Relationships Between Aquatic Plants & Reproduction of Fishes

Aquatic plants have long been associated as probably the most influential factors in fish ecology. The direct and indirect influences plants have on the reproduction of fishes was long overlooked, however, in discussion of the ecological contributors towards the success of fishes.

PLANTS AS SPAWN INDUCERS

Ethologically fishes are involved in a number of stimulus-response reactions that lead directly to the act of spawning. One of the stimuli that may be involved is the presence of a particular flora. The action of plants as triggers in spawnings does not seem to be a well studied area. Comment on just how and where the visual perception of vegetation fits into the sequence of events leading to spawning seems to be lacking. It seems evident that such a relationship must exist at least in some fish in that certain species will not spawn in the abscence of plant life. Many species actively seek out plants to reproduce in, (such is the case with many Cyprinidae).

Another area of spawn induction by plants is chemical in nature. This is more important in the still water fishes than in stream dwellers. Decaying aquatic vegetation is responsible for the release of many organic substances in the water some of which influence the gonadal development of fishes. These are gonatropins, and certain fish reared in water devoid of these hormones never develop mature sex organs (Scheel).

Oxygen content of the water may influence the breeding of some species such as those in the genus Corydoras. The relationship between plants and O_2 in a body of standing water is self evident.

AQUATIC PLANTS AS SPAWN RECPTACLES

The roles of aquatic vegetation as receptacles for the eggs of fish could perhaps be catagorized in two ways, one in which the plant remains unmodified by the spawning fishes and another catagory in which the plant is in some way transported or modified.

Those plants that remain unchanged are usually receptacles for egg scattering species of fishes. These fish, (cyprinids for example) swim into or over the clumps of plants such as Elodea or Vallisneria and randomly scatter the eggs in furious bursts. This often takes place in such shallow water that the backs of the fishes break the surface. The closer the spawning occurs to the edge of the water, the less chance that other species will venture to that depth to devour the eggs. The plants in which the eggs settle serve several purposes. The most obvious is the role of hiding the eggs from the predation of other fishes. Fine leafy plants such as Myriophyllum serve this end well. Another form of protection is when the plants prevent the eggs from drifting out into the depths of the body of water, by diffusing the action of the waves and current near the shoreline. Those species of fish that lay semi or fully adhesive eggs are well benefited by plants in that they anchor their eggs onto the leaves. This prevents the eggs from falling to the bottom where they are more subject to be eaten by small invertabrates.

Relationships Between Aquatic Plants & Reproduction of Fishes

Aquatic plants have long been associated as probably the most influential factors in fish ecology. The direct and indirect influences plants have on the reproduction of fishes was long overlooked, however, in discussion of the ecological contributors towards the success of fishes.

PLANTS AS SPAWN INDUCERS

Ethologically fishes are involved in a number of stimulus-response reactions that lead directly to the act of spawning. One of the stimuli that may be involved is the presence of a particular flora. The action of plants as triggers in spawnings does not seem to be a well studied area. Comment on just how and where the visual perception of vegetation fits into the sequence of events leading to spawning seems to be lacking. It seems evident that such a relationship must exist at least in some fish in that certain species will not spawn in the abscence of plant life. Many species actively seek out plants to reproduce in, (such is the case with many Cyprinidae).

Another area of spawn induction by plants is chemical in nature. This is more important in the still water fishes than in stream dwellers. Decaying aquatic vegetation is responsible for the release of many organic substances in the water some of which influence the gonadal development of fishes. These are gonatropins, and certain fish reared in water devoid of these hormones never develop mature sex organs (Scheel).

Oxygen content of the water may influence the breeding of some species such as those in the genus Corydoras. The relationship between plants and O_2 in a body of standing water is self evident.

AQUATIC PLANTS AS SPAWN RECPTACLES

The roles of aquatic vegetation as receptacles for the eggs of fish could perhaps be catagorized in two ways, one in which the plant remains unmodified by the spawning fishes and another catagory in which the plant is in some way transported or modified.

Those plants that remain unchanged are usually receptacles for egg scattering species of fishes. These fish, (cyprinids for example) swim into or over the clumps of plants such as Elodea or Vallisneria and randomly scatter the eggs in furious bursts. This often takes place in such shallow water that the backs of the fishes break the surface. The closer the spawning occurs to the edge of the water, the less chance that other species will venture to that depth to devour the eggs. The plants in which the eggs settle serve several purposes. The most obvious is the role of hiding the eggs from the predation of other fishes. Fine leafy plants such as Myriophyllum serve this end well. Another form of protection is when the plants prevent the eggs from drifting out into the depths of the body of water, by diffusing the action of the waves and current near the shoreline. Those species of fish that lay semi or fully adhesive eggs are well benefited by plants in that they anchor their eggs onto the leaves. This prevents the eggs from falling to the bottom where they are more subject to be eaten by small invertabrates.

The eggs of fishes in dense growths of plants are further benefitted by a more favorable hydrochemical enviornmen (Nikolsky 1963). Both live and dead plants help in this way. The release of nitrates has a definite effect on the pH of a body of water. When decaying plants release their nitrogenous organic compounds the water around them becomes soft and acidic. In moderation this condition is necessary for the reproduction of many tropical and sub-tropical fishes. *

The other common utilization of plants by nondestructive methods occurs when some fishes deposit their eggs in nests that are hidden in thick growths of plants.

Under another catagory we find plants that are modified by the fish in some way in order to facilitate a spawning site or nest. Some fishes such as the Cichlids and the Centrarchids remove plant material from the spawning site in order to produce a more sterile enviornment for their broods. Not only decaying vegetation, but also large rooted plants are removed from the area in maticulous fashion by these intelligent fish. Other nest builders assume a more positive relationship with aquatic plants. Probably the best documented case is that of the sticklebacks (Gastersteoidea). These relatives of the seahorses carefully select and dislodge the appropriate plants and weave them into a cylindrical nest in which spawning and early rearing of the fry occurs. The family of Anabantids or labyrinth fishes also use bits and pieces of plants to weave into a thick mat of bubbles that the male forms at the surface of the water. Amia calva, the bowfin, is reported to build some type of nest utilizing plant materials (Nikolsky 1963).

ADVERSE AFFECTS OF AQUATIC PLANTS ON FISH REPRODUCTION

There is usually a definite competition that takes place in an aquatic community between the algal and rooted plants for available space and nutrients (Bennett). The balance between the two is delicate and the addition of excessive nutrients to the system favors the overpopulation of the Phytoplankton. Algal blooms occur and have definite adverse affects on fish populations and their reproduction. The dense mats that are formed by the blooms shade the bottom and eliminate the slower growing rooted vegetation. Aside from the erradication of floral spawning sites, direct effects on the adults, eggs, and juveniles occur. The introduction of toxins by the following genera of Cyanophycae is responsible for many lake and pond fish kills: Aphanizomenon, Anabena, Nodularia, Coelosphaerium, and Glaeotricha (Bennett 1963). Thick blankets of filamentous may also form. Pithophora, Rhizonium, and Hydrodictyon may form blankets that entirly cover large bodies of water.

According to Bennett, "There is evidence that dense stands of submersed rooted aquatic plants may bind up nutrient materials throughout the growing season so that they are not available for production of phytoplankton and the organisms that feed upon phytoplankton." This means that although fish hatches would be large, the chances for larval survival would be greatly diminished. The table at the end of this paper shows the data supporting

---

* There is evidence that CO_2 has influence on the enzyme hatching mechanism of the killifishes which lay eggs directly on the plant.

this. Potomogeton foliosus and P. nodosus were the plants involved in this case.

In relation to fishing lakes and ponds, over-production of plants is usually frowned upon by management and fishermen. The survival rate of fishes beyond forage size is inversely proportional to the size of the fishes that reach maturity.

A few aquatic plants are predacious on the fry of fishes. The most common of these is probably the bladderworts (Utricularia) (Rodinova 1959). The plant Aldrovandia also utilizes the fish larvae as a source of nutrients. "The leaves of Aldrovandia fold together to form a chamber, the interior of which is covered with hairs. When these hairs touch an animal the leaf claps together and the animal is caught." (Nikolsky). These plants also reduce the amount of planktonic crustaceans in the water around them and thus decrease the chances for larval survival by removing one of it's major food sources.

Bibliography

Bennett, G. W. (1962) Management of Artificial Lakes and Ponds. New York, Reinhold Publishing Corp.

Nikolsky, G. V. (1963) The Ecology of Fishes. New York, Academic Press.

Rodinova, L. A. (1959) The feeding of bladderwort on animals. Papers for Higher Schools, ser. Biol. Sci. no. 3.

Scheel, J. (1968) Rivulins of the Old World. Jersey City, New Jersey. T. F. H. Publications Inc.

Other Information Sources

Breder, C.M. and Rosen, D.E. (1966) Modes of Reproduction in Fishes. Garden City, New York. Natural History Press.

Burroughes, R.D. (1973) The Sticklebacks. Tropical Fish Hobbyist Vol. XXI, no. 9.

Gerking, S.D. (editor) (1966) The Biological Basis of Freshwater Fish Production, New York, John Wiley & sons, Inc.

Hall, G.E. (editor) (1971) Reservoir Fisheries and Limnology. Washington D.C., American Fisheries Society.

* Table From Bennett

Year	Yield		Area of Open Water Not Filled with Vegetation		Net-Fishing Intensity		Angling Intensity	
	Pounds	Per Cent of 1939 Yield	Acres	Per Cent of 1939 Area	Net-days	Per Cent of 1939 Net Fishing	Man-hours	Per Cent of 1939 Angling
1939	223.4	100.0	1.25	100.0	92	100.0	27.0	100.0
1940	200.2	89.6	0.95	76.0	182	197.8	36.3	134.4
1941	129.9	58.1	0.64	51.2	330	358.8	42.3	156.7