

XIV.—TRANSPORTATION OF LOBSTERS TO CALIFORNIA.

The following is the report of M. L. Perrin, employed by Mr. Livingston Stone, for the California Fish Commission, in the transportation of live lobsters upon the California aquarium car, June, 1874.—[S. F. Baird.]

The lobsters were procured from Messrs. Johnson & Young's lobster-house, Charlestown-street bridge, Boston, and pains were taken by these gentlemen to give all the aid in their power toward the undertaking. Upon a special car from Boston to Charlestown, N. H., June 3, were packed the 150 lobsters in seven pine boxes $3\frac{1}{2}$ feet long, 15 inches wide, and 15 inches deep. The boxes were divided into two compartments, an upper and a lower, by a partition, making two tiers, and 11 lobsters were placed in each tier, save one. On this trip to Charlestown they were not packed with straw beneath them, but lay upon the wood, with sponges over and around them. We were sorry at the time for this mistake, but from experiments afterward I decided that they were as well situated as if laid upon straw. Six casks of ocean-water, each containing 149 gallons, were obtained that morning and loaded upon the car. Most of the sea-water was put into the two salt-water tanks in the aquarium-car. These tanks were made of hard wood and smeared with a mixture of resin and tallow in order to be water-tight, and during part of the overland journey salt-water fish were in these tanks. One cask of sea-water was loaded, unopened, upon the aquarium-car to be used for the lobsters during the last days of the trip, that from the tanks being used for awhile. The sea-water was obtained outside Boston Harbor, beyond the "Graves," in order that it might be purer. That which had been got two days previously for the same purpose was procured from Nahant, but the aquarium-car not starting that day made it necessary to get some more so as to have it fresh. We procured 35 pounds of sponges, most of which were used in the beginning before many lobsters had died, but afterward were not needed. The sponges were soaked with salt water, and each lobster was completely hidden by the wet sponges. Salt water was poured upon all the lobsters, and all the sponges newly wetted once during the trip to Charlestown. The lobsters were all alive when reaching Charlestown.

At Charlestown, Thursday morning, June 4, the lobsters were taken from the boxes in which they had been brought from Boston and re-packed in boxes without covers, divided by partitions into twelve apartments. The surface-extent of these apartments was just enough to ad-

mit one lobster lying within it—smaller than was well for them. The depth of the apartments was about 6 inches, and the bottoms were bored with an auger-hole to allow drainage. A handful of wet straw was put in each apartment and a lobster laid upon it, then sponges dripping with salt water were placed above and around it until quite concealed from sight and from dry air by this stratum of wet sponges.

There were twelve of these boxes, each containing twelve above-described apartments, placed in the aquarium-car, one upon another, in two piles of six boxes each, against the side of the car. In going over the lobsters twice a day, the boxes were taken down and the sponges were removed from the lobsters one at a time and squeezed over the animal, which, if alive, will respond to it by blinking its eyes and stretching its claws, perhaps moving its body a little. The sponges were then dipped into a pailful of sea-water and wetted again, and were carefully arranged as before about the lobster. Pieces of ice which another person had been breaking up meanwhile were strewn over each box, among the apartments and sponges, to keep cool the water in the sponges and the moisture in the straw and around the lobster. It was slow work, and the lobsters were too much exposed during the operations. Often, after the boxes were piled up again, pailful of salt water were poured over the whole. During the first two or three days only a few were found dead when they were repacked.

At noon, Saturday, June 6, sixty lobsters were put into one of the large salt-water tanks with the striped bass and some other salt-water fish. Into this tank, as into all the others, air was continually forced through hose from the air force-pumps, kept in motion by a band passing around the axle of a pair of the car-wheels. The lobsters in this salt water, the next morning, at Chicago, appeared to be doing very well; but Sunday afternoon the lid of this tank was discovered to have fallen, and upon raising it all the lobsters were found dead. The fish also in the tank were dead. Whether the falling of the lid was the cause of their death, we could not quite decide; but it seemed very probable that it was because the air pumped into the tank after the lid fell, having no means of escape at the top of the tank, exerted a great pressure upon the water and in this way killed them, and also because of the impure air which was confined inside for some time without being replaced by purer. The fact that the fish died also shows that it was some external calamity common to them both. The wooden tanks, the mixture of resin and tallow, though but little, with which the tank was smeared, the number in one tank, and the company with the fish, are also variable quantities whose effects might be discussed relative to this result and also to the result of the experiment which was thus checked. Therefore this case should not be considered a fair experiment and as deciding whether lobsters cannot be transported healthily, in an open tank of salt water, into which air is continually forced, without changing the salt water itself, and kept constantly at a low

temperature. I neglected to mention that upon the top of the tank much ice had been kept and stored; in this way keeping the salt water within the tank quite cold without freshening it and diluting it, which would have been caused by ice put into the salt water to cool it. The death of these sixty reduced the number of lobsters materially.

About this time on, the trip slats were laid upon the two piles of lobster-boxes, and about 500 pounds of ice kept on them, when the lobsters were not being attended to. Lobsters will live well until the fourth or fifth day, but in the present case, if at any time of repacking them I did not find from one-third to one-half of the residue dead each time, I considered it very fortunate. I went over them twice a day; so that if, at every time of repacking, one-third to one-half were to be thrown away, the number of live lobsters would be rapidly reduced, as was indeed the case. Monday, June 8, there were only 20 left alive. Nor is there any regularity in their dying; those treated the most carefully and faithfully die as readily as the neglected; and those handled much live as well as the undisturbed. After the fifth day crowds of lobsters take offense at something, and revenge themselves by dying. The reason of their death was wrapt in mystery. Numerous experiments always failed to bring any regular results, and nothing certain could be gleaned from them. Theorizing about lobsters' chances of life is vain when applied in practice. There seems to be a wide diversity in their constitutions, though unseen and imperceptible. Certain lobsters live well and persistently, while others destined to die beforehand do so irregularly and for an unassignable cause. It is easy to decide whether a lobster is dead. If so, its muscles are all relaxed, and when lifted up, its claws, instead of remaining horizontally out from the body, hang down. This is especially true of the large front claws, but not always of the small ones, which sometimes hang down when the lobster is alive, or are straightened when dead; the front claws, however, are decisive. If, on the other hand, the creature is alive, it will sometimes move its long feelers when the sponge is lifted, and move its claws, and often its body; but the constant as well as sure criterion is that when a sponge full of salt water is squeezed over its head, it will always answer it by blinking or drawing in its eyes, if alive. When lifted it will struggle; but it is a bad plan to raise them, unless necessary, though this is better than to molest and agitate too much, without lifting them, when arranging the sponges or ice about them.

We were using a good deal of salt water, and Monday, the fifth day from starting, it became evident that we had not enough on board for the whole journey. We disliked to use the salt water from the tanks in which fish were or had been; and there was not much of that. Therefore we opened the reserve cask of 149 gallons of unused salt water, and telegraphed the same day to the commissioners of California to

send by freight some Pacific Ocean water to meet us on the route as soon as possible.

Being afraid that the ice which I was in the habit of putting around the sponges and among the apartments was, by its melting and the resultant water, making too fresh the atmosphere with which the lobsters were surrounded, inasmuch as it diluted the salt water, I tried with some the effect of leaving off the ice for a few times. The results were not satisfactory, and proved that omitting the ice was not a good thing; the lobsters would not do as well without it. The coldness gained by using the ice was even more indispensable than the saltness of the water, which of course must be quite necessary. It is not well to use too small pieces of broken ice, because they melt more rapidly; and in order to exert the required influence in producing coldness, the pieces of ice must be so near the lobsters that, in melting as fast as small pieces do, the salt water in and around the sponges becomes more freshened than if larger pieces of ice were used. It is much better that the ice, in either case, should not touch the sponges, if the requisite coldness can be attained without, and if room is abundant; and still better would it be if the ice could be so arranged that, while producing the necessary low temperature, the water resulting from its melting should not mingle with the salt water nor strike anything connected with the lobsters. There can be no doubt but that having as low a temperature as possible is one of the greatest desiderata in the care of lobsters. A refrigerating apparatus would avoid the troubles with the ice spoken of above and be much more effectual than the primitive method followed on this trip. The protection which the ice provided in this case against currents of warm air was not thorough and complete, and great harm was surely done at the places and times where the defense was insufficient; and still more grew out of the fickleness of its protection. Every time the car-doors were opened or the atmosphere around the lobster-boxes disturbed, there inevitably rushed upon them a draught of warm and dry but injurious air, fatal at once to a lobster in case the current strikes it. There must be some medium, as a wide or at least constant stratum of moist atmosphere, to guard the lobster against this destructive air; and at the same time that it would prevent this evil, it should produce the needed low temperature. A refrigerating arrangement would naturally make the care of the lobsters much more convenient as well as more successful. Sometimes when lobsters died I put ice in the apartments left by them instead of upon the sponges of the live lobsters. The dripping of this ice upon the apartments below was not good; but when the lobsters were few in number, I arranged them so that the ice apartments all came under each other, and their dripping did not affect the lobsters. This plan seemed to work favorably for the lobsters. I doubt if it was best to do as was done with the boxes on this trip. Two small sticks were laid across the top of each box before the next was placed upon it. In this way a circulation of

fresh air was secured, but I suspect that other qualities in the air counterbalanced this, and did much harm.

Tuesday, June 9, I took the straw from beneath every living lobster, and packed them all entirely with sponges. The rate of mortality decreased decidedly, and I am inclined to believe that without this change none would have lived to the end. The best way undoubtedly to pack a lobster is with sponges above, around, and beneath it, and also a small one directly under its nose. The straw is quite bad for them to lie upon, because their claws become entangled in it, and it restrains them. This is very bad for a lobster. They should suffer no pressure or restraint. For this reason we were afterward glad that no straw had been used (by mistake as we thought) in their trip from Boston to Charlestown. I also tore out the partitions of several boxes, and found it much better; they were more active when opened, and appeared more healthy. The partitions offer a restraint to them, and are consequently injurious. When in an apartment with partitions, they never staid in the middle, but worked themselves over to one side, and struggled against the wooden partition; in this way tiring themselves out, which is of course an evil. A lobster needs room to stretch all its limbs, if it wants to do so. For this reason they are better in boxes without partitions, provided they are not near enough together to bite each other. Rubber bands around the claws are an extreme case of restraint, and are extremely pernicious. Treated in this way, the animals live only a few days. Struggling is very detrimental to the vigor of a lobster; therefore they should not be restrained; for as surely as they are they will struggle against it, and not violently, but slowly, almost imperceptibly. There is a reacting impulse in the lobster against confinement. Though they do not move much, they need freedom to move, or there is an incentive to struggle. Therefore it would seem, as is truly the case, that, other things being equal, unrestrained lobsters have the best chances for life.

Pressure is as injurious as restraint. Sponges exert but very little pressure upon them, and they can easily move their claws among them. Ice must not cause any pressure upon the animal, nor must it freshen the water—another requirement met by a refrigerating apparatus. To prevent this pressure on the trip, I laid the ice as much as possible across the tops of the partitions and not above the lobsters.

Wednesday, June 10, at Ogden, Utah, we left one pair to be put into Salt Lake. Two very healthy and active lobsters were chosen, to make sure of this attempt, if possible. They were put into a box packed entirely in sponges, and I gave instructions, and some salt water, to Mr. A. P. Rockwood, of Salt Lake City, Superintendent of Fisheries, who was personally to take charge of them. When leaving Utah, Wednesday night, we were reduced to eight lobsters and one pailful of salt water. Extra salt water is needed, not only to prevent the moisture in and around the sponges from becoming too fresh by

melting of the ice, and other causes, but also to wet the sponges with when they become dry. It is a good thing, and quite necessary, often to pour salt water over the lobsters and sponges, without unpacking, in order to give them a change of water. It is well to repack them twice a day; but a liberal supply of new salt water should be poured over them at least once in three hours. The shell of the lobster must always be wet. Not only should the lobster touch nothing else but wet sponge, but it is indispensable also that it should be everywhere in contact with a wet sponge. It must nowhere be bare and exposed to the air, for the water upon its surface will quickly evaporate; and should you see a lobster with a dry spot on its back, you may be sure of its death shortly. A current of warm dry air, if endured even for a moment, is the lobster's worst enemy.

Thursday, June 11, near Beowawe, Nevada, a freight-train met us, bringing from the Pacific Ocean four barrels and four tin tanks of salt water. The water in the tin tanks was of course useless, but the rest was welcome and immediately used. The effect of an abundance of salt water was evident in the appearance of the lobsters. Repacking as often as three hours would be impossible for one person, if many lobsters were taken, and furthermore useless, and, what is a more important fact, which should be avoided; it would disturb the lobster, and if packed entirely in sponge, it would be necessary to lift the animal each time. It is much better to prepare the boxes for thorough drainage, and then pour on a good supply of salt water as often as once in three hours. The ideal condition of a lobster is, unrestrained, very cold, (and evenly so,) constantly wet with salt water, which should not become freshened by any agency, but often changed; and when in as good condition as possible, then disturb them just as little as possible. Lobsters can easily be killed with care.

Upon reaching San Francisco Bay, four lobsters were alive. These were put into the sea at Oakland wharf, Friday afternoon, June 12, nine days after they had been taken from the Atlantic ocean. It would have been better had the commissioners ordered them to be put farther out to sea, where the water was not so warm, and more salty. The four lobsters themselves probably did not live; but two were very full of spawn, and this probably matured. The death of a female lobster does not kill the spawn attached, which may live quite awhile afterward; and if, as in the present case, the spawn reaches again the natural condition of things (of the ocean) in safety, it matters not whether the parent lives. The facts that these four lobsters were females, and that their spawn lived and hatched, show that the eggs of the lobster are impregnated before leaving the female, and not afterward, as is the case with fishes. As a rule the females of lobsters are stronger and longer-lived, under difficulties, than males; and of females, spawning ones are the strongest. Lobsters differ so much in constitution that, in order to succeed in the transportation of say ten animals, one cannot take them and attend

to them carefully, thus bringing the desired result, but many must be taken in order to insure the chances for the safety and success of the ten. It is like throwing a die to bring a certain number: it is ineffectual and useless to throw once and more carefully that time, but many throws must be bargained for to insure success once. In the same way this difference in the constitution, original healthiness, and chances of life, affect the certainty of experimenting.

In order to transport live lobsters, it is without question indispensable to have a special car for the purpose, or at least one which shall run the whole journey. An excellent degree of coldness can more readily be preserved in the undisturbed atmosphere of an aquarium-car than in a constantly shifting express-car. The ice melts less, and the moisture does not evaporate so fast. In an express-car there are no facilities for soaking and drenching the lobsters and for changing the water often upon them by pouring from pails or by means of many devices, which can easily be arranged in a special car. In such a car the water which flows off the lobsters can readily run out of the car or through holes bored in the floor, and that which does not is in no danger of ruining any valuable express-matter. An excellent refrigerating arrangement can be prepared, if to be stationary, and to go from beginning to end with the lobsters. A great deal of room in which to work is very necessary, and cannot be dependent upon the amount of express which happens to be on board. Draughts of warm and dry air, which rush in from the four doors of an express-car, when open to receive or deliver goods at every station, and which, as we have seen, are extremely injurious, are avoided by a special car. Lobsters cannot be packed so as to be transferred at railroad junctions and changes of express companies. They cannot with success be portably arranged, but must be so situated that they can easily be attended to. The impracticability of interrupting the person in charge, when repacking the lot of lobsters in order to prepare for a change of cars, determines at once as infeasible the plan of carrying live lobsters by express. The jarring and disturbance which they would suffer in a few changes of cars would soon end their existence. Furthermore, the transferring of the numerous necessary tools, and especially the casks of salt water, would be a very weighty item.

Though successful in the life of the innumerable spawn which lived and have hatched since deposited in the bay of San Francisco, the effort of this year was accompanied with many results which need not be considered as necessarily attendant upon the transportation of live lobsters; but in order to get a knowledge of these needless evils, and those which are to be avoided, as well as of the means for promoting success, it is necessary once to make the attempt and search them out by experience.

Respectfully submitted.

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