Woods Hole Laboratory
Manuscript Report Number
52-7

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Summary of Report on the Conservation of the Yellowtail Flounder

With the decline in the blackback fishery and the increase in the demand for food early in World War II, the catch of yellowtail flounder rose from about 23,000,000 pounds in 1938 to about 70,000,000 pounds in 1942, at which time the fishery supported a fleet of 150 small otter trawlers operating from southern New England ports with the center of production at New Bedford. This growth was followed by a marked decline to less than half of the peak production in 1944 and a continuing low production averaging a little over 30,000,000 pounds per year.

Tagging experiments involving the release of 2,597 yellowtail at 14 locations, from which 368 fish were returned, and studies of the composition of the catch identified five separate stocks of yellowtail flounder which are fished by New England fishermen. These may be named and described as follows:

1. The southern New England stock is found between Nantucket shoals and Long Island in depths of water between 15 and 35 fathoms. It appears to be limited on the west by unsuitable temperature conditions and on the east by the less favorable shoal waters of Nantucket shoals and the deep waters of the south channel.

2. The Georges Bank stock inhabits all of Georges Bank in the depth range of 10 to 60 fathoms, occurring sporadically as deep as 118 fathoms, and tends to be restricted to the Bank by the less favorable deep waters around it.

3. The Cape Cod stock occurs at depths of less than 30 fathoms east and north of Cape Cod and in Cape Cod Bay, and extends northward to the vicinity of Cape Ann and Ipswich Bay.

4. The Northern Gulf of Maine stock includes a very few yellowtail which are taken in the scattered shoal areas along the coast of Maine.

5. The Nova Scotian stock may be one or more populations, but it is quite separate from the other New England stocks.

The Southern New England stock was the principal producer, accounting for almost 63,000,000 pounds of the record 1942 catch. However, this area suffered worst in the decline, with the catch dropping to only 10,000,000 pounds in 1949. The Georges Bank catch, small in the earlier years, increased greatly so that from 1944 to 1949 the total landings were maintained in the general vicinity of 30,000,000 pounds.

Price changes or a decline in demand were not responsible for the decline in catch. The average price rose from 2.0 cents per pound in 1938 to 4.5 in 1942, to 7.0 in 1943, declined slightly with price controls in 1945, and then jumped again to 9.2 cents in 1948, the last year in which we have an overall average for New England.

The Southern New England stock -- the stock which has suffered the greatest decline in production and the stock of the greatest importance to the small boat fishermen in Southern New England -- is the stock which we studied intensively from 1942 to 1947. Our pertinent findings are as follows:

From 1942 to 1947 practically all of the yellowtail in the catch were between 10 and 20 inches long. There was no general decline in the average size of fish in the catch, as is so frequently found with stocks of fish which are being very heavily fished.

Age analysis by means of the scales indicated that the fishery depended upon yellowtail from 2 to 7 years of age, with those 2 to 5 years old predominating in the catch. There is some evidence that certain year classes are markedly more abundant than others. This was true of the classes of

1938, 1939, and 1941.

The changes in the catch per day's fishing approximately paralleled the changes in the total catch.

Observations on the sexual condition of fish in the catch indicated that all of the males in the catch and virtually all of the females were mature. The fishery did not catch important quantities of immature fish.

The spawning season was found to extend from April to the end of June. Usually this was the season of poorest fishing.

Yellowtail eggs and larvae drift for a time with the currents and may be extremely vulnerable to unusual weather conditions. In 1943 a search with a small trawl of fine mesh in the waters between Nantucket and Long Island inshore of the 20-fathom line failed to produce any small yellowtail flounders. This should be the nursery ground, if evidence of the spawning area from the commercial catch and the prevailing currents is indicative. Therefore we believe that spawning was not very successful in 1943.

Detailed data on the fishing localities for haddock, yellowtail flounder, and "trash" fish indicate marked changes in the fauna of certain areas. For example, the area southeast of No-Man's Land produced large quantities of haddock in the early 30's. In 1942 it was a major center of yellowtail production. In 1950 no yellowtail were to be found there, but large quantities of "trash" fish were being taken.

Our tentative conclusions are as follows: The great decline in the catch from the Southern New England stock of yellowtail was not caused by catching too much yellowtail, too small yellowtail, or spawning yellowtail. Most probably there was a succession of good year classes which made fish easily available in 1941 and 1942, resulting in the very large catches of

those years. This was followed by poor year classes and a failure of the yellowtail to appear on the grounds where they had been so easily taken.

We know of no restrictive legislation which would benefit the fishery with the exception of the recommendation which we have already made to the effect that small yellowtail flounder be excluded as much as possible from the catches of "trash" fish.

William F. Royce
Fishery Research Biologist

August 6, 1952

Trout Fish & Yellowtail

Whiting? a trash fish?

Check Heydecker.

DEVELOPMENT OF TRASH FISHERY AT NEW BEDFORD, MASSACHUSETTS

by George W. Snow*

The port of New Bedford, Massachusetts, led all other New England ports in the production of trash fish in 1949, with landings of 44,115,000 pounds, valued at $379,624 to the fishermen. Total landings of trash fish in the New England area during that year exceeded 74.2 million pounds (Table 1).

Table 1 - Landings of Trash Fish in the New England Area by Ports, 1949

Locality	Thousands of Pounds	Percentage of Total
New Bedford, Mass...	44,115	59%
Gloucester, Mass....	14,567	20
Pt. Judith, R. I....	9,989	13
Stonington, Conn....	4,290	6
Provincetown, Mass..	1,283	2
Total.....	74,244	100%

The 1948 landings of trash fish at New Bedford were only 4,064,000 pounds and fur-farm operators purchased the entire amount in the round from a local dealer. In 1949, however, operators of reduction plants bought the entire catch for the preparation of meal.

Fish-meal producers in this city formerly relied on the byproducts of the fish filleting plants for their supply of raw material. Recently, a much stronger demand for fish meal was created by the greater utilization of the products in animal feeds. It is believed that a new feed formula for chicken diets developed by the University of Connecticut contributed a great deal to the increased use of fish meal. This new formula increased the fish-meal content of the diet by five percent and made it possible for the poultry producers to raise four sets of brooders per year, whereas only three sets had been raised using former formulas.[1] This increased the demand for fish meal during the past two years and stimulated the fish-meal producers to look for additional sources of raw material.

For some time, fish-meal operators had tried to get the smaller boats to fish for trash, but it was not until 1949 that they succeeded. Once started, several million pounds were landed per month during the remainder of the year (Table 2). These boats were induced to participate in this fishery at that time principally because of the relative scarcity of yellowtail flounder in the areas normally fished. During this period of scarcity, these boats could not fish on Georges Bank or Nantucket Shoals because most captains were not well acquainted with these areas, and also because their gear was primarily

Table 2 - The Landings of Trash Fish at New Bedford, Massachusetts, 1949

Month	Thousands of Pounds
January to March.....	0
April.....	3,536
May.....	7,363
June.....	7,936
July.....	6,905
August.....	4,945
September.....	2,737
October.....	5,491
November.....	3,336
December.....	1,866
Total.....	44,115

* Fishery Aide, Branch of Fishery Biology, U. S. Fish and Wildlife Service, New Bedford, Mass.

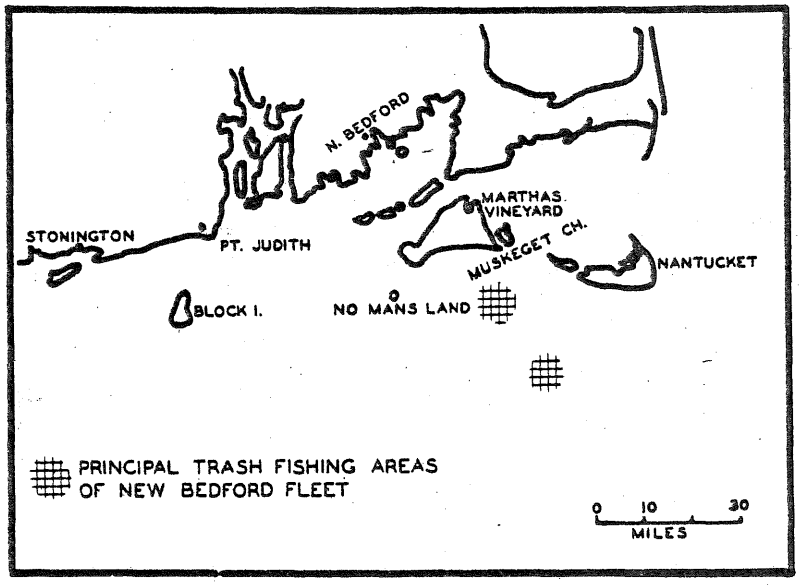
1/Boorsen, Fletcher V. The Wall Street Journal, August 27, 1949.

designed for the flounder fishery on the comparatively smooth bottom in the area between Block Island and Nantucket Lightship. The small boat owners and fishermen realized that, with large quantities of trash fish available and with an assured price for its sale, it would be possible to make a satisfactory profit during the shortage of yellowtail flounder, their usual mainstay.

The type of fishery which was established was called the "junk" or "trash fishery" because most of the fish that were caught had no marketable value for human consumption and, when caught incidental to normal trawling operations, were dumped back into the sea.

At the peak of the fishery during the summer months in 1949, and again in October 1949, 24 boats landed trash fish at New Bedford. These boats were small draggers with an average length of 51 feet and an average of 26 gross tons. Crew size varied from two to four men per boat. The same gear was used as in normal otter-trawling operations except that a liner of $1\frac{1}{2}$ or 2-inch mesh was inserted in the cod end. Boat owners and fishermen claimed that this liner was necessary to strengthen the cod end due to the heavy weight of a haul of trash fish.

The New Bedford fleet concentrated its fishing in two areas. One area was in the vicinity of Muskeget Buoy, which marks the channel between Martha's Vineyard and Nantucket Islands; the other was 20 to 30 miles south south-east of No Mans Land. Fishing was carried on in the Muskeget area usually in 12 to 15 fathoms. In the area farther offshore, fishing was carried on in 20 to 25 fathoms.



During the first few months of the fishery and again in October, the average time required to get a full load was estimated at 8 hours. As the season progressed, however, fishing time increased to 12 and often to as long as 18 hours. The average catch for most of the boats was 30,000 to 35,000 pounds or more. When red hake, which comprised the majority of the catch, migrated offshore with the onset of cold weather, most of the boats reverted to their original fishery, as yellowtail flounder were again appearing on the fishing grounds. But, once more engaged in their basic fishery, the captains of the boats no longer had the trash fish dumped back into the sea. They augmented their catches, while fishing for yellowtail flounder, with the once-despised trash fish.

EFFECT OF ASCORBIC ACID ON KEEPING QUALITY OF FROZEN OYSTERS

By S. R. Pottinger*

ABSTRACT

SHUCKED OYSTERS WERE TREATED WITH ASCORBIC ACID IN AN ATTEMPT TO PREVENT OR RETARD DARKENING AND OTHER UNDESIRABLE CHANGES DURING FROZEN STORAGE. ON THE BASIS OF ORGANOLEPTIC TESTS, CHANGES IN THE FROZEN OYSTERS TREATED WITH ASCORBIC ACID WERE NOT APPRECIABLY RETARDED IN COMPARISON WITH UNTREATED FROZEN OYSTERS USED AS CONTROLS.

INTRODUCTION

Packers and distributors have from time to time encountered difficulties due to color changes in frozen oysters. These changes are variously described as "darkening," "discoloration," or "browning," and occur during frozen storage. This darkening was also noticed in past studies of frozen oysters by the U. S. Fish and Wildlife Service.

The cause of these changes in color in oysters is not definitely known. It is known, however, that enzymatic action will cause undesirable changes in the odor and flavor of frozen fish and under certain conditions, will also cause color changes on the surface of the fish. Possibly a similar reaction occurs in frozen oysters.

Earlier work (Bauernfeind, et al, 1948; Tarr, 1946 and 1948) indicated that ascorbic acid is a practical antioxidant in retarding discoloration and undesirable flavor changes during freezing and frozen storage of certain types of fish. In similar work with oysters, conflicting results have been reported as to whether ascorbic acid is effective in maintaining quality and retarding the darkening of oysters during frozen storage.

In order to investigate further the effectiveness of this antioxidant in this respect, a series of tests with frozen oysters were made at the Service's College Park, Maryland, laboratory. Prior to beginning the tests, discussions were held with representatives of manufacturers of ascorbic acid in order to benefit from their experience with previous work along these lines. The concentrations of ascorbic acid used in these tests and the method of incorporating it with the oysters are based on the information obtained through these discussions.

PREPARATION OF SAMPLES

Freshly prepared, commercially shucked oysters were obtained from an oyster-packing house in the Chesapeake Bay area and brought, well packed in crushed ice, to the College Park laboratory. They were divided into eight groups for preparation prior to final freezing and storage.

The samples were prepared as follows:

GROUP A: THE FRESH SHUCKED OYSTERS WERE DIPPED IN ONE-PERCENT ASCORBIC ACID SOLUTION (ONE POUND OF OYSTERS IN ONE QUART OF SOLUTION) FOR ONE MINUTE, AND THEN DRAINED FOR ONE MINUTE ON A LABORATORY-SIZE SKIMMING TABLE.

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GROUPS B-1, B-2, AND B-3: ASCORBIC ACID WAS ADDED DIRECTLY TO THE FRESH SHUCKED OYSTER MEATS. THE MATERIAL WAS FIRST DISSOLVED IN A SMALL QUANTITY OF WATER AND THEN THOROUGHLY MIXED WITH THE OYSTERS. THE OYSTERS IN GROUP B-1 CONTAINED 100 MILLIGRAMS OF ASCORBIC ACID PER POUND OF OYSTER MEATS; THOSE IN GROUP B-2 CONTAINED 200 MILLIGRAMS PER POUND; AND THOSE IN GROUP B-3 CONTAINED 300 MILLIGRAMS PER POUND.

GROUP B-4: CITRIC ACID WAS ADDED DIRECTLY TO THE OYSTERS IN THE SAME MANNER AS IN GROUPS B-1, B-2, AND B-3 IN A CONTENTRATION OF 300 MILLIGRAMS PER POUND OF OYSTER MEATS.

GROUPS C-1 AND C-2: THE OYSTERS WERE FIRST FROZEN IN ONE POUND BLOCKS IN A MOLD AND THEN GLAZED. THE BLOCKS OF OYSTERS IN GROUP C-1 WERE GLAZED IN PLAIN WATER; THOSE IN C-2 WERE GLAZED IN TWO-PERCENT ASCORBIC ACID SOLUTION.

GROUP D: THIS GROUP CONSISTED OF COMMERCIALLY SHUCKED FRESH OYSTERS WITH NO FURTHER TREATMENT.

The oysters in Groups A, B, and D were packaged in moisture-vaporproof cellophane bags, heat sealed, and then placed in waxed cartons. Those in Group C, after freezing in blocks, were glazed, wrapped in sheets of moisture-vaporproof cellophane, and packaged in waxed cartons.

All samples were frozen at a temperature of approximately -20° F. and were stored as 0° F. A sufficient number of samples were prepared to permit examinations at monthly intervals for a period of one year.

Sample B-4 was included for comparative purposes. Samples C-1 and D were used at the controls.

EXAMINATION OF SAMPLES

At intervals, the samples were removed from storage and were allowed to thaw at room temperature. The general appearance of the oysters was noted and palatability tests with the raw oysters were made by a panel of 3 or 4 members of the laboratory staff. Scores were based on appearance, flavor, and texture of the product. A sample receiving a weighted score below 85 was considered unacceptable. It was not possible to have the same taste panel after the sixth month's test. To what extent this affected the scores after this time is, of course, not known.

Determinations of pH of the oyster liquor were made initially, and at intervals of several months during frozen storage. A Beckman pH meter, Laboratory Model G, was used for making these determinations.

RESULTS

The average palatability scores for the oysters are given in table 1. Although considerable variation in scores occurred from month to month, due possibly to differences in individual oysters within the pack and to the change in the taste panel, no one group receiving a particular treatment has consistently stood out as being superior or inferior. The final scores, after the oysters had been held in storage for nearly a year, were with one exception (B-4) indicative of an acceptable product. However, this one exception was very close to attaining an acceptable score. No off-flavors due to addition of ascorbic or citric acids were reported by the judges.

The average scores for appearance of the oysters are given in table 2. Practically no differences in the appearance of the oysters were noticeable through the sixth month of storage. After that time, slight changes in appearance occurred but there was no definite indication that the ascorbic acid had an appreciable effect in preventing discoloration of the oysters. Some darkening occurred in all groups.

Table 1 - Palatability Scores for Oysters Stored at 0° F.

Samples of Oysters			Average Palatability Score 1/								
			Storage Period in Months								
Group Number	Treatment	Packaging	1½	2½	3½	4½	6	8	9	10	11½
A	Dipped in 1 percent ascorbic acid solution for 1 minute	MVP 2/-cellophane bag, heat-sealed, in waxed carton	91	87	94	90	90	88	86	84	88
B-1	100 mg. ascorbic acid per pound	MVP 2/- cellophane bag, heat-sealed, in waxed carton	93	92	93	90	85	85	92	84	89
B-2	200 mg. ascorbic acid per pound	do	-	-	92	92	-	-	-	85	87
B-3	300 mg. ascorbic acid per pound	do	90	88	91	90	90	-	-	86	88
B-4	300 mg. citric acid per pound	do	92	-	93	95	93	-	82	83	84
C-1	Frozen in 1-lb. blocks, glazed with water	Frozen blocks wrapped in MVP 2/-cellophane sheets, in waxed carton	89	92	91	92	88	83	80	73	86
C-2	Frozen in 1-lb. blocks, glazed in 2 percent ascorbic acid solution	do	93	-	86	95	93	-	-	81	86
D	None	MVP 2/-cellophane bag, heat-sealed, in waxed carton	89	90	92	90	85	84	83	90	85

1/THE PALATABILITY SCORE WAS CALCULATED AS FOLLOWS: THE SAMPLE WAS SCORED ON THE BASIS OF 1 TO 10 POINTS EACH FOR APPEARANCE, FLAVOR, AND TEXTURE. THE FLAVOR SCORE WAS DOUBLED IN ORDER TO GIVE ADDITIONAL WEIGHT TO THIS FACTOR. THE MEAN AS A PERCENT OF THESE SCORES RESULTED IN THE PALATABILITY SCORE. A SAMPLE WITH A SCORE BELOW 85 WAS CONSIDERED UNACCEPTABLE.
2/MVP--MOISTURE-VAPORPROOF.

The low scores shown for group C-1 for the ninth month and tenth month of storage were due in part to desiccation of some of the oysters in these samples.

The pH values of the liquor from the various groups are given in table 3. The addition of ascorbic acid or citric acid to the oysters caused a drop in initial pH value, with the exception of group C-2. Groups A and B-4 showed further slight drops in pH upon subsequent storage at 0° F. Changes in pH during storage in the other six groups were considered insignificant

Table 2 - Appearance Scores for Oysters Stored at 0° F.

Sample Group Number	Average Appearance Score 1/								
	Storage Period in Months								
	1½	2½	3½	4½	6	8	9	10	11½
A	9	9	9	9	9	9	8	8	9
B-1	9	9	9	9	9	9	9	9	8
B-2	-	-	9	9	-	-	-	9	8
B-3	9	9	9	9	9	-	-	8	8
B-4	10	-	9	9	9	-	8	8	8
C-1	9	9	9	9	9	8	7	7	8
C-2	9	-	9	9	9	-	-	8	8
D	9	9	9	9	9	9	9	8	8

1/THE HIGHEST POSSIBLE SCORE IS 10.

Table 3 - pH of the Liquor of Oysters Stored at 0° F.

Sample Group Number	pH of Oyster Liquor		
	Initial 1/	After 3½ months' storage of oysters	After 11½ months' storage of oysters
A	6.10	6.08	5.99
B-1	6.44	6.45	6.44
B-2	6.38	6.36	6.32
B-3	6.30	6.30	6.23
B-4	6.12	6.08	5.90
C-1	6.50 2/	6.50	6.47
C-2	6.50 2/	6.48	6.50
D	6.50	6.50	6.50

1/PRIOR TO FREEZING.
2/AFTER FREEZING, BUT PRIOR TO GLAZING.

CONCLUSION

Under the conditions of these tests, the addition of ascorbic acid to shucked oysters did not prevent or appreciably retard darkening or other quality changes in the oysters during frozen storage at 0° F.

LITERATURE CITED

BAUERNFEIND, J. C.; SMITH, E. G.; BATCHER, OLIVE; AND SIEMERS, G. F.
1948. RETARDATION OF RANCIDITY IN FROZEN FISH BY ASCORBIC ACID. QUICK FROZEN FOODS, VOL. 10, NO. 8, PP. 139-142; VOL. 10, NO. 9, PP. 68-70, 72.

TARR, H. L. A.
1946. CONTROL OF RANCIDITY IN STORED FISH III. PROG. REPT. PAC. COAST STA. FISH RES. BD. CAN., NO. 68, PP. 52-54.

1948. CONTROL OF RANCIDITY IN FISH FLESH II. PHYSICAL AND CHEMICAL METHODS. J. FISH. RES. BD. CAN., VOL. 7, PP. 237-247.

TECHNOLOGICAL SECTION

Branch of Commercial Fisheries, U. S. Fish and Wildlife Service
Department of the Interior

Washington, D. C.

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Field Activities

Fishery Refrigeration

Name	Title	Address	Telephone
James M. Lemon	Technologist	Fishery Technological Laboratory P. O. Box 128 College Park, Md.	Warfield 5800

Laboratories

Location	Address	In Charge	Telephone
East Boston 28, Mass.	Fishery Technological Laboratory 61 Sumner Street	Joseph F. Puncochar, Chief, North Atlantic Technological Research	East Boston 7-4307
College Park, Md.	Fishery Technological Laboratory P. O. Box 128	H. W. Nilson, Pharmacologist, In Charge	Warfield 5800
Ketchikan, Alaska	Fishery Products Laboratory Box 647	John A. Dassow, Chief	540
Seattle 2, Wash.	Fishery Technological Laboratory 2725 Montlake Boulevard	Maurice E. Stansby, Chief, Pacific Coast & Alaska Technological Research	East 0586

TRASH FISH.
NEW BEDFORD
THOUSANDS OF POUNDS

MONTH	1949	1950	1951	1952
J	0	2,437	2,039	705
F	0	4,048	3,734	1,241
M	0	4,209	2,864	1,990
A	3,536	6,766	1,225	1,960
M	7,363	10,733	2,765	2,925
J	7,936	10,086	73	2,404
J	6,905	7,631	36	488
A	4,945	5,443	462	
S	2,737	2,283	707	
O	5,491	1,172	1,853	
N	3,336	1,069	566	
D.	1,866	630	351	
TOTAL.	44,115	56,507	16,695	

ROUTE SLIP

DATE 9-3-52

TO: Mr. Graham.

FROM: E. Premetz

FOR ASMFC Meeting.

REMARKS:
Data requested on fish meal + oil is attached. Published annually - nothing available on 1952.
Total YT production + prod. from So. N. E. Stock for 1951 is
ACTION:
Also attached. 1952 data is incomplete, since most of it has not as yet been processed and published by Bu. of Comm. Fisheries. Current New Bedford statistics ~~have been included~~

Fish meal + oil 1948-51

	Fish meal				Fish oil			
Year	# Plants	Quantity (Tons)	$ Value	$ Price per ton	# Plants	Quantity (Gallons)	$ Value	$ Price per gallon
1948	194	199,519	23,086,734	115.71 (.058)	134	16,343,407	18,475,855	1.13
1949	222	237,180	35,652,142	150.32 (.075)	144	16,860,530	7,519,522	0.44
1950	225	239,713	29,225,928	121.92 (.061)	160	21,432,592	14,041,619	0.66
1951	180	209,756	25,373,897	120.97 (.060)	119	17,872,733	14,044,296	0.78

price/pound provided in

<u>Source of Data</u>:

Canned Fish and Byproducts (annual Summary)

1948 C.F.S. 497
1949 C.F.S. 577
1950 C.F.S. 671
1951 C.F.S. 772

no figures on 1952 available.

yellowtail Production – 1951

State	Production.
Maine	82,447
Mass.	16,187,167
Rhode Island *	725,118
Conn. *	350,578
New York	699,472
New Jersey *	260
Total	18,044,982 pounds.

* Estimated

*Production from So. New England Stock in 1951 = 3,987,998 pounds

Percent of total U.S. production in 1951 from So. New England Stock = 22.1 %

YT Production - New Bedford.

Month	1951	1952
J	482,482	470,460
F	403,150	538,575
M	289,120	270,525
A	368,600	334,960
M	378,840	330,170
J	592,625	681,770
J	2,180,645 4,695,462	2,113,275 4,739,735
A	1,600,865	
S	2,381,605	
O	2,019,180	
N	1,332,985	
D	585,655	

Y/T Production 1952

Month	Maine	Mass.	NJ
J	0	657,060	625
F	0	660,057	100
M	2,330	631,123	
A	2,215	667,008	
M	8,610		