A SIMPLE METHOD FOR MONITORING THE SPAWNING ACTIVITY OF FISH IN NET ENCLOSURES

by

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Abstract

A simple method is described for monitoring the spawning activity of fish held in suspended net enclosures. The method, which involves an airlift pump, has been used successfully with the threadfin, *Polydactylus sexfilis*, and has revealed important aspects of the daily, monthly and yearly spawning rhythms of this species. It is suggested that this approach may be useful in studies of *Chanos chanos*.

Introduction

Information on the spawning characteristics of a fish species, particularly the natural spawning rhythm, is extremely useful when methods are being developed for controlled reproduction. Such information, however, has traditionally been difficult to obtain. Catches of reproductively active fish in nature are usually dependent upon chance particularly for species which spawn at sea. Rarely has it been possible to gather enough samples in this way to reveal the small-scale rhythmicity of spawning, such as the exact time of day or time of month when spawning occurs. Confinement of fish in tanks may be useful for small, hardy species, but in the case of fish such as *Chanos chanos* which are very large when sexually mature, confinement in tanks may be extremely stressful, or may require such large tanks as not to be feasible in many instances. Furthermore, certain natural stimuli such as tides are missing in tanks, and restricted or highly directional water flow and the presence of walls may inhibit normal activities.

A large suspended net enclosure is a more natural situation than a tank. Although the latter permits observation of the fish, a net maintains the fish in a natural body of water and allows the free exchange of ambient water. We have found that the threadfin, *Polydactylus sexfilis* (Cuvier and Valenciennes), exhibits its natural spawning behavior when confined in net enclosures. This led to the discovery of a well-defined lunar spawning rhythm in this species and has enabled us to define with some precision the time of day when

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spawning occurs (May, 1976; May et al, MS). To gather this information, we developed a simple airlift egg collector which may be equally applicable to other species such as Chanos chanos which produce pelagic eggs. Without such an apparatus, it may be impossible to tell whether fish kept in nets are spawning, unless frequent biopsies entailing much handling and a good deal of stress are made. While the system described here is certainly not an answer to the problem of controlled spawning, it is a simple means by which the reproductive activity of fish can be monitored in a semi-natural situation. It may also reveal aspects of natural spawning such as lunar rhythmicity, which may be extremely useful in the development of more controlled spawning procedures.

Design and Operating Characteristics

The egg collector consists of two major components: a collecting basket which retains the eggs, and an airlift pump which creates a continuous flow of water from the net enclosure into the basket (Fig. 1). The collecting basket is a commercially available, circular plastic pan with the bottom cut off and replaced with Nitex nylon mesh. Obviously, the mesh size of the Nitex should be smaller than the diameter of the eggs to be collected, but not so small that clogging becomes a problem. In the case of P. sexfilis, which has eggs of 800-825 mm diameter, we use a 500 mm mesh in the collector. The collector is checked once each day by rinsing the contents into a bucket and examining them closely with a microscope at the laboratory. The mesh is cleaned with a brush after each collection to minimize or eliminate clogging. A new collecting basket is installed every few weeks and algae which has accumulated in the meshes of the old basket is removed by soaking in a hypochlorite bath and cleaning with a high-pressure stream of water.

The airlift pump -- which, along with the collecting basket, is buoyed up by a styrofoam float surrounding the latter -- consists of a PVC pipe of 4 cm diameter, fitted with two PVC elbows at the top so that it feeds water directly into the basket. We generally use an intake pipe which is 90 cm long (about one third the depth of the net), but the length can be varied in accordance with the depth of water at which sampling is desired (this may vary eith the fish species and its spawning behavior). Air is supplied by either a compressor or a blower and is introduced through an airstone near the bottom of the intake pipe. We ordinarily use an air source, a compressor connected to an air storage tank which produces a certain cycling in the rate of airflow and hence the waterflow. The latter varies, in our instance, between 10 and 20 liters/minute with a mean of approximately 15 liters/minute.

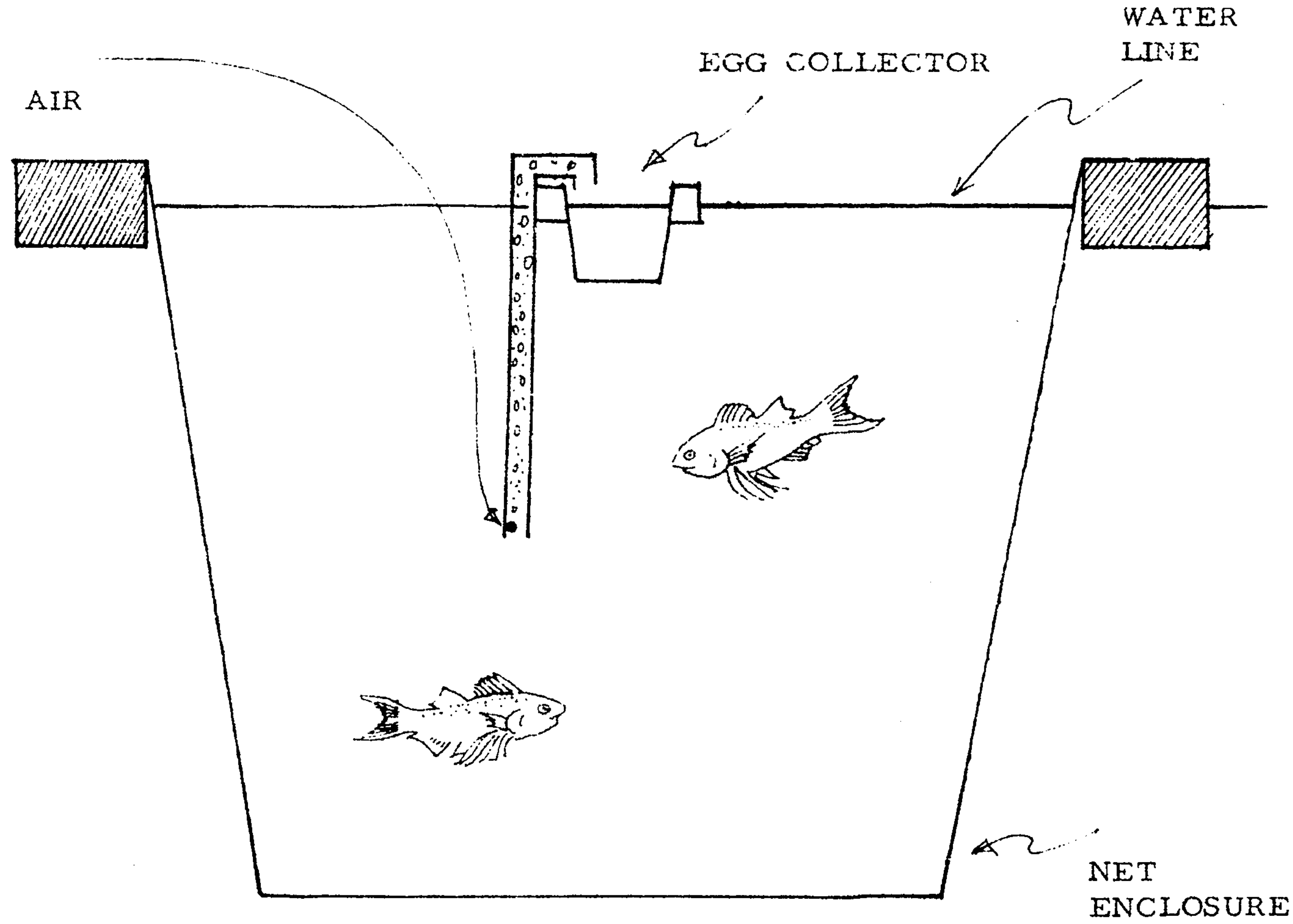

Fig. 1

After having established the time of month when P. sexfilis spawns (May, 1976; May, Akiyama, and Santerre, MS) we looked for a method of determining the exact time of day when spawning took place. For this purpose, we installed a hose in the net enclosure close to the intake of the airlift pump and connected it to a centrifugal pump on board a barge anchored next to the enclosure. In this way, we could pump water from the enclosure into a small collecting basket on board the barge where our activities, shielded from the enclosure by the super-structure of the barge, did not disturb the fish. Continuous visual monitoring of the basket enabled us to pinpoint almost exactly the time of spawning since eggs in the basket were readily apparent to the observer. By employing two observers with synchronized watches, one monitoring the collector and the other observing the fish in the net, it was possible to correlate the production of eggs with certain behavior patterns which were therefore taken to be the spawning behavior of the species (May, Akiyama, and Santerre, in preparation). It should be stressed that, whereas the airlift pump may damage eggs slightly, it nonetheless allows the majority to survive (May, Akiyama, and Santerre, MS). The centrifugal pump kills all eggs and hence is useful only in establishing the time of spawning.

Since the enclosure for the fish is made of netting, only a small sample of spawned eggs is obtained by the airlift collector, the vase majority being lost through the meshes by diffusion and turbulence. The average number of eggs collected by the airlift on peak spawning days was about 20,000 and estimates of the number of eggs released by single P. sexfilis females range from 70,000 to 500,000 (Kanayama, MS; May and Akiyama, unpublished data). Hence, if only one female spawns, the collection efficiency would be between 4% and 29%; if more females spawn on a given day, these figures would be even lower. Based on behavioral observations, we believe that on some spawning days only single females release eggs in our situation but that on other days two or more females may release eggs.

The pelagic eggs of extraneous fish species are occasionally caught by the collector. Usually these are present only in very small numbers, while eggs produced by the fish in the net are obtained by the collector in much greater abundance. Eggs of the species under study can also be distinguished from extraneous eggs by diameter and other morphological characteristics which in many cases are recorded in the literature.

Conclusions

The airlift egg collector here described has proved useful in initial work on controlled breeding in *Polydactylus sexfilis*. It has revealed the monthly spawning rhythm of this species, and a modification involving a centrifugal pump has given precise data on the time of day when spawning occurs. There is every indication that the pattern of spawning displayed by fish maintained inthe net enclosure is the same as that of fish living in nature (May, Akiyama, and Santerre, MS). In addition, the airlift collector has provided eggs which were subsequently hatched and used in studies of larval rearing methods. We suggest that a similar approach may prove valuable in the early stages of investigating controlled breeding in other fishes such as *Chanos chanos* which produce pelagic eggs.

References

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