JAMES RENNIE BEQUEST

REPORT ON EXPEDITION/PROJECT/CONFERENCE

Expedition/Project/Conference Title: Developing a reef fisheries management tool using Environmental acoustic, light and bio-chemosensory cues

Travel Dates: October 2007-January 2008...

Location: Lizard Island Research Station, Great Barrier Reef Marine Park, Australia.......................

Group Member(s): Harriet Salomonsen ....

Aims: Enhancing the efficiency of larval collection techniques used in Early Life History Phase Fisheries using the sensory driven orientation behaviour of larval coral reef fishes ....

OUTCOME (not less than 300 words):-

When many species of coral reef fishes spawn the fertilised eggs are swept away from the reef where they develop into their larval life stage in the open sea. After a varying time interval triggered by environmental cues, they return to reefs where they settle. Recently *Simpson et al. (2005*) discovered that many juvenile fish use the sounds of the reef to help them navigate to settlement sites. The discovery of the use of acoustic cues in coral reef fish recruitment has opened up new possibilities for reef fisheries management using their orientation behaviour as a tool.

Early Life History Phase (ELHP) Fisheries

On their journey back from the open sea to settle on reefs up to 70% of larval fish die. The aim of early life history phase fisheries is to target the larval fish, tapping into this natural population bottleneck. The fish can then be reared for aquaculture, the aquaria trade and for potential biomass restocking programmes without affecting the adult populations of these fishes.

From October 2007 to January 2008 I worked for Adel Heenan as a research assistant at Lizard Island Research Station in the Great Barrier Reef Marine Park in Australia. She is working in collaboration with ReefCheck and Ecocean, who are currently running a larval rearing program in the Philippines. By incorporating knowledge of the sensory driven orientation behaviour of the larvae into the collection techniques of ELHP fisheries she is investigating the possibilities of enhancing their efficiency.

We conducted experiments looking at the survivorship of reared larvae for biomass restocking. We collected sound recordings of the reef at various points of the lunar cycle to further the acoustic data already collected. We also conducted comparative experiments looking at the efficiency of the light traps used for larval collection.

Biomass Restocking Experiments

The Australian Institute of Marine Science (AIMS) light trap units, shown in *figure 1*, were deployed everyday in order to collect the larval fish needed for the experiments. The Ambon Damsel fish, *Pomacentrus* a*mboinensis,* was chosen as large numbers are often caught in the light traps.

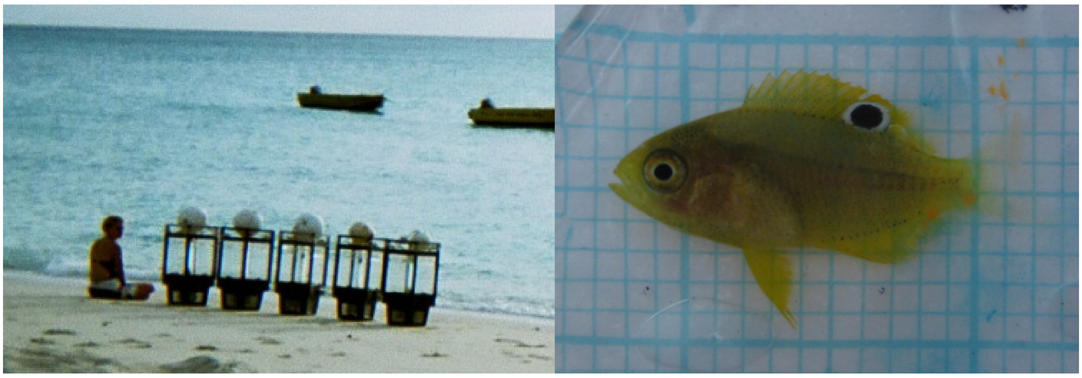

Fig. 1: a) Aims light trap units b) Pomacentrus amboinensis

Twenty patch reefs were built using coral rubble found at the edge of the reef, each with a live *Pocillopora* coral head. The standard length of the larvae was recorded and they were split into 3 experimental groups, and marked accordingly using different coloured elastomer tags. One experimental group were released onto the patch reefs the same day they were caught in the traps. The other two groups were kept in the aquaria in a blank tank, or in an enriched tank containing a *Pocillopora* coral head. The aquaria larvae were split into a further two groups, spending either 1 week or 2 weeks in the tanks before being re-measured and released onto the patch reefs. Each experimental group contained roughly 30 fish.

Once the fishes were released 3 dives a day were conducted to count the numbers on each patch reef in order to assess their survival. The patches were monitored until the numbers had reached a plateau.

Unfortunately due to low numbers of fish being captured the next month, the experiment could only be carried out once. The results suggested survival was highest in those fish reared in the aquaria in an enriched tank before being released. By having a coral head in the tank the fish could determine their hierarchical positions in an environment away from predators. They could then resume the same position when released onto the reefs. Those fish with out a coral head would have their disputes out on the reefs, so resulting in higher predation success.

<u>Sound recordings</u>
The sounds produced by the fish and invertebrates that live on the reef vary in both composition and volume depending on the time of day and its position in the lunar cycle.

For 4 days over the new and full moon period sound recordings were taken of the same reef every 4 hours to build a picture of how reef sounds altered. The recordings were taken using a hydrophone lowered 1m under the surface. In order to reduce unwanted splashing sounds, the recording was done from a semi deflated rubber ring (*Figure 2)*. To reduce disturbance further, this was released 30m out from the boat over the reef. The recordings were used in the following experiments.

Fig. 2: "The recording booth". This was released over the reef seen behind.

Light trap efficiency and design

Fig. 3: "Star of Lance", AIMS and Ecocean light traps ready to be deployed.

The Ecocean light traps are currently used in ELHP fisheries in the Philippines. These are a much cheaper design than those produced by AIMS, utilising readily available materials such as tyre inner tubes. We carried out a comparative investigation to find out which was more efficient as a larval collection technique. Using the acoustic recordings taken over the full and new moon, we also looked at the effect of the different ambient sounds on the light trap catches.

Four moorings were set up 200m apart in roughly 15m of water, with no surrounding reef for over 100m. These were labelled A, B, C and D. To account for any variation in catches due to location the traps were randomly assigned moorings every night. Two AIMS and two Ecocean traps were deployed, one of each paired with an underwater speaker. These played a 2 minute loop of a recording, which also alternated nightly to see what effect reef noise from different times of day and from the new moon and the full moon period may have on catch quantity and diversity.
Every day the catch from each trap was sorted, recording to family level the species and number of larvae that were caught.

The data for this is still being analysed. The Ecocean trap appeared to have the highest survival of larval fish, due to a larger collection area with a strong through flow of water. The AIMS trap however seemed to catch fish in higher numbers, perhaps as a result of a larger light and a more enclosed system, making it difficult for any larvae to get out. We designed a new trap, the "Star of Lance", which combined these aspects of the two light traps. Unfortunately due to low numbers of fish again in the following month we were unable to test it successfully.

After working for Adel Heenan I remained on Lizard Island a further 3 months as a research assistant to another PhD student from the University of Cambridge. I would like to thank the James Rennie Bequest committee for their generous award which has enabled me to take up this incredible opportunity and thereby allowed me to follow my ambitions to work in this field. As a result I have a place to study Marine Environmental Protection as a Masters programme with the University of Bangor. I would also like to thank Dr. Stephen Simpson for his guidance and references and Adel Heenan for the opportunity of working with her as a research assistant.