

MUD CRABS AND MANGROVES; AN EXAMPLE OF INTEGRATED APPROACHES TO STOCK ENHANCEMENT

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It is generally recognised that stock enhancement should be based on an integrated approach including studies into the population dynamics and genetics of wild stocks, habitat-stock interactions, fitness of hatchery-produced juveniles and appropriate fisheries management. However, fiscal and practical constraints typically mean that this may be a rarely-attainable ideal. The mud crabs, *Scylla* spp can be considered as an example illustrating how the adoption of such an integrated approach is both necessary and achievable in small-scale enhancement initiatives.

Mud crabs are closely associated with mangrove habitats and thus populations may be subject to the combined pressures of overexploitation and habitat loss. When considering approaches to managing the recovery of depleted stocks, this fidelity to a specific habitat has made stock enhancement an attractive option, with the potential for high recapture rates. As a result of research efforts over the last decade, hatchery production of mud crabs is becoming technically and economically more feasible, enabling trials to evaluate the potential effectiveness of releases. To date, results are very promising with recovery rates of up to 37% for some batches. The high growth rates and limited movement of released crabs mean that fisheries yields improved by up to 30% within a few months, demonstrating that a release program may be an effective strategy for short-term enhancement in specific areas. However, recapture data show significant differences in growth, survival and recovery rates between closely-related sympatric *Scylla* spp. that may be due to differences in behavior and habitat use (Figure 1). Thus stock enhancement may be more suitable for some species than others. Recovery rates for translocated wild crabs were also significantly

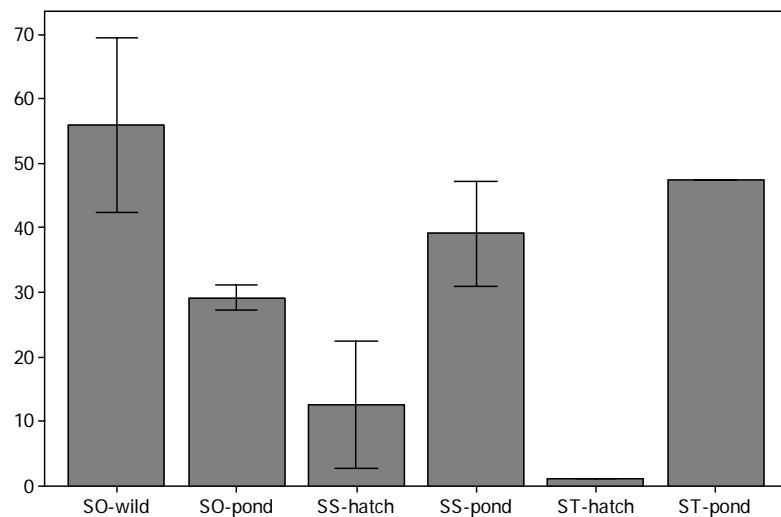


Figure 1. Recovery (mean % \pm 95% CI) of three *Scylla* spp in stock enhancement trials in the mangroves of Naisud and Bugtong Bato, Ibajay, Aklan, Philippines in 2004-5. *Scylla olivacea*: wild-released (SO-wild) and hatchery-reared, pond-conditioned (SO-pond), *Scylla serrata*: hatchery-reared, unconditioned (SS-hatch) and pond-conditioned (SS-pond) and *Scylla tranquebarica* (only one sample each): hatchery-reared, unconditioned (ST-hatch) and pond conditioned (ST-pond).

higher than those for hatchery-produced juveniles. These differences could be ameliorated by pre-release conditioning in ponds, which greatly increased recovery rates of hatchery-reared animals, indicating that there is considerable scope for further work on husbandry techniques in the hatchery to optimize juvenile quality (Figure 1).

The habitat fidelity exhibited by the *Scylla* spp. suggests that restoration of lost or degraded mangrove areas may also be an effective strategy for promoting stock recovery through natural recruitment. In this case the associated capital and management costs may be higher but yield a wider range of benefits including fisheries but also timber production and coastal protection. The need for community-based cooperation in any replanting program also presents additional opportunities for introduction of co-management of fishing effort.

In advance of experimental stock enhancement trials, baseline assessment of crab populations at a range of natural and degraded mangrove sites demonstrated that indeed crab abundance in replanted mangroves may be equivalent or even higher than that in natural forests, under similar levels of exploitation. Socio-economic studies also showed that the economic value of fisheries products in replanted mangroves can be equivalent to that of natural mangroves, though it may take some years to reach these levels. The baseline studies also indicated that there may be areas where recruitment is limiting fishery yields, whatever the condition of the habitat. Thus, a balanced approach to stock management could integrate both hatchery-release and habitat restoration programs at the same or different sites, depending on local conditions, and over different time scales, with parallel research to support increase effectiveness of releases and development of community-based management to address the underlying issues causing the initial decline in stocks.