlantic and Gulf Coasts

Nearly all of the U. S. marine oils are produced along the Atlantic and Gulf coasts. The presence of menhaden in the waters off these shores primarily explains this concentration. Marine oils produced along the Pacific Coast (including American Samoa and Puerto Rico ^{1/}) are obtained mainly from the herring, tuna, and mackerel. Smaller quantities are derived from whales, sardines, salmon, and other types. At one time, sardine oil was produced in large quantities, mostly from whole sardines diverted from canning plants when the supply of sardines exceeded demand for the canned product at a reasonable price level. Today, sardine oil output is small, due to the virtual disappearance of this species from the West Coast. A sizable portion of the oil in the Pacific region results from trimmings, particularly cannery waste of viscera heads and tails of species processed for human food consumption. The oil content of the waste materials is usually less than that of the whole fish.

Trends in Domestic Production and Use

Marine oil production in the postwar period has ranged from a low of 124 million pounds in 1952 to a high of 266 million pounds in 1961. During the 1950's, production increased rather steadily. However, the total in 1963 was down sharply, due to a poor fishing season for menhaden, and amounted to only 186 million pounds.

Domestic disappearance during this period has been irregular, ranging from 185 million pounds in 1947 to a low of 83 million in 1954. Domestic use averaged 159 million pounds in 1960-1962, but in 1963 it dropped to 104 million pounds, apparently because of increased prices for menhaden oil.

Thirty years ago, when sardine oil was more abundant, marine oils were used domestically in shortening manufacture. Use in non-food products included paints, varnishes, linoleum and other industrial commodities. Today, use in surface coatings is the major outlet. Substantial amounts are used also for lubricant production, in animal feeds, fatty acids, and miscellaneous industrial purposes. (table 21). However, use in animal feeds is limited to about 1 percent. A higher level imparts a fishy flavor to the meat of the animals fed.

Marine oil utilization in surface coatings is due to the fairly stable, moderate price and the high quality of finishes realized with fish oils. Marine oils have limitations, just as other raw materials, such as a tendency for alkyds made from fish oils to discolor on ultraviolet exposure. Nevertheless, marine oils are used in substantial volume in alkyd resins, varnishes, and paints.

^{1/} Marine oil output in Puerto Rico predominantly is tuna oil and is combined with Pacific Coast production.

Table 24.--Menhaden oil: U. S. production by coastal areas, 1953-63

Area	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963 *
	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.
North Atlantic <u>1/</u>	---	---	---	88.2	64.0	44.7	59.0	60.4	85.2	76.6	39.8
South Atlantic <u>2/</u>	---	---	---	26.7	21.7	35.7	32.3	32.4	36.5	35.5	30.3
Gulf <u>3/</u>	---	---	---	58.7	36.6	51.7	68.4	96.5	121.0	120.5	97.5
Total	137.9	144.3	163.4	173.6	122.3	132.1	159.7	189.3	242.7	232.6	167.6

1/ Includes the States of Maine, Massachusetts, Rhode Island, New York, New Jersey, Delaware and Maryland.

2/ Includes the States of Virginia, North Carolina, South Carolina and East Coast of Florida.

3/ Includes the States of Mississippi, Louisiana, Texas and West Coast of Florida.

* Preliminary.

Compiled from official statistics of the Fish and Wildlife Service, U. S. Department of the Interior.

Table 25.--Menhaden fishery: Number of plants, fish utilized and products obtained, 1953-63

Year	Number of plants	Menhaden reduced 1/	Production of menhaden products								
			Dry scrap and meal			Oil		Solubles			
			Total	Yield per ton of fish		Total	Yield per ton of fish		Total	Yield per ton of fish	
						2/					
	Total	Mil. lb.	Mil. lb.	Pct.	Lb.	Mil. lb.	Pct.	Lb.	Mil. lb.	Pct.	Lb.
1953	36	1,683.4	349.5	20.8	415	137.9	8.2	164	78.1	4.6	93
1954	34	1,740.6	366.2	21.0	421	144.3	8.3	166	112.5	6.5	129
1955	35	1,848.3	381.2	20.6	412	163.4	8.8	177	100.2	5.4	108
1956	38	2,076.6	421.2	20.3	406	173.6	8.4	167	145.7	7.0	140
1957	41	1,681.6	344.8	20.5	410	122.3	7.3	145	138.8	8.2	165
1958	38	1,544.7	316.1	20.5	410	132.1	8.6	171	144.9	9.4	188
1959	37	2,193.9	447.8	20.4	408	159.7	7.3	146	216.2	9.8	197
1960	34	1,999.0	436.8	21.8	437	189.3	9.5	189	131.7	6.6	132
1961	35	2,290.9	495.1	21.6	432	242.7	10.6	212	146.6	6.4	128
1962	33	2,227.3	479.4	21.5	430	232.6	10.4	209	169.8	7.6	152
1963	32	3/1,800.0	363.5	20.2	404	167.6	9.3	186	149.7	8.3	166

1/ May include small quantities of other species.

2/ For years 1953-61, data converted from gallons at 7.74 pounds per gallon.

3/ Estimated by U. S. Department of Agriculture based on reported production for meal, oil, and solubles.

Computed data derived from unrounded numbers.

Compiled from official statistics of the Fish and Wildlife Service, U. S. Department of the Interior.

Exterior house paints use heat-bodied marine oils mixed with raw linseed oil. These marine oils are used also in aluminum paints (exterior and interior), in barn and roof paints, rust-proof coatings, and undercoat paints. In varnish manufacture, bodied fish oil is used in connection with tung oil. This outlet probably has been gaining, since the varnish industry has been taking advantage of the lower cost of fish oil to replace some of the high-priced tung oil in varnish formulations.

U. S. Marine Oils Important In World Trade

The United States accounts for around 10 percent of total world production of marine oils and ranks as a major country in world trade. Basically, this trade consists of exporting menhaden oil and importing the domestically-scarce marine items (mostly whale sperm oil, which is valuable as a lubricant for fine instruments. Because it has few economical substitutes, it is stockpiled by the Government as a strategic commodity for defense purposes).

In 1950, the United States reversed a long-term trend by becoming a net exporter of marine oils for the first time. Since then, exports have grown markedly. During 1950-1954, exports averaged 85 million pounds or about 57 percent of domestic production. In 1963, exports totaled almost 275 million pounds, a record. Europe, the leading market, takes around 90 percent of U. S. exports. The Netherlands, West Germany, Norway, Sweden, and Canada have been the major takers (table 26). However, in 1963, exports to the United Kingdom totaled 87 million pounds, the largest for any single country that year. A large part of the menhaden oil used abroad is for margarine, shortening, and other edible products. In these outlets the oils are refined, hydrogenated, and blended with other fats. Hydrogenation removes some peculiar characteristics of marine oils, such as the odor and taste associated with fish oils.

In 1950-1954, imports of marine oils averaged 72 million pounds or equal to about one-half of U. S. production. Imports in 1963 were 83 million pounds. Western Europe and Japan are the major suppliers, each accounting for about 35 percent of total imports (table 27).

Trends in Fish Oil Prices

Fish oil prices (menhaden, crude, tanks, f.o.b., Baltimore) have declined sharply since the end of World War II, from 18.6 cents per pound in 1947 to 4.6 cents in 1962. At this lower level, they were one of the lowest-priced oils on the world market. This relatively low price of fish oil gave it a comparative advantage over that of competing drying oils such as soybean, linseed, and tung oils.

U. S. production of menhaden oil dropped sharply in 1963 and monthly prices have been moving up rapidly, from 4.0 cents per pound in January 1963 to 8.5 cents in April 1964 (table 23). World output of marine oils declined sharply in 1963, due primarily to the reduced Antarctic whale catch, and was at the lowest level since 1960. Production probably will be higher in 1964 than last year and, if so, prices should recede somewhat.

Table 26.--Marine oils: U. S. exports by area and country, 1955-63 1/

Destination	1955	1956	1957	1958	1959	1960	1961	1962	1963 3/
	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.
<u>North America</u>									
Canada	23.3	4.6	2.5	13.1	4.0	10.1	17.2	11.0	8.5
Other	.4	.4	.4	.5	.6	.7	.6	.8	.7
Total	23.7	5.0	2.9	13.6	4.6	10.8	17.8	11.8	9.2
<u>Central and South America</u>	.2	.2	.1	.1	1.1	.4	1.4	2/	.1
<u>Europe</u>									
Belgium-Luxembourg	2.2	2.0	1.3	4.7	4.3	.7	1.4	3.3	2/
Denmark	---	1.7	---	---	1.2	2/	---	---	---
France	2/	---	2/	2/	.1	2/	.1	.2	.1
Germany, West	21.0	65.0	52.6	35.2	33.7	26.7	15.6	16.9	39.5
Italy	.3	.2	.4	.2	2/	2/	2/	2/	2/
Netherlands	79.3	50.0	32.1	21.8	44.1	53.1	27.9	37.9	36.0
Norway	13.5	12.5	10.5	11.6	16.1	15.9	31.3	10.0	23.7
Sweden	2/	5.3	15.4	6.8	40.7	36.1	20.6	13.4	73.6
Switzerland	1.3	.7	1.7	1.2	---	---	.1	.1	.1
United Kingdom	1.8	1.8	1.7	---	2/	2.3	8.9	33.0	86.7
Other	2/	2/	---	---	---	2/	2/	2/	3.3
Total	119.4	139.3	115.7	81.4	140.3	134.9	105.8	114.8	263.1
<u>Africa</u>	.1	2/	.6	2/	---	2/	.1	.1	.1
<u>Asia</u>									
Philippines	---	2/	2/	---	---	2/	---	2/	2/
Other	.1	2/	2/	.1	.1	.1	2/	1.6	.5
Total	.1	2/	2/	.1	.1	.1	2/	1.7	.5
<u>Oceania</u>	---	---	2/	---	---	2/	2/	2/	.1
Grand Total	143.5	144.5	119.4	95.3	146.1	146.1	125.3	128.5	273.0

1/ Comprised mainly of menhaden oil but includes other body oils, fish liver and viscera oils and marine mammal oils. Includes re-exports but not fish liver vitamins and drugs derived from marine animals. 2/ Less than 50,000 pounds. 3/ Preliminary.

Totals computed from unrounded numbers. When reported in gallons, data were converted to pounds at 7.5 pounds per gallon.

Table 27.--Marine oils: U. S. imports by area and country of origin, 1955-63 1/

Origin	1955	1956	1957	1958	1959	1960	1961	1962	1963 3/
	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.	Mil. lb.
<u>North America</u>									
Canada	10.1	10.2	7.8	4.4	6.5	8.3	6.6	4.9	5.1
Other	.4	.3	.2	.2	.1	.1	2/	---	---
Total	10.6	10.6	8.0	4.7	6.6	8.4	6.6	4.9	5.1
<u>Central and South America</u>									
Peru	7.8	8.0	5.0	11.1	14.8	18.6	14.3	9.5	22.4
Other	.1	2/	2/	2/	2/	2/	3.0	2/	1.4
Total	7.9	8.0	5.0	11.2	14.9	18.6	17.3	9.6	23.8
<u>Europe</u>									
Iceland	3.1	3.1	2.8	1.5	2.8	1.4	1.7	1.2	1.9
Netherlands	1.6	.6	16.2	.1	3.9	8.6	6.4	16.2	14.6
Norway	34.6	21.4	9.6	12.5	12.3	6.2	10.7	6.6	9.0
Portugal	1.0	2.1	2.7	1.8	1.8	2.1	1.5	1.4	1.4
United Kingdom	6.4	3.5	3.0	1.7	2.0	4.1	4.4	2.7	2.1
Other	.3	.3	.6	.3	.3	.1	.1	2/	2/
Total	47.0	30.9	34.8	17.9	23.0	22.5	24.9	28.1	29.0
<u>Africa</u>	.2	---	2/	.2	.3	.1	2/	2/	3.7
<u>Asia</u>									
Japan	23.1	19.8	11.8	48.4	4.3	5.8	27.1	42.0	20.3
Other	.1	.1	2/	.1	.1	2/	---	2/	---
Total	23.2	19.9	11.8	48.5	4.5	5.8	27.1	42.0	20.3
Grand Total	88.9	69.4	59.6	82.3	49.2	55.3	75.8	84.5	81.9
Distribution of imports by class of oil									
Class of Oil	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Fish body oils	12	15	12	6	13	16	11	12	10
Fish liver and viscera oils	22	22	24	12	24	18	12	8	9
Marine mammal oils	66	63	64	82	63	66	77	80	81
Total	100	100	100	100	100	100	100	100	100

1/ Includes mainly whale sperm oil, whale oil, shark liver oils, cod liver oils, herring oil, cod oil, cod oil, and other miscellaneous oils but does not include fish livers, vitamins or drugs derived from marine animals. 2/ Less than 50,000 pounds. 3/ Preliminary.

Totals computed from unrounded numbers. When reported in gallons, data were converted to pounds at 7.5 pounds per gallon.

Production and Utilization Outlook

Future growth of the domestic marine oils industry (basically menhaden fish oil) still possesses considerable potential. Much depends upon research, both in maintaining a continued high menhaden catch and in better utilization of the oil and its derivatives. Utilization research efforts are concerned with long-chained, polyunsaturated fatty acids in such areas as protective coatings, textile chemicals, lubricating oil additives, alkyd resins, plasticizers, emulsifiers, aldehydes, and fatty alcohols. 1/

Demand for fish meal probably will outweigh demand for fish oil as a consideration for a profitable fishing operation, although a favorable export market for the oil should exist. Domestic utilization of fish oil depends greatly upon maintaining the price advantage over that of competing vegetable oils. Finally, "new products" research offers possibilities in such fields as human food products, animal feeds, and other industrial uses. To a large degree, this research in increased product utilization may hold the key to the future course of the industry.

1/ Research on fish oil utilization is being conducted at the Fishery Technological Laboratory, Division of Industrial Research and Services, U. S. Bureau of Commercial Fisheries, U. S. Department of the Interior, 2725 Montlake Boulevard, Seattle, Wash.

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:	The <u>Fats and Oils Situation</u> is published in :
:	January, March, May, August, and November. :
:	:
:	The next issue is scheduled for release :
:	August 27, 1964. :
:	:

