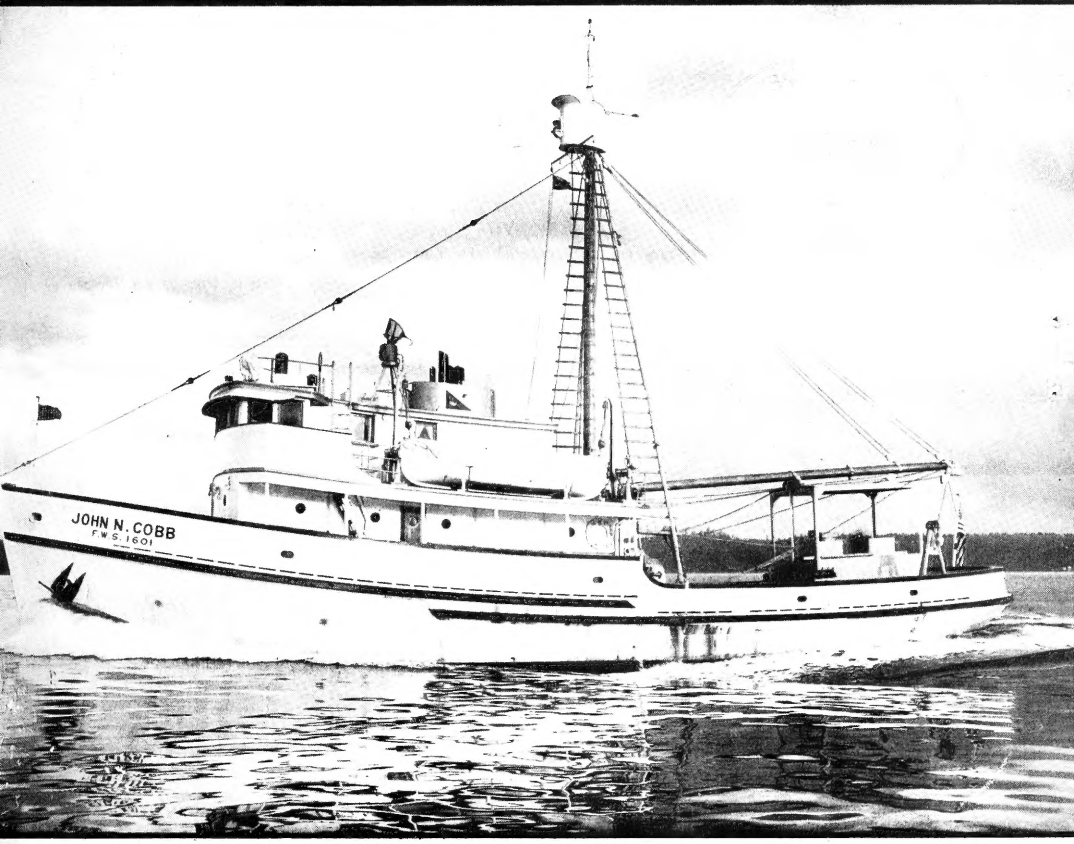
COMMERCIAL FISHERIES REVIEW



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COMMERCIAL FISHERIES REVIEW

A REVIEW OF DEVELOPMENTS AND NEWS OF THE FISHERY INDUSTRIES
PREPARED IN THE BRANCH OF COMMERCIAL FISHERIES

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COMMERCIAL FISHERIES REVIEW

February 1950 Washington 25, D.C. Vol.12, No.2

GALLIC ACID ESTER ANTIOXIDANTS FOR FISH OILS

By C. D. Bittenbender*

ABSTRACT

The report is a record of experiments conducted in an investigation at the College Park Laboratory as a wartime project to obtain information on the development of and the effectiveness of various gallic acid ester antioxidants in preventing the development of rancidity in fish oils and in inhibiting the decomposition of vitamin A in fish oils. A number of gallic acid ester antioxidants were prepared in the laboratory and tested with various fish oils. Several of the gallic acid esters served as good antioxidants. The alkyl gallates offered some protection to shark liver oils against the loss of vitamin A when the oils were blown with oxygen.

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INTRODUCTION

Considerable losses are suffered yearly in stored fishery products through deterioration of the oils contained therein. This degradation is manifested in the development of a rancid flavor, off odor, and discoloration of these products. Rancidity also is associated with the loss of vitamin A of fishery products, particularly in liver oils.

A large number and variety of compounds have been proposed as inhibitors of the development of rancidity in fats and oils. Some are particularly effective in vegetable oils, while others are more adaptable for use in animal fats. Most of these antioxidants have been developed for use in lard, shortenings, oleomargarine or other foods which usually contain a high percentage of fat. These generally contain little if any highly unsaturated fatty acids. Comparatively little work has been done on preventing or retarding rancidity in fish oils. These oils contain highly unsaturated fatty acids and are subject to serious losses because of rancidity. Therefore, an investigation was begun at the Service Laboratory in College Park, Maryland, as a wartime project to obtain information on the effectiveness of various antioxidants in preventing the development of rancidity in fish oils.

The objects of the experiments were: (1) to develop materials which would be effective antioxidants for highly unsaturated oils and (2) to develop materials which would inhibit decomposition of vitamin A in fish oils.

During the course of some earlier investigations conducted by the author and associates in another laboratory, it was found that protection was given to natural seed oils and to crude vegetable oils by substances of a phenolic nature which were related to the tannins. Various concentrates of tannins from tea and other sources were found to be quite effective in preventing rancidity in these vegetable oils. Later, gallic acid, which had been reported suitable by Golumbic and Mattill (1942), was found to be very effective as an

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NOTE: Chronic toxicity experiments with some of these antioxidants have been conducted at this Laboratory and are reported in the next article in this issue, "Feeding Tests With Gallic Acid Ester Antioxidants," pp. 19-20.

antioxidant but had the disadvantage of being rather insoluble in oil. It was found that 10 percent gallic acid in cottonseed oil, which had been partially hydrogenated as a mixture, had a strong antioxidant effect when added in small amounts to vegetable or animal oils. It is probable that under conditions of the hydrogenation, a triglyceride was formed with the gallic acid radical introduced in place of one or more of the fatty acid radicals. In the present investigation, the more promising antioxidants were incorporated into preparations of similar nature.

No conclusive evidence of the exact chemical nature of the autoxidation of fats and oils is available. It has been shown that rancidity of fats is associated with the formation of an ozone at the ethylenic double bond, or formation of monohydroperoxides, which in turn can and probably do act as catalysts to accelerate the production of additional unstable peroxides followed by the formation of aldehydes and ketones.

This is a chain reaction involving the activation of further molecules of the autoxidizable substance with the attendant liberation of energy in excess of that necessary to activate the same number of subsequent molecules. That a series of reactions induced at an ever-increasing rate takes place has been shown by the characteristic curves for rate of peroxide formation in natural fats. For fats containing no antioxidants, either natural or otherwise, the rate of peroxide formation immediately begins to increase logarithmically. The peroxide formation in fats containing antioxidants increases at a constant rate until the so-called end of the induction period is reached, at which time the antioxidant is largely destroyed. Thereafter, the rate of increase in peroxide formation is about the same as for a fat containing no antioxidant.

The mechanism of inhibition of rancidity is probably as follows: The esters of gallic acid and fatty acids combine to form triglycerides which are large molecules similar in size to the fatty glycerides themselves. These probably preferentially absorb the great amounts of the activation energy which are released and which normally cause the formation of peroxides. With efficient antioxidants there should be a constant slow rate of oxidation which is indicated by a straight-line relationship of peroxide formation with time.

Synthetic fatty triglycerides have been prepared successfully by direct esterification of fatty acids and glycerol. This method was used in these studies. Dry carbon dioxide was used as a catalyst for the reaction and to remove the water formed during esterification.

The glyceride gallate antioxidants are thick, viscous liquids. In making them, however, it is very possible that a small quantity of pyrogallol, or an ester of pyrogallol is formed during the synthesis. This was indicated by a brown tint which formed when they were treated with ferric chloride, as well as the blue-black color which developed with the gallates. The presence of the small quantity of substances containing pyrogallol was discovered late in the progress of this work. Pyrogallol probably has no toxic properties in the amounts present since no adverse effects were noted in rats fed the antioxidants in levels approximating five times the quantity used in oils as antioxidants. These chronic toxicity tests were then in progress for more than a year.

Chemically these gallic acid esters are similar to fatty acid modified alkyl resins. Substances of this nature are not crystallizable and do not distill without decomposition even under high vacuum. They are, therefore, practically impossible to separate in pure form. It was recognized that

there was a good possibility that migration of the hydroxyl groups might occur, and that the esterification reaction as indicated by formula would not be complete. There was also the possibility of cross polymerization and esterification of fatty acids with gallic acid hydroxyl groups. The characteristic blue-black color formed by the gallic acid radical with ferric chloride was depended upon as an analytical index to reveal the presence of this group. The insolubility of free gallic acid in oil and the values of the acid numbers found were used as an indication of the completeness of esterification.

The direct esterification procedure was used as it is a comparatively simple technique and could be carried out with equipment generally available, such as in a varnish kettle. These types of esters probably could be produced with fewer side reactions by esterifying triacetyl gallic acid or 4-methyl gallo-etheric acid with mono- and di-glycerides of fatty acids, followed by reestablishment of the gallic hydroxyl groups through hydrogenation or reduction with zinc and acid. The shorter and more direct method of production was chosen because any materials produced would have to be tested for chronic toxicity regardless of their composition. If no toxicity is indicated, it is the preferred method.

In the tests reported herein, all of those materials which contain gallic acid or its esters were added to the substrates in amounts equivalent to 0.1 percent of gallic acid radical. The other materials tested for comparative purposes were added at the 0.1-percent level unless otherwise stated.

During the course of oxidation of various deodorized fish oil substrates using a modified Swift test (King et al, 1933), it was found under the conditions of testing that the oils uniformly became rancid to taste at a peroxide value (p.v.) of about 20 millimoles per kilogram of oil. This peroxide value, therefore, has been taken as the value for comparison in calculating the protective factor for any particular antioxidant. The protective factor equals the time to reach p.v. 20 for the treated oil divided by the time to reach p.v. 20 for the untreated oil.

In evaluating antioxidants as inhibitors of vitamin A destruction, two protective factors were calculated. These were based on the ratio of the time necessary to destroy 10 and 20 percent of the vitamin content in a treated oil, to the time necessary to destroy 10 and 20 percent of the vitamin content in the untreated oil.

METHODS OF ANALYSES

PEROXIDE VALUES: Peroxide values were measured by a modification of the Wheeler method (1932). Samples of oil from 0.1 to 1 g. in weight, and which required a titration of not more than 15 ml. sodium thiosulfate solution, were weighed into small weighing vials. The vials plus samples were placed directly into dry, glass-stoppered 200 ml. Erlenmeyer flasks containing 50 ml. of a mixture of two parts of glacial acetic acid and one part of chloroform. After thorough mixing, one ml. of saturated potassium iodide was added, and the flask was held in the dark for three minutes. Fifty ml. of water were added together with a little starch solution, and the mixture was titrated with .002 N sodium thiosulfate. The data were expressed as millimoles of peroxide per kilogram of oil.

VITAMIN A: The vitamin A determinations were made by direct solution of the oil in isopropyl alcohol and a photometric estimation of absorption in a United Drug Company Vitamin A Meter. Some determinations were made using the unsaponifiable portion of the oil to rule out possible absorption by saponifiable materials added to the oils.

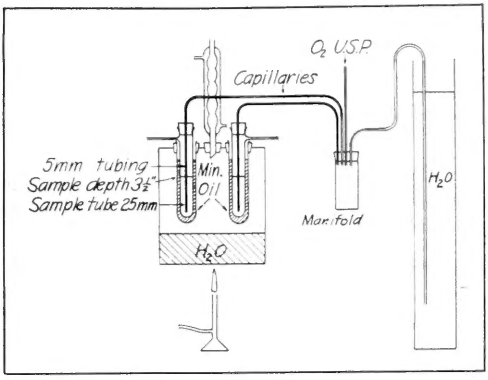


FIGURE 1 - RAPID TEST APPARATUS.

RAPID TEST FOR OXIDATION: The apparatus used embodies the principles of the well-known Swift stability test apparatus (King et al, 1933) except that in these experiments U.S.P. oxygen from a pressure cylinder was used (Fig. 1). The apparatus consists of a metal container fitted with a reflux condenser to return the moisture and to maintain a constant temperature of 100° C. within the boiling water bath. Large test tubes containing mineral oil are fitted into this metal container. These serve as oil baths in which the smaller test tubes containing the test sample are immersed. A manifold system is provided for introducing oxygen at a pressure of about 14 inches of water. The pressure is controlled by a water column manometer. Capillaries 0.1 mm. or less in diameter are placed in the bubbling-tube lines and are calibrated to allow a flow of 50 ml. of oxygen per minute at the before-mentioned manifold pressure. Pyrex test tubes, 25 mm. in diameter, are used as sample tubes. To these are sealed, near the top, horizontal short lengths of 7 mm. tubing which serve to limit the depth of immersion of the tubes in the oil bath and which are used as exit tubes for the oxygen. The gas flowing from these tubes is sniffed for rancid odors to determine how oxidation is proceeding.

All glass parts of the apparatus that came in contact with the samples were thoroughly cleaned with a wetting agent, acetone, and tap water. The parts were immersed in concentrated nitric acid at a temperature of about 90° C. for at least 3 hours, rinsed at least 10 times with tap water, and at least 6 times with distilled water, and oven-dried.

The various antioxidants tested were dissolved in the oil used as substrate by stirring with a clean glass tube through which passed a stream of hydrogen gas. Very gentle heat was used only with those samples which would not dissolve otherwise.

The oxidation apparatus was brought to operating temperature, which required about 10 minutes, before any samples were placed in it. The sample tubes were filled to a depth of 9 cm. and the bubbling tubes were inserted. The samples were allowed to remain in the apparatus without bubbling for 15 minutes to allow them to reach the required temperature. The oxygen system had been previously turned on without a connection with the sample tubes in order to flush out the air. At the end of the 15 minutes, the tubes were connected with the oxygen system.

Samples for the determination of peroxide value were taken periodically by momentarily interrupting the oxygen flow and using the bubbling tube as a sampler. Two samples were run simultaneously in this apparatus. The temperature of the oil in the sample tubes was determined periodically by using a similar tube which contained a thermometer. The temperature was found to remain constant at 99.5° C.

For the oxidation of oil samples to determine stability of vitamin A, the same apparatus was employed except that smaller sample tubes (15 x 150 mm.) were used. These were filled with oil to a depth of 6.5 cm.

STORAGE TESTS: Some samples were stored in glass bottles in the dark at 37° C. The glass bottles used were cleaned by the same methods as previously outlined for the rapid oxidation test. The bottles used were 5 cm. in diameter and 9.5 cm. deep and had mouths 3.75 cm. in diameter. Each bottle contained 50 g. of sample. The bottles were stoppered loosely with new cork stoppers.

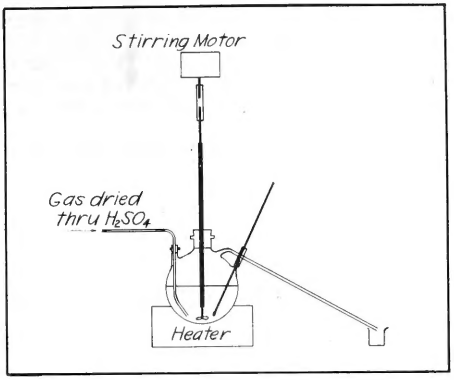


FIGURE 2 - ESTERIFICATION APPARATUS.

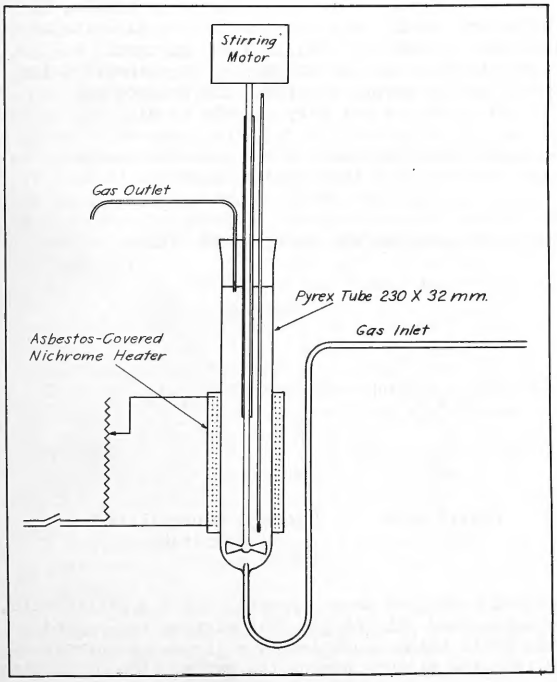


FIGURE 3 - ESTERIFICATION APPARATUS.

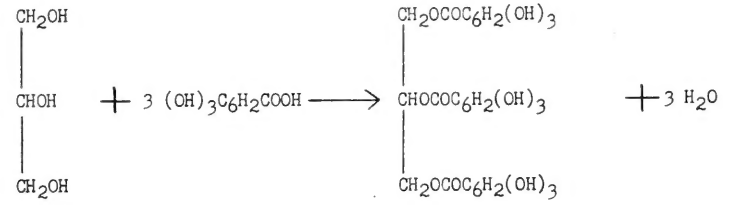
Samples for peroxide determination were taken from these bottles periodically by means of a clean glass tube. This sampling tube was used to thoroughly stir the oil, care being taken to avoid splashing oil on the sides of the bottles. This precaution was taken to avoid the formation of thin films of oil in the bottles which would subsequently oxidize rapidly, catalyzing the oxidation of the remainder of the sample.

PREPARATION OF ANTIOXIDANTS

The alkyl gallates were prepared by direct esterification using dry hydrochloric acid as a catalyst and crystallizing them from suitable solvents. The apparatus (Fig. 2) used to prepare most of the antioxidant preparations is a modified round-bottom, three-neck flask fitted with a thermometer well. The ma-

terial can be heated and stirred while hydrogen, carbon dioxide or dry hydrochloric acid is introduced. The flask used was of one liter capacity. Provision is made to carry off the water of esterification with a side tube from one of the necks. This same apparatus served for hydrogenation at atmospheric pressure. A smaller apparatus of similar design was also made from a pyrex tube (Fig. 3).

An attempt was made to synthesize glyceryl trigallate according to the reaction:

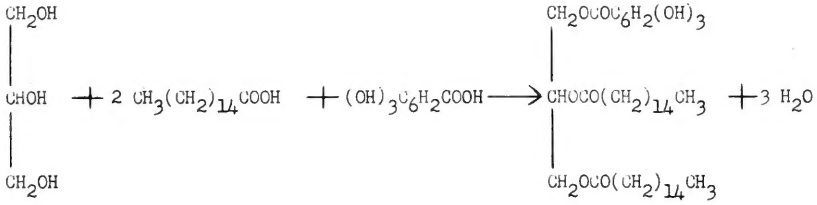


Glycerol Gallic acid Glyceryl trigallate

Because a mixture of gallic acid and glycerol is difficult to handle, it was desired to make a preparation that could be added directly to oil without first removing a solvent. A mixture of gallic acid, 12.3 g.; glycerol, 4.2 g.; and cottonseed oil, 73.0 g. was esterified at 220° C. during three hours using mechanical stirring and a current of dry carbon dioxide. The product was a dark reddish-brown, viscous liquid which was not very soluble in oil.

The following preparations are described under their lettered designations in order to facilitate reference to them when they appear elsewhere in this report.

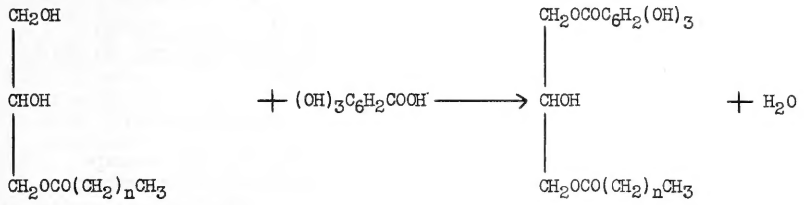
KMGP: The synthesis of this preparation was designed to follow the reaction:



Glycerol Palmitic acid Gallic acid Glyceryl monogallate di-palmitate

In preparing this antioxidant there was used glycerol, 2.5 g.; gallic acid, 2.5; palmitic acid, 6 g.; and cottonseed oil, 60 g. This mixture was heated to 200° to 210° C. for three hours while being mechanically stirred. A current of dry carbon dioxide was passed into the mixture during the entire time of heating and cooling.

KHMD: In this preparation it was desired to combine low-molecular-weight saturated fatty acids and gallic acid with glycerol to form a fatty acid-gallic di-glyceride according to the following reaction:



Monoglyceride of fatty acids having a length of 8 to 14 carbon atoms, with an average of 12 carbon atoms.

Gallic acid

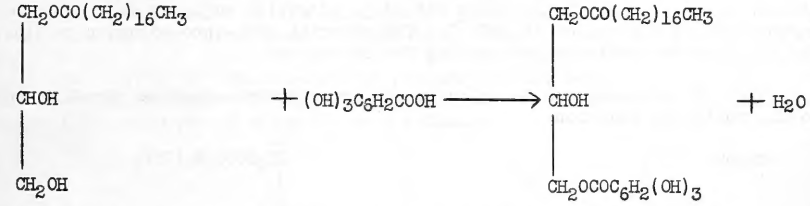
Glyceryl monogallate mono acid

The monoglycerides of low-molecular-weight saturated fatty acids were obtained by completely hydrogenating butterfat. These were saponified and acidulated, thus separating the fatty acids, both soluble and insoluble in water. Finally a fatty acid fraction with an average molecular weight of 218 was obtained by fractional distillation under vacuum. The fatty acids were esterified to monoglycerides with glycerol, using sodium hydroxide as a catalyst.

A mixture consisting of gallic acid, 3 g.; monoglycerides, 7 g.; and oil, 50 g., was used to make the soybean oil antioxidant preparation.

The mixture was heated slowly to 220° C. while being mechanically stirred with dry hydrogen passing into the reaction vessel. The solution became clear in 15 minutes at 200°C. It was cooled under hydrogen.

GMSG: This preparation was formed according to the following reaction:



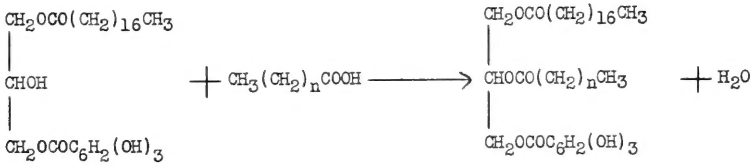
Glyceryl monostearate

Gallic acid

Glyceryl monostearate monogallate

The glyceryl monostearate (35 g.) which was obtained from a commercial source was melted carefully, and 14.5 g. of gallic acid were added. The mixture was poured into a small reaction vessel (Fig. 3). It was stirred and heated to 220° C. under hydrogen and held at this temperature for 39 minutes after which time the material was allowed to cool. The resultant product was a light-brown liquid which cooled to a brittle solid.

GSCG: This preparation was designed to introduce a low-molecular-weight fatty acid into the glyceride molecule GMSG.



Glyceryl monostearate monogallate | Capric or lauric acids | Glyceryl monostearate monolaurate (or caprate) monogallate

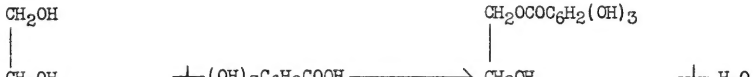
A mixture of glyceryl monostearate, 140 g., and gallic acid, 60 g., was held under hydrogen for one hour at 220° C. and cooled under hydrogen at 130° C.; 75 g. of low-molecular-weight fatty acids especially prepared from coconut oil were added. These had a mean molecular weight of 191. The temperature was brought to 230° to 240° C. and held for two hours. The product was cooled under hydrogen.

KMS40: This was similar to GMSG except that the reaction temperature was 225° C. and the time of heating was 40 minutes.

MCG: This preparation was similar to GMSG except that monoglycerides of low molecular weight fatty acids were used instead of glyceryl monostearate. The monoglycerides were made in the following manner:

Coconut oil was dried under vacuum. To 630 g. of oil were added 126 g. of a 20-percent solution by weight of U.S.P. glycerin containing 3.15 g. sodium hydroxide. The mixture was heated with continuous stirring under dry carbon dioxide. When the temperature reached 235° C., the mixture became clear. Heating was continued about 20 minutes. The mixture was then allowed to cool under carbon dioxide while being stirred. To the cool mixture was added 0.5 percent of 85 percent orthophosphoric acid with stirring. The mixture was allowed to settle overnight and the clear supernatant liquid was decanted. The yield of monoglycerides was about 80 percent of theoretical. A mixture of 40 g. of the monoglycerides of coconut oil fatty acids and 10 g. of gallic acid was stirred under carbon dioxide and heated to 220° C. The material went into solution rapidly. The solution was cooled after heating for 20 minutes.

KEG: It was proposed to esterify gallic acid with ethylene glycol according to the following reaction:

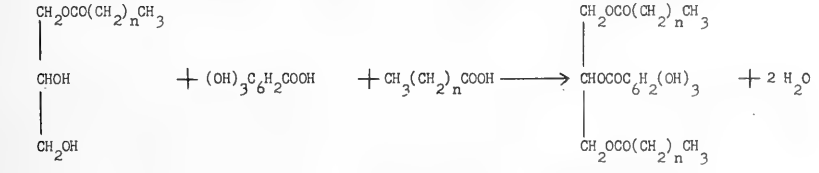


Glycol | Gallic acid | Glycol monogallate

Gallic acid with excess ethylene glycol was heated for eight hours at 190° C. under carbon dioxide. The excess glycol was removed by vacuum distillation. The residue was dissolved in ether, carbon black was added and the mixture was filtered. The ether was evaporated under vacuum.

KJW: This preparation was made in order to obtain a more concentrated antioxidant similar to KMGP. Purified palmitic acid in sufficient amount was not available so some Japan wax was substituted. The new mixture consisted of glycerol, 20 g.; gallic acid, 20 g.; palmitic acid, 20 g.; and Japan wax, 40 g. No cottonseed oil was used in this preparation. The mixture was esterified for two hours at 200° C. under carbon dioxide.

MCLG: It was desired to produce a galloglyceride with two low-molecular-weight fatty acid radicals in the molecule according to the reaction:



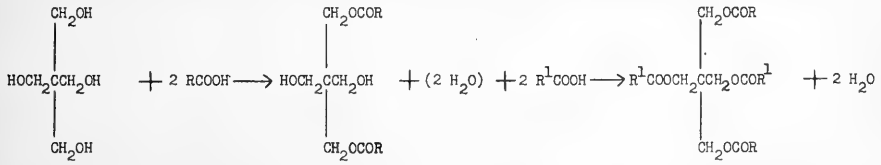
Glyceryl monolaurate or caprate | Gallic acid | Lauric or capric acid | Glyceryl dilaura- or capro-monogallate

It is possible, of course, that the gallic acid may attach itself to the terminal primary alcoholic group instead of the secondary position as shown. The mixture used consisted of monoglyceride of low-molecular-weight acid, 28 g.; low-molecular-weight fatty acid, 15 g.; and gallic acid, 7 g. This mixture was heated for two hours at 210° C. under carbon dioxide while being stirred mechanically.

PGC 190: It was planned to effect the formation of hydroxy-esters of pentaerythritol and coconut oil by alcoholysis (Burrell, 1944) and esterification of the free hydroxyl groups by gallic acid.

The mixture of coconut oil, 200 g.; pentaerythritol, 40 g.; and lithium lactate, 29 g.; was heated for one-half hour at 170° C. under hydrogen. The clear solution was cooled to 150° C. and 45.2 g. gallic acid were added. Heating was continued for three hours at 160° to 190° C.

It was desired to form an ester of pentaerythritol containing two low-molecular-weight saturated fatty acid radicals and two gallic acid radicals. R equals a fatty acid and R^1 a gallic acid radical:



Pentaerythritol | Fatty acid | Gallic acid | Ester of pentaerythritol

Gallic acid and pentaerythritol both being solids require a fluid medium when being esterified. Kerosene, the medium chosen, was shaken thoroughly with mercury to remove sulphur compounds, washed repeatedly with sulfuric acid to re-

move aromatic compounds, and distilled. A fraction boiling at 230° to 245° C. was selected. The mixture used consisted of gallic acid, 27.6 g.; pentaerythritol, 10 g.; coconut oil fatty acid, 29 g.; and kerosene, 50 g.

The coconut oil fatty acids were specially prepared by hydrogenation, saponification, acidulation and vacuum fractional distillation to obtain a fatty acid fraction that was completely saturated and had an average molecular weight of 197.

Esterification was carried out at 220° to 230° C. under a flow of carbon dioxide until the esters were in solution. This required about two hours. Upon distillation under vacuum, white crystals were deposited in the condenser along with the first fraction of kerosene to distill over. The crystals were collected and washed free of kerosene with petroleum ether. The crystals proved to be pyrogallol.

PGCR: This preparation was made from a mixture of pentaerythritol, 10 g.; gallic acid, 27.6 g; coconut oil fatty acids, 29 g.; and kerosene (b.p. 230° to 260° C.), 50 g. This mixture was esterified at the boiling point of the kerosene for 1.5 hours under continuous flow of dry carbon dioxide. The product was distilled under vacuum until all of the excess fatty acids, kerosene and the white crystals obtained previously were eliminated. The residue contained no free fatty acids. Upon saponification, the residue yielded 46 percent of fatty acids. Difatty acid digallo-pentaerythritol should contain 49.4 percent fatty acids with a molecular weight of 197. Some loss of low-molecular-weight fatty acids was expected through solution and volatilization, consequently the amount found was considered satisfactory.

CMGP: This product was made similar to KMGP but coconut oil rather than cottonseed oil was used because of the more saturated fatty acids. The mixture consisted of coconut oil, 400 g.; gallic acid, 25 g.; glycerol, 25 g.; and palmitic acid, 70 g. This mixture was heated for one-half hour at 175° C. under a flow of dry carbon dioxide with stirring. One g. of lithium lactate was added and the temperature was raised to 280° C. for 15 minutes. The preparation was allowed to cool slowly under the carbon dioxide with constant stirring.

A considerable number of other preparations were made during this study which proved unsatisfactory for one reason or another. The data are not reported.

PREPARATION OF SUBSTRATE OILS

The oils used as substrates in the testing of the various antioxidants were soybean; the body oils of menhaden, pilchard and salmon; seal blubber oil; and the liver oils of dogfish and shark. Some of the oils were deodorized in a laboratory-scale deodorization apparatus to bring them to 0 peroxide value.

DEODORIZATION APPARATUS: This apparatus is based on the conventional design but includes certain modifications which are believed to be advantageous (Fig. 4). The large distillation head on the main deodorizer flask allows rapid bubbling of water-vapor through the oil without too much carry-over. The exit tube is directed downward in order to prevent undeodorized oil from collecting and running back into the remainder of the oil. The vapor by-pass allows complete evacuation of air at the start and prevents bubbling of air through the oil at the end of a run when the vacuum is broken. Efficient traps provide maintenance of a high degree of vacuum.

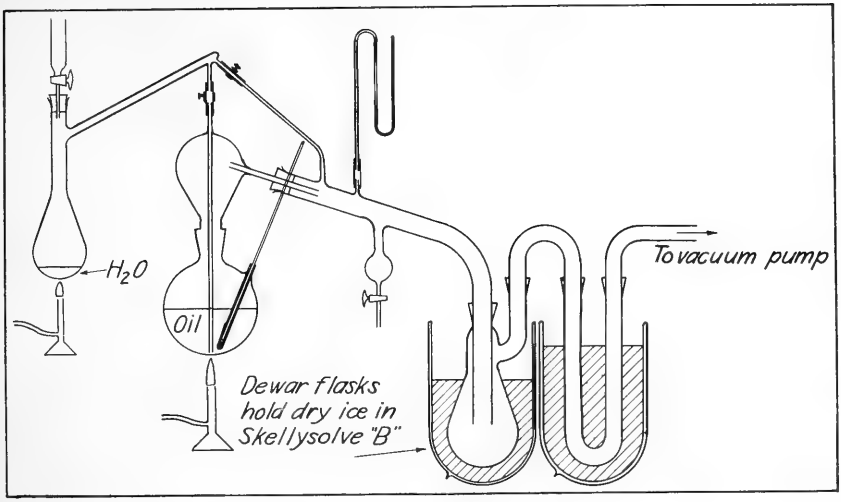


FIGURE 4 - OIL DEODORIZATION APPARATUS

A standard taper joint is used to connect the head with the main flask, which facilitates filling and cleaning. The flow of water-vapor is controlled by a Hoffman clamp which permits throttling of the tube connection at the top of the head. Direct heat instead of the usual oil bath could be used since a thermometer well was built into the apparatus. Controlled amounts of water-vapor were used to agitate the contents of the flask to prevent local heating. The modified apparatus also has a small flask with a stopcock sealed into the system to catch any carry-over of liquid. This prevents the accumulation and solidification of material in the two traps.

Information on the source of oils, description of oils and treatment given follows:

SOYBEAN OIL: This was a sample of crude solvent-extracted soybean oil. The oil was alkali refined and bleached according to the standard methods of the National Cottonseed Products Association (1945). The oil was deodorized in the deodoring apparatus for one hour at 180° C. and at one mm. absolute pressure. The oil was stored in sealed glass sample bottles at 5° C. in the dark until used.

MENHADEN OIL: A fresh sample of menhaden oil was not available for these experiments. The oil used had been stored at room temperature in a 55-gallon drum. It contained 2.7 percent free fatty acids (as oleic acid) and had an iodine value of 169. This oil was alkali refined to an acid value of .05, bleached with Fuller's earth and carbon black, and deodorized for one hour at 180° C. at one mm. absolute pressure. It was stored in sealed glass bottles in the dark at 5° C. until used.

SALMON OIL: This sample was purchased as "Edible Salmon Oil." This oil was in very good condition when received and part of it was used without further treatment. In some tests it was used after having been deodorized for one hour at 180° C. at one mm. absolute pressure. The oil was stored in the dark at 5° C.

PILCHARD OIL: This oil was from fresh stock and was supplied by producers on the Pacific Coast. It was alkali refined, bleached, deodorized and stored at 5° C. in the dark.

SEAL BLUBBER OIL: This oil was obtained by rendering the fat from the blubber of a seal which was being used in some other studies at this Laboratory. The resulting oil was alkali refined, bleached, deodorized, and stored at 5° C.

DOGFISH LIVER OIL: This sample was part of a lot from the Seattle Laboratory of the U. S. Fish and Wildlife Service and used here previously in some vitamin studies. The oil was used without further treatment.

SHARK LIVER OIL: This sample was made up of a miscellaneous group of small samples of shark liver oils and was used without further treatment.

EXPERIMENTAL DATA AND DISCUSSION

The alkyl gallates added to soybean oil in storage tests showed an average protective factor of 4.7. Of the four samples tested simultaneously, the greatest deviation from this average was a protective factor of 0.5 (Table 1). With menhaden oil, these same alkyl gallates showed in storage tests a protective factor of 2.7 with the greatest deviation within a series being a protective factor of 0.8. Six alkyl gallates used with salmon oil in the rapid test showed an average protective factor of 4.0 with the greatest deviation amounting to a protective factor of 0.7.

Table 1 - Data for Various Antioxidants in Soybean and Menhaden Oils Stored in Glass in the Dark at 37° C.

Antioxidant	Oil	Percent Added	Protective Factor[1]
Ethyl gallate	Soybean	.124	4.25
Methyl gallate	"	.117	5.12
KMGP	"	2.84	10.64
Decyl gallate	"	.184	4.2
Cetyl gallate	"	.228	5.2
Petroleum ether extract of gallic acid	"	Extract from 50 g. in 50 g. oil	1.62
Cetyl gallate	Menhaden	.228	2.5
Ethyl gallate	"	.124	2.5
Methyl gallate	"	.117	2.5
Glycol monogallate	"	.133	3.25
Decyl gallate	"	.184	3.34
KMGP	"	2.84	12.00
Gallic acid[2]	"	.1	3.0

1/ Time to reach peroxide value of 20 for treated oil.
Time to reach peroxide value of 20 for untreated oil.
2/ In deodorization apparatus for 10 minutes at 200° C.

The average protective factor for the alkyl gallates according to the rapid test (Table 2) and using salmon, pilchard, and seal oils, was 4.7. The low protective factors obtained with menhaden oil are probably due to the bad condition of the original oil together with a probable high iron content due to long storage in a steel drum while having a high free fatty-acid content.

Under the storage conditions used, antioxidant KMGP, the one glycerol ester antioxidant available at the time the storage tests were started, showed protective factors of 10.6 and 12.0 with soybean and menhaden oils, respectively. Ten

of the glyceride ester products, in 19 tests with the rapid test, using salmon, pilchard, and seal oils, gave an average protective factor of 10. MCG, in four tests by the rapid method, using salmon and pilchard oils, gave an average protective factor of 12.2. Under the same conditions, oil treated with KMGP showed an average protective factor of 10.4. Hydroquinone in pilchard and seal oil by the rapid method permitted an average protective factor of 10.2.

Gum guaiac, lecithin, NDGA (nordihydroguaiaretic acid), dilauryl thiodipropionate (0.1 and 0.4 percent), distearyl thiodipropionate (0.1 and 0.4 percent), and a mixture of 0.02 percent thiodipropionic acid and 0.08 percent dilauryl thiodipropionate, according to the rapid test, induced an average protective factor of 1.3. Another sample of beta,beta thiodipropionic acid in salmon oil, however, gave a protective factor of 5.9 by the rapid test.

The sample of NDGA received arrived late in the progress of this work and just one test was conducted using this material. In this one test, a protective factor of only 1.9 was obtained by the rapid method.

Thiodipropionic acid gave a protective factor of 5.9 in salmon oil when introduced before deodorization but this same acid and its esters gave little or no protection to salmon oil when introduced in the manner described by the producers of these materials. Resin guaiac, mixed tocopherols and lecithin lengthen the keeping quality of salmon oil very little (Table 2).

Table 2 - Data for Some of the Antioxidants in Different Oils When Tested by the "Rapid Method"

Antioxidant	Oil	Percent Added	Protective Factor[1]
Decyl gallate	Undeodorized edible salmon	.184	3.29
Cetyl gallate	"	.228	3.72
Hexyl gallate	"	.15	4.29
Octyl gallate	"	.169	4.29
PGC 190	"	.64	6.71
MCG	"	.5	7.85
Gallic acid[2]	Salmon	.1	5.24
Amyl gallate	Pilchard	.2	5.2
MCLG	"	.72	16.5[3]
MCG	"	.5	20.0
KMGP	"	2.84	7.0[3]
Hydroquinone	"	.1	6.16
d-isoascorbyl palmitate	Seal	.05	4.56
Propyl gallate	"	.1	6.28
KMGP	"	2.84	16.3
KEG	"	.2	3.8
KMS40	"	.31	9.7
KJW	"	.5	11.0
KMGP	"	2.84	14.4
Cetyl gallate	"	.228	5.8
KHMD	"	2.0	12.0
Hydroquinone	"	.1	14.2
MCG	Salmon	.5	11.5
CMGP	"	2.1	10.1
MCG	Pilchard	.5	9.66
Resin guaiac[2]	Salmon	.1	1.31
Mixed tocopherols[2]	"	.02	1.46
Lecithin[2]	"	.1	1.66
Beta, beta thiodipropionic acid[2]	"	.1	5.85
Propyl gallate	"	.1	4.0
GSCG	"	.46	5.38
CMGP	"	2.1	9.0
KHMD	Undeodorized edible salmon	2.0	4.07
KMGP	"	2.84	4.07
MCLG	"	.72	8.0
NDGA	Salmon	.1	1.86
Dilauryl thiodipropionate	"	.1	1.00
" "	"	.4	1.67
Distearyl "	"	.1	1.00
" "	"	.4	1.54
Thiodipropionic acid	"	.02	-
Dilauryl thiodipropionate	"	.08	1.00[4]

1/ Time to reach peroxide value of 20 for treated oil.
Time to reach peroxide value of 20 for untreated oil.

2/ In deodorization apparatus for 10 minutes at 170° C.

3/ Protective factor on this sample was calculated as follows:
Time to reach peroxide value of 10 for treated oil.
Time to reach peroxide value of 10 for untreated oil.

4/ The oil substrate in this case had been deodorized two weeks before use and had an initial peroxide value of eight.

Table 3 - Data on Stability of Vitamin A in Liver Oils When Tested by the "Swift Method"

Antioxidant	Oil	Percent Added	Protective Factor1/ At 10% Depletion	Protective Factor1/ At 20% Depletion
Octyl gallate	Dogfish, 20,000 U.S.P. units Vitamin A per g.	.228	5.67	6.33
Dodecyl gallate	"	.193	6.00	6.45
Decyl gallate	"	.134	5.71	5.9
Amyl gallate	"	.147	5.71	6.33
KMGP	"	2.84	12.7	12.27
KHMD	"	2.00	15.15	16.00
MCGR	"	.24	2.79	3.14
Crystals from PGGR	"	.24	8.82	13.7
Hydroquinone	"	.1	14.7	14.1
None	Dogfish, deodorized 30 min. at 150° C.	-	1.0	1.0
Amyl gallate	"	.147	11.38	10.0
Crystals from PGGR	Unsaponifiable matter from shark oil in coconut oil 60,000 U.S.P. units Vitamin A per g.	.21	1.71	1.61
Crystals from PGGR	Shark		10.4	8.1

1/Protective Factor = Time to reach 10 (or 20) percent depletion of vitamin A for treated oil. / Time to reach 10 (or 20) percent depletion of vitamin A for untreated oil.

In seal oil, d-isoascorbyl palmitate with propyl gallate, 0.05 percent each, gave a protective factor of 4.5, while propyl gallate alone at 0.1 percent gave a protective factor of 6.0. The d-isoascorbyl palmitate was not tested alone.

Data on the effect of the use of the antioxidants in various oils are shown in Figures 5 to 20. (See pages 15-17)

In respect to stability of vitamin A, the alkyl gallates tested produced an average protective factor (at 10 percent depletion) of 5.3 (Table 3). One sample of dogfish liver oil was deodorized with amyl gallate in solution and was subsequently oxidized. This process gave a protective factor of 11.4 or just about double that found when amyl gallate had been simply dissolved in the oil. KMGP, KHMD and hydroquinone gave protective factors of 12.7, 15.2 and 14.7, respectively. Figures 21 to 25 present data on shark liver oils showing the effect of added antioxidants on the vitamin A content of the oils when blown with oxygen. (For Figures 21 to 25 see page 18.)

CONCLUSIONS

These data show that the gallic acid esters are good antioxidants for fish oils. Of the special compounds containing gallic acid, KMGP, MCG, KHMD and CMGP are the best antioxidants of those tested.

Alkyl gallates offered some protection to shark liver oils against the loss of vitamin A when the oils were blown with oxygen. KMGP and KHMD gave high protective factors comparable to those obtained with hydroquinone.

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Figures 5 to 20 present data on various oils showing peroxide value versus time of storage or time of blowing.

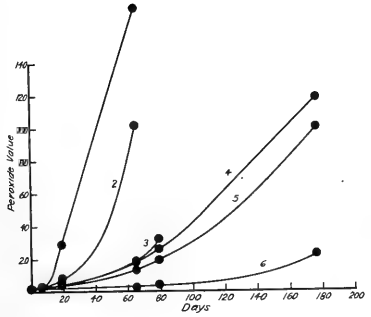

FIGURE 5 - SOYBEAN OIL STORED IN GLASS IN DARK AT 37° C.

1 - STRAIGHT OIL
2 - 3.33% KMCC
3 - .184% DECYL GALLATE
4 - .1245% ETHYL GALLATE
5 - .117% METHYL GALLATE
6 - 2.48% KMGP

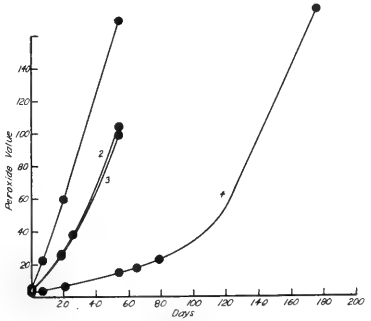

FIGURE 6 - MENHADEN OIL STORED IN GLASS IN DARK AT 37° C.

1 - STRAIGHT OIL
2 - .1245% ETHYL GALLATE
3 - .117% METHYL GALLATE
4 - 2.84% KMGP

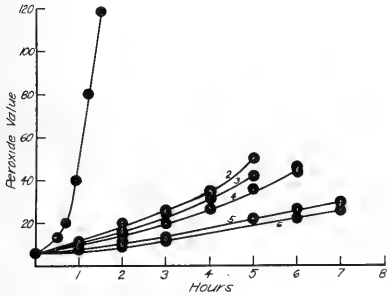

FIGURE 7 - UNDEODORIZED EDIBLE SALMON OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - .184% DECYL GALLATE
3 - .2285% CETYL GALLATE
4 - .15% HEXYL GALLATE OR .169% OCTYL GALLATE
5 - .64% PGC190
6 - .5% MCG

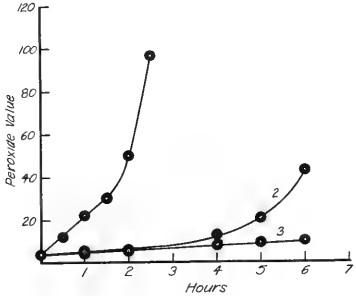

FIGURE 8 - PILCHARD OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - .2% AMYL GALLATE
3 - .72% MCIG

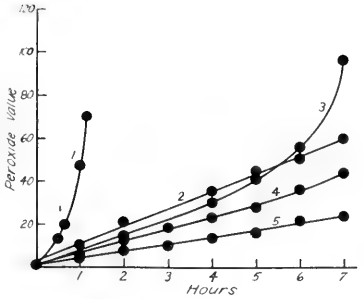

FIGURE 9 - SALMON OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - .347% PECG
3 - .1% PROPYL GALLATE
4 - .46% GSCG
5 - 2.1% CMGP

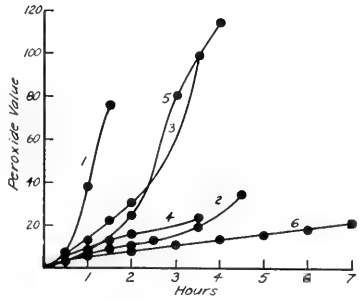

FIGURE 10 - SALMON OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - .124% ETHYL GALLATE
3 - .1% NDGA
4 - .5% DISTILLED PORTION MCG
5 - .5% RESIDUE PORTION MCG
6 - .5% MCG

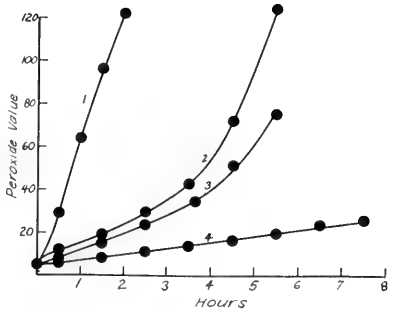

FIGURE 11 - SEAL OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - .05% PROPYL GALLATE
.05% D-ISOASCORBYL PALMITATE
3 - .1% PROPYL GALLATE
4 - 2.84% KMGP

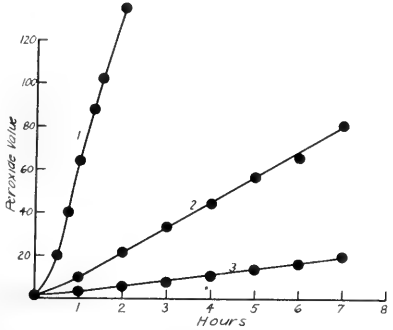

FIGURE 12 - SEAL OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - .2% KEG
3 - 2.84% KMGP

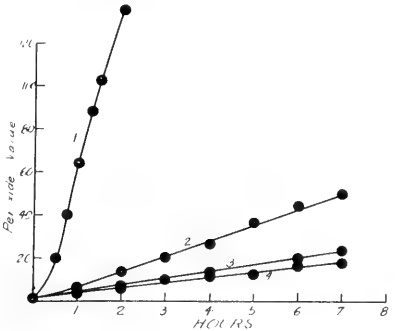

FIGURE 13 - SEAL OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - .22% CETYL GALLATE
3 - 2% KHMD
4 - .1% HYDROQUINONE

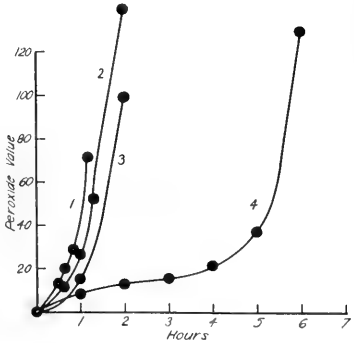

FIGURE 14 - SALMON OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

Substances added prior to deodorization for 10 minutes at 170° C. at 1 mm. abs. pressure.

1 - STRAIGHT OIL
2 - .1% RESIN GUAIAC
3 - .1% LECITHIN
4 - .1% BB' THIODIPROPIONIC ACID

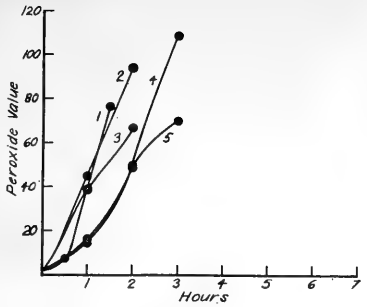

FIGURE 15 - SALMON OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - .1% DILAURYL THIODIPROPIONATE
3 - .1% DISTEARYL THIODIPROPIONATE
4 - .4% DILAURYL THIODIPROPIONATE
5 - .4% DISTEARYL THIODIPROPIONATE

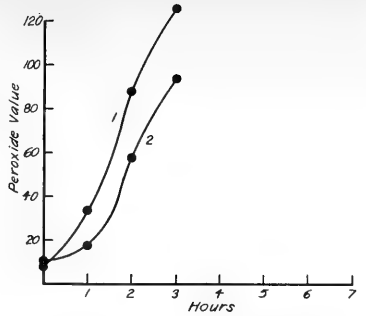

FIGURE 16 - SALMON OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - .02% THIODIPROPIONIC ACID AND .08% DILAURYL THIODIPROPIONATE
2 - .1% MCG AND .08% DILAURYL THIODIPROPIONATE

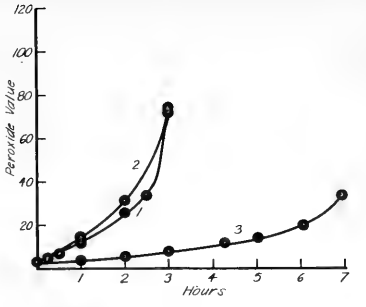

FIGURE 17 - PILCHARD OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - .1% PROPYL PARAHYDROXYBENZOATE
3 - .24% PGCR

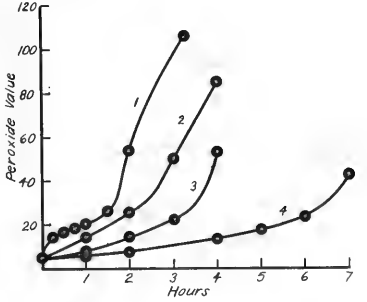

FIGURE 18 - PILCHARD OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - .5% COCONUT OIL (HYDROGENATED WITH 10% GALLIC ACID)
3 - 1% SAME
4 - 2% SAME

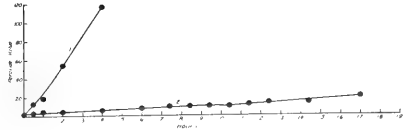

FIGURE 19 - PILCHARD OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - 5% MCG

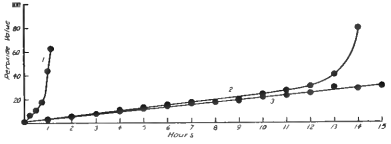

FIGURE 20 - SALMON OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - 2.1% CMGP
3 - .5% MCG

Figures 21 to 25 present data on shark liver oils,
showing the effect of added antioxidants on the vitamin A content of the oils when blown with oxygen.

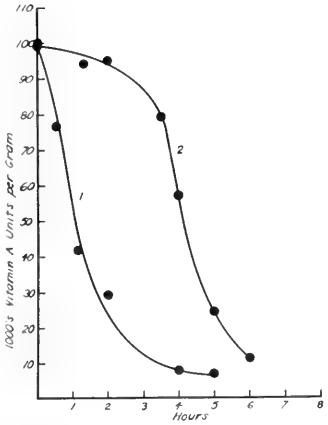

FIGURE 21 - SHARK LIVER OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - .24% PGCR

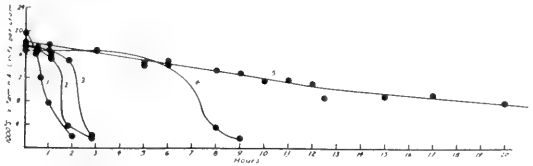

FIGURE 22 - DOGFISH LIVER OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - .24% PGCR
3 - 2.84% KMGP
4 - .1% HYDROQUINONE
5 - .24% PYROGALLOL

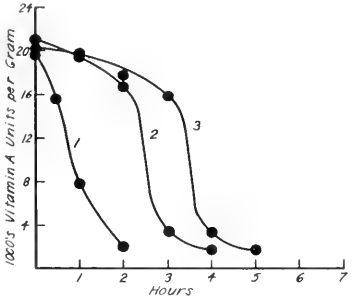

FIGURE 23 - DOGFISH LIVER OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - .2285% CETYL GALLATE
3 - .169% OCTYL GALLATE

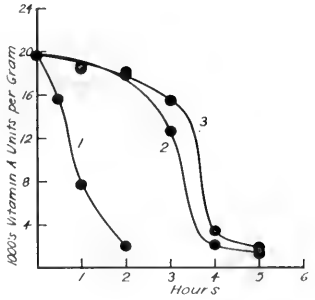

FIGURE 24 - DOGFISH LIVER OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - .184% DECYL GALLATE
3 - .147% AMYL GALLATE

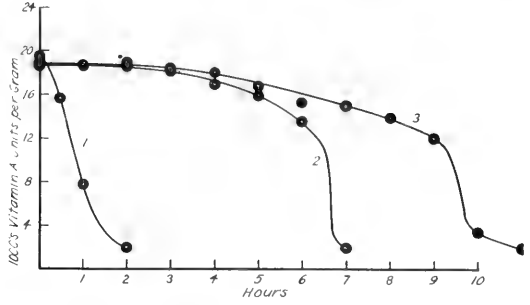

FIGURE 25 - DOGFISH LIVER OIL BLOWN WITH O_2 AT 99.5° C. AT 50 ML. PER MINUTE.

1 - STRAIGHT OIL
2 - 2.84% KMGP
3 - 2% KHMD

FEEDING TESTS WITH GALLIC ACID ESTER ANTIOXIDANTS

By Hugo W. Nilson,* Maurice Bender** and Dorothy B. Darling***

INTRODUCTION

Bittenbender (1950) at this Laboratory prepared a number of antioxidants from gallic acid for use in fish oils. The project was a wartime one and resulted from a demand for an efficient antioxidant which could be added to salt-cured herring when shipped to the tropics, or which could be added to oils for preservation of vitamin A when they had to be stored for long periods of time under adverse conditions.

Three antioxidants which appeared to be particularly promising were given a feeding test to determine possible toxicity. GMSG was a glyceryl monostearate monogallate. KHMD was a glyceryl monogallate mono acid in which the fatty acid contained from 8 to 14 carbon atoms, with an average of 12 carbon atoms. KMGP was a glyceryl monogallate dipalmitate. The other antioxidants prepared by Bittenbender could not be tested at the time due to limitations in the number of animals and cage space available.

EXPERIMENT AND OBSERVATIONS

Male rats of two College Park strains were allotted to the experiment at an average initial weight of 50 grams, and an average initial age of about 3.5 weeks. The rats were housed individually in wire screen cages fitted with screen floors. Live weight and food consumption data were taken at weekly intervals. The diet consisted of casein, 15; lactalbumin, 5; cottonseed oil containing antioxidant, 10; lard, 5; brewer's dried yeast, 5; wheat germ, 2; salt mixture, U.S.P. XII, No. 2 for vitamin A or D assay, 4; cod liver oil, 2; and an equal mixture of cornstarch dextrin and sucrose, 52 parts by weight.

Table 1 - Length of Life on Test of Male Rats Fed Various Antioxidants

Diet Designation	Time Interval to Death in Weeks
Control	36, 42, 43, 52, 54, 75, 88, 106, 113, 118
GMSG	17, 34, 56, 64, 82, 83, 98, 101, 106, 121
KHMD	15, 34, 39, 39, 57, 64, 74, 85, 86, 96
KMGP	13, 20, 42, 44, 62, 92, 102, 113, 124, 127

Table 2 - Data on Average Maximum Weight and Food Consumption Per Week Per Rat for Groups Fed Various Antioxidants

Diet Designation	Maximum Weight	Standard Error	Food Consumed Per Week
	Grams	Grams	Grams
Control	510	27.3	80.3
GMSG	574	34.1	84.8
KHMD	488	49.1	79.1
KMGP	494	54.1	88.7

The antioxidants were added to the test oils at the rate of 0.1 percent gallic acid equivalent. In these feeding tests the antioxidant was added to the cottonseed oil at five times this rate, or 0.5 percent gallic acid equivalent. Only a single level was fed. The tests were begun in 1944.

The data in Tables 1 and 2 indicate that statistically there are no significant differences in the average length of life in weeks, maximum live weight

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attained, or weekly food consumption per rat for the groups fed the diets containing no antioxidant and the three antioxidants mentioned previously. Observations at necropsy disclosed no lesions which could be attributed to the feeding of the antioxidants.

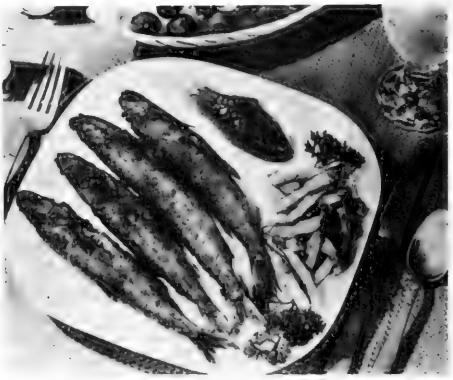
CONCLUSIONS

The results of this test indicate no chronic toxicity of these gallic acid derivatives when fed at a level of 0.5 percent gallic acid equivalent in the cottonseed oil. This is equivalent to 0.05 percent in the total diet.

LITERATURE CITED

BITTENBENDER, C. B.
1950. Gallic acid ester antioxidants for fish oils. Commercial Fisheries Review, vol. 12, no. 2, pp. 1-18.

FRIED SMELT



2 pounds smelt	1 egg
1 teaspoon salt	1 tablespoon milk or water
1/8 teaspoon pepper	1 cup bread crumbs

Sprinkle smelt with salt and pepper. Beat egg slightly, and blend in the milk. Dip fish in the egg and roll in crumbs.

Place fish in a heavy frying pan which contains about 1/8 inch melted fat, hot but not smoking. Fry at a moderate heat. When fish is brown on one side, turn carefully and brown the other side. Cooking time about 10 minutes depending on the thickness of the fish. Drain on absorbent paper. Serve immediately on a hot platter, plain or with a sauce. Serves 6.

A Fish and Wildlife Service tested recipe. This is one in the series of recipes using fishery products tested and developed in the Service's test kitchens.

December 1949

ANALYSIS: Samples of Mexican shark liver oil, halibut liver oil, Japanese shark liver oil, and Canadian whale liver oil were procured from various producers. The whole oils and the nonsaponifiable residues were assayed by the ultraviolet spectrophotometric, antimony trichloride colorimetric, and the glycerol-dichlorhydrin colorimetric methods of assay. Ultraviolet absorption curves of the spectrophotometric data were prepared for all of the oils using both the hydrogen discharge and the Wolfram light sources. It has been observed that with most oils the use of the hydrogen discharge light source gives slightly higher values for all readings made below 310 millimicrons. However, the average increase in the reading at 310 mm., one of the fixation points used in the Morton-Stubbs correction procedure and also in the new proposed U.S.P. Vitamin A Assay, is approximately 0.5 percent. Generally, the U.S.P assay gives the lowest vitamin A potency for the sample under test, while the antimony trichloride value is somewhat higher, and the glycerol-dichlorhydrin method gives a potency value somewhere between the U.S.P. and the antimony trichloride values.

* * *

Good results were obtained on microbiological biotin assay. Further work is being carried out to determine the best method of extraction of biotin from the fishery products. In results obtained so far no method of hydrolysis has proved superior to any other in giving better subsequent extraction. A comparison has been made of results using two bacteria for this estimation. Lacto bacillus arabinosus gives higher and better results than Lactobacillus casei which is contrary to some published reports.

PROCESSING: Six quaternary ammonium compounds have been tested and found to be ineffective as salmon egg preservatives. Other compounds tried during the month, which also gave little or no significant preservative action, included penicillin, streptomycin, and several other antibiotics and several substituted phenols. Work is still proceeding on sulfites and sulfites with added sodium chloride which continue to give promising results. These tests, limited in the past to short-time accelerated tests at elevated temperatures, are now being extended to include long-term experiments at 50° F.

REFRIGERATION: Frozen fillet samples from the fish-frozen-at-sea project were examined following two months of storage. In the cod series was included a sample of a commercial pack, which was in storage for one month at the time of examination. Organoleptic judgment based primarily on color, odor, and taste established preference for the fillet samples from frozen round fish over the fillets from iced gutted fish. Free drip values were erratic, some being higher and others lower than those of the previous month; however, the press

drip values seemed to present a consistent slight increase readily reproducible with small error. The salt content for any given samples remained constant.

* * *

After 9 months of storage at 0° F., the fish that were first wrapped in vegetable parchment, then dipped in water, followed by wrapping in moisture-vapor-proof material and freezing are still well coated with ice and show no signs of desiccation. The fish that were frozen first, then glazed and wrapped in moisture-vapor-proof material show considerable localized desiccation and extreme drying of the skin.

* * *

The third month organoleptic examination of frozen pink salmon fillets was concluded. The average scores on flavor of both pink flesh (over-all) and dark flesh (rancidity) indicated at this stage that:

1. Fillets glazed in water produced the best packages.
2. Fillets glazed in ascorbic acid showed no marked improvement over those glazed in plain water.
3. Fillets dipped in ascorbic acid showed a marked improvement over undipped fillets.
4. Fillets dipped in ascorbyl palmitate showed no marked improvement over undipped fillets.
5. Skinned fillets are a markedly poorer product than unskinned fillets.

* * *

The pH determinations were made on a large number of oyster samples at the shucking house and during storage at the Laboratory. Samples of oysters taken at the packing table showed a range in pH varying between 6.56 and 6.60 for selects, and 6.50 and 6.62 for standards. This was true for oysters taken singly and for several ground together. The pH of the liquor showed practically no variation, with several samples being 6.80 and one 6.82.

Several lots of strictly fresh oysters were brought to the Laboratory for storage studies. After three days at ice temperature there was a variation in pH between 6.30 and 6.50; five days, 6.20 and 6.32; 10 days, 6.08 and 6.22; 12 days, 5.92 and 6.08; and after 18 days, between 5.62 and 5.66. The samples were sour at the last examination.

NUTRITION: Results of an assay of vitamin B_{12} content of pilchard meal, using chicks, indicated that 2-percent pilchard meal added to the experimental diet, the lowest level fed, permitted maximum gain in weight during the four-week period.

Additions to the Fleet of U. S. Fishing Vessels

A total of 61 vessels of 5 net tons and over received their first documents as fishing craft during November 1949--4 less than in November 1948, according to the Bureau of Customs, Treasury Department. Virginia led with 10 vessels, followed by Florida and North Carolina with 7 vessels each. During the first 11 months of 1949, a total of 939 vessels were documented, compared with 1,125 during the same period in 1948

Vessels Obtaining Their First Documents as Fishing Craft, November 1949

Section	November		Eleven mos. ending with Nov.		Total
	1949	1948	1949	1948	1948
	Number	Number	Number	Number	Number
New England	2	6	32	49	52
Middle Atlantic	1	3	42	40	40
Chesapeake Bay	13	6	75	56	59
South Atlantic and Gulf	27	37	336	511	541
Pacific Coast	10	7	318	337	348
Great Lakes	3	4	38	46	51
Alaska	4	2	92	77	81
Hawaii	1	-	5	9	12
Unknown	-	-	1	-	-
Total	61	65	939	1,125	1,184

Note: Vessels have been assigned to the various sections on the basis of their home port.

Alaska and Pacific Northwest Exploratory Fishing Vessel Launched

The motor vessel US FWS John N. Cobb was launched January 14, 1950, at a Tacoma, Washington, shipyard, the Secretary of the Interior announced January 12. The John N. Cobb will be used in the waters off the Pacific Northwest and Alaska to explore untapped fishery resources--with special emphasis, at first, on albacore tuna.

The entirely new 93-foot vessel is constructed of wood and is to be equipped with all the latest navigational equipment--including radar, loran, two depth-finding devices, and electro-mechanical steering. An experimental-sized refrigerated hold, bait tanks, brine wells, and all the fishing equipment for seining, long-line fishing and trawling are part of the equipment, as well as some experimental rigs of unorthodox design.

The U. S. Fish and Wildlife Service will commission the vessel in a Seattle ceremony about February 15. After a shakedown cruise and brief test period, the John N. Cobb will sail to Alaskan waters to begin its fishery explorations. Tuna is a relatively new industry in Alaska and the exploratory vessel will investigate the potentialities of tuna in the area.

The vessel US FWS John N. Cobb was named after John Nathan Cobb, a foremost fishery expert in the early Bureau of Fisheries, a predecessor organization of the Fish and Wildlife Service. Mr. Cobb, who died in 1930, was also noted for his authoritative books on salmon and the Pacific cod. In 1919, Cobb helped organize, and became first dean of, the College of Fisheries of the University of Washington in Seattle.

Anglers' Fishing License Sales Continue to Increase

FISHING LICENSE SALES - JULY 1, 1948 to JUNE 30, 1949

STATE	RESIDENT	NON-RESIDENT	TOTAL	FEES PAID BY ANGLERS
ALABAMA	125,017	8,023	133,040	$ 148,197
ARIZONA	64,336	13,056	77,392	241,878
ARKANSAS	208,334	62,905	271,239	489,986
CALIFORNIA	1,017,305	13,312	1,030,617	3,138,501
COLORADO	257,925	61,704	319,629	1,032,689
CONNECTICUT	73,827	3,789	77,616	311,855
DELAWARE	4,821	1,544	6,365	14,305
FLORIDA	190,145	83,870	274,015	642,823
GEORGIA	170,048	3,274	173,322	335,717
IDAHO	164,706	40,109	204,815	717,199
ILLINOIS	758,203	24,870	783,073	815,903
INDIANA	570,474	39,202	609,676	770,750
IOWA	406,173	13,367	419,540	812,633
KANSAS	221,785	6,861	228,646	345,814
KENTUCKY	280,767	21,699	302,466	311,082
LOUISIANA	63,675	3,140	66,815	95,075
MAINE	119,391	55,316	174,707	576,201
MARYLAND	56,244	13,050	69,294	115,398
MASSACHUSETTS	225,672	6,201	231,873	518,106
MICHIGAN	826,230	283,879	1,110,109	2,102,347
MINNESOTA	647,927	214,895	862,822	1,578,006
MISSISSIPPI	105,439	30,125	135,564	379,433
MISSOURI	556,659	42,450	599,109	1,340,988
MONTANA	169,233	25,170	194,403	600,421
NEBRASKA	222,287	9,390	231,677	326,431
NEVADA	22,331	11,320	33,651	101,239
NEW HAMPSHIRE	92,132	48,012	140,144	463,351
NEW JERSEY	109,064	8,219	117,283	368,487
NEW MEXICO	65,134	31,310	96,444	355,203
NEW YORK	662,805	27,657	690,462	1,884,403
NORTH CAROLINA	189,257	29,503	218,760	547,280
NORTH DAKOTA	51,452	344	51,796	21,522
OHIO	887,876	30,166	918,042	1,033,251
OKLAHOMA	360,204	48,464	408,668	542,136
OREGON	255,849	21,222	277,071	1,064,185
PENNSYLVANIA	592,639	19,038	611,677	1,290,313
RHODE ISLAND	21,821	324	22,145	42,066
SOUTH CAROLINA	129,641	7,497	137,138	179,000
SOUTH DAKOTA	107,115	26,822	133,937	152,199
TENNESSEE	326,974	99,463	426,437	733,465
TEXAS	293,409	5,239	298,648	301,671
UTAH	85,743	4,909	90,652	313,703
VERMONT	77,436	28,424	105,860	256,381
VIRGINIA	242,700	3,035	245,735	480,379
WASHINGTON	383,085	22,591	405,676	1,749,451
WEST VIRGINIA	320,424	17,796	338,220	729,947
WISCONSIN	736,727	285,277	1,022,004	1,732,158
WYOMING	66,783	33,513	100,296	554,412
TOTALS	13,587,224	1,891,346	15,478,570	$32,657,940

Sales of anglers' fishing licenses climbed to a new high of 15,478,570 during the fiscal year ended June 30, 1949, the Director of the Fish and Wildlife Service reported on January 18. The gross revenue of $32,657,940 derived by the 48 States from the sale of these licenses also broke all records for earlier years.

The 1948-49 season totals show an increase of 1,400,609 in licenses and $5,333,296 in revenue, compared with the previous year when 14,077,961 licenses were sold by the various States for $27,324,644.

In the number of licenses issued, Michigan again headed the list, with 1,110,109. California ranked second with 1,030,617, followed by Wisconsin with 1,022,004; Ohio, 918,042; Minnesota, 862,822; Illinois, 783,073; New York, 690,462; Pennsylvania, 611,677; Missouri, 599,109; and Tennessee, 426,437.

California exceeded all other States in revenue received with $3,138,501. Michigan was second with $2,102,347, followed by New York with $1,884,403; Washington, $1,749,451; Wisconsin, $1,732,158; Minnesota, $1,578,006; Missouri, $1,340,988; Pennsylvania, $1,290,313; Oregon, $1,064,185; and Ohio, $1,033,251.

In Alaska the total fishing licenses sold numbered 26,299--21,481 resident and 4,818 non-resident. The revenue received was $58,145.

In the Territory of Hawaii, 2,027 fishing licenses were sold for $9,751.

Chesapeake Bay Institute Research Vessel

In order to study the hydrography of Chesapeake Bay, a new research vessel, Maury, was launched by the Chesapeake Bay Institute on January 20 this year. This Institute is a cooperative venture of Johns Hopkins University, the States of Maryland and Virginia, and the United States Navy.

The Fish and Wildlife Service aided in the formation of the Institute and will continue to consult with it and cooperate in the application of its findings to fishery problems.

ECA Procurement Authorizations for Fishery Products

Among the procurement authorizations for commodities and raw materials announced by the Economic Cooperation Administration during December 1949, there was only one transaction concerning fishery products--$1,250,000 to be used for the purchase of salted fish from Canada for delivery to Greece.

Since the beginning of the ECA program on April 1, 1948, through December 31, 1949, $35,211,911 was authorized for fishery products (including fish meal and oils).

The signing of an Economic Cooperation Agreement between the United States and the Federal Republic of Germany was announced on December 15 by the Department of State. Heretofore, Marshall Plan aid to Germany has been supplied under terms of the two Bilateral Agreements between the United States Government and the Military Governors of the Bizone and the French Zone, respectively. The new Agreement also covers relief supplies (The "GARIOA" aid) heretofore supplied by the Army under a separate appropriation which is now administered by ECA. The total United States dollar aid to Germany during the 1949-50 fiscal year is expected to be about $730 million. By this Agreement the new German Government also becomes custodian of the so-called "counterpart funds" of Deustchemark equivalent which the Federal Republic is required to set aside against all dollar aid it receives from the United States.

Federal Purchases of Fishery Products

DEPARTMENT OF THE ARMY, NOVEMBER 1949: Purchases of fresh and frozen fishery products by the Army Quartermaster Corps during November 1949 for the U. S. Army, Navy, Marine Corps, and Air Force for military feeding totaled 1,429,585 pounds valued at $530,647. This was a decline of 13 percent in quantity and 5 percent in value, compared with October 1949; but an increase of 19 percent in quantity and 9 percent in value, compared with November 1948.

Purchases of Fresh and Frozen Fishery Products by Department of the Army
(November and totals for 11 months, 1949 and 1948)

QUANTITY				VALUE			
November		January-November		November		January-November	
1949	1948	1949	1948	1949	1948	1949	1948
lbs.	lbs.	lbs.	lbs.	$	$	$	$
1,429,585	1,196,389	14,042,742	15,354,454	530,647	486,421	5,365,264	5,554,666

For the first eleven months this year, total purchases were 5 percent greater in quantity, but 2 percent less in value, compared with the corresponding period in 1948.

Fishery Biology Notes

NOTES ON THE NORTH ATLANTIC FISHERY INVESTIGATIONS: Haddock: Large differences in the strength of year classes and in age composition on Georges and Browns Banks have been found by the Service's North Atlantic Fishery Investigations working with the research vessel Albatross III out of Woods Hole, Massachusetts.

Length Comparisons of 1- through 5-year Old Haddock on Georges and Browns Bank, 1949

Bank	1-yr.old	2-yr.old	3-yr.old	4-yr.old	5-yr.old
	(Length in centimeters)				
Georges	22.7	36.6	43.2	49.4	52.4
Browns	17.9	22.4	30.6	41.1	46.4

These differences indicate that hereditary or environmental conditions favoring growth are different in the two areas. Of even more importance, however, is the fact that such large differences could not be maintained if any important intermigrations had occurred.

These results indicate that each Bank harbors a stock of haddock that is probably largely independent. They substantiate the necessity of the present practice of collecting and analyzing separately statistics of landings, age, growth, abundance, and other biological data for the two areas.

By the end of the past year, ten of the 1,028 haddock tagged since June 1949 on Georges Bank were returned. Of the returns, eight were reported 10 to 20 miles to the north, all along the northern edge of Georges. The other two were reported from the South Channel and Nantucket Shoals, about 150 miles to the west. The fish were out for 23 to 108 days.

No returns have been reported of the 186 that were tagged on Browns Bank, but there has been virtually no fishing on that Bank since the tagging.

Scale samples were obtained and examined from 5 of the 10 fish returned to see if false checks had been laid down at the time of tagging, but none were found. Apparently the tagging method in use does not hinder the haddock's growth too drastically.

Analysis of catches of haddock made during 135 half-hour census tows at 103 stations on Georges Bank and the Southern New England Banks resulted in a minimum estimate of 139 million fish as the size of the 1949 New England haddock stock.

Analysis of Bottom Temperatures: Bottom temperatures in degrees Fahrenheit obtained on Cruises 26 and 27 (July 27 - August 15, 1949) and Cruises 5, 6, and 7 (July 13 - August 25, 1948) of the Albatross III were correlated with the numbers of haddock, whiting, and total fish caught on these cruises. These two groups of cruises, chosen because they covered the same general area of Georges Bank and the Southern New England Banks, were the only ones where a definite area was covered in a relatively short time. The 1949 data showed that the highest catch of haddock, whiting, and total fish per tow occurred at 56 degrees. When the data were broken down into three depth zones of 0-30 fathoms, 31-60 fathoms, and 61-plus fathoms, the peak for haddock, whiting, and total fish remained at 56 degrees, showing that depth of water did not influence results.

In 1948, the majority of tows were made in temperatures below 52 degrees, and very few haddock were caught. Graphs of the bottom temperature versus number of fish showed that more fish were caught at higher temperatures.

The average bottom temperature in 1948 was about 50 degrees F. and in 1949 was 55 degrees F. More haddock were caught in 1949 than in 1948, and the greatest catches were made in areas where the bottom temperature was highest.

COMMERCIAL CLAM FARMS TO BE TRIED: Tentative plans have been made by the Service to establish experimental commercial hard clam (quahaug) farms in representative areas. Although laws of most States prohibit clam farming, it is believed that when satisfactory farming methods have been developed and commercial practicability has been demonstrated, the laws may be revised to legalize farming.

Studies on the food of hard clams to be conducted at the Beaufort, North Carolina, Laboratory will apply also to this work and may help to tell in advance whether areas are suitable for hard clam farming.

OBSERVATIONS ON GROWTH OF OYSTER SPAT: Observations on growth of spat of O. virginica, (the Eastern oyster) collected last winter and spring under laboratory conditions and then grown in Milford Harbor, were continued. The largest individuals among these oysters measured 5.8 cm. at the end of the growing season.

A comparison of the growth of the laboratory set of O. gigas (Pacific oyster) with that of O. virginica, both species setting at about the same time, showed that in general spat of O. gigas had outgrown considerably that of O. virginica. Most of the O. gigas spat measured between 6.0 and 8.0 cm., several of the largest ones were almost 9.0 cm. These measurements were made at the end of the season when the water temperature was becoming too low for

TONGING OYSTERS IN THE MIDDLE ATLANTIC STATES

growth of oysters. Examination of gonads of O. gigas spat on December 9, when water temperature was below 5.0° C., showed that the majority contained active sperm.

Some O. lurida (Western or Olympia oyster) which set in the Laboratory early in the spring, had grown to about 5.0 cm., thus reaching in one season the size of adult individuals growing under natural conditions on the Pacific Coast.

TESTS ON EUROPEAN OYSTERS IN THE UNITED STATES: The majority of O. edulis (the European oysters), from Holland, which reached the Milford Shellfishery Laboratory on October 11, are in good condition. Before shipment they were examined individually and disinfected to prevent introduction of the spores of shell disease or other parasites to our waters.

The oysters were of three age-classes, the oldest being those which set in 1947. Small numbers of them were planted in several bays and harbors of Maine to determine whether they will survive the Maine winter. If they do, observations will be made next spring and summer to determine whether they will develop gonads and spawn in Maine waters. Other oysters left at Milford will be checked also for survival during the winter, and later systematic observations will be made on their gonad development and spawning.

Groups of these European oysters are now used in Laboratory experiments to determine conditions at which their gonads will mature and the oysters will spawn. Other experiments are so devised that they will show the period of time needed by the oysters to develop gonads at different temperatures. This information is needed because maximum water temperatures attained in Maine are comparatively low and the periods of such temperatures are relatively short. Whether the period of comparatively high temperature in Maine waters is sufficiently long for maturation of gonads and for spawning of O. edulis must be determined.

Several groups of O. edulis are now conditioned in the laboratory for spawning to obtain material for experiments on various physiological and ecological

requirements of larvae and their rate of growth. Cultures of larvae will be grown at different temperatures to find the minimum at which their growth may proceed normally and to establish length of free swimming larval periods. Histological studies of gonads of oysters conditioned for spawning in the laboratory are being made.

PROPOSED SEA LAMPREY INVESTIGATIONS IN 1950: At a meeting of the Great Lakes Sea Lamprey Committee meeting in Madison on December 16, 1949, the Service's Great Lakes Fishery Investigations outlined its proposed plans for sea lamprey investigations in 1950. These cover the biology and control of the sea lamprey. Problems of organization, recruitment, and training of personnel and design and construction of special equipment will handicap the initial operations. The goal of the program is to accumulate technical information that can serve as the basis for application of effective control methods suited to all the diverse situations in which the sea lamprey is found.

During 1950, the Service plans to give particular attention to Lake Superior, especially in such matters as surveys, to determine the exact status of the sea lamprey problem. Immediate and vigorous application of control methods here may spare stocks of lake trout from the disaster that overtook them in Lakes Huron and Michigan.

In its program, the Service proposes to include education of the fishing industry, sportsmen, and the general public to an appreciation of the gravity of the present situation. However, the following points should be understood:

1. There should be no talk of eradication of the sea lamprey. The best that can be hoped for is control.

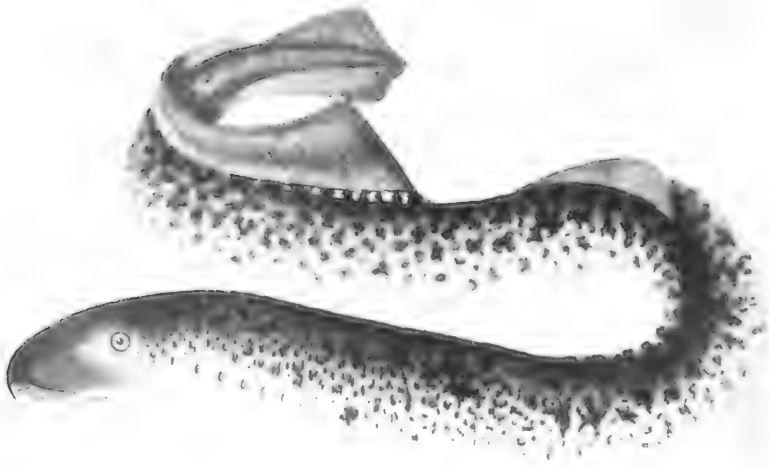
2. There is no assurance that control methods can be developed that will not cost more to apply than the value of the fishery warrants.

3. If a successful control program is worked out, it will have to be established on a permanent basis.

4. Little benefit is to be expected from haphazard, unorganized capture and killing of lampreys. Effective control will require a carefully coordinated program of wholesale destruction of the lamprey at vulnerable periods of its life cycle by means of scientifically tested procedures.

5. Stocks of fish subject to little or no lamprey depredation are threatened seriously by shifts of fishing pressure resulting from decline of lake trout in Lakes Huron and Michigan.

6. The outlook for the Great Lakes fisheries for years to come is extremely dark and no amount of governmental support, scientific investigation, large-scale application of methods for controlling the sea lamprey can change the picture. Even if control methods are devised, years may be required to bring the abundance of sea lampreys to a low level. Following that reduction, more years will be needed to rehabilitate stocks of fish if indeed they can be restored at all in the face of the heavy fishing intensity of present fishing.



GREAT SEA LAMPREY (PETROMYZON MARINUS)

The Service will continue to participate in maintenance of records of recovery and growth of lake trout from plantings of fin-clipped fingerlings made cooperatively by the Great Lakes Lake Trout Committee in Lake Michigan in 1944, 1945, and 1946. The value of this planting experiment will be impaired by depredations of the sea lamprey and the resulting decline in abundance of lake trout, a decline leading rapidly to abandonment of commercial fishing operations for the species. Some usable quantitative data may be retrieved by the Service by examination of catches of trout to determine percentage of fin-clipped fish in the catch.

For practical purposes the lake trout has disappeared as a commercial species in the United States waters of Lake Huron; in Lake Michigan the abundance has declined so rapidly that conditions bear little resemblance to the normal situation of a few years ago.

Although the Service will obtain all possible information on lake trout in the three upper Lakes, the studies must of necessity concentrate on Lake Superior, the only one of the Great Lakes in which the species is still present in fair abundance.

The success of this program will depend in no small measure on cooperation of State and Provincial conservation agencies and of the many private organizations and individuals interested in the future of the Great Lakes fisheries.

Imports of Groundfish (Including Rosefish) Fillets in 1949

Imports of fillets of cod, haddock, hake, pollock, cusk, and rosefish (ocean perch) amounted to 47,777,000 pounds during 1949—6 million pounds less than in 1948 (Table 1). The year's imports were the third highest on record, with 1948 the highest (53,727,697 pounds), and 1946 the second highest (49,171,089 pounds).

Table 1 - U. S. Imports of Groundfish (Including Rosefish) Fillets, 1939-49

Year	Pounds
1949	47,777,000
1948	53,727,697
1947	35,093,435
1946	49,171,089
1945	43,169,156
1944	24,545,569
1943	16,323,416
1942	16,674,082
1941	9,931,030
1940	9,739,853
1939	9,426,285

Table 2 - U. S. Imports of Groundfish (Including Rosefish) Fillets, by Countries of Origin, 1949 and 1948

Country	Total	
	1949	1948
	Pounds	Pounds
Canada	41,872,926	49,141,992
Iceland	4,857,806	4,181,204
Denmark	-	9,352
Netherlands	20,845	-
Belgium	17	-
Norway	438,485	395,109
Sweden	-	40
Total	47,190,079	53,727,697

The decrease in 1949 was mainly due to lighter shipments from Canada (Table 2). Imports from Norway and Iceland in 1949 were slightly higher than in 1948.

QUOTA FOR 1950 ESTABLISHED: The tariff-rate quota for the calendar year 1950 on groundfish (cod, haddock, hake, pollock, cusk, and rosefish) fillets is 26,235,738 pounds (see page 63 of this issue). The annual quota is the quantity entitled to be entered for consumption in the United States at the rate of 1-7/8 cents per pound. This quota is further divided into quarterly quotas. Any quantity entered over the quarterly quota during each quarter will be dutiable at 2½ cents per pound.

Of the total quantity of fish (26,235,738 pounds) entitled to entry at the rate of 1-7/8 cents, not more than one-fourth shall be so entitled during the first three months. The quota for the first quarter (beginning January 1 and ending March 31, 1950) is 6,558,935 pounds; second quarter, 6,558,935 pounds; third quarter, 6,558,934 pounds; and fourth quarter, 6,558,934 pounds.

Industrial Study of East Coast Shellfish Areas Approved

A grant of $10,000 to the Atlantic States Marine Fisheries Commission for an industrial study of the shellfish areas along the Atlantic Coast has been approved by the United States Public Health Service. The work will be under the supervision of the Fish and Wildlife Service and will be directed by the Service's Fishery Technological Laboratory at Boston, Massachusetts.

A study of the closed (polluted) shellfish areas along the Atlantic Coast will be made in order to obtain data on the extent of losses to the shellfish industry because of these closures.

The work will be divided into three phases:

1. A compilation of all previous surveys and investigations of pollution in coastal waters, including maps showing areas where studies have been made and where none have been made.

2. Field surveys of all areas affected by pollution to determine the economic value of the areas.

3. Appraisal of all findings under phases of 1 and 2 for their relative urgency and the communication of the facts to the proper authorities.

The initial $10,000 was approved for the period November 1949 through June 1950. Since the field survey will probably require a minimum of three years and since the appropriation was made on the basis of a continuing fund, it is presumed that additional funds will be made available if the progress of the work warrants it.

New Jersey Fishermen Using Nylon for Fish-Pot Funnels

UNLOADING SEA BASS CAUGHT IN POTS AT CAPE MAY, NEW JERSEY.

Some New Jersey fishermen are using nylon to make the funnels for their fish pots, according to the Service's Fishery Marketing Specialist stationed in that State. Fishermen who used nylon the past season are enthusiastic about the results. New funnels made of Manila and some types of cotton cord usually have to be replaced every season. However, funnels made of nylon have not needed replacement.

Although the nylon cord is expensive, it seems probable that a majority of the operators of pots in this area will be using it before the end of another season. Blue-green nylon cord has been the most successful, according to some of the fishermen.

Although many revisions have been made on the original lath pot, most of the fishermen in the New Jersey area continue to build and operate quite successfully the common wooden trap with either the wood or mesh funnels.

January always finds the pot fishermen in New Jersey repairing and building pots for their seasonal operations.

Exceptionally warm weather this winter has permitted fishing operations by various types of gear in New Jersey to continue through the middle of January. Fishermen state that the water was warmer than normal for this time of the year.

Pacific Coast Methods of Purse Seining to be Tried in East Coast Menhaden Fishery

Pacific Coast methods of purse seining for menhaden are being tried by operators in the North Carolina area in an effort to cut the production costs of the raw product going into fish meal and oil.

The Service's Branch of Commercial Fisheries has detailed two experienced West Coast fishermen to Beaufort, North Carolina, from aboard the vessel Oregon, now at Pascagoula, Mississippi, to give advice in the proper handling of this gear and to help in adapting the gear now being used in the menhaden fishery to the West Coast type of seining.

Pacific Oceanic Fishery Investigations

TUNA FISHERY IN HAWAII AND TRUST TERRITORY: Long-line catches in Hawaiian waters were good in November 1949. Landings ran heavily to big-eyed tunas, with a few albacore and a considerable amount of marlin. On several occasions the vessels caught more fish than could be absorbed by the market. A low price of less than fifteen cents a pound resulted. At the end of the month eight vessels with tuna aboard were tied to the dock, awaiting their turn to sell at auction. Each vessel had approximately as much as the auction could handle in a day.

There has been no commercial tuna development in the U. S. Trust Territory to date. The cannery in American Samoa has not been able to get into operation for lack of raw fish due to difficulties in catching tuna off Fiji, states the November 1949 report from the Pacific Oceanic Fishery Investigations.

TUNA LENGTH AND WEIGHT FREQUENCY DATA: Analysis of tuna length and weight frequency data is being continued by the Section of Biology and Oceanography. While it will require time to complete the study, it is quite possible to determine age and growth of yellowfin and big-eyed tunas from the length-frequency pattern. A very rapid rate of growth and the presence of only a small number of year classes in the fishery are demonstrated by the data.

EARLY LIFE HISTORY STUDIES OF TUNAS: Early life history studies of tunas were initiated in November 1949. Ovaries are being collected routinely from big-eyed and yellowfin tunas to determine whether or not the stage of maturity is correlated directly with weight or volume of the ovary. The purpose of the study is to provide a means whereby the degree of maturity of a fish can be established quickly and objectively by an ovary measurement. An excellent series of big-eyed tuna ovaries is being assembled, but no yellowfin tuna have been available during the month.

TAGGING TUNA: Tunas are difficult to tag successfully. For yellowfin and big-eyed tunas, a specially designed, numbered hook seems to give greatest promise

of success. For skipjack, either the hook or an internal tag similar to that used for sardines and herring seems to assure good results in the local fishery. Arrangements have been made to tag and hold tuna and reef fish in the University of Hawaii's ponds at Coconut Island.

SCHEDULE OF CRUISES: A tentative schedule for the operations of the three vessels of the Pacific Oceanic Fishery Investigations was announced late in January this year.

"Henry O'Malley:" Preparations for more extended cruises in Central Pacific waters to carry out the objectives of the program have been concluded for the Henry O'Malley. The tentative schedule of operations of the vessel is as follows:

Cruise Number	Approximate Dates	Operations
2	Jan. 21 to March 21	To French Frigate Shoals for bait; then to Johnston Island, Kingman Reef; Palmyra, Christmas and Jarvis Islands for bait and tuna exploration. Others in Line Island Group may also receive attention.
3	March 21 to April 10	To French Frigate Shoals and westward to Pearl and Hermes Reef for bait exploration; remainder of cruise same as Cruise No. 2.
4	June 26 to August 25	Repetition of Cruise No. 3, except that bait explorations may be extended to Midway Island.

"John R. Manning:" The proposed schedule of operations of the John R. Manning is as follows:

Cruise Number	Approximate Dates	Operations
1	March 20 to March 30	Shakedown cruise in vicinity of Hawaiian Islands.
2	April 10 to June 10	To Kingman Reef, Palmyra, Christmas, and Jarvis Islands. Purse-seine fishing for tuna.
3	June 25 to August 25	Repetition of Cruise No. 2

"Hugh M. Smith:" For the oceanographic and biological research vessel, Hugh M. Smith, the following schedule is proposed:

Cruise Number	Approximate Dates	Operations
2	Jan. 16 to March 5	To French Frigate Schoals, Canton, and Jarvis. Primarily hydrographic cruise with some tuna fishing near Canton.
3	March 26 to May 5	To Hawaiian waters. Using specially designed long lines to observe relation of physical and chemical oceanographic factors to vertical distribution of tuna.

Cruise Number	Approximate Dates	Operations
4	May 15 to June 15	To Hawaiian waters. Through plankton hauls to study distribution of tuna eggs and larvae and to develop methods for spawning surveys.

Periods between cruises will be used by the three vessels for general repairs, making necessary alterations to or construction of gear, and outfitting for the next cruise.

SHARK LIVERS TESTED: Eight samples of shark livers received from the islands of the Trust Territory were analyzed for oil and vitamin A content by POFI's Technological Section. Oil content ranged from 42 to 82 percent, but vitamin A content was less than 3,000 units per gram of oil.

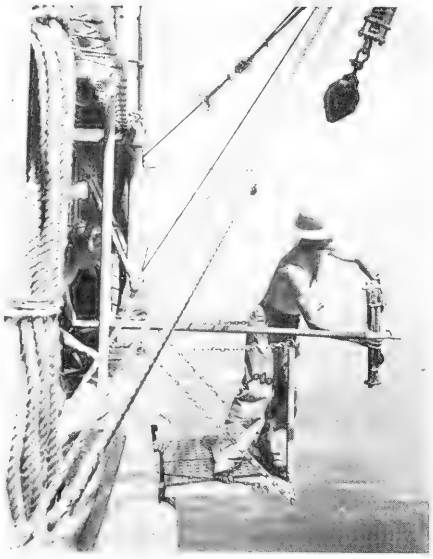
A Philippine Fishery Program Vessel Completes Assignment

The Spencer F. Baird, exploratory fishing and research ship of the Service's Philippine Fishery Program which has been operating for the past 2½ years in Philippine waters, left Manila January 10 to return to the United States, according to an announcement by the Service's Program Administrator and the Director of the Philippine Bureau of Fisheries.

As a part of the activities of the Philippine rehabilitation program of the United States Government, the vessel has been engaged in exploratory fishing and oceanographic research.

Some valuable records were compiled during the vessel's operations in Southeast Asia where an area of 810,000 square miles of Philippine Seas were explored.

In addition to exploratory fishing and oceanography, the vessel has served as a training ship for future Filipino fishermen and scientists. On practically every cruise, the Spencer F. Baird carried from one to eight students of the Philippine Institute of Fisheries Technology.



REMOVING NANSEN BOTTLE FROM LINE ABOARD THE SPENCER F. BAIRD IN THE CELEBES SEA IN THE FALL OF 1947.

A total of 526 oceanographic stations, some of them going as deep as two thousand meters and averaging 1500 meters in depth, have been occupied. From this work the currents in the seas of the Philippines have been plotted, seasonal changes both in the sea and on land will be explained, and the most important fishing areas scientifically defined and their potential productivity measured. Fishing experiments with various types of gear were carried out including long-line trawls, gill nets, jackpoles, seines, and trolling. Biological studies have revealed important data on various species of Pacific fishes, especially tunas. Spawning grounds for this important commercial fish have been discovered, spawning seasons have been described, larval and juvenile tuna have been collected from widely distributed stations in the Philippine seas, and distribution and habits are being studied.

Program for Gulf Fishery Investigations

A fishery exploratory program that would include a survey of Gulf tuna resources was recommended by the Gulf States Marine Fisheries Commission at a meeting held in Tampa on January 18-20 this year for the vessel Oregon of the Gulf Fishery Investigations. Pascagoula, Mississippi, is the base of operations for the vessel.

Although it was recognized that expanding the shrimp fishing areas and learning more about the "grooved" or "brown" shrimp was of primary importance, it was believed that a preliminary survey for tuna would be worthwhile before removing the bait tank, which would be necessary if a shrimp survey were to be undertaken.

In conjunction with the tuna exploratory work, it might also be possible to incorporate some work for new red snapper and shark grounds.

Research on Salmon Waste as an Ingredient of Hatchery Feed

Technological investigations of salmon waste as an ingredient in hatchery feed are being carried out by the Branch of Commercial Fisheries during the current fiscal year in connection with the Lower Columbia River development program on the West Coast. For this work, the Seattle Fisheries Technological Laboratory has been allocated $11,200 of the funds provided in the Civil Functions Bill.

Estimates for funds from the same source for Fiscal Year 1951 have now been approved by the Budget Bureau for continuation of the hatchery-feed research.

Wholesale and Retail Prices

Average wholesale market prices on December 13, 1949, were 0.2 percent below November 15, and 7.1 percent lower than on December 14, 1948, according to the Bureau of Labor Statistics of the Department of Labor.

Wholesale canned pink salmon prices during December 1949 remained steady and were at the same level as the previous month, but they were still 30.4 percent below December 1948. Canned red salmon prices, on the other hand, continued to rise in December 1949 and were 1.6 percent above the previous month, but 2.5 percent below December 1948.

Wholesale and Retail Prices

Item	Unit		Percentage change from-	
Wholesale: (1926 = 100)		Dec. 13, 1949	Nov. 15, 1949	Dec. 14, 1948
All commodities	Index No.	151.1	-0.2	-7.1
Foods	do	156.5	-1.9	-7.5
Fish:		Dec. 1949	Nov. 1949	Dec. 1948
Canned salmon, Seattle:				
Pink, No. 1, Tall	$ per doz. cans	3.94	0	-30.4
Red, No. 1, Tall	do	6.48	+1.6	- 2.5
Cod, cured, large shore, Gloucester, Mass.	$ per 100 lbs.	15.125	-2.4	+ 0.8
Retail: (1935-39 = 100)		Dec. 15, 1949	Nov. 15, 1949	Dec. 15, 1948
All foods	Index No.	197.3	-1.7	-3.8
Fish:				
Fresh, frozen and canned	do	299.0	-0.5	-8.9
Fresh and frozen	do	267.1	+0.3	-0.5
Canned salmon:				
Pink	¢ per lb. can	47.1	-2.3	-22.9

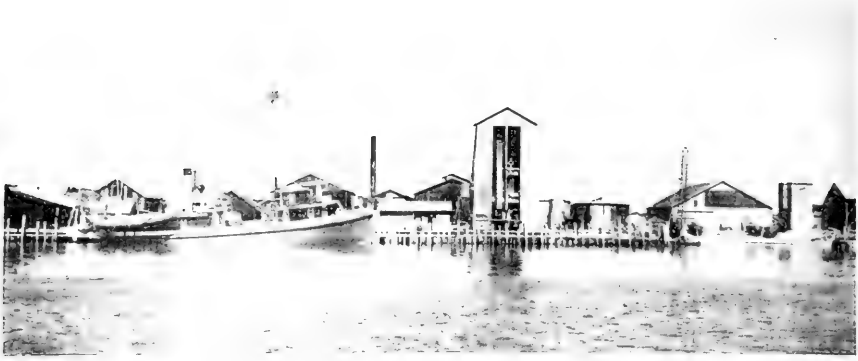
Following the general trend of all retail food prices, fresh, frozen and canned fish prices by mid-December 1949 were 0.5 percent lower than by mid-November and 8.9 percent below December 15, 1948. However, the fresh and frozen fish prices showed a slight increase of 0.3 percent over mid-November 1949 due mainly to light production in the main producing areas on the East Coast, but they were still 0.5 percent lower than mid-December 1948. Probably still reflecting the drop in wholesale canned pink salmon prices which took place in July and August, retail prices on this commodity continued to drop and in mid-December 1949 were 2.3 percent lower than in mid-November 1949 and 22.9 percent below mid-December a year ago.

United States and Alaska Commercial Fisheries, 1949

(Preliminary Review)

INTRODUCTION: The United States and Alaska catch of fishery products in 1949 amounted to about 4.7 billion pounds, with an estimated value of nearly $350 million to the fishermen. Although the catch was about 100 million pounds greater, its value was about 12 percent less than in 1948, due to a general decline in the prices of fishery products.

PRODUCTION BY SPECIES: Rosefish landings (principally at Gloucester, Massachusetts, and Portland and Rockland, Maine) were estimated at nearly 240 million pounds--possibly a new record. Tuna landed in California amounted to 324 million pounds--12 million pounds above the former record landings in the previous year. Although the Washington and Oregon tuna catch data are not available, it is reasonably certain that the Pacific Coast tuna catch in 1949 was the largest in history.



A MENHADEN PLANT NEAR FERNANDINA, FLORIDA.

Production of menhaden (taken on the Atlantic and Gulf Coasts entirely for reduction) was estimated at about 975 million pounds, making the 1949 production the second or third largest in the history of the fishery. In 1948, the catch of this species amounted to 1,008 million pounds, while in 1947, it totaled 973 million pounds. Whether or not the 1949 catch will be above or below that of 1947 cannot definitely be determined until final figures become available.

INDIANS FISHING FOR SALMON WITH HOOP NETS AT CELILO FALLS, OREGON.

Important developments in the menhaden fishery were the return of these fish to Maine waters after an absence of 40 years, the construction of new menhaden reduction plants in the Gulf States, and an increase in the catch of these fish in the latter area.

Due to an unexpected large run of pink salmon in southeastern Alaska, the catch of salmon in Alaska and the Pacific Coast States during 1949 was about 15 percent above the 1948 production of approximately 400 million pounds. Although preliminary pack figures have not been received for the Columbia River District or the Coastal Districts of the Pacific Coast States, the 1949 domestic pack of canned salmon was estimated to be about 5,375,000 cases, compared with 4,825,000 cases in 1948.

As a result of a steep decline in the price of fish oil, most herring meal and oil producers in Alaska failed to operate, and the 1949 Alaska herring catch amounted to about 37 million pounds, compared with 166 million pounds the previous year. The Maine herring catch (used principally in the canning of sardines) totaled about 150 million pounds, compared with 182 million pounds the previous year.

Pilchards were found in considerably greater abundance off the California Coast in 1949 than in the previous two years, and the catch amounted to 600 million pounds, compared with 373 million pounds in 1948, and a low of 272 million pounds in 1947. However, the 1949 pilchard production was only half as large as the average annual yield during the period of peak catches prior to World War II.

PILCHARD PURSE-SEINE FLEET AT MONTEREY BAY IN BACKGROUND. MACKEREL HAND-LINE BOATS IN FOREGROUND ALSO USED FOR SALMON TROLLING IN SEASON.

NEW ENGLAND PRODUCTION: Landings of fishery products in Maine and in the major Massachusetts ports (Boston, Gloucester, and New Bedford) indicate that the 1949 catch in the New England area declined in both volume and value, compared with the previous year. In 1948, the landings in Maine and at the major Massachusetts ports totaled 834 million pounds, valued at $55 million; the 1949 landings totaled 822 million pounds, valued at $47 million. A more pronounced decline would have been evident in 1949 were it not for the development, during the year, of the fishery for scrap fish for meal and oil. Scrap-fish landings in Maine and at the major Massachusetts ports in 1949 amounted to 57 million pounds, valued at about $600,000 to the fishermen. An additional 15.5 million pounds of scrap fish were landed at Provincetown, Massachusetts; Stonington, Connecticut; and Point Judith, Rhode Island.

UNLOADING ROSEFISH FROM A TRAWLER AT GLOUCESTER, MASSACHUSETTS.

Remarkable developments are revealed by comparing 1949 New England landings with those of a decade ago. The Maine catch in 1939 amounted to 116 million pounds, compared with over 290 million pounds in 1949. Boston landings of fishery products in 1939 amounted to about 300 million pounds, compared with 172 million pounds last year. Gloucester landings in 1939 totaled only 76 million pounds, compared with 253 million pounds in 1949. New Bedford receipts of fish and shellfish in 1939 were 23 million pounds, compared with 105 million pounds last year.

CANNED FISHERY PRODUCTS: Preliminary data indicate that the 1949 pack of canned fish was somewhat larger than in the previous year and totaled about 850 million pounds, compared with 782 million pounds in the previous year.

Production of canned salmon--which is estimated to have totaled 5,375 cases--was about 550,000 cases greater than in the previous year. In California, where pilchards were canned in much greater volume than in 1948, the pack amounted to about 3,875,000 cases--1,200,000 cases above the previous year's production. The pack of tuna in 1949 was so near the record of 7,038,000 cases canned in 1948 that it will not be possible to determine whether a new record was established until final pack figures are received.

FISH MEAL AND OIL: Fish meal production in 1949 is estimated at about 215,000 tons--an increase of about 15,000 tons compared with the previous year mainly due to large increases of pilchard meal in California and groundfish meal in the New England States. In 1949, about 38,000 tons of pilchard meal was manufactured compared with 19,000 tons the previous year; while groundfish meal totaled over 34,000 tons, against less than 22,000 tons in 1948. Declines occurred in the production of herring meal (in Maine and Alaska) and menhaden meal.

Fish and fish-liver oil production was about 18 million gallons--around 1 million more than in 1948. Although there was a large increase in the manufacture of pilchard oil during the year, there was a decline in herring oil in Alaska and menhaden oil on the Atlantic and Gulf Coasts.

INSIDE VIEW OF A WEST COAST TUNA CANNERY SHOWING THE TUNA-PACKING LINES.

PRICES: The fisheries experienced a general decline in prices during 1949, and values for a number of items declined sharply. Fishermen received about 10 percent less for their catch in 1949 than in the previous year, despite the slight gain in catch.

Fish oil prices, which had reached a peak of 24 cents per pound only two years before, fell to 5½ cents per pound. Sharp price declines also occurred for canned fish at the canners' level for Maine sardines, California pilchards, tuna, and most species of salmon. Whereas canners realized an average of about $23.50 per case for pink salmon in 1948, the return for the 1949 pack was about $16.00 per case. Lower prices for canned tuna were reflected in a decline in the price paid for yellowfin (the principal species canned) to the fishermen from $345 to $310 per ton. Despite general price declines in other fishery products, the price for fish meal was maintained at a high level because the recognized value of this product in animal feeding stabilized the demand. Prices averaged somewhat over $150 per ton--about four times the amount received in 1940.

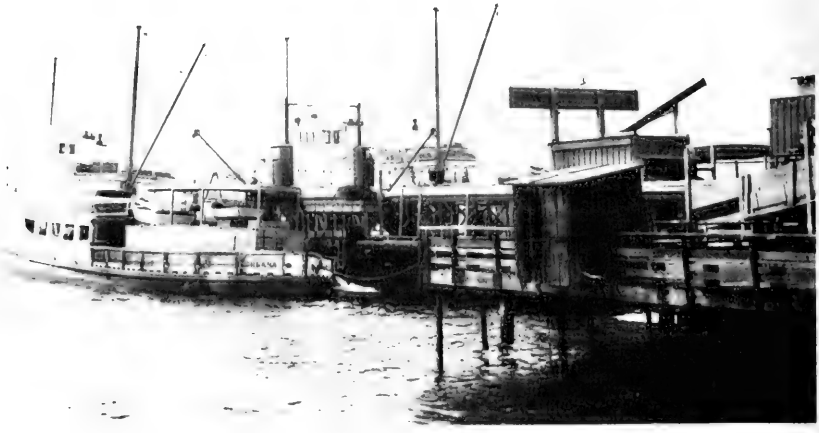
CONSUMPTION: Consumption of fishery products in the United States during 1949 was about the same, or possibly slightly less, than in the previous year, when over 11 pounds per capita were consumed. As a result of the increase in the catch of fishery products, more domestically-caught fish were available for consumption than in the previous year. However, exports of edible fishery commodities were somewhat larger than in 1948, while imports declined a little.

PRINCIPAL FISHING PORTS: San Pedro, California, continued as the Nation's leading fishing port with landings of about 540 million pounds, valued at $26.5 million to the fishermen. Monterey, California, was in second place, with 285 million pounds; followed by Gloucester, Massachusetts, with 250 million pounds. While San Diego, California, (with landings of 210 million pounds) occupied fourth place with respect to the volume of landings, it was first in importance as far as value was concerned. Value of the landings at that port were estimated at $31 million.

SHRIMP FLEET AT ST. AUGUSTINE, FLORIDA.

STOCKS OF FISHERY PRODUCTS: Stocks of frozen fishery products on January 1, 1950, were approximately 4 million pounds less than on the same date the previous year. Fish and shellfish frozen during 1949 amounted to 285,822,000 pounds, compared with 291,988,000 pounds during the previous year.

Although information is not available on stocks of canned fishery products, it is believed that supplies of a number of items (canned salmon, California sardines, and tuna) were considerably higher on January 1, 1950, than on the same date the previous year.



TWO TUNA CLIPPERS UNLOADING AT SAN DIEGO. TUNA WAS CAUGHT OFF THE GALAPAGOS ISLANDS.

FISHERMEN AND FISHING CRAFT: Current information is not available on the number of fishermen and fishing craft employed in taking fishery products. However, it was estimated that more than 8,000 vessels of five net tons and over were operated during 1949.

Number of persons employed as fishermen during the year was estimated at about 160,000.

Construction of fishing vessels continued at a high level. However, the number documented as fishing craft during the year was about 200 less than in 1948, when 1,184 vessels entered the fisheries. Although 1949 was the first year since 1945 that the number of vessels documented fell below 1,000, the number of vessels built was still two to three times the average number constructed in the five years prior to World War II.

FISHERY PRODUCTS PLANTS: During the postwar years, great improvements were made in fishery products plants. Many firms built new establishments or remodeled existing structures. It is expected that plant construction will level off during 1950. However, considerable activity is expected in some regions, particularly in the Gulf area, where new menhaden plants are planned, and where tuna canneries may be built.

FOREIGN TRADE: Exports of edible fishery products during the first 11 months of 1949 amounted to 127 million pounds, compared with 83.4 million pounds during the same period in 1948. Large shipments of salmon and pilchards to the United Kingdom, and pilchards to the Philippine Islands were the cause of the increase in exports.

Imports of fishery products into the United States during the first 11 months of 1949 totaled 428 million pounds, compared with 435 million pounds during the same period in 1948. Imports of cod, haddock, hake, pollock, cusk, and rosefish fillets during 1949 amounted to 47,190,000 pounds, compared with 53,728,000 pounds the previous year.

FISH FACTS

DO YOU KNOW.....

That the sense of smell in some fishes is extremely acute and they are attracted from great distances by certain feeds.....

Australia

TUNA CATCHES IN NEW SOUTH WALES: Conclusive evidence of the tuna potentialities of Australia's south-eastern waters was provided by the fact that there were some 300 metric tons of tuna in the Narooma and Eden canneries' freezers in October 1949, according to that month's issue of the Fisheries Newsletter of the Australian Director of Fisheries.

The tuna were Southern bluefin. They were caught by trolling. This method of taking tuna is within the financial means of most fishermen, and is proof that some species of tuna, at least, can be taken in commercial quantities in Australian waters by trolling.

Since the tuna run has been much heavier than usual this year, fishermen from Ulladulla to Eden have been encouraged to go after them.

The tuna averaged about 16 pounds. They were taken only about five miles out, but about 25 to 40 miles out there were greater quantities of much larger tuna, around 40 pounds, according to fishermen.

Trial shipments to the United States of both fresh and frozen tuna are contemplated.

The Commonwealth Fisheries Office has been exploring various means of encouraging the development of pelagic fishing for tuna and other good quality surface fish, and this work is now beginning to show results.

Canada

EXPERIMENTAL FISH-COOKERY KITCHEN ESTABLISHED: An experimental kitchen for fish cookery has just been established and completed in Ottawa by the Canadian Department of Fisheries, according to that agency's December 1949 Trade News.

The kitchen will be the headquarters for an initial staff of six home economists who will travel throughout the country giving demonstrations and lectures on fish cooking to women's groups, schools, and others. New recipes and the knowledge gained through experiments conducted in the kitchen will be passed on to consumers. It is expected that the kitchen will be used more for testing and creating new recipes than for demonstration.

Colombia

BUILDING FISHING VESSELS IN SWEDEN: A company from Colombia, with Government backing, has ordered from a Swedish concern three special-type fishing vessels of about 130 gross metric tons each and a complete herring oil factory, reports the December 24, 1949, issue of The Fishing News, a British periodical.

These vessels are to be used for fishing off the Galapagos Islands. Of wooden construction, they will each be equipped with 200 h.p. single-screw motors, refrigeration, a fully insulated fish hold capable of being kept at -15° C., and accommodations for a crew of 12. They will combine Swedish and Pacific Northwest Coast features of design and will look very much like a West Coast purse-seine troller.

Certain features of the vessel conform to Swedish design. The bow is plain and curved in the Swedish west-coast manner; the superstructure is well forward and is curved at the forward end, being one deck in height with most of the accommodations in the deckhouse; the navigating bridge is at the forward end and is "buried" into the aft end of the pilothouse. The mast is at the aft end of the superstructure, and there is a roofed-in crow's nest towards the top, just above the crosstrees with auxiliary control of the main propelling machinery possible from this position. A long derrick, stepped at the bottom of the mast, serves the aft end of the hull, which either can be employed for bait tanks or for the usual purse-seine table. Accommodations and machinery are forward, while all fishing gear is aft.

Denmark

FISH MEAL FROM STARFISH: A fish meal factory at Esbjerg, Denmark, has begun the processing of starfish into fish meal during the months when herring is not available, states a December 14, 1949, American consular dispatch from Bremerhaven, Germany. Starfish have been found to yield 30-35 percent meal with a 25-30 percent protein content. Starfish meal is reported to be suitable for chicken and pig feed.

* * * * *

FRESH-WATER TROUT INDUSTRY: An application of the Trout Exporters Central for exclusive rights on all shipments of Danish fresh-water trout to the United States was approved on December 1, 1949, by the Danish Ministry of Fisheries, according to a December 15 report from the American Embassy at Copenhagen. Exports will be handled through the newly-formed private firm, Lynfrost A/S (The Quick-Freeze Company) of Esbjerg, Jutland. The Ministry stipulated that Trout Exporters Central is required to admit to membership any and all Danish producers and exporters who may wish to participate in this trade with the United States.

The Exporters Central, which represents both producers and exporters, has held a monopoly on the export of Danish trout to European countries (except Great Britain) for several years. However, trade with the United States has not been channeled through this organization in the past.

Danish exports have increased in recent years. Practically all the Danish hatchery-raised trout are exported, mainly to Switzerland, France and Italy.

The industry expects to expand its shipments to the United States to 400 metric tons in 1950.

Danish Fresh-Water Trout Exports, 1945-49

Year	Total Exports		Exports to U.S.	
	Metric Tons	Value (U.S.$)	Metric Tons	Value (U.S.$)
1945	400	478,400	1/	-
1946	825	728,000	1/	-
1947	980	894,400	43	38,480
1948	1,255	1,206,400	132	129,584
1949 (First 11 mos.)	1,556	1,539,200	190	200,512

1/Data not available.

Note: Values converted on the basis of 1 Danish krone equals 20.8 cents U.S. (predevaluation exchange rate).

The modern pond or hatchery trout industry started in Denmark about 1890. Natural conditions have favored the industry. At present there are over 100 trout hatcheries operating in Denmark, all located in Jutland. A Danish hatchery may have from 20 to 80 ponds located near a fresh-water stream.

There are two varieties of trout produced commercially in Denmark--rainbow and brook trout. Other varieties have been tried from time to time, but found to be less suitable. Similarly, experiments in crossbreeding have not been commercially successful.

After the trout eggs are artifically fertilized they are hatched in shallow tanks under carefully supervised conditions. Hatchery feed consists of chopped or ground salt-water fish and fish offal. Slaughterhouse refuse was at one time widely used as hatchery feed but today only fresh fish offal is used in the hatcheries. As the young trout develop, they are moved to progressively larger outdoor ponds until they are two years old. At this point, they weigh approximately 200 grams (approximately 7 ounces) and are ready for market as "portion" trout. Many are shipped as live fish in specially constructed tanks which can be carried either by rail or truck to the European market, or they may be dressed and packed on ice, or quick-frozen.

Exports to the United States are all quick-frozen trout. After freezing at -40° C., the trout are glazed; they are then wrapped in paper and glazed a second time. In this way, the fish can be shipped or stored for a long period without loss of quality or flavor so long as a constant storage temperature is maintained.

The average wholesale (export) price of Danish trout is estimated to be about 40 cents per pound. To produce one pound of finished trout, about 10 pounds of food is required at a total cost of around 15 cents.

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TO FISH IN BARENTS SEA: Ten Danish cutters, of about 50 metric tons each, plan to fish continuously from March to May in Barents Sea north of Norway, according to Danish newspaper reports published in the January 5 Fiskets Gang, a Norwegian fishery periodical. Motherships, of 300 to 400 tons, from Esbjerg, Denmark, will service the cutters at 10-day intervals. The motherships will carry food, supplies and fuel north, and on the southward trip will deliver the fish to Esbjerg or an English port.

From previous experience, it is believed that the cutters can take a full load of over 44,000 pounds during this period.

The research vessel, Jens Vaever, of the Danish Ministry of Fisheries is expected to aid the fishermen in this area.

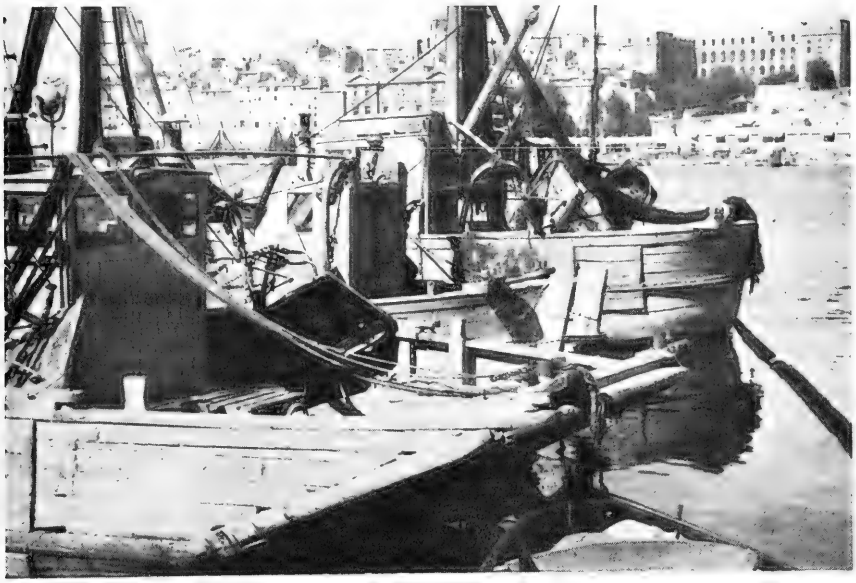
TRIPLES VALUE OF CANNED FISH EXPORTS IN 1949: The young Danish fish canning industry has tripled the value of its exports since 1947, according to Danish newspaper reports. In 1949, the value of the canned fish exports amounted to Kr. 20 million (approximately $4,160,000 at predevaluation rate of exchange).

The exports consisted mainly of sardines, mackerel, and a small amount of tuna. A large amount was shipped to England, and important quantities to Sweden, Germany, Italy, and Austria. Some has been sold to Israel and Uruguay, with lesser amounts to the United States and Australia.

Currently the canning plants are working on an English order of 100,000 cases worth between Kr. 6,000,000-7,000,000 (approximately $870,000-$1,015,000 at postdevaluation rate of exchange).

France

FISHING INDUSTRY WORRIED ABOUT EASING OF FOREIGN TRADE RESTRICTIONS: France, as a member of the Office of European Economic Cooperation, has agreed to suppress controls on 50 percent of imports and exports. This has caused considerable appre-



VESSELS OF THE FRENCH TRAWLER FLEET IN THE HARBOR AT MARSEILLES.

hension among commercial fishermen at Boulogne-sur-Mer (Pas-de-Calais), France's largest fishing port, according to a December 5 report from the American Consulate at Le Havre.

They fear the competition of imports of certain kinds of fresh fish from Denmark, Holland, and Belgium, and imports of herring and frozen fish from Norway and Iceland. All of these countries are able, they claim, to offer lower prices than can French fishermen. In addition, the reconstitution of the German fishing fleet will force them to find other foreign outlets for their products.

Protests have been made to the French Minister of the Merchant Marine.

NYLON GILL NETS FOR TUNA: A leading French nylon netting manufacturer has experimented with nylon gill nets for tuna in the Mediterranean Sea, according to Fiskaren, a Norweigian fisheries publication. Each length of gill net consisted of 10 nets--each 367 feet long, 27 feet deep and made up of 6.3-inch stretched mesh.

During the tests, a hard nylon thread was placed in various positions in the string of hemp nets. With each new trial, the position of the nylon net was changed. It was demonstrated that the average catch for the nylon net was 4 to 5 times as large as for the tanned hemp nets. This was attributed to the light weight of the net and to less color reflection because of the white color of the net in the water. Fishing occurred in the dark of the moon at depths of 5 to 6 fathoms.

The tuna caught weighed from 26 to 110 pounds. A shark 23 feet long also was taken after it became entangled, but it did no damage to the nylon net.

French West Africa

DEVELOPMENT OF FISHERIES: The Inspector General of Fisheries of French West Africa announced that the results of a recent survey of the coastal waters revealed that within a distance of 60 kilometers more than 600 species of fish were caught of which one-third were edible.

Arrangements are under way to (1) form cooperatives of the existing fishermen of the coastal region, (2) increase the number of fishermen and fisheries and (3) increase and modernize equipment, states a December 22 report from the American Consulate General at Dakar.

German Federal Republic

FISHING FLEET: Vessels of Present Fleet are Old: As the result of war losses and the small number of new launchings, the average age of the German deep-sea fishing vessels in use today has risen to 21½ years, whereas in 1939, the average age reached 12½ years, according to newspaper reports quoted by a December 29, 1949, dispatch from the American Consulate General at Hamburg. According to the Association of Deep Sea Fisheries (Verband Deutscher Hochseefischereien) approximately 100 of their 223 fishing vessels have been in service for 25 years or more.

These old and generally small fishing vessels no longer meet the present-day requirements for profitable operation. The size limitation permits their use only in the North Sea where they operate chiefly during the herring season. The number of old ships laid up is steadily increasing and now fifty fishing vessels are not being operated. German fishing circles hope that it will soon be possible to substitute these unprofitable and antiquated ships with new ones constructed in accordance with the new shipbuilding regulations.

A shipyard in Hamburg reports the laying of the keels of three fishing trawlers of 500 gross-registered metric tons which will be launched in April 1950.

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Trawlers To Be Purchased: The best 3 of the 6 Belgian trawlers now chartered by a Bremerhaven firm probably will be purchased by the charterer and converted to German registry, states a January 11 dispatch from the American Consulate at Bremerhaven. The price per vessel will be between $178,500 and $190,400. The so-called Petersberg Agreement of November 1949, by eliminating the 400-metric-ton size restriction on German trawlers, made possible German ownership of the 450-ton Belgian trawlers.

Some privately-owned Icelandic trawlers may also be converted to German registry if the about-to-be negotiated trade agreement between the two countries does not provide for sizable German imports of Iceland fish.

Trawler Fleet To Be Modernized: The Association of German Trawler Owners has proposed that the German trawler fleet be modernized and reduced in number during the year. For every new large trawler built, they suggest that two older and less economic units be retired.

Free importation of iced fish into Germany is still opposed by the Association because it feels that German trawlers are discriminated against by other fish-producing countries, especially the United Kingdom and Norway.

Trawlers to be Constructed: Construction of an unlimited number of trawlers up to 650 gross registered metric tons is permitted by the November 17, 1949, agreement between the German Federal Government and the Allied High Commission. It is estimated that plans have been drawn up for the construction of about 30 new trawlers this year, states a December 14 American Consular report from Bremerhaven. Most of the trawler companies have planned ships under 600 gross registered metric tons.

U. S. Trawlers in Germany to be Lengthened: At the end of the 1949 herring season, the three smallest of the 12 American-owned trawlers now chartered by German fishing companies were laid up preparatory to being lengthened. The firms operating these three vessels do not think that the vessels could be operated profitably outside the North Sea until the fish-carrying capacity is increased.

MUSSEL BEDS THREATENED: Germany's supply of mussels comes largely from the shallow, muddy waters around the East Frisian Islands, where the main harvesting is done in the late fall. In 1946, the parasite Credipula fornicata was discovered in a mussel bed near Norderney and many once prolific beds are now practically barren. No restorative measures have been taken, and the extinction of the beds is thought inevitable by several biologists.

NOTE: Values converted on the basis of 1 Western Deutsche Mark equals 23.8 cents U. S. (postdevaluation rate of exchange).

WHALING: A T-2 American tanker, Herman F. Whiton, recently arrived in Kiel, Germany, where it will be converted into a whaling mothership, states a January 11 report from the American Consulate. To operate the whaling fleet and to distribute the whale byproducts, a new corporation has been formed by a Dusseldorf soap and scouring powder company.

Supposedly being financed by a San Francisco firm, the German whaling fleet will consist of the extended T-2 tanker as a mothership and 10 former corvettes as killer boats. The fleet is expected to be in operation in time for the 1950/51 Antarctic season and will be manned by experienced German personnel.

EXPORTS CANNED FISH TO UNITED STATES: Two small shipments of German canned fish (1,500 cans) have been made to the United States in recent months.

These shipments represent the first German fish exports to the United States since the war. Restaurants or specialty grocers catering to German clientele are believed to have ordered the shipments consisting of canned small shrimp and small herring (rollmops).

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FISHING OFF THE COAST OF ICELAND.

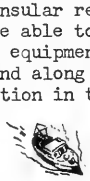
1949 PROGRAM FOR IMPORTS OF ICELANDIC FRESH FISH CONCLUDED: The 1949 program for the German importation of fresh fish from Iceland was concluded by December 1, states a December 2 American Consular Report from Bremen. The 20 or more trawlers which the Icelanders have used to catch fish under their German contract, will be directed in the future to English ports. However, the English market is now well supplied with fish. Several English trawlers are being tied up, and prices there are lower than in Germany at current rates of exchange.

Since the Icelanders do not want to lose the German market, they are expected to try to negotiate an all-inclusive trade agreement with the German Federal Republic early in 1950 in which provision will be made for continuing Icelandic fish landings in Germany.

Fish are scarce in the waters close to Germany. German trawlers must fish a large part of the time now on the grounds off Iceland. The German fishing industry does not see how it can compete with the Icelanders without protection by the German State.

Germany (Russian Zone)

NEW FISHING CUTTERS BEING BUILT: The Organisation der Fischereiwirtschaft in Sassnitz, Russian Zone of Germany, is to build 86 new "volkseigene" (fishing cutters), a December 2 American consular report states. The cutters will be approximately 80 feet long, will be able to carry 12 metric tons of fish, and will be equipped with modern radio equipment. They are intended to be used in the Baltic Sea east of Bornholm, and along the Swedish Coast. Already the Organization has 14 cutters in operation in this area.



Iceland

FISHERIES OUTLOOK FOR 1950: Prospects for the maintenance of Iceland's demersal fish production during the first six months of 1950 at the level which existed in the corresponding period of 1949 are only fair, states a January 12 report from ECA's Special Mission to Iceland. The main catch season of the year (January-May) is late in getting under way because of the Government's delay in providing for continuation of the guaranteed price and subsidy system, or in finding another means for compensating the motor vessel fishing fleet for its operating losses which arise from high production costs and the failure of recent herring seasons.

Declining fish prices on European markets and difficulties confronting Icelandic iced and frozen fish in the United Kingdom and Trizone Germany (because of expanded fish production by those countries) may adversely affect the amount of the demersal fish catch. Marketing obstacles in Northern Europe are very likely to accelerate the shift to salting for Mediterranean and perhaps Latin American markets.

No herring has been caught thus far this winter season, and hopes have just about disappeared on that score. Herring prospects are, therefore, dependent upon the summer season of 1950 (July to September). Since the last five summer seasons have produced a disappointing catch, expectations are not high for the coming summer.

Fisheries constitute an important segment of the Icelandic economy. Estimated value of the output of the fisheries and fish processing industry (including production of small plants making fishing gear) in 1949 was 220,000,000 kronur (approximately $33,880,000 at predevaluation value of krona), or 18 percent of the value of the gross national product. It is forecast that the value of production will fall slightly in 1950 to 210,000,000 kronur (approximately $22,470,000 at postdevaluation value of krona), or slightly under 18 percent of the total national product, because of declining fish prices.

Several technical assistance projects in the field of fisheries are contemplated. Recently Iceland filed for the services of an American efficiency expert to advise and assist in reduction of production costs and in plant modernization in the fish freezing plant industry.

NOTE: Values converted on the basis of: predevaluation rate of exchange--1 Icelandic krona equals 15.4 cents U. S.; postdevaluation rate of exchange--1 krona equals 10.7 cents U.S.

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MAY HAVE DIFFICULTY MARKETING ITS ICED FISH IN 1950: It is believed that the United Kingdom and Germany, which have increased their production of fishery products, will not contract in 1950 for large quantities of iced fish from Iceland as they did in 1948 and 1949, reports the American Legation at Reykjavik in a dispatch dated November 3. Consequently, a large part of the Icelandic catches in 1950 probably will have to be salted since trawler fish generally is not quick-frozen (usually fresh fish, not over 24 hours old, is used for that purpose).

Japan

FISHERIES RESEARCH: The head of the Fisheries Agency of the Department of Research and Statistics, has visited the United States to observe the facilities and organization for fisheries research, the December 3 Weekly Summary of SCAP's Natural Resources Section reports. The purpose of his trip was to gain a first-hand acquaintance with the methods by which other countries are solving their fisheries problems in the belief that this knowledge will assist in the reorientation of fisheries research in Japan.

The Japanese have conducted a great deal of fisheries study or research. No other nation has had so many fisheries research stations or vessels. Both the national and prefectural governments have enthusiastically supported research stations and staffs. Private industry also has been most active in some fields of research, especially fisheries technology.

During World War II fisheries research activities were seriously curtailed because of economic conditions and destruction of equipment and property. However, since the surrender many of the fisheries stations and vessels have been reactivated, assisted by annual increases in budgets. By 1948 about 250 fisheries research stations were operated by prefectural governments, 30 were maintained by universities and colleges, approximately 30 by the central government, and about 20 by private industry. These totals include numerous branch and field stations.

JAPANESE PURSE-SEINE OPERATION IN KANAGAWA PREFECTURE.

Before the war, Japanese research devoted much attention to exploitation of new fishing grounds, improved methods of locating and catching fish, and canning, smoking, and processing of fish products. The emphasis was on immediate production through expansion and exploitation of new fishing areas, especially overseas. Little attention was given to problems of conservation to sustain high levels of yield in long-established fisheries, especially in coastal waters. Admittedly surprising is the relatively high production maintained in Japanese coastal waters in spite of what is regarded as very intensive fishing, compared to fishing efforts in other nations. Fisheries research stations and vessels, however, did stress study of migrations of fish and improved techniques of catching fish for the purpose of maximizing production as rapidly as possible.

Japanese scientists have done excellent work on the cultivation and artificial propagation of food oysters and clams as well as the production of cultured pearls. Also, their workers have made many contributions in the theoretical and academic fields of classification of fishes, oceanography, and the life histories and habits of many species. Much of their information could be applied to conservation problems, but the Japanese administrators in the past have shown little interest in fisheries management for the purpose of obtaining optimum yields. Perhaps the lack of coordination and planning of research programs conducted by various government institutions was largely due to faulty administration. Also, the direction of these programs into fields where the results were primarily of academic interest or of value for immediate expansion of production was no doubt caused by the administrative policies in effect.

The general programs of research were consistent with the policy of expansion followed by the Japanese before World War II. In a desire to increase their profitable export trade, the Japanese did not hesitate to encroach on the fishing grounds of other nations. They conducted their operations in those areas with the same disregard of sound conservation programs that was typical of the exploitation of fisheries in their home waters. This encroachment as well as the disregard of conservation practices created international friction and gave the Japanese the reputation of being poor neighbors.

During the Occupation, Natural Resources Section has extended advice and guidance in the field of fisheries research to Japanese Government agencies, private institutions, individual scientists, and the industry in general. This activity has included the explanation of new policies in the field of fisheries administration and fisheries conservation programs, and assistance in reorganizing the Fisheries Agency to create a special research department. This reorganization will result in greater recognition by the government and industry of research programs in accordance with those sound fisheries management policies and principles that are the basis of good fisheries administration in many other nations of the world. The plan of reorganization recognized the need for coordinated and cooperative activities of the various research units of the national and prefectural governments to provide information as a basis for any sound fisheries management program.

As part of the new program, the Fisheries Agency has established eight regional research stations in strategic geographical locations. Each station is to specialize in those phases of over-all fishery problems most important to its district. The work and personnel of all stations are to be closely coordinated by the central administrative office at Tokyo. New emphasis is to be placed on population studies, collection and analysis of catch statistics, and migrations and life histories of fish. These investigations are to form a basis for the solution of fishery conservation and management problems. National, prefectural,

and private institutions will participate on a voluntary basis and will be coordinated under this plan in several of the major investigations such as that on sardines.

Emphasis also has been placed on the necessity for Japan to change its prewar concept of its right to intrude on the fisheries of other nations without consideration for the interest of those nations. Japanese administration and research personnel are being encouraged to consider that fishery resources on the high seas and in coastal areas beyond territorial limits should be fished in accordance with international agreements and in harmony with sound principles of conservation and utilization.

Some time may be required before the full significance and benefits of these new concepts for utilization of aquatic resources and cooperative relations with other nations in the high seas fisheries can be appreciated and put into effect by the Japanese Government, research workers, and the fishing industry. Mass education along these lines is complicated by the pressing need to increase fisheries production and expand fisheries exports to pay for imports required in the general economy. This mass education can be accomplished only if the Japanese Government and industry are convinced of the benefits which eventually will be derived from these policies when applied to local as well as high seas fisheries.

Some government administrators, government and private research workers, and members of the industry have proved they understand the significance of management of Japanese fisheries in accordance with the advice and guidance of Occupation personnel. This minority will educate greater numbers of individuals. Eventually the full development and maintenance of a program of fisheries research and management will give Japan more benefits through greater production from its local aquatic resources. This accomplishment also will encourage ready acceptance by other nations of Japan's participation in high seas fisheries.

HARPOONING A WHALE.

WHALING INDUSTRY: For the fourth time since the beginning of the Occupation, a two-fleet whaling expedition has left Japan to engage in whaling in the Antarctic.

Accounts of whaling operations in Japanese literature date from 200 BC. Although the industry in coastal waters assumed major proportions as early as the 17th century, Japan has been internationally prominent as a whaling nation only since 1934. In 1940 the country ranked third among the whaling nations of the world, and its catch was exceeded only by those of Norway and England. This rapid rise in prominence was due to participation in pelagic whaling in Antarctic waters.

The annual Japanese catch in the Antarctic increased from 213 whales taken by one factory ship in the 1934-35 season to 9,948 whales taken by six factory ships during the 1940-41 season. Production of whale oil and meat increased from 2,034 to 120,125 metric tons. Less important than pelagic whaling in terms of total production during the decade immediately prior to World War II were whaling

operations conducted from coastal stations in Japan and several of its colonies. During 1931-40 Japanese coastal whalers caught an annual average of 1,734 whales and produced an annual average of about 25,000 metric tons of products.

Japan never became signatory to the international agreements for the regulation of whaling promulgated by International Whaling Conventions in 1937 and 1938. Their indiscriminate hunting, without thought to conservation of whale resources, gained them an unenviable reputation.

With the beginning of the war in the Pacific in 1941 all pelagic operations were curtailed. Coastal operations continued, but they declined, particularly during the late years of the war, and they ceased with the surrender in August 1945.

Because of a critical shortage of protein foods and edible oils in Japan at the beginning of the Occupation, the Supreme Commander for the Allied Powers authorized, on September 22, 1945, the resumption of fishing and whaling operations in certain designated coastal areas. The Japanese Government was notified on November 3, 1945 that all whaling operations would be conducted in strict conformity with international whaling regulations.

Because of the success of the first expedition, and the continuing pertinence of the reasons offered in justification of it, similar expeditions were authorized to operate in Antarctic waters during the three following seasons. The importance of these expeditions to Japan and the United States is shown by the fact that the three expeditions which operated during the 1946-47, 1947-48, and 1948-49 seasons produced approximately 137,000 metric tons of products valued at about $45,000,000. Of equal significance is the fact that production per blue whale unit[1/] rose from 37 tons in 1946-47 to 46 in 1947-48, and to 50 in 1948-49.

In addition to insuring compliance with international whaling agreements, the representatives of the Supreme Commander have initiated technological studies to improve processing equipment, such as that for extracting oil from blubber and bone, and processing techniques, and have supervised projects designed to furnish scientific information to aid in establishing international regulation of catch.

In the coastal whaling industry, where an average of 1,500 whales are caught and 25,000 metric tons of products are produced annually, the Supreme Commander's efforts have been directed toward encouraging (1) democratization of the industry as rapidly as economic conditions permit, and (2) adoption of technical improvements. A corps of technicians has been formed to inspect coastal industry as required by international agreements. The major whaling companies have initiated research in newer and more efficient catching equipment, such as the electric harpoon.

The Japanese Government officials directly concerned with the control of the whaling industry and the operating companies have displayed a clear understanding of the spirit and aims of international whaling regulations. Acting jointly, they have undertaken for the first time in the history of Japanese whaling a series of scientific studies designed to furnish information which not only will contribute to the protection of whale stocks in Japanese coastal waters, but also will add to the general pool of statistical information being compiled by the International

1/ One blue whale unit equals one blue, two fin, or six sei whales.

Bureau for Whaling Statistics in Sandefjord, Norway. Further, numerous individuals, both government officials and representatives of the major whaling companies, have displayed a major change from prewar years in their attitude toward international cooperation, expressing the desire that Japan be permitted to adhere formally to the International Whaling Convention now in force, and become a signatory to that Convention.

Madagascar

WHALING EXPEDITION: The French magazine Marches Coloniaux of December 3, 1949, reported that La Societe des Peches Coloniales a la Baleine, had just completed a whaling campaign in the waters south of Madagascar and around Fort Dauphin and Sainte Marie, according to a December 19 report from the American Consulate at Tananarive. The expedition consisted of eight hunting ships and one factory ship, the Anglo-Norse. The crews consisted of about 250 Norwegians, accompanied by two Frenchmen, including a representative of the Institut de Recherches Scientifiques de Madagascar.

For 120 days of work, the apparent catch was 1,330 whales (about 11 to 12 a day) and 10,000 metric tons of oil.

Colony of Mauritius

FISHING VESSEL TO BE PURCHASED: A loan of £35,000 (approximately $98,000) has been made to a local company by the Government of Mauritius as part of the purchase price (£151,350, approximately $423,780) for an ex-Royal Navy corvette. The vessel will be used to fish between Mombasa, the Chagos, the Seychelles, South Africa and Mauritius, reports a December 16 dispatch from the American Consulate at Mombasa, Kenya Protectorate.

Norway

ELECTRO-FISHING: Electro-fishing is being carried on experimentally in Norway with such success that the Norwegian government has called the technique revolutionary, according to reports in the Bremerhaven press quoted by a January 11 dispatch from the American Consulate at Bremerhaven.

A recording marine sounder is used in the Norwegian system which permits a selection of large or small fish to be caught. No details are at present available as to the actual apparatus used.

Rudimentary electro-fishing technique used in the late summer of 1949 to catch tuna was also mentioned. In this type of fishing a lure is used which gives the tuna a severe electric shock when the fish strikes, and increases the chances of landing the catch. Although tuna are more or less a rarity in northern waters, they were encountered more frequently than usual in the North Sea during the 1949 herring season.

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FISHERMEN TO USE ASDIC FOR LOCATING FISH: Asdic will be used within the foreseeable future by the Norwegian fishing fleets to locate fish before determining their depth with depth finders, according to Norwegian newspaper reports of a statement made by the Director of the Defense Research Institute.

Derived from the first letters of Anti-Submarine Department Investigation Committee, Asdic (originally an anti-submarine weapon) uses high frequency sound waves sent out horizontally in contrast to depth finders which send out waves vertically. Asdic in large sizes is already being manufactured in Norway, and now a less expensive type for fisheries use is being constructed.

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PURSE SEINE WITH BAG: A new purse seine with a fish bag or bunt for hauling the catch on board the vessel has been constructed and patented by Ragnvald Giske of Ellingsøy, Norway, according to the December 13 Fiskaren, a Norwegian fishery periodical.

The net is knitted with relatively large meshes in the end sections and smaller meshes in the middle portion. It is also fitted with a fish bag which is equipped with a purse line and a hoisting line so that the bag can be pursed around the catch within it. After hoisting on board the vessel, it is emptied through the end, which can be opened. The bag's lower end then is pursed again and it is lowered for another filling. This operation continues until the seine is empty. By this means the seine can be emptied without use of the landing net or brail, which is of considerable importance, especially in bad weather.

The seine can be set and pursed from the large boat. It is simple to make and can be used for all kinds of purse seining, from small pollock to tuna. Because the fish bag is constructed so that it can be lengthened according to the purse seiner's size, the seine is well suited for fisheries where the catch is to be handled on board.

ESTABLISHES PRICES FOR LOFOTEN COD: Prices to the Norwegian fishermen during the current Lofoten fishing season have been set at Kr. 0.40 per kilo (2.54 cents per pound) for drawn cod without regard to whether the fish are for the fresh or frozen market, or for salting or drying. This is an increase over 1949 of Kr. 0.07 per kilo (0.44 cents per pound) for fish intended for salting and drying, and a decrease of Kr. 0.03 per kilo (0.19 cents per pound) for cod for the fresh and frozen trade, according to the December 13 Fiskaren, a Norwegian fishery periodical.

GUARANTEED PRICES FOR HERRING: Norwegian herring fishermen have been guaranteed by the Price Directorate an average price of $25.76 per metric ton for large winter herring and $21.00 per metric ton for spring herring for the first 180,000 metric tons of each type, according to December 8 Fiskaren. A sliding scale then drops the prices 78 cents per metric ton for each succeeding 45,000 metric tons.

Compared with 1949, the 1950 scale of prices results in the same return for 180,000 tons to as much as $1.04 per metric ton more if 405,000 metric tons are taken.

Prices mentioned are the guaranteed average return to the fisherman. Nothing has been said as to prices for herring according to its utilization—for icing, salting, and reduction to meal and oil.

NOTE: Values converted on basis of 1 Norwegian krone equals 14 cents U. S.

NEW DEPTH SOUNDER: After being tested on a herring research vessel of the Directorate of Fisheries, construction of 300 Norwegian echo sounders has been begun by a Norwegian firm, according to a translation from Fiskaren. Originally developed by the Defense Research Institute, the device was adapted to fishing vessel use. All the vital parts are made in Norway. It is fully patented and is expected to sell for about $1,400. The complete echo sounder is mounted in a case which is 21" x 14" x 11". Weighs about 95 pounds, and at 12 volts uses 6.5 amperes. It operates on three depth ranges: from 0 to 100 meters (0-55 fathoms), 0 to 500 meters (0-273 fathoms), and 500 to 600 meters (273-492 fathoms). The transducer system consists of a single strong metal part (7" x 8" x 3½") fitted into a fish-shaped block of wood bolted to the outside of the vessel. Holes in the hull, therefore, need not be larger than required for the leads to the transducer.

The transducer works at the same time as a receiver of the echo and induces a current which goes through an amplifier to the recorder. Like the English echo sounder this is an important simplification which makes the sounder cheaper. Construction of the transducer makes it possible to obtain a considerably greater effect than the crystal will withstand in the American sounder.

For registering the echo, the same paper is used as in the English sounder. As is known, the newer models of the American and English sounders register the depth along a circular periphery, therefore, the bottom's appearance is deformed. The Norwegian sounder registers the depth along a straight line and gives a true-to-nature picture of the bottom.

Another advantage of the Norwegian sounder is that amplifying in the upper meters of the registering belt is weakened. On the American and English sounders, registering is by reverberations blackening that part of the paper which represents the uppermost water layer. It is, therefore, difficult to detect, for example, a school of fish which stands shallower than about 10 meters (5½ fathoms) if one wishes to register the bottom at the same time. The Norwegian sounder registering eliminates this reverberation belt by an automatic decrease in the amplification, making possible the registering at the same time of schools of fish practically under the bottom of the vessel and the bottom.

On the research vessel, the bottom was registered down to 492 fathoms when the vessel was not under way, and down to 217 fathoms at full speed, a much better result than given by the vessel's regular equipment.

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EUROPE'S LARGEST HERRING OIL FACTORY IN OPERATION: Norway's and Europe's largest herring oil factory began operations during January in Egersund in Southwestern Norway, states a January 21 report from the Norwegian Information Service. Built at a cost of about 5 million kroner (approximately $700,000) it will have a capacity of about 15,000 barrels a day.

FISHERIES HAVE SECOND BEST YEAR IN 1949: With a catch of 1,035,122 metric tons, valued to the fishermen at Kr. 295,000,000 (approximately $59,442,500), the Norwegian fisheries in 1949 had their second best year. In the record year of 1948, the catch totaled 1,297,215 metric tons, valued at Kr. 316,000,000 (approximately $63,674,000). Poor weather in the early part of 1949 was the main reason why last year's catch did not equal that of 1948, states a January 14 report from the Information Service.

This year a below-average yield is expected by the Lofoten cod fisheries, according to a statement by the Minister of Fisheries.

Demand for Norwegian fish abroad (particularly processed fish), says the Minister, cannot be satisfied. In order to meet the need for this type of fish, it has been necessary to limit the export of fresh fish, for which there is also a growing demand.

Norway has won a completely new market by developing trade in frozen fish. As production of herring meal is constantly growing, the Minister also believes that Norway will now be able to export considerable quantities of the meal for animal fodder.

FROZEN PACKAGED WHALE MEAT: Whale "fillets" or steaks in an "export package" will now be a regular item in Oslo's grocery stores, according to a report of January 28 from the Information Service.

Oslo recently received its first shipment of frozen whale meat in cellophane packages when the refrigerated freighter Nord-Frost arrived from the Government's deep-freeze plant in Vesteraalem in Northern Norway with 210 metric tons of frozen "fillets."

Frozen at about -32° C., the "fillet" or steak is packed in cellophane, 2.2 pounds to a package, 6 packages to a carton, and 4 cartons to a box, and transported from Vesteraalen to Oslo at a temperature of about -12° C., at which temperature, it is claimed, the meat keeps all its fresh qualities.

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EXPERIMENTAL COD FISHERY: An expanded experimental fishery for cod in Lofoten, Northern Norway, is planned for the current season, according to Fiskets Gang.

The Directorate of Fisheries will contract with 50 purse seiners and 10 sink netters. Each purse-seining operation will utilize a seining vessel and an auxiliary vessel. The latter must be at least 35 feet in length and have at least a 25 h.p. motor. One of the vessels must have an echo sounder and the purse seine must be at least 180 fathoms long by 27 fathoms deep.

* * * * *

PRODUCTION OF SALTED HERRING: The Norwegian catch of brisling during the 1949 season was 267,500 bushels, states a December 29 report from the American Embassy at Oslo. Production of salted herring in 1949 was 900,000 barrels for export, a record, according to the President of the Salted Herring Export Association. Sales, however, have not kept pace, and it is predicted that next season's production will be reduced.

VACUUM PUMP FOR DISCHARGING HERRING: A vacuum pump for discharging herring from holds of vessels has been invented by Mr. S. O. Jacobsen. Almost 200,000 pounds of herring an hour, claims the inventor, may be discharged by using this pump, which automatically records the weight.

NOTE: Values converted on basis of 1 Norwegian krone equals 20.15 cents U.S.

Production of these new pumps has started. It is claimed that the invention has been patented.

NEW TYPE OF BILGE KEEL: Another Norwegian invention is a new type of bilge keel which is claimed to reduce the normal rolling of fishing vessels, particularly in stormy weather, without affecting speed or maneuverability.

Sweden

ONE-BOAT FLOATING TRAWL TESTED: A one-boat floating trawl, which was constructed by two Swedish engineers, Gunnar Albrechtson of Gothenburg and Karl Hugo Larsson of Stockholm, has been tested recently for five or six weeks in the Swedish herring fishery.

The trawl was operated from a motor trawler and gave satisfactory results, according to the skipper, who believes it will take hold. In a half-hour tow, 17 boxes of herring were taken; and in another haul, 18 boxes, according to the December 13 issue of Fiskaren, a Norwegian fishery periodical.

The trawl can be operated at various depths, and it is regulated for the desired depth before setting. However, while trawling the depth can be adjusted to a certain extent by hauling in or slackening off on the trawl cables. It can be used also as a bottom trawl to a depth of 100 fathoms. The price of the trawl will be about Kr. 3,000 (approximately $580), excluding the cost of the trawl cables. Tests are being continued.

U.S.S.R.

NEW TRAWLERS FOR RUSSIA: The Soviet Union has placed orders for 23 trawlers in Sweden, according to a dispatch in the November 17 issue of Fiskaren, a Norwegian fisheries periodical. They will be equipped with 800 h.p. motors of the Frederikstad type, will have a contract speed of 11.5 knots, and are designed for a crew of 44. Fish oil production and fish preservation (canning, salting, etc.) will be carried out on board.

United Kingdom

CONTROLS ON FISH TO END IN APRIL: Controls on fish will end on April 15, 1950, the British Government announced late in December, according to the December 31, 1949, Fish Trades Gazette, a British fishery periodical.

When fish prices are decontrolled on April 15, the fish transport scheme (the flat-rate plan of transporting fish by rail) will also end.

This action will mean the abolition of the present subsidy. No subsidy will be paid on fish landed after decontrol, and the system of allocations and the licensing of wholesalers, processors and salesmen by the Ministry of Food, Fish Division, will cease.

The Ministry will not pay any carriage charges on fish dispatched after the decontrol date. However, consideration is being given to the possibility of a transport scheme for herring.

No further financial assistance to quick-freezers of fish is planned by the Ministry after the scheme for the present year is terminated.

FISH CONSUMPTION: Consumption of fish in the United Kingdom in 1948-49 was 25 percent above the prewar level, but has fallen since 1948, states the White Paper on "Food Consumption Levels in the United Kingdom," according to the December 17, 1949, Fish Trades Gazette.

United Kingdom's Annual Per Capita Consumption of Fishery Products, Edible Weight, 1940-49 Compared with Prewar Average

Type of Product	(Preliminary) 1948-49	1948	1947	1946	1945	1944	1943	1942	1941	1940	Prewar
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Fish (fresh, frozen & cured)	27.3	29.0	27.9	26.5	20.2	16.0	14.2	13.1	11.3	11.1	21.8
Shellfish	1.0	1.0	0.9	0.9	1.0	1.0	1.0	0.8	0.8	0.8	1.3
Fish, canned	1.6	2.0	3.0	3.6	3.4	3.3	3.1	2.8	3.4	5.2	3.6
Total	29.9	32.0	31.8	31.0	24.6	20.3	18.3	16.7	15.5	17.1	26.7

The total annual per capita consumption (edible weight) of fishery products in 1948-49 was 29.9 pounds compared with 69.8 pounds for meat, 22.0 pounds for eggs and egg products, 50.6 pounds for dairy products (excluding butter), and 7.4 pounds for poultry, game and rabbits.

SEA FISH INDUSTRY BILL NOT PASSED: The House of Commons early in December was told by the Lord President of the Council that the Government was unable to complete the Sea Fish Industry Bill this session of Parliament.

This bill provided for financial assistance to the sea-fishing industry, licensing of fishing boats and of persons engaged in processing or wholesaling, and regulations for safeguarding the quality of sea fish. (See Commercial Fisheries Review, July 1949, p. 49.)

Venezuela

CANNED FISH PACK, 1949: Based on eight months of 1949 when 11,284,000 pounds were canned, the indicated annual pack for 1949 is estimated to be about 16,927,000 pounds, according to a December 12 dispatch from the American Embassy, Caracas.

Venezuelan Production of Canned Fish, 1945-48

Year	Pounds
1948	20,444,000
1947	16,484,803
1946	17,171,675
1945	13,274,117

Thus, the pack of canned fish for 1949 will be lower than that of 1946.

Observers contend that the market for canned fish in Venezuela is restricted because of high prices and not because of lack of demand. However, with reference to the fish canning industry, the newspaper El Nacional states:

"Two fundamental causes affect this branch of our national economy: the high costs of production in comparison with those of other fishing countries and the restricted national market. The first is manifested by the prices at which imported fish are offered which enjoy, moreover, special customs treatment. The second may be remedied by exportation."

THE SPONGE FISHING INDUSTRY IN LIBYA (AFRICA)

The sponge beds of Libya extend almost the entire distance from the Tunisian border to the Egyptian border. However, the most important beds are located near Zuara and Homs in Tripolitania, and near Benghasi and Derna in Cyrenaica. The beds vary in distance from the coast from two or three miles to more than fifty miles.

The most popular and productive method of harvesting sponges in Libya is through the use of machine diving boats employing fully outfitted divers. The best growths usually found in water from 75 feet to 100 feet deep, are taken by this method. The second most generally used method in Tripolitania is dredging with a weighted net behind a slow-moving ship, but the sea bottom is too rough in Cyrenaica to permit this type of fishing. Fernezen (helmet only) diving is practiced in relatively shallow water beds in both territories with fair results. Harpooning is at present used somewhat more in Cyrenaica than in Tripolitania. Nude diving is the least productive method, although used fairly extensively in Cyrenaica.

--Fishery Leaflet 341

FEDERAL ACTIONS

Department of the Treasury

BUREAU OF CUSTOMS

TARIFF-RATE QUOTA OF GROUNDFISH (INCLUDING ROSEFISH) FILLETS FOR 1950: The following establishing a 1950 tariff-rate quota for groundfish (including rosefish) fillets appeared in the Federal Register of January 27, 1950:

IMPORTATION OF FISH FOR CONSUMPTION DURING 1950

Tariff-Rate Quota

January 24, 1950.

In accordance with the proviso to Item 717 (b) of Part I, Schedule XX of the General Agreement on Tariffs and Trade (T. D. 51802), it has been ascertained that the average aggregate apparent annual consumption in the United States of fish, fresh or frozen (whether or not packed in ice), filleted, skinned, boned, sliced, or divided into portions, not specially provided for: Cod, haddock, hake, pollock, cusk, and rosefish, in the 3 years preceding 1950, calculated in the manner provided for in the cited agreement, was 174,904,918 pounds. The quantity of such fish that may be imported for consumption during the calendar year 1950 at the reduced rate of duty established pursuant to that agreement is, therefore, 26,235,738 pounds.

Frank Dow,
Commissioner of Customs.

Eighty-first Congress (Second Session)

JANUARY 1950

The Second Session of the Eighty-First Congress commenced on January 3, 1950. All proposed legislation of the First Session not passed by the day of Final Adjournment (October 19, 1949) can be acted upon by the Second Session.

Listed below are all the public bills, resolutions, etc., introduced and referred to committees, or passed by the Eighty-First Congress (Second Session) and signed by the President during January 1950, which affect in any way the fisheries and fishing and allied industries. Public bills, resolutions, etc., are mentioned under this section only when introduced and, if passed, when they are signed by the President.

PUBLIC BILLS AND RESOLUTIONS INTRODUCED AND REFERRED TO COMMITTEES:

House of Representatives:

H. R. 6533 (Dingell) - A bill to provide that the United States shall aid the States in fish restoration and management projects, and for other purposes; to the Committee on Merchant Marine and Fisheries.

H. R. 6536 (Bartlett) - To provide transportation on Canadian vessels between Skagway, Alaska, and other points in Alaska, between Haines, Alaska, and other points in Alaska or the continental United States, either directly or via a foreign port, or for any part of the transportation; to the Committee on Merchant Marine and Fisheries.

H. R. 6677 (Tollefson) - A bill to encourage the prevention of water pollution by allowing amounts paid for industrial waste treatment works to be amortized at an accelerated rate for income-tax purposes; to the Committee on Ways and Means.

H. R. 6687 (Tauriello) - A bill to liberalize the loan provisions in the Water Pollution Control Act; to the Committee on Public Works.

H. R. 6725 (Forand) - A bill to give effect to the International Convention for the Northwest Atlantic Fisheries, signed at Washington under date of February 8, 1949, and for other purposes; to the Committee on Foreign Affairs.

H. R. 6780 (Mack) - A bill to provide for the determination of peril points with respect to foreign trade agreements; to the Committee on Ways and Means.

H. R. 6973 (Bland) - A bill authorizing and directing the United States Fish and Wildlife Service of the Department of the Interior to undertake a continuing study of the shortage of croakers and other fish in the Chesapeake Bay and tributaries with respect to the biology, propagation, and abundance of such species to the end that such service may recommend appropriate measures for arresting the decline of valuable food fish and for increasing the abundance and promoting the wisest utilization thereof; to the Committee on Merchant Marine and Fisheries.

H. R. 6974 (Bland) - A bill appropriating to the United States Fish and Wildlife Service the sum of $55,000 for a continuing study of the shortage of croakers and other fish in the Chesapeake Bay and tributaries with respect to the biology, propagation, and abundance of such species to the end that such Service may recommend appropriate measures for arresting the decline of valuable food fish and for increasing the abundance and promoting the wisest utilization thereof; to the Committee on Appropriations.

Senate:

S. 2801 (Green) - Same as H. R. 6725; to the Committee on Interstate and Foreign Commerce.

S. 2823 (Lehman) - A bill to liberalize the loan provisions in the Water Pollution Control Act; to the Committee on Public Works.

S. 2833 (Cain) - A bill to effectuate the recommendations of the Commission on Organization of the Executive Branch of the Government with respect to the organization of the Department of the Interior.

(Sec. 6, (4) reads as follows: "So much of the functions of the Fish and Wildlife Service as relate to the commercial fisheries, and the functions of the Division of the Fish and Wildlife Service and the Secretary of the Interior in relation thereto, are transferred to the Secretary of Commerce.")

EDIBLE FISH IN THE PERSIAN GULF

The sea fish that enter the Shatt-al-Arab and the southern swamps do so to feed on the rich grazings that are found in these waters, and, subsequently, to spawn there. These fish are caught by nets, hook and line, spear, and by fish traps (milans). Fish traps are also used on the Iraqi and Iranian coasts to a great extent. Milans are fence-like erections made of date palm branches stripped of their leaves and interwoven with string. At low-tide level, these branches are imbedded on the shore. When the tide rises, the milans are inundated by water and trap the unwary fish at ebb tide. Then the fishermen simply collect their catch. Large quantities are caught in this manner, but rough weather easily destroys these frail traps and the fishermen then resort to the use of nets.

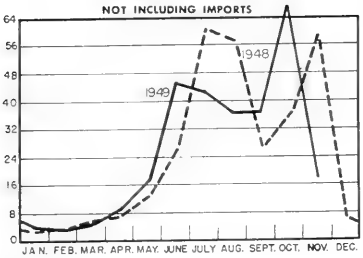
There are fifty registered Iraqi sailing craft engaged in fishing in the Persian Gulf and approximately 200 Iranian craft. These vessels fish with small floating nets, and are almost all privately owned. The number of fishermen in each craft are from three to four men, often relatives. When the craft and net are owned by one fisherman who employs others not his relatives, he normally furnishes the food and gives his fellow fishermen a share of the profits from the sale of the fish. The small sailing craft used by these fishermen are open, one-masted vessels, without a deck.

--Fishery Leaflet 304

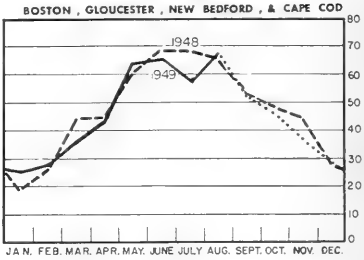
LANDINGS AND RECEIPTS

In Millions of Pounds

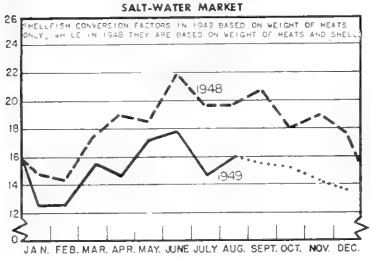
MAINE - LANDINGS
NOT INCLUDING IMPORTS



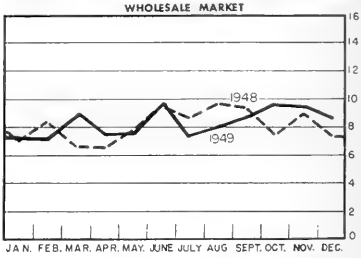
MASSACHUSETTS - LANDINGS
BOSTON, GLOUCESTER, NEW BEDFORD, & CAPE COD



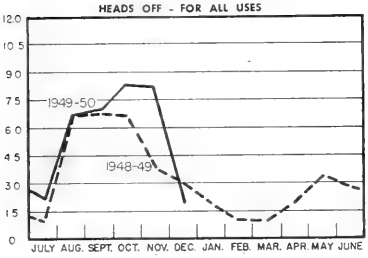
NEW YORK CITY-RECEIPTS OF FRESH & FROZEN FISH
SALT-WATER MARKET



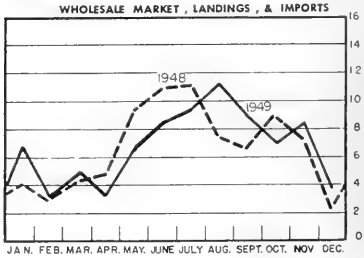
CHICAGO - RECEIPTS OF FRESH & FROZEN FISH
WHOLESALE MARKET



GULF - SHRIMP LANDINGS
HEADS OFF - FOR ALL USES

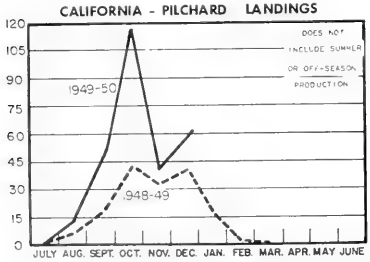


SEATTLE - RECEIPTS OF FRESH & FROZEN FISH
WHOLESALE MARKET, LANDINGS, & IMPORTS

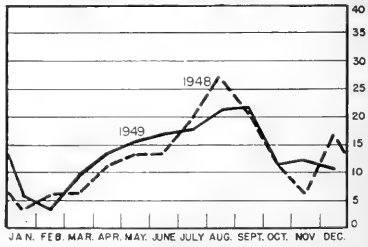


In Thousands of Tons

CALIFORNIA - PILCHARD LANDINGS



CALIFORNIA - TUNA AND TUNA-LIKE FISH

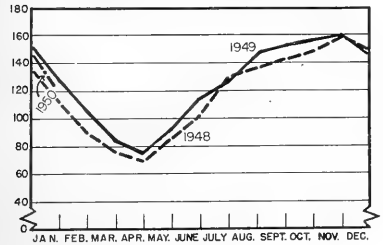


..... ESTIMATED

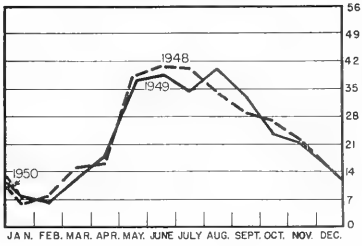
COLD STORAGE HOLDINGS and FREEZINGS of FISHERY PRODUCTS

In Millions of Pounds

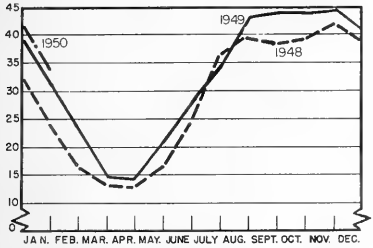
U.S. & ALASKA - HOLDINGS OF FROZEN FISH



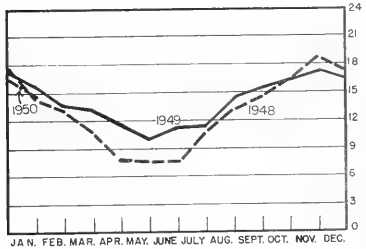
U.S. & ALASKA - FREEZINGS



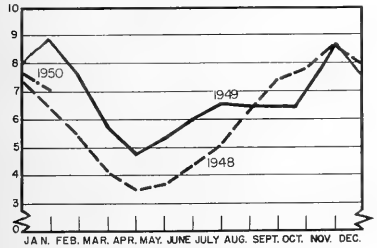
NEW ENGLAND - HOLDINGS OF FROZEN FISH



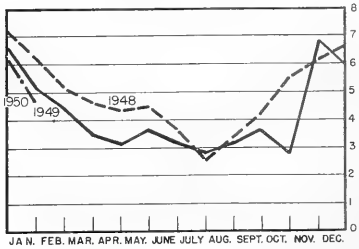
NEW YORK CITY - HOLDINGS OF FROZEN FISH



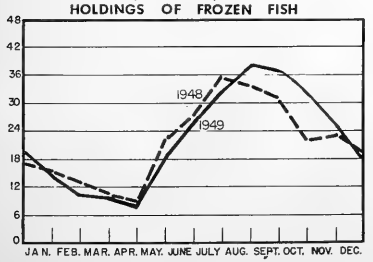
CHICAGO - HOLDINGS OF FROZEN FISH



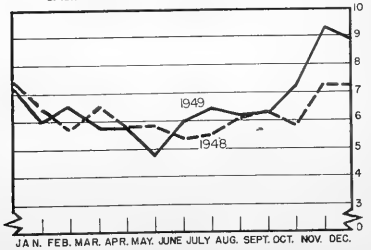
GULF - HOLDINGS OF FROZEN FISH



WASHINGTON, OREGON, AND ALASKA - HOLDINGS OF FROZEN FISH



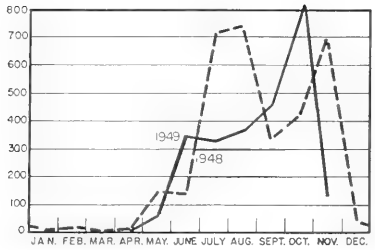
CALIFORNIA - HOLDINGS OF FROZEN FISH



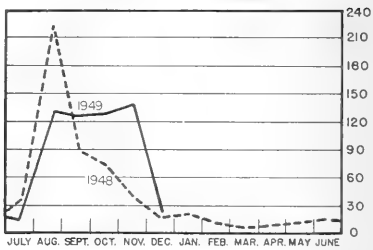
CANNED FISHERY PRODUCTS

In Thousands of Standard Cases

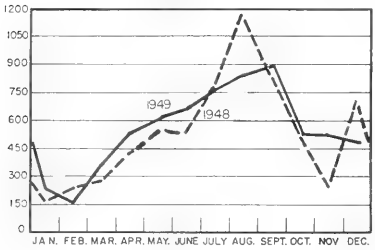
MAINE - SARDINES, ESTIMATED PACK



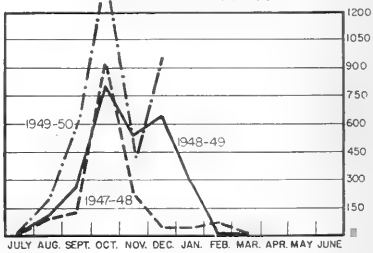
UNITED STATES - SHRIMP



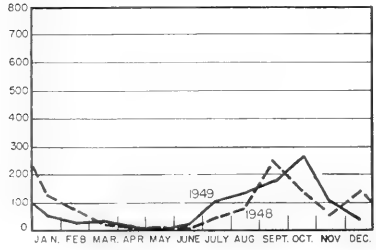
CALIFORNIA - TUNA



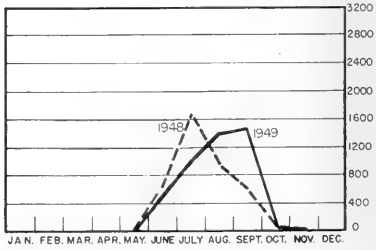
CALIFORNIA - PILCHARDS



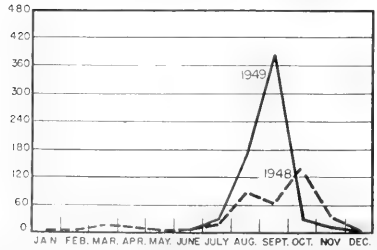
CALIFORNIA - MACKEREL



ALASKA - SALMON



WASHINGTON - PUGET SOUND SALMON

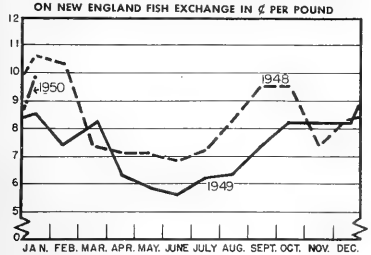


STANDARD CASES

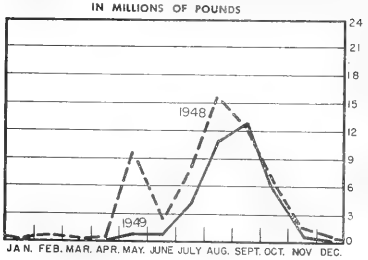
Variety	No. Cans	Can Designation	Net. Wgt.
SARDINES	100	1/4 drawn	3 1/4 oz.
SHRIMP	48	—	5 oz.
TUNA	48	No. 1/2 tuna	7 oz.
PILCHARDS	48	No. 1 oval	15 oz.
MACKEREL	48	No. 300	15 oz.
SALMON	48	1-pound tall	16 oz.

PRICES . IMPORTS and BY-PRODUCTS

BOSTON - WEIGHTED AVERAGE PRICE
ON NEW ENGLAND FISH EXCHANGE IN ¢ PER POUND

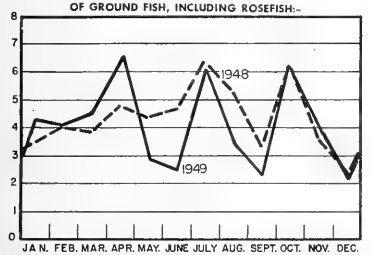


MAINE - IMPORTS OF FRESH SEA HERRING
IN MILLIONS OF POUNDS

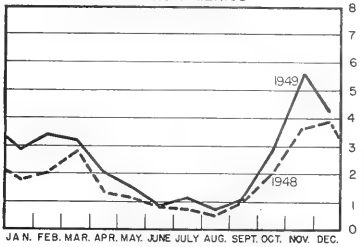


In Millions of Pounds

U.S. - IMPORTS OF FRESH & FROZEN FILLETS
OF GROUND FISH, INCLUDING ROSEFISH:-

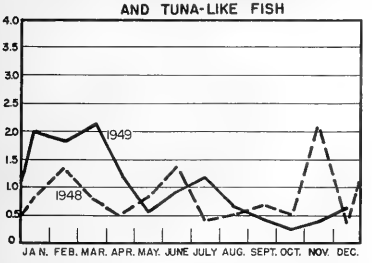


U.S. - IMPORTS OF FRESH AND FROZEN
SHRIMP FROM MEXICO

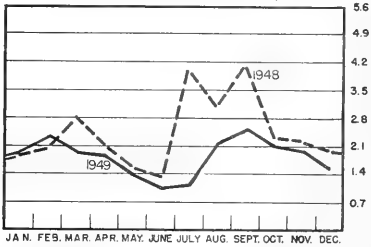


IN MILLIONS OF POUNDS

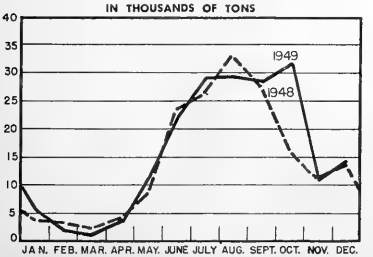
U.S. - IMPORTS OF CANNED TUNA
AND TUNA-LIKE FISH



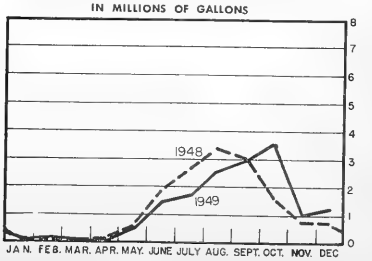
U.S. - IMPORTS OF CANNED SARDINES
(Include in oil and not in oil)

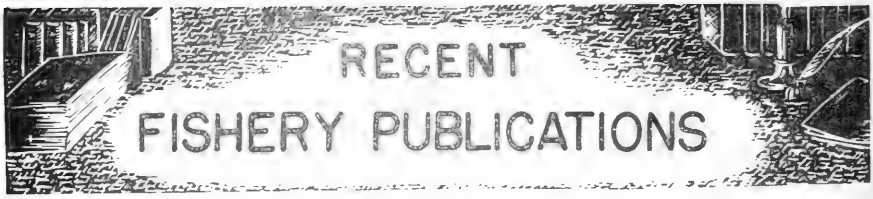


U.S. & ALASKA - PRODUCTION OF FISH MEAL
IN THOUSANDS OF TONS



U.S. & ALASKA - PRODUCTION OF FISH OIL
IN MILLIONS OF GALLONS





Recent publications of interest to the commercial fishing industry are listed below.

FISH AND WILDLIFE SERVICE PUBLICATIONS

THESE PUBLICATIONS ARE AVAILABLE FREE FROM THE DIVISION OF INFORMATION, FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR, WASHINGTON 25, D. C. TYPES OF PUBLICATIONS ARE DESIGNATED AS FOLLOWS:

CFS - CURRENT FISHERY STATISTICS OF THE UNITED STATES AND ALASKA.
FL - FISHERY LEAFLETS.
SEP.- SEPARATES (REPRINTS) FROM COMMERCIAL FISHERIES REVIEW.
SL - STATISTICAL SECTION LISTS OF DEALERS IN AND PRODUCERS OF FISHERY PRODUCTS AND BYPRODUCTS.

Number	Title
CFS-511	- Frozen Fish Report, December 1949, 10 p.
CFS-514	- Massachusetts Landings, August 1949, 14 p.
CFS-515	- Fish Meal and Oil, November 1949, 2 p.
CFS-519	- Maine Landings, November 1949, 4 p.
SL-18 (Revised)	- Wholesale Dealers in Fishery Products, Mississippi, 1949, 2 p.
FL-353	- "Little Tuna" of the Atlantic and Gulf Coasts, 5 p.
FL-356	- Fisheries of New Brunswick (Canada), 26 p.
FL-359	- Partial List of Canning, Refrigeration and Reduction Equipment Manufacturers, 3 p.
Sep. 244	- Preliminary Fisheries Survey of the Hawaiian-Line Islands Area--Part I - The Hawaiian Long-Line Fishery

MISCELLANEOUS PUBLICATIONS

THESE PUBLICATIONS ARE NOT AVAILABLE FROM THE FISH AND WILDLIFE SERVICE, BUT USUALLY MAY BE OBTAINED FROM THE AGENCIES ISSUING THEM.

The Commercial Fish Catch of California for the Year 1947 with an Historical Review 1916-1947, Fish Bulletin No. 74, 271 p., illus., printed. Bureau of Marine Fisheries, Division of Fish and Game, San Francisco, Calif., 1949. Presents the detailed records of the commercial fish and shellfish catch of California. Data is presented by species, including the tunas and tuna-like fish, sardine, mackerel, salmon, shad, striped bass, bottom fish, and a considerable number of other minor species of fish and shellfish. Included are sections dealing with the commercial fishing fleet, the fishermen, a list of common and scientific names of fishes, crustaceans and mollusks, and tables giving comparative data back to 1916.

Commercial Fishermen's Guide, 48 p., illus. Adams Net & Twine Co., St. Louis 2, Mo. This guide gives a panorama of the uses of commercial fish netting. Contains a description and diagram of nearly every type of important commercial fish net--gill, seine, trammel, and trawl. In addition it contains an illustrated section on knots for men who use nets and how to mend nets. Since net construction details and sizes change with the individual fishermen's needs, net diagrams included are general.

Eighth Annual Report of the Atlantic States Marine Fisheries Commission (To the Congress of the United States and to the Governors and Legislators of the Fifteen Compacting States), 48 p., printed. Atlantic States Marine Fisheries Commission, 11 West Prospect Ave., Mt. Vernon, N. Y., December 1949. After reviewing the highlights of the Commission's work for 1949, the report is divided into geographical sections which contain short discussions of the various programs undertaken. Under the North Atlantic Section, it reports on lobsters, striped bass, haddock, clams, Atlantic salmon, the Massachusetts shellfish survey, the Maine herring fishery, sea scallops, yellowtail, dams on the Connecticut River, and the smelt fishery. Under the Middle Atlantic Section, resumes are included on striped bass, blue crab, fluke, Hudson River and Delaware River shad, the Delaware Bay situation between New Jersey and Delaware, and disposal of acid waste at sea. Under the Chesapeake Bay Section are discussed shad, blue-crab research, hydrographic study, Chesapeake Bay authority, and fluctuations in abundance of croakers. Under the South Atlantic Section are reported the shrimp program, research for sport fishing, and new laboratory developments. Also included is a schedule of legislation needed in each State to accomplish objectives agreed upon by the Commission.

Guide for the Prospective Exporter, 57 p., printed, free. Office of Small Business, Economic Cooperation Administration, Washington, D. C., December 1949. This is a handbook on the principles of exporting designed especially for the small businessman interested in endeavoring to trade under the Marshall Plan. Guide lines for export marketing are given. An appendix contains the revised American and foreign trade definitions--1941; field offices of the Department of Commerce; and Form ECA-280, Supplier's Certificate and Invoice-and-Contract Abstract.

Importers of ECA Financed Commodities (Directory), Volume I--Food, feed and fertilizer; fuel; miscellaneous and unclassified products, 44 p., printed, free. Economic Cooperation Administration, Washington 25, D. C., January 1950. The directory, issued in three volumes, contains names and addresses of importers and the products (including fish) in which they apparently trade. Of the three volumes, Volume I may be of interest to the fishing and allied industries since it contains those importers of fish and fishery products whose transactions were completed under ECA financing during May, June and July 1949, and who may be considered representative of the importers having participated in this trade since the inception of the European Recovery Program. Volume II (Raw materials) and Volume III (Machinery and vehicles) of this Directory are not of immediate interest to the fishing and allied industries.

Regulations on How to Keep Wage and Hour Records Under the Fair Labor Standards Act of 1938 (Title 29, Chapter 5, Code of Federal Regulations Part 516, Effective September 15, 1941, Amended April 1, 1944), 31 p., printed, free. Wage and Hour Division, U. S. Department of Labor, Washington, D. C. Certain sections in this pamphlet show employers how to keep records on employees entitled to the minimum wage and to overtime after 40 hours a week. Most of the other sections deal with the keeping of records under exemptions from the Act, record-keeping regulations on exemption of executives and others, and length of time records shall be preserved.

Sixth Annual Report 1949, Maryland Board of Natural Resources, Annapolis, Md., 194 p., illus., tables. Covering the fiscal year July 1, 1948, through June 30, 1949, this report is divided into four parts. Part I consists of a short introduction. Part II contains the annual reports of the five constituent Departments of the Board, including the Department of Tidewater Fisheries and Department of Research and Education. The Tidewater Fisheries report discusses oysters, private oyster culture, fishery management, fishing gear, fishery problems, the fishery management law, and crab management. Included are tables giving 1948 data on oyster shells planted on open public bars and seed areas; seed oysters transplanted; blue crab catch; shellfish licenses; Chesapeake Bay and Atlantic Ocean landings (catch by species by gear); total Maryland landings (catch by species); and fish-net licenses issued. The Research and Education report gives information on various investigations, including oysters, fish, crab, diatoms, and hydrography. Part III contains a summary of the legislation of the 1949 General Assembly of Maryland concerning amendments to the Compact of 1785; codification of conservation laws; oysters; commercial fish and fish nets; crabs; fresh-water fish; and water pollution. Also, this part gives the proposals for the reorganization of conservation agencies, and major research projects (including some on fisheries). Part IV contains Appendix A, "The Tidelands Dispute;" Appendix B, "The Maryland-Virginia Compact of 1785."

Sixth Report to Congress of the Economic Cooperation Administration (For the Quarter Ended September 30, 1949), 150 p., printed. Economic Cooperation Administration, Washington, D. C., January 1950. Activities under the Economic Cooperation Act of 1948 as well as the programs of economic aid to China and to the Republic of Korea are covered in this publication. Included in the appendix is a summary of the status of the United States Foreign Relief Program and the United States Foreign Aid Program. Edible fishery products are specifically listed only as a group in some of the tables, and in other cases are included in the broader category of "meats and fish."

The State of Food and Agriculture (A Survey of World Conditions and Prospects) 1949, 138 p., printed. Food and Agriculture Organization of the United Nations, Washington, D. C., October 1949. This second report on the state of the world's food and agriculture is an attempt to appraise the current sit-

uation against the background of longer-term trends and to focus attention on a very few broad issues which will require consideration and action by governments. Fisheries products are discussed in one section which contains information on trends in quantity produced, changes in output of end products, international trade, trends in prices and marketing conditions, and whaling. The balance of the publication concerns agricultural and forest products and reports generally on indicators of the world situation, prices and purchasing power, consumption and nutritional levels, and prospects for 1950/51.

CONTENTS, CONTINUED

Processing -- Miscellaneous Service Division

Illustrator -- Gustaf T. Sundstrom **Compositors -- Jean Zalevsky, Betty Cady**

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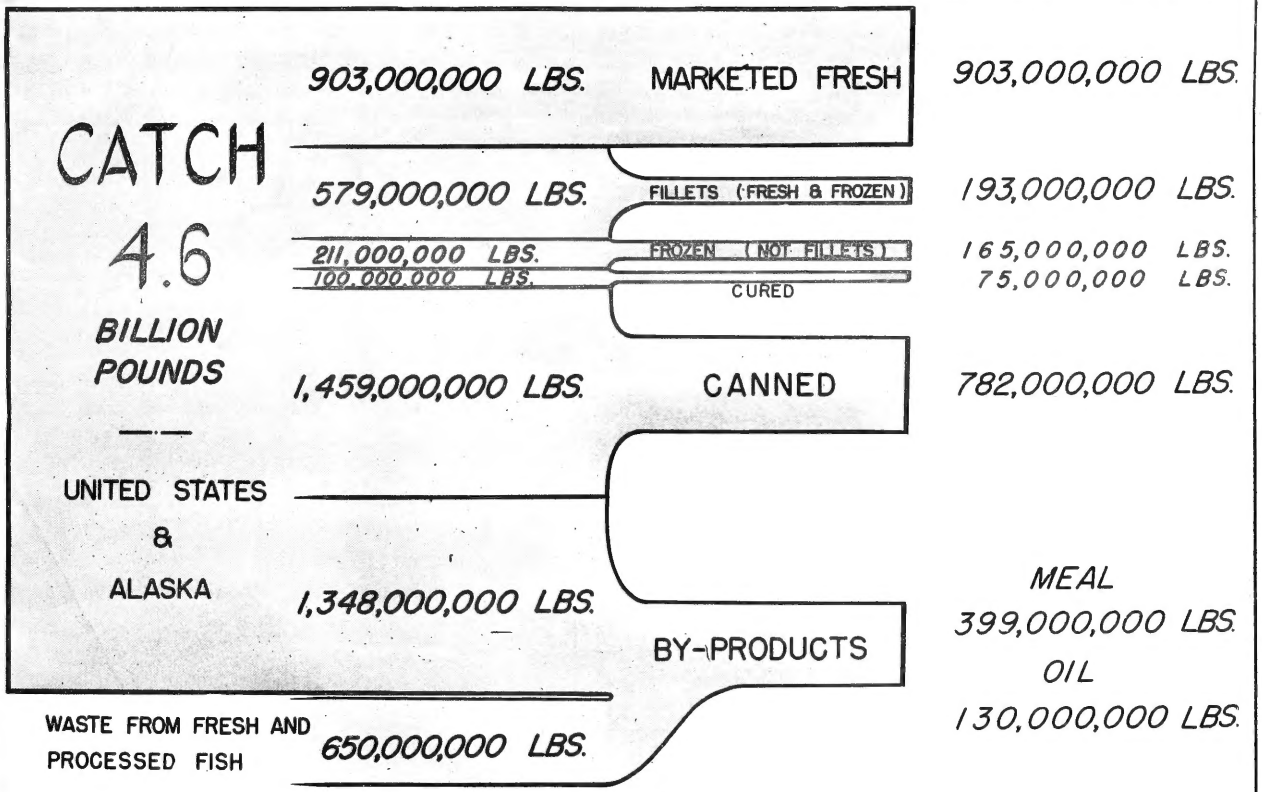
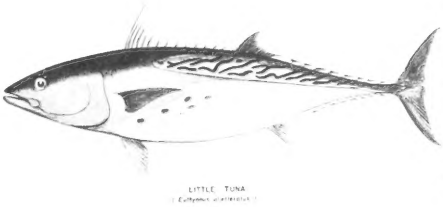
FLOW CHART OF THE COMMERCIAL FISHERIES ····· 1948



BRANCH OF COMMERCIAL FISHERIES, FISH AND WILDLIFE SERVICE

"LITTLE TUNA" OF THE ATLANTIC AND GULF COASTS

Fishery Leaflet 353, "Little Tuna" of the Atlantic and Gulf Coasts, discusses the recent developments for the commercial canning of "little tuna" (Euthynnus alletteratus) on the Atlantic and Gulf Coasts, and its potentialities.



A description of the fish and references as to where it has been found and caught and types of gear used in catching this fish are also mentioned.

Recent developments offer some encouragement for the commercial canning of "little tuna," according to the author of this leaflet. A Maryland packer canned a small quantity of this fish in 1946, 1947, and 1948. The Fish and Wildlife Service also canned a small experimental pack at College Park, Md., with encouraging results. Further research on the canning of this species is now in progress.

Copies of this fishery leaflet are available free upon request from the Division of Information, U. S. Fish and Wildlife Service, Washington 25, D. C.