

of the cultch reduced to only a small fraction of what it was originally. The longer the cultch is in the water the more this is the case. It is of great advantage to delay planting cultch until the very beginning of the time when it will be useful. To determine this time is the problem.

The time to put out cultch has been and still is largely judged by the results of previous plantings—i.e., by experience. A sort of customary time—about the last of June or first of July—has been arrived at. But this is not equally good for all places. It may be a little late for places to the south or somewhat early for those to the north. Then, again, it is not equally good for all years, for the warm weather of one summer may be considerably earlier than for another. There are other things that may interfere, such as sudden changes of temperature or a heavy fall of rain. It is useful to have in mind some approximately correct time as a reminder that certain preparations should be commenced, but the actual time cannot be foretold with accuracy for any considerable period in advance. It has to be determined for each year and, in fact, for each locality, except where places are near together and under like conditions.

Another way of obtaining information about the time to put out cultch is to open oysters from time to time to find out if they are becoming richer in colour and more swollen with reproductive matter. When ova or sperm are approaching ripeness some may be squeezed from the reproductive openings by lightly stroking the side of the abdomen. If the cells cling to one another in masses they are not yet ripe, but if they separate into individuals they may be fully mature. To be still more certain they may be examined with a microscope and a fertilization experiment may be performed.

Observation of the actual process of spawning can be seldom carried out. It is not a sufficiently conspicuous phenomenon to be depended upon as an indication of the time of ripeness and may slip by without being noticed. I have seen both Atlantic and Pacific oysters in the act of spawning. In the first the very small eggs (or sperm) are expelled with a squirting noise and can be seen as a little white cloud in the water, dispersing as it settles to the bottom. When the oysters are lying on the warm flats instead of being covered with water, the squirt can be heard and seen and the spawn remains as a white deposit on the oyster or other near objects. This phenomenon is, as stated, rarely to be observed, but what can be noted is the occurrence of thin, dark-coloured, spent individuals, that have spawned out, increasing in numbers, while the plump, fresh, healthy individuals, that have not yet spawned, are decreasing in numbers. In the Pacific species the much larger and heavier eggs drop into the gill-cavities and mantle-chamber, where they lie for some days undergoing development, and only pass to the outside when they have attained to some stage of the straight-hinge larva. This is an advantage that the western oyster offers over the eastern, for on opening them the culturist can easily recognize the soup-like spawn lying about the gills. It varies in colour from white through grey to brown, according to the age. The young white eggs are quite motionless, but the late grey or brown larvae are active swimmers, best seen under a lens or microscope.

As long as it was believed that eggs become spawned, fertilized, developed, and set as spat in a few hours (or days), the time of spawning could be accepted as near enough to the time of spatting to be used as a sign for the planting of cultch. As already mentioned, the writer showed that this was a mistake and that it required a month instead of a few hours for the process. The elaborate experiments of Ryder, as well as the simpler ones of Rice, Winslow, Nelson, and others in the United States, could hardly have succeeded against such miscalculation. Any results that were obtained were due to other (earlier) eggs than those counted on. Cultch put out a month in advance of the time when the young oysters will be ready to make use of it will become greatly reduced in efficiency in the meantime. There is no use of going to the expense of time, labour, or money in collecting, preparing, and cleansing cultch for that purpose. Besides, many things can happen the developing young in this period. Of the myriads of eggs spawned at the beginning of the period there may be very few larvae to represent them towards the end of the period. Records of previous plantings, evidence from the appearances of the oysters, ripening of eggs, spawning, fertilization, beginning of development, are all helpful as bits of information, but they are all too far anterior to the setting of the spat to be depended upon. It is evident something more is required.

The only accurate, strictly scientific, and satisfactory method of acquiring the knowledge of when to plant cultch is the plankton method. It begins where the other methods leave off and continues the following-up of the young throughout the period of time that elapses between spawning and spatting—i.e., throughout the month required for the development to the full-grown