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# IMPROVING SUSTAINABLE FISHERIES AND CLIMATE RESILIENCE

**INDONESIA MARINE AND CLIMATE SUPPORT (IMACS)  
PROJECT, FINAL REPORT**



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**FRONT COVER:** A man prepares the day's catch for transport via motorcycle in Sumba, East Nusa Tenggara province. IMACS conducted local fishing ground and supply chain surveys at significant landing locations to gather initial data for better fisheries management decision-making.

IMACS

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The authors' views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States government.



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# ACRONYMS

AP2HI	Indonesian Pole and Line and Handline Fisheries Association, or <i>Asosiasi Perikanan Pole &amp; Line dan Handline Indonesia</i>
APRI	Indonesian Crab Processing Association, or <i>Asosiasi Pengelola Rajungan Indonesia</i>
awig-awig	customary law
BPBD	Disaster Management Agency, or <i>Badan Penanggulangan Bencana Daerah</i>
BPSDM	Human Resources Development Agency, MMAF, or <i>Badan Pengembangan Sumber Daya Manusia Hukum</i>
CAP	Climate adaptation plan
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CITES	Convention on International Trade in Endangered Species
CTSP-I	Coral Triangle Support Program-Indonesia
DKP	Marine Affairs and Fisheries Office, or <i>Dinas Kelautan dan Perikanan</i>
DMC	Data Management Committee
EAFM	ecosystem approach to fisheries management
e-KARINA	International and Inter-Institution Cooperation Application, or <i>Elektronik Kerjasama Internasional dan Antar Lembaga – Kementarian Kelautan dan Perikanan</i>
I-CATCH	Indonesia-Climate Adaptation Tool for Coastal Habitats
I-Fish	Indonesia Fisheries Information System
IMACS	Indonesia Marine and Climate Support Project
IOTC	Indian Ocean Tuna Commission
IUU	illegal, unreported, and unregulated fishing
KPI	Key Performance Indicator
LEAD	Leaders, Executives, and Directors
MBAPI	Disaster Mitigation and Climate Change Adaptation, or <i>Mitigasi Bencana dan Adaptasi Perubahan Iklim</i>
MMAF	Ministry of Marine Affairs and Fisheries
MPAG	Marine Protected Areas Governance program
MSC	Marine Stewardship Council

MUSRENBANG	Community Development Meeting, or <i>Musyawaran Perencanaan Pembangunan</i>
NIAS	National Interest Analysis Statement
NOAA	National Oceanic and Atmospheric Administration
NTB	West Nusa Tenggara, or <i>Nusa Tenggara Barat</i>
NTT	East Nusa Tenggara, or <i>Nusa Tenggara Timur</i>
PDPT	Coastal Village Resilience Program, or <i>Program Desa Pesisir Tangguh</i>
Perda	local regulation
POKMASWAS	Community-Based Surveillance Group, or <i>Kelompok Masyarakat Pengawas</i>
PUSDATIN	Center for Data and Information, or <i>Pusat Data, Statistik, Dan Informasi</i>
PUSLAT	Training Center, or <i>Pusat Pelatihan</i>
PSM	port state measures
RCFI	Reef Check Foundation Indonesia
Renstra	strategic plan
RIA	regulatory impact analysis
RMCA	Regional Marine Conservation Area
RZWP3K	Coastal and Small Island Zonation Plan, or <i>Rencana Zonasi Wilayah Pesisir dan Pulau-Pulau Kecil</i>
SPR	Spawning Potential Ratio
SULTRA	Southeast Sulawesi, or <i>Sulawesi Tenggara</i>
TNA	training needs assessment
VA	Vulnerability assessment
WCPFC	Western and Central Pacific Fisheries Commission
WPP	fishery management area, or <i>Wilayah Pengelolaan Perikanan</i>
WWF	World Wildlife Fund

# OVERVIEW AND CONTEXT

## BACKGROUND

Indonesia, with more than 17,000 islands, is the world's largest archipelagic nation, possessing a tremendous richness of marine biological resources and some of the world's most important fisheries. The country is at the heart of the Coral Triangle, with nearly 20 percent of the world's coral reefs, which in turn represent habitat for the vast majority of fish harvested by coastal fishers. In addition to representing about two-thirds of the national protein supply, Indonesia's fisheries represent one of the largest supplies of marine products to the international market, providing about \$4 billion annually in exports, with the United States being the highest value market.

As in many areas of the world, overexploitation of marine resources is a crucial issue, exacerbated by the huge threat posed by illegal fishing. Some estimates suggest the illegal catch would increase total production figures by an additional 40 percent over the legal catch. Ultimately this overfishing poses a major threat to both food security and livelihoods, as well as serious broader economic consequences.

At the same time, climate change represents a major threat to the country, with especially severe ramifications for the approximately 65 percent of Indonesians living in coastal areas. Rising sea level, increasing sea temperature, flooding, saltwater intrusion, and other hazards all threaten the livelihoods and lives of coastal residents. Promoting sustainable fisheries management and other ways to enhance resilience are critical pieces for helping coastal communities adapt to climate change.

## THE IMACS PROJECT

The Ministry of Marine Affairs and Fisheries (MMAF) is the lead institution in the Indonesian government for promoting sustainable fisheries as well as managing coastal areas and promoting the welfare of coastal communities. USAID has played a significant role in supporting MMAF's establishment and capacity building to fulfill its diverse mandate. In late 2010, USAID launched the IMACS project to continue that support, including coordination and integration of its other assistance in the sector under its Marine Resources Program.



IMACS

Fig. 1. The market in Sumbawa, NTB province, reflects the small-scale nature of much of Indonesia's fishing effort. IMACS' work enhanced fisheries management to support both domestic consumption and export demand.

IMACS was designed to enhance Indonesia’s sustainable fisheries management using an ecosystem-based approach, and coastal community resilience and climate change adaptation. MMAF at the national level, together with provincial and district marine affairs and fisheries offices (DKP), were the primary partners and beneficiaries of the project and a major focus of project resources for capacity building. IMACS activities were generally co-designed and co-implemented with MMAF.

As defined with MMAF in Year 1, the project worked at the national level and primarily in 10 districts within two target provinces, Southeast Sulawesi (SULTRA) and West Nusa Tenggara (NTB). A small grants fund was important to the success of IMACS work, with grants incorporating strong local capacity building and sustainability elements. The project issued 42 small grants, primarily supporting facets of climate change adaptation and coastal community resilience in the two provinces. Grants also funded activities and innovations in fisheries data collection and management, communications and awareness raising, community surveillance, and local planning and legal reform.

Many IMACS interventions can be viewed within USAID’s science, technology, innovation, and partnership initiative. Especially for improved fisheries management, science-based approaches based on improved data collection, analysis, and reporting were integral to the work. A series of innovations focused on tools and computer applications underpinned important fisheries governance enhancements, while helping private business compile essential data supporting transparency and traceability. And while IMACS worked extensively with the government, partnerships — with the private sector, research institutions, and community groups — drove many results and have already led to sustained and expanded improvements in the sector. Under the project a total of eight public-private partnerships were established involving at least 23 companies (see Project Partners at the end of this report).

IMACS was designed to support coordination and integration of USAID’s Marine Resources Program. Throughout the project, the team liaised with other partners, primarily NOAA and USAID’s programs providing assistance in marine protected areas governance, first the Coral Triangle Support Program-Indonesia (CTSP-I) and the subsequent Marine Protected Areas Governance (MPAG) program, and also other donor projects. In addition to coordinated work planning and reporting, and periodic larger coordination meetings, other integration took place for specific technical initiatives, either ad hoc or through more established working partnerships. IMACS facilitated and jointly developed and implemented training events and other capacity building with NOAA. Training activity coordinated with NOAA included port state measures (PSMs), the ecosystem approach to fisheries management (EAFM), fishery observers, and combating illegal, unreported, and unregulated (IUU) fishing. Work with MPAG included synergies in EAFM-based capacity building and planning and coordination on site-specific interventions. IMACS also supported applied research involving major tuna supplier Anova and two USAID University Partnership institutions — UCLA and Udayana University — that examined the genetics of tuna and potential sub-populations, informing fishery management decisions.

The funding for the IMACS came primarily from USAID biodiversity funding and therefore the activities were focused on reducing key threats to marine biodiversity in Indonesia. A significant percentage of funding came from USAID climate change

adaptation funds, and was used to increase the resilience of coastal ecosystems and communities to adapt to climate change and reduce risks from disasters.

<b>Fig. 2. IMACS by the Numbers</b>	
<b>5,200,000</b>	Hectares of marine environment under improved fisheries management, primarily via multi-stakeholder data management committees and on-going data collection, with improved data across an additional 21,000,000 hectares to support better management in the future
<b>4,588,803</b>	Kilograms of tuna and crab landings for which data was recorded in the new I-Fish data base, including measurements on 707,652 individual fish and crabs from 8,826 vessel landings across 24 landings sites, leading to better fisheries management and improved transparency and traceability for the private sector
<b>25</b>	New laws, regulations, policies, and related instruments supported by IMACS to enhance fisheries and marine resource management
<b>23</b>	Private sector companies engaged in eight public-private partnerships including fishery data management committees, data collection, and training
<b>2,225</b>	MMAF and other government personnel trained in fisheries, climate change, and related areas tied to their operational responsibilities
<b>100</b>	Coastal villages with village teams developing climate change vulnerability assessments and adaptation plans using the I-CATCH tool
<b>21,570</b>	People reached with awareness campaigns on climate change adaptation and disaster risk reduction
<b>\$1,439,343</b>	Made available across 42 small grants to support improved community-level climate change resilience and adaptation, and sustainable fisheries
<b>190,600</b>	Mangrove seedlings planted in target provinces, improving coastal protection and marine habitat

## CHAPTER ONE

# INSTITUTIONAL DEVELOPMENT FOR MARINE AFFAIRS AND FISHERIES IN INDONESIA

Government responsibility for sustainable fisheries management and ensuring coastal community resilience lies with MMAF, together with provincial and district DKPs. IMACS institutional support to MMAF and DKPs underpinned and was closely linked to technical interventions across the project in fisheries and climate change adaptation. Work with the government also incorporated the roles of other stakeholders, including the private sector, research and educational institutions, NGOs, and communities. Activities focused on MMAF's evolving priority areas together with work necessary to support the implementation, institutionalization, and sustainability of interventions in other IMACS task areas. IMACS supported strategic planning; policy, legal, and regulatory reform; international treaty and convention compliance; marine planning and zonation; overarching public service performance and institutional capacity; fisheries management; and data management, analysis, and information sharing. Work where IMACS' focus was on institutional support to MMAF and DKPs is discussed in this chapter. However, subsequent chapters describing more technical interventions in fisheries and climate change adaptation make it clear that MMAF and DKPs played an essential role in virtually all of IMACS' work.

## **NATIONAL STRATEGIC PLANNING FOR FISHERIES AND MARINE AFFAIRS**

IMACS supported MMAF during an important period, the national strategic planning cycle for the Government of Indonesia. In addition to other policy support under the project, IMACS was requested to provide specific inputs supporting three major initiatives: MMAF's aspects of Indonesia's National Medium Term Development Plan 2015-2019, MMAF's Strategic Plan 2015-2019 (Renstra), and planning for future development of capture fisheries and aquaculture for 2015-2025.

To ensure that marine affairs and fisheries continue to play an important role in Indonesia's development, MMAF requested that IMACS develop a background paper on marine affairs and fisheries development from 2015-2019 to be reflected in the National Medium Term Development Plan. IMACS analysis focused on three issues: leveraging the marine sector's economic potential, fisheries production improvement for strengthening food and nutrition security, and improving the competitiveness and value added of marine and fisheries products. The issues were ultimately clearly addressed in the medium term plan, which was formally enacted by presidential regulation in early 2015. This document serves as guidance for all ministries and other

national and local government institutions for Indonesia's development in the near term.

At the same time IMACS provided assistance to MMAF by developing background papers for MMAF's next strategic plan for 2015-2019, and delivered training on several methods utilized during the Renstra development. The strategic plan is a guidance for all the directorate generals of MMAF, and marine and fisheries agencies at the provincial and district levels in Indonesia to realize the presidential vision of having Indonesia be a major world maritime power by 2019.

During the assistance, IMACS was not involved in developing or determining the actual content of the MMAF Renstra, but rather provided strategic advice for the MMAF team developing the Renstra. IMACS developed four background papers covering different aspects of marine affairs and fisheries. Through the papers, IMACS helped MMAF define strategic issues and objectives, which included combating IUU fishing, improving the integrated marine and fisheries surveillance system, optimizing marine and coastal zoning, improving the fisheries product logistics system, empowering fisheries communities, and developing self-reliance on aquaculture development. IMACS also conducted specific analysis in climate change adaptation to ensure climate change considerations were brought into the Renstra across these strategic issues.

Performance monitoring and evaluation was integral to the strategic planning process. IMACS helped develop key performance indicators (KPI) along with targets, define data sources for measuring indicator achievements, and assess the availability of baseline data within MMAF and other government institutions. To help MMAF with implementation, IMACS developed a web-based application to monitor and measure performance of all MMAF units implementing the Renstra, including implementation progress and budget performance. IMACS also supported MMAF to develop an indicator manual to serve as a guidance for all directorate generals who will implement the Renstra, as well as the internal monitoring and evaluation unit that will control and measure the implementation status of the Renstra. The manual was also used as a guidance for MMAF to flow down KPIs to all provincial marine affairs and fisheries agencies in Indonesia.

To achieve the Renstra outcomes, there needs to be strong coordination between MMAF and local governments. IMACS helped strengthen this coordination by facilitating discussions between MMAF and provincial DKPs on key elements of the plan, resulting in each province formally committing to support achievement of KPI targets. IMACS and MMAF also held a public consultation event on the final draft of the strategic plan, including other ministries, marine and fisheries business associations, academics, NGOs, and the media. The Renstra document was then formally enacted by ministerial regulation.

In a third support area, IMACS analyzed the future of Indonesia's capture fisheries and aquaculture sectors for 2015-2025. Three "triple bottom line" indicators, covering environment, economics, and social welfare, guided the approach. For both sectors the team assessed the current state, future projections, strategic recommendations, and implementation readiness.



IMACS

Fig. 3. IMACS supported MMAF's strategic planning efforts in assessing the outlook for capture fisheries and aquaculture over the coming decade. This will inform key decisions on how the government manages its major fisheries, such as those here in the Arafura Sea, which contributes more than 10 percent of the country's total fishery production.

Based on the capture fisheries analysis, IMACS recommended strategies for rebuilding the capture fisheries sector and achieving a sustainably managed and self-reliant capture fisheries sector in Indonesia by 2025. These covered improved management practices, strengthened law enforcement, enhanced use of data and information technology, and improved infrastructure with a focus on eastern Indonesia. For aquaculture, recommendations covered improved production, zoning, increased use of technology, improved funding, and re-structured distribution and marketing. Through this assistance, IMACS not only provided strategic recommendations, but also provided MMAF with a systematic framework for developing a long-term strategic plan in the future.

## COMBATING IUU FISHING

Illegal, unreported, and unregulated fishing poses a huge threat to the sustainability of Indonesia's fisheries, with rough estimates from MMAF and other sources suggesting that billions of dollars annually may be lost from the Indonesian economy due to IUU. Addressing IUU is therefore a high priority of the Indonesian government. IMACS supported MMAF's program to combat IUU primarily in four areas: policy support to MMAF, strengthened community-based surveillance groups, strengthened capacity of MMAF to implement port state measures, and other technical and capacity building support.

## Policy Support

Much of MMAF's IUU efforts had specific focus on illegal fishing. IMACS, working across multiple divisions and especially with the Directorate General of Marine and Fisheries Resources Surveillance, helped MMAF to inventory the range of fishing vessel violations, evaluate the legal and regulatory framework for fishing businesses, and assess current MMAF policies to combat illegal activities. To frame the government strategy, IMACS specialists helped MMAF develop a National Plan of Action to Combat Illegal Fishing, which includes MMAF's roles and responsibilities in fisheries monitoring, control, and surveillance as well as implementation mechanisms, reporting, and expected outcomes. This plan will be legalized through a presidential regulation on combating IUU.

In addition, IMACS helped MMAF in assessing key regulations covering a moratorium on fishing licenses for foreign vessels and prohibition on transshipments at sea. From this IMACS recommended that MMAF makes some improvements in fishing vessel registration, licensing, and surveillance; strengthen control functions at ports; improve catch documentation; and strengthen international coordination. Other recommendations included the need for better coordination among law enforcement units. The team also assessed the potential use of satellite imagery provided by NOAA to detect nighttime fishing activities and help prioritize surveillance and enforcement efforts.

Understanding the economic impact of illegal fishing was a priority for decision-makers, yet data was very limited. IMACS and MMAF's Directorate General of Marine and Fisheries Resources Surveillance worked together to create an innovative tool to model this. Using satellite data showing vessels at sea, combined with the likely legally operating vessels appearing through MMAF's vessel monitoring system, the tool estimates the fraction of illegal vessels in Indonesian waters. Imagery then allows modeling of vessel length, gross tonnage, and probable gear types. From this, the web-based "dashboard" provides rough catch estimates of vessels and the value of this illegal catch.

## Community Surveillance (POKMASWAS)

Community surveillance groups, or *Kelompok Masyarakat Pengawas* (POKMASWAS), are one aspect of Indonesia's effort to abate destructive fishing and other illegal fishing practices. Formal enforcement agencies in Indonesia often lack the resources to adequately patrol and enforce the country's expansive coastal areas. Collaboration between enforcement agencies and community-based surveillance groups offers a possible solution, expanding the reach of surveillance efforts and enabling enforcement resources to be targeted when and where they are needed most.

MMAF began promoting community-based surveillance through the establishment of POKMASWAS several years ago. An assessment by IMACS indicated that only a few of the POKMASWAS across the country are effective, with most lacking the resources to patrol effectively and a clear operational mandate and guidelines.

IMACS worked directly with MMAF on program enhancements. This included an initial survey and needs assessment of POKMASWAS members, and drafting standard operating procedures which provide step-by-step guidance for POKMASWAS roles and responsibilities for monitoring and reporting violations. The procedures were subsequently accepted by a multi-institutional group of officials including MMAF, the Navy, and the police, and will be legally adopted through ministerial decree. The standard operating procedures then formed the basis for training efforts which included MMAF surveillance specialists, POKMASWAS representatives, and village heads and focused on enhancing POKMASWAS participation in surveillance activities and ability to detect, document, and report fishery violations.

IMACS also worked with a local grantee to facilitate POKMASWAS sustainability efforts, aimed at assisting village-level groups in NTB and SULTRA with accessing corporate social responsibility funding and developing public-private partnerships. Meanwhile IMACS worked with district government to deliver a training program for representatives of POKMASWAS groups. The training aimed to increase knowledge about coastal resource and sustainable fisheries management, build surveillance and monitoring capacity, strengthen institutional groups, and enhance coordination between POKMASWAS and DKP.

In another setting, Liwuto village in SULTRA, IMACS supported a local group with an integrated approach for community involvement. The IMACS grant helped establish a shredded fish business to foster alternative, environmentally sound income sources; a marine protected area under local management; and a POKMASWAS group to help monitor the protected area and other activities, and potentially assisted by greater household income from expanded shredded fish business.



Fig. 4. MMAF surveillance vessels at East Lombok port in NTB. In cooperation with NOAA, IMACS helped build capacity in monitoring and enforcement to combat illegal fishing, including port state measures, which are requirements that apply to foreign vessels using government controlled and operated port facilities.

## Port State Measures

The FAO Agreement on port state measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing focuses on the use of robust port state measures. It details the conditions under which Indonesian harbor authorities can deny port services to foreign vessels that are suspected of IUU fishing. As a signatory to the agreement, Indonesia has a need to develop human resource and institutional capacity to implement PSM.

IMACS worked closely with MMAF's surveillance unit and experts from NOAA's Office of Law Enforcement to establish capacity for PSM. First, NOAA with support from IMACS presented training focusing on the legal and policy elements of PSM. IMACS, working with several MMAF units and NOAA, then developed a PSM training curriculum for fisheries inspectorates to allow them to implement PSM at Indonesia's ports. The course covered preparing for inspecting a foreign vessel, verifying documentation, examining the condition of the vessel and gear, examining the catch, analyzing the results, and reporting.

## Other Support to Mitigate IUU Fishing

IMACS made a series of additional contributions to IUU fishing abatement through other work. For example, on-board observers collect information to monitor compliance with fishing regulations, including fishing practices, transshipments at sea, and interactions with endangered, threatened, and protected species, and IMACS supported Indonesia's newly established national on-board observer program (see next chapter).

Small-scale fisheries comprise some 90 percent of Indonesia's total fishing fleet, and the vast majority are unregulated and unreported. There are only minimal requirements for these fishers to report catches to their local DKP. Meanwhile, these fisheries lack comprehensive management plans and harvest control rules that would underpin sustainability of the stock. IMACS implemented activities in several fisheries to enhance data collection and catch reporting, and to strengthen management planning via the I-Fish program. Meanwhile, IMACS translated this information into better fishery management and regulation (see below discussion on fishery management planning).

## OTHER NATIONAL POLICY REFORM AND REGULATORY DEVELOPMENT

### Priority Policy Analysis

Concurrent with the national strategic planning support described above, a new minister took office and commenced activity on new priorities. IMACS was asked by the MMAF Planning Bureau to support the Directorate General of Capture Fisheries with analysis of regulations addressing a moratorium on fishing licenses for foreign vessels and prohibition on transshipments at sea, which were both closely tied to efforts to combat illegal fishing, as well as assessment of a license cost exemption for fishing vessels under 10 gross tons. Another priority was developing a socio-economic indicator for peoples' welfare in the marine affairs and fisheries sector, for which IMACS helped MMAF develop the statistical basis for the index as well as the

data collection and validation approach. Finally, IMACS helped MMAF work through the implications of a new law shifting key responsibilities to provinces. The team's work with MMAF's legal bureau provided key input to the Ministry of Home Affairs for government regulations on the division of authority between the central government, provincial governments, and district governments for implementation of the law.

### National Oceans Policy and Ocean Act

The formulation of Indonesia's National Oceans Policy is undertaken by the Indonesian Oceans Council, a multi-sectorial government body formed in 1999. While the policy has had much attention from experts and working groups over the years, the policy document lacked detail to effectively reflect the vast



Fig. 5. U.S. Secretary of State John Kerry (center) inspects a ship's catch at Benoa Harbor in Bali, with the former Marine Affairs and Fisheries Minister Sharif Cicip Sutardjo (right) and IMACS grantee Aditya Utama of Anova's Fishing and Living Program. IMACS' support led to improved policies, technical tools, and ecosystem-based management approaches for Indonesia, the world's largest tuna-producing country.

work to date, including a body of new laws that were introduced during the past decade. Based on a request for assistance from the council, IMACS assessed the draft policy and helped the council identify policy gaps, categorize and align policy content, and distinguish statements of policy commitment from descriptions of desired future conditions to ensure that the national policy meets the overarching goal of sustainable management of Indonesia's marine and coastal ecosystems and reflects a consensus about approaches to be endorsed by policy.

Work on this policy ultimately supported MMAF's development of the Ocean Act, a comprehensive law for marine resource management, which addresses coastal zoning, maritime culture, marine security, and the economic potential of marine resources. The Ocean Act was enacted and entered into force in 2014.

### **Participation In Regional Fishery Management Organizations**

The Indonesian government is a member of two tuna regional fishery management organizations — the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) and the Indian Ocean Tuna Commission (IOTC) — and is a cooperating non-member of Western Central and Pacific Fisheries Commission (WCPFC). IMACS supported MMAF's Directorate General of Capture Fisheries to assess international obligations, threats, policy priorities, and representation of MMAF in these organizations. IMACS also provided recommendations to MMAF and the Ministry of Foreign Affairs for WCPFC ratification, focusing on a policy guideline to ensure compliance with the WCPFC Convention. The IMACS I-Fish approach described in the next chapter provided invaluable new data to support Indonesia's tuna management efforts and fulfillment of international obligations.

### **Regulatory Impact Analysis**

MMAF identified the need to increase its capacity to develop and assess the impact of regulations developed under its mandate. To support this, IMACS, through the University of Gadjah Mada, provided legal drafting and regulatory impact analysis (RIA) expertise to improve the knowledge and skills of MMAF Legal Bureau staff, legal staff from each Directorate General, and DKP provincial staff from Sulawesi Tenggara and Nusa Tenggara Barat. RIA is a method used to analyze and communicate the impact of new and existing government policy. It involves a systematic appraisal of the costs and benefits associated with a proposed new regulation and evaluation of the performance of existing regulations.

The legal drafting support strengthened MMAF officers' abilities to prepare and draft regulations from a technical standpoint and improve planning, preparation techniques, formulation, public consultations, approval, promulgation, and dissemination. MMAF officers gained the ability to formulate and evaluate more objective, effective, accountable, and bottom-up policies. See also discussion of IMACS' RIA training support below.

### **COASTAL AND SMALL ISLAND PLANNING AND ZONATION**

Indonesian law mandates that regional governments develop Coastal and Small Island Zonation Plans (RZWP3K) and stipulates that there be a local regulation (Perda) on coastal zonation to control spatial utilization for long-term sustainability of marine

and coastal resources. This kind of planning also helps to rationalize the range of factors that put pressure on coastal ecosystems as a result of incompatible spatial-use activities. IMACS provided both site-specific technical assistance and broad-scale capacity building support to MMAF and DKPs for coastal and small island planning and zonation.

An initial priority of the provincial and district DKPs was to increase capacity to develop and assess the impact of regulations developed under their mandate. Given this, IMACS first conducted RIA training as described above. Then, to operationalize this knowledge, IMACS worked with officials in Lombok Barat in NTB, to establish a Perda focused on small islands and coastal zone management in accordance with the RIA method. The training led to the successful development of a Perda that was enacted by the Lombok Barat local parliament.

Under a grant to PT Iname Utama, IMACS then trained and mentored North Lombok and South Konawe government officials to facilitate development of RZWP3K documents. Both North Lombok and South Konawe conducted public consultations to finalize the RZWP3K documents and coastal zonation plans that served as the basis for the Perda. Outputs from this grant included RZWP3K training materials, a series of maps on natural resources and land utilization, and RZWP3K documents that can be packaged and used by MMAF in other districts.

IMACS also facilitated the public consultation process with DKP officials to conclude and issue the draft Perda on RZWP3K for Central Lombok and Sumbawa. The two governments sent recommendation letters to the local parliament; the Sumbawa Perda was enacted and the Perda for Central Lombok is under parliamentary review.

To support broader capacity, IMACS facilitated the development of a 13-module training course to be disseminated to all of the coastal district local parliaments, local planning agencies, and district and provincial DKPs in Indonesia. The training was designed to help foster a more effective delivery of technical assistance to the provincial and district governments, and accelerate development of local plans and Perdas.

Finally, IMACS assisted MMAF to revise the policy on accrediting coastal and small islands management programs. This accreditation system — offered by the central government — incentivizes local governments, the private sector, and community groups to implement coastal and small islands management programs by offering certain benefits, including budget support and technical assistance for zonation planning to the group(s) that have achieved a high accreditation score. A software application will serve as the accreditation tool for the central government to assess the coastal and small islands management programs according to national standards. IMACS prepared the accreditation software application and user manual.

## **PUBLIC SERVICE DELIVERY AND INSTITUTIONAL COOPERATION**

In 2012, MMAF identified bureaucracy reform as its number one priority. The reform targets consist of eight pillars, one of which is public service improvement.

## Customary Law Helps Community Manage Its Own Marine Resources

Bumbang Bay covers an area of 79,000 hectares, of which nearly a third has been proposed as a Regional Marine Conservation Area (RMCA). This area has been included in MMAF's Master Plan for the district. The area of the RMCA is the largest lobster seedling area in NTB and is rich in various other natural resources, including coral reefs, breeding grounds for shrimp and fish, and seaweed farming beds, and includes multiple scuba diving and snorkeling locations, leading to strong tourism potential. However, harmful human activities including construction, destructive fishing practices, and garbage dumping have harmed the area. Conflict between fishers, fish and seaweed farmers, and tourism operators stands to further degrade the bay.



*Fig. 6. Young lobsters from Bumbang Bay in Central Lombok hold promise for the NTB province. A new traditional law will support sustainable management of this valuable resource.*

In response, the local NGO LP3M partnered with the University of Gunung under an IMACS grant to improve the community's management of this important resource. They worked with the community and local government to formulate an awig-awig, or customary law, which sets the framework for best management practices based on community member consensus building. It can also form the basis for future government regulations.

Discussions with DKP and other local officials, people from local villages, and local business representatives first identified priority issues and considerations, which through further consultation led to a draft awig-awig. This in turn went through a review process involving the public as well as legal and fisheries experts. The final agreement was signed by local chiefs, and witnessed by DKP officials. The agreement stipulates sustainable fisheries measures and zoning policies to be implemented by the communities. To promote the awig-awig, the communities held a beach cleaning event, installed large informational signboards, and distributed booklets to community members and government officials. Community members signed an MOU with the local DKP pledging support to the awig-awig and future formal government regulations.

Previously, the government ombudsman assessed public service performance of all ministries. MMAF was concerned when the ombudsman's assessment findings categorized MMAF's public service as needing improvement, and turned to IMACS to help increase its public service quality.

First, MMAF asked IMACS to facilitate training and conduct a baseline survey to assess MMAF's public service. The survey includes indices measuring user satisfaction with MMAF's public service and MMAF's capacity to deliver these public services. IMACS subsequently worked with MMAF to align its public service monitoring process and assessment instrument so the ministry could better manage and evaluate performance of ministry staff in various public service areas. According to the government system, these areas include transparency of service, accountability, service ethic, requirements for service, and employee competency. With IMACS support and changes made by the ministry, managers were able to improve public service quality.

IMACS also helped MMAF upgrade their website and shift to the electronic International and Inter-Institution Cooperation (e-KARINA) system. The e-KARINA application helps capture data on cooperation between MMAF and international government agencies, international donors, multilateral institutions, and other relevant organizations. It enables MMAF to evaluate the performance of cooperation among those organizations, including whether certain benefits are achieved from a specific cooperation. Periodic enhancements included the ability to access the system through a smart phone. The team also developed an application to record, manage, and monitor goals and outcomes of MMAF's official international missions and trained staff on its use and transition from a manual system.

### **Technical Data Management Systems**

IMACS developed several systems to help improve MMAF's data collection and management efforts to more effectively manage marine affairs and resources. The primary focal points were 1) fisheries data collection, management, and analysis; and 2) research management.

Early in the project, IMACS suggested that MMAF needed to improve its fisheries data collection and management system. The new system should take into account the changed role of district- and province-level DKPs, recent developments in fishing practices and in fishery supply lines, and recent developments in information technology (in particular the nearly universal availability of internet access). The system should allow for processing of data from various sources (e.g., village surveys, fishing companies, fishing harbors, and log books), and it should generate customized reports for each administrative level (district, province, national). Results should also be accessible to a wide range of participants in the fishery sector. The result of this analysis and further planning was I-Fish, a data collection, management, and collaboration platform launched under the project and subsequently used for various technical, planning, and management applications by the government and private sector. See Chapter 2 (Sustainable Fisheries Management) for more on I-Fish.

IMACS also supported MMAF in developing a research management database system to compile and integrate all fisheries research data from different divisions within MMAF. Previously, scientists across disparate divisions within MMAF were not able to share their raw scientific data with one another. However, the research management database can integrate scientific data from different MMAF divisions into one common platform. This supports MMAF to develop the "one data system" policy that it plans to establish. IMACS worked with MMAF to finalize the research data categories to be included, conducted a user needs assessment, and developed the final application for MMAF.

### **TRAINING AND CURRICULUM DEVELOPMENT**

Under Indonesian law, the quality of fisheries education, training, and extension programs managed by MMAF should meet international standards, and must therefore be based on internationally recognized principles and models for curriculum and module development. Within MMAF, the Human Resources Development Agency (BPSDM), is responsible for fulfilling this mandate and formulating policies on capacity building and management of education, training, and extension activities.

IMACS worked closely with BPSDM to develop guidelines for curriculum and training module development with the intention of standardizing IMACS training events across the organizational units within MMAF. This included methods for establishing training objectives and logical frameworks, mapping curricula, developing training design and methodology, drafting and finalizing modules, identification and preparation of real-world examples, and development of facilitator guides.

In addition, regular and effective evaluation of training needs across MMAF divisions is essential. Currently, there are six Fisheries Training Centers across Indonesia to meet regional needs. Training programs across these centers are expected to be based on the specific requirements of local participants that are determined from a training needs assessment (TNA). As such, MMAF requested IMACS to assist with developing a set of guidelines to standardize the way in which TNAs are conducted across all of its training centers. The TNA guidelines were ultimately submitted to MMAF through PUSLAT-BPSDM and the Personnel Bureau and adopted.

As IMACS introduced new or enhanced approaches, tools, and systems tied to MMAF improvements in implementing its mandate, including those described in the following two chapters of this report, specific capacity building efforts came along to support launch and sustainability of the efforts. Project support in collaboration with BPSDM included training and curriculum development in:

- The on-board fishery observer competency-based curriculum, which covers regulations and observer preparation, observation and collection of data, and scientific data collection for the scientific observer.
- RZWP3K implementation for local government zonation planning.
- Port state measures to help combat illegal fishing, developed together with NOAA.
- Data collection and management under the I-Fish system for MMAF enumerators, including the importance of scientific data for achieving better fishery management.



Fig. 7. Climate change vulnerability assessment and adaptation planning facilitators participate in a training session in Kendari, Southeast Sulawesi. IMACS helped MMAF adopt a national competency standard and curriculum for disaster mitigation and climate change adaptation facilitators using the I-CATCH tool under its national MBAPI program.

- GIS and the spatial planning framework developed by IMACS, including working with spatial data, maintaining database metadata, producing maps for publication, and preparing spatial analysis for decision-making.
- Understanding and using GIS-based WPP maps, including using the GIS software to read and use the maps and using maps to develop coastal zonation planning datasets to develop data on fisheries resources.
- Using applications that IMACS developed for better internal management, which include the MMAF research database prototype; public service assessments; and e-KARINA database.
- Disaster mitigation and climate change adaptation (MBAPI) implementation tied to the government's national PDPT coastal resilience program and according to the IMACS I-CATCH approach (see Chapter 3). IMACS also helped MMAF devise a national competency standard for disaster mitigation and climate change adaptation facilitators.
- Various other enhanced and innovative approaches for the ministry's work such as ecosystem approach to fisheries management, data poor stock assessment, regulatory impact assessment, and National Interest Analysis Statement for assessing feasibility of international cooperation in marine affairs and fisheries.

# SUSTAINABLE FISHERIES MANAGEMENT

The greatest thrust of the project was to assist MMAF to apply enhanced practices, incorporating EAFM principles, to manage Indonesia's fisheries for greater sustainability. The main threat to fisheries in Indonesia, and worldwide, is over-exploitation. The Indonesian government acknowledges that over-fishing represents a major challenge to the nation's fishing industry. A key issue is the need for better governance mechanisms, including more effective law enforcement and reduction in IUU fishing, to prevent or diminish this over-exploitation.

Enhanced management — considering EAFM and elements like a rights-based approach — is essential to promote the sustainability of fisheries in Indonesia, but there are important requirements that need to be fulfilled. First, better management requires fishers, fishing companies, and the government to have extensive coordination. It also requires all stakeholders to have an understanding of fishery management and the status of the fish stock. Most Indonesian fisheries are poorly understood in terms of the size of the stocks, as well as migratory patterns, growth cycles, etc. This lack of data poses a problem for sustainable management; without adequate data it is impossible to determine the maximum sustainable yield and appropriate level of effort required for a given fishery.

IMACS specialists, with the support of NOAA and other partners, helped MMAF and others put mechanisms in place to fulfill these requirements. As such, a large part of the IMACS' work was about collaborative data collection, and coordination among fishers, fish traders, and government officials (public-private partnerships).

## IMPROVED DATA COLLECTION AND TOOLS

Access to accurate and timely data on fish stocks and fisheries is critical for fisheries management planning. IMACS implemented a number of initiatives to improve the availability and transparency of fisheries data in Indonesia, contributing to better decision-making by MMAF and DKPs for fishery resources at the local and ecosystem levels, enhanced information for the private sector and increased transparency in fishery supply chains, and better reporting for requirements of international agreements. These initiatives included new databases, data management and collaboration platforms, and several technology-based tools to enhance vessel and fishery data at various scales.

Prior to IMACS' work, MMAF through the Directorate General of Capture Fisheries used a national fishery statistics system developed in the 1970s that aggregated fisheries data by landing site but did not record details of the fishing grounds from which catches were derived. While this system enabled the productivity of district and provincial fisheries to be determined, it was of limited use for informing ecosystem-based fishery management planning.

## Better Data Boosts Indonesia's Tuna Fisheries

Indonesia is the world's largest tuna producer, contributing some 1 million tons or 16 percent of total global production annually. In 2013 alone tuna exports contributed more than \$750 million to the national economy. With Indonesia's tuna fisheries playing a vital role in local economies, livelihoods, and food security, MMAF has prioritized sustainable management and conservation practices. To support this, IMACS promoted public-private collaboration for tuna fisheries assessment and management via the I-Fish platform. IMACS developed a data collection methodology in consultation with MMAF researchers, regional fishery management organizations, and international experts and facilitated the creation of multi-stakeholder I-Fish Data Management Committees (DMCs) in NTB and Maluku that were formalized via provincial government decree.

DMCs now collect data from more than 3.1 million hectares of yellowfin fishing grounds in Maluku, and 4.7 million hectares of yellowfin and skipjack fishing grounds in NTB (Lombok and Sumbawa). A large portion of these fish are exported to the U.S., and to maintain future supply lines, accurate data of stock availability is urgently required. Data collection in these tuna fisheries was initially supported via IMACS grantee Anova. DMC members have subsequently sustained data collection, with IMACS providing technical support and facilitating coordination between the DMC and MMAF. DMC members have committed financial and in-kind resources that will see the program continue until at least 2017.

This collaborative fishery monitoring program provides data that was previously unavailable to fishery managers, including information about the composition of the catch and fishing effort for specific fishing grounds. A total of 8,826 tuna and skipjack landings have been assessed over a period of almost three years, with a total of 536,683 fish measured. Enumerators entered all landings into I-Fish. This information has assisted the government in strengthening national tuna management efforts. Improved data have also been instrumental in fulfilling requirements for eco-certifications such as MSC and Fair Trade, making progress on proposed measures like harvest control rules and target reference limits, making annual submittals to RFMOs, and supporting further research.



IMACS

*Fig. 8. Anova enumerators collected data at various landing sites. I-Fish data collection informs management and planning for the government and private sector.*

## Indonesia Fisheries Information System (I-Fish)

IMACS developed I-Fish as an innovative approach to enrich existing fisheries data and statistics. The I-Fish platform collects and analyzes catch composition data — species, length, and quality — as well as operational details of fishing trips, such as approximate fishing grounds, fishing effort, and quantity of inputs like fuel and ice. It consists of fishery-specific modules and others for special priorities, including for endangered, threatened, and protected species. It is cloud based and smartphone compatible, and fully available to the government, fishers and fishing companies, and researchers.

I-Fish is also a collaboration platform for fisheries management. Multi-stakeholder collaboration — government, research institutions, private companies — is achieved via I-Fish Data Management Committees, established via decrees issued by the head of the provincial DKP. Whereas the DMCs initially focus on collaborative data collection, the intention is that they will also make recommendations for fishery regulation and management. Collaboration between data management committee members and MMAF to align and endorse data collection methodologies means that I-Fish data provided by industry can support fishery management plans and the

Indonesian government's reporting obligations to regional fishery management organizations, including the IOTC and the WCPFC.

IMACS spent significant effort institutionalizing I-Fish, including refining data collection methodologies to better align with MMAF's monitoring protocols, and providing training to about 50 MMAF enumerators (data collectors) from across Indonesia. Other efforts focused on developing an institutional framework for I-Fish to ensure the collaborative platform is integrated with MMAF's management framework for fishery management areas (WPPs), and can be sustained post-IMACS. This includes recognition of key private sector contributions in data collection and sharing, while understanding legitimate concerns regarding data ownership and confidentiality.

IMACS deployed the I-Fish approach within the skipjack tuna and yellowfin tuna fishery in NTB, yellowfin tuna fishery in Maluku, and blue swimming crab fishery in Southeast Sulawesi, with similar data collected for the tongkol fishery in the Lombok Strait and shark and ray fishery in Nusa Tenggara. Monitoring protocols have been designed for each fishery. DMCs have been established in both tuna fisheries and the blue swimming crab fishery.

### **I-Fish Sustainability and Expansion**

Already, I-Fish DMC members have committed in-kind and financial resources that will sustain the approach well after the project ends. A key driver behind the commitments made by private sector members has been the benefits afforded by improved data for specific fisheries. The I-Fish approach provides a better understanding of stock status, underpins industry engagement in management planning, and provides a basis for the development of traceability systems, including fulfilling requirements of eco-certifications.

Interest in I-Fish has continued to grow based on private sector needs and management and research priorities of MMAF. I-Fish has enabled stakeholders of the Southeast Sulawesi blue swimming crab fishery to complete a "data poor" stock assessment, and use that to determine the condition of the fishery and develop harvest control recommendations (see box below). This in turn is contributing to their efforts to work toward MSC certification. Near the end of the project specialists at IMACS partner MDPI established an I-Fish sampling protocol for the West Papuan mangrove mud crab fishery in Kaimana, which may be targeted for eco-certification. At the same time, existing I-Fish data collection efforts and DMCs proved key elements in achieving Fair Trade certification for tuna in Maluku in late 2014, and taking steps toward MSC certification for other Indonesia tuna fisheries (see discussion below). The project also helped MMAF modify I-Fish protocols to accommodate mixed species data collection in all 11 WPPs and discussed developing an I-Fish sampling protocol for the Batam aquaculture sector. In addition, there is interest in connecting I-Fish to other initiatives including combined traceability and supply chain systems, and mobile applications. Outside of the IMACS target provinces of NTB and SULTRA, I-Fish already was implemented at 22 landing sites in Eastern Indonesia.

## **E-Logbooks and Vessel Monitoring Systems**

IMACS supported development of other technologies to increase the role of the private sector in enhancing fisheries data availability, transparency, and accountability. MMAF has been implementing a logbook system for large vessels (>30 GT). However, implementation of this requirement has been difficult, and there are strong indications that most fishing vessels ask administrative staff back in the home port to fill in their logbooks. Hence, logbook data have been unreliable and have not been used yet to inform fisheries management. To help with this, IMACS and local partner ISOI developed a prototype e-logbook system for large vessels, to be connected with MMAF's Vessel Monitoring System. Senior government personnel were consulted extensively during the development to define specifications of the system and to ensure it aligns with Indonesia's fishery regulatory requirements. Field trials were completed, with data collected on fishing operations within several fisheries, and the system was handed over to the government ready for deployment pending revision to Indonesia's logbook regulations. Private sector representatives remain keen to implement the program — and have volunteered participation of their vessel fleets — as it will help certify claims of environmentally friendly fishing methods, such as pole and line and hand-line.

IMACS and grantee PT Springfields also developed a prototype e-logbook and vessel monitoring system for small-scale fishing vessels (<10 GT). PT Springfields piloted the system, which utilizes tablet PCs and GPS connectivity, with 40 vessels, and in the process provided the DKP in East Lombok with detailed information about catch composition and fishing effort. All devices were handed over to the DKP in East Lombok who, considering the success of the project, liaised with MMAF's Directorate of Fishery Resources to identify strategies for scaling up this pilot initiative.

## **FISHERIES STATISTICS AND KNOWLEDGE MANAGEMENT**

Tied to capacity building of MMAF, IMACS had several other initiatives to collect, validate, and integrate key fisheries information for improved management. In some cases this involved extensive collaboration with other ministries and agencies and on-the-ground data collection or verification.

### **Fishing Ground and Supply Chain Mapping**

IMACS, together with local DKP officers in NTB, conducted field surveys in Lombok, Sumbawa, East Flores, West Flores, and Sumba as part of a program to map fishing grounds, fisheries resources, and infrastructure in three WPPs of Central Indonesia. The focus on fishing grounds and supply chains is connected with EAFM: It takes a holistic perspective on the fishing sector, starting from the marine ecosystem instead of the harbor or the administrative unit. The surveys aimed to describe complete supply chains, starting from fishing grounds, and leading to exporters through a network of traders and fish processing plants. This information may be used by MMAF for fishery management planning, by private sector partners for the development of sustainable supply chains, and by donors and NGOs for planning fishery and marine conservation projects.



Fig. 9. Small fishing boats line the shore in southern Sumbawa, NTB. Enhanced vessel monitoring and e-logbooks, for small or large vessels, greatly improve fisheries data, including transparency essential to documenting supply chains and reducing illegal fishing.

Surveys focused on three important groups of export species: demersal fish (predominantly snappers, groupers, emperors, and sea breams); yellowfin tuna and associated large pelagic species; and small pelagic species (predominantly skipjack tuna, juvenile yellowfin tuna, big eye tuna, and Eastern little tuna). The surveys identified fishing grounds via structured interviews with fishers, and a GIS analysis was carried out to assess the total extent of these fishing grounds. The total area of fishing grounds from which data were obtained during these surveys was 20,985,462 hectares. IMACS subsequently conducted a similar assessment of fishing grounds and supply chains for the tuna, demersal, and blue swimming crab fisheries of Southeast Sulawesi, the other target area for the project.

### **WPP Maps**

In support of MMAF's EAFM-based management efforts based on WPPs, IMACS worked with the Directorate of Fisheries Resources and the Research Centre for Fisheries Management and Conservation to compile various spatial data to develop a series of fishery resource and infrastructure maps for Indonesia's 11 WPPs, an area of approximately 246 million hectares. These maps brought together for the first time a wide body of data on fish landing sites, bathymetry, coral reefs, mangroves, and infrastructure that were previously dispersed throughout numerous organizations and agencies to support science-based fishery management planning. IMACS developed a GIS-based application that was handed over to MMAF, and provided training to MMAF technical officers, ensuring that this data can be adapted and used to support various fishery management purposes.

### **Applied Research to Support Fisheries Management**

Improving the science behind fisheries management, IMACS supported research assessing the genetics of yellowfin tuna, together with Anova, its suppliers throughout Indonesia, the University of California Los Angeles, and the Biodiversity Research Center of Udayana University in Bali. The universities were partners under USAID

Indonesia's Marine Resources Program. The research sought evidence for the existence of sub-populations of yellowfin tuna. Though no clear evidence was ultimately found, if such a sub-population existed, management at small spatial scales would become meaningful, meaning also that MSC certification could be conducted for parts of the Indonesia archipelago instead of the entire archipelago. IMACS contributed to compilation of a protocol for collecting samples for genetic analysis.

## Better Data and Management Propel Indonesia's Blue Swimming Crab Fishery

The Indonesian blue swimming crab fishery developed rapidly during the 1990s to become an important source of income for Indonesian coastal communities. Because the supply of blue swimming crab from Thailand and Philippines has declined due to overexploitation, U.S. market demand for Indonesian blue swimming crab has increased. Industry data suggests that Indonesia's production peaked in 2010, with a subsequent and potentially concerning reduction in average size. At the same time, international markets are now demanding that the product's sustainability be secured and certified.



Fig. 10. An I-Fish enumerator from APRI measures a blue swimming crab for improved stock assessment at a small processing plant in SULTRA.

To address these management needs in a critical fishery, IMACS engaged — through a small grant — the Asosiasi Pengelolaan Rajungan Indonesia (APRI), the in-country trade association of processors for blue swimming crab, to establish a cooperative government-industry partnership to manage the blue swimming crab fishery. The fishery of the Tiworo Strait, Southeast Sulawesi, spanning 508,586 hectares, was selected as the target location, with this region's geography defining a clearly delineated stock and body of stakeholders that would aid project implementation. Experience with this fishery can serve as a model for co-management at the provincial level, in accordance with the national framework for blue swimming crab fisheries in Indonesia.

IMACS first facilitated the creation of a Data Management Committee — which now operates independently of IMACS via provincial government decree—for collaborative data management. IMACS also recommended, and the DKP agreed, that the DMC should be developed to become the management authority for the blue swimming crab fishery. PT Phillips Seafood, a founder of APRI, contributed to the DMC establishment and subsequent work in I-Fish data collection, stock assessment, and eco-certification gap analysis.

The team developed a fishery monitoring protocol with I-Fish enumerators employed by APRI recording data on catch composition and fishing practices, ultimately measuring 170,969 crabs in less than two years. Catch data from 20 different fishing grounds was integrated with IMACS' leading-edge work on data-poor stock assessment using the Spawning Potential Ratio (SPR) to determine stock status in relation to several reference point targets for the fishery: for maximum sustainable yield, for maximum economic yield, and levels below which crab populations are at risk of declining. Low SPR values indicated that fishing pressure was a significant concern. This informed IMACS' development of a fishery management plan and recommendations for a harvest strategy, enabling stakeholders and DMC members to make informed decisions about the future of their fishery.

With input from IMACS, DMC recommendations derived from the stock assessment included increasing the minimum allowable carapace width, introducing escape vents into crab pots, assessing harvest control measures, and restricting fishing effort. The provincial government increased the minimum allowable carapace width in line with these recommendations, and is reviewing the other recommendations. Another IMACS grantee, CV Mitra Bahari, provided essential research on the most appropriate designs for crab pot escape vents to assist fishers to implement new regulations.

In parallel with improved data and enhanced management practices, IMACS facilitated APRI's initiation of the path to MSC certification, a key voluntary standard for reaching international seafood buyers. The blue swimming crab fishery underwent an MSC pre-certification assessment and developed and began implementing a fishery improvement plan, an essential element supporting full MSC certification.

## IMPROVED CAPACITY FOR STOCK ASSESSMENT

MMAF’s need for data on fish stocks and fisheries became even more urgent following the issue of a ministerial regulation calling for development of management plans for all fishery management areas in the country. However, many of Indonesia’s fisheries — particularly the small-scale fisheries that comprise approximately 90 percent of Indonesia’s fishing fleet — are “data-poor” and considered too difficult or too costly to assess using conventional stock assessment techniques.

To address this challenge, IMACS’ work to enhance stock assessment in Indonesia focused on the emerging area of research and innovation termed “data-poor fish stock assessment,” which emphasizes methods that do not require long time series of catch-effort data. With this approach, new, fish size-based techniques have been developed that enable the status of fishery stocks to be determined rapidly.

IMACS experts assessed the feasibility of applying various data-poor stock assessment methods in Indonesia, and developed recommendations for the MMAF Research Center for Capture Fisheries as to how the most appropriate methods could be applied by district, provincial, and national fishery officers. A manual and training curriculum for data-poor methods provided the foundation for a data collection pilot on the Southeast Sulawesi blue swimming crab fishery. Together with this pilot, the I-Fish data platform was tailored to integrate the method.

IMACS fishery experts assisted MMAF with compiling historical catch records; applying conventional stock assessments to those fisheries where adequate data already exists; and preparing an assessment of the fishery resource potential within each of Indonesia’s 11 WPPs. Their work has provided valuable science-based inputs to support the development of WPP fishery management plans. At the same time, IMACS fishery experts have continued promoting data-poor stock assessments as a tool to support management planning. Using the methodology on blue swimming crab data collected in Southeast Sulawesi by I-Fish enumerators, IMACS experts proposed reference limits be applied to guide implementation of harvest control rules. Application of the limits to the Southeast Sulawesi blue swimming crab fishery showed the current stock well below the target reference point, a significant concern for management and local livelihoods, and a valuable finding for decision-makers.

## FISHERY MANAGEMENT PLANNING

### WPP Fishery Management Plans

Indonesia's fishery management planning framework is based on the country’s 11 fishery management areas or Wilaya Pengelolaan Perikanan. WPPs are large, and comprise many types of fisheries and ecosystems, ranging from small-scale near-shore fisheries on coral reefs to large-scale offshore fisheries. With the great variety of fisheries within each WPP, it is impractical to regulate all fisheries via a single plan. While these large-scale WPP fishery management plans have the potential to address interactions between fisheries and define institutional and governance structures, they also have limitations. In fisheries for highly migratory species like tuna, stocks span several WPPs, and management plans must therefore be designed at even larger scales. Meanwhile, it is unrealistic to define blanket reference limits and

catch and effort restrictions for all fisheries in a WPP; sub-WPP management plans for specific fisheries and stocks are required.

Since there is a need for management at the scale of both the individual fishery and the WPP, IMACS implemented a two-tiered approach: WPP-level planning and fishery-level (or ecosystem-level) management planning. To improve the large-scale fishery management framework, IMACS worked with MMAF's Directorate General of Capture Fisheries to develop a model WPP fishery management plan based on EAFM principles. The effort focused on WPP 718, which includes the Arafura Sea and East Flores Sea and other areas of the Pacific Ocean. This area includes some of the most important fishing grounds in Indonesia, contributing 13 percent of Indonesia's total fishery production — predominantly shrimp and demersal fish — and underpinning adjacent coastal community economies. The remote area is also a hotspot for illegal fishing.

IMACS focused on ensuring that the management plan was developed based on scientific principles, and compiled fishery data and prepared a series of reports on the status of pelagic, demersal, and shrimp fisheries in WPP 718. Inputs included results of other IMACS activities, such as landing and supply chain surveys, and WPP mapping. Following a series of public consultations supported by IMACS, the WPP 718 fishery management plan was accepted by MMAF, representing the first ecosystem-based WPP fishery management plan in Indonesia. Subsequently IMACS supported MMAF with finalizing the remaining 10 WPP fishery management plans by ensuring that lessons learned during the development of the WPP 718 fishery management plan were incorporated into the development process. This was followed by support to identify institutional arrangements and considerations to best align MMAF with the WPP management approach, using WPP 718 as an example. Also for WPP 718 IMACS provided recommendations to MMAF for revitalizing the multi-stakeholder coordination forum for fishery management plan implementation.

### **Ecosystem Approach to Fishery Management**

Indonesia is currently exploring ways to integrate the Ecosystem Approach to Fisheries Management broadly. Throughout IMACS involvement with MMAF, the team emphasized EAFM principles in management planning and capacity building activities. For formal training, IMACS worked with NOAA to facilitate EAFM training events for technical staff as well as NOAA's training for Leaders, Executives, and Directors (LEAD). IMACS, through its subcontractor the Coastal Resources Center at the University of Rhode Island, also offered a three-week "Leadership for Fisheries Management" course in the United States. At the conclusion of the training, the Indonesian team drafted a strategy and roadmap for conducting an innovative Arafura Sea Fisheries Management Planning Process. This ultimately supported development of the fishery management plan for WPP 718, which incorporated EAFM principles. In conjunction with the U.S. course, IMACS and MMAF conducted more in-depth training events on two important and varied fisheries, shrimp and finfish in the Arafura Sea and small pelagics for the Bali Strait, resulting in an outline for a fishery management plan for each fishery.

## Mapping and Monitoring Strengthen Protection for Sharks and Rays

Indonesia is the world's leading producer of sharks and rays, with exports providing a valuable source of foreign exchange earnings. While small-scale shark and ray fisheries have existed for centuries, the growth of markets for shark and ray products beginning in the 1970s has increased fishing pressure. Exports peaked in the early 1990s and by 2003 had declined by 50 percent, with a reduction in stocks driving fishing efforts eastward toward NTB and NTT. Today artisanal shark and ray fisheries are widespread throughout NTB and NTT, with Tanjung Luar in Lombok and Lamakera in Flores among Indonesia's largest centers for targeted and by-catch shark and ray fisheries.



*Fig. 11. Gantee Reef Check assessed shark and manta ray fisheries and supply chains in NTB, and established private sector collaborations with 30 dive operators. Together they developed scientific recommendations and drafted district regulations for manta ray and shark sanctuaries that are now being replicated throughout the provinces.*

At the launch of IMACS no management controls were applied to shark and ray fisheries, monitoring was limited, and there was a shortage of population, catch, effort, and economic data with which to inform management strategies. MMAF identified sharks and manta rays as a priority for conservation management following the recent listing of hammerhead sharks and manta rays under the Convention on International Trade in Endangered Species (CITES). To implement obligations under CITES and to build upon Indonesia's reputation as regional leader for marine conservation, there was a need for improved information about the status of shark and ray populations, and the extent, value, and impacts of shark and ray fishery, tourism, and other related sectors to evaluate tradeoffs, inform sustainable development strategies, and safeguard biodiversity.

In response, IMACS grantee Reef Check Foundation Indonesia (RCFI) enhanced data availability for shark and ray populations in NTB and NTT, and evaluated the costs and benefits of various management approaches. IMACS and RCFI established collaboration with four DKPs; implemented a six-month catch and effort monitoring program in NTB and NTT; engaged 30 marine tourism operators in monitoring sharks, rays and other threatened species; mapped fishing grounds and supply chains; and trained 103 participants from DKPs, universities, local NGOs, and dive operators in shark and manta ray identification, monitoring, and management. Following on this, IMACS worked with the DKP in West Manggarai in NTT to develop a district law banning fishing for sharks, rays, and other threatened species.

## MANAGEMENT IMPROVEMENT AND HARVEST STRATEGIES FOR SPECIFIC FISHERIES

In addition to WPP-level planning, IMACS supported enhanced planning for specific priority fisheries in IMACS' two target provinces and other priority fisheries defined by MMAF. The project made substantial investments with significant results in several fisheries. See accompanying boxes for work with Eastern Indonesia tuna, Southeast Sulawesi blue swimming crab, and Nusa Tenggara sharks and rays. IMACS helped MMAF in developing complete fishery management plans for three fisheries: blue swimming crab in Southeast Sulawesi, lemuru in the Bali Strait in NTB, and shrimp and demersals in the Arafura Sea. Integral to these plans, for the first time in Indonesia, were specific harvest strategies. Since the three fisheries have unique characteristics in scale and management authority (e.g., multiple provinces or districts), IMACS developed them as case studies for fisheries management planning and harvest strategies that would serve as models for other, similar fisheries. The

process included multi-stakeholder capacity development, especially for the new concept of harvest strategies, and regional meetings to incorporate inputs to the plans from the main stakeholders in the fishery: DKPs, fishery associations, fishers, university representatives, and other fishing industry actors.

The project made a variety of contributions to other fisheries as priorities evolved. In the Lombok Strait, grantee LINI implemented a participative data collection program within the 280,000-hectare fishing grounds of the tongkol fishery, and established a nine-month data series on dynamics within the fishery, something never before available. Results guided early stakeholder discussions on management planning and harvest control rules. IMACS also supported additional management improvements for the Bali Strait lemuru (sardine) fishery, conducting training and recommending management actions, accompanied by a budget commitment from the East Java Provincial Government of IDR 760,000,000 to support improvements in sardine fishery data management and strengthening of community-based management groups.

### **FISHERY OBSERVERS**

On-board observers are professionals who join commercial fishing vessels to observe and document fishing practices and catch. There are two facets to their work: collecting data needed for management and monitoring compliance with fishing regulations. Observers must also be deployed on fishing fleets as a requirement of



Fig. 12. IMACS trained on-board observers from three fisheries universities, including these from Bitung Fisheries Academy, and developed an on-board observer curriculum and training modules to sustain recruitment and training of observers. Observers help the government manage stocks, comply with international agreements, and reduce IUU fishing.

Indonesia's membership in regional fishery management organizations. These observers record information on catch composition and fishing practices and by-catch of endangered, threatened, or protected species; it is assumed that their presence on-board will help to reduce IUU fishing.

Prior to IMACS support for the observer program, Indonesia had fewer than 10 observers, and the total observer effort was far below the goal of five percent of targeted fleets. Development of the program became a priority for MMAF after the signing of a ministerial regulation in January of 2013.

IMACS, in close collaboration with NOAA, provided support to MMAF—under the primary responsibility of the Directorate of Fisheries Resources—to develop its observer program. Work with MMAF's Agency for Human Resource Development and several independent fisheries schools fully institutionalized the program in Indonesia's education system. For delivery of training, IMACS initially worked with a local fishing company that trains observers, while at the same time establishing the necessary capacity within MMAF training centers. Together the team designed and delivered an observer training and internship program, including training of trainers. This included designing sampling protocols and standard operating procedures for sampling catches from various fisheries.

IMACS prioritized activities designed to institutionalize the program within MMAF, corresponding with MMAF's objective to rapidly scale up the program for 260 new observers. With training capacity established, IMACS assisted MMAF with strengthening institutional capacity for oversight, management, and administration of the program. Key issues include: designing a deployment strategy for observers, establishing a robust observer debriefing and data validation processes, defining institutional and personnel roles and competencies for program management and administration, and establishing data management systems and procedures.

## IMPROVED HANDLING AND REDUCED POST-HARVEST LOSS

With the widening gap between the supply and demand of fish for human consumption, post-harvest losses are an unacceptable waste of scarce natural resources. Both physical and economic losses occur, with poor handling and preservation practices leading to spoilage, discard, loss of value, nutritional loss, and disease contamination. Post-harvest losses in small-scale fisheries can be among the highest for



Fig. 13. Improvements in tuna processing, such as at this facility in Mataram in NTB, will greatly increase the value of Indonesia's existing catch.

all the commodities in the entire food production system. Minimizing post-harvest losses is therefore one key to increasing revenues and food security, without intensifying the fishing effort.

Lack of awareness and knowledge about international quality standards and handling practices, together with limited access to preservation and processing facilities, leads to contaminated and poor-quality fish entering Indonesia's domestic and export supply chains. Salmonella contamination is one of the most significant problems facing Indonesia's fishing industry, and results in some exports being rejected from international markets due to non-compliance with hygiene standards.

IMACS helped to address this issue through targeted interventions such as provision of handling equipment and training to small-scale fishers. The project first worked with MMAF's Agency for Quarantine and Quality Control of Fishery Products to complete a Salmonella risk assessment within small-scale supply chains in NTB and SULTRA. This was followed by a broader assessment of Salmonella issues in Indonesia's export fisheries, including comparing the Salmonella testing methods and practices used by a key local laboratory with U.S. FDA standards.

The response included recommendations to improve laboratory testing and development of simple step-by-step fish handling guidelines for small-scale supply lines to minimize Salmonella contamination risk. The project selected a location for a pilot sanitation and hygiene improvement program and devised a joint work plan with MMAF's Directorate of Fisheries Product Processing and Marketing for the location to enhance seafood quality and safety, and develop a Seafood Safety Awareness Program.

## **CONNECTING CONSUMERS WITH SUSTAINABLE FISHERIES**

As consumers are becoming more aware of the plight of the world's oceans, they are becoming more demanding with respect to the seafood they buy. This trend is reflected in progress made by the leading eco-certification agency for capture fisheries, the Marine Stewardship Council, where the number of MSC-labeled products went from 500 to nearly 15,000 over the five years ending in 2012. Indonesia, the world's second-largest producer of seafood, has not yet caught up with the demand for sustainable fish, yet this represents an important opportunity for both export and domestic markets.

With IMACS, improvements in knowledge management, data collection and management via I-Fish, supply chain surveys, stock assessment, and various other fishery management activities all contribute to more sustainable fisheries. Much of the work has focused on priority fisheries for exports. Here, data collection with I-Fish and multi-stakeholder DMCs play key roles for MSC and Fair Trade certifications. IMACS partner MDPI helped four fisher associations on Buru and Ambon Islands in Maluku achieve Fair Trade certification for handline yellowfin tuna in November 2014. Data in I-Fish fulfilled the data requirements of the standard, and the DMC demonstrates co-management, also part of the standard requirements. Already, this certification has returned \$30,000 to a local community development fund managed by the local fishers group. In addition, Indonesia's pole and line and handline tuna fishery association (AP2HI) is the focus of an effort to achieve MSC certification for

AP2HI member companies, where I-Fish data and DMCs are expected to help fulfill relevant requirements, as they did for a recent audit of the broader fishery improvement plan for tuna across Indonesia. IMACS support to the SULTRA blue swimming crab fishery has included an MSC pre-assessment, with the local industry association, APRI, now working through a fishery improvement plan on the path to MSC certification (see box, page 22).

For domestic markets, IMACS established partnerships with two fisher groups supplying grouper and other reef fish from South Sulawesi. These partnerships aimed to establish sustainable domestic supply chains from “bait to plate,” and included 59 fishers, two fishing companies, and a seafood product retailer that markets a sustainable seafood brand “Fish’n’Blues.” IMACS grantee WWF-Indonesia assisted the partners with developing fishery management and product handling best practices guidelines, and provided training to fishing groups in sustainable fishing practices, best handling practices, administration, and product labeling. This training was designed to enhance fishers’ ability to produce the high-quality, accurately labeled products required by retailer-buyers, and to diminish the negative impacts of the fishery on the environment. WWF-Indonesia fostered market connections between fisher groups and retailer-buyer partners, and completed a cost analysis demonstrating the viability of this sustainable business model and a significant per kilogram price premium for fishers. More than 200 kilograms of high-quality seafood products were successfully shipped from producers to retailer partners, demonstrating the price incentives for producers. Meanwhile WWF-Indonesia worked with the local government and private companies to launch an awareness campaign targeting consumers and retailers that aimed to increase demand for sustainable seafood products within domestic markets, and increase awareness of best handling practices.

## CHAPTER THREE

# COASTAL COMMUNITY RESILIENCE AND CLIMATE CHANGE ADAPTATION

With 65 percent of Indonesians living in coastal areas, in the face of the ever mounting impacts of climate change, helping coastal communities prepare and cope with the inevitable challenges is crucial. Under the mandate of the MMAF to manage coastal areas for the long-term welfare of the people, the IMACS project provided support to address MMAF's climate change priorities. The objectives included using new tools to facilitate climate change vulnerability assessment and priority setting, enhancing government capacity and policies related to climate change adaptation planning, and improving public and government awareness of climate change impacts and risk mitigation measures. IMACS and MMAF developed and implemented a climate change assessment tool, and followed up with additional activities including training, incorporation into government plans, capturing lessons learned, and conducting socialization campaigns. Implementation of key livelihood and resilience



Fig. 14. Community members participate in a meeting to facilitate the I-CATCH climate adaptation plan in Jenggala Village in NTB. Village-led adaptation planning defined priorities for government planning and budgeting.

activities to address vulnerabilities identified at the village level was carried out through the IMACS small grants program.

## **COMMUNITY VULNERABILITY ASSESSMENT AND ADAPTATION PLANNING**

Coastal livelihoods are extremely vulnerable to climate change. Over the past decade in Indonesia, small-scale fishers have been taking greater risks or reducing the number of days spent at sea due to extreme weather conditions that have happened with greater frequency. This has had the effect of increasing danger to fishers and their families as well as reducing overall income. As near-shore fish stocks have simultaneously dwindled, the income potential for fishers has declined over time. The dire situation is worsened because of difficulties in accessing information, improving technical capacity, and receiving financial support.

IMACS supported the Indonesian government by developing community-based climate change vulnerability assessments and climate adaptation plans. To ensure assessments were conducted in a systematic way, IMACS and MMAF, together with input from the Indonesian National Council of Climate Change, Indonesian Meteorological, Climatological and Geophysical Agency, and Indonesian Ministry of Environment, developed a tool called the Indonesia Climate Adaptation Tool for Coastal Habitats or I-CATCH.

I-CATCH was adapted from global best practices and was developed through detailed consultations with academics, government officials, and NGO representatives. Assessment using I-CATCH is a participatory approach where village members are expected to actively engage in the process of information gathering. The tool is designed specifically for local coastal communities, with a focus on fisheries and other livelihoods. Professional community facilitators tested I-CATCH near Jakarta in several settings to ensure its effectiveness during the early development phase.

IMACS implemented the I-CATCH tool in 100 villages across 10 districts in the two IMACS target provinces of West Nusa Tenggara and Southeast Sulawesi. Villages were selected by MMAF based on inputs and priorities from local DKPs. The vulnerability assessments and adaptation plans were facilitated by local NGOs. To accomplish this work, the NGOs deployed facilitators across both provinces who were trained and mentored by senior facilitators from IMACS. DKP officials from the provinces and districts were also involved during the training of trainers for I-CATCH. The I-CATCH tool is now being used by MMAF outside of the two initial target provinces.

## **CLIMATE CHANGE ADAPTATION PLANNING AND POLICY**

To institutionalize adaptation planning and preparation of the vulnerability assessments and climate adaptation plans within the government, IMACS collaborated with MMAF, including its training center, to develop national competency standards for Disaster Mitigation and Climate Change Adaptation (MBAPI) for village facilitators throughout Indonesia under the PDPT coastal resilience program, including a standard curriculum and training modules based on I-

CATCH and other elements. The curriculum was designed to be used by MMAF to train local facilitators and extension staff on conducting vulnerability assessments and adaptation planning activities in villages. The training components are essential for supporting broader climate change training, and are paired with coastal fisheries management training events for assisting communities to restore ecosystems that are contributing to economic and social hardship.

The MBAPI modules were officially adopted by MMAF, which developed the materials and modules further and according to national standards for competency-based curricula. Finally, IMACS developed a practical and simple user guide for supporting future implementation of MBAPI/I-CATCH.

### Seaweed Farmers Explore Innovations to Take “Green Gold” to Market

As early as the 1970s in Indonesia, demand for seaweed and seaweed products was outstripping supply, and cultivation was viewed as the best means to increase production. Seaweed farming has frequently been suggested as both a means to improve economic conditions and a means to reduce fishing pressure. It can also be an alternative to destructive practices such as bomb fishing and mangrove harvesting. Some fishers have attempted to supplement their income by producing seaweed, while others have shifted completely from fishing to seaweed farming, referring to it as green gold. Yet seaweed production faces challenges similar to fishing, with data showing that increased production alone can have a limited effect on net incomes.



*Fig. 15. An IMACS grant improved seaweed farming techniques in Lamanggau village, SULTRA, providing additional income sources and improving resilience to climate change.*

Results of vulnerability assessments and climate adaptation planning with I-CATCH supported the need for additional and more productive livelihood alternatives, including better, market-oriented seaweed farming programs in targeted villages. Results also showed that seaweed farming was failing due to a number of factors such as disease control and a lack of appropriate product marketing skills.

In SULTRA, seven of nine vulnerable villages in one area identified the frequent failure of seaweed farming endeavors as a significant problem. As a result, IMACS supported approximately 10 seaweed farmers in each village as direct grant activity participants, while other farmers gained knowledge and skills through observation. I-CATCH results in part of NTB identified five villages as being highly vulnerable to climate change. Discussions with village leaders and DKP officials indicated that the low level of seaweed farming productivity and the failure to answer market demand for best quality seaweed products was a real concern. Within each village, approximately 25 seaweed farmers were identified as direct grant activity participants. IMACS also awarded CV Ocean Fresh a grant to facilitate innovation in seaweed production, processing, and marketing in SULTRA. The grant involved assessing the seaweed farming potential in SULTRA, improving farming techniques, and creating new business opportunities.

Key results of these grants included:

- New village capacity in long-line and floating raft cultivation methods, including effective nurturing, pest control, and harvesting
- Value added processing for increased income from cake and crackers versus raw seaweed
- Business organization, planning, and management capacity enhancement including inventories of commercially viable farmed and wild seaweed stocks, and marketing agreements between community group producers and seaweed merchants and re-sellers
- Demonstrated new sales and increased income from initial harvests

Other IMACS policy work supported MMAF and DKPs under Law 27 for coastal zone planning, the coastal resilience program (PDPT), and two ministerial regulations to guide local governments to develop Coastal and Small Islands Zonation Plans incorporating climate change considerations, and in other aspects of their climate response. Activities also helped develop Perdas (local regulations) that regulate and control spatial utilization for long-term sustainability of marine and coastal resources. At a broader level, IMACS helped MMAF incorporate climate change planning into its strategic planning process (see Chapter 1).

## **LOCAL GOVERNMENT PLANNING AND PRIORITIZATION**

Following completion of the vulnerability assessments and climate adaptation plans, IMACS conducted district consultations in each province to facilitate local government incorporation of climate adaptation plan findings and priorities into yearly local government development plans and the budgeting process, as well as the local government's medium- and long-term development plans. One issue identified was the need for better alignment of the I-CATCH process with the local government development process called MUSRENBANG. MUSRENBANG is a bottom-up, participatory planning and budgeting process where communities work with local governments to identify near-term priorities and resources. The vulnerability assessment and climate adaptation plan documents can be utilized during the community-level discussion for MUSRENBANG as well as by key government agencies, such as Bappeda (planning agency), MMAF, Public Works, or BPBD (Disaster Management Agency) for planning purposes.

IMACS later collected information on uptake, or actions taken by various agencies to address or implement elements of the climate adaptation plans. It was found that at least some action was taken in all 10 IMACS target districts. A higher CAP implementation rate in NTB is attributed to more effective, face-to-face follow-up with district officials. This was more difficult in SULTRA with more remote and much poorer districts. Lack of uptake was generally due to the lack of human resource capacity and most importantly, financial capacity, either by the village or the district governments, to implement identified actions. Further discussion with local government and village representatives raised the importance of several other elements to climate adaptation plan implementation, including spatial planning, zonation, public awareness campaigns, incorporating climate change needs into local budgets/plans, and setting up new regulatory regimes. It became clear that spatial planning maps and coastal zonation plans, which IMACS also supported in some districts (see discussion in Chapter 1), can have great benefits for districts by helping communities implement adaptive activities. These could include planting and maintaining vegetation buffer zones to stop coastal erosion, and identifying and limiting fishing zones to allow for fish stock recovery.

## **ENHANCING COASTAL COMMUNITY RESILIENCE**

The IMACS grants program had its greatest focus (26 of 42 total grants) on strengthening coastal community resilience and helping coastal communities prepare for and cope with the impacts of climate change. This was in addition to other grants that supported specific interventions in sustainable fisheries (e.g., data collection,

POKMASWAS), communications and education for sustainable fisheries, and local policy reform and planning.

Grants supporting climate change adaptation provided support to Indonesians living in the coastal areas of SULTRA and NTB by means of three primary technical interventions: robust economies and environmentally friendly livelihoods, ecosystem health and resilience, and strengthened social networks.



Fig. 16. The head of Liya Bihari village in SULTRA helps plant mangrove seedlings, funded through an IMACS grant to local NGO LPSM Setia Karang. Mangrove restoration improves coastal resilience and enhances fisheries habitat.

With regard to robust economies and environmentally friendly livelihoods, IMACS grantees leveraged and enhanced existing livelihood endeavors, and predominantly relied on locally available resources, as opposed to introducing new and potentially higher risk livelihood approaches. This allowed grantees to incrementally build upon existing, customary knowledge bases and to tap into and rely on local suppliers (see box on seaweed). The “think local” approach kept learning curves rising at reasonable rates, and had an economic multiplier effect by bringing in local vendors, which concentrated resources in the communities. Prime examples of this were the numerous fish-based processing activities that grantees supported in local communities, (e.g., fish powder made from fish waste, fish crackers, and shredded and smoked fish products), as well as handicraft and salt production projects. Additionally, grantees strengthened the basic business skills of local cooperatives and often broadened their marketing horizons beyond immediate, traditional markets, such as marketing dried seaweed in Java, which increased farmer revenues per kilogram by 40 percent. Another grant for seaweed farming supported higher incomes through development of local processing into cakes and crackers versus selling raw seaweed. Still other grants

supported additional income sources by developing homestay arrangements, tied in part to ecotourism activities.

With respect to ecosystem health and resilience, 10 grants focused on mangrove restoration, and often implemented the restoration in conjunction with parallel activities, such as seaweed cultivation, which can help build alternative incomes to avoid mangrove harvesting. Five grants trained and transferred knowledge and skills to local community members regarding ecosystem disciplines, such as ecotourism and youth marine eco-learning.

To strengthen social networks, every grant was initiated with a socialization event to inform communities about the grant work to be undertaken. This served to knit the community together around common, shared objectives that are in the best interest of the entire community — not just one element of the community. It also helped build a shared vision and acceptance of responsibility for dealing with common problems such as climate change. Additionally, involvement of local government officials reinforced the concept that local government is there to serve its constituents, and communities in turn must support appointed officials. Socialization events were typically broad-spectrum affairs in terms of participants, encompassing beneficiaries, community leaders, technical experts, and government officials from multiple levels. Local DKP officials not only attended but often took lead roles in building support and enthusiasm for grant activities and providing valuable technical backstopping.

Three grants were specifically focused on strengthening social networks, including community-led initiatives. Two of these facilitated the formation of *awig-awig* (customary laws) for local management of marine resources. When communities and local officials jointly realize that traditional best practices for managing common area resources, such as mangrove forests or near-shore fisheries, often correlate closely with modern, science-based, government policies, both parties take away a keener sense of ownership and commitment. Another grant supported village-level capacity building and information dissemination on coastal community resilience, sustainable fisheries management, and alternative income generation, while working to preserve local culture and practices.

## **RAISING PUBLIC AWARENESS OF CLIMATE CHANGE RISKS**

In parallel with other climate change adaptation work and in addition to substantial awareness raising under various grants, IMACS developed a public awareness campaign to increase coastal community awareness of potential disaster and climate change impacts and risk reduction practices. The campaign targeted audiences across the 100 communities where vulnerability assessment and adaptation planning work was conducted. DKP representatives played a major role in the campaign, supported by IMACS' capacity building, training community leaders to effectively convey key messages.

Planning the campaign included identifying the range of audiences — from the general public to the government — and key messages and communications mechanisms. To assess baseline knowledge, communications specialists designed a pre-campaign survey, completed by nearly 400 people in both provinces. This informed campaign messages and material design, and materials were modified based



IMACS

Fig. 17. IMACS used traditional community puppet shows, such as this one attended by 1,150 people in Malaka village in Lombok, NTB, to communicate climate change messages. The project worked with puppeteers to modernize traditional plots, with embedded climate change messaging.

on feedback from initial activities and from local stakeholders. Post-campaign surveys helped the team measure results. Campaign elements included:

- Posters, brochures, and fact sheets adapted to different audiences. Subjects covered included Mitigation and Adaptation to Climate Change, Protecting Against Coastal Erosion, Protect Mangroves So They Can Protect Us, Protect Precious Freshwater Resources, and Protect Our Communities from Flooding.
- Traditional Indonesian puppet shows, with a climate change storyline blended with traditional themes.
- Special community events with messaging provided by officials as well as printed material, including beach cleaning, community boat races, coastal vegetation planting activities, art shows, and community anniversary celebrations.
- Workshops for local government agency officials.

The post-campaign survey indicated that although there was already significant knowledge of climate change, awareness of climate change impacts increased 13 percent from baseline results. Awareness of the role of local government agencies and other stakeholders in addressing climate change issues also increased. For example, 65 percent of respondents in the post-survey (compared to 30 percent in the baseline)

stated that the DKP plays a role in addressing climate change issues. Results also indicated a significant increase in awareness of the role of other stakeholders in addressing climate change issues: fisheries extension (up 16 percent), local NGOs (up 13 percent), village governments (up 16 percent).

## CHAPTER FOUR

# LESSONS LEARNED

Throughout implementation of IMACS, the team experienced successes as well as some challenges. The following themes can inform other work:

- *Agree on roles, responsibilities, resources, and performance metrics of the primary partners early — review and validate periodically.* The IMACS team worked extensively and quite effectively with MMAF and local DKPs. Efforts could be enhanced further by clearly laying out expectations for both teams, including accountability and performance checks. This includes identifying the level of staff and other resources needed for activities so that both the government and the project can properly plan. Annual work planning is a logical time for such agreements, though the GOI budgeting cycle needs to be considered.
- *Engage government partners early and often in designing and focusing work (and the private sector too).* Clearly ownership and sustainability was greater when MMAF saw specific IMACS interventions as aligned with ministry priorities. Enhancements to the sector can be made in a number of ways, but listening to government officials carefully and choosing approaches aligned with current priorities (e.g., IUU) will be more effective. Involving the private sector early when designing interventions accrues similar benefits.
- *Use a two-tier approach for gaining acceptance of new initiatives.* For changes and enhancements to be successful, there needs to be buy-in from strategic/political levels as well as technical staff in the ministry. Appealing to the needs and motivations of both levels is crucial. In the case of I-Fish, technical staff readily saw the need and value. Senior managers then saw the benefits of obtaining data from efforts by the private sector without needing to invest precious government resources, as well as the ministry's enhanced credibility with international organizations (e.g., RFMOs) given better data.
- *Understand and work with the full range of institutional counterparts affected by initiatives.* Although I-Fish is a database that might logically belong to the unit with a data mission (PUSDATIN), the system has greater relevance and hence greater demand from units responsible for managing capture fisheries or leading research. Involving them heavily enhanced buy-in and demand for a new system.
- *Know and link closely to government schedules.* To effectively plan climate change adaptation investments at the local level, or provide analytical inputs to strategic planning at the national level, it was critical to know and have deadlines and milestones synchronized with government planning and budgeting cycles.

- *Be a facilitator and honest broker of initiatives spanning national to local governments.* IMACS worked on initiatives from national laws to local awig-awig. One helpful approach was establishment of a “coordination forum” at the provincial level that periodically brought representatives from the national to district levels to coordinate on IMACS work. With the passage of Law 23 calling for greater authority going to the provincial government, IMACS brought district officials together with provincial counterparts with straight talk that reassured district representatives that they would retain a great deal of authority.
- *The right champions can make a big difference.* Identifying champions for new initiatives is important for short-term success and sustainability. They should be identified early and investments made in their success. At the same time, their role and effectiveness should be reviewed and validated, and changes made as necessary to meet evolving needs. Champions for the vulnerability assessment/climate adaptation plan process were very important, and a more effective effort in NTB following CAP completion led to much greater uptake of CAPs by local government planners there.
- *Stakeholder mapping should include individuals as well as the organizations.* To ensure success, the project should understand all units in the organization responsible for a particular activity and the key people within those units at both technical and strategic levels and configure partnerships and day-to-day working interactions accordingly.
- *The government and private sector need each other and this can be a great benefit.* In the case of IMACS, eco-certifications of benefit to the private sector depend in part on government management of fish stocks. The government in turn can make great use of the private sector’s data and information as well as exposure to international players. Together there are substantial incentives for cooperation and sector improvements.

# ANNEX A. PROJECT PARTNERS

IMACS PROJECT PARTNERS	
Grantees	
1.	Lembaga Pengembangan Sumber Daya Masyarakat (LEPASAMA): “Shell handicraft production and marketing”
2.	Koperasi Serba Usaha Syari’ah Baitul Mal Watamwil Selaparang Mandani: “Fish powder, fodder, and oil using fish waste”
3.	CV Mitra Bahari : “Improving coastal areas with mangroves”
4.	LSM SEHATI: “Fish drying and mangrove rehabilitation”
5.	Yayasan Bina Laut Indonesia (YBLI): “Developing a ‘Go Green’ program in coastal areas ”
6.	Yayasan Potensi Indonesia (YPI/Yapindo): “Mangrove restoration and seaweed products”
7.	Koalisi Perempuan Indonesia Wilayah Sulawesi Tenggara (KPI SULTRA): “Improving the economic security of women and families”
8.	Aliansi Perempuan Sulawesi Tenggara (ALPEN SULTRA): “Increasing the income of women’s groups engaged in fish processing”
9.	Lembaga Bajo Bangkit: “Improving the capacity of Bajo communities to prepare for climate change and support sustainable fisheries”
10.	Perkumpulan YASCITA: “Marine ecotourism development and environmental management”
11.	Yayasan Aksi dan Olah Potensi Insani (YasKopi): “Household-based, environmentally friendly fish crackers business”
12.	Lembaga Pendidikan dan Keterampilan (LPK) Genius Group: “Bird watching and mangrove ecotourism”
13.	Yayasan Bina Bakti Samawa (YBBS): “Mangrove restoration and improved seaweed cultivation activities”
14.	Yayasan Annisa Karya: “Improving salt farming practices”
15.	Komunitas Penjaga Pulau (KPP): “Youth marine eco-learning ”
16.	KSM Bahari Sejahtera: “Mangrove restoration”
17.	Lembaga Penelitian Dan Pengabdian Pada Masyarakat (LPPM) Unidayan: “Distillatory units using boat exhaust to produce on-board potable water”
18.	LPSM Yasinta Buton: “Community-based Marine Protected Area (MPA) community surveillance groups (POKMASWAS), and a shredded fish business”
19.	LPSM Setia Karang: “Seaweed farming and mangrove rehabilitation”
20.	Lembaga Swadaya Masyarakat (LSM) Kapal Perempuan Wakatobi: “Reducing aggressive marine life extraction practices”
21.	Lembaga Pengkajian dan Pengembangan Sumberdaya Pesisir (LP2SP): “Improving coastal areas through mangrove rehabilitation”

<b>IMACS PROJECT PARTNERS</b>	
22.	Lembaga Pengembangan Sumberdaya Nelayan (LPSDN): “Mangrove conservation and Awig-Awig formulation to promote sustainable fisheries management”
23.	Lembaga Penelitian Universitas Muhammadiyah Mataram (Lemlit UMM): “Increasing salt production using the RAMSOL method and rehabilitating mangrove forests”
24.	LP3M Universitas Gunung Rinjani: “Management of Bumbang Bay by Awik-Awik in support of a Strategic Plan”
25.	Lembaga Musyawarah Nelayan Lombok Utara (LMNLU): “Developing processed fish products and improving seaweed farming”
26.	Yayasan Insan Hayati: “Community-based marine ecotourism management”
27.	PT. Springfield: “Developing a Vessel Monitoring System and e-Logbook for small-scale fisheries”
28.	PT Iname Utama: “Training and mentoring government officials on zonation planning”
29.	Wacana Bijak Bestari: “Media communications on sustainable fisheries”
30.	Radio Swara Alam: “Media communications on sustainable fisheries management”
31.	PT Duta Mitra Alam Cinta (DMAC): “A responsive, dynamic and sustainable POKMASWAS-PPP-CSR pilot activity”
32.	Yayasan Alam Indonesia Lestari (LINI): “Long-term monitoring protocols and an online data platform for a small-scale pelagic fishery”
33.	Yayasan WWF Indonesia: “Developing supply chains ‘from bait to plate’ for sustainable seafood”
34.	Ocean Fresh: “Innovation in seaweed production, processing, and marketing”
35.	Lembaga Studi Pers dan Pembangunan (LSPP): “Communications training for district-level DKP staff ”
36.	Asosiasi Pengelolaan Rajungan Indonesia (APRI): “Using I-Fish to collaboratively manage a blue swimming crab fishery”
37.	Reef Check Foundation Indonesia (RCFI): “Evaluating the costs and benefits of protecting threatened sharks and rays”
38.	Indonesian Society of Oceanologists (ISOI): “Development of a user-friendly e-Logbook system”
39.	PT. Waindo SpecTerra: “Compiling WPP-level spatial data on the continental shelf ”
40.	Anova Indonesia: “Supporting an ecosystem approach to fisheries management”
41.	CV Mitra Bahari: “Developing new, environmentally friendly crab pots”
42.	Lembaga Swadaya Masyarakat (LSM) Kapal Perempuan Wakatobi: “Developing non-fishing based alternative income through the development and management of homestay accommodations in East Tomia, Wakatobi”
<b>Subcontractors</b>	
1.	University of Rhode Island-Coastal Resources Center (URI-CRC)
2.	People and Nature Consulting International (PNCI)
3.	PT Ikon Utama

## IMACS PROJECT PARTNERS

4.	PT iWhite Solutions
5.	Universitas Gadjah Mada
6.	Unit Penelitian Dan Pengabdian Masyarakat,
7.	Sekolah Tinggi Perikanan (UPPM)
8.	Santiri Foundation
9.	Yayasan Cinta Alam (YASCITA)
10.	PT Harini Duta Ayu
11.	Masyarakat dan Perikanan Indonesia (MDPI)
12.	PT Moores Rowland Indonesia
13.	PT DHI Water and Environment

### Universities

1.	University of Mataram, West Nusa Tenggara
2.	University of Pattimura, Ambon
3.	University of Haluoleo, Southeast Sulawesi

### Public-Private Partnerships — Private Companies (May Be in Multiple PPPs)

1.	Usaha Dagang (UD) Baura
2.	CV Versace
3.	Usaha Mina
4.	PT. Era Mandiri
5.	Anova Asia
6.	PT. Harta Samudera
7.	CV Tiga Serangkai
8.	CV Sarana Menuju Sukses
9.	CV Alfa Raya
10.	Usaha Dagang (UD) Tampo

## IMACS PROJECT PARTNERS

11.	PT Phillips Seafood Indonesia
12.	Usaha Dagang (UD) Lapulu
13.	Usaha Dagang (UD) Robam
14.	PT Nuansa Cipta Magello (NCM) Kendari
15.	PT Offshore Crew Service (OCS) Kendari
16.	PT Harini Duta Ayu
17.	PT Aneka Sumber Tata Bahari, Ambon
18.	PT Radios Apirja Sorong, Sorong
19.	PT Bintang Mandiri Bersama, Bitung

### Public-Private Partnerships — Public Institutions

1.	Research Center for Fisheries Management and Fish Resources Management-MMAF
2.	Central Maluku District Marine and Fisheries Agency
3.	Buru District Marine and Fisheries Agency
4.	20 Southeast Sulawesi Provincial Marine and Fisheries Agency
5.	South Konawe District Marine and Fisheries Agency
6.	North Konawe District Marine and Fisheries Agency
7.	23 Kendari District Marine and Fisheries Agency
8.	Bau-Bau District Marine and Fisheries Agency
9.	Kolaka District Marine and Fisheries Agency
10.	Maluku Provincial Marine and Fisheries Agency
11.	North Kolaka District Marine and Fisheries Agency
12.	Buton District Marine and Fisheries Agency
13.	29 North Buton District and Marine Fisheries Agency
14.	Wakatobi District and Marine Fisheries Agency
15.	Bombana District and Marine Fisheries Agency

# ANNEX B. DELIVERABLES

Below is a list of deliverables from IMACS’ activities. Electronic copies are on the accompanying DVD for those documents marked with an asterisk (\*).

IMACS DELIVERABLES
<b>Institutional Development for Marine Affairs and Fisheries in Indonesia</b>
Facilitating Dialogue on IUU Fishing
White Paper on MMAF Position in Coordination with Other Marine Law Enforcement Institutions
Workshop Report on Strategies to Improve IUU Fishing Detection and Abatement
Workshop Report on Methods to Identify Potential Hotspots for IUU Fishing
General Guidelines for POKMASWAS
Support Development and Implementation of MMAF Strategies, Policies, and Plans
Book 1: Analysis of Strategy for Marine and Fisheries Development, 2015-2019
Book 2: The Condition of Indonesian and Global Marine Affairs and Fisheries, 2015-2019
Book 3: Strategic Environmental Analysis of Marine and Fisheries Development
Book 4: Observations on Marine and Fisheries Development, 2010-2014, from a National Priority Perspective
Final Report on Indonesian Fisheries Policy *
Assessment of Fisheries Management Systems In Indonesia *
Draft Policy Recommendations on Fisheries Management in Indonesia *
Review of Selected Fisheries Management Planning Processes and Plans *
Greening Indonesia’s Blue Economy *
Paper on Design of a WPP Management Institution
Training Report on Ecosystem-based Strategic Planning for Blue Swimming Crab Fisheries Management in Kendari
Training Report on Ecosystem-based Strategic Planning for Shrimp Fisheries Management in Ambon
WPP 718 Fisheries Management Plan
The Proposed Institutional Arrangement Accommodating Co-Management for Arafura Sea Fisheries *
The Proposed Management Unit and Approaches for Managing Fisheries in the Arafura Sea *
Work Stream 9: 2025 Strategic Analysis of Capture Fisheries
Work Stream 10: 2025 Strategic Analysis of Aquaculture

## IMACS DELIVERABLES

Work Stream 11: Study on Policy Development for Prevention and Mitigation of Marine Pollution Arising from Offshore Oil and Gas Extraction

Policy Paper on Standard Procedures and Criteria for Marine and Fisheries Management (Implementation of Law 23)

KINERJAKU Users Guide (With a Module that Provides for Performance-Based Budgeting)

MMAF Key Performance Indicators Manual

Roadmap for Investment in Indonesia's Marine Resources and Fisheries Sector

Policy Paper on Prosperity Index for Marine and Fisheries Communities (IKRAR)

Training Report on Study Tour for Balanced Scorecard

Training Curriculum for Regulatory Impact Analysis for Marine and Fisheries Policy Analysts

### Sustainable Fisheries Management

#### Strengthening and Expanding I-Fish and Other Data and Information Systems

Training Protocol for I-Fish Data Collection Staff \*

Data Collection Protocol for Blue Swimming Crab \*

Data Collection Protocol for Small-Scale Hand Line Tuna \*

Data Collection Protocol for Mud Crab \*

Data Collection Protocol for Small-Scale Pole and Line Tuna \*

Fishing Ground Supply Chain Reports: Lombok, Sumba, Kupang/Maumere, Sumbawa, West Flores, Southeast Sulawesi \*

11 WPP Fishery Resource Maps \*

SPR@Size Assessment of the Blue Swimming Crab Fishery of Southeast Sulawesi \*

#### Strengthening the Implementation of Fisheries Planning and Management

Fisheries Management Plan for Bali Sardinella in Bali Strait (Includes Harvest Control Strategy)

Fisheries Management Plan for Blue Swimming Crab in Tiworo Strait (Includes Harvest Control Strategy)

Fisheries Management Plan for Shrimp In Arafura Sea (Includes Harvest Control Strategy)

Framework to Revitalize Organization and Function of the Coordination Forum for Fisheries Management (FKPPS) Stakeholders

Risk Based Framework Feasibility Study for the Southeast Sulawesi Blue Swimming Crab

Harvest Control Rule and Reference Points for Data-Poor Fisheries Management in Indonesian Fisheries \*

## IMACS DELIVERABLES

### Coastal Community Resilience and Climate Change Adaptation

Vulnerability Level and Adaptation Plan Interactive Map, SULTRA

Vulnerability Level and Adaptation Plan Interactive Map, West Nusa Tenggara

I-CATCH Vulnerability Assessments and Climate Adaptation Plans (in English for Four Villages) \*

MBAPI Practical Guidelines

Seaweed Cultivation Best Practices Guideline

Module On Marine Resource Conservation for Youth

### Other Deliverables

IMACS Achievements Booklet

Infographic: IMACS Contributions to MMAF (Related to Institutional Development for Each DG)

Infographic: Prosperity Index for Marine and Fisheries Communities (IKRAR)

Infographic: Standard Procedures and Criteria for Marine and Fisheries Development Based on Law No. 23/2014

Infographic: POKMASWAS Guidelines

Infographic: I-Fish

Infographic: Aquaculture

IMACS Newsletters \*

IMACS Snapshots \*

Factsheets for Work in Each Province and District \*

Grant Profiles \*

I-Fish Video 1 (Why We Need Data? Tuna Focus) \*

I-Fish Video 2 (What Solution Does I-Fish Provide? Tuna Focus) \*

I-Fish Video 3 (What Are the Implications for Management? Blue Swimming Crab Focus) \*

I-Catch Video \*

Video of Perda for District of Lombok Barat, No. 1/2013, on Small Islands and Coastal Management \*



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