INCUBATION OF BENTHIC EGG MASSES

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EXTENDED ABSTRACT ONLY – DO NOT CITE

Pelagic eggs must be incubated with water flows that maximize respiratory exchange across the chorions of all individual eggs. For benthic egg masses, in which the eggs adhere to each other and in some cases to the substrate as well, water flows may be restricted by points of chorion attachment as well as by egg mass morphology and attachment site geometry. Optimal egg incubation requires that flows pass individual eggs equally.

For Pacific herring (*Clupea pallasi*) it has been shown that poor flows which cause egg mortality will result in chronic developmental retardation among those larvae which do survive to hatch from "overspawned" egg clusters (Marliave, 1995). Herring tend to prefer spawning substrates that minimize clumping of spawned eggs, which in turn maximizes percent hatch as well as viability during larval stages.

With lingcod (*Ophiodon elongatus*) the territorial male chooses a boulder or crevice which tends to deflect tidal currents or prevailing wave surge in such a way that flows through the egg mass are maximized. Giorgi (1981) demonstrated that nesting sites with inadequate flows for incubation result in high levels of egg mortality. In a laboratory situation, creation of a venturi effect is required, by means of placing baffles against the egg mass, so that currents flow through the egg mass rather than around it.

Another aspect of incubating benthic egg masses involves protecting the embryos from mechanical or other stimulation near the time of hatching, so that hatching enzymes are secreted gradually, as the embryos approach optimal development for hatching. Post-hatch survival data for lingcod which hatched from undisturbed embryos showed over 60% survival at 5-d post-hatch versus under 20% survival among larvae from a stimulated hatch (Marliave, et al., 1987). Forced hatches tend to show very high mortality prior to yolk resorption.

The wolf-eel (*Anarrhichthys ocellatus*) also spawns under boulders or in crevices, but the spherical egg mass does not adhere to the substrate. Parents wrap their bodies around the eggs to hold them in place. In a laboratory situation, the same type of baffle system to create a venturi effect can be used to optimize egg incubation. The techniques of venturi incubation and undisturbed hatch, together with a newly available frozen copepod food, have resulted in the licensing of wolf-eels for commercial growout in the BC aquaculture industry.

Incubation of benthic egg masses should yield a hatch of virtually all eggs and the larvae should show high survival through yolk resorption in order to have reasonable expectation of robust growth and survival through to adult size. It is not fair to say that, if they hatch, they hatch; rather, it must be expected that suboptimal egg incubation will result in chronic detrimental impacts on feeding and swimming behavior, as well as on growth and survival.

A point-source of flow from a pipe in a tank, even at high velocity, cannot equal the total energy of a uniform tidal flow in nature. Furthermore, turbulent, point-source inflows will tend to cause current around an egg mass rather than through it. For these reasons, it is necessary to restrict flow direction with baffles or inside a pipe, so that seawater is forced through the interstitial spaces between the eggs within an egg mass. This incubation system is best set up within the intended tank for larval rearing, in order that the egg mass can be allowed to reach hatching without any mechanical disturbance.

References

Giorgi, A.E. 1981. The environmental biology of the embryos, egg masses, and nesting sites of the lingcod, *Ophiodon elongatus*. Proc. Rep. 81-06, NWAFSC, NMFS, NOAA Seattle. 107 pp.

Marliave, J.B. 1995. Developmental retardation of Pacific herring larvae hatched from overspawned, low-viability eggs. In: Hay, D. and P.B. McCarter., eds. Proceeding 7th Pac. Coast Herring Workshop. Jan. 27-28, 1994, Vancouver, B.C. Can. Tech. Rep. Fish. Aquat. Sci. 2060:197-205.

Marliave, J.B., S.J.D. Martell, D.I. Kent and H.L. Blankenship. 1997. Propagation and Transplanting of lingcod (*Ophiodon elongatus*). (abstract only). World Mariculture Society, Seattle. p. 308.