

ON THE MOVEMENTS OF CERTAIN LOBSTERS LIBERATED AT WOODS  
HOLE DURING THE SUMMER OF 1898.

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For several years, during the spring and early summer, a large number of egg-bearing lobsters have been collected from the shores of Connecticut, Rhode Island, and southern Massachusetts and brought to the hatchery at Woods Hole, where the eggs have been removed and the "stripped" animals returned to the ocean, either at Woods Hole or, in special cases, near the place of capture. The lobsters were of good size, generally exceeding 10½ inches in length, although some were smaller, especially those from the shores of Rhode Island, where the marketable length is only 9½ inches.

It occurred to the writer that data respecting the movements and habits of female lobsters at the close of the breeding season might be secured if the animals should be tagged before liberation, and accordingly copper tags, bearing consecutive numbers and the request that they be returned to the Commission, were attached to the rostrums of about 500 specimens, and these animals were liberated during June and July, 1898. On the 17th of June 34 lobsters, numbered 582 to 615 inclusive, were "stripped," tagged, and liberated in Vineyard Sound, near Lackey Bay. Six of these were subsequently captured by lobster fishermen and the tags were returned to the Commission.

This group of lobsters yielded data as follows:

No.	Liberated.		Recaptured.		No. of days free.	Distance (miles).	Direction.
	Locality.	Date.	Locality.	Date.			
594	Lackey Bay .....	June 17	Menemsha.....	(?)	(?)	9	SSW.
595	.....do .....	.....do .....	Vineyard Sound ...	July 11	24	0	0
604	.....do .....	.....do .....	.....do .....	June 17	1	0	0
606	.....do .....	.....do .....	.....do .....	July 5	18	0	0
609	.....do .....	.....do .....	.....do .....	July 11	24	0	0
611	.....do .....	.....do .....	Menemsha.....	(?)	(?)	9	SSW.

The four recaptured near the place of liberation were taken by Mr. Alfred Nickerson, whose traps are near the southerly opening of Woods Hole, extending from Nobsque to Lackey Bay. The distance traveled by these lobsters can, therefore, only be estimated, although the most remote traps were probably not more than a mile or two from the point of liberation. One was captured on the day of its liberation. Mr. Hillman, whose traps were located near Gayhead, returned tags 594 and 611 to the Commission, but unfortunately he did not return dates with his tags, so that

the rate of travel of these and other lobsters taken by him can not be given. It will be noted that the general course of the lobsters is toward the south and west.

On the 18th of June 94 lobsters were tagged and placed on the steamer that runs from Woods Hole to New Bedford. The writer deposited 33 of these in Buzzards Bay, near the westerly opening of Woods Hole; 17 when the steamer was about midway between Woods Hole and New Bedford; 33 at a point south of West Island, and 11 as the steamer passed Black Rock. For convenience these stations have been named A, B, C, and D, respectively, and are so indicated on the chart at the end of this paper. Along this course of the steamer there is an almost continuous series of lobster pots extending entirely across the bay, many of them owned by Greeks and Portuguese, who are somewhat disinclined to return the tags, preferring to keep them as charms. It is perfectly safe, therefore, to conclude that only a small proportion of the tags taken are finally returned to the Commission.

From station A, 4 tags were recovered; from station B, none; from station C, 4, and from station D, 2. The details are as follows:

No.	Liberated.		Recaptured.		No. of days free.	Distance (miles).	Direction.
	Locality.	Date.	Locality.	Date.			
618	Station A.....	June 18	Near Hen and Chickens..	July 15	27	16	WSW.
628	.....do.....	.....do.....	Cuttyhunk.....	July 30	42	12	WSW.
629	.....do.....	.....do.....	Near West Island.....	July 9	21	4	WNW.
645	.....do.....	.....do.....	.....do.....	July 2	14	4	WNW.
650	Station C.....	.....do.....	Cuttyhunk.....	July 1	13	9	SW.
654	.....do.....	.....do.....	Near Station A.....	June 29	11	4	E.
667	.....do.....	.....do.....	Penikese.....	July 7	19	0	SW.
681	.....do.....	.....do.....	Near Station C.....	June 30	12	0	0
699	Station D.....	.....do.....	Near Station D.....	July 9	21	0	0
705	.....do.....	.....do.....	.....do.....	June 30	12	0	0

None of the lobsters distributed on June 18 took a northerly course, and although three were taken at points roughly described as east of their place of liberation, four traveled toward the mouth of the bay, all of them considerable distances, and No. 618 made a journey of 16 miles between June 18 and July 15, twenty-seven days. This is the longest distance traveled by any of the lobsters. Those liberated at stations B, C, and D were taken originally at Cuttyhunk. The fact that two of these, Nos. 650 and 667, returned to their former place of capture may indicate a strong homing instinct.

On the 24th of June 62 lobsters, originally from Noank, Stonington, and Block Island, were liberated at Quicks Hole at a point indicated on the chart. The tags of eight of these were returned to the Commission. The details are as follows:

No.	Liberated.		Recaptured.		No. of days free.	Distance (miles).	Direction.
	Locality.	Date.	Locality.	Date.			
711	Quicks Hole.....	June 24	Quicks Hole.....	July 5	11	0	0
714	.....do.....	.....do.....	.....do.....	June 28	4	0	0
715	.....do.....	.....do.....	Menemsha.....	(?)	(?)	5	SSE.
730	.....do.....	.....do.....	Robinsons Hole.....	June 30	6	2	E.
743	.....do.....	.....do.....	Quicks Hole.....	July 8	14	-----	-----
747	.....do.....	.....do.....	Menemsha.....	(?)	(?)	5	SE.
750	.....do.....	.....do.....	Cuttyhunk.....	July 19	25	6	WSW.
759	.....do.....	.....do.....	Robinsons Hole.....	July 5	11	2	E.

Of the animals liberated on June 24, it might be said that their course was not so characteristically toward the south as were the courses taken from some of the other stations, but the three which had traveled a sufficient distance from the point of liberation to give a distinct trend to their course did move in the same direction as

those of other stations. As the lobster pots are not set in large numbers off shore, lobsters liberated at Quicks Hole naturally would not stand the same chance of recapture toward the south and west that they would toward the north and east, and therefore it would seem to be of more than passing interest that from this southern point of distribution no lobsters were found to migrate to any considerable distance either up the sound toward Woods Hole or across the bay toward New Bedford.

A second lot, of 140 lobsters, was liberated off Nobsque on the same day as those liberated at Quicks Hole. These were quite at liberty to migrate in a northeasterly direction, but all reports of their capture came from the southwest. That so many of these and other lobsters took a southwesterly course would seem to prove that there is in general a decidedly southerly and westerly trend to their migrations, although I am not prepared to say whether this is in response to a strong homing impulse, or an effort to pass from warmer into colder water, or from shallow into deeper water. The proportion of animals captured to those liberated is noteworthy. Of 140 liberated at Nobsque, tags were received from 29. The details are as follows:

No.	Liberated.		Recaptured.		No. of days free.	Distance (miles).	Direction.
	Locality.	Date.	Locality.	Date.			
779	Nobsque.....	June 24	Woods Hole .....	July 11	17	0	0
789	do .....	do .....	Nobsque .....	July 5	11	0	0
791	do .....	do .....	do .....	July 11	17	0	0
798	do .....	do .....	Cedar Tree Neck .....	Sept. 21	89	5	SSW.
800	do .....	do .....	Woods Hole .....	July 11	17	0	0
802	do .....	do .....	Tarpaulin Cove .....	July 8	14	5	WSW.
807	do .....	do .....	Vineyard Sound .....	Aug. 11	48	2	SE.
819	do .....	do .....	Woods Hole .....	Aug. 28	65	0	0
821	do .....	do .....	Tarpaulin Cove .....	July 18-23	26	4	WSW.
825	do .....	do .....	Menemsha .....	?	?	11	SSW.
828	do .....	do .....	Nobsque .....	July 11	17	0	0
830	do .....	do .....	Tarpaulin Cove .....	July 18-23	26	4	WSW.
831	do .....	do .....	Vineyard Sound .....	do .....	26	4	WSW.
834	do .....	do .....	Menemsha .....	?	?	10	SSW.
838	do .....	do .....	Neshewena .....	July 8	14	12	WSW.
848	do .....	do .....	Gay Head .....	Aug. 15	52	13	SW.
851	do .....	do .....	Vineyard Haven .....	July 5	11	4	SE.
868	do .....	do .....	do .....	do .....	11	11	WSW.
880	do .....	do .....	Tarpaulin Cove .....	July 18-23	26	5	WSW.
872	do .....	do .....	Vineyard Haven .....	do .....	26	5	WSW.
879	do .....	do .....	Nobsque .....	?	?	0	0
883	do .....	do .....	Robinson Hole .....	July 20	26	8	WSW.
889	do .....	do .....	Quicks Hole .....	July 23	29	9	WSW.
891	do .....	do .....	Nobsque .....	?	?	0	0
896	do .....	do .....	Vineyard Sound .....	?	?	6	WSW.
901	do .....	do .....	Menemsha .....	?	?	11	SSW.
902	do .....	do .....	Nobsque .....	July 11	17	0	0
904	do .....	do .....	Menemsha .....	?	?	9	SSW.
907	do .....	do .....	do .....	?	?	11	SSW.

On the 25th of June 58 lobsters were liberated near the can buoy at the entrance of Woods Hole Harbor. Of these, only three were recaptured. No. 928 remained in the neighborhood until September 15, when it was captured near the Wepeckets. The capture of this and other specimens would go to show that molting does not always take place immediately after the eggs have reached maturity, for, if the animals had molted, the tags would have been lost.

No.	Liberated.		Recaptured.		No. of days free.	Distance (miles).	Direction.
	Locality.	Date.	Locality.	Date.			
928	Can buoy.....	June 25	Wepeckets .....	Sept. 15	82	3	WNW.
945	do .....	do .....	Woods Hole .....	July 23	28	0	0
960	do .....	do .....	Quicks Hole .....	do .....	28	9	WSW.

On July 2 two lots of lobsters were liberated, 60 at Lackey Bay and 49 at Woods Hole. Of the former, 5 were recaptured, as follows:

No.	Liberated.		Recaptured.		No. of days free.	Distance (miles).	Direction.
	Locality.	Date.	Locality.	Date.			
980	Lackey Bay.	July 2	Vineyard Sound .....	July 11	9	0	0
999	do	do	do	July 20	18	0	0
1020	do	do	Quicks Hole .....	July 23	21	6	WSW.
1034	do	do	Wepeckets .....	July 7	5	2	NW.
1098	do	do	Robinson Hole.....	July 20	18	3	WSW.

It will be noted from the above that the trend of migration of all those that had traveled a considerable distance after liberation was in the same general direction as that taken by those liberated from the stations mentioned.

The lobsters in the second lot liberated on July 2 were thrown into the water near the Fish Commission station, and not only is the direction of their course interesting, but the rate of movement of certain individuals is far beyond one's expectation. The animals traveled down the bay in a west southwesterly direction at a rate that seemed to indicate their desire to place as much distance as possible between themselves and the hatchery. No. 1000 made the journey from Woods Hole to Cuttyhunk in 3 days, No. 1022 reached the neighborhood of the Hen and Chickens lightship in 6 days, and No. 1014 reached an equally remote point in 7 days. The following table will give additional data relative to the movements of this last series:

No.	Liberated.		Recaptured.		No. of days free.	Distance (miles).	Direction.
	Locality.	Date.	Locality.	Date.			
970	F. C. Station .....	July 2	Cuttyhunk .....	July 16	14	14	WSW.
971	do	do	do	July 13	11	14	WSW.
977	do	do	do	July 16	14	15	WSW.
991	do	do	Woods Hole .....	July 7	5	0	-----
1000	do	do	Cuttyhunk .....	July 5	3	12	WSW.
1006	do	do	Wepeckets .....	Sept. 15	75	3	WSW.
1009	do	do	Woods Hole .....	July 11	9	0	-----
1010	do	do	Cuttyhunk .....	July 13	11	12	WSW.
1013	do	do	Woods Hole .....	July 7	5	0	-----
1014	do	do	Hen and Chickens ..	July 9	7	15	WSW.
1019	do	do	Wepeckets .....	Sept. 15	75	3	W.
1022	do	do	Hen and Chickens ..	July 8	6	15	WSW.
1030	do	do	Wepeckets .....	Sept. 15	75	4	WSW.
1054	do	do	do	do	75	3	W.
1055	do	do	Penikese.....	July 26	24	11	WSW.

Attention has already been called to the strong migratory impulse which controlled the movements of the animals set at liberty, and it must be left for subsequent observations to determine the reason therefor. During the latter part of June and the early part of July the water near Woods Hole ranges in temperature from 62° to 69° F., and as the water in this portion of the bay and sound is received from the presumably cooler water of the southwest, the inclination of the liberated animals to seek cooler water may account for the uniformity in their movements. But lobsters are caught about the station during the entire summer, and the uniformly small size of these animals would indicate that they remain in the locality during the season and are not caught as they pass through the sound on their migrations.

It has been already suggested that the uniformity in the movements of the tagged lobsters may be the result of a homing instinct. This question might be answered in

the following way: If lobsters caught at Woods Hole and released at Gay Head were recaptured at Woods Hole, and if lobsters taken at the same time at Gay Head and released at Woods Hole were recaptured at Gay Head, it would seem that only a homing instinct could account for the movement.

It is quite possible that during June and July lobsters seek deeper water, although it is generally believed that during the spring and early summer the general migration is from deeper to more shallow water, and that the return to the deeper water does not occur until fall. During the summer months lobsters are caught off the coast of Maine in shallow water, ranging from 3 to 10 fathoms in depth, and it is not until October and November that the pots are set in deeper water, from 35 to 40 fathoms. Professor Herrick states that the fishermen generally take their traps from the deeper water and place them in the shallow water of the sound at about the time that we have found the animals seeking the deeper water. From the neighborhood of Gay Head the general migration into deeper water is said to begin the latter part of August and to continue during September and October. If a relatively large number of both sexes, and of different sizes, should be captured at Cuttyhunk or a place similarly located, and after being tagged should be returned to the place of their capture, valuable data of a positive nature would undoubtedly be secured. One wishes that this might be attempted.

It is possible that the movements are not dependent upon any of the above-mentioned factors, but that the supply of food is all-controlling. The peculiar behavior of female lobsters in the vicinity of No Mans Land, as observed by Mr. Vinal Edwards and recorded by Professor Herrick, would seem, however, to make this improbable.

In writing of the lobster's powers of movement, Professor Herrick says that by the flexion of its abdomen the animal is able to shoot backward through the water with astonishing rapidity, sometimes going, according to one observer, 25 feet in less than a second. He quotes Travis as follows:

In the water they can run nimbly upon their legs or small claws, and, if alarmed, can spring tail forward to a surprising distance, as swift as a bird can fly. The fishermen see them pass about 30 feet, and by the swiftness of their motion suppose that they go much farther. Athenæus remarks this circumstance, and says that incurved lobsters will spring with the activity of dolphins.

While we do not know what method of progression lobster No. 1000 adopted in making her record of 12 miles in 3 days, we do know from the course taken by this animal, as well as by Nos. 1014 and 1022, that associated with their rapidity of movement there is remarkable endurance.

It is generally believed that the female lobster molts very soon after its young have escaped from the egg membranes, and although it is manifestly incorrect to consider a lobster artificially freed from its eggs as one which has completed the incubation period, the fact that many were recaptured with tags long after the period at which the young would probably have hatched under normal conditions, is a proof that in many cases females do not change their covering as soon as they are relieved of the obligations of maternity. One tag was taken as late as September 21.

One of the most interesting results from this series of experiments is the direct evidence of the merciless persecution of the lobster. The chances of continued life for a lobster that has reached a marketable size are extremely slight. Of the 140 liberated at Nobsque, more than 20 per cent are known to have been captured within three months, and 15 of the 49 liberated on July 2 at Woods Hole, or fully 30 per cent, were taken by September 15. Of course, these numbers do not begin to show

what actually occurs, for many fishermen are known not to have returned the tags; a large number of tags are doubtless lost by the process of molting, and not a few of



Figure of tag—exact size.

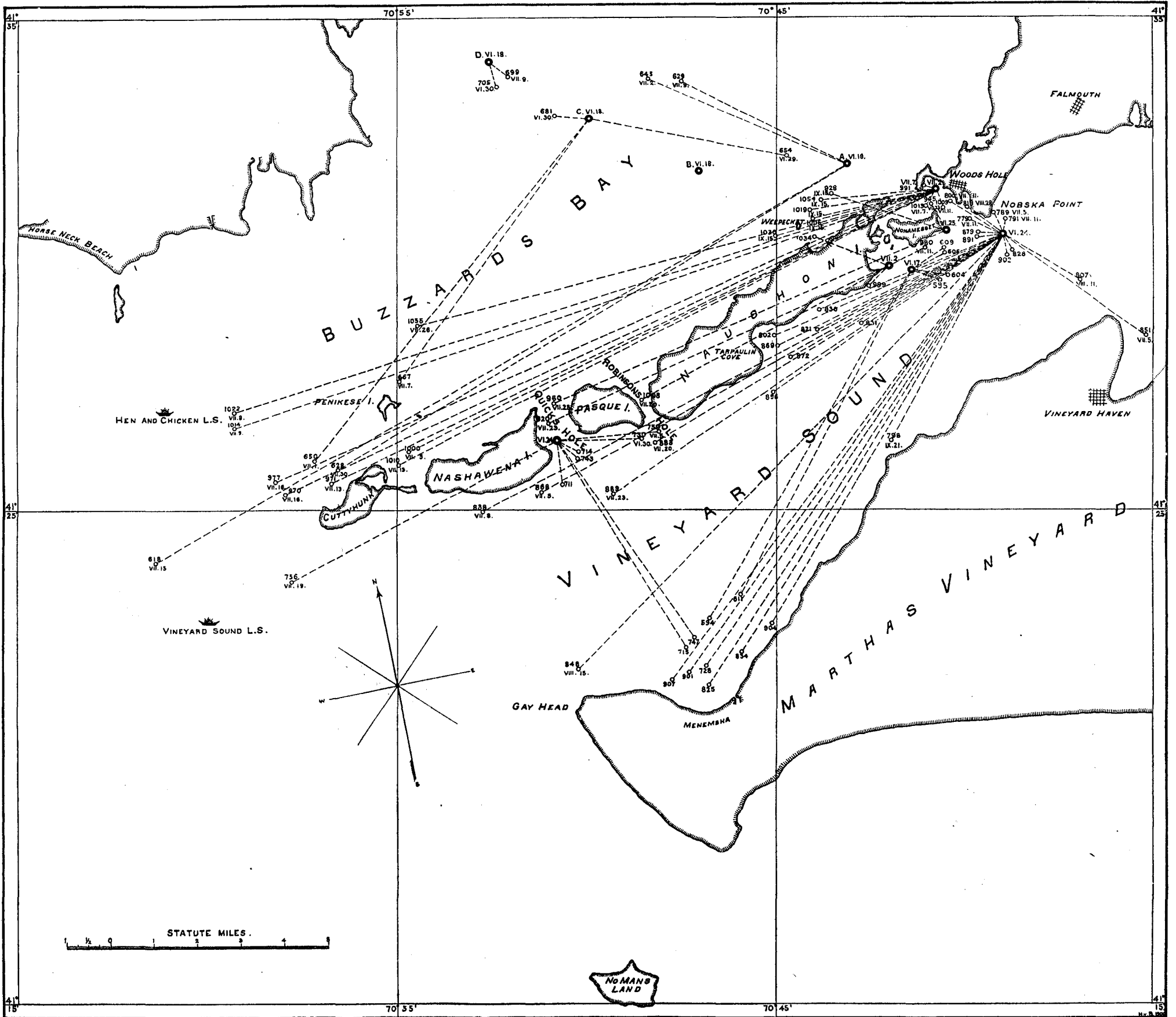
the animals perish from rough treatment received during captivity. It should be remembered that when first captured they are thrown from the pot into the boat, and from the boat into a car, where they may remain several days awaiting the arrival of a smack to convey them to the station. While in the car they suffer from their own belligerency, and when thrown into the well of the smack

and during their journey to Woods Hole not a few perish. Moreover, at the station they are handled several times before they are finally stripped, tagged, recorded, and made ready for their liberation.

But without attempting to make any estimate of the number that reached the market without leaving a completed record, and confining ourselves to the data derived from those that were recaptured, we find that of a total of 479 lobsters liberated, 76 very soon found their way to market. It is therefore evident that, unless the supply of any one locality is replenished, either by immigration or by artificial propagation, the lobster will be exterminated; indeed elimination has actually occurred at certain localities, and there is every indication that before long an industry which has yielded many millions of dollars will have perished through the inexcusable abuses of our fishing privileges.

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MAP OF THE REGION OF WOODS HOLE SHOWING MIGRATIONS OF LOBSTERS.