

# FISH for the PEOPLE

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## Optimizing Stakeholders' Cooperation for Sustainable Fisheries Development and Food Security



Southeast Asian Fisheries Development Center

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## Editorial

While recognizing the role of the fisheries sector in improving the socio-economic well-being of the peoples in the Southeast Asian region and in enhancing the region's national economies, SEAFDEC always makes sure that all its efforts are directed towards the sustainability of the region's fisheries sector through the intensified promotion of sustainable fisheries management. In so doing, SEAFDEC mobilizes its collaboration with the ASEAN in order that the necessary actions such as those that are relevant to alleviating poverty, creating job opportunities, achieving economic growth, and intensifying the adoption of sustainable fisheries management to combat IUU fishing, among others, are mainstreamed into the countries' national policies for the benefit of all stakeholders, especially those that depend on the fisheries sector for their livelihood and economic well-being.

After the global Code of Conduct for Responsible Fisheries (CCRF) was adopted, SEAFDEC with the collaboration of the ASEAN countries regionalized the CCRF to make it more applicable to the countries of Southeast Asia. The regionalization effort took focus on issues that impede the economic development of many fishing communities in the region. Towards this end, the SEAFDEC and ASEAN countries formulated and adopted the 2001 Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region during the so-called ASEAN-SEAFDEC Millennium Conference in November 2001. These instruments have since then served as policy framework that steered the ASEAN countries towards enhancing the sustainability of fisheries and its contribution to food security.

Currently however, the Southeast Asian region is again being confronted with the concern on the continued deteriorating state of its fishery resources. Moreover, there have been issues and related initiatives that emerged during the past decade that need to be addressed in order that the necessary framework is put in place that would enable the countries in the region to adapt to the changing environments. It is for these reasons that the ASEAN and SEAFDEC are organizing

## C O N T E N T S

the sequel ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 “Fish for the People 2020: Adaptation to a Changing Environment” in Bangkok, Thailand from 13 to 17 June 2011. It is also envisaged that the Conference would come up with the revitalized regional policy framework and guiding principle that could be used as basis for the countries in the region in setting sights towards achieving sustainable fisheries for food security for the coming decades.

In the preparatory processes for the Conference, technical consultations have been conducted by SEAFDEC in collaboration with the ASEAN Countries, while the countries are also convening national seminars in order to come up with the necessary elements that could serve as inputs for the draft regional policy framework which is the new decade Resolution and Plan of Action. During the preparatory processes, relevant stakeholders are involved, especially in the national seminars where the views of the fisherfolks are compiled while their experiences based on local and indigenous knowledge are documented. The Conference is also envisioned to maximize the participation of the fishers and civil societies thus, with the optimized cooperation of all stakeholders, the region could achieve sustainable fisheries development and attain food security in the years to come.

For more information about the ASEAN-SEAFDEC Conference in June 2011, please visit: [www.ffp2020.org](http://www.ffp2020.org).



### Special Features

- Roles of Local Institutions in Fishery and Coastal Resources Management 2
- Application of DNA Chips for Rapid and Comprehensive Diagnosis of Fish Pathogens 12

### Regional Initiatives

- Mobilizing Regional Expertise to Alleviate Poverty by Fisheries Intervention in Southeast Asia: SEAFDEC Initiatives 15
- Cooperative Set-net Fishing Technology for Sustainable Coastal Fisheries Management in Southeast Asia 21

### Country Reports

- Efforts by Fishers and Support Activities to Conserve and Rehabilitate Seaweed Beds: Adaptive Management of the Fishery Resources and Habitats in Japan 22
- The Role of Fishers' Group in the Establishment and Management of a *Refugia* System: Experience of Cambodia 25

### Special Report

- Boosting the Capacity of Young and Female Researchers for Achieving Sustainable Fisheries in Southeast Asia: Initiative of Hokkaido University, Japan 37
- General Hygiene Measures in Local Fish Markets and Good Handling Practices in Myanmar 44

### Calendar of Events

48

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# Roles of Local Institutions in Fishery and Coastal Resources Management

Yusri Yusof and Sebastian Mathew

This article is based on discussions during three workshops such as those conducted in Mataram, West Nusa Tenggara, Indonesia, and in Satun and Phuket Provinces in Thailand, on the roles of customary institutions and community groups in fishery and coastal resources management, emphasizing on the relevance of traditional knowledge in broadening the frontiers of scientific knowledge for sustainable fisheries management.

Local institutions have been playing crucial roles in the development and management of fishery and coastal resources, especially in creating an environment for its members to be participative in the decision-making processes and to be more productive and thus, improving their ways of life. Many countries in Southeast Asia have been promoting sustainable development and in so-doing, have implemented decentralization schemes by devolving the resources management responsibilities to institutions or units in local communities.

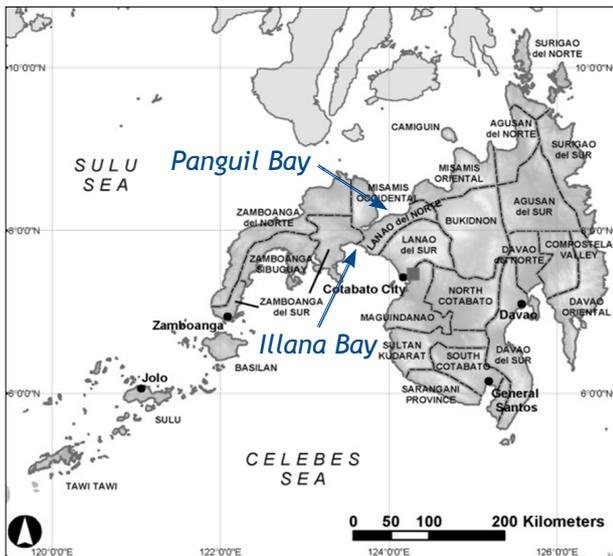
Indonesia, for example, had adjusted the direction of its fisheries management to ensure that the country's fishery resource is not depleted in spite of efforts to increase fisheries production for improved economy and sustained local livelihoods. Specifically, Law 31/4004 on Fisheries was enacted to strike a balance among the competing goals of exploiting the fishery resource, addressing some serious



Map showing the countries bordering the Gulf of Thailand

problems in fisheries management and enforcement as well as alleviating poverty in fishing communities (Patlis, 2004).

In Thailand, many laws have been promulgated to promote decentralization of administrative responsibilities to the local level, such as the National Constitution B.E. 2540 (1997), Fisheries Act B.E. 2490 (1947), AoBoTo Act B.E. 2535 (1994), among others. Specifically, the Tambon (Sub-district) Administrative Organization (TAO), as a small local government unit has also been assigned the duty of managing local coastal fishery resources for the benefit of the local people. Furthermore, for the countries of the Gulf of Thailand, namely: Malaysia, Vietnam, Cambodia and Thailand, the involvement of coastal communities



Map of Mindanao (Philippines) showing Panguil and Illana Bays

2000). In addition, there are also a number of stakeholders' groups and NGOs in the local communities of the country, one of which is the Lanao Aquatic and Marine Fisheries Center for Community Development (L AFC COD) based in Maranding, Lala, Lanao del Norte. L AFC COD, which has the main task of implementing community-based coastal resource management for peace and development assistance, covers the coastal communities in the Province of Lanao del Norte and the Municipality of Tukuran in Zamboanga del Norte in western Mindanao.

The main goals of L AFC COD include among others, the ecologically sound management and development of fisheries resources with the direct and active participation of small fisherfolks and their communities, and restoration and conservation of the coastal and marine resources in Illana and Panguil Bays (L AFC COD Online) in Mindanao.

in fisheries management could be observed (Nasuchon and Charles, 2010). Their study further suggested that in Vietnam and Cambodia, there is a need for significant legislation to control fisheries operations and greater clarity of the role of communities in management. In Thailand, there is a need for greater support of local-level enforcement and monitoring activities, while in Malaysia there is an overall need for more support to local fisheries management.

In the Philippines, the Local Government Code of 1991 (Republic Act 7160) and Philippine Fisheries Code (Republic Act 8550) have given the local communities the right to enforce fishery laws and adopt fisheries management measures in their areas of responsibility. Moreover, in line with the fisherfolks empowerment program of the Philippine Government, the Guidelines on the Creation and Implementation of the Fisheries and Aquatic Resources Management Councils (FARMCs) were established to institutionalize the major role of the fisherfolks and other resource users in the planning and formulation of policies and programs for the management, conservation, protection and sustainable development of fishery and aquatic resources (Department of Agriculture,

## Role of Customary Institutions in Fisheries Resources Management: Indonesia

A number of customary knowledge-based fisheries management systems exist in Indonesia (Adrianto *et al.*, 2009). The most common of which are: *Sasi Laut* (Haruku, Ambon, Maluku); *Mane'e/Mani'o* (Talaud, North Sulawesi); *Parompong* (Spermonde Islands, South Sulawesi); *Awig-awig Tanjung Luar* (Tanjung Luar, West Nusa Tenggara); *Awig-awig Lombok Utara* (Gili Indah, West Nusa Tenggara); *Panglima Laôt* (Nanggroe, Aceh Darussalam); *Lamalera Whales Hunting* (Lamalera, East Nusa Tenggara).

There has been a variety of situations related to the general principles of fisheries resources management in the customary institutions-based fisheries management systems in Indonesia (Yusof, 2009), such as territorial boundary system, rules system, rights system, sanctions system, monitoring and evaluation system, and authority system. In the Andaman Sea Region, the *Panglima Laôt* Aceh is a well known local customary institution which adopts most of the



Map showing the 33 provinces of Indonesia

**Box 1. General Principles of the *Panglima Laôt* Aceh, Sumatera, Indonesia (Adrianto *et al.*, 2009)**

Boundary System	Rules System	Rights System	Sanctions System	Monitoring System	Authority System
Customary-based agreements, non-administrative boundaries	Based on local customary values since 400 years ago	Rights allocated by the <i>Panglima Laôt</i> include: access rights, resources allocation, use rights	Based on customary values settled in the “ <i>Majelis Peradilan Adat</i> ” or Customary Marine Court	Undertaken by the <i>Panglima Laôt</i>	Held by the <i>Panglima Laôt</i>

general principles of fisheries resources management (**Box 1**) based on customary institutions in Indonesia (*Panglima Laôt* Aceh Online).

*Panglima Laôt* (or Sea Commander in Acehnese dialect) is a tribal leader in the fishing communities in Nanggroe, Aceh Darussalam Province of Indonesia, also known as the organizer of *Hukôm Adat Laôt* (Customary Maritime Law). This unwritten law which was developed based on the Islamic Law consists of a system of marine laws and regulations with respect to the sea as the source of people’s livelihood. The Law also varies in detail depending on local conventions and types of fishing gear used. Keeping pace with the development in fisheries in the country, the customary law has developed very rapidly covering the general procedures such as leader selection process, organizational structure, roles and responsibilities of selected officers, among others. A custom law was initially established by the Sultan Iskandar Muda (1607-1637) of the Acehnese Sultanate Samudera Pasai in order to maintain the maritime affairs under the Sultanate’s mandate, *i.e.* regulating fishing seasons and rights as well as resolving local conflicts. Such custom is still in effect under the present Customary Maritime Law.

## The Lombok Workshop

The Workshop on Customary Institutions in Indonesia: Do They Have Role in Fisheries Resources and Coastal Management?, which was conducted by the International Collective in Support of Fish Workers (ICSF) in collaboration with *Departmen Kelautan dan Perikanan* of the Ministry of Marine Affairs and Fisheries of Indonesia in Lombok, West Nusa Tenggara, Indonesia from 2 to 5 August 2009, was attended by representatives from various local institutions in Indonesia, Thailand, Malaysia, and the Philippines. The workshop discussions focused on the success stories of true community involvement in fisheries management, specifically the roles of the local institutions in the countries represented during the Workshop (ICSF, 2009).

It has been noted that the Indonesian Government issued in October 2004, the most comprehensive fisheries laws to emerge from the developing world. Law No 31/2004 on Fisheries, with its main thrust on fisheries management, is a revised version of the previous Fisheries Law No 9/1985.

The goals of fisheries management include improving the living conditions of small-scale fishers and fish farmers, and promoting optimum utilization of the fishery resources. This Law also recognizes the role of customary laws and local wisdom as well as community participation in fisheries management. Under the Law, any individual except the small-scale fishers and fish farmers, who derives direct benefit from the fishery resources within the fisheries management zone of Indonesia, would be subject to payment of levies that would be used for fisheries development and activities to ensure sustainable utilization of the fishery resources and optimum concern for the environment.

Moreover, the evolution from centralization to decentralization era in Indonesia has been re-started during its Reform Era, with the enactment of Government Law (UU) of 22/1999 (Local Autonomy Law), which has been revised by the Autonomy Law No 32/2004. The Law emphasizes on the shift in the fisheries governance regime from top-down to bottom-up approach, and encourages more participatory involvement of the communities. This has been carried out through the revitalization of its community-based management system. Considering that the small-scale and artisanal fisheries sector is an important source of employment, income and food security particularly for the poor in Indonesia, the Indonesian Government has developed several management programs anchored on local community development.

Although mostly traditional practices, true community involvement in fishery management in Indonesia has been a success, such as the *Awig-awig*, *Panglima Laôt*, and *Sasi*, among others. Although the so-called community-based fisheries management introduced by such projects has been mostly on an *ad hoc* project basis, these have proved to be very helpful. Nevertheless, there is still a need to develop nested management systems, which should be incorporated into fishery management planning and law, whereby the roles of national, provincial, district and local stakeholders are clearly defined, and that the rights and responsibilities of all stakeholders and resource participants are clarified. In addition, extending the usefulness of co-management of the key resources beyond the fixed area approach should also be explored. More particularly, a means of defining all stakeholders and other management participants should be established. Previously under a centralized system,

Indonesia's Local Government Law No. 5/1974 asserted that the local governments had no jurisdiction over the marine and fisheries resources. The only fisheries law at that time, the Fisheries Law No. 9/1985 also did not clearly specify that fisheries should be managed by the local government or the local people.

However, during the Reform Era in Indonesia starting in 1998, the Indonesian Government for the first time significantly modified the authority management rules by issuing the Autonomy Law No. 22/1999 which was revised by Autonomy Law No 32/2004, giving wider opportunities to the local government to manage certain water areas under their jurisdiction. This provided a great challenge to the government especially in finding out the most appropriate models for proper fisheries co-management. Thus, fisheries co-management system has been considered an alternative for restoring the condition of the resources and resolving issues on fishing rights, where the involvement and partnership of all stakeholders in the fishery management process under this system remained the main key factors.

The Lombok Workshop came up with the Lombok Statement (**Box 2**) which boosts the significance of local customary institutions in fisheries resources and coastal management (ICSF, 2009). The Lombok Statement specifically sought for the strengthening of customary local institutions through constitutional recognition of laws relevant to marine and fisheries resources management. Moreover, the Statement also invited all concerned to give due recognition to the models of an economy based on the needs of the people built upon traditional knowledge that uphold the principles of social justice, equality and environmental sustainability.

## Role of Local Organizations in Resources Management and Conservation: Satun, Thailand

The field trip which was part of the activities during the Workshop on Fishing Vessel Record and Inventory conducted by SEAFDEC under the SEAFDEC-Sida Project on 27-29 July 2009 in Satun Province, Thailand (SEAFDEC-Sida, 2009), provided valuable information on the role of local institutions particularly in Satun Province, Thailand. Much of the information shared by the local groups could serve as basis for a good start of community organization programs elsewhere in the ASEAN countries.

### Mangrove Conservation Group in Kok Payom Village, La-Ngu District, Satun Province

Kok Payom is located in La-Ngu (District 5), Satun Province, with a population of 666 from 132 households. Majority of the population are Muslims (80%), and their major occupations are agriculture, fisheries, and workers



Map of Thailand showing Satun Province

in the business sectors. The people in the community have been engaged in mangrove and related resources rehabilitation for a long time. The village had established six main visions, namely: (1) to obtain full (and sustainable) supplies from the natural resources; (2) to uphold religion, art and culture; (3) to promote good moral in living; (4) to promote the economic sufficiency strategy; (5) to develop the source of knowledge-base; and (6) to maintain harmony in the community. When the mangrove concessions in La-Ngu District were cancelled in 1995 as a result of mangrove degradation, the community realized the extent of degradation of their mangrove forests and the impact of the loss of mangroves to their livelihood. Hence, the village people organized themselves and joined hands in mangrove forest restoration, which led to the establishment of the Mangrove Conservation Group. In 2003, at about the same time that the villages in La-Ngu District were separated and the Mangrove Conservation Group became operational, the villagers also formed fishing groups which aim to among others, engage in fish cage culture. When the area was affected by the Asian Tsunami in 2004, many organizations provided assistance to the villages and supported the rehabilitation activities, e.g. Had Yai University, Satun Provincial Fisheries Office and the Bureau of Agriculture. In the process of rehabilitation, the groups earlier formed by the villagers proved to be valuable in getting back the situation to normal, and many activities have since then been continuously implemented.

Since the inception of the Mangrove Conservation Group, many relevant activities have been implemented by the villagers leading to the recognition of the Group and the area has also become well known. Many visitors are now coming to the area to learn from the experiences of the Group. Currently, the Mangrove Conservation Group has also started to promote agro-tourism activities with support from the Thailand Research Fund (TRF). Under the TRF framework, the main task of the Group is to conduct "Local Research" which includes studies on the environment,

## Box 2: Lombok Statement

### The ICSF Workshop on “Customary institutions in Indonesia: Do they have a role in fisheries and coastal area management?” 2-5 August, Lombok, West Nusa Tenggara, Indonesia.

Indonesia is an archipelago with deep historical roots in its maritime affairs and fisheries. The sea is seen by traditional fishing communities not just as a means of livelihood but as a way of life that accommodates the whole social arrangement of the society, its ethics and morals.

**WE**, the representatives of customary law communities, traditional fisherfolk, coastal communities, fisherwomen, environmental and other civil society organizations, and academe, who attended the workshop on “Customary Institutions in Indonesia: Do They Have A Role In Fisheries and Coastal Area Management?” from 2 to 5 August 2009 in Lombok, West Nusa Tenggara, Indonesia, believe that customary law and traditional knowledge make significant contributions to the protection of marine and coastal ecosystems, and the sustainability of marine and fisheries resources, as well as environmental sustainability.

**WE** have demonstrated that customary law, in existence since the 16<sup>th</sup> century, and traditional knowledge can make a significant contribution towards providing a just and sustainable marine and fisheries resources management regime. We believe that strengthening the social and cultural capital of customary law communities, traditional fisherfolk, fisherwomen, and coastal communities can assist in managing marine and fisheries resources, and be instrumental in addressing the multi-dimensional crisis currently faced by fisheries, marine and coastal ecosystems.

**WE** believe that marine and coastal resources management regimes should uphold environmental sustainability and social justice and gender equality, especially of marginalized members of coastal communities, including poor widows, neglected children, the disabled and the permanently ill.

**WE** have discussed the root causes that adversely impact the livelihood of customary law communities, traditional fisherfolk and coastal communities. We have united and corroborate our voices to:

First, reversing the practice of privatization, monopolization and liberalization of marine and coastal resources, as, for example, in provisions contained in Law No. 27, 2007, on Coastal Area and Small Islands Management, especially the provisions regarding the issue of Management Rights over Coastal Waters and Seabed (Hak Pengusahaan Perairan Pesisir; HP3), as well as Regulation No. 5 of 2008 issued by the Minister of Marine Affairs and Fisheries, which has now been revised and re-issued as Regulation No. 12 of 2009, on Capture Fisheries, especially its provisions for Cluster Fisheries. It is better to grant priority to the Constitutional rights of adat law communities and to harmonize them with the universal principles guaranteed in the 1945 Constitution, the Universal Declaration of Human Rights, the International Covenant on Civil and Political Rights, the International Covenant on Economic, Social and Cultural Rights, and the United Nations Declaration on the Rights of Indigenous Peoples, as well as Law No. 39, 2009, on Human Rights.

Second, in urging prioritization of the interests of customary law institutions above the interests of investors and international conservation organizations, through the creation of a Customary Law Institution Communication Forum.

In this context, **WE** are seeking strengthening of customary law institutions, especially through constitutional recognition of the adat law institutions in marine and fisheries resources management, and through undertaking documentation and giving due publicity to adapt customary law institutions.

By strengthening of the customary institutions, **WE** imply that the State should:

1. Acknowledge and protect customary law and traditional knowledge that have been handed down from generation to generation, have become part of our nation's cultural identity and have helped in conserving and managing marine and fisheries resources. This can be achieved by recognizing and integrating adat law and traditional knowledge into the national legal system, giving due consideration to diversity of value systems, national unity and gender equality.
2. Grant greater preference to sustainability of coastal and fisheries resources, and to the growing domestic fish consumption needs.
3. Adopt an economic paradigm that prioritizes the principles of social justice and environmental sustainability over economic growth; that effectively prevents environmental violations in relation to marine affairs and fisheries, especially from illegal, unreported, and unregulated (IUU) fishing; extractive activities; and various policies at local, provincial, and national levels that threaten the marine ecosystem and the sustainability of living resources.

Last but not least, **WE** invite all members of society, the government, and the international community to lend political recognition to the model of an economy, based on the needs of the people, built upon adat law arrangements and traditional knowledge that uphold the principles of social justice, equality and environmental sustainability.

Lombok, 5 August 2009. This Statement is hereby endorsed by:

1. Panglima Laôt Aceh
2. Sasi Negeri Haruku, Central Maluku
3. Sea-farming of Thousand Islands (Kepulauan Seribu)
4. Ola Nua Lefa Hari, Lamalera, East Nusa Tenggara
5. Parompong Pulau Barrangcakdi, South Sulawesi
6. Mane'e Pulau Kakorotan, North Sulawesi
7. Taluak Impian Women Fisheries Group, Lake Maninjau, West Sumatra
8. Mina Bada Lestari, Lake Maninjau, West Sumatra
9. Bina Desa Jakarta
10. Fishermen of Negeri Ouw, Saparua, Central Maluku
11. SNI (Serikat Nelayan Indonesia - Indonesian Fishermen's Union)
12. East Lombok Marine and Fisheries Committee
13. KIARA (Koalisi Rakyat untuk Keadilan Perikanan & People's Coalition for Fisheries Justice)
14. KPPL (Komite Pengelolaan Perikanan Laut or Marine Fisheries Management Committee), East Lombok
15. LMNLU (Lembaga Musyawarah Nelayan Lombok Utara -- North Lombok Fishermen Forum Institution)
16. KNTI (Kesatuan Nelayan Tradisional Indonesia or Indonesian Traditional Fishermen Unity)
17. SNSU (Sarekat Nelayan Sumatera Utara or North Sumatra Fishermen's Union)
18. WALHI (Wahana Lingkungan Hidup Indonesia or Friends of the Earth Indonesia)
19. Centre for Legal Research of Coastal and Marine Resources Management, Faculty of Law, Pattimura University
20. Social Division, Lab. SEPK, Faculty of Fisheries and Marine Sciences, Brawijaya University, Malang
21. JALA (Jaringan Advokasi untuk Nelayan Sumatera Utara or Advocacy Network for North Sumatra Fishermen)

community organizations, identification of potential tourism sites, and identification of interesting aspects of local resource management.

Social aspects also form part in the perspective and the Group has been eyeing on the learning potential of the villagers and members of the village groups, as this has been seen as an important factor for the development of the practical aspects of agro-tourism that are in line with the community's way of life and culture. In order to maintain a balanced and sustainable development, studies on the carrying capacity of the area in terms of agro-tourism, are also included in the research activities.

### **Satun Small-scale Fishery Association**

The Satun Small-scale Fishery Association is composed of 75 village members, divided into three categories: 20 villagers for resource management and profession; 34 villagers for resource management and saving; and 11 villagers for resource management, saving and profession. The activities of the Association include the establishment of groups for resources management/enhancement, coordination with other relevant agencies in the Province and support the villagers to establish sub-groups; finding alternative livelihood for the village members; and development/establishment of community shops/business/fish landing piers under the framework and regulations of the Association. One of the most notable achievements of the Association is its success in the registration of all vessels of its members and such information collection activity has been well implemented.

Satun was one of the Provinces badly affected by the Asian Tsunami in December 2004. In spite of such calamity, the Association continues its important role in ensuring the availability of improved information collection as well as in promoting a total boat owners registration to be more prepared for untoward hazards and incidents. Moreover, the Association also provided assistance to Tsunami affected members by collecting information on the damages and coordinating with other agencies in generating assistance. The Association also provided assistance in terms of facilities such as houses, boats, engines, among others, to its members and supported the fishing communities/groups using their own revolving funds. Furthermore, the Association also supported the establishment of a radio communication center, and in general, it actively supported the recovery of the community as a whole. At present in Satun Province, out of the total 3,200 fishing boats, 1,600 fishing boats have been registered of which 695 boats are owned by the members of the Association. The reliability of collecting information on boats registration has improved while the system to strengthen collaboration/coordination with governmental agencies has been established. The set

of information collected by the Association for sustainable management and conservation includes: (1) owner's name; (2) boat name; (3) boat size and engine capacity; and (4) fishing gear and operation (*i.e.* type, fishing ground, fishing season, target catch). This information is being updated every year from November to December, and is being shared with the Provincial Office. Furthermore, it has also been reported that the Association also manages the Provincial Central Bank.

**Community-based Fishing Port in Khon-Klan Village**  
Khon-Klan Village is in Tung Wa (District 6), Satun Province with a population of 525 people in 127 households, whose major occupations are fisheries and agriculture. When the mangrove concessions were cancelled as a result of mangrove degradation, many villagers turned to fishing to support their families. However, the fishers realized that they were at the mercy of the monopoly of fish buyers. Although the buyers provide them with loans in terms of fishing gears, boats, and fuel but in return the fishers had to sell their catch to the buyers. More often than not, the buyers dictate the price of their catch which practically led the fishers to the buyers' debt trap. In order to address such concern, the establishment of "the community fishing port" was initiated by the local fishers in order to gain better prices for their catch. Moreover, when the La Ngu Bay local fishers network and the Khon-Klan Village joined the Association, its objectives have been enhanced to include rehabilitation of the marine resources in the Andaman Sea area.

Furthermore, when the Association established a Savings Group in Khon-Klan Village with the main objective of freeing the fishers from debts, the concept of community-based fish market was also created. With funding support from the Association, the fishers constructed a landing site in order to be able to provide the necessary services such as: purchasing the catch of the members (local fishers) and daily transporting the catch to the market; selling petrol fuel for the fishers' fishing operations at reasonable price; and procuring fishing gears to be sold to its members. In mid 2005, the Association adopted a long term work plan to improve the livelihood of the fishers by: setting up a central fish market for local fishers; assisting the fishers in providing fishing gears including establishment of local welfare shop; and in the longer term, helping the fishers pay their debts and generating support for the central fish market concept.

The idea of a central fish market was developed by looking at the benefits of combining four separate community fish markets into a central network, such as the markets of the Khon-Klan community fishing port; 2,000 other small fishing ports; the Ban Klong Du-kang fishing port; and the Savings Group fishing port. The profits from the central community fishing port are divided on a percentage

basis and allocated to the: central fishing port's shop for administrative expenses, charity fund, fishing gears and circulating incomes; central fishing port for the management of the port; group members; individual members to stimulate outsiders to cooperate with the central market; administration committee bonus; welfare of the community fish markets; and activities related to coastal resources restoration such as releasing fingerlings, mangrove reforestation, and the like.

## Importance of Traditional Knowledge in Fishery Resources Management

The *Panglima Laôt* Aceh and the local organizations in Satun Province are examples of local systems that provide good planning and management of fisheries and habitats. Moreover, these organizations have also provided good partnerships in co-management in the respective levels in their areas using local knowledge. This has made them good advocates in fisheries and habitats management. The aforementioned examples are also important as their establishments are quite different. While the *Panglima Laôt* Aceh's origin goes back several hundred years ago, the community organizations in Satun Province are more recent. However, it should be noted that the examples are based on organizational abilities within Muslim communities.

The abovementioned organizations have always depended on traditional knowledge in carrying out their functions as champions in fisheries management in their respective areas of responsibility. Swiderska (2004) as cited by Mathew (2009), defined traditional or local knowledge as the knowledge, innovations and practices of indigenous and local communities derived from customary uses of biological resources and associated cultural practices and traditions. The traditional knowledge of fishers, *inter alia*, encompasses knowledge about biological, ecological, behavioral, nutritional and medicinal aspects of the living aquatic resources, oceanographic aspects of the habitat, morphological aspects of the coasts, climate issues, natural calamities, protection and mitigation measures, equity issues including conflict resolution mechanisms.

The relevance of traditional knowledge in fisheries management has been widely recognized in many international and regional legal instruments. For example, Agenda 21 of the UNCED on Recognizing and Strengthening the Role of Indigenous People and their Communities (UNCED, 1992), specified that: *Indigenous people and their communities have a historical relationship with their lands and are generally descendants of the original inhabitants of such lands. In the context of this chapter the term "lands" is understood to include the environment of the areas which the people concerned traditionally occupy. Indigenous people and their communities represent a significant percentage*

*of the global population. They have developed over many generations a holistic traditional scientific knowledge of their lands, natural resources and environment. Indigenous people and their communities shall enjoy the full measure of human rights and fundamental freedoms without hindrance or discrimination. Their ability to participate fully in sustainable development practices on their lands has tended to be limited as a result of factors of an economic, social and historical nature. In view of the interrelationship between the natural environment and its sustainable development and the cultural, social, economic and physical well-being of indigenous people, national and international efforts to implement environmentally sound and sustainable development should recognize, accommodate, promote and strengthen the role of indigenous people and their communities.*

Moreover, Agenda 21 also specifically indicated that in full partnership with indigenous people and their communities, Governments and, where appropriate, intergovernmental organizations should aim at fulfilling the objectives of establishing a process to empower indigenous people and their communities through measures that include, among others: recognition of their values, traditional knowledge and resource management practices with a view to promoting environmentally sound and sustainable development; enhancement of capacity building for indigenous communities, based on the adaptation and exchange of traditional experience, knowledge and resource-management practices, to ensure their sustainable development. Such declaration has been summarized in Principle 22 of the Rio Declaration on Environment and Development (UNCED, 1992), which specified that: *Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development.*

The importance of traditional knowledge has been further expounded in Chapter 17 of Agenda 21, where the States after committing themselves to the conservation and sustainable use of marine living resources under their national jurisdictions, recognized the need to: take into account traditional knowledge and interests of local communities, small-scale artisanal fisheries and indigenous people in development and management programs; develop systems for the acquisition and recording of traditional knowledge concerning marine living resources and environment and promote the incorporation of such knowledge into management systems; provide support to local fishing communities, in particular those that rely on fishing for subsistence, indigenous people and women,

including, as appropriate, the technical and financial assistance to organize, maintain, exchange and improve traditional knowledge of marine living resources and fishing techniques, and upgrade knowledge on marine ecosystems.

In a related development, the Convention on Biological Diversity (CBD) specifically calls upon countries to respect, preserve, maintain and to promote wider application of the knowledge, innovations and practices of local and indigenous communities, relevant for conservation and sustainable use of resources. Specifically, Article 10(c) of the CBD requires countries that are party to the Convention to “*protect and encourage the customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements*” (Convention on Biological Diversity On-line).

Furthermore, during the second meeting of the Conference of the Parties (COP-2) to the Convention on Biological Diversity held in Jakarta, Indonesia in November 1995, the adopted decision II/10 on the conservation and sustainable use of marine and coastal biological diversity, supported the selected recommendations of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) to the Convention at its first meeting, and subject to additional conclusions by COP (Convention on Biological Diversity On-line). It was on the same occasion that the Ministerial Statement on the implementation of the Convention on Biological Diversity was recognized as a new global consensus on the importance of marine and coastal biological diversity, which was known as the “Jakarta Mandate on Marine and Coastal Biological Diversity” or the “Jakarta Mandate”. As specified in the Draft Programme for Further Work on Marine and Coastal Biological Diversity adopted during the COP-2 (UNEP/CBD/COP/2/19), which was made part of the “Jakarta Mandate”, it was emphasized in 3(d) that: *the scientific, technical, and technological knowledge of local and indigenous communities should be incorporated, as appropriate, as well as community and user-based approaches, in the conservation and sustainable use of marine and coastal biodiversity.*

Moreover, during the COP-5 CBD (Convention on Biological Diversity On-line) held in Nairobi, Kenya in May 2000, the decisions also included the importance of decentralization and the importance of local knowledge in management. Section B on Principles of the Ecosystem Approach contains 12 principles which are complementary and interlinked. Nevertheless, **Principle 1** specified that the objectives of management of land, water and living resources are a matter of societal choices. Different sectors of society view ecosystems in terms of their own economic, cultural and societal needs. Indigenous peoples and other local

communities living on the land are important stakeholders and their rights and interests should be recognized. Both cultural and biological diversity are central components of the ecosystem approach, and management should take this into account. Societal choices should be expressed as clearly as possible. Ecosystems should be managed for their intrinsic values and for the tangible or intangible benefits for humans, in a fair and equitable way.

**Principle 2** indicated that “*Management should be decentralized to the lowest appropriate level*”. This is taking into account the fact that “*decentralized systems may lead to greater efficiency, effectiveness and equity*”. Thus, management should involve all stakeholders and balance local interests with the wider public interest. The closer management is to the ecosystem, the greater the responsibility, ownership, accountability, participation, and use of local knowledge. This is summarized in **Principle 11**, viz: *the ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.*

The Code of Conduct for Responsible Fisheries (FAO, 1995) also recognized the significance of traditional knowledge for conservation and management for sustainable fisheries development. Specifically, Article 6(4) indicates that conservation and management should take into account scientific evidence, traditional knowledge of the resources and their habitat as well as relevant environmental, economic and social factors. In addition, Article 12(12) specified the need for States to investigate and document traditional fisheries knowledge in order to assess the application to sustainable fisheries conservation, management and development. The significance of local organizations in fisheries management has also been recognized in the ASEAN region. The ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region (SEAFDEC, 2001) acknowledged the need for enhanced human resource capabilities at all levels and encourage greater involvement by stakeholders to facilitate consensus and compliance in achieving sustainable fisheries (Resolution 3). In terms of fisheries management, the adopted Plan of Action (POA) indicated the need to: *establish and implement comprehensive policies for innovative fisheries management, such as the decentralization of selected fisheries management functions to the local level ... (POA 1); and ensure local consensus building on innovative management measures through consultative processes ... (POA 2).*

On the other hand, the Workshop on Asserting Rights, Defining Responsibilities: Perspectives from Small-scale Fishing Communities on Coastal and Fisheries Management in Asia conducted in Siem Reap, Cambodia in May 2007

adopted the 2007 Siem Reap Statement (ICSF, 2007) which specified that the *protection of the inland, marine and coastal environments and the sustainable management of fisheries resources, are paramount concerns for small-scale and artisanal fishworkers and fishing communities in Asia*. The Siem Reap Statement also added that *many communities in the region have been implementing measures to restore, rebuild and protect coastal and wetland ecosystems, drawing on traditional ecological knowledge systems and deep cultural and religious values, reiterating the right of traditional and community-based organizations to conserve and co-manage coastal and inland fishery resources, and to benefit from them*.

Recently, the 2009 Lombok Statement (ICSF, 2009) specified that traditional knowledge upholds the principles of social justice, equality and environmental sustainability; and that traditional knowledge can make a significant contribution towards providing a just and sustainable marine and fisheries resources management regime. The Lombok Statement also indicated the need to acknowledge and protect traditional knowledge that have made contribution to resolving conflicts and in conserving and managing marine and fisheries resources as part of the cultural identity of the nation.

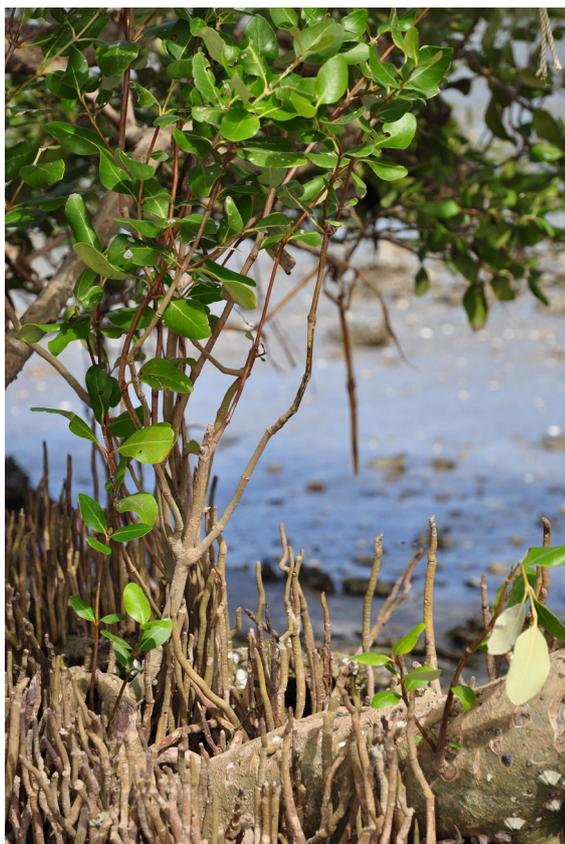
Finally, the 2009 United Nations Assessment of Assessments (AoA) adopted during the 25<sup>th</sup> Session of the UN General Assembly in June 2009 (UNESCO, 2009) has outlined some guidelines on the use of traditional knowledge in management. Among others, the guidelines indicated that: (1) traditional knowledge (TK) could be used to supplement scientist's data and information; (2) TK can be used to increase the relevance of an assessment by incorporating

knowledge of, for example, key local issues, possible response options and their likely success; (3) as TK could be the only source of information in some cases, especially of historical knowledge, it could be served to correct baseline information established by more recently collected data; (4) special arrangements may be necessary in an assessment process to ensure participation and contributions from holders of traditional knowledge, including individuals from small, often isolated coastal communities; (5) when TK is to be used in an assessment, it should be assured that there are clear rules of engagement so that all participants understand how discrepancies between data and information from TK sources and from scientific sources will be handled; (6) it should also be ensured that there is a clear understanding among all parties about propriety rights to TK remaining with the providers.

## Conclusion

Being widely recognized as a tool in fisheries management, traditional knowledge can therefore broaden the frontiers of scientific knowledge essential for integration of conservation and management into habitat protection and for developing effective mitigation measures. Nevertheless, it should be considered that the full participation of all stakeholders in developing realistic, successful, co-management programs is one of the major challenges and opportunities in decentralization. Techniques should therefore be developed and improved for locally-based management systems including traditional ones, and the local participation in larger management systems without creating unnecessary dependence on various levels of government and external funding, should be enhanced. The long-term goal is to have community-based components truly local, and supported





and funded by the fishery participants including dependent businesses. Adopting these recommendations would enhance the role of local communities in the management of the local fishery and coastal resources.

In any case, the use of traditional knowledge can help build up trust thereby improving the legitimacy of conservation and management interventions, and in some cases, traditional knowledge could help in enhancing participatory MCS regimes among the local communities. In summary, traditional knowledge could help in the process of devolution and decentralization, essential for the success of fisheries management.

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# Application of DNA Chips for Rapid and Comprehensive Diagnosis of Fish Pathogens

Tomokazu Takano, Takashi Kamaishi, Tomomasa Matsuyama, Norihisa Ohseko, Takafumi Ito, Jun Kurita, Mitsuru Ototake

Outbreak of infectious diseases caused by viruses, bacteria and parasites could cause severe economic losses in aquaculture. The precise diagnosis and appropriate treatment in the early stage of the outbreak is therefore important in order to prevent further spread of the aquatic disease. This article is based on a study conducted by researchers of the Aquatic Animal Health Division of the National Research Institute of Aquaculture, Fisheries Research Agency, Japan, which aims to develop DNA chips for the immediate diagnosis of pathogens in aquaculture.

It has been reported that in Southeast Asia, the occurrence of viral diseases in many cultured shrimps and fishes have caused devastating losses in aquaculture production. White spot syndrome (WSS) of the black tiger shrimp (*Penaeus monodon*) and viral nervous necrosis (VNN) of marine fishes are among the examples of such viral diseases that occurred in the Southeast Asian region. A number of researches have been conducted to establish and standardize diagnostic techniques for such diseases by using the polymerase chain reaction (PCR) method, which is applicable and most practical for the region (Nagasawa, 2005).

Specifically, for the detection of specific region of the genome in targeted pathogen, the PCR method has been considered as

the most popular and rapid diagnostic method. Moreover, the multiplex PCR method would allow the detection of several targets at a time. However, although PCR-based diagnostic method performs high-sensitivity, it could sometimes make non-specific reaction. The use of DNA-DNA hybridization has been found to detect a target DNA fragment from a pool of DNA fragments with high accuracy and sensitivity. Thus, it could overcome a drawback of the PCR-based method. The DNA-DNA hybridization based diagnostic DNA chips had been developed for multiple species of fish pathogens. The DNA chips consisted of an array of pathogen specific DNA probes, and are able to discriminate particular DNA fragments from DNA samples which are prepared from the specimens. The principles of the DNA-DNA hybridization are shown in Fig. 1.

## DNA chip for detection of multiple bacterial pathogens (16S chip)

For the multi-bacterial 16S DNA chip construction (Fig. 2), fifty bases of oligonucleotide<sup>1</sup> probes specific to the 16S rRNA<sup>2</sup> gene in individual species of fish bacterial pathogens were spotted on a nylon membrane. For diagnosis, 16S rRNA gene was amplified by PCR using universal 16S rRNA primers from the bacterial specimens and Digoxigenin-11-

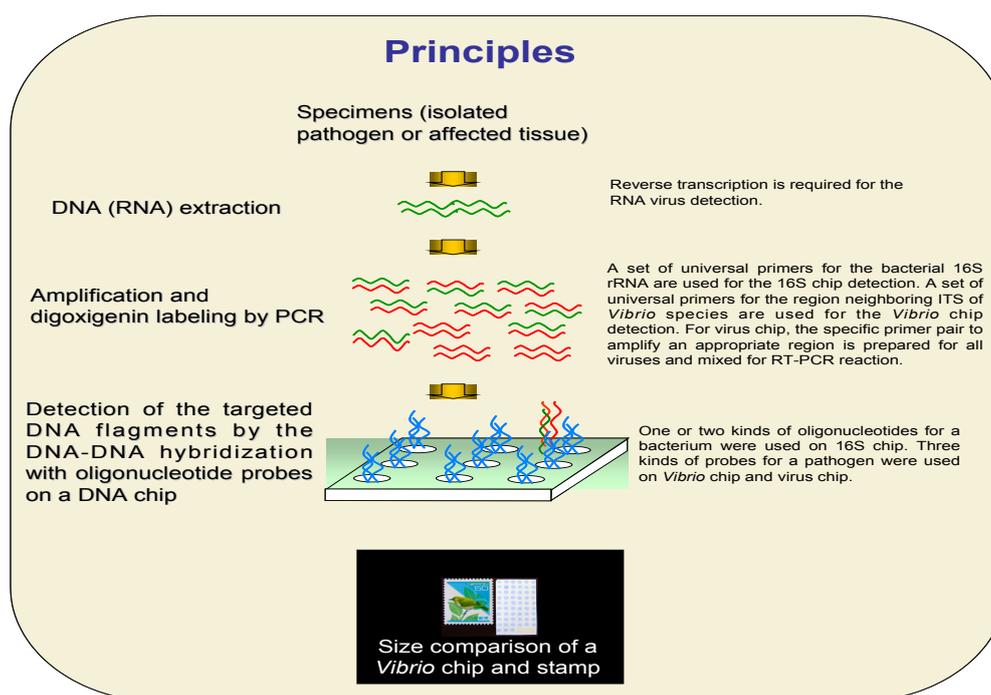


Fig. 1. DNA-DNA hybridization process

dUTP was incorporated to the PCR products. The amplified PCR product was subjected to hybridization on the DNA chip to determine the species of the bacterial specimen. Alkaline phosphatase-conjugated anti-DIG monoclonal antibody was used to detect the signals.

## DNA chip for detection of *Vibrio* species (Vibrio chip)

PCR-amplified intergenic transcribed spacer (ITS) between 16S and 23S rRNA gene of individual *Vibrio* species were spotted on the *Vibrio* chip (Fig. 3). The ITS region from the specimens was amplified with universal primers, then subjected to hybridization following the same procedure as with the 16S chip and was used for detection of the *Vibrio* species.

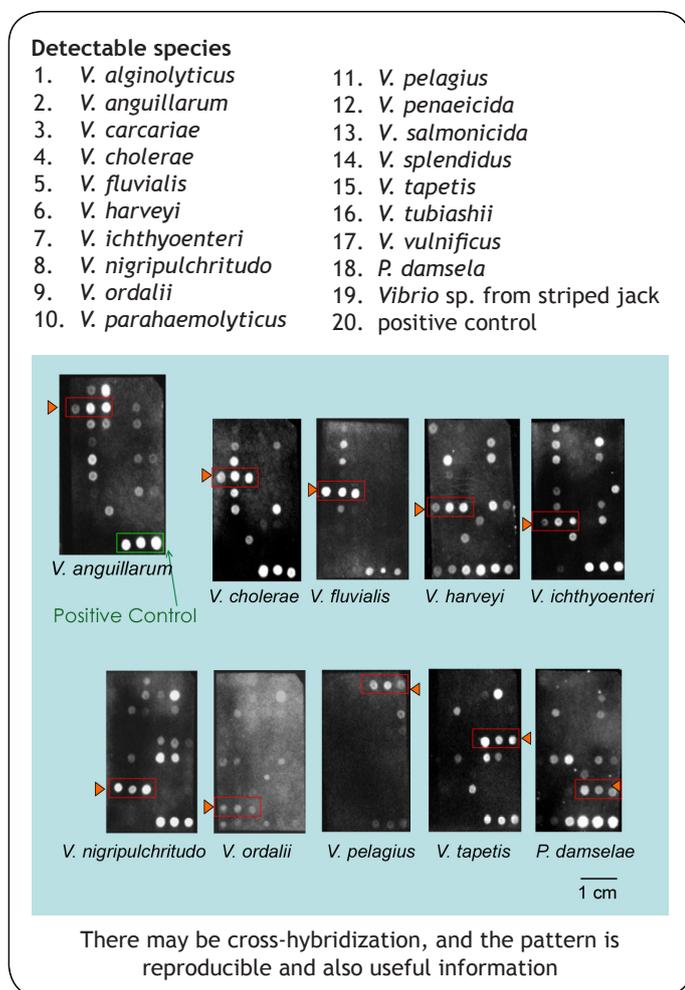


Fig. 2. Images of hybridization on the 16S chip

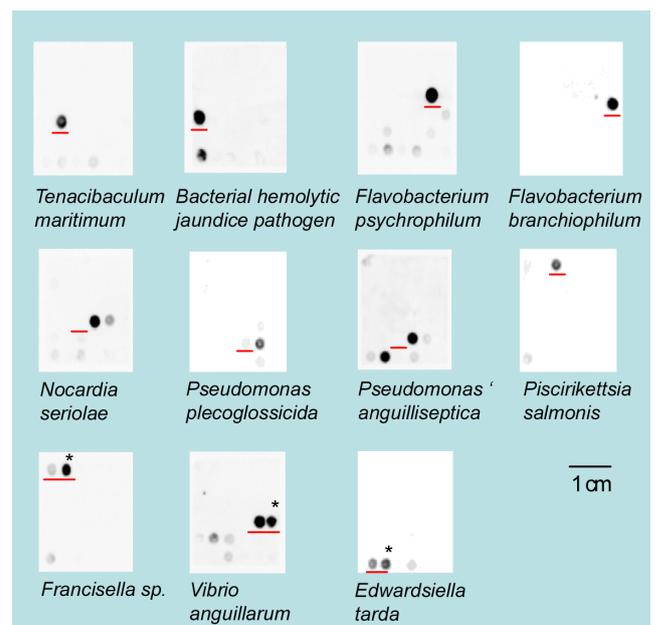
<sup>1</sup> Oligonucleotide is a short nucleic acid polymer, composed of DNA that is used in PCR analysis  
<sup>2</sup> rRNA - ribosomal ribonucleic acid is the RNA component of the ribosome, the protein manufacturing machinery of all living cells  
<sup>3</sup> Digoxigenin-labeled  
<sup>4</sup> RT-PCR - Reverse Transcription PCR is a variant of PCR used to generate many copies of a DNA sequence

## DNA chip for detection of viral pathogens (virus chip)

For the virus chip, 50 bases of fish virus specific oligonucleotide probes were spotted. To detect both RNA and DNA viruses by the virus chip, DIG-labeled<sup>3</sup> RT-PCR<sup>4</sup> product was amplified by RT-PCR using a mixture of PCR primer sets for 15 fish viral species.

### Detectable bacterial species

1. *Francisella* sp. From fishes
2. *Francisella* sp. From abalones
3. *Piscirickettsia salmonis*
4. *Renibacterium salmoninarum*
5. *Streptococcus dysgalactiae*
6. *Lactococcus garvieae*
7. *Streptococcus iniae*
8. *Streptococcus parauberis*
9. *Streptococcus agalactiae*
10. *Flavobacterium columnare*-1
11. *Flavobacterium columnare*-2
12. *Flavobacterium columnare*-3
13. *Flavobacterium psychrophilum*
14. *Flavobacterium branchiophilum*
15. Bacterial hemolytic jaundice pathogen
16. *Tenacibaculum maritimum*
17. *Mycobacterium marinum*
18. *Nocardia seriola*
19. *Vibrio anguillarum*
20. *Photobacterium damsela*
21. *Vibrio* sp. from striped jack
22. *Pseudomonas anguilliseptica*
23. *Pseudomonas plecoglossicida*
24. Abalone withering syndrome pathogen
25. *Edwardsiella tarda*
26. *Yersinia ruckeri*
27. *Aeromonas hydrophila*
28. *Aeromonas salmonicida*



\*Cross-hybridization was observed between related species

Fig. 3. Images of hybridization on the Vibrio chip

#### Detectable viral species

1. Iridovirus
  - RSIV (red sea bream iridovirus)
  - ISKNV (infectious spleen and kidney necrosis virus)
  - TRBIV (turbot reddish body iridovirus)
2. GIV (grouper iridovirus)
3. LCDV (lymphocystis disease virus)
4. FHV (flounder herpes virus)
5. HGRV (hosigarei rhabdovirus or spotted halibut rhabdovirus)
6. HRRV (hirame rhabdovirus)
7. VNNV (viral nervous necrosis virus)
8. Birnavirus
  - YTAV (yellowtail ascites virus)
  - IPNV (infectious pancreatic necrosis virus)
9. VHSV (viral hemorrhagic septicemia virus)
10. OMV (*Oncorhynchus masou* virus)
11. EHNV (epizootic hematopoietic necrosis virus)
12. KHV (koi herpes virus)
13. IHNV (infectious hematopoietic necrosis virus)
14. SVCV (spring viremia of carp virus)
15. PFRV (pike fry rhabdovirus)

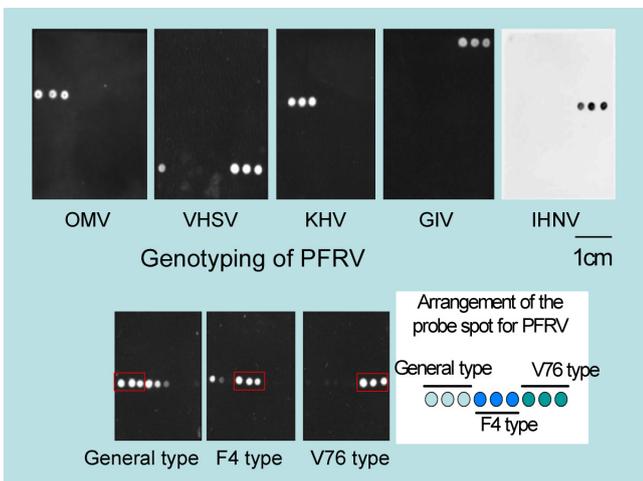


Fig. 4. Images of hybridization on the virus chip.

## Discussion

Twenty-eight (28) bacterial species were detected by the DNA chip targeting 16S rDNA. Seventeen (17) *Vibrio* species and two *Photobacterium* species were discriminated by *Vibrio* chip targeting the ITS region, while fifteen (15) viral species can be discriminated by virus chip. These results indicate that DNA chip is useful for the comprehensive detection of fish pathogens. Simple equipments, such as a thermal cycler, a shaker and a 42 m<sup>2</sup> incubator are required for this diagnosis. The cost of an assay is also cheap, approximately USD1.00 per diagnosis. Thus, this technique may be easily introduced to the field of aquaculture.

Taken together, DNA chip which was developed through this project is comprehensive, highly sensitive, and easy, and is a low-cost diagnostic tool for fish pathogens. Further studies on the comparative genomics among fish pathogens will yield more species-specific regions, and these may contribute to detect a broader range of pathogens and more sensitive diagnostic DNA chips. Currently, the project is evaluating the comparative genomics for fish pathogens using the next-generation DNA sequencer. Hence, the information from this upcoming study is expected to improve and modify the diagnostic DNA chips.

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# Mobilizing Regional Expertise to Alleviate Poverty by Fisheries Intervention in Southeast Asia: SEAFDEC Initiatives

Jariya Kankamnerd

The ASEAN and SEAFDEC acknowledge that addressing poverty issues could eventually lead to the reduction of socio-economic disparities in the ASEAN region, and that alleviating if not eradicating poverty in the countries in the region could pave the way for the ASEAN Community Building which as envisaged to be attained by 2015. Such concerns however, could only be effectively addressed through technical and development cooperation on the rational utilization of the fishery resources and in enhancing the capacity of the members of fishery communities. In addition, the capability of government officials should also be enhanced as part of the important strategy of ensuring long-term improvement of livelihoods and alleviation of poverty in the fishery communities. Towards achieving such objectives, SEAFDEC initiated in 2008 the two-year project on Human Resources Development (HRD) for Poverty Alleviation and Food Security by Fisheries Intervention in the ASEAN Region with financial support from the ASEAN Foundation through the Japan-ASEAN Solidarity Fund.

It is widely recognized that in Southeast Asia, the fisheries sector plays an important role in terms of producing food, generating income as well as in accelerating national social economic development, but the main contributor of this sector which are the fishery communities, still remains impoverished. In fact, the fishery communities are generally exposed to the multiple dimensions of poverty that include inadequate services, low level of education, politically poorly organized communities, and vulnerability to various factors that bring about poverty, among others, which are webbed into the complex conditions of the communities, making poverty alleviation difficult to achieve within a short span of time.

Since fish and fishery products remain the major source of protein for the peoples not only in Southeast Asia but all over the world, such commodities could boost the economies of the countries warranting the fisheries sector to influence the social and economic development of the fishery communities. The fisheries sector is therefore in a position to alleviate poverty in fishery communities only if sustainable resources utilization and management are put in place with the objective of enhancing the communities' livelihoods to ensure local food security of the communities.

Moreover, poverty alleviation in the fisheries sector should be made part of every country's sectoral policy and initiatives, which could include enhancing the human resource capacity of the concerned stakeholders.

It must be recalled that in 2001, the Southeast Asian countries developed a regional fisheries policy framework through the "Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region" that were adopted by the ASEAN-SEAFDEC ministers responsible for fisheries. With the objective of alleviating poverty in the Southeast Asian region through fisheries intervention, Paragraph 5 and 6 of the Resolution specified the need to "*Encourage effective management of fisheries through delegation of selected management functions to the local level*", and "*Recognize the need to progressively replace open access to fisheries resources with limited access regimes through the introduction of rights-based fisheries which may also facilitate the management of fishing capacity and promote the use of responsible fishing gears and practices*".

## Poverty Alleviation through Fisheries Intervention

The fishery communities are increasingly vulnerable to many factors such as natural hazards (due to the drastic changes in climatic conditions and unfavorable weather conditions such as typhoons, cyclones, seasonal fluctuation of fish stocks); economic disasters (increasing cost of fuel, fluctuating fish prices, poor market accessibility, intervention of middlemen in marketing); occupational risks



(poor living conditions, low educational level, inadequate medical care, unsafe fishing vessels and equipment); and political instability (weak and unfair law enforcement, top-down system of governance). The presence of any of these factors could lead to the chronic deterioration of the living conditions of the fishers (Kato, 2008).

Despite rapid and sustained rates of economic growth in the Southeast Asian region for several decades that resumed soon after the Asian economic crisis a decade ago, there are still structural reasons why an exogenous shock like a “global financial crisis” can adversely impact the poor in Southeast Asia. While USD1.0 a day purchasing power parity could be seen as extreme poverty line, USD2.0 a day should at least be considered in the Southeast Asian context as a poverty line, below which the population are already regarded as highly vulnerable to exogenous shocks, and hence are potentially liable to sink into extreme poverty if not supported through benefits and incentives (Santosh, 2009).

The statistics in 2006 showed that Indonesia, Malaysia and Thailand have very low shares of the total population below the USD1.0 a day poverty line, significant shares of their population live below USD2.0 a day (Indonesia 52% and Thailand 32.5%). Meanwhile, Cambodia, Lao PDR, Vietnam, and the Philippines have significant shares of their populations living below the USD1.0 a day poverty line at 34.0%, 26.0%, 17.7%, and 14.6%, respectively (<http://data.worldbank.org/indicator/SI.POV.NAGP>).

In the Southeast Asian region, high priority has been placed by the governments in mobilizing agriculture for poverty reduction and this includes the fisheries sector. However, while agriculture and fisheries could play the roles as main provider of environmental services that could be tapped to alleviate poverty, the unwise use and inappropriate management of the natural resources could lead to environmental disaster and eventually further aggravating poverty in the rural areas. In order to support the efforts towards attaining the aforementioned objectives, it is also necessary for the stakeholders to have a common understanding of the important and relevant terminologies that have already been developed and established by various organizations.

For example, Marcelo (2006) defined poverty as a condition where opportunities and choices most basic to human development to lead a long, healthy, creative life and to enjoy a decent standard of living, freedom, dignity, self-respect and the respect of others, are denied. Poverty alleviation by fisheries intervention is a process by which

people are becoming measurably better off over time due to their involvement/investment in fisheries activities, while poverty alleviation specifically involves “poverty reduction and protection” (FAO, 2007). Moreover, Macfadyen and Huntington (2004) defined human capacity development as the process by which individuals, groups, organizations, institutions, and societies develop their abilities---both individually and collectively---to set and achieve certain objectives, perform functions, solve problems and to develop the means and conditions required to enable such process.

Many technical interventions within and outside the fisheries sector have been advanced by national and local governments, donor agencies, and the NGOs. However, these were predominantly aimed at accelerating foreign exchange earnings through the introduction of modern fishing technologies and infrastructure development. Little focus has been given to improving the living conditions of the poor fishers because their problems are considered less technical and such social and economic issues are difficult for external parties to handle. Thus, SEAFDEC with support from the ASEAN Foundation embarked on a project on Human Resources Development (HRD) for Poverty Alleviation and Food Security by Fisheries Intervention in the ASEAN Region from 2008 to 2010.

## Role of Human Resource Development in Fisheries for Poverty Alleviation

Specifically, the HRD Project was envisaged to alleviate poverty in fishery communities by enhancing human capacity at the community level. Based on the technical expertise and capability of SEAFDEC in fisheries and aquaculture, five HRD thematic areas were identified by the ASEAN countries as means of facilitating the attainment of the HRD Project objectives. The thematic areas included local/indigenous institution and co-management, responsible fishing technologies, backyard fishery post-harvest technology, rural aquaculture, and inland fisheries development. The activities under each thematic area were conducted in the form of training of trainers by mobilizing the available regional expertise and maximizing the participation of local government officials, with the perception that the trainers would in turn train the relevant stakeholders on-site in their respective communities (**Box 1**). Moreover, the HRD Project focal points in the respective participating countries were also identified to champion the objectives of the HRD Project. The focal points comprise the relevant fisheries government officials, extension workers and those working at the local level of selected rural fishery communities.

## Box 1. HRD on the thematic areas conducted in selected countries of Southeast Asia

### *Local/indigenous institution and co-management*

As part of the activities of the HRD Project, a regional training course on local/indigenous institution and co-management was conducted to transfer technical knowledge to fisheries officials from the selected countries, the concepts of rights-based fisheries and co-management for poverty alleviation and food security.

### *Responsible fishing technologies*

The on-site training on responsible fishing technologies was focused on responsible fishing and practices, fabrication of appropriate fishing gears and small-scale insulated fish box to improve the quality of the fish catch, safety at sea and fishing sail boat to reduce the cost of fishing investment by cutting down fuel oil expense as well as to reduce the pollution from oil discharged into the water.

### *Backyard fishery post-harvest technology*

The skills of the Project focal points in basic fish handling and quality preservation, and simple fish processing technology to make value-added products from low-value edible fish were enhanced with the view that transferring the techniques to the stakeholders would also lead to the development of their skills in fish processing as a backyard industry in rural fishery communities, to improve their livelihood.

### *Rural aquaculture*

The training adopted a conceptual framework with emphasis on four important factors in sustainable aquaculture, namely: (1) aquatic resources and environment; (2) appropriate and economically feasible aquaculture technologies; (3) socioeconomic attributes of fishing communities; and (4) policy issues and institutional arrangements related to a balanced fishery management and aquaculture livelihood.

### *Inland fisheries development*

Although fisheries in the region play an important role in national social and economic development, many fishery communities remain poor especially the communities engaged in inland fisheries. Various factors contribute to the poverty level in inland fishery communities such as deteriorating habitats, competition for water uses by other sectors, and overfished resources especially among the communities relying on these resources for their living. The training therefore focused on the ways and means of addressing the concerns of these particular fishery communities such as conservation of inland water ecosystem, stock enhancement of inland waters, sustainable management of inland fisheries, supplementary sources of income from fishery-related activities (culture of food fish and ornamental aquatic species) and from non-fishery-related activities (ecotourism, backyard herbal gardening, and backyard handicraft industry), and livelihood management (establishing small-scale cooperatives, family economic management and project analysis).

## Analyzing Poverty in Fisheries Communities

The success in the implementation of any activities depends on the attitude, understanding and values of the target stakeholders, which in the case of the HRD Project comprise the fishers, fish farmers, local/central government officers, and local peoples in fishery communities. While formal training generally impart knowledge on physical, social and mental skills, emphasis should also be made on the target stakeholders' attitudes, mental understanding and psychological values which are necessary to accomplish the objectives of the activities, where psychological values could include patience, honesty and humility. While skills development makes use of physical energy, values formation makes use of the psychological energy of the personality of individuals. Since in most cases, the effectiveness and accomplishments of the target stakeholders are limited compared to the potentials and opportunities that are available, improving personal effectiveness in attaining the Project objectives through values formation was made part of the HRD Project activities.

## Empowerment of the fishery communities

The HRD Project gave more focus on capacity building to develop and/or improve indigenous/local institution that can help the people and enable them to cooperate with fisheries related agencies in achieving sustainable fisheries. The specific topics in the HRD activities included such areas as development of future leader(s), participation and recognition of the roles of women in gender equity and the youth, sustaining closer dialogue between communities and fisheries related agencies, provision of more and appropriate information, and the promotion of values formation among the people.

Considering that most members of the fishery communities are inadequately educated, there is also a need for national governments to exert efforts in improving infrastructures such as educational facilities in order that such efforts spread to the fishery communities. The HRD activities therefore, emphasized on the technical aspects balanced with socio-economic concerns. The materials used in the HRD activities were translated into the respective local languages to promote wider understanding of the technical terms. Moreover, study tours and case studies were also conducted to bring about better understanding of the ways of life in the fishery communities.



Practical session (left) and lecture (right) on backyard post-harvest technology

In selecting the target sites for the HRD activities, the important factor taken into consideration was the existence of organized groups as it would be convenient to select the target participants. The absence or shortage of community-based activities in a community could make it difficult to manage the activities. In addition, such organized groups have a good leader with confidence and able to get the support of the members. This means the need of improving the capability of the local groups' leaders by providing them leadership and management training, to enable them to take up leadership in the community activities.

Participatory approach was the key to the successful implementation of the HRD activities where in the implementation of the activities, the different ways of thinking and views among the older generation, women, and the youth in the community were assessed. The results were then used as appropriate approach in order to strike a balance of the interests of such stakeholders. This led to the empowerment of the concerned stakeholders that contributed to the effective implementation of the activities as well as effective establishment of the ownership of the activities by the relevant communities.

It should also be noted that after implementing the on-site HRD activities in selected pilot countries, an increasing number of fishery officials and extension workers also learn the concepts of responsible fisheries for food security and poverty alleviation. In order to sustain such interests, it is highly recommended that efforts should be made to promote the HRD activities as part of the countries' top priority policies on sustainable fisheries development. Specifically, extension workers should be trained in effective communication and negotiation skills, and their awareness of the issues in fisheries should be enhanced. On the other

hand, the capability of local government units should be boosted to enable their respective officers to take up the responsibility of implementing the HRD activities in the respective areas of responsibility.





### Support for fishery communities in enhancing their fisheries livelihoods or alternative livelihoods related to fisheries and non-fisheries

As means of providing support for the creation of alternative livelihoods in the fishery communities, national governments should make sure that the members of the communities have access to the resources and basic services. Assistance could also be provided to the members in identifying the appropriate and suitable livelihoods, raising the awareness of the members on the mitigation measures for the impacts of climate change, and most of all heightening the government support to the communities.

While appropriate HRD activities would be provided via strengthened extension systems, emphasis should be given on the approach of encouraging communities to diversify their livelihoods other than fisheries in collaboration with other relevant agencies and organizations. This strategy could also address the inability of most fishery communities to access to resources and basic services. This could be achieved through the establishment of freshwater and marine protected areas, improving fish seed production centers and promoting stock enhancement, promoting ecotourism



### Box 2. Regional policy recommendations from the HRD Project

- Development of the Regional Guidelines on Poverty Alleviation by Fisheries Intervention taking into consideration the draft regional policy recommendations should be initiated. This would however, require the need for further consultations to transform the policy recommendations into guidelines.
- Conduct relevant HRD activities in areas other than the selected pilot sites, which should be undertaken as soon as the Regional Guidelines are developed and adopted. The HRD activities could then include orientation and familiarization of the Regional Guidelines by the stakeholders to enable them to adapt the concept of the HRD activities in order to hasten the eradication of poverty in the regions' rural fishery communities.
- Identification of the specific roles of the various stakeholders, including the responsibilities of the ASEAN countries in the implementation of the Regional Guidelines in order to promote the implementation of HRD activities that could help eradicate poverty in the region. The role of SEAFDEC as the source of the technical support should also be specified.
- Identification of the appropriate agency responsible for monitoring the progress of the implementation of the Regional Guidelines for Poverty Alleviation by Fisheries Intervention, and the assessing the level of influence of the Regional Guidelines on the eradication of poverty in the ASEAN region.

and marine parks, and improving access to transportation and communication as well as health and safety facilities. Considering the experience in the promotion of “One Village, One Fisheries Products” (FOVOP) in the ASEAN region, the FOVOP approach could complement the support and promotion of livelihoods and poverty alleviation, as additional income sources for the fisheries communities.

Prior to the implementation of any HRD activities, it is necessary to assess the people's needs through the closely related approaches such as the Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA). These methods are useful in gathering information that could provide understanding about the communities and respective members and address the requirements of the target communities. The results would also lead to adjustments to make the activities more appropriate and are in accordance with the needs and concerns of the members.

Awareness on the impacts of climate change to the fisheries communities had been made part of the HRD activities through capacity building of stakeholders on climate change adaptation and the measures that could mitigate the impacts of climate change. Specifically for aquaculture, practices that are adapted to climate change were promoted. This would need the strong support from national governments to build up the capacity of the communities to adapt to the impacts of climate change in the environment.

### Box 3. Inputs from the HRD Project for the new decade Resolution and Plan of Action

#### Inputs for the Resolution

- “Strengthen the promotion of HRD activities for poverty alleviation by fisheries intervention through mobilization of available human and technological resources and harmonization of initiatives and support of the fisheries communities and governments”.

#### Inputs for Plan of Action

- Institution building on community organizations for community support and as basis for promotion of co-management in fisheries communities
- Improvement of members’ skills for expanding the potentials of accessing to alternative livelihoods
- Advancement of HRD on appropriate fishing, aquaculture, and post-harvest technologies for sustainable fisheries and aquaculture development in fisheries communities

Moreover, national governments should also intensify their support in various areas such as in co-management, R&D, infrastructure development, improvement of marketing systems and information, establishing small-scale cooperatives and micro-credit systems, and enhancing policy advocacy. Despite modernization of various fishing technologies, local fish marketing system has remained traditional system which had been identified as one of the problem areas that continue to drive the fishery communities to poverty. It should be noted that modernization of local market systems would require government legal and technical support for the target fishery communities to enable the members to improve their incomes.

## Conclusion and Way Forward

The Second ASEAN-SEAFDEC Regional Technical Consultation on Human Resources Development for Poverty Alleviation and Food Security by Fisheries Intervention in the ASEAN Region was organized in June 2010 to review and assess the outcomes and achievements in the implementation of the HRD Project activities. During the said Consultation, regional policy recommendations were developed (Box 2) which could serve as guide for mainstreaming poverty alleviation and food security by fisheries intervention in the respective national policies. The materials developed through the HRD Project together with the regional policy recommendations could be used as reference to support the strengthening of national policies and initiatives in promoting HRD on poverty alleviation by fisheries intervention.

## Proposed Inputs for the ASEAN-SEAFDEC “Fish for the People 2020: Adaptation to a Changing Environment” Conference

Noting the inter-linkages between poverty alleviation and food security leading to long-term sustainable development of fisheries, the regional policy recommendations should be articulated and mainstreamed into the preparation and finalization of the new decade Resolution and Plan of Action (Box 3), which will be concluded at the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 “Fish for the People 2020: Adaptation to a Changing Environment” from 13 to 17 June 2010 in Bangkok, Thailand.

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# Cooperative Set-net Fishing Technology for Sustainable Coastal Fisheries Management in Southeast Asia

Aussanee Munprasit

This article is based on the paper presented by the author during the JSPS-NRCT International Symposium in Tokyo, Japan hosted by the Tokyo University of Marine Science and Technology (TUMSAT) from 24 February to 6 March 2010.

The current state of declining coastal fishery resources in the Southeast Asian region would require urgent mitigation measures aiming towards better management policies and technical solutions. Majority of the fishers in Southeast Asia are engaged in small-scale fisheries and operate in congested and limited fishing grounds racing after the limited resources, leading to the degradation of the resources and decreasing fish catch. Oftentimes, small-scale fisheries also come in conflict with commercial-scale fisheries especially those that operate the trawls and purse seines. Development of alternative approaches that could address the existing conflicts in the fisheries sector is therefore necessary in order to solve the real critical problems in fisheries. One technical approach promoted by the Southeast Asian Fisheries Development Center (SEAFDEC) is the transfer of the community-based Set-Net fishing technology.

In 2003, the SEAFDEC Training Department (SEAFDEC/TD) initiated the pilot project introducing the Japanese-type Set-Net as an environment-friendly and energy-saving fishing gear in Rayong Province, Thailand (SEAFDEC/TD, 2005). Funded by the Trust Fund Program of the Government of Japan, the Project facilitated the organization of the local small-scale fishers of Rayong Province to undertake the group operation with the collaboration of the Rayong-based Eastern Marine Fisheries Development Center (EMDEC) of the Department of Fisheries (DOF) of Thailand. In addition, the Project also availed of the technical support from Himi City of Japan under the Japan International Cooperation Agency (JICA) grass-root partnership program and TUMSAT under the Core University Program of the Japan Society for the Promotion of Science (JSPS) and the National Research Council of Thailand (NRCT). The activity envisaged that the lessons learned from the implementation of the pilot project can be applied to other coastal areas in Thailand as well as to other countries in Southeast Asia. Thus, through the adaption of the Set-Net fishing technology, sustainable fisheries management and resource conservation could be intensively promoted in the region.

## Set-Net Fishing Technology

Developed in Japan (Fig. 1), the Set-Net is a passive type of stationary fishing gear which was first introduced in Thailand in 1953 (DOF Thailand, 1969), in Indonesia in 1956 (Zarochman, 2007; Arimoto *et al.*, 2008), and in the Philippines where the successful transfer of the technology was reported in 1957 (Aguilar, 1989). Since then, several attempts have been made to transfer the Set-Net fishing technology in Thailand and Indonesia. However, technical and management difficulties as well as the reluctance of most fishers to take part in the Set-Net operations could have contributed to the repeated un-successful results of such efforts. This time, many fishers have started to recognize the importance of the technology not only for resource conservation but also as means of increasing their catch in terms of quantity and quality.

The re-introduction of the Set-Net fishing technology in Thailand in 2003 was aimed at promoting Set-Net fisheries as means of reducing pressure on the coastal fishery resources, alleviating competition among the fishing gear types, developing common policy concept on responsible coastal fisheries management, and raising the awareness of the community on the need to conserve the coastal fishery resources and fishing grounds. Moreover, the technology was also specifically considered as an immediate solution for the declining fish catch in the Gulf of Thailand and the Andaman Sea. The 30 x 150 x 250 meter Otoshi-ami type



Fig. 1. Set-Net fishing operation in Japan (Source: Arimoto *et al.*, 2008)



Fig. 2. Set-Net fishing operation in Rayong Province, Thailand (Source: Munprasit *et al.*, 2005)

(Inoue *et al.*, 2002) of Set-Net with non-return slope net and trapping chamber was installed in the 13-meter deep coastal waters off the Mae Rumpheung Beach in Rayong Province, Thailand. After which, the Set-Net fishing has been operated by a group of small-scale fishers who were organized in the project area to attain the objective of the project (Fig. 2).

While Otoshi-ami is recommended for open coastal fishing grounds, the Choko-ami type with a slope funnel entrance can be applied in shallower and calmer fishing grounds. In both Set-Net types, modifications of the gear design would be necessary to make the gear more appropriate for the target species in certain fishing ground conditions. The Set-

Net can be installed in coastal fishing grounds giving due consideration to the environment, especially the biodiversity of the coastal areas (Fig. 3).

### Impacts of Set-Net Fishing Technology

The most important impact of the Set-Net technology was demonstrated in the enhanced cooperation of the local small-scale fishers, especially that during the net-hauling operation which is mostly conducted at day time every two days, 9-15 fishers would be needed using 3-4 small-scale fishing boats (6 m long). From their involvement in the project, the members of the fishers group were able to enhance their knowledge on the basic concept of cooperativism by working together as a group, and at the same time also learned the concepts of sustainable fisheries and community-based management.

### Sustainable Coastal Fisheries Management

The successful results of the pilot Set-Net project in Rayong had proved that the Set-Net fishing gear is environment-friendly. Specifically, the main catch consisting of trevally, sardines, mackerel, pomfret, and cuttlefish, did not include any trash fish and discards (Munprasit *et al.*, 2005). Moreover, since the Set-Net can be used as barrier for any active fishing gear in the coastal fishing grounds, it can specifically protect the bio-diversity of the coastal areas and promote the conservation of fishery resources (Ekmaharaj, 2007). Commercial fishing boats such as trawlers, purse



Fig. 3. The Set-Net fishing technology promoted by SEAFDEC/TD

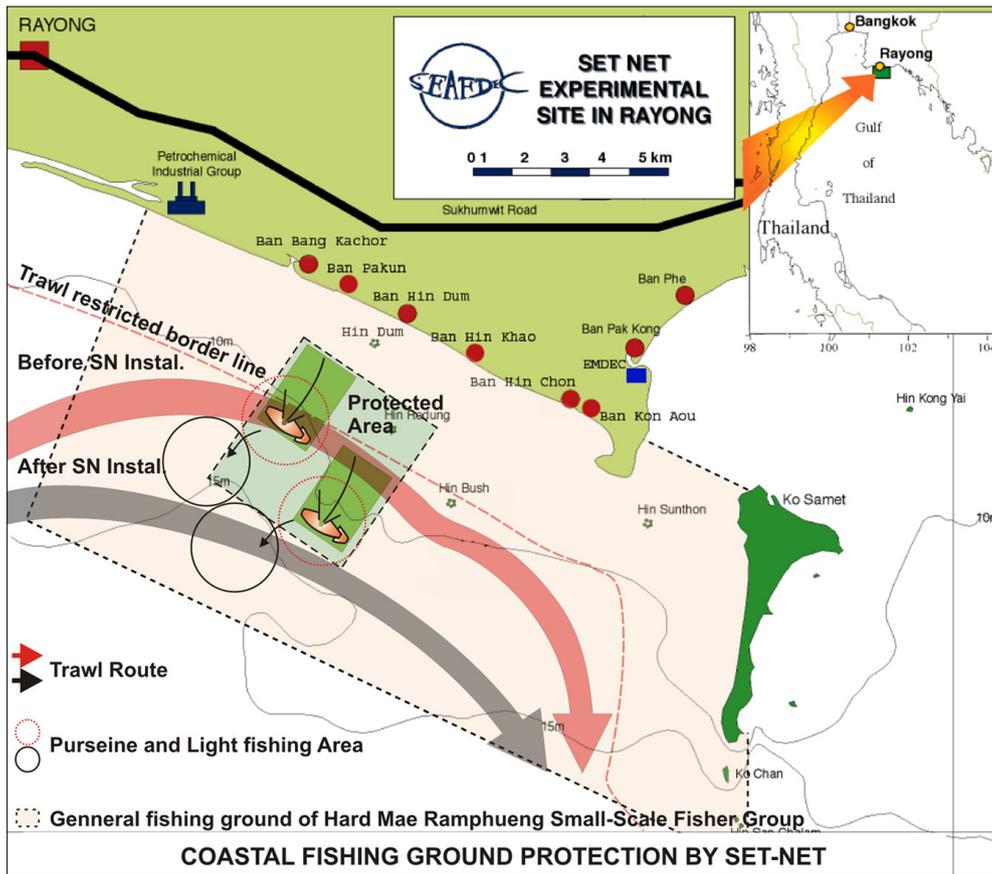


Fig. 4. Coastal fishing grounds could be protected by the Set-Net as confirmed in the project site

seiners, and light fishing gears could be kept at bay and away from the Set-Net area (Fig. 4). It can also pursue a stock enhancement function by creating certain zones not only for resources rehabilitation but also as spawning and nursery grounds of important aquatic species.

#### Group Participation and Capacity Building

The launching ceremony of the “Set-Net Experimental Project” in Rayong Province in July 2003 was attended by about 85 small-scale fishers and their family members from seven communities, where the concept of coastal resource management using the Set-Net was also presented and explained. As a result, the Administrative and Management Committee of the fishers group was organized to manage the Set-Net operation. During the implementation of the pilot project, cooperative management system was introduced gradually year by year, through the concept of group cooperation management of the fishery resources in coastal waters (Fig. 5). The daily operation of the Set-Net also served as capacity building especially in enhancing the fishers’ awareness on the concepts of environmental and resource conservation, and in better understanding of the status of the fishery resources through the adoption of responsible fishing practices.

#### Economic Growth through Increased Income

As observed during the project implementation, the Set-Net fishing operation has contributed significantly to the economic growth of the beneficiary fishers group in Mae Rumpheung, Rayong Province. Firstly, the energy-saving aspect of the Set-Net fishing technology contributed to the reduction of fishing operation costs, especially in the current high-price oil crisis. The routine hauling operation is easy



Fig. 5. Cooperation and camaraderie had been demonstrated among the small-scale fishers in the Set-Net project site in Rayong Province

to undertake in shorter period of working hours at sea (2-3 hours/day). Since the Set-Net fishing operation is done in fishing grounds near the shore, there is no need to spend more time, effort and money for finding the schools of fish. Secondly, the additional income derived from the Set-Net fishing operation had been reserved as savings fund of the fishers group for future use.

As shown in their outputs between 2004 and 2009 (Fig. 6), the average catch per day-trip increased from 255 kg to 352 kg, and correspondingly the income per day-trip increased from Baht 5,000 to Baht 10,141 (SEAFDEC/TD, 2008; EMDEC/DOF, 2009). The good quality of the catch resulted in better unit-prices, while the efforts of the fishers group in improving fish handling techniques by using ice to keep the freshness of the fish and in advancing their marketing strategies that include managing their own market for specific customers at the beach side, resulted in the sustainability of the Set-Net technology.

### Further Promotion of the Set-Net Fishing Technology

After the successful transfer of the Set-Net fishing technology in Rayong Province, Thailand, TUMSAT started a new project in Indonesia in 2007 under the JICA grass-root partnership program. The small-scale fishers in Pallette, Bone, South Sulawesi were organized to operate the Set-Net fishing with the cooperation of Himi City, Japan; and the Hasanudin University and Bone National Fisheries High School. The Otoshi-type of Set-Net was 20 x 110 x 200 meters and installed at the 13 m deep coastal waters in March 2008 after a gear modification especially its both-side chamber trap system. This model could be promoted further in Indonesia through extension services on community-based Set-Net and empowerment of the coastal

fishing communities (Arimoto *et al.*, 2008). While the project in Indonesia is in progress and would be continued until 2010, another project was also started in September 2008 by SEAFDEC/TD with the cooperation of Kasetsart University of Thailand in Sriracha in Chon Buri Province where the Choko-ami type gear was introduced. There is a great potential that the Set-Net fishing technology would be adopted in other countries in the region for sustainable coastal fisheries management.

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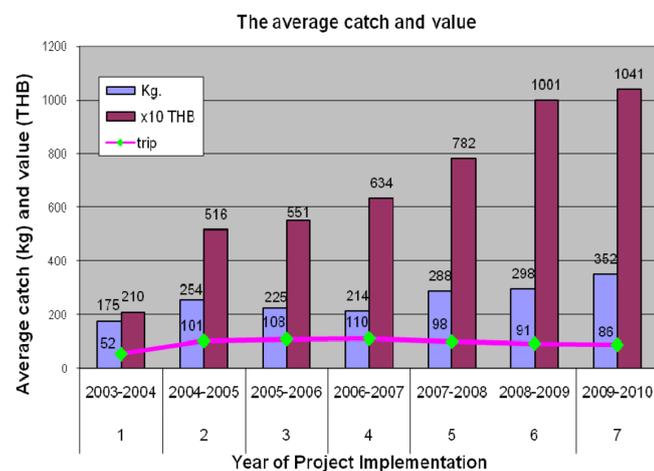


Fig. 6. Catch and income statistics of the Rayong Set-Net project

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# Efforts by Fishers and Support Activities to Conserve and Rehabilitate Seaweed Beds: Adaptive Management of the Fishery Resources and Habitats in Japan

Akito Sato, Hisami Kuwahara and Osamu Hashimoto

Seaweed beds in coastal waters serve as spawning and rearing grounds for fish and shellfish. The recent reduction of seaweed beds, called “isoyake” in Japanese, has been considered as a cause of the recent decrease of some fishery resources in the coastal waters of Japan. In order to address such concerns, the fishers have undertaken various activities aimed at managing seaweed beds. Recognizing that conservation and rehabilitation of seaweed beds is an important policy issue, the Fisheries Agency of Japan has found it necessary to provide technical support to the efforts of the fishers by enhancing activities for the regeneration and conservation of seaweed beds, starting with the development and dissemination of the “Isoyake Recovery Guidelines (2007)”. This report introduces some brief examples of the fishers’ efforts to conserve seaweed beds and the supporting activities by local and central governments in Japan, as well as the situation of the seaweed beds, importance of seaweed, and adaptive management of seaweed beds in Japan, which could serve as useful information for the countries in Southeast Asia.

## Seaweed Beds in Coastal Waters of Japan

Seaweed beds are widely distributed in the coastal waters of Japan, with three principal types of seaweed beds on rocky sea bottoms. In general, *Laminaria* beds are found in the country’s northern waters, *Eisenia* and/or *Ecklonia* beds mainly in the Pacific Ocean, and *Sargassum* beds mainly in the Nippon Sea/East China Sea (Fig.1). In Japan, these seaweed beds and other kinds of seaweed beds are indispensable for preserving the coastal fishery resources.

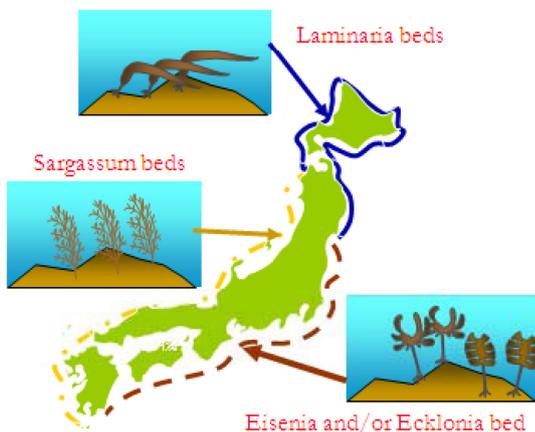


Fig. 1. Principal seaweed beds in coastal waters of Japan

Furthermore, a variety of seaweed are directly targeted in fishing activities, because in Japan many species of seaweed are used as source of healthy food and delicious soup stock. Therefore, seaweed fishing is an important activity in Japan where a number of fishers are engaged in collecting seaweed.

## Tendency of Seaweed Beds Becoming Barren

The phenomenon of barren seaweed beds, called isoyake in Japanese, where the seaweed beds become denuded or apparently burned, has been reported in Japan for more than one hundred years. Considering that for the past two decades in a number of places, seaweed beds have decreased remarkably on a large-scale, and the trend of barren seaweed beds continuously becomes eminent, the need to conserve the seaweed beds was therefore deemed necessary. As reported, the recent occurrence of barren seaweed beds has been caused for example, by the influx of floating mud from rivers (Photo 1) and by overgrazing of sea urchins and herbivorous fish (Photo 2) brought about by the increasing water temperature. This recent degradation of the seaweed beds has become a serious problem in Japan, where many people became aware of such situation through various television programs and in the national newspapers.



Photo 1: Barren seaweed beds due to piling of floating mud (Source: Isoyake Recovery Guideline)



Photo 2: Barren seaweed beds due to overgrazing by parrotfish on a large scale (Source: *Isoyake Recovery Guideline*)

## Functions of Seaweed Beds

It is generally well known that seaweed beds play a major role in fisheries. Specifically, seaweed beds function as: *spawning grounds* for the fishery resources and other marine organisms; *nursery grounds* for larvae, juveniles and adult of fish as seaweeds tend to decrease the current of seawater, and also provides a refuge from enemies by hiding among the seaweeds; *feeding grounds* for fish that feed on seaweed and/or on microorganisms and small animals gathering around seaweed beds; *absorber of nutrients* in the seawater keeping the water clean; and *absorber of carbon dioxide*, among others.

Regarding the function of absorbing carbon dioxide, seaweeds are known to release large amounts of slimy liquid made of organic compounds with carbon from their surface to the seawater. Together with these organic compounds are un-dissolved organic compounds that have been present in seawaters for several hundred years that perform the role of fixing carbon in seawater. The above functions of seaweed beds therefore show that seaweed plays an important role not only in fisheries but also in preserving the marine environment, which humankind has always depended on for food and livelihood.

## Adaptive Management and the “Isoyake Recovery Guideline”

Recent environmental issues emerging around the world such as climate change have been serious and their impacts are considered irreversible. In addressing such concern, the concept of “adaptive management” has often been promoted through environmental conservation policies. In general, adaptive management which is a management technique involves gradual carrying out of measures through repeated monitoring and giving feedback, and analyzing the results.

Adaptive management is commonly applied in the field of ecosystem restoration, specifically for marine and inland habitats.

Rehabilitation of barren seaweed beds on a large scale is more difficult for the fishers to undertake than in the ordinary management activities in seaweed beds. In order to rehabilitate the seaweed beds and support the corresponding efforts of the fishers, the Fisheries Agency of Japan therefore conducted technical pilot projects from 2004 to 2006 with the cooperation of a number of technical staff/researchers from 17 prefectures and 19 specialists. Taking into consideration the results of the pilot studies and the scientific knowledge gained, the “Isoyake Recovery Guideline” was published in 2007 which includes the concept of adaptive management for the rehabilitation of seaweed beds. The main users of the Guideline are the fishers who are at the forefront of the restoration efforts.

The Guideline consist of, among others, adaptive management for successful rehabilitation through adaptive learning and feedback mechanism; flow chart for the selection techniques; support to fishers through organized cooperation of specialists, local governments, citizens and other stakeholders; useful viewpoints for detecting decreased seaweed resources and finding critical factors in recovering seaweed beds; explanation of each technique; and other relevant topics. Also included in the Guideline are results of a number of case studies, research studies, and model practices.

The adaptive management approach for the rehabilitation of seaweed beds in the Guideline is shown in **Fig. 2**, which indicates that when the first target of recovery of seaweed beds is achieved, a new target could be aimed by starting from C: “Target of Recovery”. If the target has not been

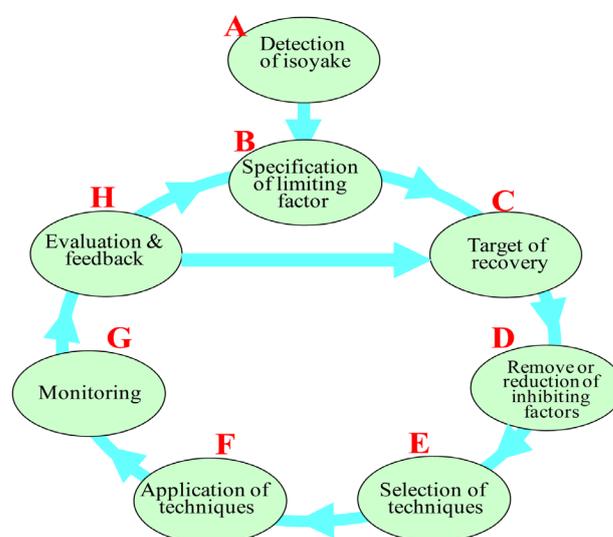


Fig. 2. Adaptive management for isoyake recovery (Source: *Isoyake Recovery Guideline*)

achieved yet, restart from B: “Specification of Limiting Factors” to clarify the reason for the failure. Once clarified, the new approach can be started all over again. In addition, the Guideline also contains additional features related to adaptive management as shown in **Box 1**.

In particular, a number of countermeasures or applicable techniques for recovering seaweed with regards to management activities are introduced in the Guideline. **Fig. 4** shows an example of the techniques for stock enhancement of seaweed, where planting includes transplantation of adult seaweed, utilization of cultured juveniles, and supplying the spores.

In the adult seaweed transplantation, adult seaweed is fixed with adhesive anchors on the sea bottom. A simpler method is to throw the adult seaweed with weights from the sea surface. Cultured juveniles are attained by transplanting seaweed using ropes or plates where embryos of seaweed grow. Maintaining the supply of spores includes putting mesh bags with adult seaweed and weights in the sea bottom, using mid-level nets with seaweed, and use of drifting catchers to trap seaweed that float near the sea surface.

**Box 1. Some features in the “Iyosake Recovery Guideline” relevant to adaptive management**

1. Due to limitation of implementing abilities, feasibilities, among others, the Guideline recommends implementation activities in a “Step by Step” process.
2. The Guideline targets specifications of limiting factors of recovery rather than the reasons of barren seaweed beds occurrence, in considering countermeasures for adapting changes of environment.
3. Since overgrazing by herbivores (sea urchins and/or herbivorous fish) is a serious issue that prevents recovering the seaweeds in many coastal prefectures, a major theme of the Guideline is how to strike a new balance between seaweed production and grazing pressure by herbivores (**Fig. 3**), *i.e.* by decreasing herbivores and/or by increasing seaweed production under a changed environment.

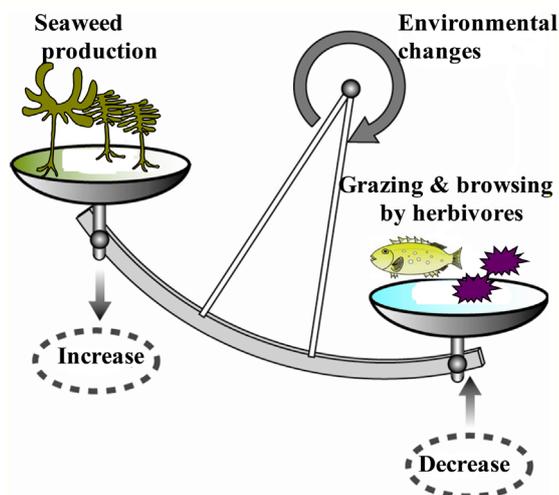


Fig. 3. Balancing seaweed production and grazing pressure by herbivores (Source: Iyosake Recovery Guideline)

## Examples of Fishers’ Efforts in Conserving and Utilizing Seaweeds

### Sustainability of seaweed fisheries in Hidaka Waters

An example of fishing ground management activities for fisheries of *Laminaria* kelp or “Kombu” in Japanese could be observed in the Hidaka Waters in Hokkaido, Japan. During the 1860s in the Edo era, improvement works for kelp fishing ground expansion were done by throwing stones into the sea. Before such works started, kelp production was about 75 tons, but the production kept on increasing year by year.

In addition, cleaning the fishing grounds and renewal of the stone grounds have been continued in Hidaka Waters for several decades. Such fishing ground management activities has contributed to the stable kelp production of Hidaka Waters, which increased from 3,500 tons to 6,500 tons every year from the 1870s. The total number of fishery establishments in Hidaka seashores is 1,510 of which 1,384 are engaged in seaweed production.

In Hidaka waters, there are several types of fisheries such as seaweed gathering/fishing, gill-net fishing, long-line fishing, shellfish gathering, large fixed-net fishing, among others. In particular, more than 90% of the fishery establishments are engaged in seaweed gathering/fishing (**Photo 3**). Therefore, since seaweed fisheries have important role in providing income for a number of fishers, the fishers in each village established their respective regulations for seaweed gathering/ fishing and rules including the self-obligation of cleaning their respective fishing grounds.

### Seaweed management activities by fishers of the Shioya Fishery Cooperative

Situated at Aomori Prefecture in the northern part of Japan, Shioya is famous for its seaweed (*Saccharina japonica*) management. Seaweed fishing and gathering of shellfish such as abalone and sea urchins which co-exist with seaweed in the fishing ground, is an important fisheries activity in Shioya. Marine conservation activities by the fishers group (about 30 fishers at present) of the Shioya



Photo 3. Drying kelp on Hidaka seashores in Hokkaido (Photo by Akito SATO)

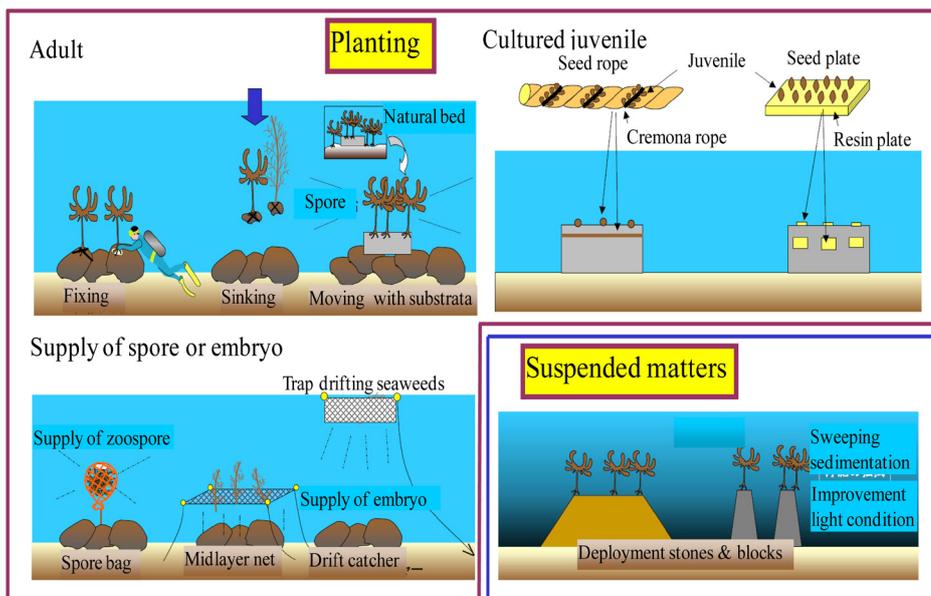


Fig. 4. Techniques for stock enhancement of seaweed  
(Source: *Isoyake Recovery Guideline, etc.*)

Fishery Cooperative (**Photo 4**) have been ongoing for half a century, and monitoring surveys of the seaweed as well as abalone and sea urchins, have also been conducted by the fishers group every year for about 30 years, in spite of minimal annual budget of the fishers group for conservation activities, which is about 150 thousand yen a year.

At one time, when seaweed in Shioya waters was seriously damaged due to volcanic ash, cultured juveniles were planted by the fishers group using seed ropes, and seaweed beds were rehabilitated by such fishers' efforts. As a result, the production of kelp had recovered from almost zero yen to several hundred million yen. However, in addition to this difficult experience, seaweed was sometimes overgrazed by sea urchins because of changing seawater temperature, and recently the barren seaweed beds have largely expanded again. In addressing the decrease of seaweed resources, the fishers group started a new management activity for



Photo 4. Members of the fisher's group in the Shioya Fishery Cooperative (Source: *Report of Isoyake Countermeasures Promotion Project, 2008, Fisheries Agency of Japan*)

controlling the density of sea urchins. This has been done by removing sea urchins from barren seaweed beds and transplanting those sea urchins to other seaweed beds in order to balance between seaweed production and grazing pressure by the herbivores.

The areas with barren seaweed beds (a few hectares per year) where the fishers group removed the sea urchins have recovered within that same year. This strategy takes into consideration the fact that coastal marine resources are local fisher's common properties for the livelihood of the communities, and where fishers derive their income from the Shioya waters. For this reason, the management activities have been passed on to generations of fishers by encouraging them to develop the frame of mind to continue such management activities.

### Example of Local Governments' Support in Reforesting Barren Seaweed Beds

#### Isoyake recovery efforts supported by local governments in the Hainan area

Along the coast of Hainan, extending from Sagara to Omaezaki on the west coast of Suruga Bay, Shizuoka, large seaweed beds encompassing more than 7,000 ha where seaweed species such as *Eisenia arborea* and *Ecklonia cava* are abundant, have reduced since 1985 and almost disappeared by 2000. As a result, production of abalone and other marine fish as well as shellfish also declined sharply along the coasts (**Fig. 5**). The damage brought about by the isoyake phenomenon exceeded the abilities of fishers to rehabilitate seaweed beds. In this regard, support activities to recover the seaweed beds were initiated with support from the Shizuoka Prefecture, which involved four fishery cooperatives and three towns in the neighboring area, as well as specialists.

Monitoring of the status of seaweed beds was conducted by Shizuoka Prefecture through its fishery research center. Initially, the concrete causes of the radically degrading seaweed beds were not clear, but based on results of several research studies by the center, it was found that the main possible causes were the effects of increased water temperatures and grazing by herbivorous fishes due to climate change as well as the continuous flow of large quantities of floating mud from the rivers. The productivity of seaweed could be lowered by worst light conditions, which in turn increase the rate of damage from overgrazing

by herbivorous fishes because of the influence of high water temperatures. In other words, the environmental conditions of the seaweed beds lost the balance between seaweed production and grazing pressure by herbivorous fish. In order to rehabilitate the barren seaweed beds again, activities that include supplying seeds through the use of ropes implanted with *Ecklonia cava* juveniles and deploying blocks implanted with *Ecklonia cava* on the barren bottom,

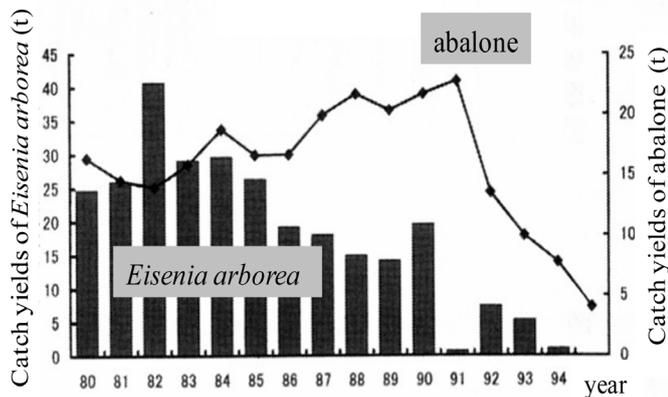


Fig. 5. Relationship between *Eisenia arborea* and abalone production in the Hainan Area (Source: *Isoyake Recovery Guideline*)

have been implemented by the Shizuoka Prefecture, while removing rabbit fish (herbivorous fish) using fixed nets and gill nets had been carried out by the fishers.

Although the shoreline survey conducted in February 2008 revealed that the *Ecklonia cava* beds of about 55 ha along the coast had already recovered, countermeasures have been implemented continuously by the local governments and fishers. It could also be noted that the recovered seaweed grounds serve as a nucleus to supply seaweed seeds to surrounding waters. The expansion of seaweed beds is ongoing little by little, while the rehabilitation of seaweed beds is aimed at adapting to changes in environmental conditions.

## Examples of Support for Conserving/Recovering Seaweed Beds by the Fisheries Agency of Japan

### Knowledge sharing for conserving/recovering seaweed grounds through National Conferences

The Fisheries Agency of Japan has been conducting National Conferences on Isoyake Recovery Measures every year since 2004. The purpose of these conferences is to reinforce all efforts towards effective isoyake recovery measures through the exchange of plans and results of surveys/studies, technical development and practical countermeasures by fishers, among others. The participants in the conference include technical staff/researchers from the local governments and specialists, who work towards the goal of accumulating knowledge from experimental scale to

practical project scale based on basic research and studies.

In addition, along with the conferences, several meetings such as technical exchange workshops and on-site workshops have also taken place. These conference activities are extremely beneficial for sharing the most recent information and challenges for the effective conservation and utilization of seaweed. Even without budgetary support, every year about 200 participants gather at the Fisheries Agency to present their support activities and to exchange information on other relevant activities. In organizing these workshops, it is important to provide the latest and most useful information, and to obtain effectively a common understanding within the time of the conference. Through knowledge sharing, the participants could substantially advance their own projects year by year. It is mainly due to these kinds of knowledge sharing among stakeholders that the technical development of practical methods for isoyake recovery countermeasures was achieved within several years.

### Training in seaweeds monitoring research for technical staff/researchers of local governments

Since 2008, the Fisheries Agency has been conducting the “Seaweed Monitoring Research Training Course” which aims to impart knowledge and skills on the survey techniques of seaweed monitoring, know-how for utilizing survey instruments, investigation methods of herbivores, and analysis of the acquired data. The training course, which also generally aims to enhance the capabilities of the administrative staff/researchers of the local governments, is being conducted at the Tateyama Station of Tokyo University of Marine Science and Technology. It is important for staff/researchers of local governments as well as fishers to know the real situation of the seaweed beds by observing with their own eyes in order to enhance the adequate supporting activities for fishers (Photo 5 and Photo 6).

### Support program for fishers’ contribution to restoration of the coastal marine environment

Since it is necessary to constantly observe the seaweed beds, it is under this framework where the fishers play a crucial role. In particular, it is indispensable that for sustainable isoyake recovery measures, fishers who have detailed knowledge of the circumstances of local seaweed beds should participate in the monitoring and conservation activities. For this purpose, the Fisheries Agency of Japan recently launched “the support program for fishers’ contribution to restoration of the coastal marine environment”, and provided financial and technical support for the environmental/ecosystem conservation activities initiated mainly by the fishers. Such support for environmental/ecosystem conservation activities covers various kinds of activities such as planning (e.g. discussions,



Photo 5. On-the-job training on monitoring survey (Source: Report of Isoyake Countermeasures Promotion Project, 2008)



Photo 6. Lecture on age-identification of sea urchins (Source: Report of Isoyake Countermeasures Promotion Project, 2008)

planning formulation, dissemination, and human awareness activities), monitoring (e.g. investigation of current status and the effects), conservation/recovery activities (e.g. placing mother algae, nursing and planting young algae, removal of herbivores), and other related activities. This program also supports the activities for conservation of other important habitats such as improvement of the productivity of tidal flats, and coral propagation activities for restoration of coral reefs (Photo 7 and Photo 8).

## Discussion

Through effective knowledge sharing, technical development and implementation of practical methods by fishers for *isoyake* recovery, countermeasures could be advanced to some extent during short period of time. These efforts and practices have often been presented in the newspapers and TV programs in Japan. Thus, the *isoyake* recovery measures by fishers have contributed in addressing a social problem which has become a concern to the people in general.

Recently, the influence of human activities and impact of climate change have been serious and irreversible, resulting in the occurrence of barren seaweed beds on a large scale and which fishers have been having difficulty in coping with such condition. Nevertheless, there is still the possibility of rehabilitating barren seaweed beds little by little, by adapting to changes in environmental conditions and using practical countermeasures that can be done mainly by the fishers (Photo 9).



Photo7. Removal and transplantation of sea urchins from barren seaweed beds in Aomori Prefecture (Source: Report of Isoyake Countermeasure Promotion Project, 2008)



Photo 8. Clean-up of rocky sea shores to recover *Sargassum fusiformis* beds in Shizuoka Prefecture (Source: Report of Isoyake Countermeasure Promotion Project, 2008)

In general, monitoring and conservation activities need sufficient human resources and budget. Since the central and local governments cannot provide the needed budgets, self-management of seaweed beds by fishers groups in communities has been effectively pursued in Japan. This has been achieved mainly because the fishers perceive the incentives that they could gain from their efforts such as the right to use the fishery resources as secured by laws



Photo 9. Recovery of barren seaweed beds by supply of spore bag and removal of herbivores in Nagoya districts of Oita Prefecture (Source: *Isoyake Correspondence Articles Vol. 1: Nagoya, 2009*)

and regulations of the government. Furthermore, the fishers group also wishes to keep the seaweed beds intact for future generations.

## Way Forward

This report has mainly focused on the conservation or recovery activities for seaweed beds. However, it should also be considered that many fishers groups and fishery cooperatives have also been making efforts to develop new products and expand the markets for seaweeds in the region. Recently, seaweeds have been brought to the attention of consumers in new food markets such as the salad market, new health markets, and soup stock markets, among others. For the sustainability of utilizing seaweeds in many communities, it may be also useful to support marketing development in addition to the conservation activities.

In Japan, a number of coastal fishers are engaged in seaweed gathering/fishing and aquaculture. Specifically, in a number of fishing communities, seaweed gathering and farming play an important role in sustaining the fishers' income and economies of fishing communities. Based on the experiences of Japan, seaweed industries in Southeast Asia also have the potentials to be developed with adequate initiative and support by the governments in order to sustain the fishing communities.

Environmental/ecosystem conservation activities led by the fishers have just begun in Japan, and several practical and technical problems still remain to be unsolved, including the human and financial resource aspects. However, some hints to solve these problems can be found in the fishers' efforts and attempts to carry out the solutions on-site.

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## About the Authors

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# The Role of Fishers' Group in the Establishment and Management of a Refugia System: Experience of Cambodia

Ing Try, Seiichi Etoh and Jariya Sornkliang

As part of the commitment of the FiA of Cambodia in the UNEP/GEF Project on the establishment of a system of fisheries *refugia* in the South China Sea and the Gulf of Thailand, a *refugia* for blood cockles was established by the local fishers group. The establishment of the blood cockle *refugia* was also made part of the activities of the SEAFDEC-supported project on ICRM-SV. The Blood Cockle Fishers Group of Sihanoukville which was organized under the ICRM-SV project has successfully managed the said blood cockle *refugia*.

The Fisheries Administration (FiA) of Cambodia collaborated with the Southeast Asian Fisheries Development Center (SEAFDEC) for the implementation of the project on Integrated Coastal Resources Management in Sihanoukville, Cambodia (ICRM-SV) starting in 2005, with funding support from the Trust Fund Program of the Government of Japan. Technical assistance to the ICRM-SV project was also provided by the Grassroots Funds of the Embassy of Japan in Phnom Penh and the Japan International Cooperation Agency (JICA) in Cambodia (SEAFDEC, 2010).

The establishment and management of fisheries *refugia* had been carried out as one of the activities of the ICRM-SV in conjunction with the UNEP/GEF project on Reversing Environmental Degradation Trends in the South China Sea and the Gulf of Thailand. While the FiA collaborated with the said UNEP/GEF project since 2006, and since SEAFDEC also participated the UNEP/GEF project's



Members of the BCFG *refugia* Committee

Regional Working Group on Fisheries (RWG-F) for the establishment of a system of fisheries *refugia* focusing on the critical links between fish stock and their habitats, the establishment and management of a fish *refugia* in Sihanoukville, Cambodia was made part of the ICRM-SV project activities (Etoh, 2010). Therefore, the establishment and management of fish *refugia* in Sihanoukville as one of the ICRM-SV activities also complied with the commitment of FiA to the implementation of the UNEP/GEF project on the establishment and management of fish *refugia* along the coast of Cambodia.

## Locating the *refugia* sites

As early as 2006, the FiA started to identify the locations along the coast of Sihanoukville where fish *refugia* could be established. A research group was organized comprising representatives from the Community Fisheries (CF) and village administrations, to carry out an extensive study in identifying the appropriate fish *refugia* sites. After a series of consultations with all stakeholders of the fisheries community, villagers and local authorities, two sites in the ICRM-SV project area were identified: one for sea grass and the other for blood cockles. Blood cockle is one of the major marine commodities in the community but the resource has been facing the risk of stocks degradation because of the destruction of the fisheries habitats from rampant illegal fishing by dredgers and over-exploitation. Recognizing its importance as a critical issue, the CF was tasked to take imminent measures on the blood cockle resources for food security of the fishers in the community.

In the meantime, the issue on sea grass beds was not considered urgent since sea grasses are neither directly utilized for human consumption nor used for any commercial purposes. In fact, the issue could be outside the criteria of fish *refugia* as defined by the RWG-F, viz: "*Fish refugia is spatially and geographically defined marine or coastal areas in which specific management measures are applied to sustain important species (fisheries resources) during critical stages of their life cycle for their sustainable use*" (Pernetta et. al, 2010).

Thus, only the *refugia* for blood cockles had been initiated. Moreover, the selection of the proposed specific site for the *refugia* was conducted by the fishers with sufficient

experience at sea, and using their local knowledge, the *refugia* site was found in an area where there was dense aggregation of blood cockles and where abundant juvenile cockles have been observed.

## Organization of Blood Cockle Fishers Group

As soon as the site and the target species for the *refugia* were determined, the beneficiary group was organized to be directly involved with the establishment and management of the *refugia* on blood cockles. The Blood Cockle Fishers Group (BCFG) was then established under the Community Fisheries of Prey Nup II, a district of Sihanoukville. With its initial 25 members in 2006, the number increased to 208 towards the end of 2009. During the series of consultations, the BCFG initially recommended that the *refugia* should cover only a 20-ha area to take into consideration their practical managerial capacity. However, since a 20-ha could be too small to meet the requirements of a fish *refugia* dimension, a 200-ha area which include the 20-ha blood cockle *refugia*, was declared as a demarcated zone which could be used for the further expansion of the *refugia* (Fig. 1).

## Management of the blood cockle *refugia*

Along with the enforcement of the demarcated zone, a simultaneous effort was made by the BCFG to formulate the fisheries management plan within the concept of community-based fishery resources management which

has been promoted under the ICRM-SV project. Such effort led to the development of the Self-regulatory Measures for Blood Cockles Fishing in conjunction with the establishment of the *refugia*. Among the provisions was the required minimum size of harvestable blood cockles which should be limited to less than 100 pc/kg or over 10 g in weight or over 32x22 mm (LxH) in size. Consistent with the size restriction, the mesh size of the filter sieve to be used for controlling the harvest of blood cockles was also fixed with the dimension of the mesh at 19x19 mm. At the start of the implementation of the said regulatory measures, four units of sieves were distributed to four blood cockles middlemen who were responsible in regulating the size of blood cockles purchased from the fishers.

The introduction of the size regulatory measures was made possible through the collective efforts of the BCFG with assistance from the CF and the fishery officers in the Cantonment of FiA. The CF was mainly responsible for monitoring the compliance of the regulatory measures shown in **Box 1**.

Moreover, in order to conserve the gravid blood cockles during the spawning season, harvesting of mature blood cockles with sizes exceeding 20 g per piece in weight or over 40x28 mm (LxH) in size was prohibited. In order to determine the period of the spawning season, a research on the biological aspects of the blood cockles was also carried out as part of the activities of the ICRM-SV project with the cooperation of the members of the BCFG. Meanwhile, the application of the abovementioned provisions was enforced

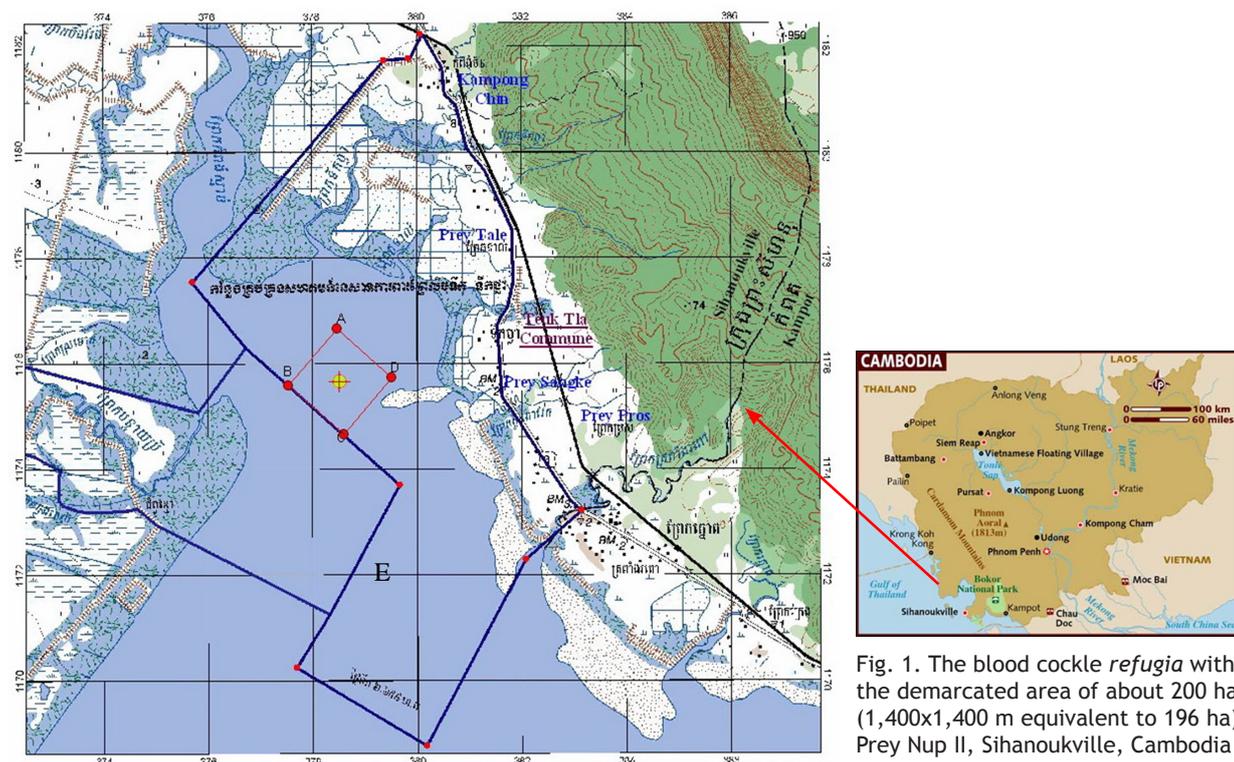


Fig. 1. The blood cockle *refugia* within the demarcated area of about 200 ha (1,400x1,400 m equivalent to 196 ha) in Prey Nup II, Sihanoukville, Cambodia

**Box 1. Self-regulatory measures for blood cockles fishing (Community Fisheries of Prey Nup II)**

**1. Demarcated fishing area (Khos Angkok)**

*Spatial description:*

- (A). Long. 103° 53.328 E, Lat. 10° 38.544 N
- (B). Long. 103° 52.824 E, Lat. 10° 37.968 N
- (C). Long. 103° 53.400 E, Lat. 10° 37.470 N
- (D). Long. 103° 53.904 E, Lat. 10° 38.046 N
- (E). Long. 103° 53.364 E, Lat. 10° 38.007 N

Area of coverage: 1,400 x 1,400 m = 1.96 km<sup>2</sup> = 196 ha or about 200 ha

**2. Fishing rights and entry**

The fishing rights in the demarcated blood-cockle resource management zone are awarded not only to the members of the BCFG, but also to any outsider who strictly abides by the provisions spelled out in the self-regulatory measures.

**3. Fishing methods**

The fishing method permitted in the demarcated zone is limited to manual fishing or only the use of hand collection without using any mechanically-driven cockle collectors like dredgers.

**4. Fishing seasons**

All year round

**5. Limitation of fishing hours**

None

**6. Restriction of harvestable size**

- Juvenile blood cockle, over 100 pc/kg or less than 10g/pc in weight or less than 32 x 22 mm (L x H) in size are not allowed to be collected the whole year
- Broodstock of cockles, less than 50 pc/kg or over 20 g/pc in weight or over 40 x 28 mm (LxH) in size should not be collected during the whole month of August (spawning season)

**7. Tool for size selection**

- Filtering of harvested cockles using a sieve with mesh size 19 x 19 mm (blood cockles sifted through this sieve should not be harvested)
- During the month of August, in addition to the above tool, another sieve with mesh size 26 x 26 mm is used to filter gravid blood cockles (blood cockles not sifted through this sieve should not be harvested)

Source: SEAFDEC (2010)

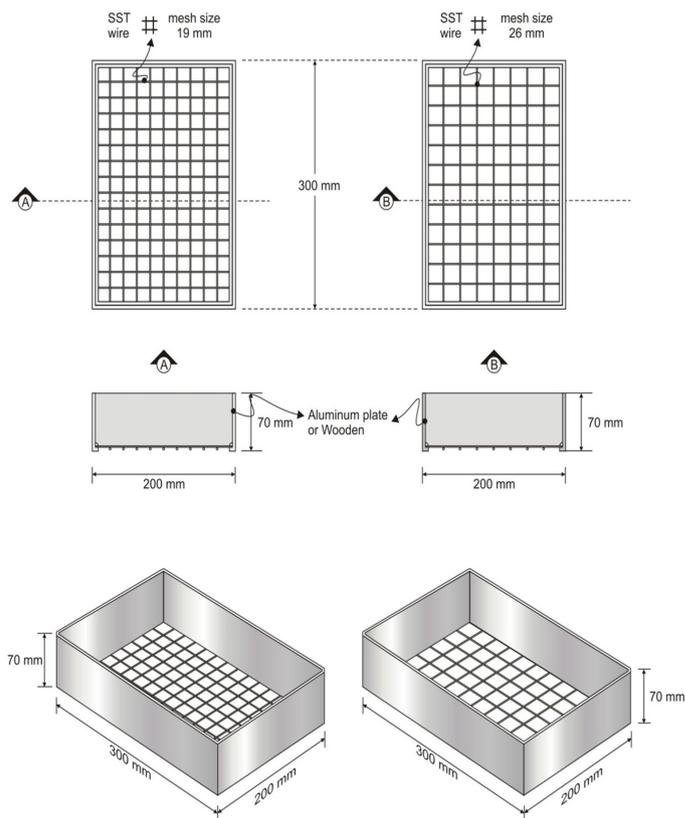


Fig 2: Designs of the two sieves prescribed for sifting the blood cockles

methods. The results indicated that 85% of the samples collected in April 2008 had mature gonads while 15% had developing gonads. In June, 60% of the cockles had already spawned showing spent gonads, 35% were mature and 5% were still developing gonads. In August, 60% of the samples were mature, 35% had spawned and 5% with developing gonads. In November, 95% had developing gonads while 5% were mature. In December, 60% were mature and 40% had developing gonads. Finally, in February 2009, 55% of the blood cockles had mature gonads, 40% had spawned and 5% had developing gonads (Fig. 3 and Fig. 4).



Filtering of blood cockles by members of BCFG using the sieve prescribed in the self-regulatory measures

requiring that all blood cockles harvested should be filtered by the members of the BCFG committee who are responsible for the implementation of the regulatory measures, using the prescribed sieve (Fig. 2), before selling the harvested cockles to the middlemen.

**Biological research on blood cockles**

The *refugia* system established under the ICRM-SV project was specifically meant for the fisheries management and conservation of blood cockles. In order to confirm the self-regulatory measures for blood cockles in the *refugia* area in Prey Nup II, it was deemed necessary to conduct a research to obtain data that would include the gonad development of blood cockles as well as the abundance and distribution of the blood cockles. Thus, the one-year research study on the gonad development of blood cockles was conducted from April 2008 to February 2009 with the blood cockle samples analyzed using the histological and condition index

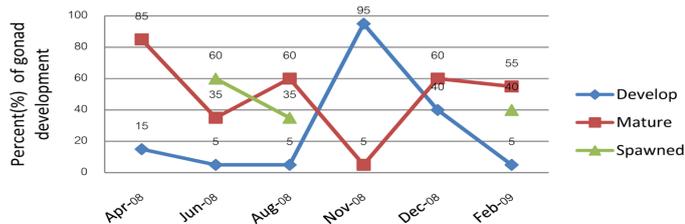
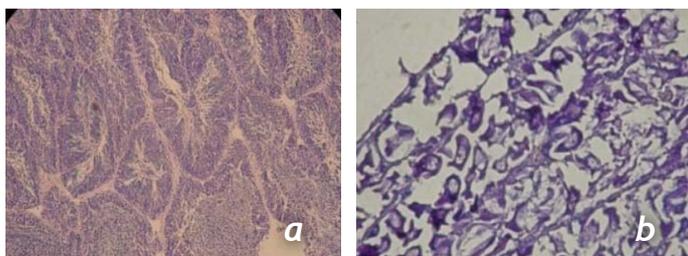
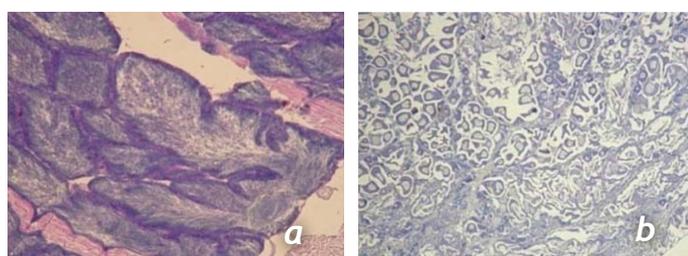


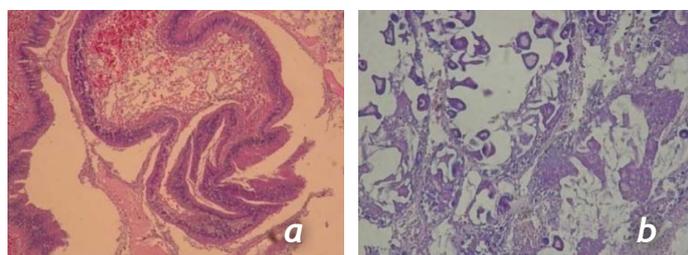
Fig. 3. Gonad development of blood cockles collected in the refugia area



Gonad development in blood cockles: male (a) and female (b)



Mature development in blood cockles gonads: male (a) and female (b)



Spawned stages of gonads in male (a) and female (b) blood cockle

Fig.4. Gonad development of blood cockles (using microscope)

Moreover, an analysis using the condition index was conducted to support the histological method. The rapid declining of the stage of the gonads indicated the spawning period. **Fig. 5** shows the low condition indices which averaged in June, August and February. This concurred with the results of the histological collection, indicating that there could be two spawning periods for blood cockles in one year in Prey Nup II, which are June to August and February. Based on such findings, it was recommended that harvesting of blood cockles could be allowed only during March to May and September to January.

## Abundance and distribution of blood cockles in the refugia area

Sampling of the blood cockles by the BCFG was done every two months for one year. The analysis of the results showed that the biggest size of blood cockles was found in February while the smallest was in August. Furthermore, the data on CPUE obtained in Prey Nup II showed that the trend of the CPUE of blood cockles in the refugia did not show any difference in each month (Sornkliang, 2010). The maximum CPUE was at 0.7 kg/hr/person and the minimum at 0.2 kg/hr/person, indicating that the CPUE of blood cockles in the area is 0.2-0.7 kg/hr/person. Moreover, considering that blood cockles have long spawning periods, therefore it can be harvested during the whole year. However, during the spawning season the restrictions for harvesting blood cockles should be enforced.

## Installation of marking posts and obstacle devices

In conjunction with establishment of the refugia for blood cockles, the next concern of the BCFG was to protect the refugia area from illegal fishing boats especially those using the mechanical cockle dredgers. As means of addressing the concern, marking posts and obstacle objects were installed by the BCFG in the demarcated zone with the main objective of protecting the illegal fishing boats from entering the demarcated zone, bearing in mind that such objects should be eco-friendly and could be used in conserving the fish resources and in enhancing the habitats. Furthermore, considering that the bottom strata of the area have soft mud layer covering, the design of the obstacle objects should consider such conditions. Following such requirements, 30 units were appropriately designed, constructed by SEAFDEC and installed in the refugia area by the FiA in November 2009. Similarly, the BCFG put up marking poles in every 200 m distance around the refugia area in order to define the area and for the effective management of the refugia area.

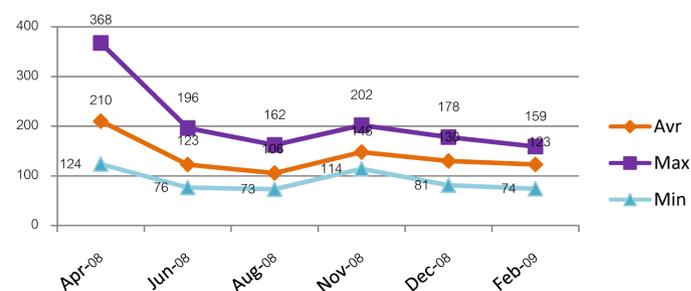


Fig. 5: Condition index of the gonads of blood cockles



Construction (above) and installation of the obstacle objects (below)

## Dissemination of the concept of refugia

After the establishment of the fish *refugia*, the BCFG considered it crucial to disseminate its existence and its function to the neighboring villages where some fishers share in harvesting of the blood cockles in the same area. Since the Self-regulatory Measures indicated that outsiders are allowed to harvest the blood cockles provided that “they abide by all the provisions spelled out in the self-regulatory measures”, the BCFG initiated the dissemination of the information to the neighboring villages.

Disseminating the concept of the *refugia* was made possible through the cooperation of the ICRM-SV project staff, FiA officers and representatives from CF of Prey Nup II especially the members of the BCFG. In each village, the implications of the establishment of a *refugia* and its expected function in line with the self-regulatory measures were thoroughly explained by the BCFG committee members. After learning the concepts of the *refugia*, the fishers from neighboring communities while appreciating the new approach, expressed their willingness to cooperate with the management of the *refugia* especially in complying with the self-regulatory measures. To re-emphasize the *refugia* concepts, the BCFG also put up posters explaining the Self-regulatory Measures on every community house in each village.

## Way Forward

Although the involvement of SEAFDEC in the ICRM-SV Project was completed in December 2009, implementation of the project activities including the management of the *refugia* by the BCFG has been pursued by the CF with the assistance of the FiA. The continued support of the Grassroots Funds of the Embassy of Japan to the project had also been sought by the FiA in order that the project would attain its goals.

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# Boosting the Capacity of Young and Female Researchers for Achieving Sustainable Fisheries in Southeast Asia: Initiative of Hokkaido University, Japan

Junichiro Okamoto, Katsutoshi Arai and Sawitree Chamsai

This article highlights on the initiative of Hokkaido University, Japan in enhancing the role of young and female researchers through the “Fostering Program for Young and Female Researchers in Sustainable Fisheries Sciences in Southeast Asia” under the JENESYS exchange program with funding support from the JSPS, and in collaboration with relevant partners including the Faculty of Fisheries of Kasetsart University (Thailand), Walailuk University (Thailand), the Asian Institute of Technology, and the Southeast Asian Fisheries Development Center.

In an effort to create a “strong solidarity among the Asian countries” through the promotion of mutual understanding among the youths in East Asia, the former Prime Minister of Japan, H.E. Shinzo Abe launched the Japan-East Asia Network of Exchange for Students and Youths (JENESYS) during the Second East Asia Summit in January 2007. The five-year youth exchange program which was started in 2007, received a total budget of 35 billion yen from the Government of Japan. Since then, 6,000 young people from the East Asian countries had been invited to Japan every year to take part in the exchange program.

Under the JENESYS initiative and through the “Exchange Program for East Asian Young Researchers” implemented by Japanese universities and institutions, the 12-month **Fostering Program for Young and Female Researchers in Sustainable Fisheries Sciences in Southeast Asia** was initiated by the Faculty of Fisheries Sciences of Hokkaido University of Japan in 2009 with financial support from the Japan Society for the Promotion of Science (JSPS). The Fostering Program which was completed in September 2010 had forged the collaboration between Hokkaido University with important partners in Thailand such as the Faculty of Fisheries of Kasetsart University, the Asian Institute of Technology (AIT), the School of Agriculture Technology of Walailuk University, and the Southeast Asian Fisheries Development Center (SEAFDEC). With the objective of developing high-caliber human resources and creating a regional science and technology community in the East Asian countries, the activities under this Fostering Program included the participation of 14 young researchers from the aforementioned collaborating institutions in short-term cooperative research, study tours, lectures, relevant symposia, and the like, which were conducted at Hokkaido

University. As an end-of-program activity, the Wrap-up Workshop was held at the Faculty of Fisheries of Kasetsart University in Bangkok, Thailand on 26 August 2010.

## Exchanging Knowledge, Exchanging Culture

Through several activities conducted in Japan and also in Thailand, the Fostering Program envisaged that exchange of information/knowledge and culture among relevant partners would be fashioned. Thus, the program envisaged that the students, professors and staff should exchange opportunities that promote understanding and tolerance between cultures. Ideas, values and experiences of the young and female exchange researchers had been shared through scientific related activities. Through the Fostering Program, the networking opportunities of Hokkaido University has been expanded by providing mentorship throughout the various stages of the research period of the young and female researchers. As further envisaged, a side to side mutual understanding had been established.

Within the scope of the Fostering Program, two main discussion avenues were set in motion in Japan. The first was aimed at learning the experiences accumulated in Southeast Asian academia, governmental and inter-governmental organizations on gender-equal society, which was explored



Fostering Program participant and SEAFDEC Researcher, Dr. Nathinee Sukramongkol presenting a paper during the Seminar on Human Resource Development for Female Researchers and Lessons Learnt from Southeast Asia on 2 July 2010 at Hokkaido University, Japan

during the international seminar on “*Human Resources for Female Researchers and Lessons Learnt from Southeast Asia*”. The second was the international symposium on “*Role of Young and Female Researchers for Achieving Sustainable Fisheries in Asia*”, which underlined the role of young researchers in the context of sustainable fisheries.

## Promoting a Gender-Equal Society

Records have shown that gender imbalance is quite common in most Japanese universities, with the rate of female researchers being much lower in science and technology-related faculties, especially in the fisheries faculties where the number of female instructors and professors has been observed to be very few. At the Faculty of Fisheries Sciences of Hokkaido University, for example, women composed only 2.4% of the academic staff. In contrast, in many universities and institutes in Southeast Asia, there are high percentages of female researchers and professors. Recently however, it has been noted that the number of female undergraduate and graduate students at Hokkaido University is rapidly increasing. The female scientists from Japan and Thailand could therefore serve as role models for encouraging more students to continue their careers in science, especially in fisheries science. “Gender-Equal Society” has been a major concern dealt with under the Fostering Program, focusing on the scenario of research institutions in Thailand. Nevertheless, other institutions in the Southeast Asian region could also learn from the experience of the 12-month Fostering Program.

In Thailand, the report of the National Research Council of Thailand (NRCT, 2010) showed that in 2009, the female researchers comprised 52.08% of the total number of Thai researchers. Majority of them are involved in the field of medical sciences (66.27%), chemical and pharmaceutical sciences (64.01%), and social sciences (58.43%). Moreover, a few female researchers are involved in political science and public administration (38.12%), law (33.03%), and engineering and industry research (17.24%) as shown in **Table 1**. In many instances however, female researchers

are largely accepted as project leaders in view of their professional efficiency and legitimacy.

It has also been noted that the Thai female researchers like in many countries in the region, are being confronted with the problem of balancing between their research work and private life. In the Asian culture where women have to take priority on family concerns has affected in a way, their research endeavors as they are confronted with daily household tasks and childcare responsibilities. Moreover, teaching and administrative loads are also affecting the female researchers in the academia, reducing their time for research activities, as they have to pay more attention to many things at the same time. Female researchers also tend to be less assertive than men due to cultural norms, resulting to certain difficulties in making decisions in terms of prioritizing families over their careers. In addition, female researchers seem to be less mobile than men due to family demands, making it more difficult for them to enjoy both. Nonetheless, still a number of female researchers in Thailand have overcome the major constraints and become very successful in their fields of endeavor.

## Status of female researchers at the Department of Fisheries of Thailand

Through time, Thai women have gradually altered their role particularly in the government sector. With more women now armed with enhanced literacy and the fact that women are already accepted in higher positions, many government agencies and also some private sectors are now attempting to promote gender equity within their organizations. The Department of Fisheries of Thailand in particular, is now administered and managed by female executives, such as the current Director-General and two Vice Director-Generals. In addition, the country’s fisheries institutes and development centers are mostly run by female researchers, which had been justified by the fact that women are adept at managing their homes and thus, could also manage their offices more effectively. Although, most of the executives are women but men still have high proportions at the primary-level positions.

**Table 1. Number of Thai researchers based on gender and fields of expertise**

Fields of expertise	Male		Female	
	Number	%	Number	%
Medical sciences	5,003	33.73	9,831	66.27
Chemical and pharmaceutical sciences	998	35.99	1,775	64.01
Social science	1,819	41.57	2,557	58.43
Political science and public administration	1,016	61.88	626	38.12
Law	511	66.97	252	33.03
Engineering and industry research	3,772	82.76	786	17.24

Source: NRCT (2009)

Therefore, female researchers should beat the men in terms of academic and scientific achievements and qualifications in order to land in high positions and retain such positions. Although women have had more successes in entering and obtaining promotions to the highest ranks of some organizations, but the gender composition remains magnificently skewed towards being male-dominant especially in the primary stages of professional and career development.

### **Role of women researchers in the Southeast Asian Fisheries Development Center of Thailand**

The Southeast Asian Fisheries Development Center (SEAFDEC) is an intergovernmental organization established in December 1967 for the purpose of promoting sustainable fisheries development in the Southeast Asian region. In Thailand, SEAFDEC has two main offices: the Training Department and the Secretariat, where women make up 38% of the total number of researchers. The female researchers are mostly working in the field of coastal fisheries management, marine capture fisheries, socio-economics, policy and program coordination, training, extension, and oceanography.

The major challenge that the women researchers of SEAFDEC faces is in the aspect of balancing between their career and private lives, especially since some of them have to be away from home due to longer period of time at sea during surveys and study cruises or during international meetings. Fortunately, the SEAFDEC women researchers are able to carry out the multiple roles in their careers with strong support from their families. Although at present, men are still dominant in SEAFDEC with only about one-third of the leading positions in management and research occupied by women, the number of female employees in SEAFDEC is growing as there are equal opportunities for both genders in its employment processes. Thus so far, there has always been room for bringing in better productive contributions, and means of personal improvement and career advancement for women in SEAFDEC.

### **“Why Thai female scientists succeed in the career market?”**

The increasing trend of Thai female researchers must have been brought about by a number of reasons, one of which is financial. In a society where every adult member of the family should earn income not only for personal expenses but also to support other members of the family who could not earn income such as the children and old parents, adult women are also forced to work. In fact, it has been noted that most women in big cities like Bangkok and Chiang Mai seem to remain single or maintain independent status

because of the pressures from their work which require their full time and effort.

Thus, the number of Thai women in many organizations/institutions as well as in the career market has been noticeably increasing leading to high competition in some aspects. For example, women had to enhance their capabilities especially that the traditional criteria used to screen and choose applicants for employment include high academic grade point average (GPA), good working experience, skills in English (written and spoken), well-known university attended and graduated from, emotional intelligence (EQ), and communication skills. Therefore, in order to compete with male applicants, females are pursuing further studies and enhancing their capacities to become well-qualified and be employed in the midst of stiff gender competition.

Furthermore, the female character of having high level of responsibility, more flexibility, and high ability to do other things more than routine jobs could also be “plus” factors for female applicants’ increased probability of landing in jobs and fulfilling organizations’ objectives. However, considering that the other role of female scientists as “mothers” could also impede the proper management of their time, many female scientists are now comfortable with being “scientists” only where they can work independently and not necessarily as “mothers” where they have to be contented with working as part of a team. Nevertheless, many single and married females are capable one way or another, of getting advantage from being women in order to become successful scientists.

### **Enhancing the Role of Young and Female Researchers in Achieving Sustainable Fisheries**

Fisheries science plays an important role in conserving the aquatic environments, sustaining the aquatic resources, promoting safe food supply, and developing the local economies. It is for these reasons that education in fisheries science is vitally important to all nations. Considering that the goal of “sustainable fisheries” should be incorporated in all aspects of fisheries science education and research, the role of young and female researchers should be enhanced and their potentials recognized through the promotion of international exchange and academia-industry collaboration. This has been the main concern of the Fostering Program which succeeded in addressing the issue through the conduct of short-term research activities that aimed to stimulate further progress in realizing the concept of sustainable fisheries. Such efforts had been enhanced through education and international collaboration.

## Discussions and Recommendations

### **International collaborative education and research for the development of fisheries and related industries for food security and food safety**

Strategies to enhance international collaboration among academic and research institutes should be developed in order to ensure food security and food safety from the fisheries industries and related activities. Thus, in the seafood channel from “source to plate”, steps must be carefully developed in such a way that many factors are considered, such as sound environment, sustainable production, and responsible food chain/logistical system. Hence, it is necessary to enhance capacity building in all aspects involved in the production process.

Moreover, the end-users such as consumers are now becoming more anxious and concerned about safety of food. Such concern has accelerated the need for best practices in the food industry. The industry therefore has to expand financial liability, address technological challenges, and improve marketing and knowledge networks through trained and efficient manpower. This means that there is greater need for all educational and research institutions to develop comprehensive and collaborative methods in order to produce effective and efficient work force in the fisheries sector considering that the “source to plate” management should be implemented in the most proper way. Moreover, achieving food security and safety by one country could be secured through the effective collaboration among neighboring countries.

### **Sustainability of fisheries science and ecosystem conservation**

The increasing trend of aquatic resources degradation and higher demands for food fish in the world should be properly addressed and thus, appropriate actions should be advanced for the sustainability of fisheries production for food security, taking into consideration the need to strike a balance between resource protection and utilization. Many scientists proposed various ways of maintaining the fishery resources based on their knowledge in science and technology. However, the sustainability of fisheries science and aquatic ecosystem still need to be assessed considering the complexity of the system. A possible solution at the current situation could be by accounting the status and potential limits of the carrying capacity of the ecosystem. Furthermore, it is well recognized that the possible scenario of the carrying capacity corresponds to the changes in the ecosystem and *vice versa*. The fisheries industry should therefore put more emphasis on economic efficiency and food security within the context of the ecosystem. In order

to adapt to such changes, there is a need for a paradigm shift from the traditional fisheries science to ecological fisheries science in order to protect the ecosystems and secure human food resources for enhanced human well-being today and in the future. The Fostering Program therefore promoted adaptive management and precautionary principles that comprise the essential components for sustainable fisheries management based on the ecosystems approach.

### **Fisheries development through collaboration of the academia and fisheries-related organizations**

Each academia and institution usually develop collaboration with interested and target partners. In the case of the Fostering Program of Hokkaido University, the development of more partnerships was explored while the capacity of young professionals to serve other partners and/or promote mutual interests had been enhanced. In the like manner, collaboration in fisheries education and research should aim to establish close collaboration among partners in promoting sustainable fisheries development.

Recently, there have been emerging changes in the educational policies including fisheries education in the ASEAN region. Given the fact that education comprised a major part in the building of the ASEAN Economic Community (AEC) which is envisaged to be achieved by 2015, many challenges lay ahead for the fisheries educational institutions in the region. However, the concern on fewer students opting for fisheries education should be addressed considering the expected free flow of skilled labors under the AEC 2015, while allocations of scholarships and grants for capacity building in fisheries education had been decreasing.

Through several efforts, strong graduate degree training programs should be ensured in the region. From the outcomes of the Fostering Program for instance, suggestions were made on the need to establish “sandwich” graduate



Participants in the August 2010 Fostering Program Wrap-up Seminar at Kasetsart University in Bangkok, Thailand



Dr. Arai explaining the Fostering Program during the Wrap-up Seminar in August 2010

programs<sup>1</sup>, develop regional center of excellence model, intensify distance learning, and conduct English language training programs, among others. Now, the challenge would be on how to make these suggestions become reality and practical. Since these issues concern human capacity building especially in the areas of fisheries sciences where less interest had been observed among the youth, connection, networking and collaboration should be therefore enhanced to address such realities.

Several national/international research and academic institutions have contributed to the development of the fisheries sector, SEAFDEC is one of such institutions. In most cases, activities conducted by such institutions had been enhanced through collaboration with relevant agencies and organizations, particularly in promoting human capacity and conducting research and development activities in various fields to serve the requirements of the fisheries-related industries. For example at the international level, SEAFDEC has enhanced its collaboration with several institutions/organizations in terms of technical as well as financial support and cooperation. Specifically, the collaboration between SEAFDEC and research/academic institutions in Japan, Thailand and other countries in the ASEAN region has been in the areas of human resource development in fisheries, research and development as well as in information generation, sharing and exchange.

1 A “sandwich” graduate program usually involves students initiating graduate programs in their own countries by taking classes and defining their thesis/dissertation problems, then carrying out their thesis/dissertation research in foreign universities, and finally returning to their home countries to finish their studies and present their thesis/dissertations, and receive the corresponding degrees from the foreign universities. This system could be exemplified by the initiatives being promoted by the JSPS.

In addressing the need for sustained enhancement of the capacity of the region’s young researchers, fisheries institutions in the region could make use of the existing programs carried out by other organizations. For example, the Training Department of SEAFDEC bi-annually conducts a training program which caters to the university students of Thailand. The two-week Human Capacity Building for University Students is aimed at developing the skills of the students in responsible fishery practices and methods, and envisaged that the students can apply the experiences gained from the training course in their works in the future. This program could be one of the practical approaches that the region could adopt, considering the existing facilities and modalities. Therefore, cooperation among the institutions should be forged and/or strengthened in order to avail of the partners’ existing programs and thus, save on unnecessary costs.

Considering the possibility of adapting the aforementioned capacity building approach, other institutions in the ASEAN could be tapped to support any collaborative human capacity arrangements, such as for example, the ASEAN Foundation based in Indonesia and the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) in the Philippines. The possibility of obtaining financial and technical support for the human capacity building activities of institutions in Thailand could be explored with such organizations.

It is noteworthy to consider the existing dearth of fisheries-related expertise in Southeast Asia. The initial result of an ongoing survey conducted by SEAFDEC showed that there is the need to put a plug on the continuous decreasing trend of the region’s expertise in the fields of taxonomy, physiology, fishery laws and regulations, cross-cutting issues including climate change, and other areas. Since it would be expensive to start training the necessary replacements, cooperation and collaboration would be necessary to fill the gap. Considering that in the development of national policies, justifications would be futile if these are not backed by scientific findings, therefore it is necessary that the aforementioned inadequate expertise in fisheries science should be immediately addressed, before blame would be put on the academic sector for not providing the required information based on scientific findings.

Since the Fostering Program of Hokkaido University was already completed in September 2010, the collaborating partners under the Program were encouraged to explore the possibility of continuing the exchange program even if this could be considered under some forms of bilateral arrangements. Thus, establishment of a network of educational institutions in the region would be necessary

as this could pave the way for human capacity building in the region. This is all envisaged that in the end, the promotion of sustainable fisheries development in Asia could be enhanced.

## Comments from Some Fellowship Recipients of the Fostering Program

Getting an opportunity for short-term research under the Fostering Program of Hokkaido University, Dr. Natinee Sukramongkol, Fishery Oceanographer of SEAFDEC/TD said that, *“the knowledge and experiences gained from the program are very useful to support the program of SEAFDEC on deep-sea resources exploration and to the training workshop on the impact of fishing to the deep-sea ecosystem on 16-20 October 2010 in Brunei Darussalam”*.



Participants during the Wrap-up Seminar in August 2010

*“I learned how to properly collect data and the ways for students to be good researchers. In addition, I also obtained not only technical knowledge, but also the tradition and language of Japan”*, Dr. Jariya Kankamnerd, Policy and Program Officer of the SEAFDEC Secretariat said. She also mentioned that *“I would now be able to use the outcome of my research study under the Program in my reference studies in the future. Although my research study is not yet finished, I can continue the connection and network among Thai and Japanese researchers to come up with good result”*.

Mr. Pavarot Noranarttragoon, Ph.D. student from AIT said *“I learned a lot from my supervisor, not only technical knowledge but also the tradition, culture, and society of Japan. For the technical knowledge, I learned about marine fisheries, fisheries management, and fisheries researches in Japan. I met many researchers from several countries and discussed about technical researches in their countries as well. After this Program, I can integrate the experience and knowledge I gained to improve and develop the researches for sustainable development of the fisheries sector in Thailand. Moreover, the network and relationship established between Thai and Japanese researchers should be sustained so that if there are updated information and technology available, we can quickly communicate. In the future, I hope to continue sharing my experiences and knowledge and also learn more on the technical aspects in Japan”*.

*“The opportunity to work with Japanese researchers at Hokkaido University have definitely deepened my understanding and expanded my vision related to bioremediation techniques used in aquaculture. The program benefits me as a teacher, since the knowledge I gained from my short-term stay in Japan can improve my teaching skills and I have shared my experiences with my colleagues and students. Besides, this program also promotes the linkage between Thai young researchers into the international research network”*, Dr. Idsariya Wudtisin, Lecturer from Kasetsart University said.

## Conclusion

The activities under the Fostering Program were reviewed and concluded during the Wrap-up Workshop of the Fostering Program held in Thailand, where the approach to *“Promote Sustainable Fisheries Development in Asia through Academia and Fisheries related Organization Collaborations”* were fruitfully discussed. During the Workshop, it has been noted that one of the most important outcomes included the fact that young and female researchers were offered the opportunities to explore the larger scientific

discipline. Moreover, clear signs of being more focused on gender issues were also observed from the outcomes of the Program. Thus, proposed future programs should ensure that women should have the same opportunities to contribute to science as those enjoyed by men. Furthermore, in order to achieve gender equity in research/science, it is necessary to increase women's access to education and empower them with the required knowledge and skills.

It is in this important aspect that the academia can play a major role, as they represent the scientific elite and are thus held in high respect. Any related future program should also explore the options and challenges associated with future management of sustainable fisheries, by seeking lessons from the academia and from related fisheries development organizations such as SEAFDEC.

From the fisheries management point of view, hunting for ways to conserve and utilize fisheries resources has become a must, and there is no simple way to manage fisheries in sustainable manner except through enhanced education, which is clearly the main tool to achieve such vision. In addition, a wider scientific understanding of the ecosystem-based approach will contribute to a better scenario and linkages between each element of a system. Finally, the suggested solutions could include strengthening collaboration among fisheries educational institutions in the region, sharing of resources and expertise, and increasing the regional exposure of students to better prepare them for different cultures and languages, and that any relevant consortium should take up these tasks and work closely with their collaborating partners in order to further promote sustainable fisheries development through enhanced educational processes.

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# General Hygiene Measures in Local Fish Markets and Good Handling Practices in Myanmar

Akito Sato, Kenji Matsumoto, Tadahiro Kawata

Generally in many Southeast Asian countries, local fish markets are located in fishing ports or behind jetties along seashores where marine fish and shellfish are collected from fishers and sold to middlemen for distribution to consumers. Recently, local fish markets have received attention for the need to enhance quality control and traceability system in order that fish products would be acceptable among retailers and consumers. In local fish markets, there are many risks of acquiring and/or increasing bacteria on fish products especially during the various operating procedures, which could cause food poisoning to humans. In order to address such concerns, many local fish markets have now been undertaking various activities aimed at managing quality control and safety of fish products from landing to transport. This report introduces the importance of hygiene measures in local fish markets for marine fish products and provides an example of good handling practices in a local fish market in Myanmar, which could be useful for other local fish markets in the ASEAN-SEAFDEC member countries.

## Importance of General Hygiene Measures in Local Fish Markets

### Role of Local Fish Markets

Marine fishing activities have recently been generally concerned with difficulties in supplying stable daily amount of fish to meet the demands of retailers, which could be due to inclement weather conditions and migration or fluctuation of marine fish stocks, a situation which is different from agricultural activities. In addition, large numbers of local fisheries using small-scale fishing vessels are in operation because of abundant kinds of marine resources and favorable fishing ground environments with semi-tropical or tropical climate in the Southeast Asian region. Under such conditions, local fish markets have been developed in fishing ports or jetties along seashores to distribute the daily landed fish effectively to middlemen, fish processing companies, retailers, and local consumers. Local fish markets play an important role in the supply chain of



Fishing Vessels Mooring at the Annawar Aung Landing Site in Myanmar  
(Photo: Akito Sato)

effective fish distribution from catching in fishing grounds to selling by retailers.

In general, selling fish products either through auction or 'face to face' transactions involves negotiation between the local fish market and middlemen. However, the negotiated prices depend not only on the general consumers' demand but also on the distribution or sale abilities of local fish markets and middlemen. From the negotiated prices of the fish products, the local fish markets usually pay benefits to fishers minus commission fee, so local fish markets are also important for fishers to realize certain favorable income, considering that small-scale fishers in particular, are not familiar with retail or food markets. In addition, local fish markets often play other roles such as fishing, fish processing and retailing by themselves, and providing services and provisions for fishers such as ice, water, fuel and to some extent financial support. Furthermore, since local fish markets have daily landing records from various fishing vessels, they have the potentials for improving the statistics of the region's fisheries and from the administrative viewpoint, for analyzing the daily fish data for research and evaluation of the fishery resources.

### Risks on Hygiene of Local Fish Markets and Importance of Hygiene Measures

Fish is generally safe to eat and offers lower risk in terms of hygiene and from its effects to one's health compared with other foods, in fact, food poisoning from fish is very rare. Even the incidence of food poisoning caused by the tetrodotoxin in globefish or puffer fish could be avoided through appropriate handling measures. Although cases of food poisoning brought about by consuming fish are reported every year in many places, such cases are mostly caused by bacteria such as the *Escherichia coli*, vibrios and salmonella, which could be attached on fish and propagated along the supply chain from catching to landing, processing, distributing, and retailing.

Various handling activities such as landing, selecting, dealing, packing and distributing take place in local fish markets, where fish goes through many risk factors generating additional sources of bacteria. Therefore, the risk of propagating bacteria on fish through human hands, trays, buckets, market floor, waste water, bird droppings, among others in local fish markets could be relatively high. One of key important measures is to prevent attachment and/or the propagation of bacteria on fish during the series of activities in local fish markets. Thus, proper cleaning of equipments and facilities as well as frequent washing of hands are effective ways to avoid risking the hygiene of fish. Furthermore, accountability is already required for food safety nowadays, so that if incidence of food poisoning occurs in the supply chain of fish products,



The normal hygiene measure zone at the Annawar Aung Landing Site in Myanmar (Photo: Akito Sato)



The high hygiene measure zone at the Annawar Aung Landing Site in Myanmar (Photo: Akito Sato)

the concerned local fish markets are held responsible and should be able to explain their accountability. With this in mind, the development of manuals on hygiene measures, including maintaining cleaning records and periodical check records on facilities and equipment would be useful to ensure that hygiene measures are being undertaken by local fish markets.

In an effort to address such concerns, local fish markets in many places have been undertaking the required activities little by little within their limited operation/maintenance budgets, aimed at managing quality control and safety of fish during operations from the landing sites to consumers' table. Since hygiene measures involve not only the activities that deal with operations but also those focusing on the facilities/equipments, operational measures are most fundamental for small budget entities. Specifically, training on proper operations, fish handling and maintenance for persons concerned in local fish markets would be especially important, in which case on-site technical support from extension staff of central/local governments and resource persons are beneficial for improving and promoting quality control and hygiene measures in local fish markets.

## Hygiene Measures for Local Fish Markets

Hygiene measures comprise two aspects: the essential measures for food safety and advanced measures mainly for retailers' needs. The levels of hygiene measures are influenced by the consumer market, to which the local fish markets are directly or indirectly selling fish products. **Box 1** shows examples of hygiene measures in local fish markets, mainly based on the practices of local fish markets in Japan.

## Examples of Good Handling Practices on Local Fish Markets in Myanmar

### Background of Hygiene Measures in Myanmar

Myanmar, with a long coastline of about 2,832 km and wide continental shelf of about 228,751 km<sup>2</sup>, has favorable conditions and abundant marine resources for fisheries. The

#### Box 1. Examples of hygiene measures in local fish markets

- 1) **Operational measures**
  - i) *management of people concerned*  
Clean hands, boots, and clothes, and health check of staff are recommended. Improving knowledge of staff on hygiene measures through on-site training are recommended.
  - ii) *management of water*  
Freshwater supplied by waterworks or from wells in addition to seawater is used for washing trays and floor, preserving fish, etc. In utilizing seawater or well water, sterilizing water is recommended if necessary, depending on water quality.
  - iii) *washing facilities and equipment*  
Freshwater supplied by waterworks or from wells is effective to reduce vibrios which are found in seawater. High-pressure water is effective to reduce bacteria even with small water volume. If possible, disinfecting by hot water is recommended. A most important measure is adequate drying of market floors, trays, etc.
  - iv) *preserve fish temperature*  
Ice or iced water is used to preserve fish temperature. Efficient preservation of fish from landing to transport is recommended.
  - v) *check list and keeping records*  
Keeping of operation records, cleaning records and periodical check records on facilities and equipment in addition to catch documentations are recommended in order to show that hygiene measures have been taken.
- 2) **Facility/equipment measures**
  - i) *fish handling floors*  
It is desirable not to put fish directly on floors of fish handling areas, even if floors are often used for efficient handling. In these cases, some equipment measures are recommended to avoid external risks such as those caused by people, cars, birds, etc.
  - ii) *toilets*  
Water supply equipment is essential to wash hands or long boots. Toilets should be maintained clean to prevent insect invasion.
  - iii) *landing facilities*  
Landing wharfs and preparation/rest wharfs for vessels are best kept separate from local fish markets for good hygiene measures.
  - iv) *Drainage system*  
Small-scale drainage facilities, with simple treatment of wastewater, are recommended especially when wastewater is contaminated or in order that the wastewater is not expected to be diffused with the seawater current.

country's total production from marine capture fisheries was about 1,680,000 metric tons in 2008. Traditionally, the people of Myanmar are used to eating freshwater fish, so that the country's marine fish products are mainly

#### Box 2. Outline of Activities of a Local Fish Market, the Annawar Aung Landing Site

**Operator of local fish market:** Domestic private company  
**Location:** Yangon (along the river)  
**Area of fish market site:** nearly 4 acres  
**License:** 1999-present  
**Landing vessels:** 130 fishing vessels  
(Trawl net: 76, Purse seine Net: 38, Drift net: 4, Surrounding net: 4, Carrier: 8)  
**Main landing species:** Variety of fish and shrimps  
**Handling volume:** About 22 thousand tons per year  
**Staff employed:** 131 male and 164 female  
**Main facilities:** landing facilities (jetty), ice making machines, cold storage, water treatment system, facilities for fuel supply, facilities for freezing, offices, etc.

#### Box 3. Outlook on Hygiene Measures in the Local Fish Market focusing on Annawar Aung Landing Site

- 1) **Catch documentation**  
This fish market as well as other local fish markets submits daily catch documents including vessel name, fishing area, catch by species, catch by weight and other relevant documents to the DOF of Myanmar. Based on the reports provided by local fish markets, DOF submits the Product Movement Document (PMD) to processing plants, while the catch certification documents are sent to importing countries, including the EU countries.
- 2) **Training on hygiene measures**  
Training on fish handling for jetty workers, training on jetty operation for fisheries supervisor, and training on jetty management for fisheries executives have been implemented with the support of DOF of Myanmar. The Manager of the Annawar Aung Landing Site specifically mentioned that such training activities had enabled its staff to carry out the hygiene measures efficiently.
- 3) **Facilities and equipment in auction sites**  
Fish and shrimps are sold mainly to middlemen through auction. During the auction, fish and shrimps are kept in trays or buckets with ice or iced water. Auction sites are divided into two zones: the high hygiene measure zone and the normal hygiene measure zone. The high hygiene measure zone which adopts the EU standards is mainly used for the auction of tiger shrimps. Although both auction sites are open air, the high hygiene measure zone is covered with nets and its entrances have facilities to disinfect boots.
- 4) **Handling of fish and shrimps**  
This local fish market has tried to comply with the emerging requirements of foreign retailer needs, and has realized the high hygiene measure standards effectively through its efficient staff.
- 5) **Cleaning and putting things in order**  
This local fish market is highly aware of cleaning equipment and putting these in order. This is mainly because of the training of its staff on hygiene measures.
- 6) **Water treatment system**  
Facilities for water treatment system are installed in the local fish market to purify wastewater. Water treatment system is important as a criterion for high hygiene measures.

exported to many countries such as China, Thailand, Japan, Malaysia, Saudi Arabia, Hong Kong, Bangladesh, Singapore, the United Arab Emirates, and the United Kingdom. Improvement of local fish markets for marine fisheries had been advanced in Myanmar especially during the last decade to be able to adapt not only to the directives of the Department of Fisheries (DOF) of Myanmar but also to needs of foreign markets. For example, several local fish markets have been adopting hygiene measures to meet the standards of the EU for exporting fish products mainly to the United Kingdom.

### **Example of a Local Fish Market for Marine Fisheries Adapting the Hygiene Standards of EU**

Many local fish markets for marine fish products in Myanmar have adopted the hygiene standards of EU especially on good handling practices. **Box 2** shows the information on one of such local fish markets, the Annawar Aung Landing Site. Moreover, the Outlook on Hygiene Measures in the Local Fish Market focusing on the Annawar Aung Landing Site is shown in **Box 3**.

### **Features of the Local Fish Market on Hygiene Measures**

The Annawar Aung Landing Site is a local market which ensures that adequate hygiene measures are carried out not only in the high hygiene measure zone but also in the normal hygiene measure zone, where almost similar facilities and equipment are used. The same facilities and equipment are also being used in many other local fish markets in ASEAN countries. However, a very significant feature of the high hygiene measures found in this local fish market is mainly in its operations. Such practices including the devices used and persistent efforts offer suggestions for other local fish markets in the region to comply with the hygiene standards of EU within limited operational and maintenance budgetary allocations.

### **Discussion**

Training on operations, fish handling and maintenance for persons concerned in local fish markets are especially important for improving and promoting quality control and hygiene measures in local fish markets. Based on the observations from the abovementioned local fish market in Myanmar, many local fish markets in ASEAN countries have the possibility and the capability of complying with the relatively high hygiene standards required by importing countries, through the devices used and efforts exerted mainly within their operations, even if operation/maintenance budgets are limited.

### **Way Forward**

Considering that many local fish markets in the region remain without adequate hygiene measures especially those for distributing fish products in domestic/local markets, the observations from the abovementioned local market in Myanmar could set as examples. Local fish markets for distributing fish products among the ASEAN countries will also require adequate hygiene measures for food safety. Nevertheless, since hygiene measures are not mainly concerned with the scale and period of use of the facilities, it is crucial that guidelines on adequate hygiene measures should be developed for the local fish markets in the region. This is one way of promoting and supporting the implementation of support hygiene measures for the local fish markets.

### **References**

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# CALENDAR OF EVENTS

Date	Venue	Title	Organizer
<b>2010</b>			
27 Sep-1 Oct	Phuket, Thailand	5 <sup>th</sup> Session of the FAO Sub-Committee on Aquaculture	FAO
27 Sep-6 Oct	Samut Prakan, Thailand	Training Course on Improvement on opinion and Methodology in Integrated Coastal Fisheries Management for Thai Officer	SEAFDEC/TD
29 Sep-19 Oct	Iloilo, Philippines	Training Course on Abalone Hatchery and Grow-out	SEAFDEC/AQD
2 October	Phuket, Thailand	Coordinating Working Party on Fisheries Statistics (CWP) - Intersessional Aquaculture Group Meeting	FAO
5 Oct 2010 - 25 Feb 2011	Samut Prakan, Thailand	Training Course on Fishing Vessel Operation for Tinsulanonda Fisheries College	SEAFDEC/TD
6-22 October	Iloilo, Philippines	Special Training Course on Crab Seed Production and Grow-out	SEAFDEC/AQD
12-14 October	Singapore	Regional Technical Consultation on Traceability Systems for Aquaculture Products in the ASEAN Region	SEAFDEC/MFRD
12-15 October	Samut Prakan, Thailand	Regional Technical Consultation on Sustainable Fisheries Management	SEAFDEC/TD
12-26 October	Iloilo, Philippines	1 <sup>st</sup> Training Course on Seed Production and Nursery of Sandfish ( <i>Holothuria scabra</i> )	SEAFDEC/AQD
16-20 October	Brunei Darussalam	Training Workshop on Research Methodology for Study on Impact of Fishing on Deep-sea Ecosystem	SEAFDEC/TD
18-22 October	Bangkok, Thailand	World Small-scale Fisheries Congress	CDC
18-29 October	Samut Prakan, Thailand	Short-term Training Course on Fishing Technology for University Students	SEAFDEC/TD
1-4 November	Bangkok, Thailand	Regional Technical Consultation on Adaptation to a Changing Environment	SEAFDEC Secretariat
8-17 November	Iloilo, Philippines	Training Course on Community-based Freshwater Aquaculture	SEAFDEC/AQD
9 November	Bali, Indonesia	First Sub-Regional Public Private Sector Dialog on Sustainable Fisheries and Aquaculture	ASEAN
11 November	Bangkok, Thailand	Second Sub-Regional Public Private Sector Dialog on Sustainable Fisheries and Aquaculture	ASEAN
13-26 November	Samut Prakan, Thailand	International Training Course on Coastal Fisheries Management and Extension Methodology	SEAFDEC/TD
17-21 November	Khonkaen, Thailand	Wetland Ecosystem Service Conference	Khonkaen University
22 Nov-4 Dec	Philippines	Special Training Course on Fish Nutrition	SEAFDEC/AQD
30 Nov-2 Dec	Bangkok, Thailand	33 <sup>rd</sup> Meeting of SEAFDEC Program Committee	SEAFDEC
3-4 December	Bangkok, Thailand	13 <sup>th</sup> Meeting of the Fisheries Consultative Group (FCG) of the ASEAN-SEAFDEC Strategic Partnership (ASSP)	ASEAN-SEAFDEC
6-10 December	Rome, Italy	Technical Consultation for Development of International Guidelines on By-catch Management and Reduction of Discards	FAO
7-10 December	Vientiane, Lao PDR	Ecosystem Approach to Inland Fisheries: Data Needs and Implementation Strategies	FAO-USGS-NACA-DLF of Lao PDR
<b>2011</b>			
18-20 January	Bangkok, Thailand	Regional Technical Consultation on International Fisheries Related Issues	SEAFDEC Secretariat
31 Jan-4 Feb	Rome, Italy	29 <sup>th</sup> Session of FAO Committee on Fisheries	FAO
7-9 February	Rome, Italy	3 <sup>rd</sup> Meeting of Regional Fisheries Body Secretariats Network	FAO
17-25 March	Sri Lanka, Colombo	15 <sup>th</sup> Session of Indian Ocean Tuna Commission (IOTC)	IOTC
4-8 April (tentative)	Malacca, Malaysia	43 <sup>rd</sup> Meeting of SEAFDEC Council	SEAFDEC
13-17 June	Bangkok, Thailand	ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 "Fish for the People 2020: Adaptation to a Changing Environment"	ASEAN, SEAFDEC, DOF Thailand

## Southeast Asian Fisheries Development Center (SEAFDEC)

### What is SEAFDEC?

SEAFDEC is an autonomous intergovernmental body established as a regional treaty organization in 1967 to promote sustainable fisheries development in Southeast Asia.

### Mandate

To develop the fisheries potential of the region by rational utilization of the resources for providing food security and safety to the people and alleviating poverty through transfer of new technologies, research and information dissemination activities

### Objectives

- To promote rational and sustainable use of fisheries resources in the region
- To enhance the capability of fisheries sector to address emerging international issues and for greater access to international trade
- To alleviate poverty among the fisheries communities in Southeast Asia
- To enhance the contribution of fisheries to food security and livelihood in the region

### SEAFDEC Program Thrust

- Developing and promoting responsible fisheries for poverty alleviation
- Enhancing capacity and competitiveness to facilitate international and intra-regional trade
- Improving management concepts and approaches for sustainable fisheries
- Providing policy and advisory services for planning and executing management of fisheries
- Addressing international fisheries related issues from a regional perspective



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In the occasion of the Millennium Conference, a drawing contest was organized for the children among ASEAN-SEAFDEC Member Countries, on the theme of "Fish and the Culture". This is the drawing from Brunei Darussalam.