

INCREASING FRY SURVIVAL IN NATURAL FOOD-BASED CARP (*Cyprinus carpio*, L.) HATCHERIES IN MADAGASCAR: AN EXOGENOUS FEED EXPERIMENT

Antsa Rafenomanjato^{1,2}, Julie Mandresilahatra², Modestine Raliniaina¹, Jean-Michel Mortillaro^{1,3}
¹FOFIFA DRZVP, ²APDRA Pisciculture Paysanne, ³ISEM, Univ Montpellier, CNRS, IRD, CIRAD
antsarafenomanjato7@gmail.com

CONTEXT

In Madagascar, common carp (*Cyprinus carpio*) larvae and fry are reared in rice-fields or ponds with low inputs thus they rely almost completely on natural productivity for feed. In these systems, the survival rate is low (less than 5%). It was hypothesized by farmers that one of the main cause of mortality is food shortage. Thus our study aimed to evaluate the effect of exogenous feed supply in the system.



Photo 1: Feeding fish fry in Tananomby

METHODS

An on-farm experiment was conducted during two rearing seasons with a total of 15 farmers' hatcheries. The effect of the combination of soybean and maize flour (SM) and commercial fry feed (LFL®, tilapia starter fry feed) were compared to a control treatment (without exogenous inputs). Protein content was 43% for the commercial feed, and estimated to reach 30% for SM. Farmers performed all activities in a participative approach with scientists acting as supervisors. At the end of the experiments, fry production (ind./m²) as well as average individuals weight were measured. The experiment was completed by carbon and nitrogen stable isotopes analyses in order to characterize the food web relationships between carp fry, feeds and the aquatic fauna collected at harvest.

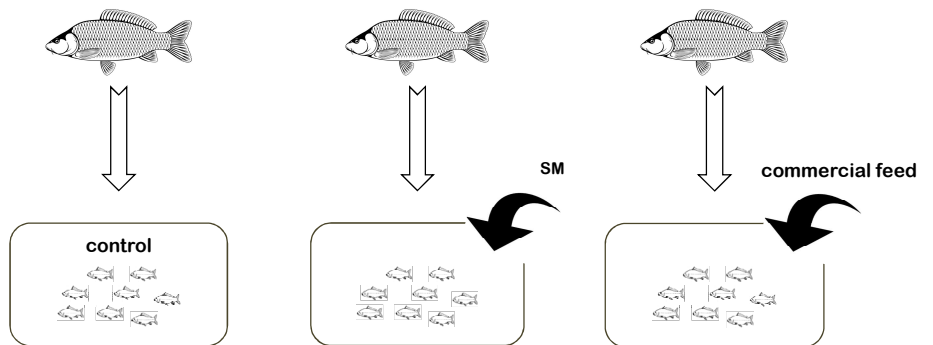


Fig. 1: Experimental design (at every farmers hatcheries, three similar females and ponds were used, larvae from each female reared in each field until 45 days old, one without exogenous feed, a second fed with SM and a third with commercial feed)

RESULTS & DISCUSSION

Fry weight was in average 0.41 ± 0.27 g (45 days old) without significant difference between the three treatments, but fry production (ind./m²) was 3 to 4 times higher in the systems fed with exogenous feeds (Fig. 2). Thus, it was concluded that exogenous feed increased fry survival but not individual size and weight. However, stable isotopes analyses showed little or no direct contribution of the exogenous feed to the fry diet according to the trophic enrichment factor (TEF, Fig. 3). Leading to news questions on how feed participated in increasing fry production as well as the impact of insects and tadpole as predators/competitor.

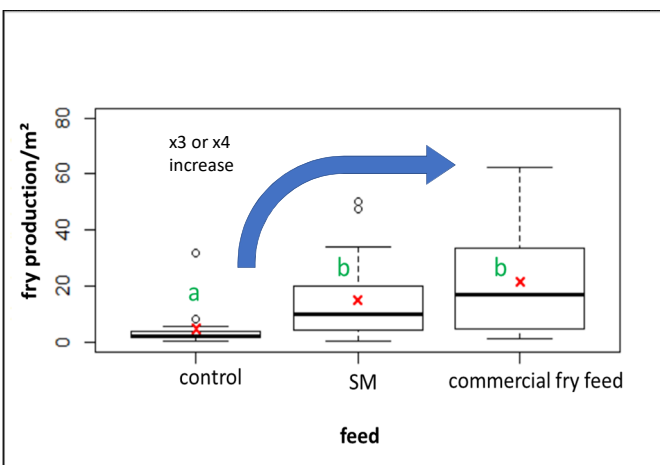


Fig. 2: Fry production in each treatment harvested at 45 days post-hatching

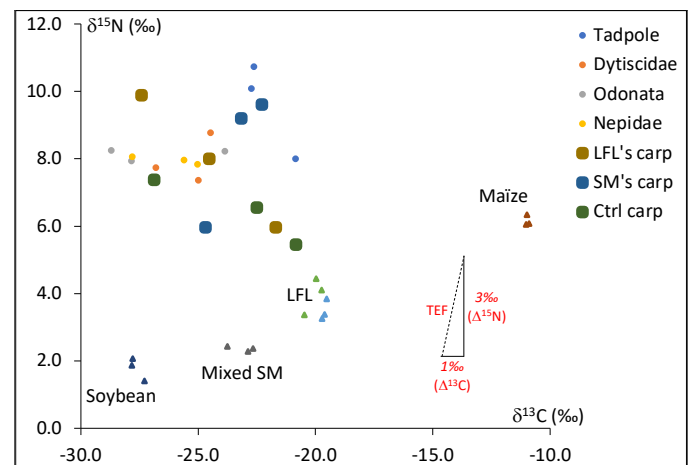


Fig. 3: Stable isotope analyses showing contribution of feed on carp larvae and aquatic fauna diet present in the experimental ponds

CHARACTERIZATION AND FARMERS' PERCEPTION ON AQUATIC FAUNA PREDATION IN MADAGASCAR SMALL-SCALE FRY HATCHERIES

Antsa Rafenomanjato^{1,2}, Julie Mandresilahatra², Modestine Raliniaina^{1,3}, Jean-Michel Mortillaro^{1,3}
¹FOFIFA DRZVP, ²APDRA Pisciculture Paysanne, ³ISEM, Univ Montpellier, CNRS, IRD, CIRAD
antsarafenomanjato7@gmail.com

CONTEXT

In Madagascar, common carp (*Cyprinus carpio*) larvae and fry are reared in rice-fields or earth ponds without effective protection to prevent unwanted organisms to enter the hatcheries. Thus predation and competition by invertebrates and other aquatic fauna cause high mortality. The study aimed to characterize aquatic fauna population structure present in hatcheries, and assess their impact on fry production from farmers perspective.

METHODS

Samplings were performed on 16 hatcheries in 2019 with the objective of making inventory of fauna taxa groups present and classifying them by frequency and abundance (Photos 1 and 2). Survey was conducted with 42 farmers to evaluate the risk displayed by each taxa identified during the sampling using ranking method. The experiment was completed by carbon and nitrogen stable isotopes analyses in order to characterize the food web relationships between carp fry and the aquatic fauna.



Photo 1: Sampling using drop-trap method



Photo 2: Catch inventory

RESULTS & DISCUSSION

According to the sampling, the dominant groups are *Amphibian* larvae (tadpoles), *Notonecta* (backswimmer), *Dytiscidae* adult/larvae (diving beetle), *Odonata* larvae (dragonfly larvae) and *Gambusia* (mosquitofish) (Fig. 1).

According to farmers, the most troublesome aquatic fauna are *Dytiscidae* (diving beetle) larvae, *Nepa* (water scorpion), and *Odonata* (dragon fly) larvae due to their predation on carp larvae and fry, and *Notonecta* (backswimmers) by predation on carp eggs and larvae. *Amphibian* larvae (Tadpoles) are mainly competitors for natural productivity and fry feed. The *Procambarus virginalis* (marbled crayfish) cause some trouble due to burrowing behaviour resulting in water leakage out of ponds (Tab.1).

According to stable isotopes, tadpoles were the highest consumers, suggesting predation on insects as well as carp fry which shared the same trophic niche (Fig. 2).

This work helped to identify the main aquatic pest to be controlled in order to improve fry survival in Madagascar small scale hatcheries. However dissimilarities between abundances, farmer perceptions and food web characterisation suggest further investigations on the impact of each organisms on carp fry survival.

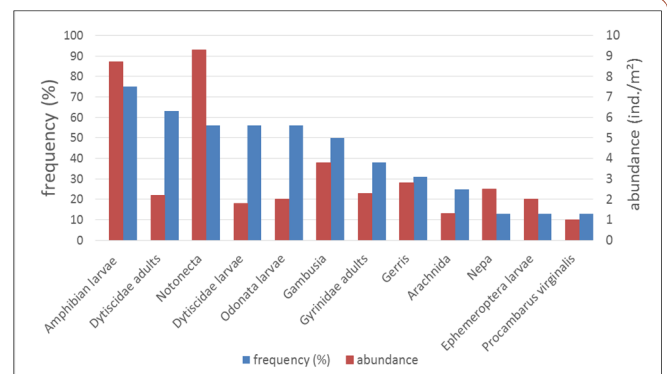


Fig. 1: Dominant fauna group by frequency and abundance

TAXA GROUP	ILLUSTRATION	RANK (AVERAGE)
<i>Dytiscidae</i> larvae		2
<i>Nepa</i>		2.4
<i>Notonecta</i>		4.4
<i>Procambarus virginalis</i>		4.7
<i>Odonata</i> larvae		4.8
<i>Gambusia</i>		7
<i>Gyrinidae</i>		7
<i>Amphibian</i> larvae		7.5

Tab.1: Harmfulness assessment by farmers using ranking method (lower rank means highly harmful to fry production)

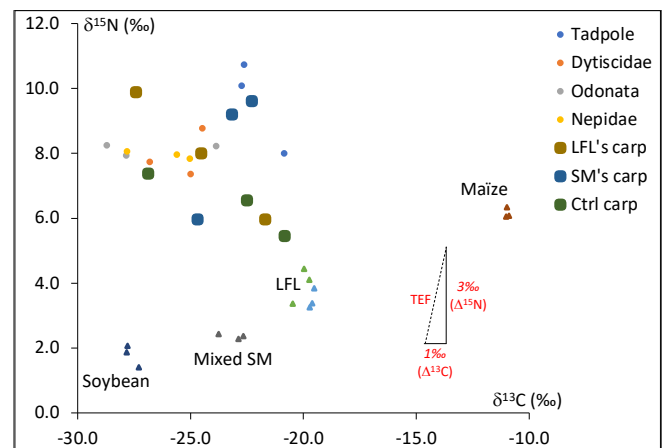


Fig. 2: Stable isotope analysis showing the predation/competition of aquatic fauna with common carp in experimental ponds