



Sustaining Indonesia's fisheries

Indonesians are heavily reliant on wild-catch and aquaculture fisheries production/resources to sustain their livelihoods. These resources are under threat. Over-fishing and illegal, unreported and unregulated (IUU) fishing are serious problems in many Indonesian fisheries, including those shared with Australia and other neighbours.

In aquaculture, Indonesian smallholder shrimp farmers have faced catastrophic losses to crops caused by disease, soil degradation issues and management practices. An estimated 100,000 ha of small, brackish-water ponds (tambaks) lie idle, leaving many farmers without the means to make an income from shrimp.

These complex problems affect many people in Indonesia, which is ACIAR's major partner country.

Coordinated research and management are essential to keep the fishery and aquaculture industries viable, and to ensure sustainable yields and improved livelihoods for farmers.

The response from ACIAR

ACIAR has invested around A\$20 million in Indonesian fisheries research and development (R&D) since the 1980s. A total of 41 projects has addressed aspects of the management of wild stocks and aquaculture farming practices. Our investment spans three areas, which include many interlinked activities:

- **Wild, or capture, fisheries**
Motivated by concerns that stocks are being depleted, this R&D focuses on reliable catch data collection and analysis, and developing fisheries models to better inform and improve management. Projects involve red snapper, shark and rays, tuna and IUU fishing.
- **Aquaculture**
Early projects focused on combating recurrent disease outbreaks that caused major losses in shrimp farming. Subsequent projects are looking beyond shrimp health, to water and soil quality, better management practices, and the potential use of alternative crops and commodities to reduce production risks. They also focus on assessing land suitability for aquaculture.
- **Other commodities**
This R&D involves marine finfish, mudcrab culture and reservoir fisheries. Work is being conducted to improve aquaculture practices for high-value reef fish, such as

groupers. Another project is investigating strategies to optimise cage-fish production while reducing the conflict between cage farmers and poor fishers reliant on capture fishing in reservoirs.

Estimating the impacts

ACIAR's recent independent review of its fisheries R&D program in Indonesia and impact assessment of two projects show substantial and emerging impacts.

The impact assessment study into tuna fisheries shows potential benefits, in net present value (NPV) terms, of A\$168 million for the R&D attributable to ACIAR's investment. The smallholder shrimp farming assessment reports an expected return of A\$547 million on total R&D investment.

Lead times have been long and it should be noted that much of the research has only recently been completed or is in progress, so assessment of the impacts is ongoing. Much of the estimated impact is based on expected future returns.

The major achievement of all the projects has been a marked improvement in capacity within Indonesia for research and extension, and technical capability to support future research.

Breakthroughs in understanding are creating better practices and technologies, and should generate long-term rewards.

(Details of the two impact assessment studies are featured on pages 2–4 of this fact sheet.)



Photo supplied: Lilis Sadiyah

R&D is focused on reliable catch data collection and analysis to address concerns about depletion of fish stocks.

ACIAR

The Australian Centre for International Agricultural Research (ACIAR) operates as part of Australia's development assistance program, with a mission to achieve more productive and sustainable agriculture for the benefit of developing countries and Australia. ACIAR commissions collaborative research between Australian and developing-country researchers. It also administers Australia's contribution to the International Agricultural Research Centres. ACIAR conducts a program of independent impact assessments of the research it funds.

Summary of returns on ACIAR's investment in fisheries R&D

Tuna fisheries R&D		Tambak remediation R&D	
Present value (PV) of benefits (A\$m)	169	PV of consumer & producer surplus (A\$m)	232
PV of costs (A\$m)	1	PV of R&D costs (A\$m)	4.4
Net benefits (A\$m)	168	Net present value (A\$m)	227
Benefit:cost ratio	179	Benefit:cost ratio	52
Internal rate of return (%)	210	Internal rate of return (%)	26

Impact assessment one: tuna fisheries—halting the decline

Australia and Indonesia have exclusive economic zones in the eastern Indian Ocean, where Indonesia's commercial and artisanal tuna catch accounts for 15% of the total catch of tuna in the Indian Ocean.

However, since 2000, fishers have reported declining catches for some species, in terms of numbers and size of fish caught.

These declines indicate fishing at current levels in this area is unsustainable and could signal the collapse of a fishery and threaten fishing communities' livelihoods.

This area contains key spawning grounds for tuna species, and the waters south of eastern Java and Bali are the only known spawning area for southern bluefin tuna (SBT).

Focusing solely on catch and size indicators will not pick up important changes in population distribution or reproduction rates. To ensure survival of the species and the fishing industry through better management practices, Indonesian researchers need greater capacity to monitor, analyse and report on fisheries.

The response from ACIAR

ACIAR'S objective was to address Indonesia's stated priority to develop an effective national capacity to monitor and assess its tuna and billfish fisheries, and to improve its ability to report to international management organisations.

With the support of CSIRO, work involved improving and extending national data systems, conducting a thorough review of fisheries, and building governmental capacity to analyse, interpret and report on data.

In 1994 the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) was formed to ensure the conservation and optimal utilisation of bluefin stock.

Australia, Japan, Korea and Taiwan sought Indonesia's membership of the CCSBT, to ensure better fishery management. A key requirement for Indonesian membership (and to allow continued sale of tuna to the high-value markets of Japan, Taiwan, Korea and the US) was an objective assessment and agreed management of tuna fisheries stock.



“This information can be beneficial for fishers to improve their catch efficiency and targeting practices, and to conduct responsible fishing activities to maintain sustainable yields.”
— Lilis Sadiyah

Lilis Sadiyah (centre) is an Indonesian mathematics graduate who, through ACIAR's John Allright Fellowship program, is undertaking her PhD at The University of Tasmania. Ms Sadiyah was one of the original stock assessment trainees and is now working with CSIRO to analyse data from the trial observer program, and historical and time series data.

As well as impacting positively on her professional life, her research will contribute to data analysis and interpretation, assessments for international fisheries management forums and the development of a tuna-monitoring scheme.

Building new knowledge and capacity

ACIAR worked with CSIRO to establish a trial scientific observer program and database, training six Indonesian observers to collect fishing data from longline vessels.

This supplemented the existing port-based monitoring system, which had been developed through earlier Australian and international support, and ongoing postgraduate training provided to an Indonesian specialist in stock assessment.

The program equipped Indonesia's Ministry of Marine Affairs and Fisheries with improved capacity to analyse, interpret and report on data for stock assessment.

In April 2008 Indonesia was accepted as a member of the CCSBT and its capacity to provide reliable data was fundamental to its membership.

With more reliable modelling, fisheries management and sustainability are expected to improve.

Fishers as well as consumers will benefit from lower costs and more guaranteed supplies in the longer term.

Impact assessment two: shrimp farm remediation

In the 1980s Indonesia made a substantial investment in tambaks—smallholder brackish-water ponds for shrimp production.

Many farmers converted their rice paddies into ponds, with great hopes aquaculture would transform their lives by providing them with a valuable product for export.

Later that decade there was a devastating collapse in tambak shrimp production as disease took hold. Farmers were hit with substantial stock losses and abandoned their ponds, leaving around 100,000 ha of tambaks idle to this day.

Some farmers manage local production of milkfish or seaweed but most struggle to make a living because their land is unsuitable to resume rice production, and is unviable for further aquaculture.

The response from ACIAR

ACIAR funded workshops that investigated disease losses. Researchers realised another major factor was acid sulfate soils, which are linked to an increased vulnerability to disease, reduced crop yields and sudden mass mortality events.

A project led by the University of New South Wales focused on remediation techniques. Further projects focused on assessing land capability and suitability for shrimp farming, investing in disease control and improving farm management practices, and building technical and extension capacity.

The research team developed a remediation process for ponds, incorporating liming and cleansing, aquaculture rotations and polyculture, disease-free seedstock, and isolation.

A major challenge has been low adoption levels by farmers.

Estimating the value of impacts

With continued extensive R&D and fisheries modelling, the ACIAR investment is estimated to deliver potential benefits, in present value terms, of A\$168 million. This represents a benefit of \$180 for every \$1 invested, and an internal rate of return of 210%.

The benefit to Indonesia is estimated at close to \$10 million. Consumer gains of \$924 million are estimated for Japan, Korea and Taiwan with the predicted longer-term supply of SBT, while fishers from these nations are estimated to gain \$170 million in profits. Profit gains for Australian and New Zealand industry workers are estimated at \$30 million.

Aside from direct economic benefits, there are:

- broader ecological benefits
- improved relations with Australia
- social benefits for Indonesian fishing communities, with higher incomes for the fleet
- a better understanding of tuna species.



Photo: Jes Sammut, University of New South Wales

Researchers Dr Jes Sammut from the University of New South Wales and Dr Akhmad Mustafa from the Research Institute for Coastal Aquaculture are building capacity in tambak remediation with local farmers.

These farmers are hindered by limited access to new knowledge, and the costs and risks associated with significant upfront remediation investment.

However, farmers in some areas have successfully adopted the processes, and the key has been close involvement of researchers in establishing demonstration trial ponds and working closely with interested farmers.

The Indonesian Government has announced plans to revitalise the ailing aquaculture industry, including remediation of

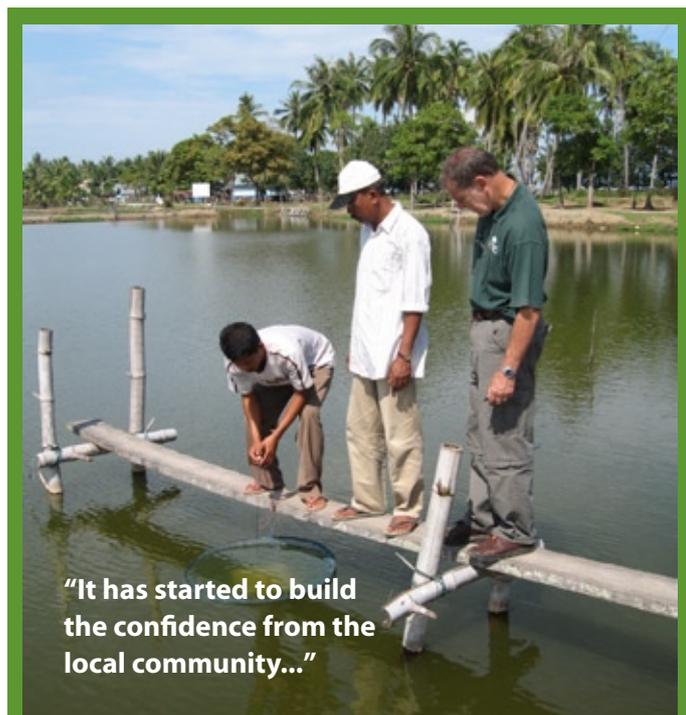


Photo: Mike Rimmer, James Cook University Aceh Aquaculture Rehabilitation Project

"It has started to build the confidence from the local community..."

From left: Aris Sutartono from Indonesia's Department of Marine Affairs and Fisheries, farmer Zulkifli Ahmad and Richard Callinan from the University of Sydney examine a shrimp feed tray at a demonstration pond in Aceh.

"This demonstration pond activity was very good especially as it already proved to the community that through the appropriate techniques we can rear the shrimp successfully till harvest. It has started to build the confidence from the local community that live near the demonstration pond site." — Aceh fish farmer Zulkifli Ahmad, talking about the demonstration pond in Meuliek village.

abandoned tambaks for white shrimp and black tiger shrimp production. With a proposed major investment in extension services, the ACIAR-funded R&D will contribute substantially to the Government's plans.

Estimating the impacts

The real benefits of ACIAR's R&D will depend on adoption levels. An impact assessment of the initial remediation project, which was funded by ACIAR, sketched scenarios in the event the Government's revitalisation plan was achieved.

The best-case scenario estimated cost reductions could deliver farmers with a surplus of around A\$2,000 million, in present value terms, over 20 years if local extension services make a substantial investment.

Local support has historically been difficult, so a less-optimistic scenario was formulated. It estimates return benefits in NPV terms of \$547 million over 20 years. This means for every \$1 invested by ACIAR, Australian research agency funding and partner funding in Indonesia, \$52 of benefits will be returned. The internal rate of return is estimated at 26%.

Lasting benefits for farmers and planners

A major achievement of ACIAR-funded remediation has been the development of technology to help locate acid sulfate and other problem soils.

This technology will help farmers and local governments avoid planning errors, enabling them to better assess land suitability for different production uses.

New knowledge about acid sulfate soils in Indonesia has benefitted Australia: the same issues arise in coastal regions of New South Wales, for example, and this knowledge is taken into account in residential and agricultural developments.

Another major benefit of the project became evident following the Boxing Day 2004 Tsunami, when many traditional ponds were destroyed in Aceh. Indonesian researchers trained through the ACIAR projects, in collaboration with Australian researchers, were quickly able to respond to the situation.

Many agencies working on reconstruction of the area underestimated the likelihood of acid sulfate soil problems in Aceh. Extensive mapping during the ACIAR project showed many ponds were constructed in risky areas.

Researchers also worked with other agencies to improve their approaches to conventional engineering and lime application, and in promoting better management practices and technologies for mapping. Without this capability, it is likely shrimp farm recovery on Aceh would have been delayed.

The full report

ACIAR fisheries projects in Indonesia: review and impact assessment (IAS No. 55) by Greg Martin, IDA Economics, can be downloaded for free from www.aciar.gov.au/publication/IAS55

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ACIAR's Impact Assessment Series

At ACIAR, we undertake careful analysis of R&D investments to assess our projects' effectiveness and quantify impacts. This information informs stakeholders and helps us to continuously improve. ACIAR has been commissioning independent impact assessments for many years.

- Impact assessment analysis of 90 ACIAR projects up to 2004 demonstrated total benefits of A\$6.6 billion.
- Benefit-to-cost ratio is \$30 for each \$1 invested.