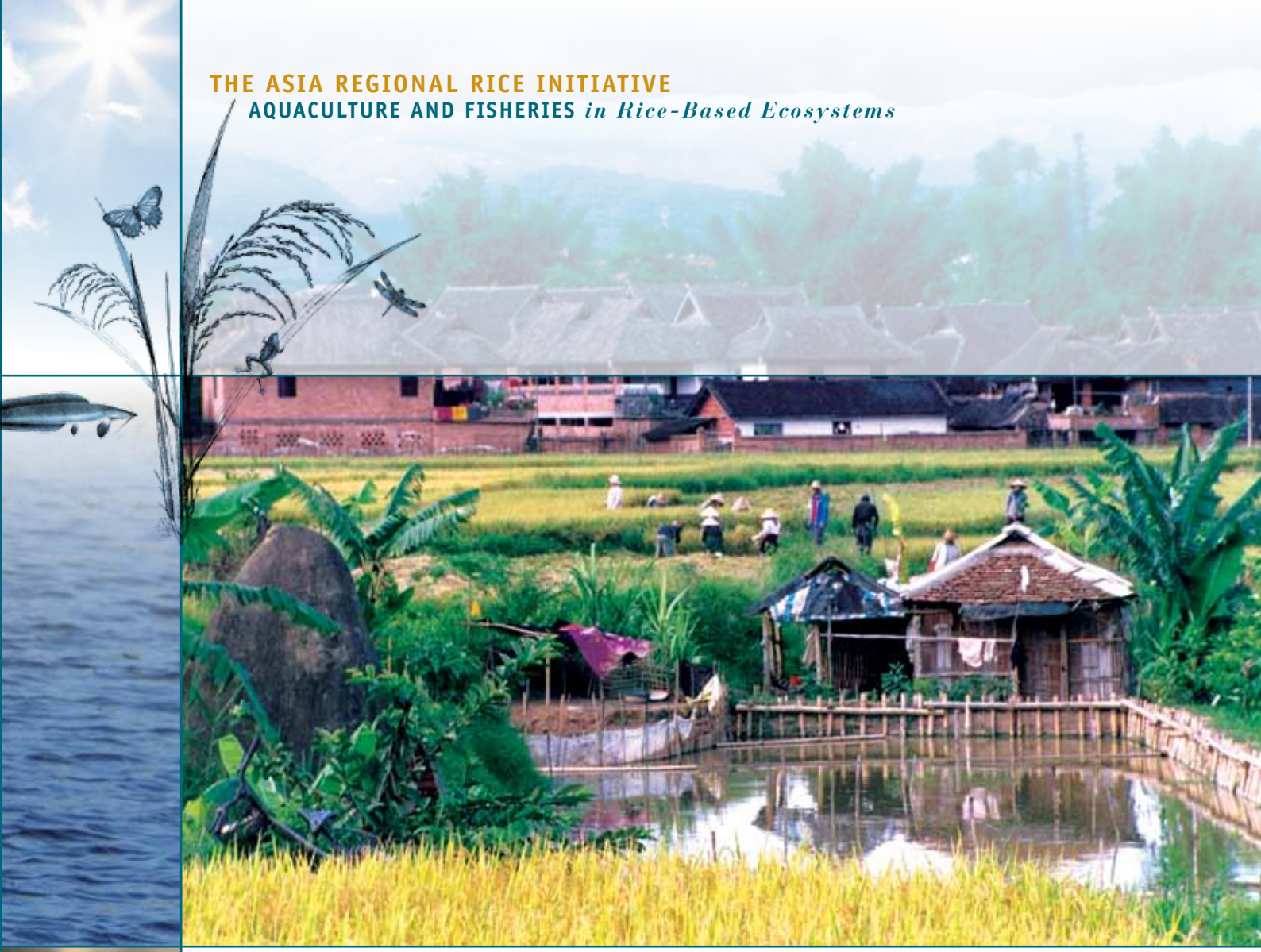
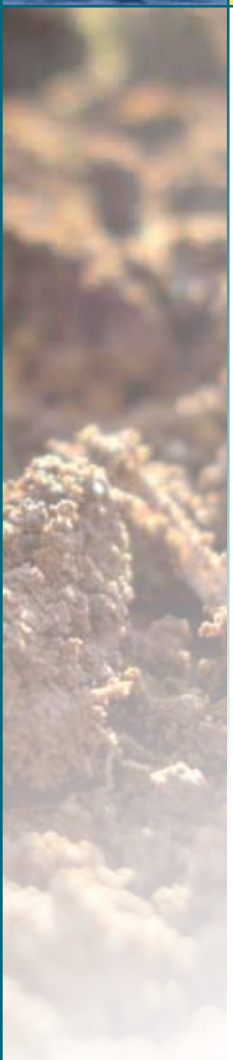
THE ASIA REGIONAL RICE INITIATIVE

AQUACULTURE AND FISHERIES *in Rice-Based Ecosystems*



AQUATIC BIODIVERSITY IN RICE-BASED ECOSYSTEMS

STUDIES AND REPORTS FROM INDONESIA, LAO PDR AND THE PHILIPPINES



AQUATIC BIODIVERSITY IN RICE-BASED ECOSYSTEMS

STUDIES AND REPORTS FROM INDONESIA, LAO PDR AND THE PHILIPPINES

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PREPARATION OF THIS DOCUMENT

This document compiles the findings from selected activities conducted under the Regional Rice Initiative (RRI) Component 1 on water and rice-fish systems in 2013 in Indonesia, Lao PDR, and the Philippines. It includes a summary as well as the individual assessment reports on availability and use of aquatic organisms from rice-based ecosystems and a report on integrating assessment findings into local and national policy development by supporting local government agencies and communities in Lao PDR. The assessments were done by national teams.

The studies were performed in close collaboration with counterparts in relevant ministries and partner organizations in the countries as indicated in the reports, as well as team members in the FAO Regional Office and Country Offices.

The implementation of the studies was guided and supported by an interdisciplinary group of the Regional Rice Initiative Team members including Caterina Batello, Weimin Miao, Naoki Minamiguchi, Jan Willem Ketelaar, Alma Linda Abubakar, Simon Funge-Smith, Barbara Herren, Manuela Allara, Aristeo Portugal, Joy Masongsong, Jean Celeste Paredes, Ageng Herianto, Novah DeLeon, Nick Innes-Taylor, Ole Pedersen, Peter Balzer, M.C. Viray-Newingham, under the overall coordination of Mr Matthias Halwart.

Thanks are due to all the local contributors for the studies, and particularly to the guest editors Messrs. Pedro Bueno and Nick Innes-Taylor, to Ms Danielle Rizcallah for the copy-editing, and Mr Pietro Bartoleschi for the layouting and graphics design.

ABSTRACT

This report contains the assessments of availability and use of aquatic organisms in rice ecosystems conducted in late 2013 in four sites in Indonesia (three in West Java and one in Bali), three sites in Xieng Khouang Province in Lao People's Democratic Republic and four sites in three provinces on Luzon Island in the Philippines. A standard methodology was applied in conducting the assessments. The documentation was made of the animal and plant organisms found in the study sites and being collected by the people, the methods and tools to capture or gather them, and their uses as food, medicine and for other purposes. Local people have generally acknowledged a general decline in the abundance and diversity of the species. Factors included the intensification of rice cultivation accompanied by the use of chemical inputs, increasing exploitation driven by population increase and in some cases a high market demand for some species, and destructive fishing. Recommendations range from expanding the study period to observe biodiversity changes during other seasons of the year, locally tailored management measures using the study sites as pilot areas, national policy that protect the ricefield ecosystem biodiversity and enhance their flow of services, extending the assessment to the value chain of the species which have an increasing market demand, to institutional arrangements and collaboration between national, regional and international agencies and organizations. Awareness raising of the value of the products and services of ricefield ecosystems and capacity building for communities and government agencies for management of the ecosystem were strongly recommended. This was taken one step further in Lao PDR where a small pilot project was undertaken with the Department of Livestock and Fisheries, to develop improved methodologies for integrating work on the valuation of aquatic resources into local policy development processes. This included the development of local capacity and demonstrated that a facilitated process of collaboration between local communities and local government agricultural extension officers, can successfully influence local policy and establish institutional mechanisms to sustain this work at both local and national levels.

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ACKNOWLEDGEMENTS

The excellent collaboration with the national counterparts and the kind support extended by colleagues in the Asia Regional Rice Initiative under FAO's Strategic Objective 2 on the improved provision of goods and services from agriculture, especially Mr H. Konuma, Mr C. Campanhola, Mr I. Soesilo, Mr J. Jia, Ms C. Batello and Mr N. Minamiguchi are gratefully acknowledged.

▲ *Participants of the FAO Regional Training Workshop on Aquatic Biodiversity Assessment in May 2013 were welcomed by Dr Ruben C. Sevilleja, President of the Central Luzon State University.*

▲ *Presided over by Mr Hiroyuki Konuma, FAO Assistant Director-General and Regional Representative for Asia and the Pacific, the Workshop on the Regional Rice Initiative held in Bangkok in November 2013 brought together many key partners.*

SUMMARY

The studies reported in this volume represent the second batch of assessments of aquatic biodiversity in ricefield ecosystems carried out in Asia. The first was done in early 2000 with studies in central Cambodia, southwestern China, northeastern Laos and northwestern Viet Nam [1]. Two more countries, Indonesia and the Philippines, were covered by this second study, which was carried out in late 2013. The Indonesian studies in West Java and Bali were carried out by two different teams and are thus reported separately. The assessment study in Lao PDR was conducted in collaboration with the GEF-funded FAO/UNDP *Mainstreaming Biodiversity in Lao PDR's Agricultural and Land Management Policies, Plans and Programmes* Project in Xiang Khouang, which is home to a number of ethnic minorities.

In Lao PDR, earlier assessment activities had been followed up by a detailed household survey examining aquatic resource collection and consumption [2]. The survey demonstrated that ricefield habitats are very important as a source of fish and other aquatic organisms for rural households, but noted that this was not adequately recognized in agricultural policy. It was considered important therefore to work — as exemplified in Lao PDR — with local communities and local government officers to explore ways to integrate the valuation of aquatic resources into the local processes of agricultural planning and policy formulation.

This project was conducted as an activity under the Regional Rice Initiative, a pilot project of the Strategic Objective 2 of FAO, designed to focus on the importance of the services provided by rice ecosystems, and to identify and implement sustainable rice production practices to enhance resilience and increase efficiencies in rice production to improve food security.

Each study was conducted by a national team using standard approaches, assessment methodology and documentation tools that were agreed during the FAO Regional Training Workshop on Assessment of Aquatic Biodiversity in Rice-based Ecosystems held at the Central Luzon State University in Munoz, Nueva Ecija, the Philippines in May 2013 which formed an integral part of the overall assessment process. The process included site reconnaissance to identify and describe a study area and specific sites, participatory rural appraisals that included familiarization of the farmers, local leaders, government authorities and extension operatives with the study objectives

1 Halwart, M. and Bartley, D. eds. 2005. Aquatic biodiversity in rice-based ecosystems. Studies and reports from Cambodia, China, Lao People's Democratic Republic and Viet Nam. (CD ROM). Rome. FAO. Also available at ftp://ftp.fao.org/fi/CDrom/AqBiodCD20Jul2005/default.htm

2 See MAF and FAO 2007. Aquatic biodiversity and human nutrition – the contribution of rice-based ecosystems. Ministry of Agriculture and Forestry, Lao PDR and Food and Agriculture Organization of the United Nations, Rome, Italy and Garaway. C.J., Photitay, C., Roger, K., Khamsivilay, L. and M. Halwart. 2013. Biodiversity and nutrition in rice-based ecosystems; the case of Lao PDR. Human Ecology 41: 547–562.

and methodology, interviews of key informants, interviews of farmers and gatherers on-site, direct field observation including participation in the actual gathering or capture of the organisms, photographic documentation of caught or collected organisms (by the gatherers and in some instances by the members of the study team), identification of the species by an expert, matching the local name of each species with the scientific name, and validation of the team's findings with the local people. The methods and tools to catch or collect the organisms were also documented. The uses of the organisms and how they are prepared were part of the documentation.

Laos reported the most number of species (56 animals and 39 plants) and the widest diversity of species being gathered for food and medicine. The least number and least diverse are the Philippine sites with some 28 species of aquatic animals and reptiles and 4 species of edible plants. The study of the site in West Java found 52 animal species gathered for food and medicine and 9 species of mostly edible plants. The Bali study reported 34 species of animals that are mostly used for food, some as food and medicine, and some for fashioning into souvenir items, and 24 species of plants for food, medicine and feed to livestock and poultry. Some species are used as bait and the golden apple snail is used in a soup dish as well as collected in Indonesia and processed into feed for ducks and pigs. The armoured catfish is mostly seen as a nuisance species especially by gatherers using passive gears in the Philippines but is also used as food when other species are unavailable. Traditional food preparations were varied and mostly simple and made use of other locally available ingredients. Some species but especially insects are considered a delicacy, as in Laos.

Among the species, especially of fish, crustaceans and mollusks, are introduced species that have become an important food item such as tilapia and carps, the giant freshwater prawn, and a species of loach – now highly endangered – introduced by the Japanese in the early 1900s to the highlands of Northern Luzon, Philippines. Others became invasive, notably the giant apple snail (in all the sites) and the armoured catfish, also known as janitor fish, in the Philippine sites. The snail was deliberately introduced for food and the latter is an aquarium fish that escaped or was inadvertently released into the wild.

Farms in the study sites are small, many farmers are lessees and depend largely or wholly on rice farming for livelihood. Some farms engage the landless for seasonal farm work. The farm workers and landless benefit most from the products of the ricefield ecosystems. The organisms that were documented as available and used for food, medicine and other purposes consisted of species of fish, crustaceans, mollusks, amphibians, reptiles, insects, annelids, and plants. In general, the highest diversity was documented by the Laos study team. The most number of species used as food was also reported by them. A number of species particularly reptiles as well as some plants are medicinal. Insects have a good market demand in Laos and frogs of the Rana species in Bali.

An important historical information is the trend in the abundance of the species, which was elicited through recall. The local people were requested to think to 25 years back (in the West Java study, the team asked for 10 years) and describe the status of the biodiversity in general

and some particular species or taxa. The people were unanimous in acknowledging a general and steep decline in the abundance and diversity of most of the species. Fish species that have flourished are the indigenous species that have no economic value, the introduced species such as tilapia and carps that have become important food fish, and the invasive species especially the armoured catfish and the giant apple snail.

While the use of chemical inputs associated with intensified rice cultivation is generally associated with the decline there are other factors that have combined to exert intense pressure on the aquatic and terrestrial resources in the ricefield ecosystem. These include destructive fishing, introduced species that became invasive, over-exploitation driven by population increase and for some species a good market price. Circumscribing all these is the general lack of appreciation of the value of the ecosystem. In this regard, the assessment in Laos PDR was extended to obtain information that measured the monetary value to a household (six families comprised this part of the study) of consuming the species usually gathered from the ricefield ecosystems.

It is important that such findings are integrated into local and national policies; the work done in Savannakhet province developed and tested methods for bridging this policy gap. FAO's support and technical assistance to the Lao Department of Livestock and Fisheries to develop an increased level of local ownership of valuation research activities (at both community and local government levels) enabled a locally driven process of enquiry and discussion on the importance and valuation of aquatic resources. Establishing an increased level of local ownership resulted in new and innovative approaches being developed that could influence local agricultural planning and policy formulation.

AVAILABILITY AND USES OF AQUATIC BIODIVERSITY IN A RICEFIELD ECOSYSTEM IN SUBANG DISTRICT, WEST JAVA PROVINCE, INDONESIA

Imron Nawawi, Bambang Gunadi, Harry Krettiawan, and Bambang Iswanto

INTRODUCTION

Aquatic biodiversity in rice-based ecosystems have long been an important source of human food. Besides rice, they provide a cheap and readily available source of animal protein, mineral and fatty acid. These ecosystem services could have been sustainable with the traditional farming systems. But population growth which increased demand for the staple crop, rice, drove intensification of rice cultivation, which was marked by higher cropping intensity, monoculture, and – even with the respite provided by a successful integrated pest management (IPM) programme – increased application of chemical inputs. The impact was predictable: the abundance of aquatic organisms has been declining. This study explores the status of aquatic biodiversity in ricefield ecosystems in the district of Subang, West Java Province, Indonesia.

The District of Subang is one of the 26 districts of West Java Province. It is located between longitudes 107° 31'-1070 54' and latitude 6° 1'-6"49'. It occupies an area of 2.051 km^2 and in 2012 had a population of more than 1.5 million. Subang comprises 30 sub districts and 245 villages (desa or kelurahan). It has three zones based on topography: mountainous highland in the southern part, hilly areas in the central part, and lowlands in the northern part. Agriculture comprises most of the economic activities in all three zones. The southern part is dominated by plantations (mostly tea and pineapple) and is a tourism destination. The central part is dominated by plantations of rubber, sugarcane, and fruit trees while the lowland north has been a center for rice production area (Anonymous, 2014a). The rice production system is supported by an efficient surface water irrigation. Owing to these topographic characteristics, along with several other districts in West Java such as Indramayu and Karawang, Subang is one of the rice production centers in Indonesia.

The activity of collecting and using aquatic organisms derived from ricefield ecosystem has long been practiced by rural people. The activity, however, has not been captured in official statistics of local government possibly because of the small amount of yield per unit effort, the non-rice products are mainly used for subsistence, seasonality of the effort, and most importantly the lack of appreciation of what a ricefield ecosystem can provide to support the basic needs of rural people. This study was designed to obtain information on the availability and uses of aquatic biodiversity from a ricefield ecosystem. It was focused on aquatic organisms that generally support rural people's livelihoods by being gathered for food, medicine, ornament and other uses. The baseline data collected from this study is expected to be useful for policy makers to make more informed decision with regard to sustainable uses of environmental services, including from ricefield ecosystems.

METHODOLOGY

The study was carried out for four months starting from the middle of August to December 2013. This period covered all the phases of one rice cropping season. The series of activities included a preliminary Participatory Rural Appraisal (from now on called Pre PRA), Participatory Rural Appraisal (PRA), data collection, data verification and analysis and reporting.

Preliminary PRA

The preliminary PRA was aimed to (1) identify specific sites where the study will be conducted; (2) identify suitable persons to be invited to the PRA; and (3) prepare tools for the PRA. For the purpose of this study, the study sites needed to meet these criteria:

1. the presence of paddy field and aquatic organisms which people actually gather for economic purposes;
2. cropping season: availability of aquatic organisms is related with cropping season. Within the selected sites, rice farming activity takes place from September to December; and
3. accessibility, because of the need for regular visits for data collection.

Field surveys were conducted to locate specific areas that meet these criteria. Once suitable sites had been identified, the local farmer leader and administrative authority were contacted to identify prospective persons to be invited. From the farmer leader and local administrative authority, we obtained information on geographic and demographic condition of the village of interest. A list of 70 respondents representing three selected sites to be invited for the PRA was obtained. It consisted of 25, 25 and 20 persons representing Ciasem Girang, Pabuaran and Gempolsari, respectively. As a PRA tool, we made a poster of aquatic organisms containing the images of five groups of taxa – fish, mollusk, amphibian, reptile, and aquatic plants – that are likely to be found in a ricefield environment.

Participatory Rural Appraisal (PRA)

The PRA was carried out to obtain preliminary information and get some insight on present knowledge about the aquatic organisms in rice-based ecosystem, including the way they are collected, specific sites in the paddy field ecosystem where they are commonly found, and in the way they are used by the people. The PRA activity was conducted by holding a gathering attended by the local leader, administrative authority, and participants who had been identified previously. This preliminary information was verified further during data collection.

Data collection

Based on the information obtained from PRA, team members regularly visited study sites and documented activities, organisms collected, and explored further information with the collectors.

Taxonomy-related work, particularly verification of scientific name of aquatic organisms was based on several sources. These include the manual on taxonomy and fish identification (Saanin, 1968), online resources such as fishbase (Froese and Pauly, 2014), reptile database (Uetz and Hosek, 2014) amphibia web (Anonymous, 2014b), Wikipedia, etc., and direct consultation with an ichthyologist.

Data verification

A meeting with the respondents was organized to verify the accuracy of the data that had been compiled. This was carried out prior to the end of the study.

RESULTS

The results presented here are divided into two parts. The first describes the study sites which include both aspects of geography and demography. This information was obtained from farmer leader and villagers. It was explored and verified during pre-PRA and PRA[3]. The second part of the results describes the aquatic organisms and their utilization.

SITE DESCRIPTION

A. Geographic and demographic features

Based on the criteria described in the methodology, three sites were selected: (a) Ciasem Girang village, Sub district of Ciasem (latitude 6° 19′ 51.32″ S; longitude 107° 40′ 19.65″E), (b) Pabuaran village, sub district of Pabuaran (latitude 6° 23′ 59.03″ S; longitude 107° 36′ 6.67″E) and (c) Gempolsari village, sub district of Patokbeusi (latitude 6° 22′ 33.31″ S; longitude 107° 37′ 32.55″E).[4] The three locations cover an area of 3 248 hectares, 62 percent of which are rice fields. In addition several fish ponds had been built on lands adjacent to the rice fields. This was particularly the case for the study sites in Pabuaran and Gempolsari.

3 Photos and posters documenting pre-PRA and PRA activities as well as all maps, both those generated by Google and sketches provided by local authority, will be made available in an updated version of Halwart, M. and Bartley, D. eds. 2005. *Aquatic biodiversity in rice-based ecosystems* available online at ftp://ftp.fao.org/fi/CDrom/AqBiodCD20Jul2005/default.htm

4 See footnote 1.

TABLE 1. DESCRIPTION OF THE AREA AND SEVERAL DEMOGRAPHIC FEATURES OF SELECTED STUDY SITES

FEATURES	CIASEM GIRANG	GEMPOLSARI	PABUARAN
AREA			
Paddy field (hectare)	760	380	869
Residential (hectare)	98	106.7	246
Total village (hectare)	1 465	507.4	1 276
INHABITANT			
Men	6 459	4 492	5 813
Women	6 849	4 628	6 005
Total	13 308	9 120	11 818
Household	4 708	2 835	3 314
Farmer	373	746	2 456
Landless farmer (worker)	762	613	642

Source: Anonymous, 2009a; Anonymous, 2009b; Anonymous, 2009c

B. Rice production system and utilization of aquatic biodiversity

Supported by an efficient irrigation system, three rice crops are planted in a year in the study sites. The cropping calendar is presented in Table 2. Intensive rice farming has been applied in the sites. Mechanized cultivation with a hand tractor and the use of chemical fertilizers and various insecticides and herbicides have been a common practice.

Gathering of aquatic organisms in paddy field ecosystem, has also been a traditional practice. (The term "paddy field ecosystem" adopted in this study covers the paddy field and the surrounding structure connected directly to the paddy field such as inlet and outlet irrigation canals). Collection of aquatic life is commonly carried out by farm workers and landless farmers. Some of these groups depend much for their livelihood on this ecosystem service. This is possible because access to aquatic biodiversity in paddy field environment is open. Anyone in the community can go and collect the organisms.

TABLE 2. RICE CROPPING SEASON IN 2013

MONTH	1	2	3	4	5	6	7	8	9	10	11	12
CROPPING SEASON	-	Cropping season-1				Cropping season-2				Cropping season-3		
CROPPING ACTIVITIES	Harvesting and post harvesting	Land preparation and Seeding	Planting and Growing	Harvesting and post harvesting	Harvesting and post harvesting	Land preparation and Seeding	Planting and Growing	Harvesting and post harvesting		Land preparation and Seeding	Planting and Growing	
SEASON	Rainy season					Dry season				Rainy season		

C. Availability and uses of aquatic biodiversity

The information on the availability and use of aquatic organisms in the site are summarized as follows[5]:

a. Species

Eight groups of animal and plant species collected during the study included fish (32 species), crustacea (3 species), mollusk (5 species), amphibian (2 species), reptile (3 species), insect (5 species), worms (2 species) and plant (9 species).

b. Availability and cropping season

Supported by continuous water supply from an efficient irrigation system, the farmers in Sukamandi area grow three crops a year. We correlated the availability of aquatic organisms in this area with specific stages of farming practices, namely, land preparation and seeding, planting and rearing, and harvesting and post harvesting stages. The data presented here indicate the availability of aquatic organisms during each of these stages.

In general, aquatic organisms in paddy field ecosystem are less abundant today than they were 25 years ago. The study found that the decline covered 84 percent of the organisms. But some increase occurred in several taxa including five fish species, one species of mollusk, one species of reptiles, and two species of aquatic plants. The fish *Hypostomus plecostomus,* showed the most significant increase, likely because of its lack of economic value and ability to adapt to polluted and eutrophic water bodies. The increase in the availability of the fish species *Cyprinus carpio, Pangasianodon hypophthalmus, Clarias gariepinus and Oxyeleotris marmorata* was associated with aquaculture activity around the study sites, in other words, it was the result of fish escapes. A similar explanation holds for *Pomacea canaliculata* and *Amyda cartilaginea*. For aquatic plants, the increasing abundance of gunda, *Spenochlea zeylanica* and genjer, *Limnocharis flava,* seemed to be associated with their reproductive capacity being faster than the rate of their exploitation.

Availability of aquatic organisms in ricefield ecosystems seemed to be associated with the group of organisms, farming stage and habitat. Within fish group, except for lundu, *Mystus gulio,* and keting *M. nigriceps,* abundance through the entire cropping season was stable. The abundance of *M. gulio* and *M. nigriceps* was affected by water supply; they were found more abundant when water supply in ricefield environment was high. With respect to habitat, most fish groups inhabit secondary or tertiary canals whose water supply was relatively stable. Around

5 The details have been entered into excel worksheets designed for the assessment and will be published separately as an update of Halwart, M. and Bartley, D. (eds.) 2005. *Aquatic biodiversity in rice-based ecosystems* available online at ftp://ftp.fao.org/fi/CDrom/AqBiodCD20Jul2005/default.htm

30 percent of the species within fish group also inhabit paddy area, such as the belut *Monopterus albus,* betrik *Anabas testudineus*, gabus *Channa striata*, sepat *Trichopodus trichopterus and* some small sized fishes (less than 5 cm in length). This pattern seemed to be associated with the extent of the habitat that they occupy. They were found in paddy area and in secondary and tertiary irrigation canals.

During the course of the study, several species were found to be more abundant than others. These included betrik (*Anabas testudineus*), sepat rawa (*Trichopodus trichopterus*), sapu-sapu (*Hypostomus plecostomus), Onyong-onyong (Dermogenys pusillus) and* gendot (*Gambusia affinis*). These species were throughout the farming season.

For aquatic plants the highest abundance occurred during planting and rearing stage. They were growing mostly in paddy area except kangkung (*Ipomoea aquatica*) which grows mostly in irrigation canals. For insects the highest availability was during land preparation, except simeut, *Oxya chinensis,* which occurs most during the harvest and post-harvest periods. All insect group were found only in paddy area. No particular trend was observed for other groups. They were found throughout most of the cropping season and in every habitat.

c. Uses

Landless people and farm workers benefit most from the aquatic biodiversity of the ricefield environment. Many landless people make a living on gathering aquatic organisms for household consumption and sale. This activity allows the use of aquatic organisms beyond the ricefield environment. Farm workers normally collect aquatic organisms for household consumption. Collection is extra activity while conducting their primary paid work.

In general, there are five uses of aquatic organisms derived from a ricefield ecosystem: food, medicine, aesthetic or decorative purposes, poultry and livestock feed, and fish bait. Fifteen ways of using the animals and plants were recorded; ten are related to human consumption i.e. grilled, satai, fried, tumis, rebus, sayur kuah, pepes, dried, keripik and fresh eaten. Two are related to aesthetic purposes, namely, souvenir items and ornamental.

All taxa of fish, crustacea, mollusk, amphibian, reptile and insect can be used as food. The same holds for aquatic plants except grasses and lumut or filamentous algae. The last two taxa of aquatic plant are normally used for livestock feed and fish bait, respectively. In addition to filamentous algae, worms (annelids) are exclusively used as bait.

As to fishes, the most common ways of preparation as food are fried and pepes. Frying is mainly associated with practicality in its processing, while pepes is associated with local preference. Gabus is the only taxa of fish used as medicine, for healing wounds and as a remedy for diabetes.

Mollusks have long been a traditional food for rural people. One taxa, *tutut* (*Bellamya javanica*) is becoming a popular food for the people in urban areas. All taxa of mollusk are also used for their medicinal attributes, specifically for liver ailments.

Almost all aquatic organisms found in ricefield ecosystems have economic value; they can be sold. Roughly 90 percent of the taxa found during study are gathered also for sale. Boboso was priced highest in the market at Indonesian Rupees (IDR) 100 000/kg, followed by belut at IDR 45 000/kg. Despite a lower price belut has better economic potential as it was much more abundant than boboso. The price per kg of the other taxa were on average IDR 10 000-30 000 for fish, IDR 10 000–40 000 for crustacea, IDR 2 0005 000 for mollusks, IDR 25 000 for amphibians, IDR 8 000–40 000 for reptiles, IDR 2 000–5 000 for plants, IDR 40 000 for insects, and IDR 2 000–3 000 for annelids[6].

d. Tools

Eleven types of fishing tools were documented. Among these, the electric probe, anco and scoopnet were widely used because a user is able catch a variety of species with little effort. An electric probe for example is used to catch all fish and crustacea, while anco and scoopnet are used to catch 32 out of 34 taxa of groups. In contrast, there are particular tools for specific targets. Among these are the posong and urek. The former is exclusively used to catch belut *Monopterus albus* while the latter is for catching belut (*Monopterus albus*) and oled (*Ophisternon bengalense*). No specific tool was used to catch mollusks, amphibian, reptile, aquatic plants and annelids. Those groups were simply fished by hand.

In ricefield ecosystem, all tools can be used in all habitats except anco and posong. Anco is used only in secondary irrigation canals and posong in paddy fields.

With regard to the user of tool, the following trends were documented. The father can use all (11) tools, while 6 and 4 tools were used by the children and mother, respectively. Several tools were observed to be exclusively used by the father, i.e. cast net, electric probe, trap, and susug, while several other tools such as scoop and hook and line were used by every user.

CONCLUSION

A total of 61 taxa of aquatic organisms consisting of fish (32) crustacea (3) mollusk (5), amphibian (2), reptile (3), plants (9), insect (5) and annelids (2) were documented. The abundance of most of these organisms have declined over the past 25 years.

The landless people and farm workers benefit most from aquatic biodiversity provided by ricefield environment. Most of the aquatic organisms found were used as food.

Despite the variety of tools documented, the electric probe seemed to be the most common and widely used tool for collection.

6 The exchange rate was IDR 12 000 per USD 1 (December 2013).

REFERENCES

Anonymous. 2009a. Rencana Pembangunan Jangka Menengah Desa 2009–2014 Desa Gempolsari. Desa Gempolsari, Kecamatan Patokbeusi, Kabupaten Subang, Provinsi Jawa Barat.

Anonymous. 2009b. Rencana Pembangunan Jangka Menengah Desa 2009–2014 Desa Ciasem Girang. Desa Ciasem Girang, Kecamatan Ciasem, Kabupaten Subang, Provinsi Jawa Barat

Anonymous. 2009c. Rencana Pembangunan Jangka Menengah Desa 2009–2014 Desa Pabuaran. Desa Pabuaran, Kecamatan Pabuaran, Kabupaten Subang, Provinsi Jawa Barat.

Anonymous. 2014a. Informasi berkala – Profil kabupaten (letak geografis, iklim, topografi dan demografi) [Online]. Available by www.subang.go.id/p_kab.php Retrieved on 10/01/2014.

Anonymous. 2014b. AmphibiaWeb: information on amphibian biology and conservation (web application) [Online]. Available by www.amphibiaweb.org Accessed on 10/01/2014.

Froese, R. and Pauly, D. 2014. Fish Base [Online]. Available on: www.fishbase.org (accessed on 01/2014).

Saanin, H. 1968. Taxonomi dan kunci identifikasi ikan. Binatjipta, Bogor. pp. 256.

Uetz, P. and Hosek, J. 2014. Reptile Database [Online]. Available by www.reptile-database.org accessed on 01/08/2014.

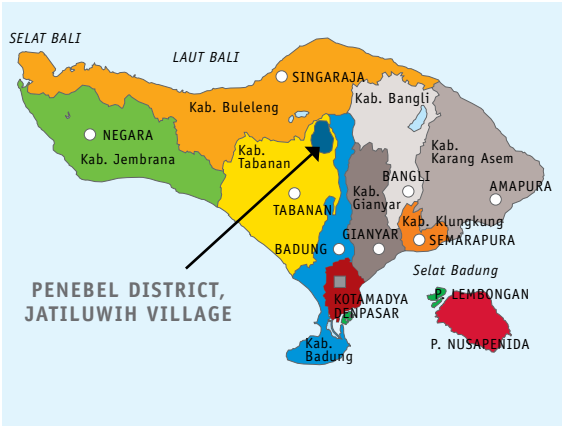
AQUATIC BIODIVERSITY IN RICE-BASED ECOSYSTEM OF TABANAN DISTRICT, BALI PROVINCE, INDONESIA

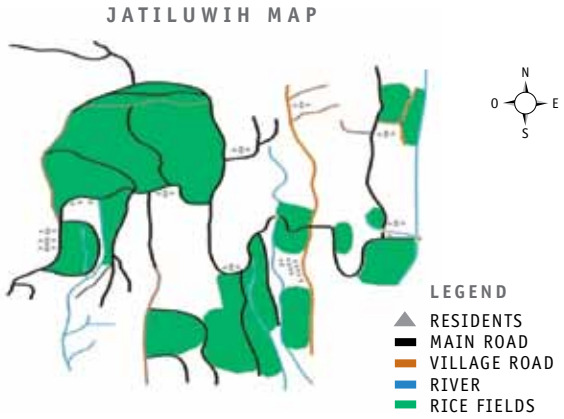
Ketut Sugama, Made Subagya, Nyoman Puniayasa, Wayan Ardita and Dwi Prsetyo

INTRODUCTION

Tabanan district, one of 8 districts of the Province of Bali, is predominantly agricultural. It has an area of 899.33 km$^{2.}$ Administratively Tabanan is divided into 8 sub districts (Baturiti, Penebel, Pupuan, Marga, Selemandeg, Kerambitan and Tabanan City) and 103 villages. One of these is Jatiluwih, the study site.

FIGURE 1. THE JATILUWIH VILLAGE LANDSCAPE





SITE DESCRIPTION

Jatiluwih village is within the Penebel sub district, which lies in the northern part of Tabanan District. Its paddy fields are terraced. The fields are irrigated by means of the *"Subak"* system, a thousand-year old ecologically sustainable system that binds Balinese agrarian society within the village's Bale Banjar (the building where the village community meets) community center and Balinese temple. Management of the system is under the authority of the priests in the water temple, guided by "Tri Hita Kirana" (the Balinese Hindu philosophy of harmonization of the relationships of humans and God, humans and humans and humans and the environment into an integral unit). The *Subak* system is found only on Bali Island.

Jatiluwih is also a tourist destination, with the imposing Mount Batukaru and Mount Agung providing the backdrop to the village and its rice terraces.

The rice varieties planted in the village are the tall traditional ones (most other areas plant the high yielding modern varieties). Many Jatiluwih farmers are known for their practice of organic agriculture. The climate is relatively cool owing to its elevation of 700 meters above sea level.

The work routine of Jatiluwih farmers includes plowing or preparing their field, pulling out the paddy weeds, reaping the ripening grains, collecting vegetables and fish for the family, and cutting grass for livestock.

FIGURE 2. JATILUWIH FARMERS AT WORK

METHODOLOGY

The study was conducted from October 13, 2013 when the first Participatory Rural Appraisal (PRA) was held until January 2014. During the PRA, the study team explained the purpose of the study and showed by PowerPoint presentation examples of aquatic animals and plants the people would have been collecting from the paddy fields and surrounding areas for food or medicine.

The extension workers were interviewed to obtain information on the range of aquatic resources used in the village, their seasonal availability and abundance, local preferences in terms of use, and the kind of tools for collection. Likewise, the head of the *Subak* and the village head were also interviewed concerning farmer activities, availability and use of ricefield aquatic animals and plants, seasonality and collecting gears and methods.

Field survey was carried out every week by walking around the paddy fields to interview farmers and observe the collection activities, methods used and tools employed. Samples of the aquatic animals collected by the farmers or the members of the research team were photographed; some were preserved for further identification.

The first PRA was joined by 50 farmers, the head of *Subak* and their members, the head of Jatiluwih village, the head of Penebel sub district, the head of the fisheries and agriculture services of Tabanan District, district fishery and agriculture extension officers, and the research team (Figure 3). Much of the information offered was on the kind of aquatic organisms found in the paddy fields, their decline or increase in number over the years, and their abundance compared to 25 years ago. The general trend was that of decline and while some can still be found, their abundance has considerably decreased.

In the second PRA, the discussion focused on the confirmation of local names of species and their uses.

FIGURE 3. PARTICIPATORY RURAL APPRAISAL ACTIVITY IN JATILUWIH VILLAGE

RESULTS

FISHES

In November 2013 when the study began, the rice plants were almost ready for harvest and paddy fields were dry. The crop was harvested in mid November when the rainy season has begun. The onset of the rains also signal the appearance of more fish species. Until the end of January 2014, 17 species of fish were observed in the paddy fields; 16 are finfish and one is the swamp eel, *Monopterus albus*. Tilapia, common carp and ornamental fishes such as Rasbora, Swordtail fish are common in paddy fields. Rice-fish culture for Tilapia and Carp is a common practice in Penebel sub-district, and fish is the preferred daily food. Recently, nursing of the catfish *Pangasius* and *Clarias* has been practiced in rice fields as source of seeds for on- growing in cages and ponds.

Fishes were captured with scoop net, cast net and *anco*; the swamp eel is trapped with the *bubu*) when irrigation water is let into the paddy fields (when the rice plants are 2 weeks old) and after harvest.

CRUSTACEA

The Giant freshwater prawn *(Macrobrachium rosenbergii)* and one crab, most probably *Parathelphusa convexa* were found in rice fields. The freshwater prawn would likely have come from the 1000-hectare rice-prawn development project of the Directorate of Aquaculture. One of the trial sites is Jatiluwih. The crab is from the wild.

MOLLUSKS

Six species of gastropods were observed in paddy fields. The most abundant is *Keong Mas* (Golden Apple Snail). Farmers collect the snail for ducks and pigs. Some families use it in a soup dish.

AMPHIBIANS

Five species of frogs were observed, of the *Rana* sp., and *Fejevarya* sp. Farmers told that *Rana* species is very popular for Chinese restaurant. Some people collect bigger sized frogs in paddy fields at night time for sale to the restaurant. The frog collecting season is usually October to March, the rainy season.

REPTILES

Four species of reptiles were noted: water snake, blind snake, lizard, and soft-shell turtle. The water snake and lizard are frequently seen in paddy fields. The lizard, *Varanus salvatir*, is usually used by the local people for skin medicine.

PLANTS

Twenty-four different species of plants were collected. Two species, water spinach and goose weed, are used in the traditional Balinese salad, *urab Bali*). The water hyacinth is a raw material for pig food mixed with meat of golden apple snails. Boiled water of the yellow velvetleaf is usually used by local people as medicine for ailments associated with a high level of uric acid. Centella is mostly used as a herbal treatment for stomach disorder. The rest of the plants are used as salad or herbs.

GEARS

Seven types of gear are used to capture fish. The most common is the scoop net and, for eels, the bamboo trap or *bubu*. The other gears are used only occasionally.

PROCESSING

Aquatic products are processed and prepared in various ways depending on the species. There are eleven common ways to prepare and process fish for human consumption. These are grilled, sate, fried, sauteed, boiled, soup, steamed, dried, crisps, and abon and fresh eaten. Other uses are as fish bait, livestock feed, and as ornamental fish.

CONCLUSION

The study benefited from the excellent cooperation of the people; the local authorities such as head of *Subak*, head of village, head of sub district, and of the district fisheries services effectively coordinated the field activities and arrangements with the *Subak* farmer-members and the extension officers.

This study confirms the importance of aquatic resources from ricefield ecosystems to the local people in the supply of animal protein, vegetable, raw material for livestock and poultry feed, and medicine.

Subak enables, among others, an efficient ricefield irrigation system. Some farmers produce organic rice and recently some rice fields have been used for rice-fish culture for product diversification and additional income. Rice-fish culture is becoming more popular in the area.

Finally, the people of Jatiluwih acknowledge that over the last three decades the abundance and diversity of fish have greatly decreased. They attribute this mainly to the ricefield intensification programme that started in 1977 and the use of pesticide.

LITERATURE CITED

http://www.fishbase.org (online)

http://amphibianweb.org (online)

http://bugguide.net (online)

www.insect.org (online)

www.reptiledatabase.org (online)

www.plantsystematics.org (online)

Mayun I.M and Suastika I.M. 2014. Program Penyuluhan, Pertanian, Perikanan and Kehutanan Kecamatan Penebel Bali. 15 pp.

UNESCO. 2013. The Subak system as a Manifestation of The Tri Hita Kirana Philosophy. Wikipedia. 6 pp.

AQUATIC ORGANISMS IN RICE-BASED ECOSYSTEMS IN NAXAITHONG,PAEN AND POUNGMANH VILLAGES, PHOUKHOUT DISTRICT, XIENG KHOUANG PROVINCE, LAO PDR

Ole S. Pedersen, Fuevue Chertchai, Amphone Chanthavang, Xia Khamvang and Bouaphan Yoysaykham

BACKGROUND

Agro-biodiversity in paddy rice based ecosystems is very important for the people of the Lao People's Democratic Republic and especially for the rural population many of whom rely on paddy rice plus a huge number of other species in the rice-based ecosystem. The system yields plants and animals that are sources of protein and micronutrients, traditional medicine as well as income. Capture of animals and gathering of plants are generally seasonal and specific to groups of animals and plants.

In Lao PDR, nearly 500 fish species (22 exotic) have been recorded, however other aquatic animals (shrimps, frogs, crabs, snails, insects, grubs and worms) and plants are less studied, in particular about their uses by farming communities in the upland areas (Phonvisay, 2013).

Some 97 percent of the population in Lao PDR eat 160 different insects (ant eggs, crickets, grasshoppers, cicadas, worms, bugs, wraps, flies, etc.) containing 20–70 percent dry weight protein.

Supported by FAO, a field assessment on aquatic biodiversity in paddy rice based ecosystems was carried out during the rainy season of 2003 in Khoum and Hok villages, Kham District of Xieng Khouang Province and in Xieng Louang Village Viengxai District of Huaphan Province. The study revealed a total of 82 species and stated that due short duration of the study, not all species could be recorded (Choulamany, 2005).

A study (Gregory *et al.*, 2007) from Xieng Khouang and Luang Prabang noted that the diversity of aquatic species used by villagers is highly dependent on location and noted that at least 20 species of fish, four species of frogs, three species of mollusks, and 22 plant species were regularly consumed by upland villagers. The species were provided in local names without accompanying photos and scientific names. The same study reported a significant reduction of species during the last decade.

In May 2013, the Lao Agro-biodiversity Project[7] was invited to become a partner to the FAO Regional Rice Initiative (RRI). It contributed this assessment of aquatic organisms in rice based ecosystems in Phoukhout District of Xieng Khouang Province. This assessment was carried out in addition to RRI assessments planned in other RRI member countries.

7 Full title of the project: Mainstreaming Biodiversity in Lao PDR's Agricultural and Land Management Policies, Plans and Programmes (GEF/UNDP: 0075435 and FAO: UNTS/FAO/015/GEF).

METHODOLOGY

A. Initial Training

Two university graduates from the area were trained for one day at the Department of Livestock and Fisheries in Vientiane on the overall assessment methodology. They were familiarized with the background material and standardized data sheets.

B. Preparatory meetings at local level

Guidelines for site selection were provided by FAO; the site should be a paddy field area of at least 50 ha and preferably with villagers of different ethnic background.

Prior to the field assessment a number of local consultations and planning meetings were held. Proposed by the deputy governor and head of Agriculture and Forest Office (DAFO) the village authorities agreed on Naxaithong, Poungmanh and Paen villages for the assessment.

In each of three participating villages, a meeting with 20–25 villagers was held to inform the villagers of the data gathering methodology and to obtain information on the farming systems, water sources, major species and their use, fishing gears, and if possible a 25-year trend on the abundance of species. The meeting revealed some confusion regarding the correct name of species. It was learned that pesticides and synthetic fertilizers were not applied.

C. Survey area and duration

The survey area is a valley some two km wide and six km long with a small gravity irrigation system and scattered rice fields amidst hills and low mountains. Supplementary irrigation water for the paddy fields originates from the small streams and small earthen canals and feeder canals. Water is drained into the Nam Ngum and Wah rivers. The area is a part of Nam Ngum watershed and the villagers benefit from aquatic animal and plant species thriving in this agro-ecological environment consisting of the paddy fields and the tributaries and streams as well as earthen canals and small trap ponds in the rice fields. Productivity of the various aquatic related species is regarded as high indicating a healthy eco-system.

The assessment was conducted over three months from August to October 2013, coinciding with the rice growing period.

FARMING SYSTEMS AND ECOSYSTEMS

The farming system practiced by farmers in the three villages is diverse but dominated by wet season rice followed by dry season vegetables. This is made possible by the relatively easy access to supplementary irrigation. In addition farmers have a small number of scavenging livestock (see details below). The area is rather cold and temperature can drop to near freezing in winter. It goes up to 30 degrees during the summer.

TABLE 1. CROPPING AND COLLECTION OF AQUATIC SPECIES CALENDAR (MAIN PERIOD)

ACTIVITIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Paddy land preparation and nursery												
Paddy rice transplanting and growing												
Paddy rice harvesting												
Dry season cropping												
Fishing period in paddy fields and canals												
Fishing in trap ponds												
Fishing in streams												
Fishing in rivers												

Raising fish in (trap) ponds is an integral part of the rice field ecosystem and no significant differences were recorded between the three villages.

Naxaithong Village

The village was established in 1987 and consists of 178 households of Thai Phouan (Lao Loum) and Hmong ethnic minorities. The total population was 840 people (54 percent females), with 12 percent belonging to the Hmong ethnic group. The main agricultural activity is paddy rice cultivation. Some cattle, buffalo, goat, pig, and poultry are raised in addition to small scale vegetables growing. The total paddy rice area is 123 ha. In addition to the paddy fields, harvesting of aquatic resources is also done in Nam Ngum River, Khueng stream and two small village ponds.

A few years back, the village established regulations aimed at the conservation and management of aquatic species in the river. Some illegal fishing gears, however, are still used in the river and streams by some villagers and outsiders.

Paen Village

The village was established in 1985, consisting of Thai Phouan (Lao Loum) and Hmong (17 percent) ethnic groups. The number of households is 123 and population was 573 (50 percent females). The main occupation of the villagers is paddy rice cultivation (48 ha). Livestock (buffalo, cattle, goats, pigs) and poultry and vegetables are raised mainly for own consumption.

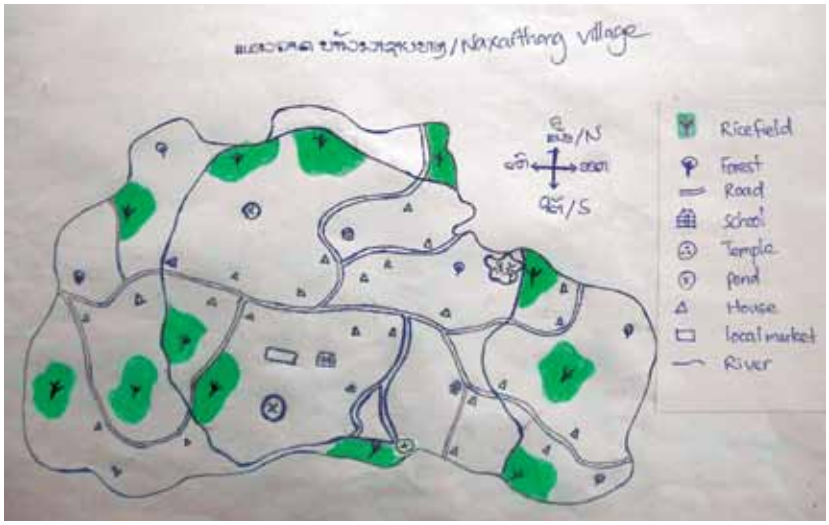
In addition to the paddy rice fields, the aquatic resources include Ngum and Xanh rivers which are located near the village.

The village has promulgated regulations on fishing including fines on illegal fishing in streams, ponds and in the Nam Xanh and Nam Ngum rivers.

Poungmanh Village

Poungmanh village was established in 1793. It has 103 households and a total population of 483 (54 percent female) all belonging to the Thai Phouan (Lao Loum) ethnic group. The key occupation is paddy rice cultivation (25 ha) supplemented by raising livestock (cattle, buffaloes, pigs, goats, and poultry) and growing own vegetables.

In addition to the rice fields, the villagers have access to the Ngum and Wah rivers and the various streams, and maintain four village ponds.



◀ *Naxaithong Village*

◀ *Paen Village*

◀ *Poungmanh Village*

RESULTS

This section presents the plant and animal species divided into seven groups ranked in order of frequency. There were 39 plants, 21 insects, 13 fishes, 7 amphibians (frogs and toads), 5 reptiles (snakes, skinks and lizards), 5 mollusks (snails and mussels), 4 crustaceans (crabs, and prawns) and one annelid (freshwater leech), for a total of 95 recorded and photographed species (Table 2)[8]. With the exception of tilapia and common carp all the species are indigenous.

TABLE 2. NUMBER OF AQUATIC SPECIES BY GROUP

Plants	39	Reptiles	5
Insects	21	Mollusks	5
Fish	13	Crustaceans	4
Amphibians	7	Annelid	1
Total : 95 species			

A. Plant species

Plants species are easily available compared to the animal species. A total of 39 species were recorded of which one species was a green algae (*Cholorophyta spirogyra)* and two fern species, (*Diplazum esculentum)* and water clover (*Marsilea quadrifolia)*. A total of 22 species are used solely for family food, eight species for food and sale, four species for food and medicine, one species for food, sale and medicine, and five species for medicine only. The plant species are collected by hand or with a knife or some other sharp instrument. The plant species are mostly available from May to October, but are generally picked year round, except for 10 highly seasonal species.

Compared to 10 years ago, six plant species are more frequent, one species (pak nork noy) is much more frequent, while 15 plant species are less frequent, 10 plant species are much less frequent, and seven plant species are regarded as equally frequent.

8 The complete list of species will be provided in an updated version of Halwart, M. and Bartley, D. eds. 2005. Aquatic biodiversity in rice-based ecosystems (CD ROM). Rome. FAO. Also available at ftp://ftp.fao.org/fi/CDrom/AqBiodCD20Jul2005/default.htm.

▲ *Green algae – Thao*

▼ *Water clover – Phak waene*

B. Insect species

A total of 21 insect species were found and photographed during the field survey with the majority belonging to various groups of crickets (see photos), a few grasshoppers and green bush crickets, a sting bug (*Tesseratoma sp.*), giant water bug da na (*Lethocerus indicus*), a Chinese mantis (*Tenodera sinensis*), a diving beetle (*Cybister fimbriolatus*), and a fly and a water scorpion (*Nepa cinera*).

Most (16) are eaten the same day and five species (crickets, fly, grasshopper, and diving beetle) are also sold at local markets.

The catching methods are by hand and with scoop basket, scoop net, triangular net, and mosquito net. The fly is caught by hand or with help of a glue. The high season is from June to December, although most species, except four (some crickets), are caught year round.

Compared to 10 years ago the villagers reported that 9 species are less frequent, 7 species are more frequent and 5 species at same level.

▾ *Grasshopper - Tak taen khiao*

▲ *Cricket – Maeng chi lith*

C. Fish species

A total of 13 fish species were reported by villagers during the participatory meeting at the village and the same number of species were found and photographed during the survey period. These included mully catfish (*Wallago attu*) and walking catfish (*Clarias batrachus),* snakehead *(Channa striata),* and the swamp eel *(Monopterus albus*). The exotic Nile tilapia (*Oreochromis niloticus*) was also on the list.

All fish species were caught in all of the water resources i.e. the rice fields, trap ponds, small connecting earth canals, streams and rivers. The preferred fishing gear is a net. Baskets and traps are also used. No illegal fishing methods were reported, although not uncommon in the area.

All species are preferred to be consumed on the same day or sold at local market. Alternatively, all species may be dried, smoked or fermented (except the Nile tilapia and the swamp eel). The species preferred for fermentation is pa bin.

Compared to 10 years ago, the villagers reported that six species are much less frequent, 5 species are less frequent, while two species the Pa kat and Pa kham appeared more frequent. The main reason given for declining abundance of fish is high market demand, but certainly the negative effect of illegal fishing gear on the ecology (up or down stream) should not be underestimated. The greater abundance of Pa kat and Pa kham could not be explained.

▲ *Swamp eel – Ian*

▼ *Carp – Pa nai*

▲ *Common tree frog – Kiet ka path*

D. Amphibians

A total of seven frogs and toads were found during the field survey, mainly in or nearby the rice fields and three species also in/close to the river/stream. Two of the species i.e. the goangdong frog (*Rana macrodactyla*) and the kop hoi were only caught in the paddy rice field.

The species are generally preferred to be consumed fried or smoked the same day, though they may also be sold. One species, the black-spined toad/Asian common toad (*Bufo melanostictus*), is used as traditional medicine.

The species are caught by hand, with nets and baskets, and often with the help of a torch. All species, except the Chinese edible frog *(Hoplobatrachus rugulosus),* are available year round, with the season corresponding to the rice growing period. Villagers reported that four of these species are in decline while two species are now more frequent and one species is at same frequency, compared to 10 years ago.

E. Reptile and annelid species

A total of five reptiles and one annelid species were reported and photographed. The reptiles consisted of three snakes: i.e. the red necked keelback *(Rhabophis subminiatus),* the Indo-chinese rat snake *(Ptyas korros* see photo*)* and the checkered keelback *(Xenochrophis piscator);* one skink i.e. the four striped skink *(Mabuya multifasciata)* and one lizard called kar pom khang by the villagers. One freshwater leech (annelid) with the local name, ping, was also recorded.

The checkered keelback natrix and the skink were widely found, whereas the remaining four species were limited to the paddy fields. All species could be found year round with a small peak during June to September except the lizard which peaked during December to March. Only the unidentified skink was recorded to be declining in number, whereas the remaining species were of the same abundance compared to 10 years ago. The unnamed skink was used only for medicine and the rest are eaten while the Indo-chinese rat snake was the only reptile sold in the local market.

▾ *Red-necked keelback – Ngou kor daeng*

▲ *Snail – Hoi nai*

F. Mollusk species

Four snails (hoy pak kouang, hoy lai, hoy leck chane and hoy noy), one freshwater mussel (hoi kii) were found and photographed during the field survey. The hoy pak kouang and the hoy noi are found in all the wetland habitats, whereas hoy leck chane is only caught in rivers and streams and the hoy lai only in rice fields. The mussel (hoi kii) is caught from trap ponds and rivers and streams. The species are available year round, but mostly from June to October, except the hoi hii which has a slight peak during the October-April dry season.

The species are primarily caught by hand and in case of hoi pak kouang, hoy leck chane and hoy noy also with scoop net and scoop basket. One species (hoi pak khouang) has medicinal use. The others are consumed and sold in the local market.

Crustacean species

Villagers told during the participatory meeting that five species are harvested, but only four were caught and photographed during the field survey: three crabs and one prawn. Except for pou houay (caught only in rice fields), the species are found in all the wetland types. The most common method to catch the species is by hand, but also scoop baskets and scoop nets are used. To catch pou na and pou leuang, a touch and a shovel are also used.

These species are mostly available from June to October. The villagers reported that three species (koung na, pou na and pou houay) have slightly increased in number compared to 10 years ago whereas pou leuang has slightly decreased.

The four species are in high demand for various traditional dishes. They are sold in the local market. The prawn is dried and the pou na and pou hoay are fermented.

▲ *Rice field crab – Pou na*

▼ *Rice field crab – Pou houay*

▲ *Trap – Xai pa nai*

FISHING GEAR AND COLLECTION METHODS

Twenty different fishing and collection methods were identified during the survey, which can be classified broadly into baskets, nets, traps and other tools.

In most cases 3–4 gears/tools are used for the same species. A shovel was used for some plants (phak see xang, phak, phak bou leuart, and wane kae pit) and a cricket (maeng chi lor), and a stick for collecting green algae. A torch was used for crabs, toads and frogs at night time when these are most active.

LOCATION OF SPECIES IN THE ECOSYSTEM

The assessment divided the interconnected aquatic ecosystem into four main wetland parts i.e. rice field, the trap ponds, the earthen canals, and the streams and rivers. Most (95 percent) of the 95 species used by the three villages originate from the rice fields, followed by the earthen canals (71 percent), the trap ponds (54 percent) and the streams and rivers (38 percent). Nearly half of the 95 species (and all of the fish species) could be found in all the aquatic sources. The plant group was the most habitat-specialized group; only wild taro, phak khoot nong and phak kook are growing in all wetland types.

UTILIZATION OF AQUATIC SPECIES – COMMON FISHES

Most of the aquatic species in the paddy field ecosystem are taken as food. These are used in various traditional food dishes by local villagers as well as throughout the Xieng Khouang Province. Six popular dishes are described below.

A. Pa dek – fermented fish

Fermented fish (Pa dek) is prepared by many fish species and the most common species is Pa bin/math /croaking gourami (*Trichopsis vittata)*. Cleaned fish is dried and smoked on a stove, then mixed with big chilies and salty boiled water, kept in a tightly covered plastic box or jar for at least 2 months. The fermented product is very popular and eaten with sticky rice or added in soups and other dishes to give taste.

▲ *Pa bin/math – Croaking gourami*

▲ *Fermented fish*

B. Or Pa douk/Pa dek – stewed fish with fermented fish sauce

Or Pa douk (fish stew) and Pa dek (fish sauce from fermented fish) is a common dish on the family menu. Cleaned and sliced fish are mixed with various ingredients, put into a cooking pot with little water and put on a fire stove until it boils. Sliced eggplants, chilies, salt, and spices are then added, together with onion and garlic. The stew goes with sticky rice or steamed rice.

▲ *Pa douk – walking catfish*

▲ *Catfish with fermented fish sauce*

C. Nam Pou – crab paste

Crabs are used in numerous food dishes although the most preferred is in making a crab sauce (Nam pou). Cleaned crabs and sliced lemon grass and young stalk of Kha are ground together. After adding water the filtered sauce is kept for two days before adding salt and spices and boiled until preferred concentration. The crab sauce can be added as a flavor for papaya salad.

▲ *Pou na – Rice field crab*

▲ *Preparation for crab paste*

D. Meng paste (Jiao meng da) – Giant water bug paste

Meng da na (giant water bug) is made into paste (jao). Cleaned bugs are grilled with chilies, thereafter seasoned with salt and spices and eaten with sticky rice.

▲ *Meng da na – Giant water bug*

▲ *Giant water bug paste*

E. Meng chi lor – fried cricket

Fried cricket (Meng chi lor) is considered as a very tasty dish at home and in local restaurants. The crickets are fried in oil in a pan. Sliced lemon grass, garlic, Kha and lemon leaves are added together with spices and salt. The mixture is stirred until the cricket is well fried.

▲ *Meng chi lor – cricket*

▲ *Fried cricket*

F. Phak nork – Centella salad

Pak nork plants are collected for food dishes and eaten fresh or fried in salads. Cut leaves are boiled and then ground. Fried garlic, ginder, peanuts, and pepper are added together with fresh sliced onion.

▲ *Phak nork – Centella*

▲ *Centella salad*

DISCUSSION AND CONCLUSION

The upland paddy fields in the three villages (Naxaithong, Paen and Poungmanh) are rather scattered but well connected by small streams, irrigation and drainage canals, which connect with smaller streams and trap-ponds. Half of the total paddy rice area of some 200 ha was surveyed.

The assessment confirmed that paddy rice-based aquatic ecosystem encompasses a diverse range of aquatic, semi-terrestrial and terrestrial niches for numerous species. Of these, 95 species (of plants and insects which make up two-thirds of the species) were recorded as useful for the three villages, either for own consumption (most plants and half of the insects) or for sale in local markets. Three plant species (gna lack na, wane pai and pak boa leuat) and the freshwater leech (bing) were used for medicinal purpose and another five plant species and the black-spined toad are used as food and medicine. Compared to initial discussions with villagers the number of recorded (photographed) species was slightly lower than the number informed beforehand.

The number of plant species (39) used by villages, however, is less than the number of 115 herbal species recorded by Kosaka *et al.*, 2003, but from a larger study area in Huaphan Province.

Compared to the FAO supported survey 10 years ago, which recorded a total of 82 species (Choulamany, 2005), the current survey reported a similar number of crustaceans, amphibians, mollusks, and reptile species, less fish species (13 compared 22), and many more insect and plant species. On this basis one can conclude that the number of species have not declined over the last 10 years, which is probably due the fact that farmers in this area use no pesticides. The lower number of fish species in this study might be due to the different location. The villagers did not mention a significant reduction of fish species during the last decade.

Uncertainty over the identification and correct scientific name of species proved to be a major challenge. One species often has several local names while several species have the same name. In many cases specialized assistance is needed which is not readily available in the Lao PDR.

An earlier survey (Gregory, Thongdam and Somboun, 2007), of two villages in Xieng Khouang Province (Ban Pung Bang and Ban Namechat village), which are at middle elevation, recorded some 50 aquatic species. The number of fish species i.e.13 is the same as the number recorded by this current survey. However, many of the local names differed between the two studies. The above mentioned survey of 2007 noted a general reduction of biodiversity and depletion of natural aquatic resources. This study confirms the decrease in fish species and most plants and frogs compared to 10 years ago. However, one plant species (phank nork hoi) is much more abundant nowadays. Some other species seems to have flourished but perhaps at the expense of other species. There seems to be scope for more in-depth studies to understand the dynamics of the species abundance and decline. The study could include non-edible species.

The survey also revealed that a relatively high number of the animal species are to be found year round (90 percent), whereas most of the plant species are seasonal. This is due to the fact

that the villages are located close to the rivers and streams and that most of the paddy fields are dry after the main harvest. The survey did not reveal any differences in use between the two ethnic minorities.

Several fishing gear and catching methods (a total of 20 were recorded) were used for catching the same species. Notably, illegal fishing methods were not recorded including use of explosives and poison. This information was provided during the initial village meetings but it was suggested that only outsiders used them.

The survey confirmed that upland rural population in Laos make use of a huge number of species to support their livelihood and the number adds to cultivated species and NTFPs.

Following the rich biodiversity used by villagers a great number of dishes, mainly for immediate consumption (90 percent), but also as dried and smoked (all fish species and most crabs). All fish species (except the swamp eel) were also fermented.

The initial village meetings turned out to be an excellent forum to gain common understanding of purpose and interest in participation. Ways, however, should be considered to generate an understanding of how the villages can benefit from this programme.

FOLLOW-UP

Follow-up activities suggested by the villages included setting-up conservation zones and enforcement of local regulations in order to avoid illegal fishing. Other suggestions are the domestication of certain species of frogs and training on rice-fish cultivation.

More specific suggestions and needs related to the assessment include:

- Identification of backstopping experts on specific animal and plants groups
- Recording name of species during the survey, on line to experts – to facilitate identification
- More information on plants species, as most experts seem to originate from fisheries
- More field reference material for on-the-spot identification
- More instructions in photo-taking (flowering plants, background, shadow, etc.), although the good number of photos taken of the same species to some degree compensate
- Include some socio-economic aspects and agricultural input use
- Involve more closely national experts from the Institute of Traditional Medicine and LARReC
- Support for training on the aquatic biodiversity conservation and sustainable use including establishment of fish conservation zones
- Increase awareness of negative aspects of illegal fishing
- Prepare technical report/posters/leaflets

REFERENCES

Choulamany, X. 2005. Traditional use and availability of aquatic biodiversity in rice-based ecosystems. III. Xieng Khouang and Houa Phanh provinces, Lao PDR. In Halwart, M., Bartley, D. (eds), S. Funge-Smith (guest ed.). 2005. Aquatic biodiversity in rice-based ecosystems. Studies and reports from Cambodia, China, Lao People's Deomcratic Republic and Viet Nam. [CD-ROM]. Rome, FAO. Also available at ftp://ftp.fao.org/fi/cdrom/aqbiodcd20Jul2005/default.htm

Gregory, R., Thongdam, P. & Somboun. 2007. *Upland aquatic resources in Laos PDR. Their use, management and spatial dimensions in Xieng Khouang and Luang Prabang Provinces*. LARReC. 68 pp.

Kosaka, Y., Xayvongsa, L., Vilayphone, A., Chanthavong, H., Takeda, S. & Kato, M. 2013. *Wild edible herbs in paddy fields and their sale in mixture in Houaphan Province, in the Lao Peoples' Democratic Republic*. Economic Botany 67(4), 2013, pp. 335–349.

Phonvisay, S. 2013. *An Introduction to the Fisheries in the Lao PDR*, Mekong Development Series, No 6, Mekong River Commission. Phnom Penh, Cambodia, 64 pp.

SUGGESTED READINGS

FAO Forestry Paper 171. 2013. *Edible Insects, Future, prospects for food and feed security*. Rome. 190 pp. www.fao.org/docrep/018/i3253e/i3253e00.htm

Hanboonsong, Y. 2012. *Edible insect recipes: edible insects for better nutrition and improved food security*. Vientiane, FAO and the Government of Lao PDR.

Inthakoun, L. & Delang, C.O. 2008. *Lao Flora: a Checklist of Plants found in Lao PDR with Scientific and Vernacular Names*. 238 pp.

Lindsay, S. & Middleton, D.J. 2012 onwards. *Ferns of Thailand, Laos and Cambodia*. http://rbg-web2.rbge.org.uk/thaiferns/index.htm

ASSESSMENT OF AQUATIC BIODIVERSITY IN RICE-BASED ECOSYSTEMS IN SELECTED SITES IN LUZON, THE PHILIPPINES

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INTRODUCTION

This assessment of aquatic life forms used as food by local people was carried out in three selected lowland areas in Central Luzon and one highland area in Northern Luzon. It was conducted from September to December 2013 in the villages of Mabini, Santo Domingo and Villa Cuizon, Muñoz in Nueva Ecija, in Talampas, Bustos in Bulacan, and in Batad, Banaue, Ifugao. In the three Central Luzon sites, residents are mostly leasehold farmers and the majority are totally dependent on rice farming for livelihood. In Batad, the lands under cultivation are ancestral domain.

The study was conducted from September to December 2013. The Mabini site was chosen for its proximity to the Philippine Rice Research Institute, the Villa Cuizon site for its proximity to the Freshwater Aquaculture Center, where canals receive "fish escapees", and the Talampas site because the large channels of the National Irrigation Authority's AMRIS tributaries that pass through it are sources of food of the barangay (village) residents. The Batad site in Banaue was being developed into an eco-tourism destination and the residents are reviving traditions including rituals and farming practices.

METHODOLOGY

The following strategy was followed based on procedures used by Balzer, Balzer and Pon (2002):

1. The sites were visited and local officials were met to formally ask for permission to conduct the study on site, seek their cooperation in the conduct of the study, and ask for references on key informants.
2. Different groups were met for interviews to gather information that helped to identify target sites where aquatic food resources were obtained.

3. During the course of the study, the sites were visited at least thrice a week to identify the users of the target sites.
4. Sampling was done by recording only the species taken out for food by the users. Intentional sampling was avoided.
5. Photo documentation of edible species, catching implements/methods used, preparations, abundance during the sampling period, as well as other relevant data were also taken.
6. The species were later identified using the facilities of the Central Luzon State University Department of Biological Sciences, the Freshwater Aquaculture Center and the Bureau of Fisheries and Aquatic Resources in Science City of Muñoz, Nueva Ecija. For confirmation, photographs were sent to Peter Balzer via FAO facilities.
7. To establish a dateline to illustrate appearances and/or loss of aquatic species, interviews with barangay elders were done to gather historical information of the area.

RESULTS

This section is organized by site, the species of aquatic animals and of plants found in the site including their abundance, capture or harvesting methods and tools used, and food preparations using the species.

A. MABINI, SANTO DOMINGO, NUEVA ECIJA

a. Species

i. Fishes

Fifteen (15) fish species were documented in this site. According to locals, *Pangasius sp*. specimens were caught in the area but the assessment was unable to confirm the presence of the species. The species that were seen in the area were as follows:

1. Gourami (3 species) – all can be found in the inlet canals (*palige*) but not in the rice field.
   - Guraming tigre / Snakeskin (*Trichogaster sp*.)
   - Guraming tuldok / Three spotted (*Trichogaster trichopterus*)
   - Guraming puti (*Trichogaster sp*)
2. Tilapia (*Tilapia nilotica*) – seldom found inside the rice fields during planting time but still can be seen during fallow periods in parts of the fields that retain water (*bana*).
3. Catfish or *Hito* (*Clarias sp*.) – this species can still be found in the fields.
4. Mudfish or *Dalag/Bulig* (*Channa sp*) – this species can still be found in the fields especially during land preparation after initial field irrigation or while draining the fields for rice crop ripening.
5. Freshwater eel or *Kiwet / Palos / Igat na pula* (*Monopterus albus*) – this is an introduced species that are seen as pest because they bore holes in the dikes that result in water leakage and nutrient loss. Farmers try to control its presence by electro-fishing.

6. *Talandi* or *karpang* silver or *Silap* (*Cyprinus sp*) – used to be found in the fields but at present being observed more in the canals and ponds than in the fields.
7. Climbing perch or *Liwalo* (*Anabas testudineus*) – used to be found in the fields but now can be found only in the main irrigation canal.
8. Carp or *Karpa* or *Banak* – used to be abundant in the fields but now very rare. Large specimens are rare and only small ones are caught in irrigation canals.
9. *Burasi* or *Buan-buan* (*Carassius cyprinus*) – mostly found nowadays in ponds near the fields and in the main irrigation canal ("*ilog*").
10. *Suswe* or *Susay* or *suwi-suwi* (*Dermogenys pusillus*) – used to be abundant in the *palige* and can be caught by hand ("dakma") but now can only be caught in the *ilog* by electro-fishing.
11. Goby or *Biya* (*Glossogobius giuris*) – can still be seen in the temporary holding ponds and the *ilog* but not in the rice fields.
12. Silver perch or *Lukaok* or *Ayungin (Leiopotherapon plumbeus)* – a delicacy but now very rare. The species used to be abundant in the holding ponds.
13. Armoured catfish or "janitor fish" (*Pterygoplichthys* sp) – introduced exotic species, destroys fish traps and outcompetes most local species. During lean months some local residents cook the fish for food.

ii. Mollusks

In Mabini, seven species of mollusk were documented; two species of freshwater clams were found but only one species (*tulya, Corbicula sp*) was photo-documented on site.

1. *Tulya* (*Corbicula sp.*) – still very common in areas near paddy fields but very rare inside the cultivated rice field. This bivalve is commonly found in streams and canals. They are rarely found in the fields and if found they are not taken as food due to fear of being tainted with pesticides. The *tulya* is a very popular food prepared for lactating mothers. They are incorporated into soup with malunggay (*Moringa oleifera*) leaves to induce breast milk production.
2. *Sulib* (*Ligumia sp*) – still can be found in holding ponds inside the rice fields. The *sulib* is usually taken as pulutan, or appetizer, with an alcoholic beverage because of its tasty but tough meat. Five (5) species of gastropods were documented on site. Only three were photographed.
3. *Kuhol* or *bisukol* or *susong* native (*Pila luzonica*) – used to be very abundant in the rice fields before the golden apple snail was introduced in the late 70s. Now very rare but specimens can still be found in Mabini.
4. Golden *kuhol* (*Pomacea canaliculata*) – considered a pest and invasive species; eaten only if no other food source is available. It is mostly fed to ducks or used as frog bait.
5. *Susong pilipit* or *Agurong* or *Bukasit* (*Melanoides sp*) – the snails are considered a delicacy and can still be found in the fields. They might owe their resilience to their tough and thick shells, which makes them less affected by pesticide residues in the field. Only those gathered from the ilog or tertiary canals are consumed.

6. *Susong papa* (for identification) – rare freshwater snail also considered a delicacy. Used to be abundant in the rice fields but is now rarely found in the holding ponds.
7. *Kuskusiling* or *Liddeg* or *Birabid (Physa sp.)* – thin shelled species and very sensitive to pesticides. Mostly found clinging to screens or trapped by means of the *sagat* while draining the fields. *Susong* native and *kuskusiling* are rarely found in the rice fields. The susong pilipit is preferred as food over this mollusk.

iii. Crustaceans

Four species of crustaceans were documented, among which are one species of crab, two species of shrimp and one crayfish.

1. Crab or *talangkang bukid* (*Parateiphusa sp*) – commonly called as *pehe*, this small freshwater crab is traditionally caught by hand in holes in the rice field bunds. At present the easiest way of capturing the crab is with an electro-fishing gear.

2. *Ulang* (*Macrobrachium idella*) – rarely found in the fields during the cropping period but can be caught in the canals surrounding the fields and in the main irrigation canals by *sagat* or with an electro-fishing rod.
3. *Hipong malaki* (*Metapenaeus ensis*) – still common in the irrigation canals but rarely seen in the fields. They can also be found in the holding ponds and can be caught by hand (*kappa* or *dakma*) when water level is low.
4. *Hipong maliit* or *kuros* (for identification) – still abundant in the fields and in surrounding water bodies in the area.

iv. Plant species

Based on interviews with residents only three species of aquatic plants are eaten in the area: taro (*Colocasia esculenta*), kangkong (*Ipomoea aquatica*) and tukal (*Nelumbo sp*). Kangkong is also used as feed for pigs and ducks. *Tukal* stalks are cooked *inasiman*, stewed in *bagoong munamon* (fermented anchovy sauce) and tamarind. Another aquatic plant, the water hyacinth (*Eichhornia sp*), may be of economic importance particularly to the women's group. The stems of the hyacinth plant are harvested and dried as raw materials for woven handicrafts and as base frame for flower arrangements.

b. Catching methods and implements

Ten (10) catching methods still in use were documented in Mabini. These are:

- ***Bingwit*** – fishing poles with lines made of nylon strings and may have single or double hooks to catch fishes; in Mabini, double hooked fishing lines are more widely used. Single hooked lines are for catching frogs.
- **Screen** – fish traps installed inlet and discharge canals.
- **"Skylab"** – installed in water inlets/outlets, used for catching fish and shrimps.
- **Mini skylab** – similar to the screen but usually made of nylon nets with wood frame.
- ***Pante*** – fishing net used in still waters, with floaters made from cut pieces of rubber slippers and lead weights. Made of fine nylon netting material, it is commonly used to catch tilapia and catfish. These are often damaged by the armoured catfish when they are caught in the trap.
- ***Lambat*** – drag nets used to catch fish without draining the pond.
- ***Sagat*** – used for catching snails and shrimps at the pond edges/banks.
- ***Yakayakan*** – improvised tool from old electric fan grill used for catching clams.
- ***Aparato* or *pangoryente*** (electric fishing gear with a battery and probes) – used to catch fish or crustaceans by running a 9–12 volt electric current generated by batteries to stun the fish. The practice is banned but it is still rampant in the area as it requires less effort and time.
- ***Dakma* or *kappa method* –** most common method, catching the animals with bare hands.

i. Containment

Traditional implements used to contain caught animals were also documented. Several basket type containers generically called *buslo* in assorted shapes were described but only one type was photographed:

- **Buslo** – cylindrical basket for fish and *tulya* constructed from bamboo, plastic bottles and nylon twine.

c. Cooking and preservation methods in used in Mabini

i. Fish

- Fried (*pinirito*)
- Stewed in vinegar, ginger and chili peppers (*paksiw*)
- Stewed in tamarind or tomatoes or *kamias* (*sinigang* or *pinangat*)
- Fermented with rice (*binuro*)

ii. Clams

- Stir-fried/sautéed in ginger (*ginisa*)
- Parboiled then dipped in vinegar, salt, pepper (*kinilaw/ginulat*)

iii. Crustaceans

- Boiled (*pakulo*)

iv. Frogs

- Stewed in soy sauce and vinegar (*adobo*)

B. TALAMPAS, BUSTOS, BULACAN

a. Species

i. Fishes

Eight (8) species of fishes were documented during the course of the study in Talampas, Bustos, Bulacan.

1. Guraming tigre (*Trichogaster sp.*) – found in irrigation canals surrounding the fields and in the main irrigation canal.
2. Tilapia (*Tilapia nilotica*) – introduced in the mid 70s, the species became one of the most common freshwater fish species in the area displacing local varieties such as *ayungin* and *liwalo*.
3. Hito (*Clarias sp.* – can still be found in the fields especially in between cropping periods.
4. Bulig (*Channa sp*) – can still be found in the fields when water is low or during initial irrigation and while the fields are being drained.

5. Silap (*Cyprinus sp*) – can still be found in the fields but rarely. The specimens are mostly found in ponds.
6. Karpa – most of the specimens are small and caught in the irrigation canals with cast nets.
7. Goby or *Biya* (*Glossogobius giuris*) – most abundant species in the area. Most probably because of its proximity to the Bustos Dam where the species are thriving.
8. Armoured catfish or Janitor fish – invasive exotic species that has become a nuisance. They are used as fish bait but not eaten.

ii. Mollusks

Only 3 species of mollusks, 1 bivalve and 2 gastropods, were documented in the area and both species were caught by hand or *kapa* method.

1. The bivalve *tulya (Corbicula sp)*, can still be found in the fields and are also favored are food especially for lactating mothers. They are obtained in the irrigation canals after sieving the mud by hand when water is low.
2. *Susong pilipit* (*Melanoides sp*.) is preferred as food by the locals while the golden *kuhol (Pomacea canaliculata*) is commonly used as bait for fishing poles or duck feed.

iii. Crustaceans

Four (4) species of crustaceans were listed in Talampas: 1 species of freshwater crab, two species of shrimps and 1 crayfish.

1. Crab or *talangkang bukid* (*Parateiphusa sp*) – also called *pehe* in Talampas, the species is caught by hand (*dakma*) and is considered rare in the area.
2. *Ulang* (*Macrobrachium idella*) – can only be found in the main irrigation canal and not in the fields.
3. *Hipong malaki* (*Metapenaeus ensis*) – not seen in the fields anymore but still can be caught by traps or *salok* at the irrigation inlets
4. *Hipong maliit* or *kuros* (for identification) – still abundant in surrounding canals in the rice field during the early planting season once water is released from the dam.

iv Amphibians and reptiles

1. Frogs or *palaka* (*Rana sp*) are caught by hand (*dakma*) and eaten as a delicacy (*bobotok* or stuffed) in the area. Most of the expert catchers based on interviews are children aged 5–9 years old.
2. Turtles and snakes were also seen and caught previously by use of *baril* or *pana* (spear gun) in the irrigation canals but none were seen during the course of the study.

v. Plants

As in Mabini, only the taro (*Colocasia esculenta*) and kangkong (*Ipomoea aquatica*) are consumed as food in Talampas. The consumption of kangkong harvested directly from the fields was dwindling in popularity for fear of pesticide poisoning.

b. Catching methods and implements

Nine (9) fishing methods were observed in Talampas.

1. ***Bingwit*** – also called *sima* used in catching tilapia and goby from the irrigation canal. A variety of fishing rod types was seen in the area. The most common are those made from thin bamboo poles with single hooks although some were modified with improvised reels. Most of the users are children, sometimes as young as 3 years old.
2. ***Baril* or *Pana*** – it was reported during interviews with local residents that farmers were hunting turtles and snakes (particularly the *sawa*) with the *baril* or *pana* in Talampas although no animals were caught by this method during the duration of the study.
3. ***Pangkolong*** – similar to screen traps used in Mabini. In Talampas, they are baited with crushed golden kuhol or fishmeal but instead of placing them in water inlets they are submerged in deeper portions of the main irrigation canal.
4. ***Salok*** – rounded scoop nets installed in water inlets (similar in function to a mini skylab).
5. ***Lambat*** – drag nets used to catch fish without draining the pond.
6. ***Dala*** – rounded cast net with lead weights at the bottom.
7. ***Salakab or Pangdakob* –** basket-shaped fish traps.
8. ***Kuryente* or Electro-fishing** – although the practice of electro-fishing is illegal, some persist in using the method to capture fish and crustaceans.
9. ***Dakma or Kapa* –** using bare hands.

c. Cooking/preservation methods in talampas

i. Fish

- Fried (*pinirito*)
- Broiled over charcoal (*inihaw sa baga*)
- Stewed in vinegar, ginger and chili peppers (*paksiw*) for both fishes
- Stewed in tamarind or tomatoes (*sinigang* or *pinangat*)
- Cooked in coconut milk (*ginataan*)

ii. Mollusks

- Stir-fried/sautéed in ginger (*ginisa*)
- Parboiled then dipped in vinegar, salt, pepper (*kinilaw/ginulat*)

iii. Reptiles (turtles and snakes)

- Stewed in soy sauce and vinegar (*adobo*)
- Stewed in tamarind (*sinampalukan*)

iv. Frogs

- Stuffed with meat or rice (*relleno* or *battue or bobotok*)
- Stewed in soy sauce and vinegar (*adobo*)

C. VILLA CUIZON, MUNOZ, NUEVA ECIJA

a. Species

i. Fishes

Twelve (12) fish species were documented in Villa Cuizon as follows:

1. Gourami (2 species) – all were found in the inlet canals (*palige*) coming from the main irrigation canals but not inside the rice field.
   - Guraming tigre / Snakeskin (*Trichogaster sp*.)
   - Guraming tuldok / Three spotted (*Trichogaster trichopterus*)
2. Tilapia (*Tilapia nilotica*) – can still be found in supply canals but rarely inside the paddy field.
3. Catfish or *Hito* (*Clarias sp*.) – this species is now rarely found in the fields. Mostly caught by electro-fishing which is a very common practice in the area.
4. Mudfish or *Dalag/Bulig* (*Channa sp*) – this species can still be found in the fields especially during land preparation after initial field irrigation or while draining the fields for rice crop ripening.
5. Freshwater eel or *Kiwet / Palos / Igat na pula* (*Monopterus albus*) – this species can be caught in the fields and in canals. Locals consider them pests in the fields but they are valued as a delicacy.
6. *Talandi* or *karpang* silver or *Silap* (*Cyprinus sp*) – can still be found in the fields but rarely and at present being observed more in the canals and ponds than in the fields. Specimens seen were small.
7. Carp or *Karpa* or *Banak* – very rare inside the fields and now caught only in the ponds and irrigation canals. Large specimens are rare.
8. *Burasi* or *Buan-buan* (*Carassuis cyprinus*) – mostly found in the main irrigation canal and rarely in the fields.
9. Silver perch or *Lukaok* or *Ayungin (Leiopotherapon plumbeus)* – this species can still be found and is considered a delicacy. The species used to be very abundant in the area.
10. Armoured catfish or Janitor fish (*Pterygoplichthys* sp) – considered a nuisance fish, the species are sometimes used as bait. Some local residents eat the fish.
11. Flowerhorn cichlid fish – introduced exotic species. Popular as an aquarium fish, locals find the species comparable to tilapia.

ii. Mollusks

In Villa Cuizon, 5 species of mollusks were documented; two species of freshwater clams are used as food.

1. *Tulya* (*Corbicula sp.*) – still very common in the canals near the fields but very rare inside the cultivated rice field. Some locals sell excess harvest in the market at Php 15–25 per kilogram.
2. *Sulib* (*Ligumia sp*) – rarely found in the fields. Their sharp shells pose as cutting hazard for farmers walking barefoot in the mud. Most are found in ponds near the area and in irrigation canals. Three kinds of gastropods were observed on site but only one was photographed.
3. *Kuhol* or *bisukol* (*Pila luzonica*) – used to be very abundant in the rice fields but now very rare. Most are now caught in irrigation canals and in fish ponds in the area.
4. Golden *kuhol* (*Pomacea canaliculata*) – only large ones are gathered as food and eaten only if no other food source is available. The species is considered as a pest.
5. *Susong pilipit* or *Agurong* (*Melanoides sp*) – the snails are considered a delicacy and can still be found in the fields but in lesser quantities than those gathered from irrigation canals.

iii. Crustaceans

Based on interviews, five species of crustaceans can still be found in Villa Cuizon: one species of crab, two species of shrimps and two species of crayfish. Unfortunately only one species of crayfish (*sugpo* or *ulang*) was photographed and evidence of the other four had yet to be confirmed when this report was prepared.

- *Sugpo* or *Ulang* (*for identification*) – can be caught in the canals surrounding the fields and in the main irrigation canals by electro-fishing

iv. Plant species

Four aquatic plants are eaten in the area: taro or gabi (*Colocasia esculenta*), kangkong (*Ipomoea aquatica*), tukal (*Nelumbo sp*) and sintas-sintasan (*Vallisneria sp*). Kangkong is also used as feed for pigs and ducks. Like in Mabini, *tukal* stalks are cooked *inasiman*, with grilled fish. Sintas-sintasan is crushed in salt and prepared with fresh tomatoes, shallots and vinegar and partnered to grilled or fried fish. The water hyacinth (*Eichhornia sp*), plant stalks are also sold as raw materials for base frames of flower arrangements.

b. Catching methods and implements

Four catching methods were documented in Villa Cuizon:

1. ***Bingwit*** – single hook fishing poles with lines made of nylon strings, and poles usually made of bamboo. They are used for fish and frogs.
2. ***Pante*** – fishing net used in still waters, with floaters made from cut pieces of rubber slippers and lead weights. Made of fine nylon netting material, it is commonly used for tilapia and catfish.
3. ***Aparato* or *pangoryente*** (electric fishing gear battery and probe) – used to catch fish or crustaceans by running a 9–12 volt electric current generated by batteries to stun the fishes. The practice is banned but it is still rampant in the area since catching fishes using this method requires less effort and time.
4. ***Dakma* or *kappa method* –**most common method, catching organisms by using bare hands.

i. Containment

Traditional implements used for containment of fish, shrimp or mollusks were also documented in Villa Cuizon. As in Mabini, several basket type containers called buslo in assorted shapes were also described.

1. **Buslo** – bottle-shaped basket for fish and the small bivalve, *tulya,* constructed from bamboo strips and nylon twine.

c. Cooking and preservation methods in used in Villa Cuizon

i. Fish

- Fried (pinirito)
- Stewed in vinegar, ginger and chili peppers (paksiw)
- Stewed in tamarind or tomatoes or kamias (sinigang or pinangat)
- Fermented with rice (binuro)

ii. Clams

- Stir-fried/sautéed in ginger (ginisa)
- Parboiled then dipped in vinegar, salt, pepper (kinilaw/ginulat)

iii. Crustaceans

- Boiled (pakulo)

iv. Frogs

- Stewed in soy sauce and vinegar (adobo)

D. BATAD, BANAUE, IFUGAO

This upland site is in the same area that is famous for the thousand-years old rice terraces. Assessment was done during the land preparation for the next crop so that no aquatic-based food gathering was observed. Moreover, inclement weather and bad roads prevented the researchers from exploring the entire community. The information gathered was thus based on interviews with local residents and transients passing through the junction at Saddle Point (the gateway to Batad) and in the main village itself. In sites where access was possible, photographs of edible aquatic resources were taken.

a. Species

i. Fishes

No fishes were found inside the fields during the visits. According to residents in the area, the appearance of the golden *kuhol* and the subsequent campaign for its eradication with the use of pesticides greatly affected the populations of local fishes that were found inside the rice fields. Nowadays fish can only be caught by the waterfalls and in the creeks supplying water to the fields; tilapia is the most common.

Considered highly endangered in the area is the dojo fish or *yuyo*, a loach, which was very popular among the Ifugaos. The species was introduced by the Japanese in the early 1900s. Also endangered in the area is the mudfish or *dolog (Ophicephalus striatus)* and the catfish or *partat*.

Efforts to bring back the *yuyo* have been initiated by the local government of Banaue and locals are being encouraged to go back to organic farming and to make the fields more friendly to aquatic life by using less chemical additives.

ii. Mollusks

Only the golden kuhol or *batikul* (*Pomacea canaliculata*) was observed present inside the fields and not very popular among the residents although they are eaten locally. The freshwater horn shells known as *aggudong* or *agkhuyong* are eaten and the shells are ground into powder and used as lime additive (apog) to betel nut chew mixture known as *moma* or *nganga*. According to residents, some species of snails called kulip-po or 'oleppo, pewwet, lawwah and ginga are now extinct.

Teh'am is the generic term for bivalves. Specimens of *sulib* and *tulya* can still be found in the area but are very rare in the fields.

iii. Crustaceans

Freshwater crabs or *el-lema* or *al'lama* can still be caught in the waterfalls but not in the fields.

iv. Amphibians

Bullfrog-raising was introduced in the 1970s as a cottage industry in the area but nowadays bullfrogs are rarely seen. Native field frogs (*tukak* or *tua*) can still be found in the vicinity of the waterfalls.

v. Plants

Seven aquatic plants used as food were documented in Batad. The taro plant (*Colocasia esculenta*), kangkong (*Ipomoea aquatica*), untsoy, ka-in, kit-kitang, runo and watercress. Only the first five species were photographed. Runo and watercress were not in season during the visit.

b. Catching methods and implements

Seven types of catching methods were documented in Batad. Fish and frogs are caught by using fishing poles (*bingwit*) or spear guns (*pana*). Those species that are too small are trapped using basket traps (*bubo*) or nets (*lambat* or *hiju/hichu*). Mudfish and catfish are commonly caught by plunge baskets (*salakab*) or by hand (*ima-ima*). Frogs are also caught by hand.

Although its use is denied by the adults in the community who were interviewed, the practice of electro-fishing was rampant in the area.

c. Cooking/preservation methods in used in Batad

Batad cooking is very simple. The food is either fried (*prito*) or boiled with salt and water with the occasional ginger root (*ipaburek* or *ilambong*) or grilled over charcoal.

SUMMARY

By study site, 15 species of fish were documented in Mabini village. Also found in the area were 2 species of bivalves, 5 species of gastropods, 4 species of crustaceans, 2 species or reptiles, and 4 aquatic plants (3 species used as food and 1 species as handicrafts). In the second site – Talampas village – 8 fish species were observed to be present in the area during the study. Also present are 3 species of mollusks, 4 crustaceans, 1 amphibian and 2 species of plants used as food.

Ten methods of catching aquatic life forms were documented in Mabini while 9 methods were observed in Talampas. In both sites, the pole line or *bingwit* and the use of electrofishing – a destructive form and banned fishing method – were observed. In both villages electrofishing has been declared as illegal but its use remains rampant.

Tilapia was the most abundant and the most commonly caught fish species in the rice fields and irrigation canals in both sites. In Mabini, the *bulig* and the *hito* can be found during pre-harvesting time while draining the fields to facilitate the ripening of the rice grains. This used to be the case in Talampas, but both species are now very rare or totally absent in the area. The same fate befell the *liwalo* or *ayungin*. Locals attribute the loss of the fish species in the fields to the indiscriminate use of pesticides and other chemicals, as well as electrofishing. *Biya* is commonly caught by *bingwit* in Talampas and is very common in the area. This may be due to the proximity of the site to the Angat Dam where the species are abundant. In Mabini, biya can only be caught by electrofishing. Also noted were the problems attributed to introduced invasive species like the armoured catfish or janitor fish, the golden *kuhol* and the *kiwet*. The golden *kuhol* took over the niche being occupied by the native rice field gastropod and almost wiped it out. The janitor fish was introduced as an aquarium fish but it started being a nuisance in the mid-2000s when some fish escaped, bred and invaded waterways, damaging fishing gears as well as net barriers of commercial fish nurseries. As the species is a carnivore it preys on the young of the indigenous species. The *kiwet,* a very tasty fish, is a nuisance because it bores holes in the rice field bunds resulting in loss of leakage of irrigation water and subsequently loss of nutrient. In the highland village of Batad, a species of loach introduced in the early 1900s from Japan, which that had been very popular, has all but vanished because of overfishing but greatly abetted by the application of molluskicides to eradicate the golden apple snail, an invasive species introduced from Taiwan that became a severe rice field pest.

Food preparations using these animal and a few plant species are simple – boiled, grilled, salad and with the suitable seasonings and spices – and mostly similar to the common countryside dishes.

Though extremely limited in geographical scope and duration, the assessment has nonetheless yielded useful baseline information from which management measures could be developed and piloted, preferably in the same sites. A broader national assessment that includes rice areas in the Visayas and Mindanao regions would provide a better basis for a national policy.

CONCLUSION

The study was able to provide a limited but nonetheless useful baseline information regarding species of aquatic flora and fauna used as food in rice-based ecosystems using four pilot sites in two broad types of agro-ecological systems – lowland and highland. Likewise, the study was able to document existing means and methods to obtain this food resource and the way they were utilized by the community. However, there was not enough time to document or confirm the existence of "seasonal" species that have been lost or introduced into the community. Likewise unforeseen factors like the effect of two typhoons that blew across the region and created some impacts on the environments of the study areas had greatly affected the conduct of the study.

RECOMMENDATION

Replicating the assessment in other rice growing areas in the Visayas and Mindanao regions would provide a broader and national-scope basis for a national policy on the management of rice-based ecosystems aimed at conserving or enhancing their biodiversity. Assessments would benefit from a longer time frame (at least 2 seasons) to allow a better description of the people's activity pattern in terms of harvesting or collecting the aquatic organisms and the occurrence – abundance and seasonality – of these organisms.

REFERENCES

Balzer, T., Balzer, P. & Pon, S. 2002. Traditional use and availability of aquatic biodiversity in rice-based ecosystems – I. Kampong Thom Province, Kingdom of Cambodia. Series editors: M. Halwart and D. Bartley, FAO Inland Water Resources and Aquaculture Service. Guest editor: H. Guttman, Mekong River Commission. CD ROM, ISBN 92-5-104820-7. FAO, Rome.

SUGGESTED READINGS

Choulamany, X. 2005. Traditional use and availability of aquatic biodiversity in rice-based ecosystems. III. Xieng Khouang and Houa Phanh provinces, Lao PDR. In Halwart, M., Bartley, D. (eds), S. Funge-Smith (guest ed.). 2005. *Aquatic biodiversity in rice-based ecosystems. Studies and reports from Cambodia, China, Lao People's Deomcratic Republic and Viet Nam*. [CD-ROM]. Rome, FAO. Also available at ftp://ftp.fao.org/fi/cdrom/aqbiodcd20Jul2005/default.htm

Halwart, M. and D. Bartley eds. 2005. *Aquatic biodiversity in rice-based ecosystems. Studies and reports from Cambodia, China, Lao PDR and Viet Nam*. [CD-ROM]. Rome, FAO. Also available at ftp://ftp.fao.org/fi/cdrom/aqbiodcd20Jul2005/default.htm

Luo, A. 2005. Traditional use and availability of aquatic biodiversity in rice-based ecosystems. II. Xishuangbanna, Yunnan province, P.R. China. In Halwart, M., Bartley, D. (eds.), J. Margraf (guest ed.), 2005. *Aquatic biodiversity in rice-based ecosystems. Studies and reports from Cambodia, China, Lao People's Deomcratic Republic and Viet Nam*. [CD-ROM]. Rome, FAO. Also available at ftp://ftp.fao.org/fi/cdrom/aqbiodcd20Jul2005/default.htm

Meusch, E. 2005. Traditional use and availability of aquatic biodiversity in rice-based ecosystems. IV. Lai Chau and Hoa Binh provinces, Viet Nam. In Halwart, M., Bartley, D. (eds.), 2005. *Aquatic biodiversity in rice-based ecosystems. Studies and reports from Cambodia, China, Lao People's Deomcratic Republic and Viet Nam.* [CD-ROM]. Rome, FAO. Also available at ftp://ftp.fao.org/fi/cdrom/aqbiodcd20Jul2005/default.htm

INTEGRATING FINDINGS ON THE VALUE OF AQUATIC ANIMALS AND PLANTS IN RICE-BASED ECOSYSTEMS INTO LOCAL AND NATIONAL POLICY DEVELOPMENT – EXPERIENCES FROM LAO PDR

Nick Innes-Taylor and Chanthaboun Sirimanotham

BACKGROUND AND INTRODUCTION

Lao PDR has rich aquatic biodiversity and the rice fields have become a sanctuary for a diverse set of aquatic organisms. The aquatic resources from rice-based ecosystems have become vital to the Lao people, especially those living in rural rice production areas. An earlier study has been carried out which examined the role and nutritional value of aquatic resources in the diet and livelihoods of rural people. It revealed that the aquatic organisms are a substantial part of the food supply of Lao rural people and provide animal protein and micronutrient resources for consumption in rural households. Thus aquatic resources contribute significantly to the local diet. A household survey conducted on the importance of ricefield fisheries, with the primary objective "to make the invisible fishery visible", suggested that fish and other aquatic organisms caught in rice fields are not only sufficient for human consumption but that the total amount can be sizeable. The preliminary insights gained from the studies indicated the critical importance of rice-based ecosystems as a source of aquatic foods and livelihood. Based on the assessments conducted and follow-up work, MAF is able to compile a comprehensive of database that can be used for further analysis work (MAF and FAO, 2007).

While much has been gained from the studies relating to aquatic biodiversity carried out over the last ten years, there is still an information gap that needs to be filled. There is a need for a more accurate and updated estimate of the yields of fish and aquatic organisms caught in rice-based ecosystems, its consumption/proportion of the Lao diet, and on the area of marketing. There is also a need to build on the existing database that can be used for decision making i.e. policy and strategy formulation, programming and planning processes.

As a follow-up to the previous studies and assessment conducted, the Department of Livestock and Fisheries (MAF/DLF) has been collaborating with the Food and Agriculture Organization

(FAO) of the United Nations to implement a locally driven initiative under the first phase of the Regional Rice Initiative (RRI) Component 1 (focusing on water and rice-fish systems) in 2013. This small pilot project supported selected provinces in Laos to update existing information on the importance and use of aquatic resources by local communities. The project is expected to continue in the second phase of the RRI in 2014 and will have a strong capacity building component and work closely with MAF/DLF to strengthen recent developments in Lao government policy which aim to promote greater ownership of rural development initiatives at the local level.

The main objectives of this project are:

1. Raise awareness of rice farmers about aquatic biodiversity and explore options for its enhancement
2. Validate previously collected information about the importance of rice fields as a source of aquatic organisms (both in terms of species as well as quantity consumed)
3. Conduct market studies to provide current information about price ranges for aquatic organisms at local markets
4. Investigate, document and promote innovative farming systems and improved production practices which enhance biodiversity and result in multiple production
5. Inform policy

To develop local ownership of this pilot project, MAF/DLF and FAO agreed to organize a planning workshop at district level which would facilitate and support district agriculture development officers (DAFO staff) and representatives of local communities to (a) understand the objectives of the project; (b) develop a detailed implementation plan which would be driven by local government staff and community representatives.

Following a period of preparation by MAF/DLF and FAO, the district of Outhoumphone District in Savannakhet province was selected for this pilot project. In October 2013 a Planning Workshop was organized in this district and this report summarizes important aspects of the discussions held during the workshop and the locally owned implementation plan that was developed.

SUPPORTING THE DEVELOPMENT OF A LOCALLY-OWNED WORKPLAN

Venue and participation

The RRI Component 1 planning workshop was held in the meeting room of the District Agriculture and Forestry Office (DAFO) in Outhoumphone District, Savannakhet province. The workshop was organized over a period of one-and-a-half days by Outhoumphone DAFO with support from DLF Vientiane and the Provincial Agriculture and Forestry Office (PAFO) office in Savannakhet. The main objective of the workshop was to develop a locally owned plan for the implementation of the FAO supported project RRI Component 1. A total of 22 people participated in the workshop, six of which were farmer representatives from local rural communities.

The first morning of the workshop was dedicated towards developing an understanding of the RRIR Component 1 pilot project and discussing the relevance to the local context

Linkages with World Food Day

At the beginning of the workshop it was explained that both the provincial and district authorities considered this event to be extremely relevant to their work and appreciated the opportunity to highlight the importance of aquatic resources in the livelihoods of local communities. Local authorities were in the process of finalizing preparations for World Food Day (organized in Savannakhet 18th – 20th October) and the workshop would be an opportunity for both community representatives and local government agricultural development officers to discuss practical ways they could contribute towards the protection and conservation of one of their most valuable food sources – aquatic animals and plants.

Linkage to local concerns about health

The workshop opening remarks and subsequent initial discussions confirmed that a perceived rapid degradation in natural productivity was a serious concern among local communities. Community representatives found the decline in aquatic animal (e.g. crabs, toads and frogs) productivity particularly worrying. They explained that while over exploitation and a destruction of natural habitat was clearly a major cause of this decline, recently introduced methods to intensify rice production (e.g. through the increased use of chemical fertilizers and/or the use of pesticides), were also having an impact, but its extent was less clear. However, both local government and community representatives repeatedly emphasized the broader impacts on human health that pesticides were having and the importance of (a) reducing the use of chemicals and (b) improving awareness and understanding of the use of dangerous chemicals, especially among ethnic communities who have little or no knowledge of the dangers of these chemicals.

Relevant, but not addressing immediate local requirements

As the discussion began to focus on the objectives of the workshop, local government officers and community representatives clearly saw a need to move beyond assigning a "value" to the aquatic resources they see in rapid decline. They were more interested in addressing the pragmatic issue of; "How do we get them back?" or "What can we do now to stop the decline?" From the local perspective, the high value of edible aquatic animals and plants was obvious and the real question they wanted to address was what should be done to mitigate the decline in these resources.

Developing a understanding of the broader context

This was an opportunity for representatives from the Department of Livestock and Fisheries (MAF/DLF) to explain the broader policy context of the workshop and the importance of community representatives, local authorities and central government agencies jointly developing a strategic approach to answering these practical questions. The Department emphasized that finding answers to these questions requires the careful development of long-term solutions which

help local communities themselves find the correct balance between the need for agricultural intensification with the demands for the protection and conservation of the natural environment. Being able to put a value on this resource [edible aquatic animals and plants] was "a first step" in the development of a pragmatic long-term solution to this problem of decline.

Through a facilitated discussion the workshop participants gradually narrowed their focus from one of "How do we get them [edible aquatic animal and plants] back?" to one which started to explore ways in which DAFO and local communities could work together to put a figure on the value of these resources – "When compared with the rice you harvest from your rice fields, how much are the other edible plants, insects, frogs and crabs [etc.] worth?".

Inviting the participants to consider the broader implications of this workshop in terms of policy development, the participants were reminded of the national policy framework (Resolution #9) which establishes an ambitious target to improve the average consumption of meat to 53kg/person/year by 2020. Aquatic resources are expected to contribute approximately 40% to this target and it is important to better understand what is being consumed now. By developing an action plan for RRI Component 1 which would assign a value (in the local currency Kip) to the aquatic animals and plants currently being consumed by local communities, Outhoumphone District would make a valuable contribution towards better understanding the context in which these targets should be pursued.

Developing an understanding of the wider policy objectives was important

▲ *Clearly documenting agreements reached during the workshop as the discussion progressed, was an important part of MAF/DLF facilitation*

Supporting the government's policy to decentralize responsibility for development

Discussing the broader policy context of the workshop, participants also considered the methodological approach adopted by the Department in organizing this event. With the support of FAO, MAF/DLF has the opportunity to test and develop new approaches to local consultation and project development which support the principles of the government's Sam Sang policy. It concerns the devolution of responsibility and authority for rural development to the local level and emphasizes the importance of developing the coordination capacity of local government authorities and local communities. While in the past, collaborative projects with Development Partners such as FAO would largely be formulated at central level (with local consultation), central-level government agencies are now looking for better ways to formulate development projects in which local communities and local authorities (e.g. DAFO) take a much greater role in the design process. This workshop was an opportunity for MAF/DLF to work with local authorities in Savannakhet to develop these new approaches and in this workshop MAF/DLF aims to develop a workplan for the RRI Component 1 project which not only responds to the needs of local stakeholders, but is designed and drafted by them also.

Important to the local economy

The opening discussions during the workshop also highlighted the special features of Outhoumphone District as an important location in the developing East-West corridor transit route between Thailand and the coastal ports of Viet Nam. The Head of DAFO noted how Laos has been exporting significant quantities of its edible aquatic resources (e.g. frogs, snails, fish etc.) to both Thailand and Viet Nam. He explained that the fact that these resources are now in rapid decline, is a serious problem and urged both the government officers and representatives from local communities to explore ways of restoring natural productivity. He encouraged the meeting participants to freely express their views and develop some concrete suggestions for what can be done in practice.

THE AGREED WORKPLAN FOR RRI COMPONENT 1

To facilitate the discussions on the development of a collaborative workplan, MAF/DLF workshop facilitators classified the issues raised during the initial discussions into four *thematic areas*:

- Activities which **demonstrate the importance of edible aquatic animals and plants** (in rice fields and ponds) to the livelihoods of local rural communities
- Activities which collect detailed information of the **monetary value of edible aquatic animals and plants** consumed by local communities
- Activities which **document local farming systems** considered as examples or models (local success stories) of how the intensification of agricultural production can be balanced with the protection and conservation of the natural environment
- Activities which aim to **influence policy dialogue** (at both central and local levels) and communicate the results and conclusions of studies conducted under the RRI Component 1 workplan

Agreements on the activities that would jointly be undertaken are summarized in the table below together with notes on the reasoning behind some of the decision taken and how activities will contribute towards other projects and programs of MAF.

THEMATIC AREA	ACTIVITY NAME	ACTIVITY DESCRIPTION	SCHEDULING	WORKSHOP COMMENTS/NOTES
DEMONSTRATING THE IMPORTANCE OF EDIBLE AQUATIC ANIMALS AND PLANTS	Camera video capture training by SKU	Students and staff from Savannakhet University (SKU) will organize a short one-day training workshop for DAFO (2 staff) and PAFO (1 staff) in simple video capture techniques using digital cameras or mobile phones. The digital equipment will be provided by DAFO staff (their own personal equipment) and the training event will be run/ facilitated by SKU as a "professional learning workshop" and will include assisting DAFO staff to produce (on DAFO computers) short video clips (using standard windows video editing software).	During the period 25th – 27th Oct	This training provides PAFO/DAFO staff with some of the basic capacity required to capture Most Significant Change (MSC) stories using the video features on locally available cameras and mobile telephones. The popularity of using the MSC approach to improve M&E capacity especially at the local level, is increasing in Laos. Using video to collect MSC stories leverages off the recent rapid expansion of mobile networks and the availability of cheap electronic equipment from China.
	Recording short video clips about importance	Following training in video capture by SKU, DAFO/PAFO staff will visit at least three local farming families to collect video clips which relate significant stories about the importance of aquatic resources. Community members interviewed by local government officers should include both men and women (approximately 50/50) and the final edited video clips of recorded stories should not exceed 3min each in length.	During the period 25th – 27th Oct	Although there was insufficient time during the workshop to explore details of the Most Significant Change (MSC) approach to monitoring and evaluation (M&E), the workshop participants quickly saw the value in using a "story-based" approach as the most pragmatic way of collecting data of this type within the short period of time available for the implementation of the RRI Component 1 project. The workshop was an opportunity for community representatives and local agricultural development staff to intuitively explore the possibilities of using this technique and under this activity they will have the opportunity to experiment with the approach in the field.
DETERMINING THE MONETARY VALUE OF EDIBLE AQUATIC ANIMALS AND PLANTS	Design farmer record books and district market surveys	DAFO organize a one–day meeting to (a) design a farmer record book for recording quantity and (village-level) market value of aquatic foods eaten by 6 farming families over 7 days; and (b) an outline of the scope of a survey of edible aquatic animals and plants sold in the local District market.	15th Oct	The possibility of farmers collecting data on the value of edible aquatic plants and animals was suggested by local community representatives and represents a very tangible contribution which can be made to this project by this group of stakeholders. The participation of Savannakhet University will strengthen other developing collaboration between MAF/ DLF and SKU to develop professional education for poverty reduction.
	Collect farmer record book and district market data	Collect and summarize data on edible aquatic animals and plants collected using farmer record books and data collected from DAFO visits to local District market.	16th Oct – 26th Oct	DAFO staff will take responsibility for ensuring the information is collected once record sheets have been completed.
	Summarize and analyze farmer record book and district market data	Summarize and tabulate data collected on the value of edible aquatic animals and plants (from farmer record books and District market surveys). Prepare for presentation of summary data at DAFO data review workshop (5th Nov).	27th Oct – 4th Nov	DAFO staff (with backstopping support from PAFO and MAF/DLF) will summarize this data and prepare presentations for the DAFO Data Review Workshop (5th Nov).
	DAFO data review workshop	A workshop organized by DAFO in Outhoumphone District to present summaries of the data collected on monetary value (at both community and district market level) as well as a first screening of the short "video stories" produced by DAFO staff and local community representatives (with the assistance of SKU) on the importance of edible aquatic animals and plants to the livelihoods of local communities.	5th Nov	Workshop to be organized by DAFO with PAFO and MAF/DLF support.

THEMATIC AREA	ACTIVITY NAME	ACTIVITY DESCRIPTION	SCHEDULING	WORKSHOP COMMENTS/NOTES
DOCUMENTING LOCAL FARMING SYSTEMS	Record examples of local eco-friendly farming systems	Using the techniques developed with SKU, DAFO staff will interview selected local farmers to document (using video and text) examples of local aquatic farming systems which while being profitable, protect and conserve the natural environment.		Depending on the availability of DAFO staff and local farmers, this activity will be undertaken in parallel with the collection of "stories" from local farming families about the importance of edible aquatic animals and plants to their livelihoods. The aim of this activity is to identify and record the details of at least one aquatic farming system (e.g. fish in rice system) which is not only eco-friendly, but represents a practical approach to farming which could be promoted and disseminated to improve the current situation in this district.
INFLUENCE POLICY DIALOGUE	Community-level policy discussions	Community representatives participating in the workshop will identify opportunities in their local communities for disseminating information on the importance of aquatic resources to local livelihoods and explore ways in which this issue can be more effectively integrated into community level policy dialogue. The opportunities they have identified and the steps taken at the community level will be summarized and reported in the DAFO data review workshop (Nov 5th).		The specific details of the community-level action that would be undertaken could not be identified during the workshop. The community representatives required tike to consult with their local communities and with them explore the options available. They were uncomfortable to commit to specific actions that they may not be able to implement. This component of the workplan will be reviewed during the Nov 5th workshop and possible follow-up action will be .
	FAO national workshop	Participate in a national workshop being jointly organized by MAF and FAO. Support participation for local stakeholder groups and prepare summaries of information and conclusions reached through the implementation of RRI Component 1 pilot project in Savannakhet.	End of Nov 13	
BACKSTOPPING SUPPORT	PAFO provincial coordination and backstopping	On a demand-driven basis and in accordance with the agreed workplan for RRI Component 1, provide support and assistance to DAFO and community representatives in collaboration with MAF/DLF.	14th Oct to End Nov 13	
	DLF central coordination and backstopping	On a demand-driven basis and in accordance with the agreed workplan for RRI Component 1, work with PAFO to provide support and assistance to DAFO and community representatives to implement activities in this workplan.	14th Oct to End Nov 13	

▲ *Clearly documenting agreements reached during the workshop as the discussion progressed, was an important part of MAF/DLF facilitation*

SUPPORTING DLF WORKSHOP PLANNING

An investment in planning and preparation

In October 2013 a planning workshop was organized for RRI Component 1 at the District Agriculture and Forestry Office (DAFO) in Outhoumphone District, Savannakhet province. The workshop developed a locally owned plan for the implementation of this project which focused on collecting local data on the importance and value of edible aquatic resources to local communities (see previous section). To interpret data collected during this project, the workplan included a Data Review workshop. Facilitating local government staff and community representatives to take an active role in the Data Review Workshop and lead the process of data analysis, was seen as central to developing local ownership of the study.

From previous collaboration with FAO, MAF/DLF understand that developing this ownership is the key to influencing local policy. It was therefore important for the Department to make careful preparations for the Data Review Workshop in which central and provincial level DLF staff effectively facilitate and *not* lead the process.

The importance of ensuring PAFO participation

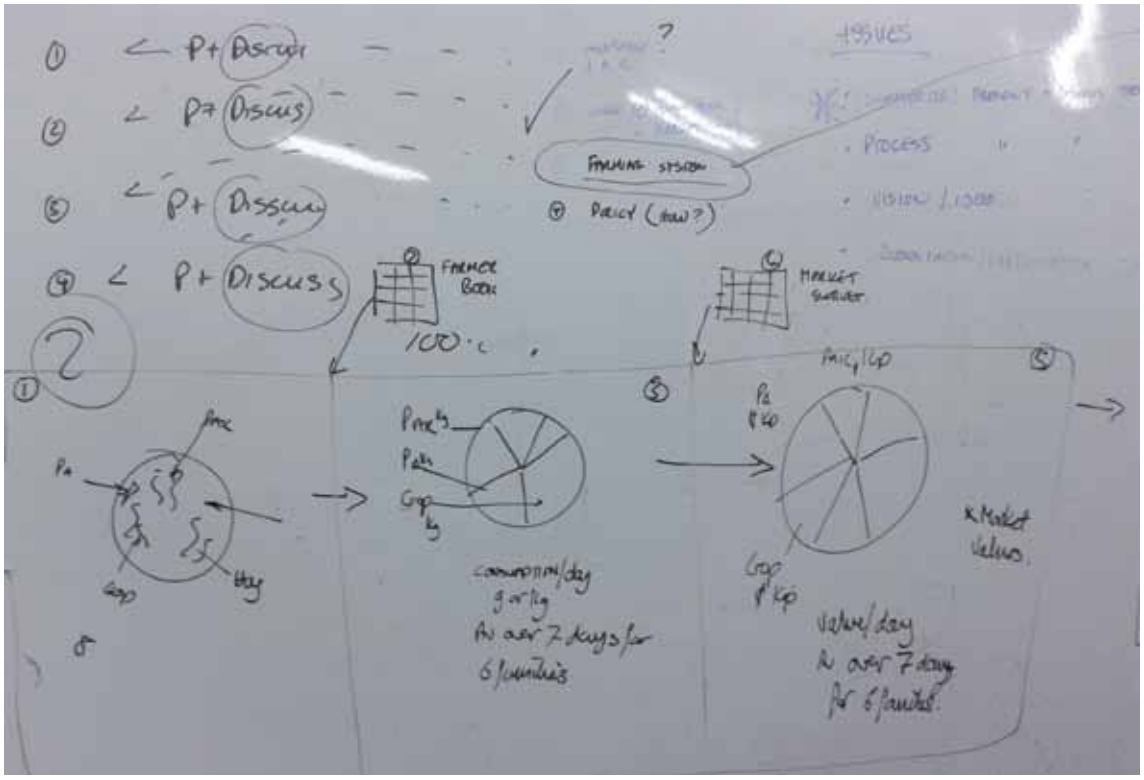
Ensuring that PAFO staff actively participate in the planning and preparation of the Data Review workshop is an important element of the improved model of project implementation which MAF/DLF aims to pilot under RRI Component 1. Until recently, planning and preparation for these types of events has largely been undertaken at central level and local contribution has largely been confined to logistical issues such as arrangements for transport, meeting rooms

and invitations. However, new government policy places an increased emphasis on central-level agencies such as MAF/DLF playing a supportive (backstopping) role which develops an increased local ownership of development initiatives. Relocating the planning and preparation of this event to the provincial level and supporting PAFO staff contribution to this process, represents a practical way in which MAF/DLF is contributing to government decentralization policies through the implementation of this project. This "shift" in responsibility for research planning represents an important change in MAF/DLF standard implementation procedure and lays the foundation for the future development of more locally owned collaboration with the Department's international development partners.

Identifying the objectives and outputs of the workshop

Following a clarification of the RRI project and the activities which had already been undertaken, planning for the District Data Review Workshop began with a discussion of the objectives of this event. It was agreed that the workshop should aim to deliver the following outputs:

- Present in an easily understandable format data collected by Outhoumphone DAFO staff and community representatives on the importance and value of edible aquatic resources (in accordance with the agreed RRI Component 1 workplan developed during the District Planning Workshop 9th-10th Oct 13). Provide an opportunity for the participants to discuss and interpret this data and reach a consensus on its importance and suggestions for further action. The presentation and subsequent discussion of this data is the main task to be undertaken during the workshop.
- Summarize agreements and conclusions concerning the most appropriate process for the implementation of this type of project. MAF/DLF collaboration with FAO under the RRI Component has provided an important opportunity for government agencies at central and local levels to experiment with alternative approaches to the implementation of collaborative research projects in aquatic resource management and it is important to ensure the key lessons learned from this collaboration are discussed and documented. During the discussions with PAFO staff MAF/DLF emphasized the importance of model development in order to align FAO collaboration with new government policies of decentralization. Under the new "Sam Sang" policy, provincial authorities have a greater role to play in establishing development strategy and districts have a greater responsibility for coordination and technical support of development projects which are directly managed and implemented by local communities.
- The third expected output of the workshop concerned the joint development of an agreed future vision and strategy for a continuation and expansion of this work on aquatic resources. The possibility for securing funding for a further phase of collaboration with FAO has already been discussed as central level and it was considered important that this workshop provide an opportunity for local communities and authorities to provide inputs on the type of projects they would like to see.



▲ *Planning short power point presentations to effectively communicate key concepts was an important part of the discussion*

The workshop should also provide an opportunity to discuss plans and priorities for contribution to and participation in the planned MAF/FAO National Workshop scheduled for the end of November 2013 (28th – 29th Nov 13). Workshop participants will discuss the details of what should be presented at this meeting, who will represent the Component 1 project and the desired outputs of the event.

Further confirmation of relevance

The discussions with PAFO staff during the planning meeting again highlighted the relevance and importance of the project. Senior PAFO staff emphasized the decline in the quality of the natural aquatic environment and how this was having a major impact on the livelihoods of local communities, especially the rural poor. While they recognized that the province already has considerable data on the quantity and importance of this resource which has been collected by many projects over a period of more than 10 years, it is only relatively recently that the decline of the natural environment and in particular aquatic resources, has become a "hot issue" - an issue which local policy makers and local government development strategies are keen to address.

▲ *MAF/DLF staff preparing summaries of data collected by local communities*

PAFO needs a trusted partner to amplify local voices

However, to incorporate issues of sustainable aquatic resource management and conservation into local policies and development strategies, PAFO staff highlighted the importance of having a locally credible source of reference for the estimated value of this resource. PAFO staff explained that in this respect, they see the collaboration with FAO as very appropriate. They explained that in general, UN agencies are seen by the government as "trusted partners" and FAO is recognized as a respected source of information by local government agencies concerned with developing food security.

PAFO staff anticipates that the collaboration between MAF/DLF and FAO under RRI Component 1 will therefore provide legitimacy to "local voices" on the decline and importance of these resources. With this "tool", they will be significantly better equipped to address the decline in aquatic resources at a time when there is renewed interest among local policy makers in practical ways of "rejuvenating" the natural environment.

SUPPORTING A LOCAL PROCESS OF DATA REVIEW AND INTERPRETATION

A Data Review workshop organized by DAFO

Following detailed planning described in the last section, MAF/DLF supported staff from the Provincial Agriculture and Forestry Office – Livestock and Fisheries Section (PAFO/LFS) and the District Agriculture and Forestry Office (DAFO) in Outhoumphone District to organize the planned Data Review Workshop.

A summary of the conclusions and agreements reached at this workshop are presented below. Many of these were later presented at the National workshop in Vientiane at the end of November 2013 by representatives from DAFO, PAFO and local communities.

Agreements on video production for National Workshop

After reviewing two video clips prepared by DAFO and Savannakhet University (SKU), the participants agreed that the two clips should be combined into one short video for presentation at the MAF/FAO RRI National Workshop.

Workshop agreements were as follows:

- Two draft videos produced by DAFO and Savannakhet University (SKU) should be consolidated into one version
- The final product should be kept short (more appropriate for "policy makers") and not exceed 4 min
- The final video should include English language subtitles so that it can be used to communicate the importance of this issue to an international audience.
- It should include both (two) farmers who are featured in the draft videos giving their opinions
- It should include still pictures which emphasize the variety of the resources and its importance as food for many rural Lao people.

Following these agreements, a final version of this video was produced by MAF/DLF with backstopping support from FAO. The video was presented at the RRI National Workshop (28th and 29th Nov 2013) and a copy uploaded to YouTube.

This may be viewed at: www.youtube.com/watch?v=Il5x5YvSjWk

One of the major tasks undertaken by the participants during the Data Review workshop was to review and interpret consumption data collected by six farming families over a period of seven days. The data were presented to the participants by DLF and DAFO staff (as prepared during the planning meetings), together with a summary of data collected from local markets on the monetary value of the plants and animals consumed.

It was agreed that the data confirms importance of this resource and validates data already available at national level.

Workshop participants discussing video editing

A copy of the MAF/DLF video posted on YouTube

A summary of the analysis of this data prepared by DLF (with FAO backstopping support) is shown below.

FIGURE 1. ONE FAMILY CONSUMES ABOUT 10.5 KG OF FISH, AND OTHER AQUATIC ANIMALS (E.G. SNAILS, CRABS, INSECTS) AND AQUATIC PLANTS IN ONE WEEK

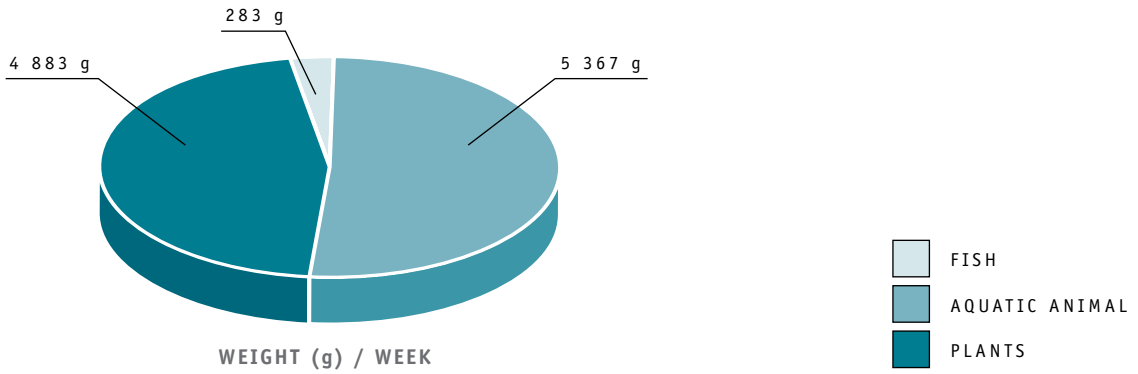


FIGURE 2. HIGH VARIABILITY WITH SOME FAMILIES CONSUMING NEARLY 3 KG PER DAY

Other aquatic animals such as frogs, snails, crabs and insects are as important as fish

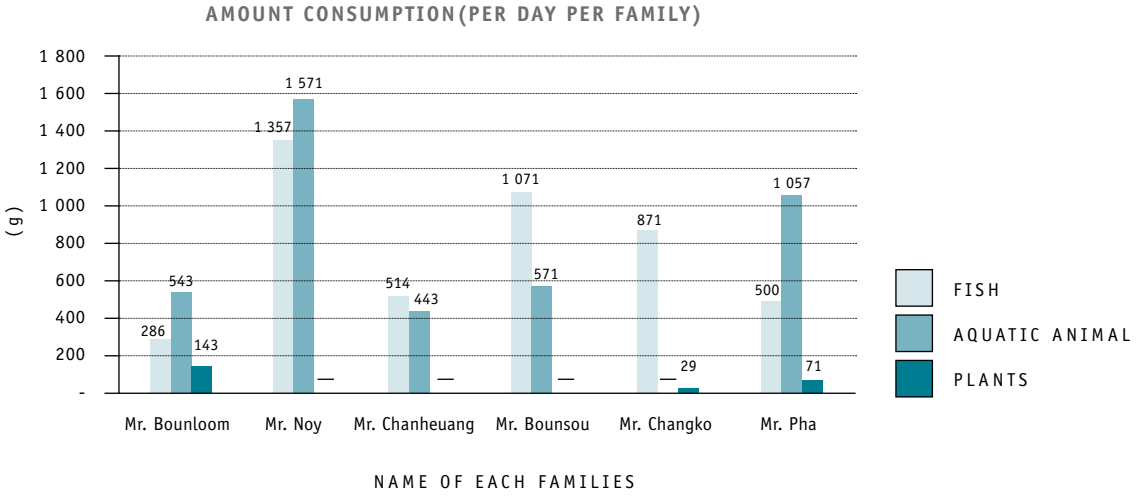


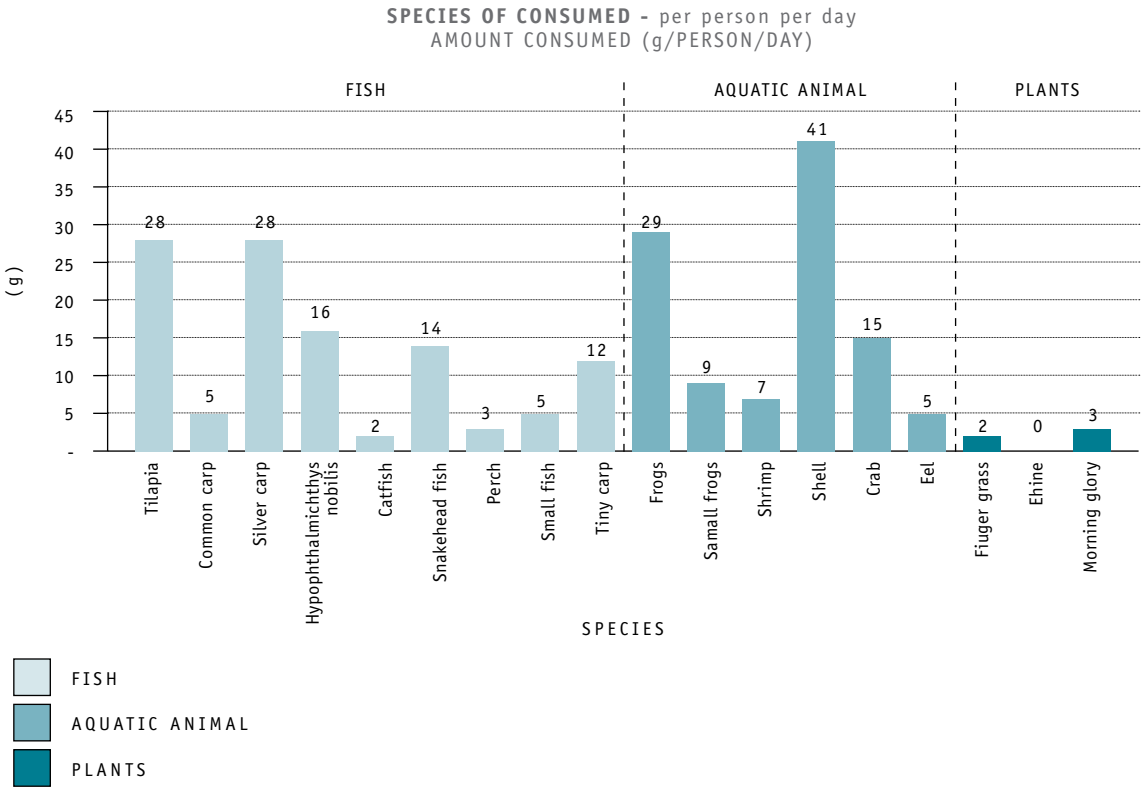
TABLE 1. THIS SMALL SURVEY REVEALS THAT EACH PERSON IS CONSUMING AN AVERAGE OF JUST OVER US$1.0 WORTH OF AQUATIC RESOURCES PER DAY (ABOUT 10,000 KIP WORTH PER DAY).

This is roughly double the value of the rice each person consumes per day in Laos

No	HH	DAILY CONSUMPTION (g)	VALUE/HH (Kip)	VALUE/PERSON (Kip)
1	Mr. Bounloom (10 people)	972	27 071	2 707
2	Mr. Noy (04 people)	2 928	118 929	29 732
3	Mr. Chanheuang (08 people)	957	26 500	3 313
4	Mr. Bounsou (06 people)	1 642	50 357	8 393
5	Mr. Changko (02 people)	900	22 500	11 250
6	Mr. Pha (10 people)	1 628	47 286	4 729

FIGURE 3. FAMILIES CONSUMED A WIDE RANGE OF AQUATIC PRODUCTS

Snails and frogs are important, especially for the poorer communities



Additional considerations highlighted by participants

In addition to the above summaries, the participants thought it important to highlight the following issues related to the consumption of aquatic resources in rice-based farming systems:

- Insects are more important in the diet of rural people during the rainy season. There is a higher volume of insects during the rainy season that are associated with rice-based farming systems. The price of insects in the rainy season is low and there is a large variability in the value of these insects.
- Toads (Eung) are not included in the survey data. These represent an important source of food for many rural communities, but during the time when the date was collected, toads were not available (in season).
- Another important rice-based farming system food consumed is small frogs/toads (tadpoles) which are collected during the rainy season. Luk Ot or small toads, are an important source of food.
- Although the amount of vegetables consumed is small, rural communities in this area eat a large amount of fresh green vegetables which they source from vegetable plots near their house. As this is food not sourced from rice fields or associated ponds, this was not included in the household consumption data.

COMMUNITY SUGGESTIONS FOR FURTHER ACTION

The final session of the Data Review workshop discussed possible future follow-up action that could be taken to mitigate the clear decline in local aquatic biodiversity and a destruction of the natural ecology of rice-based farming systems.

The representatives from local communities and government agencies proposed the following Action Areas:

Reduce the use of chemicals use in local agriculture

- The widespread use of chemicals in sugar cane fields is currently seen to be one of the biggest threats to the local aquatic environment and the preservation of local “natural” ecology. Mainly used by large agribusiness companies and very little control or regulation over what they use
- There is a need to reduce the use of agricultural chemicals generally
- The use has a clear impact on insects which are an important source of food for many local rural families
- Efforts should be made to promote the production and use of organic fertilizers and reduce the rapid increasing use (and dependency) on inorganic fertilizers

Develop public awareness on the need to protect and conserve aquatic resources in rice-based systems

- Opportunities for including awareness raising on this issue into school curriculum should be explored. Recognized that influencing local school teaching methods and curricula is not easy, but this needs to be addressed for the longer-term resolution of these problems
- Using any types of media should be investigated (e.g. TV, radio and posters)
- One way of spreading messages to build awareness would be to build local farmer/community "experts" who could easily provide local training and advice. It is important to develop local capacity in this area to sustain an awareness campaign

Promote methods of breeding/propagating edible aquatic animals and plants

- Not just strategies to breed fish. Also need to promote local production and sale of other aquatic animals such as frogs, eels etc.
- In-line with local government extension policy, explore ways in which farmer groups can be established to produce "seed" (animals and plants) to restore and develop natural habitats
- Need to be careful about the introduction of exotic species as much of the current seed production technologies promote exotic species. Native species also have a value and could be promoted as high value organic products

Establish conservation and protection areas

- Not only conserve existing "wild/natural" area, but also work with communities to establish new areas
- Possibility to introduce the wild area habitat development into individual village plans and assign responsibility to village heads. Annual competition for wild habitat creation could be launched

Improve regulations for protection and conservation

- Opportunity to improve existing village regulations in both villages which have good natural habitat and also in villages which do not
- There could be regulations/guidelines which encourage and support villages without productive natural (rice-based) habitat to create new areas with the participation of local farmers
- An incentives scheme should be developed to encourage communities to create and manage (on a long-term basis) rice-based natural habitats which would enhance community harvesting of wild edible aquatic animals and plants

Community capacity building in aquatic animal protection and conservation

Organize a series of events which put in place the local expertise and skills to systematically provide training for local communities in aquatic animal and plant protection and conservation

Support local organizations and institutions to develop schemes which will build widespread public understanding of the key concepts

NOT to focus on a few farmer groups, but target the wider community. Build general awareness and understanding among larger groups of the community

LOCAL PRACTICES TO ENHANCE PRODUCTION OF AQUATIC ORGANISMS

Innovative local practices exist

Discussions between local farmer representatives and local government agricultural extension workers clearly demonstrated there were many local farmers experimenting with approaches to augment or enhance the natural production of edible aquatic animals and plants.

Artificial fish breeding techniques have been practiced by local farmers since the mid-1990's and this knowledge together with the wider availability of fish seed (mainly from Thailand and Viet Nam), has had a significant impact on increasing productivity of the aquatic environment.

But from the workshop discussions, it was clear local farmers are now searching for additional approaches to augmenting the natural aquatic production and there was much interest in local farmers who have started to experiment with the culture of native frogs and catfish.

A local farmer with his new experimental frog culture system constructed next to his rice fields

▲ *Some farmers are experimenting with the use of small cages in their rice fields as ways to enhance the natural production of aquatic animals.*

Many of these farmers were reported as having received advice from their relatives or children living in other parts of Laos (e.g. Vientiane) and in some cases had received cash contributions to the establishment of an experimental new culture system. Some examples of these systems described by farmers during the workshop included the construction of simple concrete shallow tanks next to rice fields in which native frogs were "fattened" using fish pellets or provided with a suitable environment in which they would breed. Intensive catfish culture was also being experimented with in these concrete tanks. The intensification of the systems varied from farmer to farmer, but the general approach was one of augmenting the existing natural ricefield environment through controlled "fattening" or protected breeding.

The investment needed for these special [concrete] habitats was not beyond the means of many farmers, but it seemed that many farmers considered the potential risk quite high as the culture techniques (e.g. how much feed to give, how to promote breeding etc.) are not widely known.

The potential for government agricultural extension services to support these farmers with the provision of appropriate technical advice was discussed. There already exists a number of useful documents (in Lao and Thai), but there are little or no funds available for district government officers to copy these materials or distribute them to local farmers.

The workshop discussions also revealed that local farmers are experimenting with the use of small cages in rice fields to enhance local aquatic habitats. The cages are being used to culture both frogs and fish, but generally the animals are only confined to these environments for part of their life (e.g. for a fattening or breeding period).

The recent increased availability of cheap black plastic netting (which does not foul as quickly as the blue netting with smaller holes), has promoted the development of this innovation. It is a less cash intensive option than the construction of concrete tanks, but at the same time makes the animals very easy to steal (e.g. if the cages are left unattended over night).

Promoting a farmer-to farmer extension approach

The workshop participants concluded that there is considerable potential to spread proven examples of this type of innovation. Relevant extension materials already exist and there are many examples of local farmers already experimenting with a range of innovative techniques to enhance aquatic habitats.

What is most needed now is to distribute and communicate this information and experience to a wider sector of the local community. It was agreed that at a local government facilitated farmer-to-farmer extension approach would be most appropriate mechanism to do this. However, additional financial support for this extension approach would need to be secured, if the district is to make a significant impact on the rapid decline in the aquatic resource currently being witnessed by local communities.

REFERENCES

MAF and FAO. 2007. *Aquatic biodiversity and human nutrition – the contribution of rice-based ecosystems*. Ministry of Agriculture and Forestry, Lao PDR and Food and Agriculture Organization of the United Nations, Rome, Italy.

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AQUATIC BIODIVERSITY IN RICE-BASED ECOSYSTEMS
STUDIES AND REPORTS FROM INDONESIA, LAO PDR AND THE PHILIPPINES

Aquatic resources derived from rice fields and associated environments often contribute a large share of the animal protein and other nutrient intake of poor households, particularly in Southeast Asia. However, the importance of these aquatic resources in the food security of rural households is generally underestimated and undervalued because the local consumption or marketing usually prevents this production from entering official national statistics. This in turn means that policies and resource allocation decisions cannot adequately take into account the important ecosystem services provided by the rice-associated aquatic biodiversity. To address this, studies on the availability and use of aquatic organisms in rice-based ecosystems as well as on the tradition and current practices of rice-fish farming have been conducted in Cambodia, China, Lao PDR and Viet Nam since 2001. In 2013, the approach was extended to Indonesia and the Philippines, and validated in Lao PDR, within the framework of the FAO Asia Regional Rice Initiative. Further, a small pilot project in Lao PDR developed improved methodologies for integrating work on the valuation of aquatic resources into local policy development processes.

The full version of the studies, including more detailed tabulated information on the aquatic species, their use and tools to catch and collect them, is being published as an update of the CD ROM on Aquatic Biodiversity in Rice-based Ecosystems published by FAO in 2005 (ISBN 92-5-105363-4).




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