Investigating the Role of Algae in Tilapia Production

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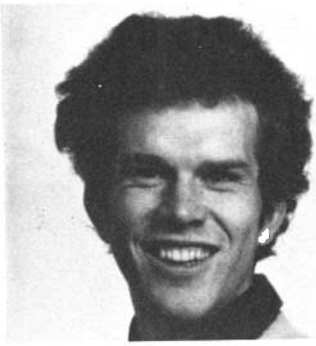
Evidence for the role of algae as food in tilapia production is contradictory and typifies a general uncertainty about the importance of the algae-to-fish food pathway in aquaculture. Viewpoints regarding the importance of algae cropping by fish reflect this uncertainty. Some aquaculturists believe that the commonly cultured tilapias harvest algae inefficiently, eating only about 10% of the total net algal production, and that this feeding pathway is already fully exploited by current practices of promoting algal blooms with inorganic fertilization of ponds. Others, believing the algal feeding pathway for tilapia to be efficient, recommend its application, even as a biomass recovery method in algal biomass ventures.

The joint ICLARM/AIT project is attempting to resolve these opposing positions by field measurements of algal production and its incorporation into fish.

The central problem for tracing the algae-to-fish food pathway is to measure the correct net algal production rate within fish ponds. Measuring the net production is complex because of the removal of algae by fish and zooplankton grazing and by cell death which occur simultaneously with algal growth. The approach taken is to quantify oxygen transformation in sun-lit culture tanks—exchange at the air-water interface, concentration changes during the light and dark periods, and oxygen consumption by fish—and to convert these data to a carbon budget. The procedure is similar to the light-dark bottle method familiar to biologists, but records carbon changes throughout the culture tanks and on a 24-hour rather than on a daylight basis only.



A joint project between ICLARM and the Asian Institute of Technology (AIT), Bangkok, began in 1983 to determine the effects of water quality factors on fish yields in a variety of waste-fed aquaculture systems, such as manured ponds, and sewage- and waste vegetation-fed ponds. A second goal is to investigate the chemical and biological basis of fish production in waste-fed aquaculture systems, concentrating initially on the tilapias.

Dr. John Colman, an ICLARM scientist, is based at AIT for this project. He receives funding from the Rockefeller Foundation as a Postdoctoral Fellow. Dr. Colman has extensive experience in aquatic chemistry and pollution in Thailand.

A computer program was developed to process the large amount of data generated by the daily oxygen measurements. The program provides the following parameters: algae produced (no subtraction made for consumption by bacteria and zooplankton); total carbon produced (includes carbon of algal and of fertilizer origin); and net carbon produced (subtractions are made for water column and benthic respiration of carbon by organisms other than fish).

During the initial experimental period, three 4-m^3 tanks stocked with *Oreochromis niloticus* (5 fish/m^2) and fertilized with both inorganic and organic materials were monitored for 64 days. The results showed that the conversion ratio to fish flesh from the net input of organic materials to the food chain (both algae and added organic fertilizer) averaged 2.0 (dry weight organic material to fresh weight fish basis). Furthermore, a comparison of total and net carbon inputs showed that very little of the algal production (about 5%) could have been converted to bacteria or zooplankton biomass before being consumed by fish. Carbon availability to the fish was evenly divided between algal and fertilizer sources. Thus, the preliminary indications are that both algal and fertilizer organic carbon (septage in this experiment) were efficiently extracted from the water and assimilated by the fish.

Fish yields from the tanks were high, equivalent to 58 kg/ha/day, but net algal production was low, about 4 g/m^2/day, dry-weight basis. Future research is planned to confirm the initial results. In addition, investigations are being made to determine whether algal production rates in fishponds can be increased to levels obtained in algal biomass production (20-25 g/m^2/day) while maintaining a low food conversion ratio. If so, substantial increases in fish production would be realized. ●

Harvesting tilapia from concrete experimental ponds at the Asian Institute of Technology, Bangkok.