

Factsheet final findings Global Challenges Programme Call 3



Project for sustainable Aquaculture to Support restoration of Mangrove forest in Indonesia (PASMI)

Summary

PASMI's goal was to design sustainable aquaculture producing shrimp, milkfish, mussels, seaweeds and blue swimming crab along the threatened north coast of Java, Indonesia. This coastal landscape is threatened by subsidence and water pollution due to urbanisation and industrialisation that lead to abrasion and salinity intrusion, and reduce livelihood options of the farmers. PASMI collaborates with the project Building with Nature in Demak regency (BwN-Demak) focussing on the natural restoration of the mangrove coastline and creating resilient livelihoods. [BwN-Demak](#) was funded by the governments of Indonesia and the Netherlands and several Dutch partners, and led by Wetlands International. The focus of the socio-economic component of BwN-Demak was the improvement of aquaculture through training of the farmers in Coastal Aquaculture Field-Schools (CAFS) by the Indonesian NGO [Blue Forest](#).

PASMI's research questions were as follows:

1. Can Integrated Multi-Trophic Aquaculture (IMTA) with tiger shrimp (*P. monodon*) contribute to sustainable livelihoods?
2. Can grow-out aquaculture of juvenile blue swimming crab (*Portunus pelagicus*), a by-catch from fishing, be sustainable?
3. Can the value chain contribute to technology adoption?

These questions were tackled through researcher led experiments and followed by tests on-farm to adjust the design and quantify the gross margins.

Research findings

Related to the food system

- One of the main constraints for smallholders to adopt IMTA and the culture of blue swimming crab is the focus of government policy on intensive monoculture of shrimp.

Related to the IMTA

- Combining 100 gr m⁻² seaweed (*G. verucosa*) and 60 gr m⁻² green mussel (*P. viridis*) gave the most optimal effect on water and soil quality, including the nitrogen accumulation in culture water and soil, and on the performance of seaweed, mussel and tiger shrimp.
- The mucus of tilapia (*O. niloticus*) inhibits vibrio bacteria, a shrimp disease agent; milkfish (*C. chanos*) does not.
- Even in years with heavy flooding leading to losses of stocked fish and shrimp, farmers applying an IMTA with tiger shrimp, milkfish, tilapia, seaweed and green mussel, earned more money than before in good years using traditional practices.

Related to the blue swimming crab

- Shrimp pellets were suitable for grow-out of juvenile crab, and more efficient considering cost and resources, than waste of fish processing, green mussel or small dried shrimp.
- Rearing juvenile crab to market size in cages in brackish water ponds may have a future if cannibalism can be reduced effectively.

Outcomes achieved	<ul style="list-style-type: none"> In Tambakbulusan, Mr. Kasmudi (see picture above) had stopped stocking shrimp more than 10 years ago, used chemicals to prevent and kill pests, and applied urea and phosphate in his ponds stocked with milkfish. His yields were low. After PASMI's kick-off and participating in the CAFS four years ago, he bought 1,000 kg of seaweed that apparently disappear in the rainy season, but afterwards grow again and keep the pond water clear, without use of chemicals. He reduced the frequency of water exchange to manage salinity, and keeps water quality good by adding home-made liquid compost every week. He stocks shrimp post-larvae in three nursery ponds and transfers the good sizes to his grow-out pond. Every 4 to 6 weeks, from April to December, he harvests >150kg big shrimp that he sells to a monger in Semarang. There, he fetches 50-100% more than what the village collectors pay him. At least two farmers in Wedung village started culturing juvenile blue swimming crab in a storage pond. Five months a year they earn 6 USD a day from the collection and sales. 		
Project messages to	<p>A) Actors from private sector:</p> <ul style="list-style-type: none"> Through their collectors, the processors of blue swimming crab should stimulate fisherman and farmers to return the females and grow-out the male juveniles before selling these. <p>B) Civil society and practitioner' organizations:</p> <ul style="list-style-type: none"> Stimulating discussions and tests in groups of participating farmers strengthens the impacts of training efforts. <p>C) Policy makers:</p> <ul style="list-style-type: none"> Training and applying IMTA and Low External Input Aquaculture (LEISA) can more than double the output of Indonesia's shrimp and milkfish ponds, protect mangrove and reduce poverty, without the financial risk of local intensive shrimp farming practice and the ecological damage coming along with the latter. 		
Knowledge products	<ul style="list-style-type: none"> Effect of three types of liquid compost combined with <i>Avicennia marina</i> leaves on growth and survival of tiger prawns (<i>Penaeus monodon</i>). <i>International Aquatic Research</i> 11, 311-321 (2019). Is Integrated Multi-Trophic Aquaculture (IMTA) an Answer to Abraded Coastal Area? A Stakeholders' Perspective Analysis. <i>IOP Conference Series: Earth and Environmental Science</i> (2018). <i>Still in review</i> The Impact of Aquaculture Field School on the Shrimp and Milkfish Yield and Income of Farmers in Demak, Central Java. (In review at <i>Journal of the World Aquaculture Society</i>.) Improving nitrogen use efficiency by combining <i>Gracilaria verucosa</i> and <i>Perna viridis</i> for sustainable intensification of traditional <i>Penaeus monodon</i> culture in Indonesia. (In review at <i>Fisheries and Aquatic Sciences</i>.) The Sustainability of Using Three Locally Available Feeds for Grow-out of Blue Swimming Crab (<i>Portunus pelagicus</i>) in Central Java. (In review at <i>Journal of Applied Animal Research</i>.) 		
Knowledge networks	<ul style="list-style-type: none"> Mangroves for the Future NACA Network of Aquaculture Centres in Asia-Pacific 		
Knowledge co-creation	<ul style="list-style-type: none"> At PASMI's kick-off a wide range of stakeholders, from farmers to academia, gave input to the research protocols. Mid-term, the identification of key boundary partners in PASMI's 'Spheres of Influence', led to interest of more farmers in IMTA trials and extension services in developing guidelines. PASMI's final workshop encouraged (1) alumni and a company to involve in testing guidelines for blue swimming crab grow-out, and (2) provincial government to start a program on blue swimming crab. 		
Consortium partners	<ul style="list-style-type: none"> Wageningen UR – Aquaculture & Fisheries group – AFI Wetlands International Indonesia Diponegoro University - UNDIP, Faculty of Fisheries and Marine Science Ecoshape Foundation 		
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Project website	F&BKP Research Project page		