Annex J: Fish Species & Migration

Table J.1: Distribution of fish species in the Xe Bang Fai & Nam Theun basins by river sector (source: Kottelat, 1998, updated with Kottelat, 2001 and Kottelat, 2002)

FAMILY *(Species)*	Xe Bang Fai			Nam Theun				Distribution Outside the Xe Bang Fai & Nam Theun
	Lower	Middle	Upper	Lower	Middle	Plateau	Upper	
NOTOPTERIDAE								
Chitala blanci (d'Aubenton, *1965*)		•						Mekong Basin
Chitala ornata (Gray, *1831*)		•						Mekong and Chao Phraya basins
Notopterus notopterus (Pallas, *1769*)		•						South and Southeast Asia
CLUPEIDAE								
Clupeichthys aesarnensis Wongratana, 1983	•							Mekong Basin
Clupeoides borneensis Bleeker, 1851	•							Southeast Asia
Tenualosa thibaudeaui (Durand, 1940)	•							Mekong Basin
SUNDASALANGIDAE								
Sundasalanx mekongensis Britz & Kottelat, 1999	•							Mekong basin
CYPRINIDAE								
Bangana elegans Kottelat, 1998				•	•	•	•	Nam Theun endemic, possibly in Nam Ngum basin
Barbichthys laevis (Valenciennes, 1942)		•						Mekong and Chao Phraya basins
Barbonymus altus (Günther, 1868)	•							Mekong and Chao Phraya basins
Barbonymus gonionotus (Bleeker, 1850)	•							Southeast Asia
Barbonymus schwanefeldii (Bleeker, 1853)	•							Southeast Asia
Cirrhinus microlepis Sauvage, 1878	•							Mekong and Chao Phraya basins
Cirrhinus molitorella (Valenciennes, 1844)	•	•		•				Mekong and Chao Phraya basins, China
Crossocheilus atrilimes Kottelat, 2000	•	•						Mainland Southeast Asia
Crossocheilus reticulatus (Fowler, 1934)	•	•						Mekong and Chao Phraya basins
Cyclocheilichthys armatus (Valenciennes, 1842)	•	•						Southeast Asia
Cyclocheilichthys repasson (Bleeker, 1853)	•	•			•	•		Southeast Asia
Cyprinus rubrofuscus La Cepède, 1803					•			Xiangkhouane, N.Vietnam and China
Danio fangfangae Kottelat, 2000					•	•	•	Mekong basin Laos
Discherodontus ashmeadi (Fowler, 1937)		•						Mekong basin
Epalzeorhynchos frenatum (Fowler, 1934)	•							Mekong and Chao Phraya basins
Epalzeorhynchos munense (Smith, 1934)		•						Mekong basin
Esomus metallicus Ahl, 1924		•						Mainland Southeast Asia
Folifer brevifilis (Peters, 1881)							•	Mekong, Chao Phraya, Salween and Red River basins, S. China
Garra cambodgiensis (Tirant, 1884)		•	•	•		•	•	Mainland Southeast Asia
Garra cf. *cyrano* Kottelat, 2000							•	Mekong basin
Garra fasciacauda Fowler, 1937	•							Mekong basin
Garra theunensis Kottelat, 1998				•	•		•	Mekong basin Laos
Hampala dispar Smith, 1934		•						Mekong basin
Hampala macrolepidota Kuhl & van Hasselt, 1823	•	•	•	•	•	•		Southeast Asia
Hemibarbus cf. *umbrifer* (Lin, 1931)							•	S. China, N. Vietnam
Hemiculterella macrolepis Chen, 1989			•			•	•	Mekong basin in Yunnan
Henicorhynchus lineatus (Smith, 1945)	•	•						Mekong basin
Henicorhynchus siamensis (Sauvage, 1881)	•	•						Mekong and Chao Phraya basins
Hypsibarbus vernayi (Norman, 1925)	•			•	•	•		Mainland Southeast Asia
Labeo chrysophekadion (Bleeker, 1850)		•						Southeast Asia
Labeo pierrei (Sauvage, 1880)		•						Mekong, Chao Phraya and Salween basins
Labiobarbus leptocheila (Valenciennes, 1842)	•	•						Southeast Asia
Laocyprinus sp.		•						Nam San and Nam Mang basins
Lobocheilos melanotaenia (Fowler, 1935)		•						Mainland Southeast Asia
Lobocheilos rhabdoura (Fowler, 1934)		•						Mekong and Chao Phraya basins
Luciocyprinus striolatus Cui & Chu, 1986				•		•	•	Mekong basin in Yunnan

Family *(Species)*	Xe Bang Fai			Nam Theun				Distribution Outside the Xe Bang Fai & Nam Theun
	Lower	Middle	Upper	Lower	Middle	Plateau	Upper	
Macrochirichthys macrochirus (Valenciennes, 1844)		•						Mekong and Chao Phraya basins
Mekongina erythrospila Fowler, 1937		•		•				Mekong basin
Mystacoleucus atridorsalis Fowler, 1937	•							Mekong basin
Mystacoleucus greenwayi Pellegrin & Fang, 1940		•						Mekong basin
Mystacoleucus marginatus (Valenciennes, 1842)	•	•	•	•	•	•		Southeast Asia
Neolissochilus stracheyi (Day, 1871)							•	Mekong basin in Laos
Onychostoma fusiforme Kottelat, 1998				•	•	•	•	Mekong Basin
Onychostoma meridionale Kottelat, 1998			•					Mekong basin in Laos
Opsarius koratensis Smith, 1931	•	•						Mekong and Chao Phraya basins
Opsarius pulchellus Smith, 1931		•		•	•		•	Mekong and Chao Phraya basins
Oreichthys parvus Smith, 1933		•						Mainland Southeast Asia
Osteochilus hasselti (Valenciennes, 1842)		•						Southeast Asia
Osteochilus lini Fowler, 1935	•	•						Mekong and Chao Phraya basins
Osteochilus melanopleura (Bleeker, 1852)		•						Southeast Asia
Osteochilus striatus Kottelat, 1998		•						Mekong basin in Laos
Osteochilus waandersii (Bleeker, 1852)		•						Southeast Asia
Oxygaster pointoni (Fowler, 1934)		•						Mekong and Chao Phraya basins
Parachela siamensis (Günther, 1868)	•							Southeast Asia
Paralaubuca barroni (Fowler, 1934)	•							Mekong basin
Paralaubuca typus Bleeker, 1865	•	•						Mekong and Chao Phraya basins
Poropuntius carinatus (Wu & Lin, 1977)				•	•	•	•	Mekong basin in Yunnan
Poropuntius laoensis (Günther, 1868)	•	•	•					Mekong basin
Puntioplites falcifer Smith, 1929	•	•		•				Mekong basin
Puntius aurotaeniatus (Tirant, 1885)		•			•	•		Mekong basin
Puntius brevis (Bleeker, 1850)		•			•	•		Southeast Asia
Puntius jacobusboehlkei (Fowler, 1958)	•	•						Mekong and Chao Phraya basins
Puntius rhombeus Kottelat, 2000		•						Mekong and Chao Phraya basins
Raiamas guttatus (Day, 1870)	•	•			•	•		Mainland Southeast Asia
Rasbora atridorsalis Kottelat & Chu, 1988		•						Mekong basin in Yunnan
Rasbora borapetensis Smith, 1934		•						Mainland Southeast Asia
Rasbora daniconius (Hamilton, 1822)		•						Mainland Southeast Asia and South Asia
Rasbora dusonensis (Bleeker, 1851)	•	•						Southeast Asia
Rasbora paviei Tirant, 1885		•			•	•		Mainland Southeast Asia
Rasbora trilineata Steindachner, 1870		•						Southeast Asia
Rhodeus laoensis Kottelat, Doi & Musikasinthorn, 1998						•	•	Nam Theun endemic
Scaphiodonichthys acanthopterus (Fowler, 1934)			•	•	•	•	•	Mekong and Chao Phraya basins
Scaphognathops bandanensis Boonyaratpalin & Srirungroj, 1971		•						Mekong basin
Scaphognathops stejnegeri (Smith, 1931)		•						Mekong basin
Scaphognathops theunensis Kottelat, 1998				•	•	•		Nam Theun endemic
Sikukia gudgeri (Smith, 1934)	•	•						Mekong and Chao Phraya basins
Tor ater Roberts, 1999							•	Nam Theun endemic
Tor cf. tambra (Valenciennes, 1842)				•	•	•	•	Southeast Asia
Tor laterivittatus Zhu & Cui, 1996			•	•	•	•	•	Mekong basin
Tor tambroides (Bleeker, 1854)				•	•		•	Southeast Asia
GYRINOCHEILIDAE								
Gyrinocheilus aymonieri (Tirant, 1884)		•					•	Mainland Southeast Asia
BALITORIDAE								
Annamia normani (Hora, 1930)			•					Annamit Cordillera
Balitora cf. annamitica Kottelat, 1988				•				Se Kong basin in Cambodia
Balitora lancangjiangensis (Zheng, 1980)			•	•	•		•	Mekong and Red River basin in Yunnan
Hemimyzon papilio Kottelat, 1998				•	•		•	Mekong basin in Laos
Homaloptera smithi Hora, 1932	•	•	•	•	•	•	•	Mainland Southeast Asia
Homaloptera yunnanensis (Chen, 1978)	•	•	•					Mekong basin in Yunnan
Nemacheilus arenicolus Kottelat, 1998					•	•	•	Nam Theun endemic
Nemacheilus longistriatus Kottelat, 1990	•	•						Mekong basin
Nemacheilus masyae (Smith, 1933)		•						Southeast Asia

Family *(Species)*	Xe Bang Fai			Nam Theun				Distribution Outside the Xe Bang Fai & Nam Theun
	Lower	Middle	Upper	Lower	Middle	Plateau	Upper	
Nemacheilus pallidus Kottelat, 1990	•	•						Mekong and Chao Phraya basins
Nemacheilus platiceps Kottelat, 1990		•	•					Mekong basin in Cambodia
Schistura atra Kottelat, 1998					•	•	•	Nam Theun endemic
Schistura sp. big head							•	Possibly endemic, status unresolved
Schistura cataracta Kottelat, 1998					•	•	•	Nam Theun endemic
Schistura daubentoni Kottelat, 1990		•						Mekong basin in Cambodia
Schistura dorsizona Kottelat, 1998				•			•	Mekong basin in Laos
Schistura isostigma Kottelat, 1998		•						Mekong basin in Laos
Schistura kongphengi Kottelat, 1998				•	•		•	Nem Theun endemic
Schistura nicholsi (Smith, 1933)		•	•					Mekong basin
Schistura nudidorsum Kottelat, 1998							•	Nam Theun endemic
Schistura obeini Kottelat, 1998				•	•	•	•	Nam Theun endemic
Schistura punctifasciata Kottelat, 1998		•						Xe Bang Fai endemic
Schistura sombooni Kottelat, 1998				•	•	•	•	Nam Theun endemic
Schistura tubulinaris Kottelat, 1998						•	•	Nam Theun endemic
COBITIDAE								
Acanthopsoides delphax Siebert, 1991	•							Mekong and Chao Phraya basins
Acanthopsoides gracilentus (Smith, 1945)		•						Mekong basin
Acanthopsoides hapalias Siebert, 1991	•	•						Mekong basin
Acantopsis sp. large spots		•						Mekong and Chao Phraya basins
Acantopsis sp. small spots	•	•						Mainland Southeast Asia
Botia beauforti Smith, 1931	•	•	•					Mainland Southeast Asia
Botia caudipunctata Taki & Doi, 1995		•						Mekong basin
Botia eos Taki, 1972		•						Mekong basin
Botia helodes Sauvage, 1876	•							Mekong and Chao Phraya basins
Botia lecontei Fowler, 1937		•						Mekong basin
Botia modesta Bleeker, 1865	•							Mekong and Chao Phraya basins
Botia nigrolineata Kottelat & Chu, 1987			•					Mekong basin
Lepidocephalichthys aff. hasselti (Valenciennes, 1846)		•			•	•		Mainland Southeast Asia
Misgurnus anguillicaudatus (Cantor, 1842)					•			East Asia
Pangio anguillaris (Vaillant, 1892)	•	•						Southeast Asia
Pangio fusca (Blyth, 1860)					•	•		Mekong and Salween basins
Serpenticobitis zonata Kottelat, 1998		•						Mekong basin in Laos
BAGRIDAE								
Hemibagrus nemurus (Valenciennes, 1840)	•	•						Southeast Asia
Hemibagrus wyckioides (Fang & Chaux, 1949)				•	•			Mekong basin
Mystus atrifasciatus (Fowler, 1937)	•	•						Mekong and Chao Phraya basins
Mystus mysticetus Roberts, 1992	•							Mekong and Chao Phraya basins
Mystus singaringan (Bleeker, 1846)	•	•						Southeast Asia
Pseudomystus siamensis (Regan, 1913)		•					•	Mainland Southeast Asia
AMBLYCIPITIDAE								
Amblyceps serratum Ng & Kottelat, 2000		•						Mainland Southeast Asia
SILURIDAE								
Belodontichthys truncatus Kottelat & Ng, 1999		•						Mekong and Chao Phraya basins
Kryptopterus bicirrhis (Valenciennes, 1840)	•							Southeast Asia
Kryptopterus cryptopterus (Bleeker, 1851)	•	•						Southeast Asia
Micronema apogon (Bleeker, 1851)	•							Southeast Asia
Micronema cheveyi Durand, 1940	•							Mekong and Chao Phraya basins
Pterocryptis inusitata Ng, 1999					•	•	•	Nam Theun endemic
Wallago leeri Bleeker, 1951		•						Southeast Asia
SCHILIBIDAE								
Laides longibarbis (Fowler, 1934)	•							Southeast Asia
PANGASIIDAE								
Helicophagus leptorhynchus Ng & Kottelat, 2000		•						Mekong and Chao Phraya basins
Pangasius larnaudii Bocourt, 1866	•							Mekong and Chao Phraya basins

Family *(Species)*	Xe Bang Fai			Nam Theun				Distribution Outside the Xe Bang Fai & Nam Theun
	Lower	Middle	Upper	Lower	Middle	Plateau	Upper	
CLARIIDAE								
Clarias batrachus (Linnaeus, 1758)		•			•	•		Southeast Asia
SISORIDAE								
Bagarius bagarius (Hamilton, 1822)		•						Mekong, Chao Phraya and Ganges basins
Bagarius yarrellii Sykes, 1841		•						Southeast Asia and South Asia
Glyptothorax lampris Fowler, 1934		•	•					Mekong and Chao Phraya basins
Glyptothorax laosensis Flowler, 1934					•		•	Mekong and Chao Phraya basins
Glyptothorax macromaculatus Li, 1984				•	•	•	•	Mekong basin in Yunnan
Glyptothorax zanaensis Wu, He & Chu, 1981					•			Salween and Mekong basins in Yunnan
Oreoglanis hypsiurus Ng & Kottelat, 1999							•	Nam Theun endemic
Pseudecheneis sympelvicus (Roberts, 1998)					•			Nam Theun endemic
AKYSIDAE								
Akysis varius Ng & Kottelat, 1998	•	•						Mekong basin
SYNBRANCHIDAE								
Monopterus albus (Zuiew, 1793)		•						Southeast Asia
ORYZIIDAE								
Oryzias pectoralis Roberts, 1998				•			•	Mekong basin, N. Vietnam
Oryzias sinensis Chen, Uwa & Chu, 1989					•	•		Yunnan
BELONIDAE								
Xenentodon canciloides (Bleeker, 1953)	•	•						Mainland Southeast Asia
SYNGNATHIDAE								
Doryichthys contiguus Kottelat, 2000		•						Southeast Asia
AMBASSIDAE								
Parambassis sp.				•				possibly Nam Theun endemic
Parambassis siamensis (Fowler, 1937)	•	•						Mainland Southeast Asia
TOXOTIDAE								
Toxotes chatareus (Hamilton, 1822)	•							Southeast Asia
PRISTOLEPIDIDAE								
Pristolepis fasciata (Bleeker, 1851)	•	•						Southeast Asia
DATNIOIDIDAE								
Datnioipes undecimradiatus (Roberts & Kottelat, 1994)	•	•						Mekong basin
ODONTOBUTIDIAE								
Neodontobutis aurarmus (Vidthayanon, 1995)					•	•		Mekong basin
Terateleotris aspro (Kottelat, 1998)		•						Xe Bang Fai endemic
GOBIIDAE								
Papuligobius ocellatus (Fowler, 1937)	•	•	•	•	•	•		Mekong basin
Rhinogobius lineatus Chen, Kottelat & Miller, 1999				•	•			Mekong basin
ANABANTIDAE								
Anabas testudineus (Bloch, 1792)		•				•		Southeast and South Asia
OSPHRONEMIDAE								
Osphronemus exodon Roberts, 1994		•						Mekong basin
Trichogaster trichopterus (Pallas, 1770)		•						Southeast Asia
Trichopsis schalleri Ladiges, 1962					•	•		Mekong basin
CHANNIDAE								
Channa gachua (Hamilton, 1822)		•			•	•		Southeast and South Asia
Channa micropeltes (Cuvier, 1831)	•							Southeast Asia
Channa striata (Bloch, 1793)		•			•	•		Southeast and South Asia
MASTACEMBELIDAE								
Macrognathus semiocellatus Roberts, 1986	•							Mekong and Chao Phraya basins
Macrognathus siamensis (Günther, 1861)		•						Mekong and Chao Phraya basins
Mastacembelus armatus (La Cepède, 1800)	•	•	•	•	•	•		Southeast and South Asia
SOLEIDAE								
Brachirus harmandi (Sauvage, 1878)	•							Mekong and Chao Phraya basins
TETRAODONTIDAE								
Monotrete abei (Roberts, 1998)	•	•						Mekong and Nan basins
Monotrete suvattii (Sontirat & Soonthornsatit, 1985)	•							Mekong basin

Table J.2: Distribution, migration and potential imacts on migration for key fish species.

Nam Theun
Cyprinids
Species: *Bangana elegans* **Distribution:** Possibly restricted to the Nam Theun basin where it has been collected at numerous localities (Kottelat 1996, 2002, 2004). **Migration/Spawning:** Local people maintain that the species migrates and spawns in rapids in November. Kottelat identified three discrete size classes suggesting the existence of a discrete spawning season. Juveniles of apparently two size classes occur both in the headwaters and downstream of the Nakai dam site. This suggests there are several spawning grounds and possibly the species does not undertake extensive migrations. **Potential Impacts on Migration:** Nakai dam will prevent migration between the lower/middle and the upper Nam Theun. This will fragment the stock into disjunct populations which would have to complete their entire life cycle in smaller basins. As there are rapids in these smaller basins (needed for spawning and feeding) it is possible that the species will be able to survive in the tributaries. The species will likely disappear from the Nakai reservoir and from the middle Nam Theun as far downstream as the Nam Phao confluence. It is likely that the population in the Nam Kading has already been negatively impacted by the Theun Hinboun dam. The cumulative impact of the two dams will likely be to create four fragmented populations: upper Nam Theun population; Nam Xot tributary population; lower/middle Nam Theun/Nam Phao tributary/Nam Gnouang tributary population; and lower Nam Kading population. Some unidirectional genetic interchange might be possible between populations, due to downstream larval drift.
Species: *Luciocyprinus striolatus* **Distribution:** Occurs in the middle and upper Mekong basin and prefers large, deep rivers with slow current (Kottelat, 2001). It has been collected at numerous localities throughout the Nam Theun basin (Kottelat 1996, 2002, 2004). **Migration/Spawning:** The species spawns in rapids during the dry season (January-February) (Kottelat, 1996). **Potential Impacts on Migration:** Longitudinal migration within the Nam Theun basin will be curtailed by the Nakai dam, resulting in stock fragmentation. The species will likely disappear from the Nakai reservoir and from the middle Nam Theun down to the Nam Phao confluence. Other impacts will probably be as for *Bangana elegans*.
Species: *Hypsibarbus vernayi* **Distribution:** Occurs widely in the Mekong basin in medium size rivers (Rainboth, 1996). It has been collected at numerous localities in the Nam Theun basin (Kottelat 1996, 2002). **Migration/Spawning:** Kottelat (1996) observed two discrete size classes suggesting a discrete spawning season. However, its life history is unknown and it has not been recorded in dry season refuge pools in the Mekong. However, H. malcolmi, has been recorded from Mekong pools (Poulsen *et al*, 2002a), and is known to migrate to medium size rivers during the wet season. This species spawns at the end of the wet season/early dry season when the water level falls (Rainboth, 1996). It is suggested that *H. vernayi* may have a similar life history. **Potential Impacts on Migration:** Because it is not clear if this species needs to migrate down to the Mekong mainstream during part of its life cycle, the impact of Nakai dam on migration cannot be properly assessed. If the species does not migrate to the Mekong, then the impacts are likely to be as for *Bangana elegans* and *Luciocyprinus striolatus*, with fragmented populations surviving in tributary basins. However, if the species does need to migrate to the Mekong, then it is likely that the cumulative effect of Nakai and Nam Theun-Hinboun will result in *H. vernayi* becoming restricted to the Nam Kading.
Species: *Scaphognathops theunensis* **Distribution:** Endemic to the Nam Theun basin, and is distributed in the lower, middle and Nakai plateau (Kottelat, 2001). It prefers deep pools with rocky shores, and occurs in small groups (Kottelat, 2002). **Migration/Spawning:** It is reported to spawn in the early wet season (June-July) when it travels in large aggregations. It spawns in groups at night. (Kottelat, 2004). There are also contradictory reports that it spawns in the dry season (February-March) on sand banks near rapids (Kottelat, 1996). It is thought not to migrate long distances. In some locations it remains all year round, while elsewhere (Nam On tributary) it migrates into small streams during the wet season. **Potential Impacts on Migration:** The various populations of this species are likely to become fragmented by the Nakai dam as for *Bangana elegans* and *Luciocyprinus striolatus*. It is not clear to what extent genetic interchange occurs at present as the species is not considered to migrate long distances. Downstream larval drift will allow limited genetic interchange to continue to occur. Kottelat (2004) predicted that *Scaphognathops theunensis* would disappear above Nakai Dam. He also predicted that it would likely disappear in a few years below the Nakai Dam as far as Theun-Hinboun.
Species: *Tor tambroides* **Distribution:** Widely distributed in the Mekong basin (Rainboth, 1996; Kottelat, 2001). It occurs in the lower, middle and headwater Nam Theun but not yet recorded from the Plateau (Kottelat, 1996). **Migration/Spawning:** No information is available about spawning in the Nam Theun basin. However, Kottelat observed juveniles and large adults in many localities in the lower and middle Nam Theun, which suggested that the species probably has several spawning grounds and possibly does not undertake extensive migrations. **Potential Impacts on Migration:** The Nakai Dam will cause fragmentation although the species appears already bisected as it does not appear to occur on the Plateau. Because the species is thought to have several spawning sites and not thought to migrate long distances, the impact on migration will be localized, and will not endanger its survival in the Nam Theun basin.
Species: *Tor laterivittatus* **Distribution:** It occurs in the middle and upper Mekong basin (Kottelat, 2001). Large adults prefer deep pools, while juveniles select shallow areas with sandy substrate. In the Nam Theun basin, it occurs the lower, middle, Nakai plateau and headwater sections (Kottelat, 1996, 2002, 2004): **Migration/Spawning:** In the Nam Theun it is reported to spawn in June and juveniles move downstream. In the Nam Gnouang it is present year round and spawns in February-March. Kottelat (1996) observed two size classes of juveniles and speculated that different populations may spawn at different seasons, that the species has an extended spawning season, or that it spawns twice a year. Kottelat proposed that the species probably has several spawning grounds and possibly does not undertake extensive migrations. **Potential Impacts on Migration:** The impacts on this species will likely be similar to *T. tambroides* but, as it also occurs on the Nakai plateau, the disjunction will be greater than for *T. tambroides*.
Sisorid Catfishes
Species: *Bagarius yarrellii* **Distribution:** Widely distributed throughout the Mekong basin. Kottelat (1996) recorded it in the lower and middle Nam Theun. **Migration/Spawning:** Spawns in the Nam Gnouang tributary in August-September. It is reported from Nam Theun but moves downstream during part of the year. It uses deep pools in the Mekong as dry season refuge habitat (Poulsen *et al*, 2002a). In the middle Mekong basin, the species carries out a protracted upstream spawning migration which peaks during the middle of the wet season (Poulsen *et al*, 2004). **Potential Impacts on Migration:** The cumulative impact of Nakai and Theun-Hinboun dams will be to extirpate the species from the Nam Theun basin. It will become restricted to the Nam Kading basin from which it has unimpeded access to the Mekong mainstream.

Nam Theun cont.
Bagrid Catfishes
Species: *Hemibagrus wyckioides* **Distribution:** Wide distribution and occurs in upland rivers in the Mekong basin (Rainboth, 1996). It uses various habitat types, including floodplains and areas with rocky bottoms and irregular depths. Kottelat (1996, 2002) records it from the lower and middle Nam Theun. **Migration/Spawning:** In the Nam Theun it is reported to be a migratory species which spawns in June. In the Nam Gnouang tributary it is reported to be present year round and to spawn in August-September. **Potential Impacts on Migration:** It is not completely clear if this species needs to migrate down to the Mekong mainstream during part of its life cycle. Assuming it does, the impact of Nakai dam (in tandem with Theun-Hinboun dam) will be similar to *Bagarius yarrellii*, and the species will likely disappear from the Nam Theun basin and be restricted to the Nam Kading.
Xe Bang Fai
Cyprinids
Species: *Sikukia gudgeri* **Distribution:** Widely distributed in the Mekong basin. Kottelat (1996) recorded it in the lower and middle Xe Bang Fai. The species is not known to take refuge in pools in the Mekong during the dry season (Poulsen *et al*, 2002a). **Migration/Spawning:** Little is known about its migratory habits (Rainboth, 1996). Evidence suggests that the Xe Bang Fai contains a resident stock, that the species is part of the small cyprinid upstream migration at the end of the rainy season, and that as a minimum the species spawns during the dry season in February. **Potential Impacts on Migration:** The impact on migration is not clear for this species. The increase in discharge during the wet season and its subsequent decrease at its end will presumably continue to be adequate triggers for migration events in this species' life cycle.
Species: *Puntioplites falcifer* **Distribution:** Widely distributed in the Mekong and takes refuge during the dry season in pools in the middle Mekong and in tributaries (Poulsen *et al*, 2002a). Kottelat (1996) recorded it in the lower and much of the middle Xe Bang Fai. **Migration/Spawning:** It is known to spawn in both the Mekong mainstream and in tributaries, and each major Mekong tributary may have its own population (Poulsen *et al*, 2004). It is a social species and migrates in large schools, apparently in association with other cyprinids such as *Labeo chrysophekadion*, *Cosmochilus harmandi*, *Cirrhinus spp*, and *Bangana sp*. Migration is triggered by changes in water level, and often intensifies during rapid rises and falls. At the end of the wet season when the river level falls, the species migrates back downstream to the Mekong. **Potential Impacts on Migration:** This species is likely to be attracted in larger numbers into the Xe Bang Fai from the Mekong mainstream during the early wet season by the increased discharge caused by the Project. More intensive inundation of marginal floodplains will likely promote greater spawning success and increase population size.
Species: *Labeo chrysophekadion* **Distribution:** Widely distributed in the Mekong. Kottelat (1996) records it from the lower and middle Xe Bang Fai. **Migration/Spawning:** In the middle Mekong it takes refuge in pools during the dry season (Poulsen *et al*, 2002a). During the early rainy season it migrates upstream and into tributaries to spawn opportunistically in a variety of habitats (swamps, floodplains, river channels) (Rainboth, 1996; Poulsen *et al*, 2004). At the end of the wet season it migrates back downstream to its dry season refuge pools. **Potential Impacts on Migration:** The impact of increased discharge is likely to be similar to *Puntioplites falcifer*.
Species: *Labiobarbus leptocheila* **Distribution:** It occurs widely in the Mekong basin. Kottelat (1996) records it from the lower and middle Xe Bang Fai **Migration/Spawning:** It is not recorded from dry season refuge pools in the Mekong (Poulsen *et al*, 2002a). It appears to move from rivers on to floodplains during the early wet season to spawn, and returns to rivers during the dry season (Rainboth, 1996). **Potential Impacts on Migration:** It is not clear if this species in-migrates from the Mekong, or if it is a year round resident of the Xe Bang Fai. If the former, the impact is likely to be similar to *Puntioplites falcifer*. If the latter, the increased discharge may increase the area of available habitat and in turn increase the population abundance. In either case, the upstream migration (triggered by increased discharge) during the early wet season is likely to continue as before.
Species: *Hypsibarbus vernayi* **Distribution:** Widely distributed in the Mekong basin in medium size rivers (Rainboth, 1996). Kottelat (1996) records it from the lower and middle Xe Bang Fai **Migration/Spawning:** Its life history is unknown. However, *H. malcolmi*, has been recorded from Mekong pools (Poulsen *et al*, 2002a), and migrates from large rivers to medium size rivers during the wet season, and spawns at the end of the wet season/early dry season when the water level falls (Rainboth, 1996). It is here suggested that *H. vernayi* has a similar life history, and the species may be part of the small cyprinid upstream spawning migration at the end of the rainy season. **Potential Impacts on Migration:** The migratory habits of *H. vernayi* are not exactly known, and it is not clear if this species needs to migrate down to the Mekong mainstream during part of its life cycle. If the species is part of the small cyprinid upstream spawning migration, the increased discharge may have some effect on this migration by causing stress on weak swimming species. Upstream migration is likely to continue to be triggered by change in discharge as before.
Pangasiid catfish
Species: *Pangasius larnaudii* **Distribution:** Widely distributed in the Mekong mainstream and its floodplains (Rainboth, 1996). Kottelat (1996) records it in the lower Xe Bang Fai. **Migration/Spawning:** Occurrence in the lower Xe Bang Fai is probably due to in-migration from the Mekong. It takes refuge during the dry season in pools in the Mekong (Poulsen *et al*, 2002a). It migrates upstream at the onset of the wet season, and spawning has on floodplains (Rainboth, 1996) and in the Mekong (Bardach, 1959). Both juveniles and adults return to the Mekong at the end of the wet season to take refuge. **Potential Impacts on Migration:** *Pangasius larnaudii, P. macronema, P. pleurotaenia and P. bocourti* are all likely to be impacted in a similar manner. The increased discharge is likely to be attracted in larger numbers into the Xe Bang Fai from the Mekong. More intensive inundation of marginal floodplains will likely promote greater spawning success and increase population size.
Species: *Pangasius macronema* **Distribution:** It occurs widely in the Mekong mainstream (Rainboth, 1996). **Migration/Spawning:** The species takes refuge in pools in the Mekong mainstream and possibly larger tributaries during the dry season (Poulsen et al, 2002a). **Potential Impacts on Migration:** It spawns in large schools in the Mekong mainstream (exact spawning grounds and habitat requirements are unknown). Juveniles and adults then enter floodplains to feed, and move back to river channels at the beginning of the dry season, eventually returning to refuge pools (Poulsen, 2004).

Xe Bang Fai cont.
Species: *Pangasius pleurotaenia* **Distribution:** Widely distributed in the Mekong basin, but is most common in the middle Mekong where many populations are thought to exist (Poulsen *et al*, 2004). Shoemaker *et al* (2001) record it from the Xe Bang Fai. Poulsen et al (2002a) record it from dry season refuge pools in the Mekong. **Migration/Spawning:** Migrates upstream at the first monsoon rains to spawning habitats (thought to be small tributaries), after which the larvae drift downstream to extensive floodplain nursery habitats in the lower basin (Poulsen, 2004). At the beginning of the dry season, the juveniles move back into the main river channel and then migrate upstream to the dry season refuge pools.
Species: *Pangasius bocourti* **Distribution:** Widely distributed in the Mekong basin, and possibly has two distinct populations (Poulsen, 2004). Shoemaker *et al* (2001) recorded the species in the Xe Bang Fai. **Migration/Spawning:** It is known to take refuge in pools in the Mekong mainstream during the dry season (Poulsen *et al*, 2002a). **Potential Impacts on Migration:** Occurrence in the Xe Bang Fai probably due to in-migration. Wet season rainfall triggers upstream migration to spawning grounds in the Mekong mainstream (exact location unknown). The hatched larvae drift downstream to nursery-feeding grounds associated with flooded vegetation. When the flood recedes, the juveniles return to the river and migrate upstream to their refuge pools (Poulsen *et al*, 2004).
Species: *Helicophagus leptorhynchus* **Distribution:** It occurs widely in the Mekong basin, and is particularly common along the middle Mekong where it may consist of several distinct populations associated with particular tributaries (Rainboth, 1996; Poulsen *et al*, 2004). Kottelat records it from the middle Xe Bang Fai. Poulsen *et al* (2002a) found that the species remains in refuge pools in the Mekong mainstream during the dry season. **Migration/Spawning:** The species carries out a mid-dry season upstream migration (mainly immature fish) possibly for feeding or dispersal, which is in advance of the normal spawning migration during the early monsoon (Poulsen *et al*, 2004). Spawning occurs in the Mekong mainstream and possibly in some major tributaries. The larvae drift downstream to nursery habitats, and subsequently move to deep pools at the beginning of the dry season. **Potential Impacts on Migration:** The impacts will in general be similar to *Pangasius larnaudii*. In addition, the mid-dry season migration of juveniles will likely be intensified by the increase in discharge caused by the project.
Silurid catfish
Species: *Wallago attu* **Distribution:** It is widely distributed, particularly in the lower Mekong basin (Rainboth, 1996; Poulsen et al, 2004). **Migration/Spawning:** It is not a long distance migrant, and consists of multiple populations each with a small distribution range (Poulsen, 2004). Adults use deep pools in the Mekong and larger tributaries as dry season refuges, while juveniles may spend the dry season in permanent lakes and swamps on floodplains (Poulsen *et al*, 2002a, 2004). The species takes short longitudinal migrations to the nearest stream, and spawns on the floodplain during the wet season in swamps, canals and streams. When the flood recedes, it swims back to the Mekong or large tributaries. **Potential Impacts on Migration:** It is possible that the increased discharge of the Xe Bang Fai during the dry season will not be tolerated by this species, and broodfish may abandon the impacted sections of the Xe Bang Fai during the dry season and swim to the Mekong to seek suitable dry season refuge habitat. The increased discharge during the wet season caused by the Project will likely result in larger in-migration from the Mekong, and greater spawning success.
Species: *Wallago leeri* **Distribution:** Widely distributed in large upland rivers but seems to be less common than *W. attu* (Rainboth, 1996). Kottelat records it from the middle Xe Bang Fai. It is known to use deep pools in the Mekong mainstream as a dry season refuge habitat (Poulsen *et al*, 2002a). **Migration/Spawning:** Migrates in groups into smaller streams during the early wet season, and spawns on flooded grassland and forest. It migrates downstream at the end of the wet season (Poulsen, 2000). **Potential Impacts on Migration:** The impacts on migration may be similar to *Wallago attu*.
Sisorid catfish
Species: *Bagarius yarrellii* **Distribution:** It is widely distributed throughout the Mekong basin, but is not a long distance migrant and probably has many subpopulations (Poulsen *et al*, 2004). Kottelat (1996) records it from the lower and middle Xe Bang Fai. It is reported as using deep pools as dry season refuge habitat (Poulsen *et al*, 2002a). **Migration/Spawning:** In the middle Mekong basin above the Khone Falls, the species carries out a protracted upstream spawning migration which peaks during the middle of the wet season (Poulsen *et al*, 2004). The species swims up large rivers (preferring rocky habitat with white water rapids) and also seasonally inundated riverine habitats. It is not known how far downstream larvae and juveniles are transported by the swift current. **Potential Impacts on Migration:** Bagarius yarrellii: The increased discharge during the wet season caused by the Project will likely result in larger in-migration of stock from the Mekong mainstream, and greater spawning success. This species is unlikely to experience stress due to high water velocity because its morphology is adapted to fast current. It is possible that the abundance of the juveniles of this species in the Xe Bang Fai will increase during the dry season due to expansion of riverine habitat.
Schilbeid catfishes
Species: *Laides longibarbis* **Distribution:** A common species in some parts of the Mekong basin,. Kottelat (1996) records it from the lower Xe Bang Fai. It is known to take refuge in pools in the Mekong mainstream during the dry season (Poulsen *et al*, 2002a). **Migration/Spawning:** Possibly a migrant occurring in medium size rivers and flooded forests (Rainboth, 1996). Further details of its life history are unknown. It is suggested that *L. longibarbis* carries out short migrations from dry season pools to nearby tributaries to spawn during the wet season, and then returns to the mainstream Mekong during the dry season. **Potential Impacts on Migration:** Similar to most other Mekong catfishes, the increased discharge during the wet season caused by the Project will likely result in larger in-migration of stock from the Mekong, and greater spawning success.

Xe Bang Fai cont.
Bagrid catfishes
Species: *Hemibagrus nemurus* **Distribution:** Very common throughout many habitats of the Mekong basin (Rainboth, 1996; Poulsen, 2004). Kottelat (1996) records it from the lower and middle Xe Bang Fai. The species uses deep pools in the Mekong mainstream and its tributaries as dry season refuge habitat (Poulsen 2002a, 2004). **Migration/Spawning:** Spawning migrations occur in the early wet season. These are probably short distance movements from refuge habitats to smaller tributaries and then on to floodplains and flooded forests where it spawns. At the end of the flood season, it migrates back to larger river channels and refuge pools. **Potential Impacts on Migration:** The increased discharge during the wet season caused by the Project will likely result in larger in-migration of stock from the Mekong and greater spawning success.
Species: *Hemibagrus wyckioides* **Distribution:** Widely distributed and occurs in upland rivers in the Mekong basin (Rainboth, 1996). **Migration/Spawning:** Little has been recorded of its life history and migration pattern. It is likely that it exhibits similarities with *H. nemurus*. Assuming the migration habits are similar to *H. nemurus*, it is predicted that the impacts will also be similar to that species.
Species: *Mystus spp* **Distribution:** Three species (*M. atrifasciatus*, *M. mysticetus*, *M. singaringan*) occur widely in the Mekong (Rainboth, 1996). *M. atrifasciatus* and *M. singaringan* have been recorded in the lower and middle Xe Bang Fai; and *M. mysticetus* in the middle Xe Bang Fai. **Migration/Spawning:** They move on to floodplains during the wet season. They are unlikely to carry out long distance migrations, and they are not known to use deep pools in the mainstream Mekong as dry season refuge habitat. **Potential Impacts on Migration:** These short distance migrants are likely to benefit from increased discharge due to habitat expansion but may suffer from stress due to higher current velocity.
Nandids
Species: *Pristiolepis fasciata* **Distribution:** It occurs widely in the Mekong basin (Rainboth, 1996). It prefers areas of aquatic vegetation or submerged tree limbs, and is more common in permanent lakes than in rivers. Kottelat (1996) records the species from the lower and middle Xe Bang Fai. It is occasionally recorded from deep pools during the dry season in the Mekong mainstream (Poulsen et al, 2002a). **Migration/Spawning:** The species undertakes short lateral migrations (and not longitudinal migrations). It moves from the main river to smaller stream and floodplains at the beginning of the wet season, and returns at the beginning of the dry season. It breeds mainly during the beginning of the wet season (Poulsen et al, 2000). **Potential Impacts on Migration:** This species is likely to be impacted in a similar manner to the previous *Mystus spp*. It is probably not a strong swimmer so may find higher current velocities problematic.
Chandids
Species: *Parambassis siamensis* **Distribution:** Widely distributed in the Mekong basin (Rainboth, 1996), and prefers standing and slow moving water. Kottelat (1996) records it from the lower and middle Xe Bang Fai. It is not known to use deep pools in the Mekong as dry season refuge habitat. **Migration/Spawning:** It probably carries out only very short lateral migrations to floodplains for spawning during the wet season. **Potential Impacts on Migration:** This species is likely to be impacted in a similar manner to *Mystus spp* and *Pristiolepis fasciata*. It is probably not a strong swimmer so may find higher current velocities problematic.