OBSERVATIONS ON FISHES AND FISHERIES IN SOUTHERN LAOS AND NORTHEASTERN CAMBODIA, OCTOBER 1993-FEBRUARY 1994

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ABSTRACT

Fish species, migrations, and fishing activities were observed on the Mekong River in southern Laos from October 1993 through February 1994 and in northeastern Cambodia in February 1994. November through January is the time of the reproductive migrations and spawning of the large cyprinid fish *Probarbus jullieni*, upon which important but steadily declining fisheries are based. January and February is the time of important non-reproductive migrations of many species, predominantly Cyprinidae, also heavily fished.

INTRODUCTION

We are just beginning to document the scale and complexity of fish migrations in the Mekong basin. Much more observation and study are needed before an adequate account can be given of these events. Cambodia and southern Laos are perhaps the only remaining places where extensive Mekong fish migrations and the intensive fishing activities based upon them still can be observed. It is probably too late to find out what the migrations were like before they were seriously damaged in southern China (Yunnan), Thailand and Vietnam by negative homogenic impacts.

Reconstructing the Mekong fish migrations that formerly occurred in Thailand is fraught with difficulty. Asking fishermen to remember migratory fish activity from years gone by is like asking people what the weather was like. Responses—unless accompanied by written records—are largely anecdotal, highly fragmentary, and sometimes unverifiable. The detailed and extensive written records kept by Chinese market women on fish species and prices could provide the most useful documentation available on Mekong migratory fish species over the years. So far as we are aware, no effort has been made to retrieve or to utilize this potentially invaluable source of information.

Our present observations confirm unanimous statements by fishermen just above and below Lee Pee Waterfalls in southern Laos that 1993–94 has been the worst fishing season they have ever experienced. We feel that this situation is representative of a long-term basinwide decline of Mekong fisheries. Poorly documented though it may be, we have no doubt that substantial decline has occurred, and that it will continue. We know that some (mostly non-observers) consider the decline a product of the imagination of overly con-

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cerned conservationists and fishermen with vested interest in reporting poorer and poorer catches. We wish to refute them by producing as much solid data and information as possible at this relatively late date. In this regard it should be pointed out that much of the decline involves species that are of relatively little or almost no previous or present importance to the fishermen, so that they have nothing to gain by reporting such declines. Of course the more important fisheries species are also declining.

Decline of Mekong fisheries is attributable to overfishing and destructive fishing practices together with environmental deterioration. Deterioration of the environment is due primarily to deforestation, pollution, and dams. Of particular concern is the recently constructed Manwan high dam on the Mekong mainstream in Yunnan. Also of concern is Pak Mun Dam at the mouth of the Mun River. The Mun is Thailand's most important Mekong tributary and has been a major objective of many of the migratory fish species reported upon in the present paper and in ROBERTS (1993). For a critique of Pak Mun Dam and its negative impacts on fishes, see ROBERTS (1994). The worst impact of Pak Mun may be downstream pollution resulting from industrialization based on hydroelectricity.

Observations on the June–July 1993 fish migration just below Lee Pee Waterfalls in southern Laos were reported by Roberts, 1993. That paper also gives a list of over 100 species with scientific identifications and Lao names caught just below the waterfalls in June–July 1993, and a preliminary account of the yearly cycle of fish migration and artisanal fisheries there.

REPRODUCTIVE MIGRATION AND SPAWNING OF *PROBARBUS* JUST ABOVE LEE PEE WATERFALLS, OCTOBER 1993–JANUARY 1994

The following account of migration and spawning of *Probarbus jullieni* (Fig. 6) is based mainly on Terry Warren's intermittent interviews with fishermen and observations just above Lee Pee Waterfalls from August 1993 through the end of January 1994.

From 29 October through end of November 1993 pa uhn or *Probarbus jullieni* was the only fish species observed in reproductive condition just above the waterfalls, and from the end of November all fish catches except those of *P. jullieni* went way down. During this period all pa uhn caught either had eggs or milt. The fish ranged in size from 3 to 20 or more kg, with most about 5 or 6 kg.

Don Hee (Hee Island) is the site of a *Probarbus* spawning ground. The actual spawning ground, located 100 m or so above Ban Don Hee on the middle of the western side of the island, is a shallow area only 80 to 120 m long and 2 to 3 m deep at the time of spawning. Fish ready to make the spawning run lie or mill around in deeper water below and around the spawning ground. The fishermen of Ban Don Hee have been fishing this site intensively, immediately before and during the actual spawning period, for many years.

On 1 November 1993, Bun Mah, an experienced fisherman and fish buyer of Ban Don Hee, said that the water was still too high and too colored for pa uhn to migrate, and that fishermen would not put out special gillnets for pa uhn (mawng pa uhn) until at least 20 November. On 17 November the first migratory *Probarbus* of the season (a running male) was caught. In 1992, a year of relatively high water, *Probarbus* did not begin to arrive in large numbers at Don Hee until the end of December.

According to Bun Mah, Ghet, and other fishermen, there are three things that signal the beginning of fishing for *Probarbus* at Don Hee: 1) certain rocks come out of the water (white water can be seen swirling around them); 2) turbidity goes down rather suddenly (water changes from a wet-season look to a dry-season look); 3) cold weather sets in (this probably corresponds to a drop of mainstream Mekong water temperature from about 27 to 17 or 18° C).

According to Bun Mah, every year males far outnumber females for the entire migration period. The big migratory fish gather in the general area of the lower west side of Don Hee for several weeks before intense spawning for 2 or 3 days. He observed actual spawning events at 4 p.m. and also between 7 and 8 p.m. Spawning involved a lot of rolling and splashing at the surface. He could see eggs streaming out of females at the water surface, with pa gae (small *Pangasius conchophilus*), small pa goht (*Mystus nemurus*), and small pa pia (*Labeo chrysophekadion* and/or *L*. cf. *barbatulus*) gorging on them.

The fishermen of Ban Don Hee and other sites above the waterfalls recognize four kinds of pa uhn: pa uhn dtah daeng (red-eyed pa uhn, the commonest form, *Probarbus jullieni*); pa uhn muam (black-headed pa uhn), identified by the first author from photographs taken by Ian Baird as a melanic form of *P. jullieni*; pa uhn yuam, pa uhn mae yuam, or pa uhn khao (mare pa uhn, mare's mother pa uhn, or white pa uhn), the relatively uncommon large species *P. labeamajor*; and pa uhn mah bohk, said to be just like pa uhn dtah daeng but short and very deep-bodied (not identified scientifically). Fishermen from just above and just below Lee Pee Waterfalls readily recognize *P. jullieni* and *P. labeamajor* from color photographs, but seem not to know the small species *P. labeaminor* at all. For an account of the systematics, distribution, and distinguishing characters of the species of *Probarbus*, see Roberts, 1992a.

According to Bun Mah when interviewed in August 1993, as recently as 1986 and 1987 they were catching up to 100 *Probarbus* per night during the spawning run. In 1992 the maximum was down to about 60 fish per night.

From 17 November 93 through 19 January 1994 92 *Probarbus* were recorded as caught at Ban Don Hee. All were *P. jullieni* in spawning condition. Sex was recorded for 82 of these 92 fish: there were 53 males and 29 females. Males averaged 7.1 kg, females 11.2 kg. The largest was a 24-kg female. A daily catch record was kept from 17 November through 19 January. A big peak occurred on 8–10 January when 22, 11 and 6 fish were caught per day. This represents the three days of peak spawning activity. On most other days during the observation period 0, 1 or 2 fish only were caught. At the height of fishing up to 200 gillnets (all about 40–50 m long, and about half with 20–25 cm mesh) were deployed completely surrounding the spawning site just upstream from Ban Don Hee. By 17 January the pa uhn migration and spawning was definitely finished, and fishermen quit fishing for them.

This is the first year the fishermen at Ban Don Hee did not catch any *P. labeamajor*. Incidentally, the flesh of this species is locally regarded as inferior, and sells for only about half the price of that of *P. jullieni*. *Probarbus labeamajor* apparently migrates together with *P. jullieni*, and evidently has been decimated by the intensive gillnet fishery directed at that species. Further investigation is needed to find out whether it shares the same spawning grounds and times. Goh Sampeeaye fishermen (south of Stung Treng) interviewed by the first author report that they catch *P. labeamajor* in January and February, when fish are migrating upriver with eggs. The largest are 70 kg. These fish disappear in February. The same fishermen report catching *P. jullieni* of up to 50 kg migrating upstream with eggs in January, and that they can catch small fish of this species throughout the year.

The species of *Probarbus* inhabit mainly the mainstream of large rivers. In the Mekong basin they are nearly restricted to the Mekong mainstream. *Probarbus jullieni* of any size may be caught individually or in small numbers, incidentally with gillnetting and other fishing activities, at virtually any time or place in the Mekong mainstream. Exclusive or nearly exclusive fishing for the species occurs only during the upstream reproductive migrations and actual spawning periods, from November through January or sometimes into February in the area near the waterfalls. Father upstream the fishery occurs at progressively later times. The most important catching sites are at or near actual spawning sites. These include Hoo Saddam, next to Don Saddam, about 3 km below Lee Pee Waterfalls; 2) Ban Don Hee, about 10 km above Lee Pee Waterfalls; 3) Phatuphome, 48 km S of Pakse; and 4) Don Kho, 8 km N of Pakse. There probably are at least three or four more sites between Don Kho and Luang Prabang.

Our observations and interviews indicate that this important fisheries species is involved in a serious longterm decline (see also ROBERTS, 1993). This decline evidently is basinwide, and the most obvious (but not necessarily only) reason is overfishing with gillnets during the reproductive migrations and spawning periods.

OBSERVATIONS ON MIGRATORY FISH SPECIES JUST ABOVE LEE PEE WATERFALLS, FEBRUARY 1994

Observations on fishing activity and fish migrations just above Lee Pee Waterfalls were made by the second author from 6 through 18 February 1994. Population samples of about 50 to 100 "pa soi" were purchased daily from one of three fisherwomen who sold their overnight catch at Kinnak market. The fish were caught with small fine-meshed fixed gillnets (mawng sae) or with canary-cage shaped traps (dtoom) set in shallow water against, or very near to, the shore. Kah traps, used to catch the same species of pa soi in June and July (ROBERTS, 1993: 59, fig. 16), cannot be used in January and February because they quickly become clogged with kai hin (filamentous algae). The specimens were sorted to species, photographed, and the entire sample preserved for future reference. All photographs were examined and analysed jointly by the authors in Bangkok. The day by day records for these samples are as follows:

6 February. N (total number of specimens) = 99: Cirrhinus sp. 90, Labiobarbus leptocheilus 6, Lobocheilos melanotaenia 2, Cyclocheilichthys apogon 1.

7-8 February. No observations.

- 9 February (Chinese New Year's Day). N = 91: all Cirrhinus sp.
- 10 February. No observations.
- 11 February. N = 73: Cirrhinus sp. 70, Paralaubuca typus 2, Osteochilus sp. (juv.) 1.
- 12 February. N = 51: Cirrhinus sp. 33, Labiobarbus leptocheilus 13, Paralaubuca typus

3, Cirrhinus siamensis 1, Lobocheilos melanotaenia 1.

- 13 February. N = 62: Cirrhinus sp. 44, Labiobarbus leptocheilus 17, Paralaubuca typus 1.
- 14 February. N = 74: Cirrhinus sp. 64, Labiobarbus leptocheilus 10.
- 15 February. N = 86: Cirrhinus sp. 68, Labiobarbus leptocheilus 18.
- 16 February. N = 70: Cirrhinus sp. 50, Labiobarbus leptocheilus 18, Lobocheilos melanotaenia 2.
- 17 February. N = 93: Labiobarbus leptocheilus 47, Cirrhinus sp. 42, Gyrinocheilus pennockii 2, Cyclocheilichthys apogon 1, Paralaubuca typus 1.
- 18 February. N = 70: Labiobarbus leptocheilus 51, Cirrhinus sp. 19.

Several comments are in order. These catches are all or almost all based on small, non-reproductive cyprinid fishes migrating upstream. By far the most abundant species is *Cirrhinus* sp., the smallest *Cirrhinus* species recorded from Lee Pee, locally known as pa soi hua lem. This species dominated the samples every day until 17 and 18 February, when it was surpassed by *Labiobarbus leptocheilus*. It is the species reported by Ban Hang Khone fishermen to begin the Chinese New Year's Day fish migration (ROBERTS, 1993: 46) and in fact on 9 February it comprised 100% of the sample observed. The species composition of these non-reproductive pa soi in February 1994 resembles that of the reproductive pa soi migrating in June–July 1993, but differs notably in the absence of *Crossocheilus* sp. For more remarks on this and other species of *Cirrhinus*, see ROBERTS (1993: 38), and the present paper under accounts of individual taxa.

The second author also observed that hundreds of pa moo, *Botia modesta*, also appeared daily in Kinnak market during the toot jin (Chinese New Year) migration period. Although several species of *Botia* occur in the Lee Pee area (both above and below the waterfalls), *B. modesta* is the only one for which substantial migratory activity has been noted.

In addition to observations on pa soi and pa moo at Kinnak, the second author observed larger migratory fish species at the fishing village of Ban Wernsonkhram on Don Hat (Hat Island), where only large drifting gillnets were being used to catch fish. Observations were made daily from 6 through 14 February, and then 3 times/week until 25 February. The daily observations were as follows:

- 6 February. Very few fish being caught, almost no one fishing.
- 7 February. Two or three fishermen went out for one hour or one-half hour in the morning and again in the afternoon, came back reporting no fish.
- 8 February. Same as for 7 February. Very hot weather.
- 9 February. Explosion of fishing activity. Some 70 boats out fishing, repeatedly coming in to unload 5-6 kg catches and then return to fish again. Most abundant fish were two species of pa pien, Scaphognathops stejnegeri and S. bandonensis; largest fish pa wa nah nuk (Labeo behri) of about 1 kg. Other species: pa pak (two or perhaps three species of deep-bodied large-scaled cyprinids, Hypselobarbus spp.; pa wa sooang (Labeo cf. pierrei); pa sa-ee (Mekongina erythrospila); pa gaw (Gyrinocheilus pennockii); and pa geng (Cirrhinus molitorella).

- 10 February. Similar to 9 February. Pa pawn (Cirrhinus microlepis) added to species being caught.
- 11 and 12 February. Similar to 9 and 10 February. On 12 February pa sagang (*Puntioplites* sp.), pa sanghooa (*Micronema* cf. *apogon*) and small numbers of pa noo (*Helicophagus* waandersii) added to catch.
- 13 February. No observations.
- 14 February. Very small catches, mainly pa pien, pa pak, pa pawn, pa w (both species), pa sa-ee.
- 15 February. No observations, but fishermen interviewed next day reported very low catches.
- 16 February. Very low catches of pa sa-ee, pa wa (both species), pa gaw (Gyrinocheilus), pa pien, pa pak (Hypselobarbus), and pa nyawn tawng khom (Pangasius pleurotaenia). Fishermen declared that migration was finished.
- 17 February. No observations.
- 18 February. Pa pien (two species) dominated the catch; pa jawk (Cyclocheilichthys enoplos) and pa mak ban (Cosmochilus harmandi) suddenly showed up together; also pa wien fai (Barbodes altus).
- 19-20 February. No observations.
- 21 February. Pa pien (dominant), pa mak ban, pa pak, pa wien fai, pa noo.
- 22 February. No observations.
- 23 February. Pa pien (big catch), pa pak, pa noo, pa wa sooang (only 1 or 2 fish).
- 24 February. No observations.
- 25 February. Pa pien (both species) and pa nyawn tawng khom (*Pangasius pleurotaenia*) dominant; also pa noo, pa pak.

The important thing to note here is, of course, the explosion of fishing activity based on migratory fish that occurred on 9 February, Chinese New Year's Day, exactly as described by Ban Hang Khone fishermen (ROBERTS, 1993: 46). The fish species and their participation in the February 1994 migratory period at Kinnak and at Don Hat above the waterfalls is also very much as that reported by Ban Hang Khone fishermen from below the falls (ROBERTS, 1993). Thus the accuracy and usefulness of their reports is confirmed.



Figure 1. Se San at Stung Treng.



Figure 2. Se Khone a few km upriver from Stung Treng (5 February 1994).



Figure 3. Stung Treng market, 8 February 1994.



Figure 4. Stung Treng market, 8 February 1994.



Figure 5. Anguilla cf. marmorata, 1.4 m and 11 kg, Mekong River just above Lee Pee Waterfalls, July 1993.



Figure 6. Probarbus jullieni, about 70 cm, Ban Hang Khone, June 1993.



Figure 7. Mekongina erythrospila, about 25 cm, Stung Treng, February 1994.



Figure 8. Mekongina erythrospila, close-up of fish in Fig. 7.



Figure 9. Labeo cf. pierrei, about 80 cm and 4 kg, Ban Hang Khone, June 1993.



Figure 10. Labeo cf. pierrei, close-up of fish in Fig. 9.



Figure 11. Labeo behri, 455 mm, Stung Treng, February 1994.



Figure 12. Labeo behri, close-up of fish in Fig. 11.

MARKET SURVEY OF FISH SPECIES AT STUNG TRENG, FEBRUARY 1994

From 2–10 and 16–18 February 1994, with the help of Kai Erik Witte, a daily survey of fish species was conducted in the Stung Treng market. The time was chosen to coincide with Chinese New Year's Day, which came on 9 February, because this is the date we expected the commencement of migratory fish activity (ROBERTS, 1993: 46, 61). The survey was done for an hour or more each morning, mainly between 7:00 and 9:00 a.m. Spot checks were made at other times of the day, but contributed very little additional information since nearly all fish marketed arrived by 8:00 a.m. Locally used Khmer names were obtained for nearly all of the species. In all instances these were checked and rechecked with several informants, not always with uniform results. Some 114 fish species were observed in the market place (Table 1).

Most people selling fish in the market did not know the names of very many of the fish species. Khmer names currently used in Stung Treng generally are similar to those used elsewhere in Cambodia, e.g. Phnom Penh and Siem Reap. Among the more note-worthy exceptions are the names for *Tenualosa thibaudeaui* (trey thebaw at Phnom Penh and Siem Reap) and *Mystus microphthalmus* (trey tanil in Phnom Penh and Siem Reap).

MIGRATORY FISHES AT STUNG TRENG, FEBRUARY 1994

Among the more important migratory species at Stung Treng in February 1994 were trey sa-ee and the two kinds of trey wa (discussed separately). Other important large species involved in migratory activity were *Cirrhinus microlepis* and *Cyclocheilichthys* enoplos. Of the smaller species, most important were trey real, *Cirrhnus siamensis* and *Cirrhinus* sp., and trey salak rusai, Paralaubuca typus. The endemic Mekong herring *Tenualosa thibaudeaui*, formerly an important migratory species, was represented by only a half-dozen specimens. With the exception of a few large ripe or ripening females of one species of trey chapun (*Hypselobarbus* sp.), all of the market fish observed were in nonreproductive condition.

No really sharp jump in abundance of smaller migratory fish species was noted on or before the Chinese New Year's Day, 9 February 1994. That is, from 2 through 18 February there was very little difference in the daily availability of trey real, trey Salak rusai and associated small migrators. These were mainly sold by a half-dozen women, individually or with partners, selling from a half-dozen wood tables in the main, awning covered selling area. On 7 and especially on 8 February there was a marked jump in the number of fish sellers: the "core group" of about 15 sellers in the main marketing area with tables and awnings and 10 to 15 sellers on the ground just behind the main selling area for fish, were joined by some 20 to 40 new sellers on the ground along the roadside immediately behind the market (Fig. 4). On 9 February there was about a 30% decline in the number of sellers compared to 8 February, but still far more than on the other previous days. More fish were being sold than previously, but many of the species involved may not have been migratory at this time. It was difficult to judge whether increase in the number of fish sellers was related to increased availability of migratory fish.

Table 1. Fish species observed during Stung Treng market survey, 2–18 February 1994. All Khmer names are preceded by the word "trey". Species known or thought to be involved in migratory activity during this period marked with an asterisk(*).

Dasyatididae (whiptailed stingrays)	
Dasyatis laosensis	pawbel
?Himantura chaophraya (in pieces)	pawbel
Notopteridae (featherbacks)	
Chitala blanci	grai
Chitala lopis	grai
Chitala ornata	grai
Notopterus notopterus	chalat
Clupeidae (herrings)	
Tenualosa thibaudeaui	samloan; samloey; jamloan
pellonulin gen. sp. undet.	changwa
Engraulididae (anchovies)	-
Setipinna melanochir	pokmawt chmar (cat chin)
Cyprinidae (carps)	-
Amblyrhynchichthys truncatus	gambote jeramo
Barbichthys nitidus	
Barbodes altus	kahai
Barbodes schwanenfeldii	kahai
Cirrhinus jullieni	ampool toom; pakatcha
Cirrhinus microlepis*	pruol
Cirrhinus molitorella	-
Cirrhinus siamensis*	real
Cirrhinus sp.*	real
Cosmochilus harmandi*	chikaowk kdah
Crossocheilus sp.	real toht
Cyclocheilichthys enoplos*	chikaowk
Cyclocheilichthys slender	
Cyclocheilichthys deep	
Cyclocheilichthys red fins	
Discherodontus ashmeadi	gantoye grahawm (redtail)
Garra fasciacauda	noenung
Hampala macrolepidota	kaman
Hypselobarbus cf. daruphani*	chapun mir (gold chapun)
Hypselobarbus cf. pierrei*	chapun
Hypselobarbus sp.*	chapun
Labeo cf. barbatulus	ka aik
Labeo behri*	wa muk pee (two faced wa)
Labeo chrysophekadion	ka aik
Labeo cf. pierrei*	wa; wa muk mooi

Labiobarbus leptocheilus* Leptobarbus hoevenii Lobocheilos melanotaenia Luciosoma bleekeri Macrochirichthys macrochir Mekongina erythrospila* Mystacoleucus sp. Osteochilus enneaporos Osteochilus hasselti Osteochilus microcephalus Paralaubuca typus* Poropuntius deauratus Probarbus jullieni Probarbus labeamaior Puntioplites proctozysron* Rasbora aurotaenia Scaphognathops bandonensis* Scaphognathops stejnegeri* Sikukia cf. stejnegeri Thynnichthys thynnoides* Tor cf. tambra Gyrinocheilidae (spiracled suckers) Gyrinocheilus aymonieri* Gyrinocheilus pennocki* Cobitididae (loaches) Acantopsis sp. Acantopsis sp. Botia eos Botia helodes Botia modesta* Ariidae (marine catfishes) Arius stormii Hemipimelodus borneensis Sisoridae (catfishes) Bagarius bagarius **Bagarius** suchus Bagarius yarrelli Bagridae (catfishes) Bagrichthys macropterus Leiocassis cf. siamensis Mystus macronema Mystus microphthalmus Mystus mysticetus Mystus nemurus Mystus rhegma

kanongwen? proluhng kanongwen?, ai chikaok? changwa pleiang dao; dongtaeng sa-ee srawkah gadam (crab scales) jangkhote chawng garawng salak rusai lolok saw trawsawk (cucumber) trawsawk (cucumber) chekaine changwa mool chapun chapun real: linh taow?; kampoe? tamor; angoht tamor; angoht ruchayt (banana root) ruchayt (banana root) ka oak ka oak gropuh (crocodile) gropuh (crocodile) gropuh; grabaye (ox) johk prah rah gancho khiya gancho chalang

Mystus wyckii chalang tamore Clariidae (catfishes) Clarias sp. angdyne Pangasiidae (catfishes) Helicophagus waandersii chandohl Pangasius conchophilus gai Pangasius hypophthalmus prah Pangasius macronema cheewit Pangasius larnaudii poh Pangasius pleurotaenia cheewit cheewit Pangasius polyuranodon Siluridae (catfishes) Belodontichthys sp. klang hai Hemisilurus mekongensis gamahm Kryptopterichthys sp. Kryptopterus cryptopterus krawmohn Kryptopterus cf. limpok Micronema cf. apogon keh prak; keh mir Ompok cf. bimaculatus tahawn Ompok cf. hypophthalmus Wallago attu sandai Wallago leerii tuok; chitok or stohk Polynemidae (threadfins) Polynemus cf. dubius priem Mastacembelidae (spiny eels) Mastacembelus armatus kadung or katung Mastacembelus favus kadung or katung Channidae (snakeheads) Channa cf. marulia mbong Channa micropeltes chadao Channa striata raw Belontiidae (gouramies) Osphronemus exodon romir (rhinoceros) Anabantidae (climbing perches) Anabas testudineus kraihn Belonidae (needlefishes) Xenentodon cf. cancila kahtohng Hemirhamphidae (halfbeaks) ?Hyporhamphus limbatus bahn kooey Pristolepidae (combscaled perches) Pristolepis fasciata gantrope Ambassidae (glass perches) Parambassis apogonoides gantrawng preng Parambassis siamensis gantrawng chira Parambassis wolffii gantrawng preng

Coiidae (tigerperches)	
Coius sp.	klar (tiger)
Sciaenidae (croakers, drums)	
Boesemania microlepis	promah
Eleotrididae (sleepers)	
Oxyeleotris marmorata	damrai (elephant)
Gobiidae (gobies)	
Glossogobius sp.	kahsah
gen. sp. undet.	
Cynoglossidae (tongue soles)	
Cynoglossus microlepis	andat chikai (dog tongue)
Soleidae (soles)	
Euryglossa pan	andat grabaye (ox tongue)

ANNUAL FISHING CYCLE AT STUNG TRENG

Stung Treng lies at the junction of the Mekong River with its largest tributary, the Tonle San (Se San in Lao, and on most maps of Cambodia). The Tonle San drainage includes the Se Khone and Se Pian, which flow into Cambodia from southeastern Laos. Important fish migrations occur in the Tonle San system, but very little is known about them. The following brief account of fishing activity at Stung Treng is based mainly on observations during February 1994 and on several interviews, mainly with Tung Vung Sen, Fisheries Officer at Stung Treng, assisted by Touch Seang Tana.

January through March. — Fishing involves five main kinds of fishing gear: gillnet (mawng), castnet (samnan), dragnet, various traps, and longlines. Most important fish species in catches are, in order, trey real (*Cirrhinus* spp. and associated small cyprinid species), trey chapun (deep-bodied large-scaled cyprinids, mainly *Puntius* or *Hypselobarbus*), trey wa, trey wa muk pee, trey sa-ee (*Labeo* cf. *pierrei*, *L. behri*, *Mekongina erythrospila*), trey tamor or trey angoht (predominantly *Gyrinocheilus pennocki*) and trey prah (*Pangasius hypophthalmus*, other *Pangasius*). Virtually all of the fish caught at this time are non-reproductive.

April through first half of June. — Lowest water of the year; very little fishing, no fish in market.

Middle June through late July. - Most abundant fish of year; fish make sound.

Late July to end of September. — Less fish, less fishing activity. Fish present mainly in small streams and flooded forest. Fishermen use bamboo barrier with traps to catch fish at mouths of canals and streams. Very intensive activity with longlines, subsistence fishing with small traps in or near the flooded forest and in mouths of tributaries or canals.

October to November. — For about one month very good fishing; fish less abundant than in June and July, but of much better quality, especially larger size. Fishing with daye, barrages, trawl (mahn).

November and December. — Progressivly fewer fish than in October but still good fishing. Trey wa, wa muk pee, and sa-ee.

ANNUAL FISHING CYCLE AT GOH SAMPEEAYE

Goh Sampeeaye is an elongate island about 4 km long on the left bank of the Mekong River, about 10 km downstream from Stung Streng. It is the site of important fishing activity by Lao fishermen, with much of the catch being marketed in Stung Treng. On 10 January 1994 I visited Goh Sampeeaye and received the following brief account of annual fishing activities:

January. — Gillnet fishing for large pa uhn (Probarbus jullieni), pa wa (Labeo cf. pierrei), pa sa-ee (Mekongina erythospila), pa wa nah nuk (Labeo behri), pa haet (Osphronemus exodon). Upstream migration of P. jullieni and P. labeamajor with eggs. Fishing with large basket trap (lope) for pa sooai yeuak (Pangasius hypophthalmus) from January into March.

February. — Gillnetting and castnetting for large fish: pa pawn (Cirrhinus microlepis), pa wa (both species), pa promah (Boesemania microlepis), pa uhn khao (Probarbus labeamajor).

March. — Fishing for non-reproductive small cyprinids, pa soi: pa soi hua lem, pa goom (not identified), pa kraduk kaeng (Crossocheilus).

April. — Pba mok (?Cirrhinus siamensis).

May. — Upstream migration of pa jawk (Cyclocheilichthys enoplos).

June, July, August. — Downstream (?) reproductive migration of pa soi, etc. Same species as those involved in non-reproductive migrations in March. Fish eggs spread everywhere by river during downstream migration.

September, October, early November. — No fishing; all fish in tributaries and in flooded forest (Goh Sampeeaye fishermen apparently confine their fishing to the Mekong mainstream, i.e. they do little or no fishing in the flooded forest). Fish that go into flooded forest include trey real (*Cirrhinus* spp.), trey linh (*Thynnichthys thynnoides*), trey chapun (large-scaled, deep-bodied Barbodes and Hypselobarbus spp.), trey salak rusai (*Paralaubuca typus*), trey prohlung (*Leptobarbus hoeveni*), trey chikaowk (*Cyclocheilichthys enoplos*), trey real (*Pangasius gigas*), trey cheewit (*Pangasius macronema*, *P. pleurotaenia*), trey chadaow (*Channa micropeltes*), trey raw (*Channa striata*), trey romir (*Osphronemus exodon*).

Mid November through December. — Very few fish caught.

ANNUAL FISHING CYCLE AT KRATIE

Kratie is a town on the Mekong mainstream just below the important mainstream rapids at Sambor. The following brief account of the fishing cycle is the result of an interview assisted by Touch Seang Tana with two fishermen from Kratie, Sinrim Saim (age 47) and Sian Kun (29), in Phnom Penh on 20 February 1994.

January and February. — Fishing mainly for small non-reproductive fish migrating upstream from downriver, mostly trey real (*Cirrhinus* spp. and associated small cyprinids), small trey chikaowk (young *Cyclocheilichthys enoplos*), trey ai kaowk (*Labeo chrysophekadion, L. cf. barbatulus*), trey salak rusai (*Paralaubuca typus*). This migration usually starts two months earlier than Chinese New Year's Day—around mid-December or earlier—and ends around Chinese New Year's Day. If Chinese New Year's Day comes late, trey real migration usually starts two months before it and stops about 10 days before it, and does not begin again. In 1993–94, however, this migration started two months early, then stopped 10 days before Chinese New Year's Day, and then on Chinese New Year's Day it started again and lasted for five days. This is the first time it has happened like this.

March and April. — No fish migration, much less fish caught than in January–February. In mid-April (during or after Cambodian New Year), there usually is a very heavy dry season rain, after which occurs a downstream migration of reproductive trey real, trey prah, trey chikaowk.

May and June. — Fish in advanced reproductive condition. Floodwaters start in June. From then on fish enter the flooded forest, swamps and lakes. A very few *Probarbus* caught with gillnets.

June and July. — All fish species migrate downstream, enter tributaries, lakes, and flooded forests.

August and September. — Catch fish with gillnets in flooded forest, lakes, and tributaries.

October. - Fish hiding deep in flooded forest, very difficult to catch.

November and December. — Fish appear in tributaries, start migrating downstream to Mekong, and then on down Mekong itself.

TREY SA-EE AND TREY WA

In January and February three highly regarded migratory fish species are abundant at Stung Treng. The species and their tentative scientific identifications are trey sa-ee, Mekongina erythrospila (Figs. 7-8); trey wa or trey wa muk mooi (one-faced trey wa), Labeo cf. pierrei (Figs. 9-10); and trey wa muk pee (two-faced trey wa), Labeo behri (Figs. 11-12). They can be distinguished as follows: both kinds of trey wa have a well developed rostral cap completely separate from the well developed upper lip. Large twofaced trey wa have an extremely prominent secondary rostrum or second face, the beginnings of which can be detected even in rather small juveniles. In very large fish the entire head and tail are yellow, the body and other fins grey. One-faced trey wa have no secondary rostrum at all. Trey sa-ee has only a primary rostral cap, and it is completely fused to (and therefore indistinguishable from) the upper lip. It is also much more slenderbodied than either of the trey wa, with only about 12 instead of 14 or more transverse scale rows. Both kinds of trey wa commonly attain 3 or 4 kg; in the smaller species trey saee the largest fish are only 1 or 2 kg. All three kinds are migratory, but their migrations are poorly known and the details remain to be worked out. The three species inhabit mainly parts of the Mekong mainstream and its larger tributaries (especially the Se San-Se Khone-Se Pian system) characterized by rocky stream beds and numerous rapids.

According to Tung Vung Sen, fishery officer at Stung Treng, large trey wa muk mooi and trey sa-ee are most abundant at Stung Treng in October and November. Later, in November and December, the number of both decreases as they migrate downstream together. This occurs on moonless nights during cold weather. The time of their upstream migration is unknown. Trey wa muk pee has a different migratory schedule, later than trey wa muk mooi and trey sa-ee. After March and April trey sa-ee completely disappears, although trey wa of both kinds remain at Stung Treng. During the flood season (July through October) all large trey wa completely disappear; they do not go into the flooded forest (perhaps they go into deep pools and rocky rapids where they cannot be caught). During very low water some large trey wa are caught in rapids with special castnets. These have large (12 cm) mesh and are very heavily weighted (to 7 kg). Fingerlings of trey wa and trey sa-ee appear when the flood waters withdraw from the flood plains (October or November). Trey wa muk mooi also migrate back and forth from the Se Khone-Se Pian tributaries in Attapeu, southern Laos, to Ahnlohng Bah Chang, where the Se San River has its mouth into the Mekong River at Stung Treng.

Fishermen of Goh Sampeeaye report that trey wa (both kinds) and trey sa-ee occur in the Mekong mainstream only as far south as Prek Chiralong, at the great rapids of Sambor about 40 km south of Stung Treng. According to Kratie fishermen Sinrim Sain and Sian Kun, however, all three species are present at Kratie. They say trey wa muk mooi and trey sa-ee are very scarce there. Many Laotian and Cambodian fishermen agree that the Labeo cf. pierrei, L. behri, and Mekongina erythrospila do not occur south of Kratie.

Large *Labeo* cf. *pierrei* seem to be particularly abundant in the Sekong River of southern Laos. Several tens of fish, 3 to 8 kg, were observed in Sekong town market in August 1993 by Ian Baird. Sekong fishermen interviewed by Baird reported that in July and early August fish migrate down the Sekong, leaving the rocky areas and holes they normally inhabit, and are then observed swimming in midtream near the surface and spawning in pairs. After spawning in the Sekong near the Lao-Cambodian border, or just inside Cambodia, they apparently almost immediately turn around and migrate back upriver to rocky reaches in the upper Sekong. They also go up some large Sekong tributaries, such as the Se Kaman. It is unknown what happens to the eggs and very young fish, but they may drift very far down the Sekong, possibly even to the Mekong mainstream. (Ian Baird, pers. commun. April 1994).

During January and February 1994, when non-reproductive pa wa sooang were migrating up the Mekong River, all of those caught at Ban Hang Khone weighed less than 1 kg (Baird, pers. commun. April 1994). A few large fish, 3 or 4 kg, were caught at Ban Hang Khone in June-July 1993 (reproductive condition not recorded). In my report on fishes obtained at Ban Hang Khone just below Lee Pee Waterfall in June-July 1993, pa wa was misidentified as *Mekongina erythrospila* (ROBERTS, 1993: 33). The correct Lao name for this species is pa sa-ee. The only one of the pa wa-pa sa-ee complex observed at Ban Hang Khone in June and July 1993 was *Labeo* cf. *pierrei*, pa wa sooang. *Labeo behri* is known in Lao as pa wa nah hak (broken-faced pa wa) or pa wa nah naw (bumpfaced pa wa) (Baird, pers. comm. April 1994).

ACCOUNTS OF INDIVIDUAL FISH TAXA

The following accounts deal with individual fish taxa (in systematic order) mentioned in the present paper or in the report on fish and fisheries in southern Laos by ROBERTS (1993).

Pristidae. — Identification of sawfishes from the Lower Mekong is uncertain, and there might be more than one species. Thus far only a single species has been reported, as *Pristis microdon* (KOTTELAT, 1985) or as *P. pristis* (KOTTELAT, 1989; ROBERTS, 1993). It is now known that up to four species of *Pristis* live in fresh water in the Indo-Pacific region: *Pristis microdon*, *P. pristis*, *P. perotteti*, and *P. clavata* (LAST & STEVENS, 1994). According to elasmobranch specialist Peter Last (pers. comm. Oct. 1993), the species most likely to occur in the Lower Mekong are *P. clavata* and *P. microdon*. The smaller and poorly known *P. clavata* differs from other *Pristis* expected in fresh water in having first dorsal fin over or slightly in advance (rather than considerably in advance) of pelvic fin; color usually greenish brown (rather than grayish); and maximum length possibly not more than 140 cm. Efforts should be made to obtain whole preserved specimens from the Mekong for identification.

Fishermen reported that sawfish caused considerable damage to gillnets and were occasionally caught as recently as 10 years ago just below Lee Pee Waterfalls (ROBERTS, 1993: 37). Ban Hang Khone fisherman Sooai used to see 2–3 fish with a maximum size

of 10 kg each year, always in February-March; he presumes they were following migrating fish such as pa wa (*Labeo* cf. *pierrei*), pa pien (*Scaphognathops*), pa pak (*large Hypselonotus*), and pa pawn (*Cirrhinus microlepis*).

A *Pristis* was landed at Ban Wernkam (just downstream from Ban Hang Khone towards the end of 1993. According to Naoh Thuok sawfish are now absent or very rare in the Great Lake of the Tonle Sap; the most recent capture of which he has heard occurred 40 years ago. The Cambodian name for sawfish is tray thekaw. Sawfish are extremely susceptible to gillnet fishing, and the numbers of all species are probably drastically reduced as a consequence, but perhaps especially so for those occurring in large rivers with intensive gillnet fisheries such as the Mekong.

Anguillidae. -- There are only a few records of true fresh-water eels or Anguilla from the Mekong basin, most of them very poorly documented. Since 1989 I have seen a number of specimens and photographs of Anguilla from the Middle and Lower Mekong, all identifiable as A. cf. marmorata. All have the dorsolateral parts of the head and body strongly mottled or marbled, and the dorsal fin placed very far anteriorly. On 6 March 1991, in a private aquarium in Nakhon Phanom, I saw a live specimen 87 cm long that reportedly had been caught in the mainstream of the Mekong River near Nakhon Phanom about eight months previously (around July 1990). Although some live shrimps and other food had been offered, it reportedly had not eaten during the entire eights months of its captivity. The fish was alert and healthy looking in March 1991. Yasuhiko Taki recently gave me a set of black and white photographs by M. Masuo of a 137-cm fish caught near Pakse, southern Lao, on 10 April 1972. Terry Warren obtained the head of a 1.4-m, 11kg fish caught at Don Loppadi just above the Lee Pee waterfalls in July 1993 (Fig. 5). Ian Baird obtained a whole specimen of a 54-cm fish from just below the falls shortly thereafter. Chea, assistant fishery officer in Stung Treng, showed me a photograph of a large fish caught in the Se San near Stung Treng within the last three years. Finally Naoh Thuok showed me photographs of a 1.5-m fish caught in the Great Lake near Siem Reap in 1991. Thuok knows of only three or four fish caught in the Great Lake in the last ten years; it is known there as trey dombohng. It is caught only during times when the water level is exceptionally high.

I have not yet seen any specimens or photos of Mekong Anguilla that could be identified as Anguilla bicolor or A. japonica. These species are characterized by having the dorsal fin origin much further posteriorly, or slightly advance of the anal fin origin, and more or less sharply defined uniformly somber or dusky dorsal coloration and pale or whitish ventral coloration. The oral dentition of these two species is also fundamentally different from that of A. marmorata.

Chitala. — During the period 29 October through 11 December 1993 20–30 mostly large *C. blanci* were observed daily in Kinnak market (just above Lee Pee Waterfalls). In November 1993 large *C. blanci* were also present in large numbers at Ban Hang Khone (just below the falls). During these times no other species of *Chitala* and very few *Notopterus notopterus* were observed. The sudden appearance of relatively numerous *C. blanci* in fish catches suggests they were migrating.

During the February 1994 market survey at Stung Treng nearly 200 individual *Chitala* were observed, mostly large fish to 1 m long. By far the most abundant was the rheophilic species *C. blanci*, but *C. ornata* and *C. lopis* also were present. The numbers actually

observed were *C. blanci* about 150, *C. ornata* about 30, and *C. lopis*, 3. All of the *C. lopis* were large fish, 60 cm to 1 m long, with black spot on base of pectoral fin and none of the oblique stripes on the posterior part of the body diagnostic of *C. blanci*. The 60-cm specimen, which was preserved, had numerous small round spots near the middle of the body, coloration diagnostic of the species at that size. This is the first record of *C. lopis* from the Mekong basin. The species is otherwise known from the Meklong basin in western Thailand, the Malay peninsula, Sumatra, Borneo and Java. It apparently also occurred until recently in the Chao Phraya basin in central Thailand. For further information on the species of *Chitala*, their distinguishing characters and geographical distribution, see Roberts, 1992b.

Aaptosyax grypus. — This spectacular predatory fish, recently described from the Mekong River of Laos and Thailand (RAINBOTH, 1991) evidently is an endangered species particularly susceptible to gillnet fishing of the kind used to catch *Probarbus*. I have observed several fish of 6–15 kg (80 cm to 1 m long) caught near Khong Chiam or the mouth of the Mun River; a single small specimen was obtained below the rapids at Lee Pee in June 1993 (ROBERTS, 1993). So far the species has not been observed in Cambodian waters, but it certainly must be there. Only one large specimen has been observed below the waterfalls at Lee Pee since June 1993 (Ian Baird, pers. comm.), and none above the falls.

Aaptosyax formerly was relatively common just above Lee Pee Waterfalls. Mr. Mahasida, chief of Ban Dom Som, reported that many of these fish came to Ban Dom Som in 1952, 1959, and 1962. Most of them were about 60 cm long (*Aaptosyax* larger than this unknown to local fishermen).

Catlocarpio siamensis. — The giant Mekong carp, reportedly attaining 300 kg, has declined drastically in Thailand, where it was formerly abundant. There is probably no longer a naturally occurring population in the Chao Phraya. In hundreds of hours of visits to markets in the Chao Phraya basin (at Angthong, Ayuthaya, Chainat, Kampaeng Phet, Lopburi, and Nakhon Sawan) in 1988–90 I did not observe a single wild-caught fish of this species. In over 1000 hours of visits to fish markets in the Mekong basin of Thailand in 1985–90 I saw only a half dozen wild caught *Catlocarpio*, mostly very young fish of 1–5 kg. A single large fish, 70 kg, probably caught at or near Khong Chiam, was observed at a freezer in Phibun Mansahan in 1990. None were observed during many hundreds of hours of visits to markets in Ubol Ratchatani (on the Mun River) in 1985–90.

Nor have any *Catlocarpio* been observed during our recent fish surveys just above and below Lee Pee Waterfalls in southern Laos (beginning in June 1993 and continuing), or in the market survey done at Stung Treng (Cambodia) in February 1994. The species is now very rare in the Great Lake of the Tonle Sap, where fishing for it has been prohibited for several years; if one is caught, it is supposed to be set free immediately.

Catlocarpio siamensis (pla kaho in Thai, pa kaho in Lao, ca ho in Vietnamese) has three names in Khmer. Small fish, up to about a kilogram, are called trey krawhao; larger fish, to 50 kg, trey kolriang; and the largest fish, over 50 kg, trey kromawl.

Cirrhinus. — *Cirrhinus* includes several of the ecologically most important fish species in the Mekong basin. Foremost are two small species, *Cirrhinus* sp. and *Cirrhinus siamensis*, both known as pa soi in Lao and trey real in Khmer. One or the other of these species usually dominates catches of smaller fish species (sometimes collectively known

as pa soi or trey real) in southern Laos and in Cambodia. Work on the scientific identification of *Cirrhinus* sp. is underway; it is the species known in southern Laos as pa soi hua lem. At Ban Hang Khone this is known as the first species to start migrating on Chinese New Year's Day (ROBERTS, 1993: 46).

The two largest Mekong species are *Cirrhinus microlepis* and *C. molitorella*, both present in the Middle and Lower Mekong. The highly migratory species *C. microlepis* is one of the most important fisheries species in Laos and in Cambodia. It attains 50 cm and 4–5 kg. *Cirrhinus molitorella* gets almost as long but is less heavy bodied. This species occurs throughout the Middle and Lower Mekong; it has recently been observed above and below the waterfalls at Lee Pee, at Stung Treng, and at Pnom Penh, but always in small numbers. We suspect that it has been decimated by fishing (probably mainly by gillnetting) so that its migrations are now disrupted or at least difficult to detect. The Lao name for this species is pa gaeng (Khmer name not known).

Cirrhinus jullieni is a relatively rare and poorly known small species known only from the Chao Phraya and the Lower Mekong. It attains only 140 mm standard length, has a steep predorsal profile compared to other species in the genus, and differs from all other species in usually having the pectoral, pelvic, anal, and lowermost part of the caudal fin bright blood red (sometimes only orangish red or pink). Except for the original description, virtually all reports of this species are actually based on *Cirrhinus siamensis*. *Cirrhinus jullieni* may be a highly migratory species that was more abundant formerly. Small numbers of the species were observed at Ban Hang Khone below Lee Pee waterfalls in October–December 1993, at Stung Treng in February 1994, and in Phnom Penh markets in January–February 1994. Lao and Khmer names unknown.

Cirrhinus molitorella are caught in the waterfalls during low water with oo-netting suspended between two poles. After fish jump into the oo, they are removed with long-handled dipnets. Another fish caught in the same manner is pa wa sooang (*Labeo* cf. *pierrei*).

Labeo cf. barbatulus, L. chrysophekadion. — It seems that two closely related Mekong species of Labeo (in its broadest sense) have been confused as L. chrysophekadion. One of these evidently is the true L. chrysophekadion (pa pia itoot, trey ka aik). The other tentatively is identified as L. barbatulus Sauvage, 1878 (pa pia kee gum; trey ka aik).

The two pa pia were by far the most abundant fish in Kinnak market (southern Laos) from 6 February until 7 March 1994. About 80% of the fish were pa pia itoot. Almost all of the pa pia (of both kinds) were 30–40 cm long and mostly not more than 1 kg. and none were in reproductive condition. Local people say they appear in reproductive condition in June and July. In February and March the fish live over rocky bottom and graze on filamentous algae (kee tao or kai hin). Microscopic examination of a sample of kee tao collected by Warren from above the waterfalls revealed that it was composed entirely of several species of chlorophytous filamentous algae with a large proportion of *Spirogyra* spp.

Pangasiidae. — Recent observations indicate that all Mekong species of the catfish family Pangasiidae are migratory. Migratory activity of several species is reported in Roberts (1993).

Several species of *Pangasius* are collectively known as pa nyawn in Lao and trey cheewit in Khmer, including *Pangasius macronema*, *P. pleurotaenia*, and *P. polyuranodon*. These also are migratory. The important upstream reproductive migration of *P. macronema*

at Ban Hang Khone in June 1993 is reported in ROBERTS (1993). Possibly some of this migratory activity involved the species *P. pleurotaenia*.

Large numbers of migrating non-reproductive *P. polyuranodon* 20–35 cm long were caught at Ban Hang Khone in mid-November 1993. Fishermen were getting 10–15 fish every evening, using single hooks on nylon leader 1 m long baited with various kinds of fruit. Stomachs of fish caught were filled with leaves, fruits, flowers and detritus. A single 63-cm gravid female was observed at Ban Hang Khone in July 1993 (ROBERTS, 1993: 45). A Lao name for the species is pa nyawn hang hian. Small numbers of non-reproductive fish were observed at Stung Treng in February 1994.

The molluscivorous pangasiid *Helicophagus waandersii* (pa noo) was the dominant fish in catches at Don Khong (Khong Island), just above Lee Pee Waterfalls, from 29 October through 11 December 1993. These fish, in non-reproductive condition, were up to 60 cm long and 1 kg. Khong Island fishermen report that they catch this species all year long, but that it is particularly abundant at the end of the year. The fishermen stick their finger into the expansible vent and work it around to force mollusk shells out before selling the fish.

Polynemidae. — A polynemid species with seven long pectoral filaments has been reported from the Lower Mekong as *Polynemus paradiseus* by KOTTELAT (1985; 1989) and ROBERTS (1993). Polynemid specialist Ross Feltes (pers. comm., 4 February 1994) suggests the species is more likely to be *P. dubius* Bleeker. *Polynemus melanochir* Valenciennes is another species with seven long pectoral filaments that may occur in the Lower Mekong; in has black pectoral fin and filaments. There may also be a species in the Lower Mekong with 15–17 long pectoral filaments, *Polynemus* (or *Polistonemus*) *multifilis. Polynemus paradiseus*, originally described from India, apparently does not occur east of the Andaman Sea.

TALKING ABOUT FISHES IN KHMER

Ichthyologists or fish biologists wishing to learn Khmer are encouraged to begin by learning some simple expressions and the names of as many of the fish species as they can. Khmer speakers will always know when you are speaking or trying to speak about fishes, because the word trey (or perhaps more closely tra-ee) is the essential first part of the name of each fish species (as pla in Thai, pa or pba in Lao, nga in Burmese, niya in Karen, ca in Vietnamese). Table 1 provides Khmer names for many fish species observed at Stung Treng. In learning the fish names and their meanings, the beginner will also acquire a considerable vocabulary. Thus the Khmer words for cat, elephant, pig, rhinoceros, and tiger-chmar, damrai, kantcheroo, romir and klar-are also used for fish species: trey chmar (engraulids), trey damrai (Oxyeleotris marmoratus), trey kancheroo (Botia spp.), trey romir (Osphronemus), and trey klar (Coius). Many fish names of course, have no simple meanings in Khmer. This may be because they are borrowed from other languages, or because they have been shortened beyond recognition, or (in many instances) simply because they are proper names with no other meanings. Examples of this are trey chikaowk (often shortened to trey skaok). Another example of shortening is provided by trey chapun or trey chapin, often shortened to chpun, spun, spin, or even pin or pil.

Beginning Khmer learners are confronted by an exceptionally difficult alphabet (much harder than the Cyrillic or Thai alphabets). There is no easy way to transcribe Khmer into other alphabets and come up with pronounciations acceptable to native Khmer speakers. The only practical way to learn to pronounce Khmer is with the help of native speakers. The transcriptions provided here follow relatively simple equivalent sounds (insofar as they exist) based upon my pronunciation of American English. As such, they are only approximations.

Learners with little or no background in Asian languages will find spoken Khmer relatively easy, because it is atonal. Those with knowledge of Thai or Lao will also find it easier learning Khmer, since although the vocabulary is on the whole very different, there are nevertheless many shared words, idioms, and ideas, and the syntax is similar. Thus, the Khmer speaker forms phrases with much the same word order as Thai, and has many of the same grammatical peculiarities (which are peculiarities only to persons unfamiliar with this language group). For example, "what is this fish called" or "what is the name of this fish" is "pla ni cheu arai?" in thai, and "pa ni su nai?" in Lao, while in Khmer the expression is "trey ni chamoo ai?" (literally "fish this called what?").

It should be noted that many fish species have more than one Khmer name. Young and adult fish are often given different names, e.g. trey kralang and trey pruol for young and adult of *Cirrhinus microlepis*. On the other hand, the same name may be used for several fish species, such as trey real for *Cirrhinus* spp. and associated other small cyprinid species, trey prah for several larger species of *Pangasius*, and so on.

GLOSSARY OF KHMER WORDS RELATED TO FISH AND FISHING

ahnlohng large pool or stretch in the river (wang in Thai and Lao, fosse in French). **bongkeer** prawn (see gadam, gahmpuh).

bpa awk fermented fish (pla la in Thai, pa daek in Lao).

bpohng, bpohng trey fish eggs.

buhng lake.

buhng tonle sap Great Lake of Cambodia.

chairah large castnet used in Great Lake.

chalam [trey] shark (pla chalam in Thai). See takaw.

chamohl [trey] male fish. See nyi.

chanote stripe (see oight oight).

chiroey land between river fork. See piem.

chunlen earthworm.

domchuh tree.

gadam crab.

gahmpuh shrimp (short explosive "puh").

gantieh softshelled turtle, Trionychidae. Species observed or expected in the Mekong in the vicinity of Stung Treng are Amyda cartilagineus and Pelochelys cf. bibroni.gawh island.

gontoye fish tail or caudal fin.

gropuh crocodile. According to Naoh Thuok, the only naturally occurring species in the

Great Lake is now Crocodylus siamensis. kroom Cristaria plicata (Leach, 1850), very large thin-shelled unionid bivalve, found in Great Lake and at Stung Treng. lope very large cylindrical fish trap; man goes inside to collect fish. low nehsat fishing lot. As of 1994 there were some 136 officially recognized fishing lots in Cambodia, mainly in the Tonle Sap and Great Lake. mahn freshwater midwater trawl. mawng go lek dropping gill net. mawng home seine. mawng peh gillnet. moat tonle river bank. muat mouth (of animals including fish, river). nehsat fishing. See low nehsat, nyet nehsat, opahgaw nehsat, roht dao nehsat. nuy bait. nyet nehsat fisherman. nyi [trey] female fish. See chamohl. oight oight roundish mark or spot (see chanote). ondak hardshelled turtles. opahgaw nehsat fishing gear. passout dolphin; sometimes called pisao, trey passout. pehoo took rapids. piem fork (e.g. formed where two rivers join). See chiroey. plai fruit. plai sontooch fish hook (see sontooch plai mooi, sontooch roh nong). ploh took waterway or canal (natural or artifical). pooh belly or viscera. pooh wien intestine. pra hoc fish paste. prei forest. prei lik took flooded forest. prek smaller river. proee fish fin. proee knong dorsal fin. proce muat barbel. proce pooh pelvic and anal fins. reach [trey] giant Mekong catfish, Pangasius gigas [reach from Sanskrit raj; thus trey reach = royal fish]. rohn hole; including hole in the river inhabited by fish. roht dao nehsat fishing season. ruh roots. salak leaf, leaves slai filamentous algae, growing on submerged rocks and tree trunks; an important food for many fish species, especially during low water periods. samnanh castnet. sat animal; classifier word for birds, snakes, animals other than fishes.

sat puak snake shrawmaoch ants. shrawmaoch kamao black ants. shrawmaoch krohom red ants. snoh spear. spee-uhn bridge. sontooch plai mooi fishline with single hook. sontooch roh nong trotline or setline with numerous hooks. srawkah scales. tahnawng scoop net with two long sticks (sawn in Thai and Lao). takaw [trey] sawfish. See chalam, pabel. tonle large water body, lake or river (sometimes pronounced taleh). took water. took lahng rising water. took srawk falling water. took taleh waterfall. trahng large fish cage, used to store live fish. trawgieh literally, "ear"; Khmer as well as Thai and Lao speakers designate various fish structures as "ears", including the spiracles of stingrays, sawfishes and gyrinocheilids; pectoral fins of Anguilla; and color marks just behind the head, such as the black tympanic spot of *Pangasius larnaudii*. The term also refers to a river channel. trey fish. A more exact pronounciation would be trai-ee; pronounciation is variable. As a prefix, used only for names of fish and occasionally for dolphin; see passout. trev bpohng gohn fish spawning trey hahl sundried fish. trey joe downstream migration of fish. trey lahn upstream migration of fish. trey lahn joe fish migration (literally meaning "fish go up come down"). trey nyit dry salted fish. trey prawlak salted fish (not dry). tumnup took dam or dyke. woa vine.

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