Participatory Fisher Survey Pilot Study in Sangthong District, Vientiane Capital, Lao People's Democratic Republic

Final Summary Report (October 2013-January 2014)

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Lao Department of Livestock and Fisheries, Provincial Agriculture and Forestry Office and District Agriculture and Forestry Office

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1. Project Description

The Mekong Fish Network (MFN) is a voluntary association of people interested in expanding knowledge of the Mekong River's unique and valuable fish assemblage. As the network develops further, it will include individuals, researchers, and resource managers representing government agencies, universities, and other organizations. The MFN seeks to engage local people in conservation research and sustainable management in the Mekong Basin through a program of standardized Participatory Fisher Surveys. Small-scale fisheries, such as those in the Lao People's Democratic Republic (Lao PDR), are often dispersed in hard-to-access rural locations, and thus are difficult to monitor using traditional methods. Such fisheries require non-traditional approaches to sampling, such as participatory research methods. There are many types of participatory studies, and the example presented here enables the fishers themselves to conduct fish catch and fishing effort surveys of wild fish harvest, under the guidance of technical experts. This strategy directly involves resource users in the monitoring process (which is key for fisheries co-management approaches), builds on their local ecological knowledge, and is generally a cost-effective method to sample fish harvest.

This report summarizes the results of a pilot project conducted to test the proposed Mekong Fish Network Participatory Fisher Survey protocols. This project trained local fishers to gather data essential for developing effective conservation and management strategies. The objectives of the pilot study were to:

1. Test the proposed standard sampling program protocols and methods, which could be applied throughout the Mekong Basin
2. Obtain basic fish harvest data on a continuous basis
3. Collect baseline information on Jullien's Golden Carp (*Probarbus jullieni*) and other local fishes listed as "endangered" on the IUCN Red List
4. Train local fishers and a university student or young professional to participate in the data collection process
5. Produce accessible information products that can be used by local partners to improve fisheries management and conservation strategies

2. Methodology

The short-term pilot study was conducted over a three-and-a-half-month period between 1 October 2013 and 17 January 2014. FISHBIO staff led the study, with assistance from District and Provincial Agriculture and Forestry Offices (DAFO and PAFO). Funding was provided by The Mohamed bin Zayed Species Conservation Fund and FISHBIO.

2.1 Protocol Development

The overall objective of the MFN Standard Sampling Program is to use fundamental, reproducible methods to provide vital information on status and trends of Mekong fishes. To

achieve this, one goal of the Program is to expand upon existing programs and collect data in a standardized way that is comparable with these existing programs. Thus, the fisher surveys were intentionally developed to be compatible, to the extent possible, with the Mekong River Commission (MRC) Fish Abundance and Diversity Monitoring protocols (Halls et al. 2013). The protocols were also informed by key publications such as the *Guidelines for the Routine Collection of Capture Fishery Data* (Food and Agriculture Organization of the United Nations 1999), *Standard Methods for Sampling North American Freshwater Fishes* (Bonar et al. 2009), and work by Dr. Ian Baird and colleagues on fisheries in Southern Lao PDR (Roberts and Baird 1995, Baird et al. 2003, 2004). The key fisheries indicators for this study were catch-per-unit-effort (CPUE), number of different species (species diversity), and maximum fish length. Likewise, the key indicators used by the various MRC fisher catch monitoring programs have included: CPUE (weight), species diversity, relative abundance, and maximum fish length (MRC Fisheries Programme 2012).

2.2 Study Site Selection

Sangthong District, Vientiane Capital, Lao PDR was selected as an ideal area to test the MFN Participatory Fisher Survey protocols based on its proximity to Vientiane Capital and nearby reports of spawning habitat for Jullien's Golden Carp (*Probarbus jullieni;* pa eun ta deng) and thicklipped barb (*Probarbus labeamajor;* pa eun khao or pa eun fai), both commercially valuable fish listed as "endangered" on the IUCN Red List. A pre-assessment visit to the district was conducted in October 2013 by FISHBIO and DAFO staff, who met with village leaders and fishers. During the pre-assessment interviews, fishers identified *Probarbus* sp. as key target species for fishers in this area in the dry season using large mesh gillnets. The two villages with the largest numbers of regular fishers were selected for the study: Ban Ang Noi and Ban Sakai (Figure 1).

2.3 Fisher Training

FISHBIO researchers and the community leadership selected a group of fishers in each village to be trained as fisher technicians (fishers that would collect data on their own catch). One fisher technician per village was selected to act as team leader, responsible for collecting the datasheets for that village. A member of the village Lao Women's Union was selected to be the data keeper, to look after the data sheets for the researchers and to review them for completeness. A "fisher" was considered anyone who fishes regularly (at least two or three times a week) for either subsistence or income. Based on those fishers who expressed interest in participating in the study and the project budget, five fishers were selected to represent each of the two villages (ten fishers total). Fisher technicians and the Lao Women's Union representatives were each paid a small stipend for the extra time they spent each day collecting data.

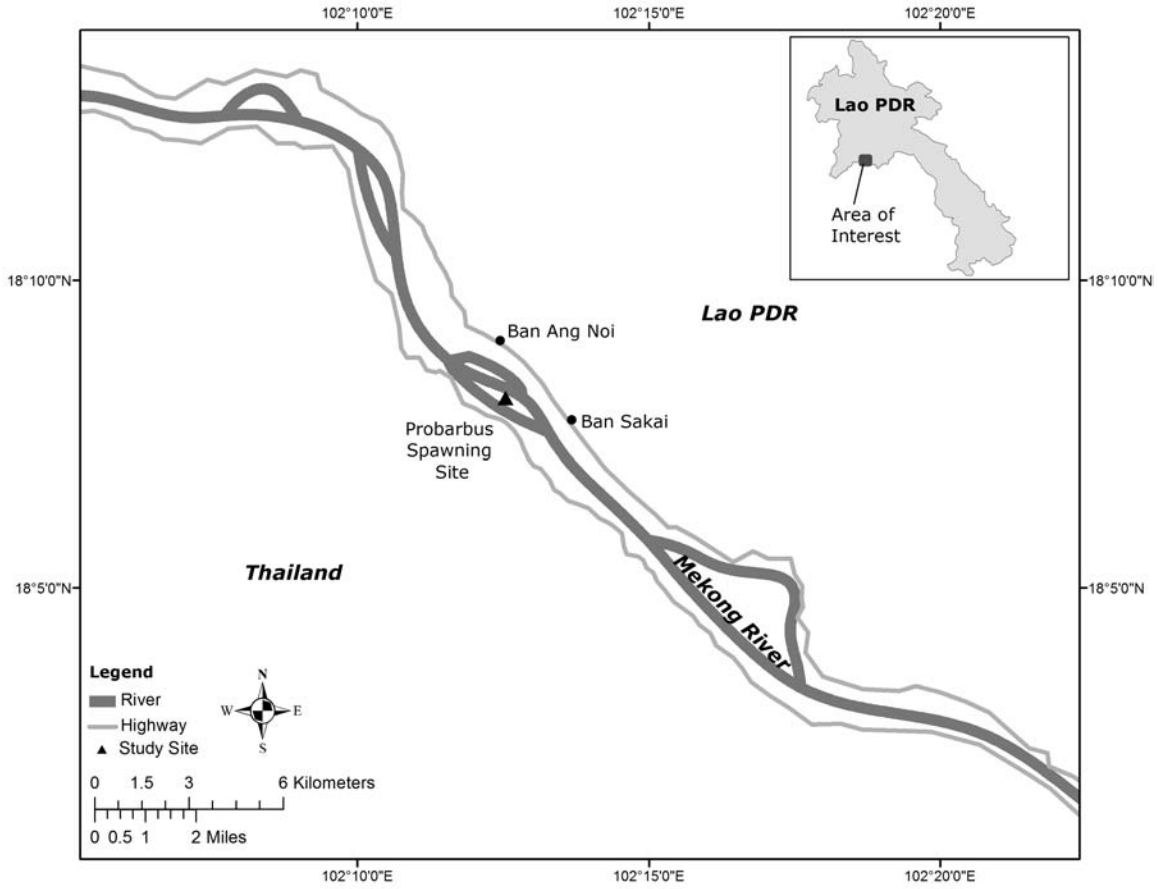


Figure 1. Study Sites at Ban Ang Noi and Ban Sakai, Sangthong District, Vientiane Capital, Lao PDR.

All fisher technicians and the Lao Women's Union representatives received instruction during a two-day, hands-on training session with FISHBIO researchers and PAFO and DAFO staff in October 2013. Local fisher technicians were trained to record fish species based on their local names. Since local names can sometimes vary between communities, we showed participants posters and books with fish pictures and their local Lao fish names, and confirmed that the two villages used the same local names. Additionally, fishers were taught to use the sampling equipment provided to accurately and precisely measure and weigh their fish catch. Researchers and fishers walked through the data collection process step by step, and fishers learned how to record information on the datasheets. There were two fishers who were unable to read or write, and thus they received help recording data from the Lao Women's Union representative or from a family member.

2.4 Data Collection

The fishers were trained to record essential data on their fish catch and fishing effort for each day they spent fishing. The fishers were asked to maintain their normal level of fishing effort, and to not modify their behaviors or methods based on their participation in the program. There are numerous techniques used by fishers in Laos (Claridge et al. 1997), but for the purposes of this

study, researchers grouped the most common gears used by the fishers in the district into a few broad categories (i.e., net, longline, single hook, trap, or other). Gear names were standardized using Claridge et al. (1997). Gear data collection included the type of gear used (gear name and category), habitat where the gear was set (e.g., mainstream Mekong River, deep pools, floodplains, wetlands, and rice fields), fishing method (e.g., one end of net attached to bank, gear left in water) and the number of hours the gear was fished (i.e., start time and end time). For each gear used, fishers recorded the dimensions of the gear as follows:

Net:
- Length (m)
- Height (m)
- Mesh size (cm)

Trap
- Length (m)
- Height (m)

Longline
- Number of hooks
- Hook size

Single hook
- Hook size

Other gear type
- None

If more than one unit of the same gear type was used in a single fishing trip, the fisher would record the number of gear units used for that gear type, and combine the catch on the data sheet. For example, if a fisher used 20 single-hook fishing poles, they could fill out the combined fishing catch information for that gear type and note that 20 units of the gear type were used. Hook sizes were reported using the local numeric system, where hooks are assigned a standard number based on their size (dimensionless unit).

The biological data collected included: fish species, total fish counts and weights by species, and a subsample of individual fish lengths. Each fisher technician was provided with:

- Water resistant datasheets
- Digital hanging scale
- One large and one small plastic basket for weighing fish
- Digital watch set to the 24-hour clock
- Measuring tape

Each Lao Women's Union representative was provided with:

- Digital camera to inventory unique or unidentified fish species
- Photo logbook to record each photo

Fishers were instructed to keep the catch from each gear type separate when they harvested fish each day. At the end of each fishing trip, fish catch for each gear type was sorted by species, or using as fine a taxonomic grouping as possible. In some instances, fishes were not identifiable to the species level; under these circumstances fishers were asked to photograph the individual fish, and record them at a higher taxonomic level (e.g., Genus). In addition to photos, notes were taken of any fishes for which identification was uncertain. The primary researchers reviewed these photos and, when possible, identified the fishes to species. The fisher technicians recorded

the weight of the total catch for each species, and counted the total number of fish caught of each species. Fishers recorded whether they used the small or large basket (or no basket) to weigh the fish. If many fish were captured (>50 individuals) and the fisher did not have the time to count them all, then only a sub-sample of the fish were counted and weighed. In this case, a basket was filled with a random sub-sample of the fish, and the fisher checked the appropriate box on the datasheet to denote sub-sampling. Standard lengths (centimeters) were recorded for up to 10 randomly selected individuals per species per gear type each day. The fishers also measured the maximum length per species per gear type each day.

2.5 Data Management

Data flow from the field to the office proceeded as follows: raw data was recorded by fishers on the paper datasheets, which were collected by the team leader or data keeper and given to the project intern, who reviewed the data sheets for completeness. The intern entered the data into a bi-lingual Microsoft Access database designed specifically by FISHBIO for this project. Quality assurance and quality control (QAQC) was conducted by FISHBIO office staff by checking the data entered into the database against the data recorded on the paper datasheets. Incorrect entries and missing information were corrected, or were noted if a correction could not be made. Additionally, exploratory data analysis (e.g., histograms, bivariate x and y plots) was used to identify potential outliers or extreme values that may represent errors in data collection or data entry.

2.6 Final Workshop

At the end of the project, FISHBIO staff hosted a final workshop in the study villages with the fisher technicians and PAFO and DAFO staff. The workshop co-chairs included the Deputy Head of the Livestock and Fisheries Section (PAFO) and the Head of Sangthong District DAFO. This was an important opportunity to gain insight into any issues that may have arisen during the data collection process. Fishers were asked to provide feedback on the study through a brief, eight-question survey that was conducted in small groups, administered by FISHBIO and DAFO staff. These interviews provided insight into whether the fishers understood the protocols they were conducting, and provided valuable recommendations for future studies.

The Survey Questions included:

1. What was the hardest part of collecting data on your fish catch?
2. What was the most difficult part of filling out the data form?
3. Do you feel that you had enough training in October to understand the tasks?
4. Do you feel that we had enough communication between FISHBIO and the participants?
5. If we continue this project would you be interested in participating in the future?
6. What changes to the study do you think we could make to encourage more fishers to participate?
7. What is your primary reason for participating in the study?

8. Do you have any general recommendations for making improvements to the study in the future?

3. Study Results

3.1 Gear Types Used and Fishing Effort

A total of 623 fisher days were recorded among the 10 participating fishers, with 890 different gear sets reported over the course of three months of sampling. Although there are numerous gear types employed by fishers in Lao PDR, the fishers participating in this study reported using only four main gear types during the study period, which occurred in the dry season. Fishers reported using cast nets (*he*), gill nets (*mong*), drop-door basket traps (*jun*), and bottom longlines (*bet piak join*), which they weigh down with rocks so that the hooks stay on the bottom. Only one fisher reported once using a pole and line with a single hook (e.g., '*bet teuk'*, '*bet pak'*, '*bet sit*', '*bet khen*' or '*bet leuam*'). FISHBIO staff reported seeing upright basket traps (*toum*) and funnel basket traps (*sai*) at fisher's homes, but no fishers reported using these traps during the study period. In Ban Ang Noi, the most common gear type was a net (usually a gill net), and one fisher also mainly used a drop-door basket trap (Figure 2). Fishers tended to use one main gear type; however, two fishers (one in each village) used nets and longlines in roughly even proportion (Figure 3). The gill nets ranged in length from 10 to100 m long (Figure 4) and were most often left to fish passively in the water, but in many cases (about 26% of the time) fishers using gill nets reported actively herding fish into small mesh nets (generally less than 4 cm). In Ban Sakai, the most common gear type was a bottom longline, but some fishers also used gill nets and drop door traps (Figure 2). Fishers reported using longlines that were rigged with between 3 and 50 hooks ranging in hook size from 5 to 20 (Figure 4). All but one fisher used at least two gear types over the course of the three-month study, but fishers often fished with just one type of gear in a single day (Figure 5).

Fishers were asked to record the dimensions of the gill nets, but there was a misunderstanding regarding how to measure and record the height information. It is standard in Lao PDR to measure gill nets by number of 'meshes deep' rather than in meters. Some fishers counted the number of mesh squares (e.g., 50 meshes deep), while others measured in meters (as was asked on the datasheet). Thus, the height or area of the gill nets were not included in the results.

Fishers only recorded fishing in the mainstream Mekong River. There was inconsistency in recording habitat fished within the Mekong River (e.g., deep pool, sand bar); therefore, these data were not included in analysis. Due to the high number of datasheets that were missing crucial information, it was not possible to estimate fisher effort in hours fished for all fishers. Of the 890 gear sets reported, 12% are missing either the start time or the end time. Additionally, it was discovered after the first month of data collection that several fishers were not properly trained in the process of recording start and end times, or had misunderstood the training and were recording their time spent checking their passive gear for fish, rather than recording the time the gear was left in the water. It was not possible to readily identify these incorrect records,

and separate them from correctly recorded times. For these reasons, it was not possible to calculate catch-per-unit-effort in hours fished as an indicator using these pilot study data; however, CPUE could be estimated by as total biomass of catch per fisher per fishing day. Although not ideal, this method of using kg of fish-per-fisher-per-day as a rough form of CPUE is similar to the method employed in the analysis of the Mekong River Commission's logbook data, due to the lack of detailed information on catch-per-gear type (Halls et al. 2013). This basic method is not usually preferred because it could be biased if the fishers tend to fish longer days at certain times of year, or if fishers could be fishing for variable periods of time each day as the effort needed to catch fish changes (e.g., fishing for more hours when fish catch per hour is lower).

The overall total weight of catch for the study period was higher in Ban Sakai than in Ban Ang Noi, but total effort (number of days fished by all fishers summed) was higher in Ban Ang Noi than Ban Sakai (Table 1). Therefore, the average daily catch was higher in Ban Sakai (1.15 kg/fisher/day) than Ban Ang Noi (0.73 kg/fisher/day). The average daily fish catch for the fishers ranged between 0.52 kg/fisher/day fishing to 1.67 kg/fisher/day fishing. It is important to consider that this does not account for the difference in the number of hours spent fishing in a given day, as described above.

Table 1. The total weight of the overall catch (kg), the total number of days fished, and the average daily catch weight (kg) for each fisher for the study period.

Village	Fisher	Total Weight (kg)	# of days fished	Average Daily Catch (kg)
Ban Ang Noi		**267.47**	**364**	**0.73**
	1	37.59	72	0.52
	2	69.26	65	1.07
	3	51.68	76	0.68
	4	63.05	75	0.84
	5	45.89	76	0.60
Ban Sakai		**298.39**	**259**	**1.15**
	1	23.40	25	0.94
	2	82.73	65	1.27
	3	36.94	51	0.72
	4	93.40	56	1.67
	5	61.92	62	1.00

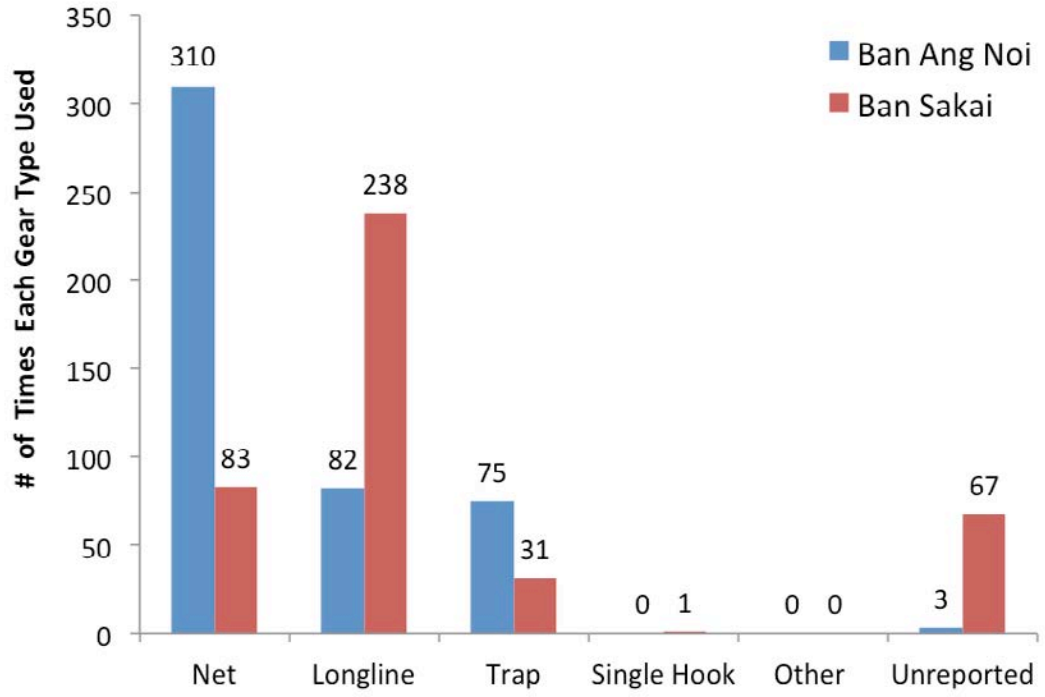


Figure 2. The number of times each gear type was used during the course of the study in Ban Ang Noi and Ban Sakai.

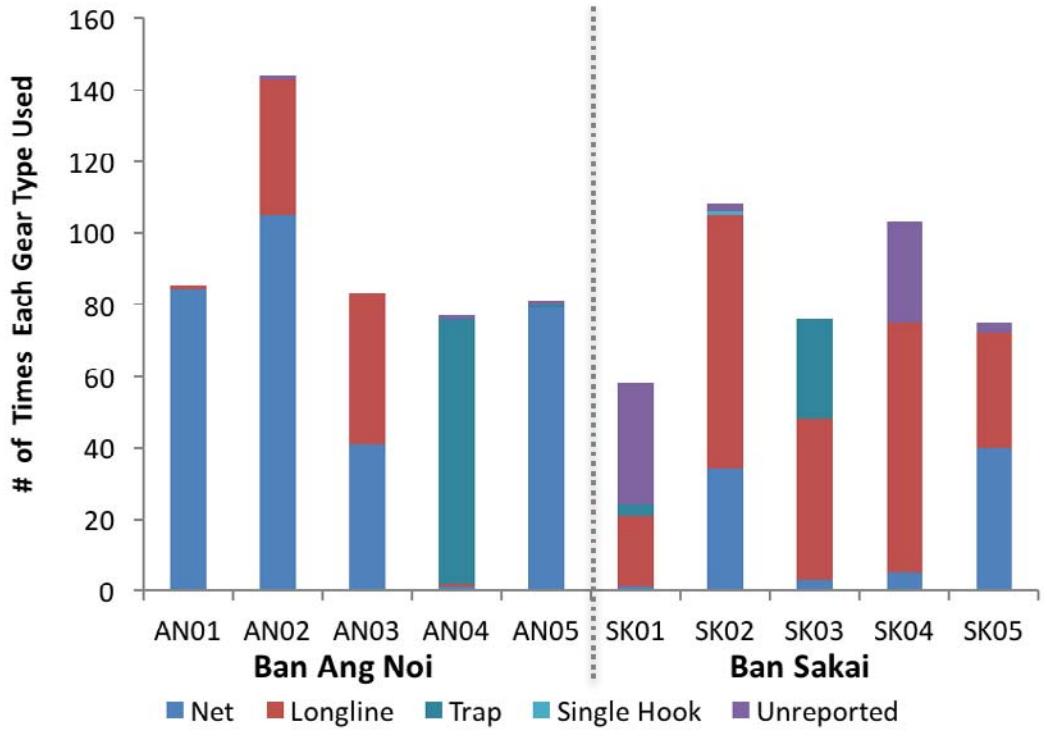


Figure 3. The number of times each gear type was used during the study by each individual fisher, with fisher names coded for privacy.

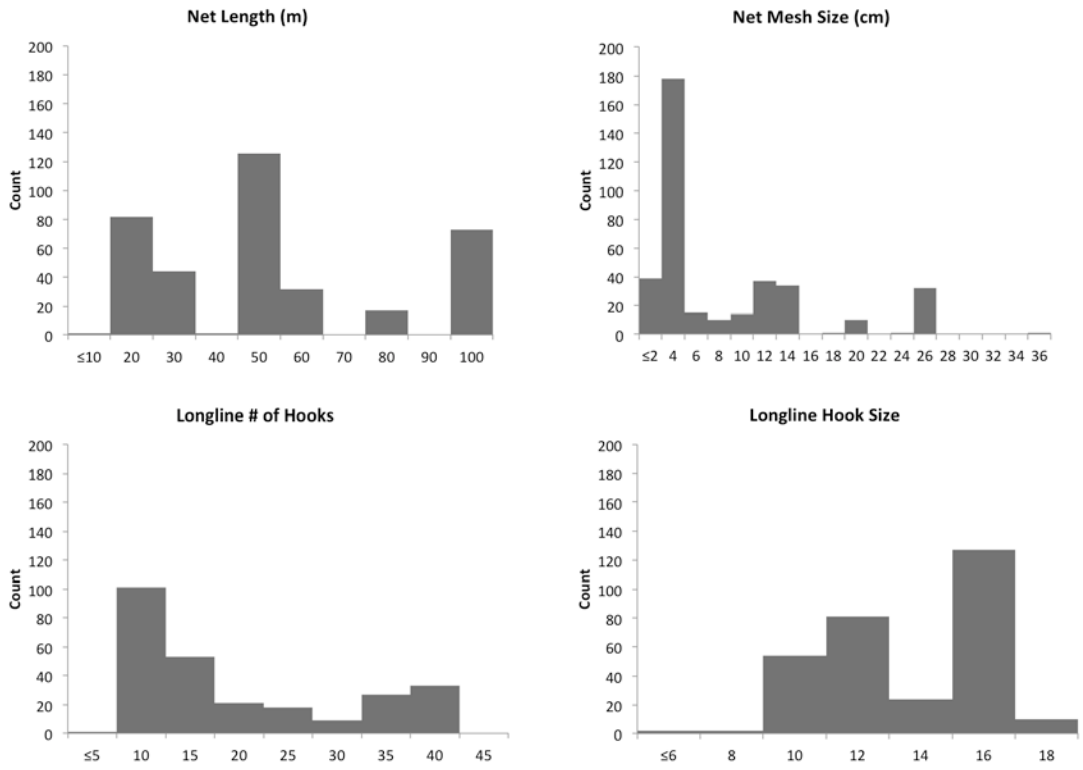


Figure 4. The number of times each net length and mesh size was reported.

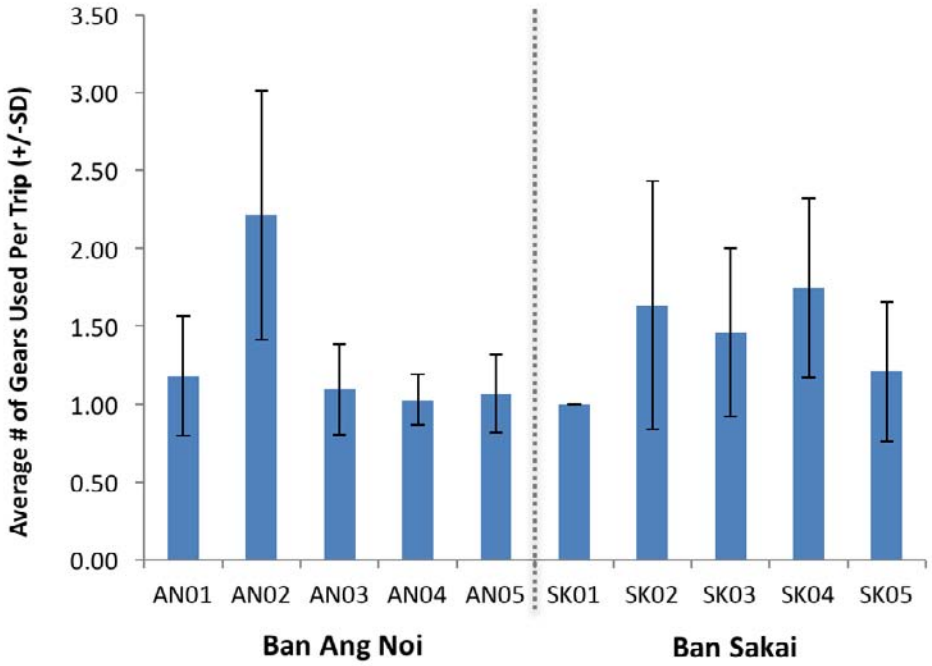


Figure 5. The average number of gear units used by each individual fisher during a single trip (i.e., each day fishing) over the course of the study, with fisher names coded for privacy. The error bars represent standard deviation.

3.2 Composition of the Catch (Species Diversity)

Fishers reported more than 54 species (40 genera), and many individuals were only reported to the genus. Composition of the fish catch differed between villages during the period of study. Catch in Ban Ang Noi was dominated by *Amblyrhynchichthys truncatus*, which made up 89% of the catch by number of individual fish and 25% of the fish catch by weight (kg) during the study in this village (Figures 6, 7 and 10). In contrast, *A. truncatus* only made up 2.5% of the individual fish captured in Ban Sakai, where various unidentified *Bagarius* species were the dominate fish in the catch, at 43 percent (Figure 9). *Bagarius sp*. made up 37% of the fish catch by weight in Ban Sakai (Figure 11). See Appendix B for a table of fish captured by number and by weight.

Probarbus species were infrequently seen in the catch, making up only 0.43% (n = 19) and 0.41% (n=3) of the catch by number of individuals in Ban Ang Noi and Ban Sakai, respectively. However, it is notable that *Probarbus sp*. made up 18% of fish catch by weight in Ban Ang Noi (Figure 10; Appendix B).

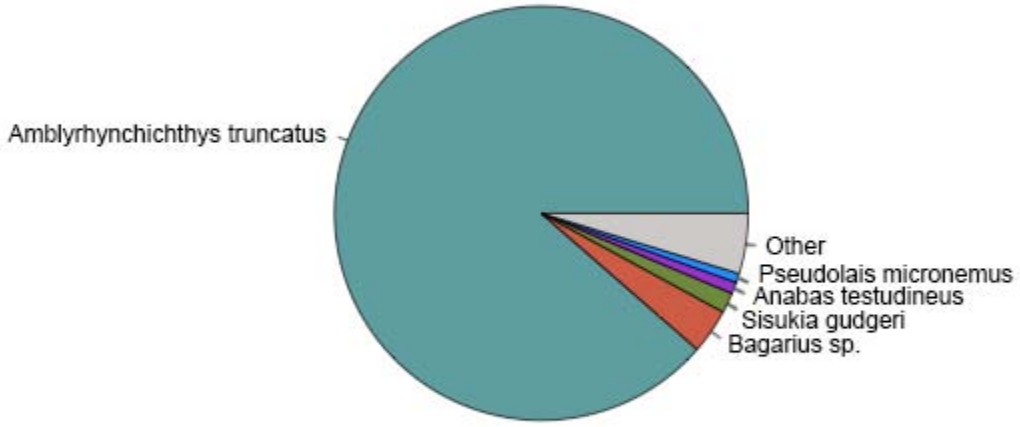


Figure 6. Species composition by number of individuals in the catch in Ban Ang Noi.

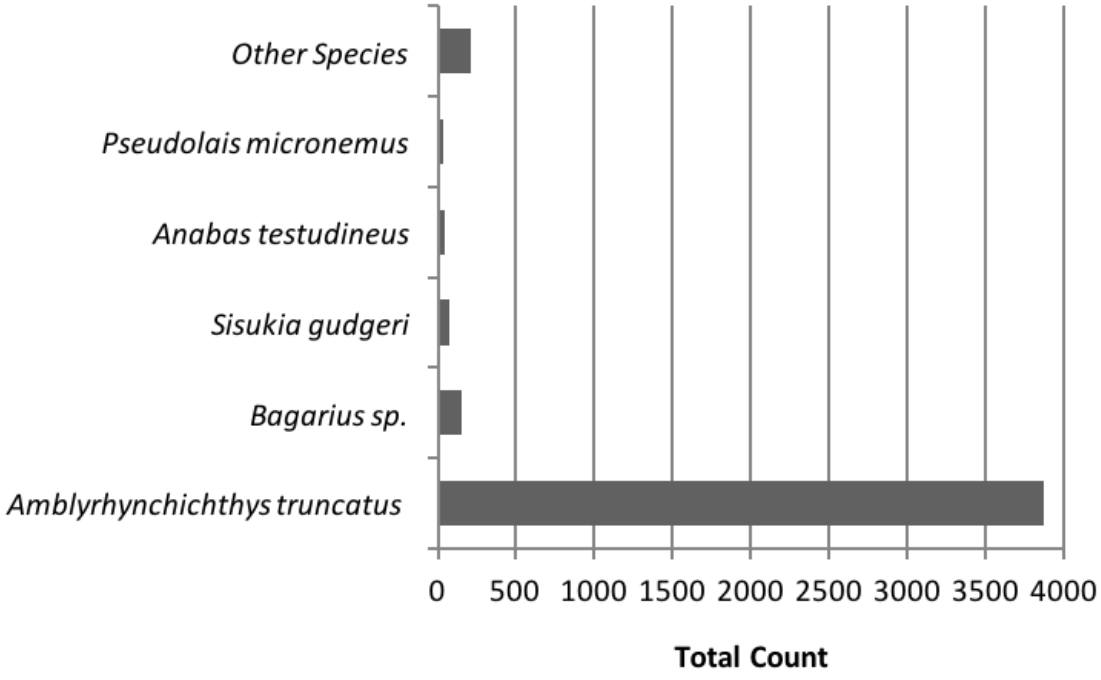


Figure 7. Species composition by number of individuals in the catch in Ban Ang Noi.

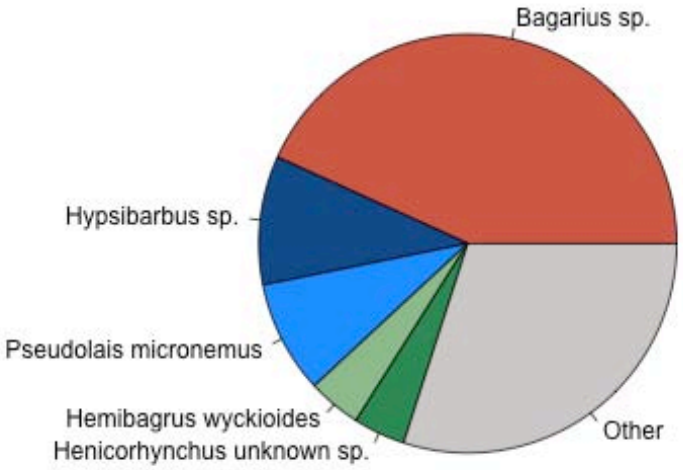


Figure 8. Species composition by number of individuals in the catch in Ban Sakai.

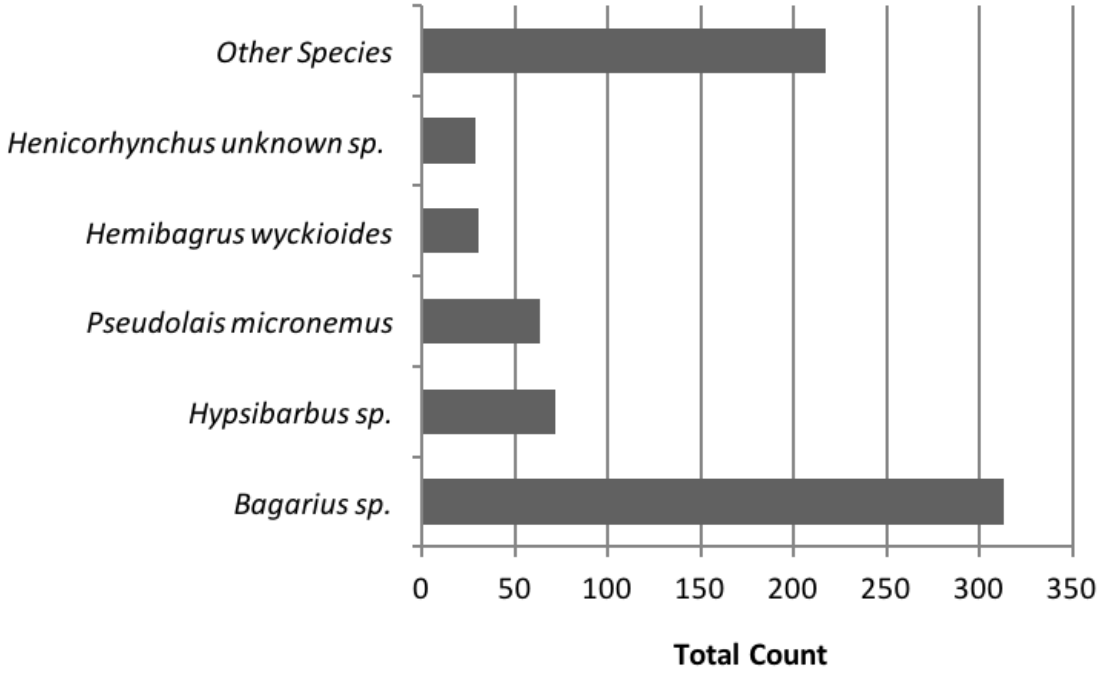


Figure 9. Species composition by number of individuals in the catch in Ban Sakai.

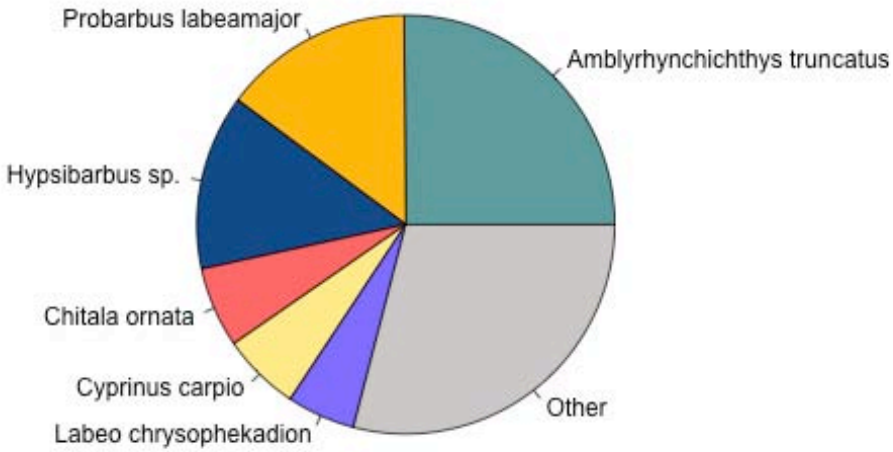


Figure 10. Species composition by weight (kg) of species in catch at Ban Ang Noi.

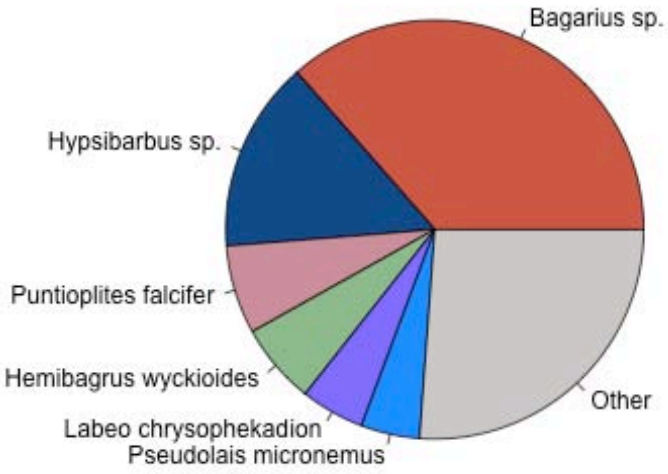


Figure 11. Species composition by weight (kg) of species in catch at Ban Sakai.

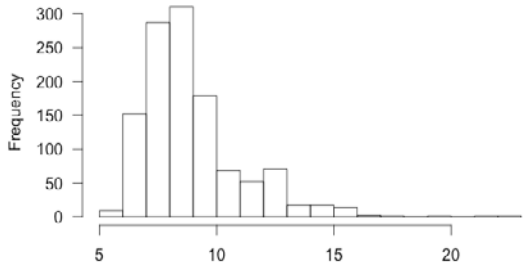
3.3 Size of Fish in the Catch

Fishers recorded lengths for at least 54 different species, and the greatest number of lengths was recorded for *Amblyrhynchichthys truncatus* (n=1,182) and *Bagarius sp*. (n=463). Fish ranged from 5 to 94 cm in standard length (Figure 12). The largest individual captured was a *Pangasius larnaudii* (94 cm SL) that was captured by gill net in Ban Ang Noi on 30 December 2013. The smallest fish reported were two *Amblyrhynchichthys truncatus* (5 cm SL) captured by in Ban Sakai on 12 January. Two smaller fish were reported, a 1 cm *Hemibagrus wyckii* caught on hook and line and a 4 cm *Belodontichthys truncatus* caught by gill net, both of which were likely incorrectly recorded, given that these sizes were extremely small compared to other fish captured of these species.

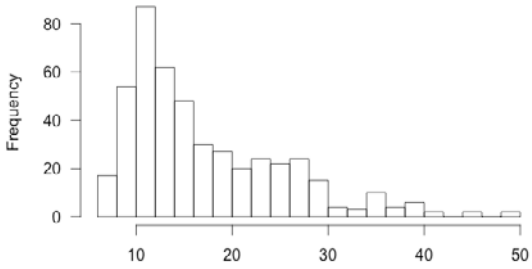
Maximum length was measured for each species captured in each gear type each day. Maximum length was recorded most frequently for *Bagarius sp*. (n=202) and *Amblyrhynchichthys truncatus* (n=117) (Figure 13). Maximum length for individuals of *Bagarius* unidentified to species ranged from 8 to 50 cm SL, with a mean maximum length of 23 cm SL (NOTE: this potentially includes individuals from different species in the genus). Maximum length of *Amblyrhynchichthys truncatus* ranged from 8 to 23 cm, with a mean of 12 cm SL. *Pseudolais micronemus* maximum SL ranged from 11 to 34 cm, with a mean of 21 cm.

Smaller *Probarbus* individuals (less than 30 cm SL) were captured throughout the entire sampling period, and larger individuals of both *P. jullieni* and *P. labeamajor* (up to 89 cm SL) were captured after mid-December (Figure 14). Two smaller *Probarbus sp*. were captured with a cast net (both 14 cm SL from Ban Sakai), and three *Probarbus sp.* were captured using hook and line gear (ranging from 16 to 31 cm SL, one from Ban Sakai). However, the majority of the individuals were captured using gill nets in Ban Ang Noi.

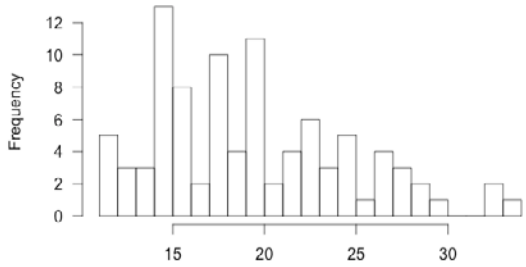
Amblyrhynchichthys truncatus



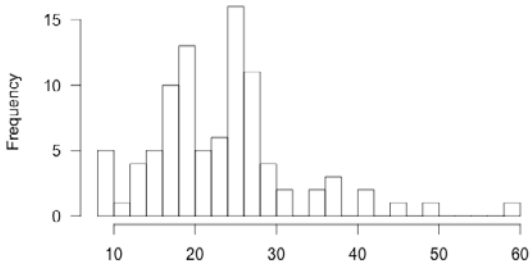
Bagarius sp.



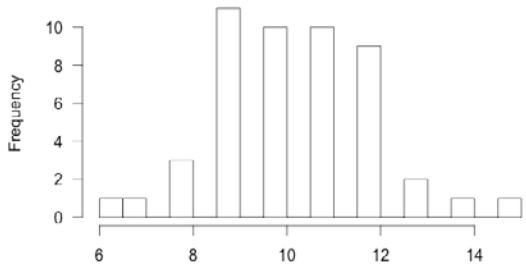
Pseudolais micronemus



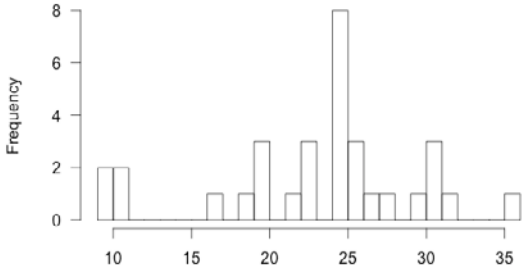
Hypsibarbus sp.



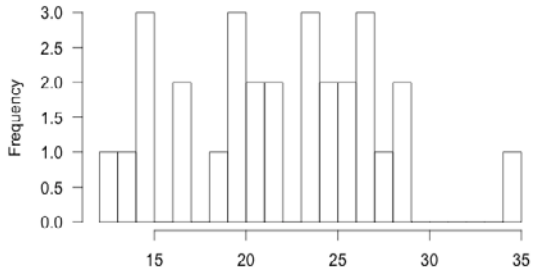
Henicorhynchus sp.



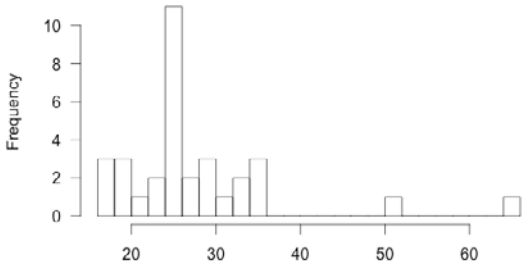
Phalacronotus sp.



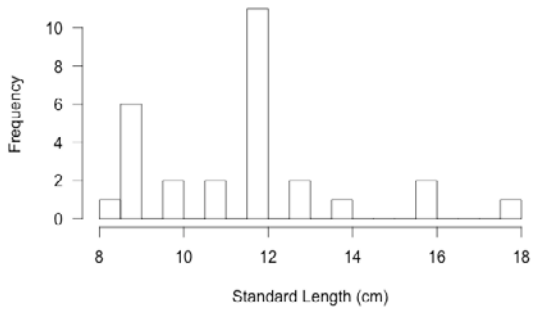
Hemibagrus nemurus



Hemibagrus wyckioides



Sisukia gudgeri



Labeo chrysophekadion

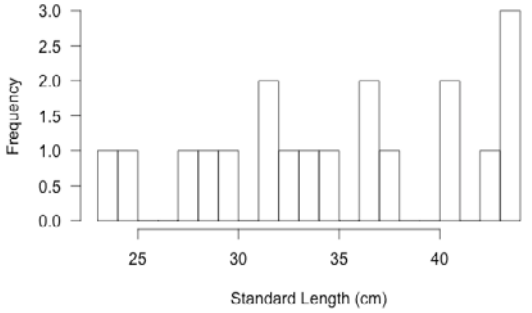
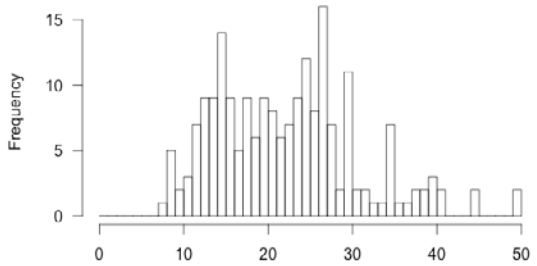
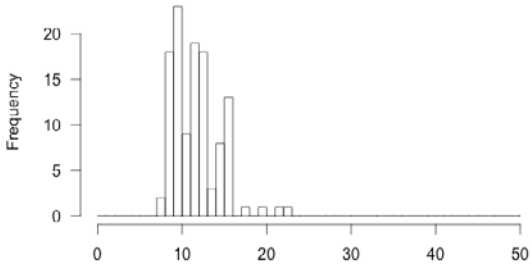


Figure 12. Frequency of standard length (cm) of measured fish, including the maximum size fish for species in each catch

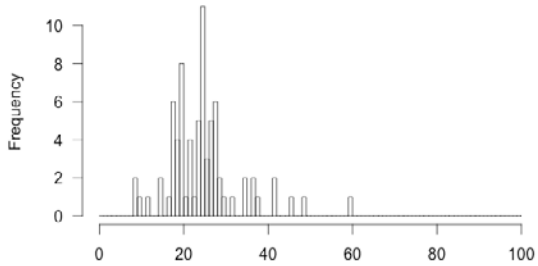
Bagarius sp. (n=202)



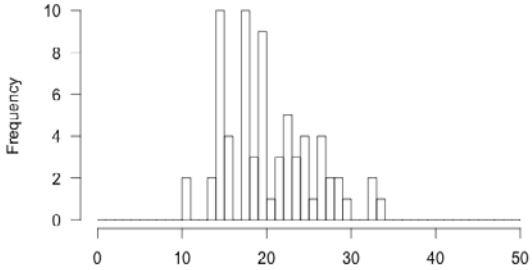
Amblyrhynchichthys truncatus (n=117)



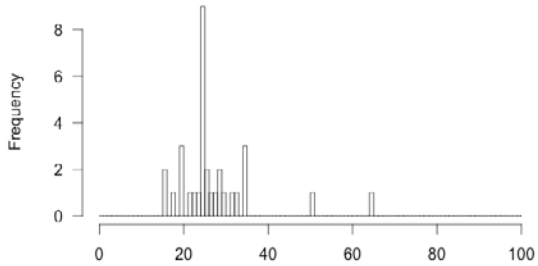
Hypsibarbus sp. (n=75)



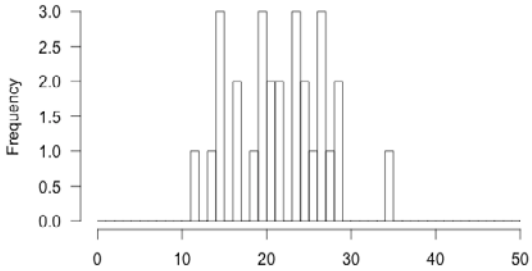
Pseudolais micronemus (n=69)



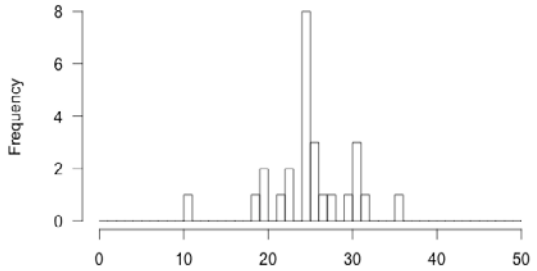
Hemibagrus wyckioides (n=32)



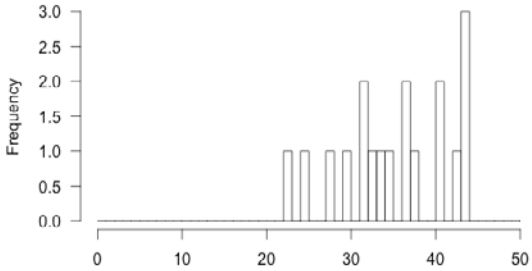
Hemibagrus nemurus (n=28)



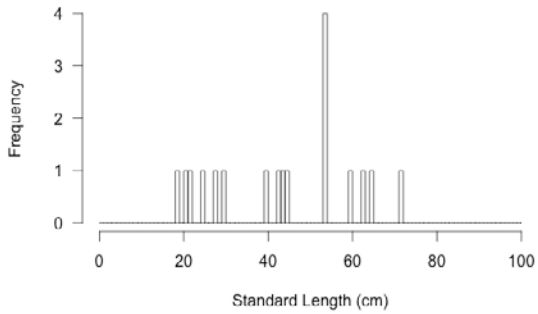
Phalacronotus sp. (n=26)



Labeo chrysophekadion (n=18)



Chitala ornata (n=18)



Pangasius bocourti (n=17)

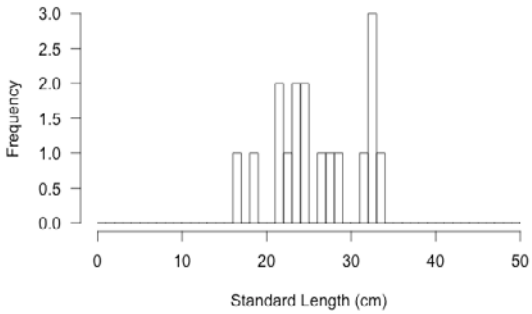


Figure 13. Length frequency of standard length (cm) of only the maximum size fish for species in each catch

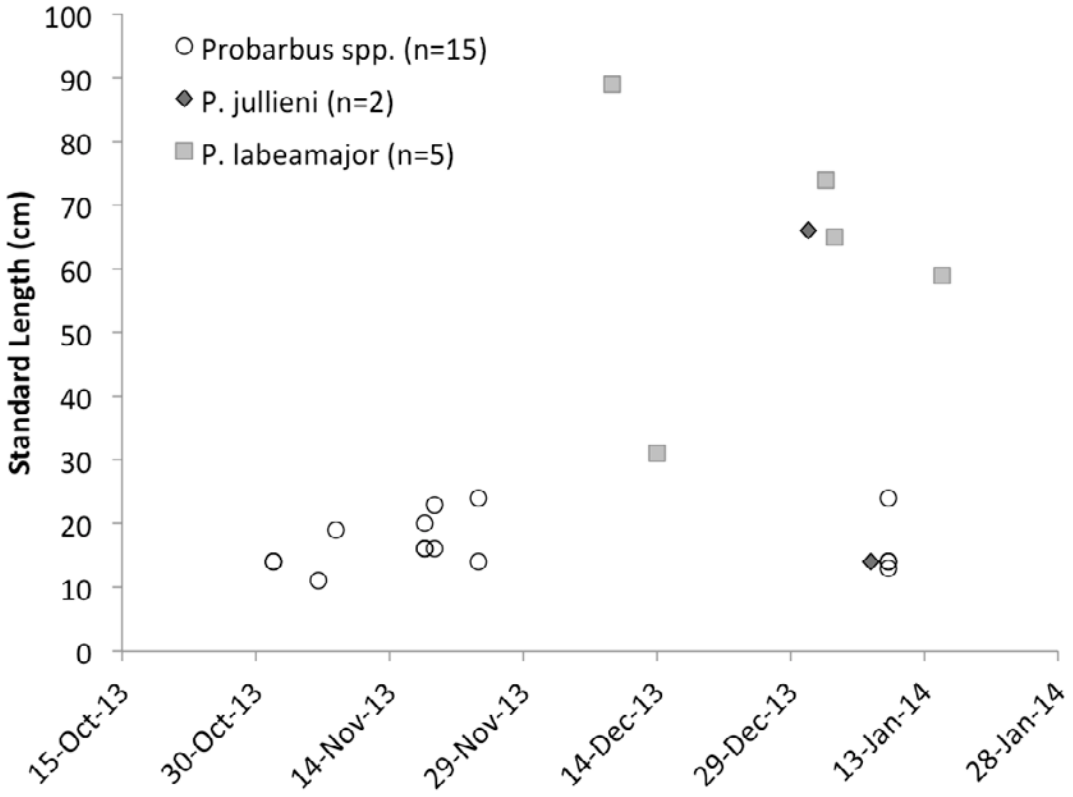


Figure 14. Size of *Probarbus* individuals captured over time throughout the study period. Smaller individuals were often not identified to species.

4. Discussion

4.1 Gear Types Used and Fishing Effort

Fishers in the two villages preferred different gear types for fishing in the mainstream Mekong River, which reflected differences in habitat fished. Despite the proximity of the two villages, the contiguous mainstream river habitat varied considerably between the two. In Ban Sakai there is a deep pool and rapids near the village. In Ban Ang Noi the river is more shallow and sandy, which can cause disconnected off-channel pools to form in the dry season. Fishers said they are usually selecting gear to target certain sizes of fish, not necessarily to target a particular species; however, these habitat differences likely had a strong impact on fishing gear selection and catch. The habitat data gathered was intended to describe the relationship between gear type and habitat fish, but the data were not consistently collected and most fishers just recorded "mainstream" rather than "mainstream/deep pool" or "mainstream/sand bar".

The average daily fish catch for the fishers in this study ranged between 0.52 kg/fisher/day of fishing to 1.67 kg/fisher/day of fishing. Halls et al. (2013) report that the fisher catch in the MRC log book program ranged from 0.1 to 392 kg/day and averaged 0.32 kg/day (S.D.= 1.1 kg/day).

4.2 Composition of the Catch (Species Diversity) and Size of Fish

During initial interviews with fishers from Ban Ang Noi before data collection began, fishers reported that commonly harvested species in their village included: *Hemibagrus sp.*, *Pangasius larmaudii*, *Bagarius yarrelli*, *Labeo sp., Hypsibarbus sp., Laides sp., Amblyrhynchichthys truncatus, Henicorhynchus sp.* Fishers reported occasional catches of *Probarbus species* and rare catches of *Pangasianodon gigas*. Some of these species were also commonly reported in the catch during this study and are discussed in more detail below.

Catch in Ban Ang Noi was dominated by *A. truncatus,* cyprinids that can grow up to 40 cm SL (Rainboth 1996, Baird et al. 1999). Individuals measured during this study were between 5-23 cm SL and were likely mostly juveniles. This species was sometimes caught by herding fish into a gill net, which implies the fishers were in shallow waters. The species was reported as 'formerly very common' between January and February in the Khone Falls region of Southern Laos (Roberts and Baird 1995), and has two periods of abundance in Southern Laos (Baran et al. 2005). In Cambodia, the species moves into inundated habitats during the wet season and returns to mainstream habitats in October and November (Rainboth 1996). Small numbers of *A. truncatus* were reported attempting to ascend a passage from the Mekong River to an adjacent floodplain between April and July in Central Lao PDR (Baumgartner et al. 2012). This species was recorded only during the wet season (June through September) in fisher catches from the Nam Kading, a tributary to the Mekong River in Central Lao PDR, but were absent from catch during the dry season (FISHBIO unpublished). However, Ounboundisane et al. (2013) captured over 500 *A. truncatus* by gillnet, ranging in size from 9 to 24 cm SL in the Nam Kading in April and May 2012, before the start of the wet season. Since the present study was only conducted in the dry season, it is not possible to say whether fish are present in the mainstem Mekong River in Santhong District in the wet season as well.

In Ban Sakai, *Bagarius* species from the family of Sisorid catfishes dominated the fish catch. There was a broad range of maximum sizes for this species group, and there appear to be two peaks in the distribution, indicating that the catch likely comprised of a couple different species within *Bagarius* and/or more than one life stage of the same species. There are four species in the genus *Bagarius*. The majority of the *Bagarius* reported in this study were identified only to genus; however, three individuals of *Bagarius bagarius* were reported in December in Ban Sakai. *Bagarius bagarius* is often caught by hook and line, but it is small for the genus, growing up to 25 cm (Rainboth 1996). The size range for *B. bagarius* matches well with one of the peaks in maximum size in this study of around 15 cm. It is unclear to which species the larger *Bagarius* belonged. The genus also includes *Bagarius yarrelli* (Pa kae ngoua), which grows up to 200 cm (Rainboth 1996) and is distributed throughout the basin in large rivers with strong currents (Poulsen et al. 2004). It spawns in the early wet season (June-July) and may migrate short distances (Poulsen et al. 2004). *Bagarius suchus* occurs in large rives of the Mekong Basin and is known to occur in the middle part of the lower basin on the Thai-Lao border (Rainboth 1996).

Bagarius rutilus is a recently identified species from the Red River basin in Northern Vietnam and Laos (Ng and Kottelat 2000).

Two species reported in the catch are listed on the IUCN Red list: *Probarbus jullieni* (Sauvage) and *Probarbus labeamajor* (Roberts) are both listed as endangered. In Lao PDR, *P. labeamajor* is on the List II for protected species (controlled aquatic fauna). These species are two of the largest freshwater fishes in Southeast Asia, growing up to 1.5 m long and 70kg (Baird 2006). The largest individual captured in the study was a *Probarbus labeamajor* that was 89 cm SL and 16.74 kg. Baird (2006) reported that only individuals 4–5 kg or heavier were found in spawning condition at Hang Khone in Southern Laos, indicating that size at maturity may be around 4 kg. Of the 22 *Probarbus* captured in this study, four *P. labeamajor* and one *P. jullieni* were over 4 kg (all greater than 50 cm SL) and may have been mature.

Probarbus jullieni occurs throughout the Mekong River, as far north as Luang Prabang, Lao PDR, while *P. labeamajor* has a more restricted range, occurring from Nakorn Phanom Province, north-eastern Thailand, to Sambor district, Kratie Province, north-eastern Cambodia (Baird 2006). Baird (2006) reports that the *Probarbus* fishery in Khone Falls area occurs between October and February, with a peak around December. The capture of juvenile and reproductively active adult *Probarbus* fishes in the early dry season (Nov-Jan) confirms their presence in the study area during this season. The fishers strongly recommended that sampling be continued through the mid-to-late dry season (February-June) when fish abundance and harvest levels typically are at their highest, and when fishers have previously caught juvenile *Probarbus*.

In 2012, fishers in Sakai reported that a total of 70 *Probarbus* were caught by Thai and Lao fishers in their area, with the maximum size of 40 kg. A fisherman from Ban Ang Noi with over 40 years of experience fishing in the Mekong reported that in 2012 he caught 13 *Probarbus* ranging from 5 to 13 kg using a 25-cm-mesh gill net. He said he has only been using gill nets for the past 10 years. Previously, he used traditional fishing gear, such as bamboo traps and hook and line, and using this gear he did not catch *Probarbus*. This fisher's story highlights the changing fishing methods that have occurred over the past few decades in Lao PDR. Baird (2006) reports that before the early 1970s, *Probarbus* were generally abundant in Southern Laos, and large-mesh nylon gill nets were rare; however, *Probarbus* are now an important target fish in a gill net fishery, and catch has been declining in recent years. This information suggests that declines in *Probarbus* in Laos may be associated, in particular, with the modernization of fishing gears.

5. Pilot Project Assessment

The primary task of a pilot project is to assess whether the project succeeded in achieving the objectives, and to ascertain areas in which the methods may be improved in the future. The project was successful in achieving its stated objectives, which were to:

1. Test the proposed standard sampling program protocols and methods, which could be applied throughout the Mekong Basin
2. Obtain basic fish harvest data on a continuous basis
3. Collect baseline information on Jullien's Golden Carp (*Probarbus jullieni*) and other local fishes listed as "endangered" on the IUCN Red List
4. Train local fishers and a university student or young professional to participate in the data collection process
5. Produce accessible information products that can be used by local partners to improve fisheries management and conservation strategies

We examine the strengths and weaknesses of the pilot effort, below, as part of the first objective of testing the participatory fisher survey methods. In addition, this project proved successful in meeting Objectives 2 and 3, by gathering on basic fish harvest data and important baseline data on juvenile and reproductively active adult *Probarbus* fishes, as well as raising awareness about the need for their conservation. This study had a capacity-building component (Objective 4), which as to train both local fishers and a university student or young professional to participate in the data collection process. There were challenges to this approach, as discussed below under strengths and weakness, but the project achieved the stated objective and the participants gained valued experience. Sangthong District fishers are now capable of recording information such as the presence of fish species, number of fish species, and fish catch biomass in their own village, which they can compare over time and between villages. The goal of this report is to communicate the results of the pilot study to the local line agencies, and provide relevant recommendations for future activities, as part of meeting Objective 5. In addition to this report, a presentation was given to the participating fishers to communicate the results at the end of the study.

At the final workshop, FISHBIO staff presented the preliminary results of the project and surveyed the participants. Based on this feedback and FISHBIO staff experience, we present below the strengths and weaknesses of the project. See Appendix A for a summary of responses to our final survey of participants by question and village.

Strengths of the Study

The strengths of this project were that the project:

- Had a supported budget for fisher volunteers and the necessary equipment to conduct the study.
- Had a detailed work plan and monitoring system.
- Succeeded in testing the methods proposed for the monitoring of fisheries in the Mekong River.
- Emphasized capacity building for the local people and district staff of the target villages through a training course in fish catch monitoring methods.
- Collected data on fishing effort for unsuccessful fishing trips. Fishers consistently recorded effort on days when they did not catch fish, which is important for estimating catch-per-unit-effort.

- Provided species composition and gear use data for the fishery in two villages.
- Provided valuable information on *Probarbus* species.
- Represented the first study of wild capture fisheries in the mainstream Mekong River in Sangthong District.
- Increased interest in wild capture monitoring in Sangthong District. Fishers enjoyed participating in the project, and expressed interest in continuing the project so that they can learn more about their fishery.
- Gave the fishers a forum to meet and discuss other, related fishing issues such as a need for enforcement of national fisheries regulations (e.g., control of illegal fishing gears), and the establishment of fish conservation zones.
- Was worthwhile to the participating fishers, who said they would continue the project if given the opportunity.

Weaknesses of the Study

The weaknesses of this project were that the project:

- Was short in duration (3 months) and did not have continued funding lined up after the initial project.
- Could have conducted additional follow-up capacity building and training after the initial training course. A few fishers felt that the training course was too short, and that the follow up training was insufficient. Some fishers reported confusion over some aspects of the data collection, and recommended more follow up from project staff. In particular, the project did not have enough training for taking digital photographs of fishes, so that many photos were blurry, and could not be used for species identification.
- Some fishers had trouble using the digital scale because they would accidentally change the settings from kilograms to U.S. pounds. In the future, we will look for scales that only measure in kilograms, and we will consider using mechanical scales instead of digital scales, because the fishers are not as familiar with the digital scales.
- Did not establish a formal quality control process for the paper datasheets. Fishers sometimes did not record all the necessary information on the datasheet. It was difficult to go back many days later and remember what information should have been written on the sheets.
- Fisher volunteers were mostly older generation villagers (50-80 years old), and some fishers could not read and write data on the datasheet. In these situations, their family members or a representative from the Village Lao Women's Union helped them to complete the datasheet. In the future, if a family member is regularly assisting with filling out the datasheet, they should also participate in the training.
- Needed to clarify with fishers what to do when they did not go fishing. We asked fishers to fill out the top part of the datasheet even if they did not go fishing. Some fishers partially filled out their datasheets for the day and made a note about why they did not fish, but not all fishers made a note on these datasheets to indicate that they did not go fishing.

- Did not involve the fisher technicians in the development of the datasheets, which could have prevented some misunderstandings and ensured more accurate data collection.
- Needed better coordination between the data keepers and the field intern so that it was clear which days the intern would be in the village to pick up all the datasheets.
- Focused on the kind of wild-capture fishing that is predominately performed by male fishers in the region. While men generally fish from boats in main river channels, women usually collect fish, frogs, snails, insects and other aquatic animals from wetlands, rice fields, or nearshore areas.
- Did not go out in the field with fishers regularly to assess the accuracy of fish identification and to verify that the species local names were correctly associated with the scientific names in our database.

Additional Challenges of the Study

Study Design

The fish catch data for the two villages was likely under-reported for two reasons. First, many fishers from outside of the study area villages, who were not participating in the study, also target and exploit spawning *Probarbus* at our study site because these fish fetch a high price in neighboring Thailand (across the river). Future studies could collaborate with Thai fishers to fill in this data gap. Second, it was not possible to include fish caught from illegal fishing gear, such as electro-fishing, because there is currently no enforcement and monitoring of illegal fishing practices. The fishers say this is a common practice in their villages, and it may account for a substantial part of the fishing.

An initial goal of this project was to work with a university student intern (either in their final year of study or at master's level), but our target students had full-time course work and were unable to participate in the weekly trips to the villages. In addition, there are very few students that study fish at the National University of Laos. Instead, we worked with a young professional (recent university graduate).

Data Collection

Initially, the fishers admitted that they did not measure small fishes when project staff were not present. After project staff emphasized the importance of measuring all size classes of fish in the weekly follow up meetings, the completeness of data improved. However, fishers still did not always record all information requested in the datasheet, or they recorded information in another unit of measure. For example, rather than measuring the height of their gill nets, some fishers counted the number of mesh squares, which is a common way that gillnet manufactures measure the nets. It is not possible to translate the number of mesh squares into height of gill net, since we do not know for certain when the fishers measured using mesh counts and when they measured using meters. Additionally, fishers did not appear to clearly understand the instructions for sub-sampling their catch. The data indicate that when they said they subsampled, which was rare, they did not weigh the whole catch first before sub-sampling. Also, sometimes the sub-sample box was checked, but the catch was small, and the check mark may have been accidental. There

was also confusion over how to record start and end times for the fishing. In the future this can be corrected by asking for start time and duration (but not asking for end time).

Other Commitments
Most fishers were also farmers and they had limited time to keep daily records for the project during rice harvest periods. Also, during the study period there were a few outside events, such as wedding parties, which drew fishers outside of their own village and prevented them from fishing and recording data. These types of interruptions are expected for a participatory research project, since the project itself is not the main occupation of the participants; thus, this is not a weakness of the project, but an aspect to consider during project design.

6. Conclusions

There is currently no existing line agency program in Sangthong District to study fishes in the Mekong River, according to DAFO staff, and this project represents the first wild capture fisheries research project to take place in this area. The local DAFO staff welcomed the opportunity to be involved in a wild capture fisheries project. The project provided capacity building for PAFO and DAFO staff, a young professional intern, village fishers, and Village Lao Women's Union members on standard fisheries monitoring techniques. The results constitute baseline data that villagers can use to propose fisheries management regulations, including establishment of fish conservation zones (FCZs) for target fish species like *Probarbus* fishes.

The fishers that participated in the study were concerned about having enough fish for future generations. They have expressed a strong interest in continuing to monitor their fishery harvest levels through the remainder of the dry season, and establishing, enforcing, and monitoring FCZs to better manage their community-based fisheries in the future. Baird (2006) reported dramatic declines in *Probarbus* catch in a targeted fishery in Southern Laos in the 1990s. The author suggested that if *Probarbus* are found to be discrete populations at each location instead of one continuous population throughout the region, then localized management of stocks through co-management could be an effective action. Baird and Flaherty (2005) report that many communities in southern Laos identified that *Probarbus jullieni* were directly benefiting from the FCZs in their area, as indicated by an increase in the number of juveniles. Additionally, the fishers interviewed by Baird and Flaherty felt that *Hemibagrus wyckioides*, *Hemibagrus nemurus*, *Pangasius bocourti,* and *Chitala ornata* (all species often captured in this study) also benefited from FCZs. The results of the present study indicate that there is also fishing pressure on juvenile *Probarbus* occupying shallow areas of the river. Establishing fishing regulations or FCZs limiting the fishing pressure on juveniles could help to increase the population.

Now that the pilot phase of data collection has concluded, the program will be evaluated based on practicality, cost effectiveness, and sound science. Based on this analysis, the protocols will be modified and improved, and the final Participatory Fisher Survey protocols will be established to provide detailed descriptions of all equipment and materials, field sampling techniques, and

tools needed to conduct routine field participatory sampling using the MFN Standard Sampling Program.

7. Specific Recommendations for Sangthong District

This study was conducted in the early dry season (November to January), which is a time of lower fish abundance, according to the fisher participants. The capture of juvenile and adult *Probarbus* fishes confirms their presence in the study area during this season, but the fishers strongly recommended that sampling be continued through the mid-to-late dry season (February-June) when fish abundance and harvest levels typically are at their highest, and when fishers have previously caught juvenile *Probarbus*. A baseline survey of *Probarbus* juveniles and adult abundance would inform fisheries co-management decisions at the local and district level. Year-round participatory monitoring would provide an estimate of annual harvest (kg) and catch-per-unit-effort (kg/day) in Sangthong District, which are important indicator variables for fisheries management. Continuing to work in these villages using participatory methods would increase the capacity of local people to conduct fish catch monitoring and provide them with valuable information for co-management decision making.

This study focused on the type of wild capture fishing that is predominately performed by male fishers in Laos. However, women also play an important role in Lao fisheries, and often collect fish, frogs, snails, insects and other aquatic animals from wetlands, rice fields, or nearshore areas. The results of this study indicate that the participants (all male fishers) reported fishing only in the mainstem river, and only using a small portion of the gear types reportedly used in Laos (e.g., gill nets and bottom longlines). There are currently few studies that examine the importance of women's role in the aquatic fisheries of Laos, but there is growing evidence that this is an often overlooked, important aspect of the fisheries sector (Food and Agriculture Organization of the United Nations et al. 2003). In order to properly monitor the aquatic resources of Sangthong District, it is important to collect data on other fishing techniques used in the community (e.g., scoop nets, lift nets) and other habitats fished (e.g., fish ponds, flooded rice paddies, and wetlands). In the future, the methods should be modified to specifically include a gender perspective of the fisheries to ensure a more complete assessment. These additional data would greatly improve understanding of the aquatic resources of Sangthong District, and ensure that the roles of both genders are considered by fisheries co-management activities.

Based on conversations with the fishers, there is great concern among the community regarding the lack of enforcement for illegal fishing gears (i.e., electro-fishing gear and dynamite), and the community would like to establish a legal approach to conserving fishes and avoiding the use of such illegal gear. The first step toward improved management would be the development of co-management committees and regulations for the two communities. The results of this study indicate that the two communities have very different fishing methods, habitats, and catch; thus, we recommend that the communities establish separate co-management committees and regulations. However, the communities are in close proximity to each other, and the same illegal

fishers may be working in both areas; hence, we recommend that the two committees meet often to discuss enforcement strategies and exchange lessons learned.

There are currently no FCZs or fisheries co-management committees in the area of study, and participants in the two villages expressed considerable interest in establishing a co-management committee as well as establishing FCZs, actions which are both permitted at the community level under Lao fisheries law. The participants stated that they would like to protect their important resources by establishing FCZs for the target endangered species, as part of the sustainable management of resources for the next generation. Fishers also expressed an interest in establishing enforcement patrolling and monitoring of FCZs at the community level. Fisheries information needed to help formulate local fishery co-management plans includes: fish species, catch weight or value, fishing gears and seasons, socio-economic categories and numbers of fishers, fisheries legislation, and management responsibilities (Halls et al. 2005). This study lays the groundwork for collecting such information, and the data presented here can serve as a starting point for developing local fisheries co-management plans.

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Appendix A. Closing Ceremony Survey Questions for Participants

Below is a summary of the different responses to our survey questions for each village

Village Name: Ang Noi

Date: 29 Jan 2014

Number of Interview Groups: 5

1	What was the hardest part of collecting data on your fish catch? - The hardest part of collecting data on my fish catch are noting information in the form when fishing immediately. - The hardest part of collecting data on my fish catch is about the hour of fishing such as start time and end time - The hardest part of collecting data on my fish catch is distinguishing species - The hardest part of collecting data on my fish catch is distinguishing species - The hardest part of collecting data on my fish catch is distinguishing species
2	What was the most difficult part of filling out the data form? - the most difficult part of filling out the data form are water level and weather - the most difficult part of filling out the data form are measuring and photographing fish - nothing was difficult - the most difficult part of filling out the data form is photographing fish - I do not understand most of it
3	Do you feel that you had enough training in October to understand the tasks? - I can understand when I ask friends - There was not enough, because it was short time - Yes, there was enough. - There are not enough, it was a short time to deal with each other and don`t understand fully - There was not enough, because it was a short time
4	Do you feel that we had enough communication between FISHBIO and the participants? - There was not enough, it should be more times - There was not enough, communication between FISHBIO and the participants did not continue - Yes there was enough. - would like your project to contact with us more than it did - There was not enough to explain work clearly

5	If we continue this project would you be interested in participating in the future? - If you continue this project I would be interested in participating in the future - If you continue this project I would be interested in participating in the future - If you continue this project I would be interested in participating in the future - If you continue this project I would be interested in participating in the future - If you continue this project I wouldn`t be interested in participating in the future, because I am very old now
6	What changes to the study do you think we could make to encourage more fishers to participate? - should have more face time to explain - should pay more salary - should have time to explain more clearly - Follow up on fishery regulations such as electro fishing and using dynamite. - Fishers have to set the rules for people strictly - Want to have fishers participate and want to learn more about fishing
7	What is your primary reason for participating in the study? - My primary reason for participating in the study is I want to know information about fishing - My primary reason for participating in the study is I want to know about planning to do work for fishing - I am willing to participate with your project - Can be included as part of their fishing routine - I am satisfied
8	Do you have any general recommendations for making improvements to the study in the future? - Would like to have protection for fishes that become extinct by restricting equipment for fishing and to upgrade the level awareness about fishing to the people - Would like your project to come to the regular monitoring - No recommendations, everything is good - Would like to have some people explain instructions more carefully - No comment

Village Name: Sakai

Date: 29 Jan 2014

Number of Interview Groups: 6

1	What was the hardest part of collecting data on your fish catch? - The hardest part of collecting data on my fish catch is change of scale - The hardest part of collecting data on my fish catch is about hour of fishing - The hardest part of collecting data on my fish catch is change of scale - The hardest part of collecting data on my fish catch is photograph - The hardest part of collecting data on my fish catch is everything, because I can`t hear and can't write - The hardest part of collecting data on my fish catch is change of scale
2	What was the most difficult part of filling out the data form? - The most difficult part of filling out the data form are measuring and photographing the fish - Everything is difficult, because I do not understand - Everything is difficult, but have children help me for filling out the data form - The most difficult part of filling out the data form is weather - The most difficult part of filling out the data form is measured - No comment
3	Do you feel that you had enough training in October to understand the tasks? - I can understand - There was not enough, because have short time - Yes, enough, I can understand - Yes, enough, I can understand - Mostly I do not understand - There was not enough, I still don`t understand
4	Do you feel that we had enough communication between FISHBIO and the participants? - Yes, there was enough - Yes, there was enough - Yes there was enough, we had many times to get to interact with each other - Yes, there was enough, we had many times to get to interact with to each other - There were not enough, we had little contact
5	If we continue this project would you be interested in participating in the future? - If you continue this project I would be interested in participating in the future - If you continue this project I would be interested in participating in the future - If you continue this project I would be interested in participating in the future but I

	could not read and write on the record sheet and also it was very difficult to hear. - If you continue this project I would be interested in participating in the future - If you continue this project I would be interested in participating in the future - If you continue this project I would be interested in participating in the future
6	What changes to the study do you think we could make to encourage more fishers to participate? - I think should explain more to the fishers. I would like to have somebody help me for filling out the data form, because I can`t write - I think should have rules strictly for fishing and stop use of illegal fishing - Follow up fishery regulations such as electrofishing and using dynamite. Fishers have to set the rules for people strictly - Would like to have more time - I think should have paid more attention to the fishers
7	What is your primary reason for participating in the study? - I like fishing - Have to learn more and I like fishing - Would like to participate in the conservation of fishes with you - Would like to participate in the conservation of fishes with you - I am a fisher to the profession and I want to help your project - Can understand more about fishing
8	Do you have any general recommendations for making improvements to the study in the future? - No recommendations, mostly is good - No recommendations, mostly is good - No recommendations, mostly is good - Would like to the salary to increase - No recommendations, mostly is good - Want to collect number hook and line

Appendix B. Table of Fish Captured by Number and Weight

Fish in table are grouped by scientific name, species code, and Lao name(s). Total number of individuals in the catch and total weight of individuals in the catch is provided by village and as a total.

Scientific Name	Lao Name(s)	Ban Ang Noi		Ban Sakai		Grand Total # in Catch	Grand Total Weight (kg) of Catch
		Total # in Catch	Total weight (kg) of Catch	Total # in Catch	Total weight (kg) of Catch		
Amblyrhynchichthys truncatus	ปาม่วงตาโป	3873	67.23	18	0.92	3891	68.15
Anabas testudineus	ปาเข้	40	0.40			40	0.40
Bagarius (species uncertain)	ปาแอ้	153	9.30	313	108.86	466	118.16
Bagarius bagarius	ปาแอ้			3	0.46	3	0.46
Barbonymus altus	ปาอ่องไฟ			4	0.10	4	0.10
Barbonymus (species uncertain)	ปาอ่องไฟ	2	0.10	8	1.60	10	1.70
Belodontichthys truncatus	ปาข็บ	2	1.72	5	2.01	7	3.73
Channa striata	ปาถ่			1	0.32	1	0.32
Chitala (species uncertain)	ปาตอง			4	1.17	4	1.17
Chitala ornata	ปาตองดาอ	10	16.64	8	7.72	18	24.36
Cirrhinus jullieni	ปาส้อยห้อแหม	1	0.12			1	0.12
Cirrhinus molitorella	ปาแกง	1	0.09			1	0.09
Cirrhinus mrigala	ปามอมจัน	1	3.77			1	3.77
Clupisoma sinensis	ปายอมหอง	18	2.28			18	2.28
Cosmochilus harmandi	ปาโจก	1	3.25			1	3.25
Ctenopharyngodon idella	ปากินหย้า	1	6.24			1	6.24
Cyclocheilichthys enoplos	ปาจอกห้อหู่ม	9	1.80	1	1.81	10	3.61
Cyclocheilichthys furcatus	ปาจอกห้อโป	1	0.15			1	0.15
Cyclocheilichthy (species uncertain)	ปาดอกงื้อ	3	0.16			3	0.16
Cyprinus carpio	ปาไน	9	16.19	5	2.69	14	18.88
Hampala (species uncertain)	ปาสูด	4	0.11	1		5	0.11

Helicophagus leptorhynchus	ปาซอยขู	9	1.24	1	0.03	10	1.27
Helicophagus waandersi	ปาข้าขู, ปาขู	4	1.14	1	6.43	5	7.57
Hemibagrus (species uncertain)	ปากົด			1	0.52	1	0.52
Hemibagrus nemurus	ปากົดเຫຼືອງ	2	1.09	29	10.59	31	11.68
Hemibagrus spilopterus	ปากົด	4	0.31			4	0.31
Hemibagrus wyckii	ปากົดໝໍ້, ปากົดดຳ			16	4.76	16	4.76
Hemibagrus wyckioides	ปาเถິງ	3	1.16	30	18.66	33	19.82
Henicorhynchus sp.	ปาส้อย	20	0.52	29	12.20	49	12.72
Hypsibarbus (species uncertain)	ปาปาก	24	36.21	72	44.06	96	80.27
Hypsibarbus malcolmi	ปาปากหวอด	4	2.92			4	2.92
Hypsibarbus pierrei	ปาปากดำ			2	0.29	2	0.29
Hypsibarbus wetmore	ปาปาตาเຫຼືອງ	1	0.16			1	0.16
Hypsibarbus vernayi	ปาปากกົม	2	0.48			2	0.48
Kryptopterus 1 (species uncertain)	ปาปີกไก่ 1	1	0.05	4	0.52	5	0.57
Kryptopterus 2 (species uncertain)	ปาปີกไก่ 2			2	0.61	2	0.61
Labeo barbatulus	ปาเผ้ย, ปาอี่ตู่			1	1.14	1	1.14
Labeo chrysophekadion	ปาหว่าซ่อง	8	14.13	11	14.74	19	28.87
Macrognathus (species uncertain)	ปาຫຼົดบา,ปาหຼົดน้อย			1	0.09	1	0.09
Mastacembelus armatus	ปาหูาด	1	0.10			1	0.10
Mystacoleucus 1 (species uncertain)	ปาหຼັงหวาม 1	3	0.07			3	0.07
Mystacoleucus 2 (species uncertain)	ปาหຼັงหวาม 2			6	1.43	6	1.43
Mystus (species uncertain)	ปาละแยง			3	0.62	3	0.62
Mystus albolineatus	ปาละแยงโล	1	0.05			1	0.05
N/A (no species reported)	xxxxxxxxx	1	5.30	1	0.16	2	5.46
Ompok bimaculatus	ปาเຊือม			5	3.41	5	3.41
Oreochromis niloticus	ปานิน	6	1.48			6	1.48
Osteochilus waandersii	ปาข้างลาย	1	0.16			1	0.16
Oxyeleotris marmorata	ปาบู่			2	0.76	2	0.76
Pangasius (species uncertain)	ปาໜັง	8	0.96	3	0.63	11	1.59

Pangasius bocourti	ปาเพาะ	1	0.45	17	7.72	18	8.17
Pangasius larnaudii	ปาปึ๋ง, ปาหูໜາດ	1	13.39			1	13.39
Pangasius macronema	ปายอນสูบ			5	0.71	5	0.71
pleurotaenia Pangasius	ปายอนท้องลิ่ม	2	0.25			2	0.25
Parachela williaminae	ปาກะแตบ			8	0.44	8	0.44
Phalacronotus (species uncertain)	ปานาง	8	1.84	25	5.39	33	7.23
Probarbus (species uncertain)	ปาเอิน	13	2.02	2	0.14	15	2.16
Probarbus jullieni	ปาเอินตาแดง	2	6.64			2	6.64
Probarbus labeamajor	ปาเอินขาอ	4	39.41	1	0.62	5	40.03
Pseudolais micronemus	ปายาง	31	3.93	63	13.53	94	17.46
Puntioplites falcifer	ปาสะกาง	2	0.32	11	20.46	13	20.78
Raiamas guttatus	ปาสะนาก	3	0.13			3	0.13
Scaphognathops sp.	ปาป่วน	1	0.05			1	0.05
Sisukia gudgeri	ปาໜางเป็น	69	1.87			69	1.87
Systomus orphoides	ปาปึก	1	0.03			1	0.03
Tetraodon baileyi	ปาเป้าเผือง	1	0.03			1	0.03
Yasuhikotakia (species uncertain)	ปาหมู, ปาแข้ไก้	1	0.03			1	0.03
Yasuhikotakia caudipunctata	ปาหมู, ปาหมูมัน			1	0.06	1	0.06
Grand Total		**4372**	**267.47**	**724**	**298.39**	**5096**	**565.86**