REARING LUGWORMS FOR FISH BAIT

By John L. Taylor* and Carl H. Saloman*

The lugworm, Arenicola cristata (Stimpson), is a prospect for bait worm aquiculture. It is an excellent bait for sport fishes and has characteristics that suit it well for rearing under artificial conditions. Preliminary experiments show that lugworms can be grown in sediment trays submerged in a sea-water system. In 6 months, 72 worms worth $3.00 were grown in a tray, 39 in. square (1 $m.^2$) by 6 in. (15 cm.) deep, in a 6-in. layer of sand.

At present, the bait worm business depends on digging for two species--the blood worm, Glycera dibranchiata, and the clam worm, Nereis virens. The annual wholesale value of these worms in the United States is $1.3 million, but both species have biological features that make them poorly suited for aquiculture.

This report introduces the idea of rearing the lugworm, Arenicola cristata (Stimpson), for fish bait (fig. 1). This species occurs along the Atlantic, Gulf, and Pacific coasts of the United States, and related species have worldwide distribution in shallow, temperate seas (Wells, 1962). Lugworms and other large sea worms are collected and sold for bait, but to our knowledge none is cultivated for that purpose (Pope, 1961).

Fig. 1 - The lugworm, Arenicola cristata (Stimpson), from Tampa Bay, Fla., reared under artificial conditions for 6 months.

THE SEA WORM BUSINESS

The sea worm business was established in the United States about 1900 and is based on two species of worms collected along the north Atlantic coast--the blood worm, Glycera dibranchiata Ehlers, and the clam worm, Nereis virens Sars (Westman, 1939; MacPhail, 1954; Klawe and Dickie, 1957). These worms supply bait for sport fisheries along the mid-Atlantic states for a variety of fishes that include blackfish, bluefish, kingfish, porgy, weakfish, sea bass, striped bass, and flounders (MacPhail, 1954; Hawkings, 1966; Anderson, 1968).

Worm digging is a part-time occupation for watermen because weather normally limits the collecting season to about 20 weeks between spring and fall. Where worms are abundant, a digger can work about 0.1 acre (400 $m.^2$) of bottom on a favorable tide (about 4 hours) and collect 1,000-2,000 worms worth $20 or less (Ganaros, 1962; Dow, 1964; Dow and Wallace, 1967; Anderson, 1968).

Sea worms for the bait trade come mostly from Maine, where production has grown from 118 thousand pounds in 1946 to more than 1.5 million pounds in 1966 (Dow and Wallace, 1967). Massachusetts and New Hampshire together market 100 thousand pounds of worms annually, and a small quantity is imported each year from the maritime provinces of Canada. Fishery statistics for the United States show that in 1965 blood worm production totaled 776 thousand pounds and clam worm production 809 thousand pounds.

* Fishery Biologists, BCF Biological Laboratory, St. Petersburg Beach, Florida 33706.
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Wholesale value of both species that year amounted to $1.3 million (Lyles, 1967). Blood worms wholesale for about $1.00 per pound (100 worms), and clam worms sell for about 60 cents per pound (50 worms). On the retail market, however, blood worms sell for as much as $3 per pound, and clam worms bring about $1.25. At these prices, marine bait worms are one of the most valuable products from the sea (Dow, 1964; Hawkings, 1966; Dow and Wallace, 1967).

Pope (1961) suggested that the culture of marine worms would have many advantages over digging them from tidal flats. It would be necessary to develop techniques to make sea worm farming as profitable as the highly successful practice of growing earthworms as a bait for freshwater fishes. A number of problems, however, face the prospective sea worm farmer.

PROBLEMS OF SEA WORM AQUICULTURE

The main difficulty in rearing sea worms is the procurement of enough young worms for farm stock. Blood and clam worms, like most other marine worms, spawn in the open sea where their young are dispersed by tides and currents. The problem is amplified because the juvenile worms require a special diet of plankton that would be difficult to furnish even if they could be obtained by induced spawning under artificial conditions, or by other means. Other factors that prospective growers would need to consider include choice of a seawater system (Clark and Clark, 1964; Parisot, 1967; Fuss and Kelly, in press), site location, capital investment, operating costs, marketing channels and, of course, potential profit.

THE LUGWORM-- A BAIT WORM FOR AQUICULTURE

The lugworm, Arenicola cristata, is good bait for a number of fishes. It has biological characteristics that make it better suited for aquiculture than blood and clam worms, or other sea worms that produce free-swimming larvae. Furthermore, preliminary rearing experiments indicate that engineering and economic aspects of lugworm aquiculture present no serious problems.

In Tampa Bay, Fla., A. cristata is dug in intertidal areas as a fish bait for private use, and occasionally small lots are sold by bait dealers for 50 cents per dozen. On productive grounds, 150 to 200 lugworms can be dug during a low tide. The worms keep well and stay alive for 2 or more weeks in a submerged bait bucket. The lugworm is regarded by local fishermen as an excellent bait for sheepshead, Archosargus probatocephalus (Walbaum), spotted sea trout, Cynoscion nebulosus (Cuvier), red drum, Sciaenops ocellata (L.), and black drum, Pogonias cromis (L.). Lugworms are large enough so that several hooks can be baited by sectioning a single worm, and the tough skin holds a hook well. Fishing trials by a local fisherman[1/] showed that as many as 40 sheepshead can be caught on 10 lugworms.

The foremost characteristic that makes A. cristata well suited for aquiculture is its mode of reproduction. Eggs are fertilized in the female burrow and pushed out in a jelly-like capsule that is anchored to the burrow by a short stalk (fig. 2). Larvae develop inside the capsule, emerge after several segments have developed, and then dig into the sediment. Young worms, therefore, can be collected by simply gathering egg capsules from tidal flats where they have been deposited.

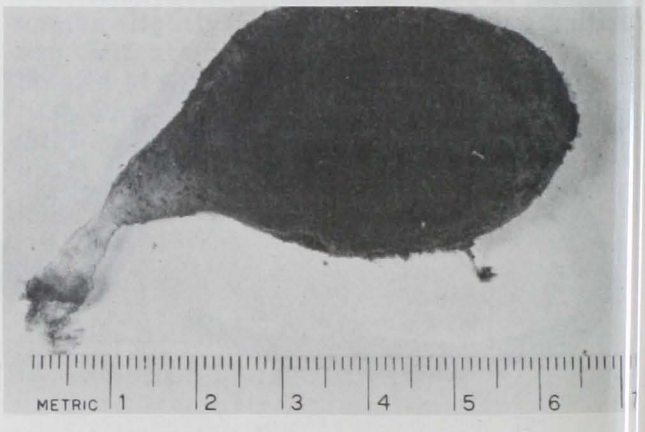

Fig. 2 - Egg capsule of the lugworm, Arenicola cristata (Stimpson), from Tampa Bay, Fla.

Feeding habits of the lugworm are also suited for aquiculture. Embryos are self-sufficient inside the egg capsule and, after hatching, the worm feeds on mixed organic detritus available in sediments. Other advantageous features of lugworms include rapid growth, tolerance of low dissolved oxygen, a sedentary habit, and tolerance to crowding.

REARING LUGWORMS

The first rearing of lugworms was accidental. In September 1966, 12 large specimens

1/L. W. Clay, 4916 Camellia Way, South, St. Petersburg, Fla. 33705.

were discovered in trays of sediment that had been submerged for 1 year in holding tanks of an experimental seawater system. The trays contained transplants of sea grasses; apparently, young lugworms had been introduced to the trays attached to plant sprigs. Sand and gravel in the trays came from a building supply yard, and the seawater system was equipped with a filtration system that eliminated plankton and other particulate material. Filamentous algae also entered the tanks on sea grass leaves and became established on the walls. It provided food for the worms when fragments sloughed off and accumulated on sediment in the trays.

The second success at rearing lugworms was by design. On June 15, 1967, a plywood sediment tray, 39 in. square and 12 in. high (1 m.^{2} by 30 cm. high), was filled as before with a 2-inch (5-cm.) layer of small river gravel covered by 6 in. (15 cm.) of white sand. The bottom of the tray was perforated and covered with fine plastic screening to allow water circulation through the sediments. The tray was submerged in a holding tank that contained a good growth of algae, and a lugworm egg capsule from Tampa Bay was added. The egg capsule contained thousands of embryos--enough to produce a lugworm population that would be limited only by available food and space.

When the tray was raised on November 11, 1967, 72 lugworms were recovered from the sand-layer of sediment. Whole wet weight of the worms was slightly over 1 lb. (462 grams) and average length was 6 in. (15 cm.). On the basis of the local retail price of 50 cents per dozen, the lugworms produced in less than 6 months were worth $3. If two crops of lugworms could be produced in 12 months, yearly production on an area of sediment 39 in. square (1 m.^{2}) would be about 2 lbs. of worms worth $6. Whether or not such a return warrants the expenditure that would be required to establish a commercial enterprise has not been demonstrated. Results of our attempt to culture lugworms are encouraging, however, and the possibility is good that a practicable method can be developed for rearing them on a commercial scale.

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