

DISCUSSION OF SESSION 2

Recorded by C.A. Hair and C.A. Gray

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Each panel presentation was followed by a time for questions, after which the session was opened for General Discussion.

Following *Paul Brown's* panel presentation Jim Tait asked how closely the succession of plankton recorded in ponds paralleled that in the wild. Peter Gehrke replied that it was fairly similar but you generally see a greater diversity of plankton in and between isolated billabongs than in ponds. Jim Tait then asked if breeding of native freshwater fish was aimed to coincide with any particular environmental cue. Paul Brown said he would be looking at this more closely next year. Stephen Battaglione added that golden and silver perch are both cued to spawn on floods, and floods increase the flood plain and presumably the amount of food and space available to larvae.

Campbell Davies wanted to know from *John Burke* whether larval bass are stocked back into the same stream from which the broodstock were collected. John Burke indicated that most stocked bass came from broodstock collected from the Noosa River System. He added that electrophoretic studies of bass from different drainages have not been quite completed, but seem to indicate there is not a lot of variation in stock from stream to stream.

John Glaister questioned *Bill Talbot* as to whether the 'Texas method' of using naturally occurring plankton in ponds with red drum had been tried with bass. Bill Talbot replied that this

was tried initially with bass of various ages but they grew slower and there was higher growth and survival in ponds supplemented with *Artemia*. He pointed out that in brackish water ponds, unlike freshwater ponds, it is harder to get good pond preparation and you must make sure that you are getting food to the larvae during early development. Hence the value of supplementary feeding. Stephen Battaglione referred to the fact that in Texas, red drum larvae are stocked into ponds as yolk-sac larvae, and while this has also worked for barramundi it has not worked with bass. He suggested that this may have something to do with differences in the succession of plankton in summer ponds used with barramundi and red drum versus winter ponds for bass. He also pointed out that yolk-sac larvae may be less tolerant of poor water quality in under-prepared ponds.

The process of initial swim bladder inflation was suggested by Stephen Battaglione as another possible reason for the low survival of yolk-sac bass larvae stocked into ponds, in particular the role of light was mentioned as inhibiting inflation. Iain Suthers asked whether the larvae have to gulp air at the surface to inflate their swim bladders. Bill Talbot said this was the case with bass and that a surface skimmer to take the oil off the top of the water surface increased swim bladder inflation rates in intensively reared bass. Other species which have similar inflation mechanisms were then mentioned and included golden perch, snapper, striped bass and European

sea bass. Stephen Battaglone emphasised that factors influencing swim bladder inflation were species specific.

Jim Tait wanted to know from *Peter Gehrke* whether any studies had looked at the physiological cost of larvae having to regulate trace metal concentrations. Peter Gehrke was not aware of any such studies.

Following *Frances Ruwald's* presentation, Maria Milicich asked what wild zooplankton had that rotifers and *Artemia* did not. Frances Ruwald suggested it may be essential fatty acids. The general aim of the striped trumpeter program was then discussed. Frances Ruwald hoped that ultimately striped trumpeter will be farmed in the same way as Atlantic salmon are today and highlighted the almost total lack of information available on the species.

Nigel Preston suggested that there was an opportunity to put larvae in enclosures and examine their diet. Frances Ruwald mentioned some early pond trials which had been run to look at natural diet. There was then considerable discussion on the value of enclosure studies to determine what larvae ate in the wild. Bill Talbot doubted that the density of food would be high enough in enclosures for larvae to survive. Stephen Battaglone supported these remarks by pointing out the patchy nature of food in the wild and the very low survival rate of larvae in the wild. The value of extensive larval rearing as a means of determining what larvae may prefer to eat was then discussed. Peter Doherty made the point that marine fish larvae in a laboratory may require high densities of food, but this was not necessarily the case for larvae in the wild, a view shared by Mike Sinclair. This point raised considerable discussion.

In general the aquaculture representatives thought food density was a critical factor determining survival in reared larvae and extrapolated this to the survival of larvae in the wild. Mark M^cCormick spoke about experiments with juvenile goat fish where two different types of net enclosures were tried in a very high current

area. He thought this would ensure a large quantity of zooplankton but the fish were starving within ten days. He indicated that the larvae in the laboratory also starved within ten days and questioned the use of cages with young larvae (<20 days).

Iain Suthers mentioned the problem of determining what a larva eats from its stomach contents, particularly things like rotifers. Bill Talbot who has looked at the stomach contents of bass larvae explained that the lorica of rotifers usually stays intact. Frances Ruwald indicated that no work had been done on striped trumpeter larvae in the wild.

Iain Suthers wanted to know whether tropical fish larvae were starving because of high water temperature? Mark M^cCormick said no – and the temperature was about 26-27 °C.

Mike Sinclair asked *Martin Daintith* why the whitebait fishery declined. Martin Daintith replied that it was due to overfishing and had been very slow to recover.

The *General Discussion* on Session 2 commenced with debate on the importance of swim bladder inflation as a possible factor influencing larval mortality. Aldo Steffe thought swim bladder inflation was very important as an energy conservation mechanism at night and pointed out that different species have different inflation strategies depending on where they are in the water column. Stephen Battaglone asked whether there was a diurnal pattern to swim bladder inflation. Aldo Steffe said there are two main patterns; some fish have totally deflated swim bladders by day and inflate by night, the others have inflated swim bladders both day and night but increase the volume of their swim bladders at night.

Johann Bell asked whether nutrition affected swim bladder inflation in reared larvae. Stephen Battaglone replied that some recent studies have linked high levels of highly unsaturated fatty acids (HUFA) and thyroid hormone to improved swim bladder inflation rates. Aldo Steffe discussed the phylogenetic principle that

more primitive fishes have a connection from the swim bladder to the alimentary canal throughout their entire life. The more advanced fishes have the connection only in early life, flat fishes have no swim bladder, and some fish have developed a closed gas gland.

Barry Bruce wanted to know whether snapper needed to go to the water surface to inflate their swim bladders and suggested that turbulence might affect larval mortality. Stephen Battaglène replied that reared snapper had similar requirements to bass with regard to inflation; only the strongest larvae are probably capable of swimming to the water surface.

Peter Doherty asked the panel if they had any advice on appropriate measures to determine larval fitness. Stephen Battaglène suggested stress tests. John Burke described stress testing as a useful tool and listed air exposure, salinity shock and temperature shock as tests which appear in the literature. He mentioned that these techniques are not commonly used in Australia. Stephen Battaglène mentioned the shortcomings of using larval length as an index of condition. Iain Suthers asked if larvae were more fragile to handling at various stages in their development. Stephen Battaglène said this was the case with larvae he had reared and cited studies with sea bream and sea bass in France which showed that larvae are most delicate during weaning from live food to pellets.

Peter Gehrke put up a slide of the daily ration of food in relation to prey density. He cited a study by McKenzie where the critical prey density was around 180 mg per litre of prey. He pointed out that no matter how much you increase the prey density above this point there was no apparent effect on daily ration. He went on to explain that at NSW Inland Fisheries Research Station (IFRS) they aimed for about 3000 mg of prey per litre, not to have a large amount of prey at the start of a trial but to ensure enough food was available by the time they harvest some 3 months later. He suggested the energetics, prey density, and foraging ability of

larvae are important considerations when examining the question of food limitation.

Stephen Battaglène said that larvae in a tank often band together in a very tight mass, and wondered if this was the case in the wild. John Burke said this was also his experience with cultured barramundi and bass. Peter Gehrke asked them if there was even distribution of food in cultured fish, but they did not think the clumping behaviour was related to food distribution. Greg Jenkins made the point that collection techniques in the wild are not sophisticated enough to detect spatial changes on this scale. He indicated that larvae can have a depth preference on a particular day and be quite concentrated (22 larvae per cubic litre).

The role of disease as a possible factor affecting larval survival was raised by Stephen Battaglène who said that disease, in particular ectoparasites, in both fresh and salt water, are a limiting factor in extensive rearing. Martin Daintith asked what diseases caused problems and what treatments were used. Bill Talbot replied that protozoans such as *Trichodina* and *Scyphidia* caused problems and he treated ponds with malachite green 0.5 ppm or formalin 15 ppm.

Aldo Steffe commented on the energetic arguments put up by Peter Gehrke earlier. He said that the larvae are not just passive drifters and there was a trade off between the time where the larvae can spend feeding and the time when they would avoid being swept away into an unfavourable area. He therefore suggested that the energetic constraints are going to be very different in the wild to those derived in the laboratory. Peter Gehrke agreed with this comment.