Evaluation of floating cages as an experimental tool for marine shrimp culture studies under practical earthen pond conditions

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Introduction

Scientific and technical studies carried out under semi-intensive farming conditions, with large earthen ponds (Fig 1), to assess the effects of treatments on zootechnical results are highly complex due to the many logistical, economic and/or experimental constraints involved. In our study, we evaluated the use of floating cages (Paquotte et al., 1998) immersed in earthen ponds as an experimental tool in order to design future powerful and economical experiments under semi-intensive farming conditions.

Earthen ponds

The size of the farming earthen ponds and the subsequent production constraints make it difficult to use them as experimental units for random experiment. Moreover in within and / or between-farm experiments the sources of variability cannot be controlled (size, shape and hydraulic of the ponds, origin of PL, management….) with the direct consequence that the Coefficient of variation (CV) will be increased leading to a rise in the number of replicates requiered for experiments of fixed power (80%).

In this study, we estimated a CV for each parameter (mean survival, final body weight, daily growth rate and FCR) from results obtained in six similar earthen ponds (1500 m²) from our facilities.

Floating cages

We built 20 cages of 17,6 m² net surface (2 x 4x 0.8 m) consisted of four polyvinyl chloride pipes (PVC; 110 mm diameter) connected by PVC elbows and waterproofed with silicone adhesive. The plastic net of 5x5 mm (Sunnet™) was manufactured by the company Sansuy (Brazil).

The results of several trials (fig 2) confirmed that zootechnical outcomes (mean survival, final body weight, daily growth rate and FCR) in floating cages are comparable with those recorded in the pond. According to these results, floating cages do not present any zootechnical biases which may hide the effects to be tested.

Fig 1 : Aerial view of a commercial shrimp farm in New Caledonia.

Comparaison between ponds and cages

We determined, based on an *a priori* power analysis (Aaron and Hays, 2004), the number of replicates needed for powerful experiments. We then compared the replication requirements for a fixed power (80%) and significance level (α = 5%) for both systems (pond and cage) (table 1). The number of replicates needed is generally higher if ponds are used as experimental units, which is directly linked to higher CV between ponds than cages.

Experimental unit	Parameters	Average CV	Expected difference (% of mean)			
			5	10	15	20
Cages	Survival (%)	11	71	20	10	7
	Final body weight	5	6	4	3	3
	Daily growth rate	6	8	4	3	3
	Final biomass	14	32	15	9	7
	FCR	7	9	5	4	3
Ponds	Survival (%)	16	207	48	21	12
	Final body weight	8	43	12	6	4
	Daily growth rate	5	21	6	4	3
	FCR	8	40	11	6	4

Table 1 : Estimated number of replications needed depending of which rearing system is used as experimental unit.

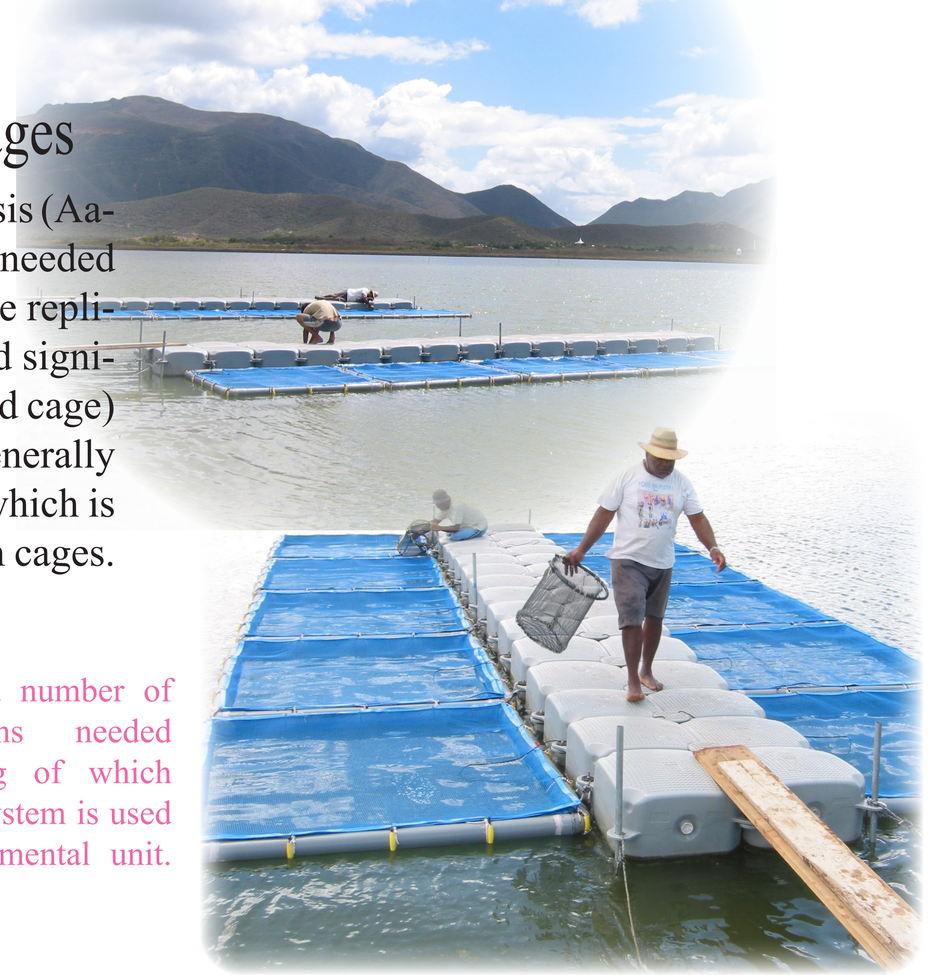

Fig 2 : Floating cages used as experimental units by a local shrimp feed manufacturer (SICA) to test feed formulation in a private farm.

Conclusion

Our study shows that floating cages provide a reliable method for carrying out powerful experiments under near-pond conditions and are an economical and handy experimental tool to access, on a pilot scale, scientific results obtained under laboratory controlled conditions (Castex et al., 2008). Floating cages are probably more representative of the pond conditions than laboratory trials in clear water and thus offer a good compromise for shrimp applied research.

References

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