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# GENERAL METHODS FOR STORAGE OF LOBSTERS.

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## GENERAL METHODS FOR STORAGE OF LOBSTERS

Three types of storage unit are used for holding lobsters in Ireland, namely:

(A) Tidal pounds

(B) Recirculation or direct circulation pounds, and

(C) High density units.

A. TIDAL POUNDS. These units are usually large and in their construction, use is made of the natural rock formation on a suitably sheltered coastline. They are expensive to construct because they usually involve massive reinforced and often high walls to fill in the natural rock perimeter. Additional protective fencing is often necessary to prevent unauthorised persons from gaining entry. Tidal pounds can hold large quantities of lobsters, are inexpensive to operate and provided they are lightly stocked with lobsters, may be used for long term storage for sale of the lobsters during the winter when prices are good. However, they have disadvantages also which can be summarised as follows -

(1) Because tidal pounds are dependent on the rise and fall of the tide for renewal of their water supply, packing of the lobsters must be done at low water. This means that lobsters must often be handled at night under artificial light and under other adverse conditions.

(2) Tidal pounds can have little differentiation into discrete areas. Lobsters therefore become very mixed and because of the large area involved, it is difficult to distinguish between lobsters placed in the pound at different times. At the end of the season, in October/November, a thorough search often uncovers considerable quantities of partially hidden lobsters.

(3) Because individual attention cannot be given to the fish, the weak lobsters are often heavily "cannibalised" by the stronger ones.

(4) During neap tides, when the interchange of new water in the surrounding seas may be slight, and the oxygen conditions are poor, there is a grave danger that pounded lobster will suffer from oxygen deficiency. Under these conditions mechanical means for a regular injection of oxygen into the water is not always practicable.

B. RECIRCULATION OR DIRECT CIRCULATION POUNDS. These pounds, which are expensive to construct and operate, have become fairly common in Ireland. They have many advantages over tidal pounds but are not quite so useful for long term storage. Lobsters can be stored in them over the winter, but the quantities so stored are smaller than can be stored in tidal pounds. The main advantages of these pounds are:-

(1) They are usually sited on land above the source of sea water. The sea water is brought direct to them by pumps, and when the tide is out, the water in the pounds may be re-circulated.

(2) In the individual sections of a circulation pound it is not necessary to have a water level of more than 24 inches, and 18 inches is adequate.

(3) Land based circulation pounds are usually designed for short term storage lasting from 2 days to 4 months and because they normally have many internal divisions, it is possible to separate lobsters in them by date of entry, size and weight, into whole and maimed individuals, and to have special "hospital" areas for weak lobsters.

(4) When the oxygen level in the sea water in a circulation pound is inadequate it is possible by the use of special air/water mixers in the inflow pipes to increase it to a satisfactory level.

(5) Packing and handling can be carried out at any time of the day or night, and individual attention can be given to lobsters.

The requirements of lobsters in re-circulation or direct circulation units are as follows:-

(i) a plentiful flow of water,

(ii) a regular low water temperature,

(iii) a good supply of oxygen,

(iv) adequate provision for the separation of large, medium and small lobsters,

(v) protective areas for weak lobsters,

(vi) facilities to thoroughly clean out the sections or "pens" of the pound and remove mud, sand, mucus, dead lobsters, etc.

In order to provide these conditions the following precautions must be taken:-

(a) The pump must be located in a sheltered position where it can be used under all conditions of tide and weather. Clearly the further the pump house is located from its water supply, the greater the pump power required. Even where there is only a gentle slope from the sea to the pump there is considerable friction between the water and the inner face of the pipe. Therefore, the shorter the length of suction pipe used from the sea bottom to pump house, the more efficient and less costly will be the pumping operation. It must be borne in mind that a pump cannot suck up water in the vertical direction to a height of more than 33 feet and, therefore, the smaller the vertical

height between the pumphouse and the suction pipe on the sea bottom, the more efficient and less costly the pumping operation will be. A pump will push water over considerable distances and heights to a storage pound.

(b) A stand-by pump must be available to cover any periods of breakdown of the main unit.

(c) The walls and roof covering of the pound should be well insulated to block or reflect as much of the sun's heat as is practicable. The pound requires plenty of ventilation and the use of transparent or translucent materials should be avoided. It may be necessary to rely on artificial light.

The walls of the various sections of the pound should be rendered in a very smooth finish either in cement or in one of the modern insoluble (in sea water) wall binders. Rough pound walls will cause abrasion of lobster shells with resulting contusion in the tiny blood vessels which are located on the lobster's surface. On cooking, such lobsters will be seen to be dotted with black spots and their value is diminished accordingly. No live lobster should be introduced into a newly constructed pound until the cement or other wall covering has been washed thoroughly many times by sea water. In any case lobsters should not be introduced into a new pound for at least three weeks after its completion.

(d) The corners of each section of the pound should be rounded, not squared. Lobsters are natural seekers of shelter, and the nearest thing to this in a pound will be found at the corners. If the corners are square, the circulating movement of water within the section will be such that there is a minimal carriage

of oxygen into the corners. If therefore lobsters congregate in these corners, they may quickly further reduce the poor oxygen supply there, become weak and often die. There is little tendency for lobsters to gather in rounded corners, which in any case encourage a more efficient mixture of the incoming oxygen laden water.

(e) Direct sunlight should never be allowed to strike any part of the sections of the pound. If a shaft of sunlight penetrates the water, lobsters will try to avoid it and so will tend to crowd into the unlit part of the section.

(f) Each section of the pound should have its own water supply and exit point. In this way it will be possible to cut off the incoming flow of water to a section and to allow it to be completely drained, without interfering with the operation of any other sections.

(g) Where a section has rounded corners, the most suitable entry point for the water is through a single pipe directed at one "corner" of the section. A central drainage point is preferable and quite easy to manipulate, if slightly more difficult to construct.

(h) A good supply of oxygen can be obtained by direct sea water pumping, especially during spring tides. However, during neap tides and during these periods when it is necessary to recirculate the water within the pound, considerable advantage will be found if the water is mixed with air using the venturi technique of forcing air and water together so as to increase the oxygen content.

(i) For recirculation it is necessary to instal a pump of sufficient size to accommodate enough water to be pumped through the pound. The pump can be equipped with a separate release valve, so that all water used during a period of re-circulation may be expelled during direct circulation from the sea.

C. HIGH DENSITY STORAGE UNITS. These units have already been described by Gibson (1962). It is sufficient to say here that the purpose of these units is to store lobsters in urban centres where input and output are fast (of the order of less than 1 month).

## SPECIAL REQUIREMENTS OF LOBSTERS IN STORAGE

The most important factor in successful lobster storage is an adequate flow of water. In a tidal pound the water flow is small but this is in part compensated for by the high ratio of water to lobsters. In a circulation pound it is a false economy to reduce the horse power of the pump to that which will give the minimum water flow necessary for lobster survival. The greater the water flow the better the survival rate of pounded lobsters.

Second in importance to the rate of water flow, are the associated factors of oxygen and temperature. Lobsters take up oxygen in measurable amounts which differ according to temperature. Furthermore, small lobsters are very active and consume more oxygen than large ones. In general the uptake of oxygen is lowest at low temperatures and highest at high temperatures, e.g. the oxygen uptake of a lobster at 21°C is 3½ times that at 5°C. Temperatures of the water in pounds vary from 9°C in the early summer to 17°C in the early autumn. At 9°C a lobster of 1 lb weight will consume 432.00 ml. of oxygen in 24 hours, and at 17°C, 795.00 ml of oxygen in the same period. This range of oxygen uptake shows that the higher the water temperature the greater the

amount of oxygen required by a lobster in order to survive and thrive in a pound. Clearly it is most important that all steps necessary be taken so as to ensure that maximum oxygen conditions are maintained in pounds, particularly in warm weather.

Within the temperature range of 8°C to 18°C, sea water will contain from 9.16 to 7.43 parts of oxygen per million parts of sea water. Pound water which needs to be recirculated within the pound will quickly assume the air temperature inside the building, which is usually much higher than that of normal sea water in summer. It is essential, therefore, to increase the oxygen content of the water in a pound by using a venturi to force air and water together so that the water enters each section of the pound laden with "atomised" air bubbles to ensure the quickest and fullest absorption of oxygen.

The important considerations to bear in mind are that -

(a) the higher the water temperature the greater the uptake of oxygen (per 1 lb body weight of the lobster), and

(b) the higher the water temperature, the lower its natural content of oxygen.

When conditions are adverse, either the pumping rate must be increased or the aeration of the water must be improved. The worst conditions will be met under the following combination of factors:-

(a) Neap tides.

(b) High barometric pressures.

(c) High temperatures.

(d) Heavy stocking of lobsters.

Should the water temperatures rise above 16°C in conditions of high density stocking at periods of neap tides and high barometric pressure, then mortalities on a large scale can occur, and the best remedy is to lower the density of lobsters per section

whilst the adverse conditions last.

Avoidance of copper, bronze and brass in pumps etc: Very small quantities of copper in solution in sea water are harmful to lobsters. Consequently the use of copper or copper alloys, bronze and brass in pumps, pipelines and fittings must be avoided.

## GENERAL CONCLUSIONS

Many problems arise wherever living animals are kept in captivity in densities many hundreds of times greater than they occur in Nature. As to the storage of lobsters in a pound, however, the following general principles may be followed -

(a) An adequate water flow permeating all parts of the pound is essential. Lobsters should receive an adequate supply of well aerated sea water (i.e. 2,500 gallons per ton per hour for sea water at 16°C (see Appendix).

(b) Overstocking of the pounds should be avoided. Densities can be increased in cold weather but must be kept down in warm weather.

(c) All steps should be taken to prevent heating up of the building used for storage, particularly by providing natural ventilation. When sea water temperatures rise above 19°C heavy mortalities may be expected.

(d) Mixing of strong and weak lobsters in the one section of a pound must be avoided. Not only will strong lobsters "cannibalise" weak ones but the remaining dead tissue will be attacked by bacteria, thus using up more oxygen than an equivalent weight of live lobster.

REFERENCES:

Gibson, F.A. (1958). Notes on lobster storage in Ireland Rep. Sea. Inld. Fish. 1958.

APPENDIX

Number of gallons of water, salinity 35 parts per thousand, at selected temperatures required to maintain 1 ton of lobsters in storage at 100%, 75% and 50% oxygen saturation.

| Temperature | | | Minimum gallons of water per hour per ton | | |
|---|---|---|---|---|---|
| | | | At 100% saturation + | At 75% saturation ++ | At 50% saturation +++ |
| C | or | °F | | | |
| 8 | " | 46 | 1,065 | 1,400 | 2,220 |
| 12 | " | 54 | 1,530 | 2,000 | 3,150 |
| 16 | " | 61 | 2,500 | 3,350 | 5,000 |
| 18 | " | 64 | 3,015 | 4,100 | 6,030 |

\+ $O_2$ content unlikely to be at this level unless incoming sea water arises from strong spring tides or is mixed with air and forced through a venturi system.

++ $O_2$ content likely from ordinary spring tides incoming water, with no additional aeration.

+++ $O_2$ content likely during calm, warm, humid weather coinciding with neap tides. Venturi aeration would bring this water up to 75% saturation as above.