THE MUSSEL RESOURCES OF THE NORTH ATLANTIC REGION

PART III - DEVELOPMENT OF THE FISHERY AND THE POSSIBLE NEED FOR CONSERVATION MEASURES

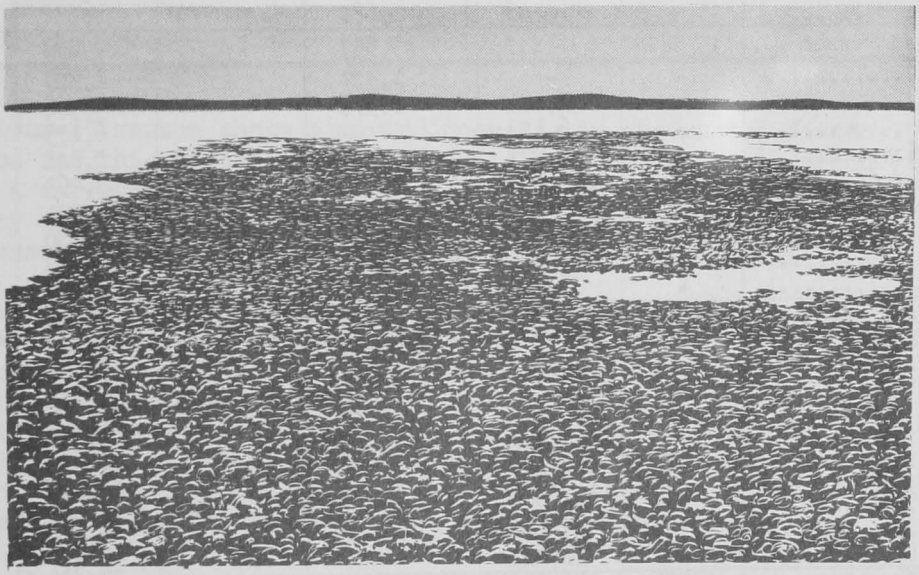
By Leslie W. Scattergood* and Clyde C. Taylor**

INTRODUCTION

This is the third and concluding paper concerning the North Atlantic mussel fishery. The two previous papers have discussed the efforts to determine the possible magnitude of a mussel fishery and then to assist in the development of the fishery. This article presents the history of the recent fishery and the role of conservation.

DEVELOPMENT OF THE FISHERY

The year 1942 marked the beginning of the mussel canning industry in New England. A small pack of pickled mussels was processed in May 1942 by a Maine cannery. In the summer of 1942, another Maine cannery packed a few cases of mussels as an experiment. At the same time, the Fish and Wildlife Service similarly was preparing some trial packs. In October and November, the mussel



A BED OF SEA MUSSELS, MARTHAS VINEYARD, MASS.

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NOTE: Part I (The Survey to Discover the Locations and Areas of the North Atlantic Mussel Producing Beds) of this series appeared in the September 1949 issue of Commercial Fisheries Review, pp. 1-10. Part II (Observations on the Biology and the Methods of Collecting and Processing the Mussel) of this series appeared in the October 1949 issue, pp. 8-20.

canning was still on an experimental basis. During December 1942, one cannery processed a total of 400 bushels, and an increasing number of cannery operators became interested in the potentialities of the mussel industry. In January 1943, representatives of the Fish and Wildlife Service held a meeting in Boothbay Harbor, Maine, to discuss the prospective mussel fishery as revealed by the survey.

Table 9 - Yield of Maine Mussel Fishery, By Counties, By Months[1/]

Month	COUNTIES					Value
	Knox	Hancock	Washington	Other	Total	
	Bushels	Bushels	Bushels	Bushels	Bushels	Dollars
May 1942	-	-	[2/]1,500	-	1,500	750
Total 1941-42 season	-	-	[2/]1,500	-	1,500	750
December 1942	-	-	400	-	400	160
January 1943	-	-	817	-	817	327
February 1943	1,264	2,205	1,198	-	4,667	4,667
March 1943	11,804	780	6,006	-	18,590	14,872
April 1943	5,157	30,177	807	-	36,141	28,913
May 1943	1,743	26,725	7,651	-	36,119	28,895
June 1943	-	3,724	7,237	-	10,961	8,769
Total 1942-43 season	19,968	63,611	24,116	-	107,695	86,603
November 1943	151	1,794	476	-	2,421	1,695
December 1943	4,630	15,243	2,641	-	22,514	9,006
January 1944	3,114	13,924	2,461	-	19,499	7,800
February 1944	5,184	13,569	3,383	-	22,136	8,854
March 1944	9,457	25,841	3,941	-	39,239	15,695
April 1944	12,682	37,858	1,693	[3/]1,497	53,730	21,492
May 1944	314	23,213	3,081	-	26,608	13,304
June 1944	-	-	1,681	-	1,681	504
Total 1943-44 season	35,532	131,442	19,357	1,497	187,828	78,350
October 1944	-	-	1,327	-	1,327	398
November 1944	-	4,189	1,377	-	5,566	1,948
December 1944	-	6,123	-	-	6,123	2,143
January 1945	-	12,041	-	-	12,041	4,817
February 1945	832	11,361	1,170	-	13,363	4,009
March 1945	1,343	15,553	4,195	-	21,091	6,327
April 1945	1,465	32,496	3,459	-	37,420	13,097
May 1945	469	27,396	5,463	-	33,328	13,331
June 1945	-	8,016	2,747	-	10,763	3,767
Total 1944-45 season	4,109	117,175	19,738	-	141,022	49,837
September 1945	-	-	1,082	-	1,082	325
October 1945	592	8,058	6,483	-	15,133	6,053
November 1945	1,269	16,711	5,288	-	23,268	9,307
December 1945	2,392	16,848	4,985	-	24,225	9,690
January 1946	1,648	14,246	4,720	-	20,614	8,246
February 1946	535	7,631	2,100	-	10,266	4,106
March 1946	548	30,945	3,083	[4/] 4	34,580	13,832
April 1946	71	53,548	-	-	53,619	21,448
May 1946	-	14,343	568	-	14,911	5,964
Total 1945-46 season	7,055	162,330	28,309	4	197,698	78,971
October 1946	-	1,332	842	-	2,174	734
November 1946	-	-	890	-	890	267
December 1946	-	-	10,496	-	10,496	4,010
January 1947	-	546	-	-	546	218
Total 1946-47 season	-	1,878	12,228	-	14,106	5,229

1/From statistical reports of the Maine Department of Sea and Shore Fisheries.
2/This quantity credited to Hancock County through error.
3/Lincoln County.
4/York County.

Cannery operators and representatives of the Massachusetts Division of Marine Fisheries, the Maine Department of Sea and Shore Fisheries, the U. S. Pure Food and Drug Administration, and the Fish and Wildlife Service attended. The meeting provided the necessary facts for utilizing mussels, and shortly thereafter, with the seasonal increase in yield of meats per bushel, the onset of favorable fishing weather, and the presence of a promising market, there was a considerable expansion of the fishery.

Table 9 shows the yield of the Maine mussel fishery for six seasons. Similar information is not available for Massachusetts, but it is known that several thousands of bushels were packed in that State during both the 1943 and 1944 seasons. The Massachusetts mussels were obtained from Cape Cod and Buzzards Bays, while those in Maine were predominantly from the Hancock County region which includes the areas of Frenchman, East Penobscot, and Blue Hill Bays.

From Table 9, it is apparent that the three-month period, March to May, represented the peak of production in five of the six seasons. The primary reason for this seasonal peak was that the mussel meats were well developed during this period, and thus the cost of the raw material was lower. There are several reasons why the April pack was higher than that of May, when the meats were even heavier. Perhaps, the most important reason was that the canned mussel market was generally uncertain and canners were reluctant to have too great a pack of unsold mussels. During the spring months, the production greatly exceeds the immediate demand. In late May, some canners stop packing mussels because they are approaching the spawning period. As the gonads near their maximum development, the enlarged mantle is torn easily during the shucking or washing operation, and the meats have a poor appearance in the can. Still other canneries begin in May to process or make preparations for canning fish, and therefore, cease mussel packing.

The 1946-47 season shows a marked decrease in the mussel fishery. The primary reason for this abrupt decline from the previous season's production is that there was a carry-over of some of the 1945-46 pack and the canners were reluctant to pack any quantities until the extent of the postwar demand could be determined. Consequently, no mussels were processed during the 1947 spring season.

At the present time, a small but fairly steady demand for canned mussels has been established, but this was not always so. When the first large quantities of mussels were processed in 1943, the product was almost unknown to the American public. However, due to the shortage of other types of canned shellfish, wholesalers and retailers did not hesitate to purchase the pack. In 1944, there were reports that consumers were not buying the mussels, and that retailers were overstocked. The future of the fishery appeared to be uncertain, since brokers were becoming reluctant to handle the product.

Several meetings to discuss this problem were held by the mussel canners, the Maine Development Commission, the Department of Sea and Shore Fisheries, and the Department of Agriculture, and the United States Fish and Wildlife Service. Several important facts were revealed. First, some of the canned mussels were of inferior quality because of careless handling, and these inferior packs tended to discourage the future sales of mussels. Second, certain regions had developed into good markets for this shellfish, despite a lack of concerted advertising. While there was a recognized need for advertising, the canners were somewhat reluctant to finance a well-organized campaign. It was apparent that advertising would not be efficacious unless the entire mussel pack was of prime quality. The

establishment of standards for canned mussels was discussed, but no definite commitments were made by the packers.

Subsequently, some of the canners set up and maintained certain standards of quality, and carried on local advertising and demonstrations in various cities. These more energetic packers can be given the credit for increasing the sales of mussels after 1944. Lowered prices, improved quality, and a seafood of distinct merit were responsible for their success.

CONSERVATION

The production of mussels probably will be limited in the future by the available supply. In many regions, especially those in which the mussel beds were located in shallow water, it has not been difficult to deplete seriously the local supply of marketable mussels within a fishing season or less, especially when all sizes of mussels have been removed. Where the growth rate is slow, these depleted mussel beds may be rendered practically worthless for several years, until seed mussels have a chance to set and grow to marketable size. The stripping of mussels from the shallow water beds is relatively simple, for mussels, unlike clams, lie exposed on the flats. When it is apparent that the mussel population is being depleted, the possibility of applying conservation methods must be considered.

Regulation of the mussel fishery should be based on the need for utilizing the mussel resources to greatest advantage in order to maintain a sustained high yield. Obviously, mussel regulations would not be necessary because of any possible extinction of the mussel, for the fishery would be unprofitable long before extinction. Unfortunately, there are a great many factors affecting mussel population about which little is known. An optimum conservation policy cannot be formulated until an intensive study of the North Atlantic mussel beds is carried on to determine the relationship between natural and fishing mortalities; the growth and survival rates under various conditions, such as occur at various levels of the tidal range or on beds of different population densities; factors influencing spawning, larval drift, and the resultant setting of spat; and the practicability of transplantation to build up a depleted mussel area.

While there is not yet a clear understanding of all the factors influencing the establishment and growth of mussel beds, there are two measures which can be taken to assure that the present mussel resources are utilized to the best advantage. These regulations are:

(1) A closed season when mussel meats are thin.

(2) A minimum size law to eliminate destruction of young mussels.

It is understood, of course, that these two measures will not wholly prevent further depletion but they will, however, eliminate an obviously unwise utilization of the shellfish. Similar regulations are in effect for the soft-clam fishery.

A closed season when no harvesting could be done would prevent the use of mussels whose yield of meats is at a seasonal low. From the data accumulated at Friendship and Boothbay Harbor, Maine, it is evident that in the period July through March, mussels are relatively thin. For example, as shown in Table 6,[1/] a bushel of Friendship mussels collected in the first week of December yielded 5.87 pounds of steamed meats. In the first week of April, a bushel yields 8.55

1/ See Part II of this article which appeared in the October 1949 issue of Commercial Fisheries Review, p. 13.

pounds, an increase of over 45 percent; while in the first week of May, a yield of 9.36 pounds would be obtained, an increase of over 59 percent. At Boothbay Harbor, a bushel yields, during the period July 8 to February 22, between 11.0 and 13.5 pounds of raw meats. In April, weight of the raw meats would have increased between 14 and 40 percent; in May, from 30 to 59 percent; and in June, from 43 to 76 percent. Thus, the practice of harvesting mussels in months other than April, May, and June is a wasteful one.

During the war years, every effort was made to encourage the canneries to process mussels. A closed time was not urged because a maximum production of sea food was needed and the canneries were best able to process this species during December to May, without interference with other canning activities. In 1942-45, due to both the need for protein food and the definite uncertainty of the future of this new product in postwar years, it was felt that a maximum utilization of mussels was justified even if it was necessary to use them when poorly meated. Figure 6 shows that a considerable portion of the catch of the three greatest seasons was taken before the mussels reached their prime condition.

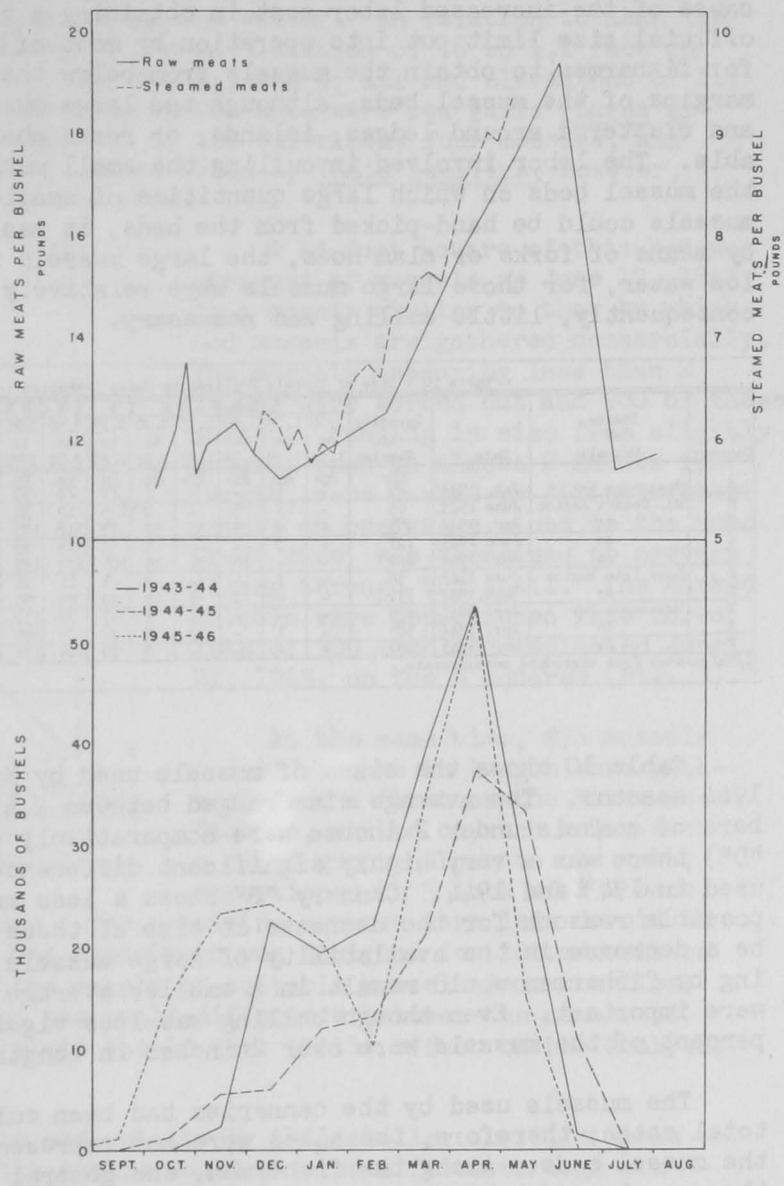

FIGURE 6 - THE SEASONAL YIELD OF RAW MUSSEL MEATS AT BOOTHBAY HARBOR, MAINE, AND OF STEAMED MUSSEL MEATS AT FRIENDSHIP, MAINE, AS COMPARED WITH THE SEASONAL PRODUCTION OF THE MUSSEL FISHERY FOR THREE SEASONS.

Because the mussel fishery in eastern Maine has developed to the stage in which actual local depletion of marketable mussels exists, it is advisable to propose a minimum size law which will protect the smaller mussels from destruction. It may be possible that after extensive study, a proposed 2-inch minimum size will be found too small, or perhaps even too large, to obtain the greatest continuous yield from a given mussel area. However, at the present time, some protection must be given to the mussels, or the yield from the mussel beds undoubtedly will decline further.

The Maine canneries insisted at the beginning of the 1943 fishery that the fishermen bring in no small mussels; the majority of all mussels purchased would have to measure between 2½ and 3 inches long. Small mussels were not desired because of the increased labor cost in obtaining a given volume of meats. This unofficial size limit put into operation by most of the canneries made it necessary for fishermen to obtain the mussels from below the low-tide mark, usually on the margins of the mussel beds, although the large mussels also were found submerged and clustered around ledges, islands, or rocks where growing conditions were favorable. The labor involved in culling the small mussels precluded the utilization of the mussel beds on which large quantities of smaller mussels existed. Although the mussels could be hand-picked from the beds, it was much more profitable to collect, by means of forks or clam hoes, the large mussels from two or three feet below mean low water, for those large mussels were relatively free of the smaller sizes and, consequently, little culling was necessary.

Table 10 - Size of Mussels Utilized by Maine Canneries in 1943 and 1944 Seasons

Cannery	Source of Mussels	Date	Quantity in Sample	LENGTH IN INCHES: 1.00 to 1.24	1.25 to 1.49	1.50 to 1.74	1.75 to 1.99	2.00 to 2.24	2.25 to 2.49	2.50 to 2.74	2.75 to 2.99	3.00 to 3.24	3.25 to 3.49	3.50 to 3.74	3.75 to 3.99	4.00 to 4.24	Average length 1/ 1943	Average length 1/ 1944	Percent below 2 inches 1943	Percent below 2 inches 1944
			No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	Inches	Inches	%	%
A	Muscongus Bay	Jan. 1943	86	1	1	-	-	2	12	42	23	5	-	-	-	-	2.63	-	2.3	-
B	Mt. Desert Region	June 1943	55	-	3	5	1	2	5	10	24	5	4	6	-	-	2.72	-	13.8	-
B	do	Apr. 1944	485	-	-	5	14	52	79	118	107	85	18	5	2	-	-	2.69	-	3.9
C	do	June 1943	127	-	2	-	-	5	4	15	28	32	26	10	4	1	3.04	-	1.6	-
C	do	Apr. 1944	622	-	-	10	36	70	101	124	137	84	51	8	1	-	-	2.67	-	7.4
D	Deer Isle Region	June 1943	98	-	1	-	-	2	3	11	16	39	12	9	5	-	3.08	-	1.0	-
D	do	Sept. 1944	332	-	-	2	3	13	40	75	95	63	32	8	1	-	-	2.83	-	1.5
E	Muscongus Bay	Apr. 1943	475	-	-	-	-	3	33	77	132	129	74	25	6	2	2.99	-	.0	-
E	do	Apr. 1944	589	-	1	-	2	3	48	109	207	138	64	14	3	-	-	2.91	-	.5
F	do	May 1943	460	-	-	-	-	2	20	103	174	125	27	9	-	-	2.91	-	.9	-

1/ Calculated from ungrouped measurements.

Table 10 shows the sizes of mussels used by Maine canneries in the 1943 and 1944 seasons. The average size ranged between 2.63 and 3.08 inches and the numbers of mussels under 2 inches were comparatively small. At two canners ("C" and "D") there was a very highly significant difference between the sizes of mussels used in 1943 and 1944. Cannery "B" shows a less marked decrease. There are two possible reasons for the decrease in size at these canneries. First, there could be a decrease in the availability of large mussels; and second, less strict culling by fishermen would result in a smaller average size. Probably both factors were important. Even though culling was less vigorous in 1944, 93 percent to 100 percent of the mussels were over 2 inches in length.

The mussels used by the canneries had been culled by the fisherman from his total catch; therefore, the sizes were not representative of the total drain on the mussel beds. Among the fishermen, the general practice has been to harvest the mussels and load the boats or scows during low tide. After the tide has risen over the beds, the mussels were taken ashore where the culling operation was performed, often under shelter. Those mussels which were undersized were not returned to the beds but were left on the shore where they soon died of exposure. The great mortality among these small mussels exposed to unfavorable conditions on the shore or upper part of the intertidal zone has been responsible for a common belief among fishermen that culling kills the small mussels.

An experiment was designed at Boothbay Harbor, Maine, to measure the effect of returning or transplanting small mussels to beds exhausted by commercial exploitation. Although transplantation is vigorously practiced wherever mussel culture is carried on in Europe, a practical demonstration of the value of returning small mussels to the beds was needed.

The area selected for this experiment was a small mussel bed near the Fisheries Station at Boothbay Harbor, Maine. This bed is in a cove sheltered from storms and relatively free from ice during the winter. In relation to mean low water, the experimental area (Figure 7) has an elevation of .6 to 1.1 feet on A_3, B_3, and C_3 plots, while A_2, B_2, C_2, A_1, B_1, and C_1 all had elevations of 1.1 feet. The only natural enemies observed in the area were sea gulls (Larus argentatus) and crows. At the termination of the experiment four mussles, all dead, showed perforations similar to those bored by Thais lapillus; however, this gastropod was not abundant in the area.

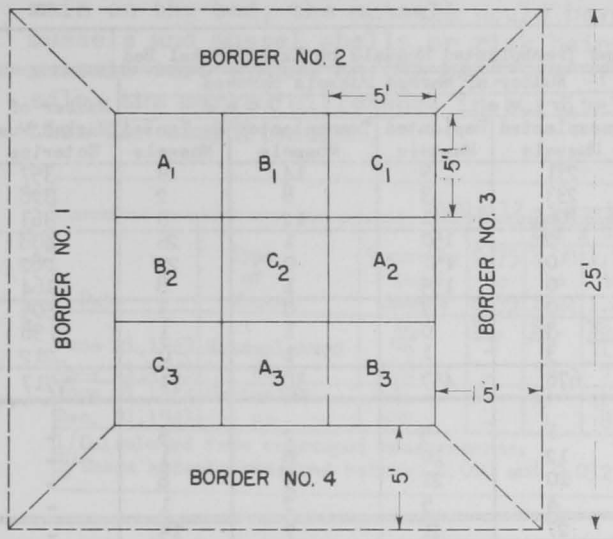

FIGURE 7 - DIAGRAM OF THE EXPERIMENTAL MUSSEL BED AT BOOTHBAY HARBOR, MAINE. MUSSELS WERE TRANSPLANTED TO A_1, A_2, AND A_3 PLOTS, REPLANTED ON B_1, B_2, AND B_3 PLOTS, WHILE C_1, C_2, AND C_3 PLOTS WERE LEFT BARE.

A 15-foot square of this bed was stripped of mussels on June 17, 1943, in a manner similar to that by which bed mussels are gathered commercially. The mussels measuring less than 2 inches were sorted out and 900 of these mussels, ranging in size from slightly under 1 inch to almost 2 inches in length, were marked by filing a short groove on one valve close to the umbo. Great care was exercised to prevent filing through the shell. The marked mussels were apportioned into three lots of 300 each and replanted June 21, 1943, on the B squares (Fig. 7).

At the same time, 876 mussels under 2 inches in length were gathered from a float at the Fisheries Station, marked on each valve with a filed groove close to the umbo, apportioned in 3 lots of 292 each, and transplanted to the A squares. The remaining squares were left devoid of mussels to serve as controls. The experiment was designed for 300 mussels on each of the A and B plots, but the supply of suitable mussels from the float was insufficient. The effect of the small difference between the number of planted mussels on the A and B plots should have little effect on the analysis of the experimental results.

As the transplanted mussels had relatively thin shells, the file marks had to be long and shallow or the shells would have been filed through completely. The replanted mussels, which had thicker shells, were marked with a short, much deeper groove. Thus, no problem of identification was presented when only one marked valve was later recovered. To determine the mortality resulting from marking, 40 mussels were marked in equal lots with one and two grooves and held for two weeks in one of the station's aquaria. No mortality was observed.

On December 21, 1943, the mussels were removed from the experimental area. The results are shown in Table 11. Since it was discovered that some marked mussels had shifted from one square to another during the course of the experiment, the area immediately surrounding the bed was examined on April 8, 1944, at which time, all mussels were removed from a 5 foot border around the experimental area. The numbers of marked mussels found within this area are also shown in Table 11.

As will be noted from Figure 7, the design of this experiment is that of a Latin Square, which tends to equalize the effect of conditions prevailing over the area and provides a standard method of analyzing the results.

An analysis of variance of the survival data in Table 11 indicates that no significant difference is apparent among the numbers of unmarked mussels entering the rows, columns, or types of plots. The center plot C_2 has the lowest number of unmarked mussels, as could be anticipated, due to that plot's being the farthest from any source of unmarked mussels. It must be remembered

Table 11 - Survival of Replanted and Transplanted Mussels on Experimental Bed

Plots	Date Planted	Number of Marked Mussels Planted	Date of Removal	Number of Marked Mussels Removed				Number of Unmarked Mussels Entering Bed
				Live		Dead		
				Transplanted Mussels	Replanted Mussels	Transplanted Mussels	Replanted Mussels	
A1	June 21,1944	292	Dec. 21,1944	231	9	14	9	357
A2	do	292	do	233	3	8	2	328
A3	do	292	do	206	1	12	0	363
B1	do	300	do	2	150	1	26	408
B2	do	300	do	0	151	0	22	282
B3	do	300	do	0	135	1	8	164
C1	-	-	do	0	7	0	3	505
C2	-	-	do	3	0	1	1	98
C3	-	-	do	3	1	1	0	212
Total	-	1,776	-	678	457	38	71	2,717
Borders:								
No. 1	-	-	Apr. 8,1944	1	5	2	5	-
No. 2	-	-	do	12	10	0	1	-
No. 3	-	-	do	10	21	3	8	-
No. 4	-	-	do	4	5	2	1	-
Total	-	-	-	27	41	7	15	-
Grand Total	-	1,776	-	705	498	45	86	-
Percent Survival	-	-	-	80.5	55.3	-	-	-

that the experimental bed is not exactly comparable to an area which has been commercially stripped of mussels. The experimental bed was immediately surrounded by an unexploited mussel area which could be the source of the unmarked mussels which entered the plots. Such a repopulating of a stripped area would not be as readily possible on a large area from which most or all mussels had been removed.

Since the greater part of the unmarked mussels found on the experimental bed were seed mussels, the numbers and average sizes of these small mussels were analyzed to determine the effect of the type of plot on spat setting. Any mussel on the bed with a length of .50 inches or less in December was considered to belong to that year's spat. No significant differences were found.

A highly significant difference is evident, however, between the survivals of the transplanted and the replanted mussels. This difference is readily apparent in the percentage survivals in Table 11--80.5 percent of the transplanted mussels had survived in contrast to a survival of 55.3 percent for the replanted mussels. No significant difference appears between the rows and columns of the bed.

Consideration of the data shows that the replanted mussels, both alive and dead, were recovered on the borders and on the plots other than those on which they were planted, about twice as frequently as were the transplanted mussels--46 specimens (5.25 percent) of the total transplanted mussels and 92 (10.2 percent) of the replanted mussels had strayed from their plots. Thus, part of the

apparent lower survival rate of the replanted mussels may have been due to migration from the bed and beyond the borders. Migration would also affect the recovery of transplanted mussels, but to a lesser extent. It is evident, however, that the replanted mussels suffered a greater mortality than the transplanted ones, for 9.6 percent of the total replanted mussels were recovered as dead, but only 5.1 percent of the transplanted mussels were found to have died.

A probable explanation of the different survival rates of the two lots is that the transplanted mussels were more vigorous than the replanted ones, and were able to adapt themselves better to conditions on the bed. In order to remain on the bed, the mussels would have to attach byssal threads quickly to other mussels and mussel shells or risk being carried off by tidal action. When the mussels were placed on the bed, few of them were attached to each other. Undoubtedly, the marked difference in survival warrants additional study and experimentation for clarification.

Table 12 - Growth of Marked Mussels on Plots

Date	Type of Mussel	Quantity in Sample	LENGTH IN INCHES 0.75 to 0.99	1.00 to 1.24	1.25 to 1.49	1.50 to 1.74	1.75 to 1.99	2.00 to 2.24	2.25 to 2.49	2.50 to 2.74	2.75 to 2.99	Average Length 1/	Average Increase	Percent above 2 Inches
		No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	Inches	Inches	%
June 21,1943	Transplanted	96	-	9	31	27	21	2/8	-	-	-	1.597	0.475	3.3
Dec. 21,1943	do	678	-	-	7	46	185	294	128	16	2	2.072		64.9
June 21,1943	Replanted	151	10	33	41	32	26	2/9	-	-	-	1.476	0.450	6.0
Dec. 21,1943	do	457	-	1	8	86	203	120	37	2	-	1.926		34.8

1/ Calculated from ungrouped measurements.
2/ These mussels measured between 2.000 and 2.032 inches.

Analysis of the data on growth of the mussels does not reveal any significant difference between the rate of growth of the two lots of marked mussels. Neither is there any apparent difference between the growth increment of the marked mussels found on the plots and on the borders. The replanted and transplanted mussels grew at about the same rate during the 6-months period that they were on the bed and border, as shown in Table 12.

The mussel bed experiment has demonstrated that, under conditions prevailing on a Boothbay Harbor mussel bed, small mussels returned or transplanted to the bed have a relatively high survival. This refutes the oft-heard statement that replanting mussels is always useless because of the ensuing high mortality.

A minimum size regulation of two inches could be readily applied, easily enforced, and would be of little inconvenience to the fisherman. After culling, he would hold the small mussels in burlap bags suspended in water or put them into submerged crates. On the following day or soon after, the mussels could be returned to the beds from which they were taken. As indicated in the results of the planting experiment, most of the small mussels between one and two inches would be ready to harvest either later in the same season or during the next season. The minimum size regulation would be most applicable to the Maine beds; in Massachusetts, the problem may be quite dissimilar, for in 1942-43, only large mussels existed on the commercially important beds in Cape Cod Bay and Nantucket Island.

The mussel fishery has great potentialities and every effort should be made to insure that the resource is not misused. It is only by further study and by the utilization of conservation measures based on such study that this shellfish resource can be maintained or increased.

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THE SHRIMP AND THE SHRIMP INDUSTRY OF THE SOUTH ATLANTIC AND GULF OF MEXICO

Nutritive Value of Shrimp: Shrimp possess the same general food properties that are commonly attributed to fishery products. In general, marine products are an excellent and economic source of highly digestible proteins, a good source of vitamins, and an excellent source of minerals in quantity and variety. Shrimp are unusually rich in minerals and contain a high natural content of iodine. As a consequence, shrimp like other marine foods are ideal for those areas in which goiter is prevalent. It is well known that iodine deficiency in the diet is the cause of the most prevalent type of goiter. Shrimp also contain vitamins A and D.

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