Traditional use and availability of aquatic biodiversity in rice-baased ecosystems

IV. Lai Chau and Hoa Binh provinces, Viet Nam [1]

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INTRODUCTION

The provinces of Hoa Binh, Son La and Lai Chau in northwestern Viet Nam are known for their long history of rice-fish culture. It has been noted that rice-fish farming is a traditional practice particularly for the ethnic Thai minority groups in the uplands of Viet Nam. Rice-fish culture remains popular with farmers and various rice-fish technologies have been promoted in many parts of the country (Cong et al. undated).

There is a growing understanding of aquaculture development that production technologies alone may not be the best way to reach the rural poor. Farmers' livelihoods are often very complex and use many types of aquatic resources as a way to spread risks and reduce vulnerability (FAO-NACA, 2002). A complementary study conducted as part of the "Aquaculture Development in Northern Uplands" Project[2] (hereafter referred to as "the Project") investigated and documented traditional and current practices related to aquatic resources management in rice production systems in northwestern Viet Nam (see Meusch, this volume). This study showed that there is a robust mixture of traditional and introduced aquaculture practices taking place in the area, and that small-scale household fishery remains of some importance in many areas as well. Village level activities have shown there are numerous aquatic organisms, both plant and animal, that people see as "important" in their livelihood. These include the direct products of culture-based systems, by-products of culture based systems, as well as organisms taken from the wild. Central to much of this aquatic production, both capture and culture, is the aquatic environment of the rice-based production system.

However, the important role of aquatic organisms in rice-based systems for rural livelihoods is often overlooked because their availability and use are only known locally and remain undocumented. Therefore, the main objective of this study was to collect and document information on living aquatic recourses availability and use in rice-based production systems. This includes the primary products such as aquaculture species, but also the lesser-known products that are often of importance in rural livelihoods.

RICEFIELD FISHERIES IN NORTHWESTERN VIET NAM

Northwestern Viet Nam is a mountainous region characterized by steep slopes and narrow, winding valleys that follow swift running streams. The region is associated with three major river systems, the Mekong, the Song Ma and the Red. Much of the agriculture production is of various upland crops planted on the steep hillsides. The valleys along the rivers, however, open up into broad, flat plains where paddy rice cultivation is practiced. There is some degree of terracing higher in the valleys to extend rice cultivation areas as far up the mountains as possible.

Most of the rain in the area comes from May to October. Because of an abundance of water from the rivers and mountain streams, however, most of the valleys are irrigated for the production of two crops of rice. The first crop is grown with irrigation from March to June, and the second crop is grown during the rainy season from July to October.

Over the past several decades there has been a trend to intensify agricultural production, including rice. This was originally done through production cooperatives, but in the mid-1980s the management of agricultural land was devolved to the household level. Because only a limited amount of production land is available to each household, obtaining and maintaining high productivity is essential. Most rural households have integrated systems that include rice, vegetables, fruit trees, livestock, and a fish pond all in close proximity to each other. In many cases, a small aquatic garden is kept near the rice fields and pond where various aquatic vegetables are grown.

There is a rich diversity of aquatic fauna in the area, and fish have been historically abundant. In recent decades, however, most of the fish species have been greatly reduced and farmers rely heavily on aquaculture for fish. The culture of fish is popular in both ponds and rice fields, and is regarded as

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[2] The UNDP supported and nationally executed "Aquaculture Development in Northern Uplands" Project, VIE/98/009/01/NEX (hereafter referred to as "the Project") aimed at poverty alleviation through building local capacity based on community participation to enable poor and remote ethnic minority groups to develop various forms of aquaculture in northwestern part of Viet Nam (UNDP, 1998). Rice-fish culture had been identified as one of the major technical focus areas of the Project.

high in importance as other types of livestock. Household-level fishing nowadays is regarded of relatively low importance but still routinely practiced. Many of the species targeted in household-level fishing activities are favoured and still considered important to livelihoods (Meusch, this volume)

Although the agricultural production system has steadily been intensified, there are still many traditional elements remaining. One of the most noteworthy is the overall integrated nature of the system. Ponds are often located near rice fields and the culture of fish often integrates both systems. Because of this arrangement, many traditional ricefield organisms have become common and valued by-products of pond culture (Meusch, this volume)., In the case of this study, the term “ricefield fishery" refers to aquatic resources management in rice-based production systems. This includes both capture and culture of aquatic organisms in both rice fields and other adjacent water bodies such as ponds or ditches.

MATERIALS AND METHODS

This study was conducted during a three week period from 17 August to 7 September 2002. The activities were linked to and draw heavily from the “Study on Rice-Fish Farming Tradition and Current Practices in Northwestern Viet Nam” that was carried out in the project area from January to August 2002 (hereafter referred to as the Study on Traditional Practices – see Meusch, this volume).

Rice based production systems are often very diverse in terms of biodiversity represented.

SITE SELECTION

Two study sites were selected based on the results of the Study on Traditional Practices and discussions with Project Management, Tuan Giao District in Lai Chau Province and Mai Chau District in Hoa Binh Province. Criteria for site selection included:

- Areas where village-level inquiry activities had been conducted as part of the Study on Traditional Practices to provide an overview of aquatic resources and household fishing.
- Areas outside Son La province. The villages in Son La had been visited repeatedly during the 3rd and 4th missions, and were possibly over-burdened by the amount of time they were contributing to the activities of the study.
- Areas within the same major river system. Because the project area straddles 3 major river systems (the Mekong, Song Ma, and Red rivers), there is a very complex assemblage of aquatic fauna. By selecting one system it was hoped that problems involving subtle differences between species and confusion between common names could be minimized. The diversity involved with the differences between watersheds is important, but beyond the scope and means of this initial study.

The two areas selected included villages where previously information had been collected, and are located in the watershed of the Song Ma River.

METHODS USED

Activities conducted during this study included:

- Review information collected during participatory assessment activities conducted as part of the Study on Traditional Practices;
- Interview key informants concerning ricefield aquatic resources availability and use, preference, seasonality, harvest methods, etc.;
- Collect samples of aquatic organisms encountered. Samples were photographed and preserved (no plants were preserved) for further identification. Conduct walks in the rice fields to view examples and demonstrations of harvest methods and fishing gears used.
- Analysis and compilation of information.

Key informants were asked to locate as many examples of biodiversity and its use as possible, and then interviews were conducted over the examples. This sequence of work greatly improved the information provided during the interviews, because it helped eliminate confusion caused by local names.

Participatory assessment activities

As part of the Study on Traditional Practices, detailed village-level participatory assessment activities were conducted to provide an overview of local livelihoods and the role of aquatic resources. These activities included inquiry into the following:

- physical setting;
- village history;
- economic and non-economic activities;
- inventory of aquatic resources, including prioritization;
- historical trends, including aquatic resource use;
- annual cycles (seasonality) of production activities including aquatic resources production.

The results of these activities provided an overview of the importance of aquatic resources in livelihoods, a clearer understanding of typical household fishing activities conducted in the study area, and an inventory of aquatic organisms being used. Because ricefield-based production is a subset of the overall aquatic production, the information from the participatory assessment activities provided a framework for further investigation of aquatic resources in ricefield environments.

Participatory activities allowed villagers to share their knowledge on aquatic resources

Interviews

Key informants were identified through consultation with the Project's Commune Action Groups. These informants were farmers who were locally known to be knowledgeable about aquatic resources. The informants were typically older men, and represented farmers collaborating with the Project, as well as those who were not.

Interviews initially investigated the range of aquatic resources used, their availability (in terms of seasonality and abundance) and the local preferences in terms of use. Gear types were also discussed and, when possible, examples were viewed.

Species collection

Specimens of those species used from rice based productions systems were gathered and either preserved for future reference or recorded by photograph when possible. This was important in the study area because inconsistent local names in minority languages often caused confusion. . Specimens were collected in four ways:

- Collected during rice field tours. Fish and other aquatic animals were collected using various nets, mollusks were collected by hand, and plants were collected and observed while walking through rice fields with key informants.
- Collected by informants. In the later part of the study, key informants were asked to gather examples of ricefield organisms prior to a scheduled appointment, to be used as examples during the interviews.
- Collected at the local market. Species that were mentioned in interviews, but no specimens found, were sometimes seen in the local market. Local markets were surveyed to assess the amount and value of ricefield production being traded.
- Collected and prepared by local area project staff. Prior to conducting field activities, guidelines for collecting samples were circulated to field staff in each province. This was done out of recognition of the fact that time for actual sampling was quite limited (3 weeks), and advance preparation would be helpful. Such sampling was conducted in Tuan Giao district, Lai Chau province, and the samples were reviewed during the field work in that area and included in the overall collection.

A demonstration on the use of a household gear while collecting sample specimens.

Analysis and compilation of data collected

At one level, analysis and compilation was conducted as information was collected. This was required to better understand remaining gaps in information during the interviews, as well as avoid confusion caused by the often inconsistent uses of common names. Results of each interview were

reviewed in terms of the database, constantly updating the overall status of information collected. This allowed for continued clarification and confirmation of information through cross-checking between information sources.

The second level of analysis and compilation was conducted by consulting with various national experts in Hanoi. Fish identification experts at the Research Institute for Aquaculture No. 1 (RIA 1) were consulted for clarification of fish species. Mr. Nguyen Van Hao reviewed photographs and examined various samples to identify fish species encountered during the study. The samples collected were labeled and left at RIA 1 in the care of Mr. Ngo Sy Van should review or further clarification be required.

Information on plants was reviewed by Dr. Nguyen Nghia Thin, Head of the Department of Botany, Hanoi University. Dr. Thin used common names and photographs to identify and confirm the species of plants that were encountered during the study.

The identification that was possible for crustaceans, mollusks, amphibians, reptiles, and insects was based on Vietnamese language reference books that were available at RIA 1 to the National Experts involved in the study.

The format used for the database was based on the example of the one used in Cambodia (see Balzer et al. 2002).

RESULTS

FISHES

Of the original list of 42 fish species reported during the village-level participatory assessment activities of the Study on Traditional Practices, 19 species were listed as being a current part of the ricefield production. Three of these species are strictly culture species that are stocked in rice fields and ponds: grass carp (*Ctenopharyngodon idellus*), mrigal carp (*Cirrhinus mrigala*), and silver carp (*Hypophthalmichthys molitrix*). Tilapia (*Oreochromis spp.*) are commonly stocked, but have also established reproducing populations in ponds allowing self recruitment. Common carp (*Cyprinus carpio*) are considered both a culture species as well as a capture species. The remaining fish species were considered either part of the ricefield capture fishery or by-catch from culture systems. They included at least 14 species from 13 families. Two of these fishes have been introduced to the area and established populations. These include climbing perch (*Anabas testudineus*), which was introduced from the lowlands with the seed of other culture species, and mosquito fish (*Gambusia sp.*) which was introduced during the French colonial period for mosquito control.

Macropodus opercularis are commonly harvested from rice fields.

Availability and use

There is some variability concerning preference and availability of the different fishes from the ricefield systems, however, ten of the fourteen species were considered of high availability, at least on a seasonal basis. Although many of the fish species are available all year, the peak of availability in the rice fields is during the rainy season from May until October. Much of the fishing pressure occurs at the end of the rainy season, after the rice is harvested and people can enter the fields without risk of damaging the rice plants. The rest of the year, the fishing pressure is mostly in streams, ditches, ponds and other water bodies located in and around rice fields.

Most of the fish was used fresh, and in some locations there was no preservation of fish reported. There was, however, fermentation of smaller fish which allowed storage for 4 to 6 months. This type of preservation, common in other parts of Southeast Asia, is not widespread in the study area.

CRUSTACEANS

Three different crustaceans were listed during this study. These include two types of shrimp (probably *Macrobrachium nipponensis* and *Caridina spp*.), and one type of crab (probably *Somanniathelphusa sinensis*). Another type of crab was mentioned as part of the household fishery, but it is found in mountain streams rather than ricefield environments.

Availability and use

All of the crustaceans were considered highly available, with some slight variation from location to location. The shrimp are of high preference, with the paddy crab of medium preference. The stream crab was reported to be larger and highly preferred, but becoming scarce. The crustaceans are harvested with simple gear, such as scoop nets, which is common in almost every house hold. Almost every household captures and consumes these species in small amounts on a frequent basis, especially during the rainy season (May to October).

MOLLUSKS

Seven types of mollusks were reported in this study, four gastropods and three bivalves. In the case of the gastropods, some confusion was caused by different local names (often conflicting) being used from one location to another. There are potentially several species in this group.

Mollusks found in the ricefield systems are commonly available at local markets.

Availability and use

The mollusks are, in general, highly preferred and highly available. There is some local variation and, in one case, a snail that is highly preferred is low in availability (possibly a perception due supply and demand, or the result of overharvesting). Most mollusks can be found at local markets and bring a good price.

Mollusks are found in streams, ditches, and ponds in and around rice fields as well as in the rice fields themselves. They are also a common by-catch product of other aquatic culture systems. They are captured by hand, or collected with nets by sifting through mud.

AMPHIBIANS

Three different types of frogs (possibly *Rana spp.*) were reported during the interviews as being routinely harvested from rice fields. Specimens of these frogs were not collected, so exact identification was not possible. Also reported were frog larvae (tadpoles). The species of these tadpoles was not specified, so they could represent the larvae of any or all of the frogs listed as well as other frog types that aren't harvested as adults.

Availability and use

The capture of frogs is highly seasonal and mostly takes place during the beginning of the rainy season (May-June). During this period frogs are breeding, and can be easily located from their calls at night time. Frogs are hunted at night using electric lamps and are captured by a number of means including nets, capture by hand, and shooting with crossbows, among others. During the winter months (December – February) frogs are dug out from burrows in the ground.

Frogs are highly preferred and are eaten fresh. They bring a good price in the market. In the past there had been an export market for frogs across the border into China, but that has ceased presumably because of competition from frog culture being practiced by the Chinese.

REPTILES

Three species were reported as harvested and used from ricefield systems. These include a soft-shell turtle (possibly *Pelodiscus sinensis*), a turtle (possibly *Cuora trifasciata*), and a water snake (possibly *Enhydris plumbea*). There were no examples of these organisms observed or specimens collected, so precise identification was not possible.

Availability and use

The capture of reptiles from rice-based systems was reported to be very low in frequency and intensity. When these organisms are observed they are captured, but they are not targeted specifically. It was reported that the reptiles do not inhabit the rice fields, with the exception possibly of the water snake, and are only occasionally seen there (perhaps while moving across to reach another destination).

The turtles are highly favoured as food, while the snake is less popular.

INSECTS

Insects that were reported as being captured from rice fields included three types of grass hoppers, dragonflies (both adult and larvae), the giant water beetle, and one other unidentified insect. During this study, only the dragonfly larvae was observed and collected as a specimen. It is possible that these insects listed could consist of groupings rather than individual species, so the actual number of species involved could be quite high. More rigorous sampling and expert identification would be required to develop a better understanding.

Availability and use

The various grass hoppers are captured using a long handled net swept over the tops of the rice plants. This is typically done when the rice plants are mature and near harvest. All of the hoppers were scored high in preference, but only one type was considered abundant.

The adult dragon flies are captured using a similar method as the grasshoppers, but were only reported eaten in one area and are low in preference. The larvae of dragon flies, however, were high in both preference and abundance. They are aquatic and are captured in the rice fields using scoop nets at the beginning of the rainy season (April to July).

Giant water beetles were reported as highly favoured, but becoming quite rare. They were only reported as still occurring in the Mai Chau area. In Tuan Giao they were previously available, but are now no longer found.

Most of the insects are consumed fresh, prepared by frying. The giant water beetle (especially the males) have a very pungent flavour and are a popular ingredient in sauces.

"Grass hoppers" are collected from ripening rice plants.

PLANTS

Plants were by far the largest group of organisms used from the ricefield environment. There were a total of 26 different plants reported (including rice) as being collected and used.

Availability and use

Most of the plants were considered to be highly available, although some of the more popular plants were reported as lower in abundance. The 26 plant types reported include seven that are sometimes cultivated in or near rice fields, at least 22 that occur naturally. Many of the plants are consumed by humans, several are used as spices or have medicinal value, and some are used as livestock feed or green fertilizer.


Many households have aquatic gardens adjacent to their rice fields.

COLLECTION METHODS USED: GEAR AND TECHNIQUES

Nets

The most common type of equipment reported during this study was the scoop net. It was found in every household interviewed, and was reported to be owned and used in every household in some villages. It consists of a triangular frame with a small-mesh pouch. It is used in a number of ways in both standing and moving water to catch fish, shrimp, crabs, insects, and mollusks, as well as for collecting duck weeds.

A variation of the scoop net is the long handled net. This a small round frame with a small-meshed pouch attached. It has a long handle and is sturdily built to hold up to rigorous use in the water. Its use is similar to that of the scoop net and in some areas it commonly replaces the typical scoop net as the main household gear.

The cast net is another common gear used by many households. It is hand woven in various mesh sizes and has a light chain attached to the outer border to speed sinking. It is typically used by men and is used to target fish.

The lift net is a square, woven mesh net that is stretched by a frame and suspended from a pole. It is placed in the water, and lifted to capture fish in the net. They come in various sizes (typically 2x2 meters or larger) and various mesh sizes. Larger mesh sizes are used to capture fish, smaller mesh sizes are used to capture shrimp. It is fairly common as a household gear, being used by both men and women, but not typically by children because of the physical strength required.

Gill nets made of monofilament nylon line are used in streams throughout the year to target various species of fish. This is considered a specialized type of gear and only households that do a lot of fishing own them.

Insect nets are very similar to long handled nets, but they are lightly built with large hoop frames, light, fine-meshed nets, and long bamboo handles. They are used in the rice fields when the rice is mature and becoming ripe to capture various types of grass hoppers and other flying insects. The net is swept from side to side over the top of the rice plants, capturing the hoppers as they are startled into jumping from the rice plants.

Traps

The most common type of trap used is the cylindrical trap. Along with the scoop net, it is the type of gear that is most likely found in a “typical” rice farming household. This trap is usually woven from bamboo and comes in many shapes and sizes. It is used in many ways including baited, capturing fish moving against water flow, and capturing fish moving with water flow. One common way to use the traps is to place them in rice field bunds

where water is flowing from one field to another. The trap can be placed to capture fish moving up against the flow, or fish moving down following the flow depending on the season and type of fish targeted. These traps also catch shrimp, crabs, and snakes.

Various types of cylindrical traps are commonly used by many households.

A variation of the cylindrical trap made especially for eels is the woven eel trap. In this case the trap is woven very tightly and used with bait to capture swamp eels. A second type of eel trap is made from a section of bamboo with a woven “entrance” placed in one end to trap the eel once they enter. These traps are also baited, usually with earth worms. Trapping eels is a fairly common activity and some families were observed to own as many as 50 such eel traps.

The hand trap is a conical-shaped, basket-type trap that is used by placing quickly down into shallow water pressing the bottom edge of the trap firmly against the bottom. The person using the trap can then reach in the top of the trap and capture anything caught within. This was not a common type of gear, being reported as “used by some people” but not observed in any households visited.

Others

Hook and line are another common household gear used in the study area. The method used is simply using a single baited hook on a pole, tended by the fisher person. The hook and line is used in all types of water bodies and is typically used by men and boys.

Methods for collecting eels include the use of an “eel fork”, a tool made from bamboo. The user locates an eel hole, entices the eel out and immobilizes the eel by pinning it to the bottom for capture. Chopping the eel’s head with a machete or large knife was another technique reported.

Cross bows with bamboo bolts are used for hunting frogs at the beginning of the rainy season. The frogs are hunted at night and located with the use of an electric lamp. This technique is also used to capture larger fish in shallow water.

Electric lamps are used at night time in combination with various types of gear to capture different organisms. Frogs are the most note worthy of this practice, being located at night during the breeding season by following the sound of their call and using an electric lamp to locate them. They are then captured by hand, scoop net, or shot with a cross bow.

Cross bows are used with electric lamps to harvest frogs from rice fields an night.

Using hands to collect various types of organisms is very common. Plants and mollusks are the most obvious because of their lack of mobility, but frogs, crabs, and some types of fish are also commonly captured by hand.

SOCIO-ECONOMIC AND CULTURAL ISSUES

Importance to livelihoods

Detailed information about the importance of aquatic resources from rice based production systems in local livelihoods was not collected. There was, however, a great deal of anecdotal information that insinuates the importance of these resources is quite high. This indicative information includes the following considerations:

- There is a large number of species reported as being used from ricefield systems. These include many organisms that are secondary to the primary pursuits of rice production and, in some cases, fish culture. The majority of the species listed were considered wild.
- Estimates of consumption were, in some cases, high. One household reported consuming wild caught fish from ricefield systems up to three times a week, at about one-half kilogram per meal. This is easily extrapolated to 100-200 kg of consumption per year, which if considered as an “average”; multiplied by the number of households this becomes very substantial.
- Households all own and use various types of fishing gear. Although fishing effort is considered low as compared to other types of activities, it still typically adds up to several hours per household per week.
- It was estimated that all households frequently consume fish during the rainy season when ricefield aquatic resources are abundant. Only people with ponds, however, can maintain this level of frequent consumption during the drier seasons. Other households must either increase the amount of money spent on animal protein, or consume less. The poorer the household, the more dependent they are on local aquatic resources, perhaps especially those from rice based production systems.

Ethnicity

During this study the only ethnic group encountered was the Thai ethnic group. This group is the majority group in the areas studied and has mostly settled in the valleys where rice production systems are established. By selecting areas where the rice-based production is typical, areas settled by the Thai were also selected. Other groups also practice rice cultivation, and in many cases are poorer and more marginalized than the majority Thais. Any

further studies on the availability and use of aquatic resources from rice fields should devote some resources into investigating the livelihoods of some of these other ethnic groups.

CONCLUSIONS AND RECOMMENDATIONS

This study shows that aquatic resources from rice based production systems play an important role in the livelihoods of rural people in north-western Viet Nam. A wide range of organisms including fish, crustaceans, mollusks, amphibians, reptiles, insects and plants are commonly harvested from these systems for human consumption, livestock feeds and medicinal uses. Although aquaculture in rice based systems is becoming more popular and widespread, traditional capture-based systems are still important.

The information provided by this study shows that there are many aspects and complexities of the rice-based production systems that are often overlooked. This study, however, only provides a small cross-section of information on the aquatic diversity of the rice fields and its importance to rural livelihoods. Because of the seasonal nature of the resource, a more in-depth study should be conducted, recording the succession of plants and animals that are harvested and used over the course of an entire year. Detailed household surveys should be conducted to understand the amount and types of aquatic resources that are being consumed, paying particular attention to disadvantaged groups such as the poor, ethnic minorities, and women headed households.

Fish is commonly raised by rice farmers to generate cash, as well as to provide protein.

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ABSTRACT

A participatory study was conducted on the availability and use of living aquatic resources from rice-based production systems in north-western Viet Nam. The study, conducted in Lai Chau and Hoa Binh provinces in August 2002, used participatory group activities, key informant interviews, market surveys and field observations to identify aquatic organisms being used by rural households. The findings show that 19 fish, 3 crustaceans, 7 mollusks, 3 amphibians, 3 reptiles, 7 insects, and 26 plants are commonly used from the rice fields. Information on seasonality, capture/harvest methods, use, preference, availability, and types of aquatic environment found is included for each organism. To access these resources, 16 different types of small-scale gears and harvest methods are reportedly used by men, women and children in the study area.