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THE FISHES OF DANAU SENTARUM NATIONAL PARK AND THE KAPUAS LAKES AREA, KALIMANTAN BARAT, INDONESIA

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***ABSTRACT.* –** Two hundred and twelve fish species are recorded from the Kapuas Lakes Area (western Borneo). One hundred and forty six species are definitively recorded from within Danau Sentarum National Park (DSNP) boundaries; 43 (29 %) of them have been recorded for the first time during the present survey. Eleven species new to science have been discovered and nine additional species are either new or require further study before their identity can be cleared. Taxonomy of *Chitala*, *Scleropages* and *Parachela* are briefly discussed. The published data do not justify recognising more than one Southeast Asian species of *Scleropages*. *Macrognathus tapirus* is proposed as a new replacement name for *Mastacembelus paucispinis* Fowler, 1939. A neotype is designated for *Ophidium aculeatum* Bloch. A large number of fish species migrate upriver to headwaters or downriver to the Kapuas main river at some time of the year; in addition there are lateral movements between the rivers and lakes and the flooded forest during the wet season.

***KEY WORDS.* –** Borneo, Indonesia, *Macrognathus*, *Scleropages*.

INTRODUCTION

Danau Sentarum National Park (DSNP) is located in the Kapuas basin on Borneo (Kalimantan Barat province of Indonesia), in the area called Kapuas Lakes, about 700 river-km from the sea (Fig. 1). DSNP is situated about between 0°40' and 1°05'N and 111°56' and 112°20' E, at an average altitude of 40 masl. It was officially established as a wildlife reserve since 1982 (although effectively managed only since 1992) with an area of 80,000 ha and was designated as a national park in 1999 through Decree of Ministry of Forestry SK No. 34/Kpts-II/99, and its area increased to 132,000 ha plus a buffer zone of 65,000 ha (Giesen & Aglionby, 2000; Wadley et al., 2000).

The Kapuas Lakes area is part of the Kapuas floodplain, surrounded by hills. It is characterised by the presence of a maze of both seasonal lakes and permanent or temporary flooded forests and swamp forests which play an important role in buffering the water level fluctuations of the Kapuas main river.

The annual rainfall in the area averages 3500-4000 mm per year. The area is inundated for about 9 months of the year, particularly during the rainy north-east monsoon (beginning September or October). Towards the end of September or October, heavy rains begin to fall in the area and surrounding hills and the main rivers begin to overflow. From around December until April, the water level stays very high and reaches peak levels to up to 10-15 m in February and March (Fig. 2). In the dry season, the water is gradually drained and in some years the lakes are completely dried. Depending on the altitude, the lakes will be dry for one to two months (July-August) in the year. In the rainy season, water from the Kapuas main river enters the lakes from different rivers and channels, while in the dry season the flow is reversed and the lakes are drained into the Kapuas. Villages in the Lakes Area are either on high piles on land, or consists of boats anchored along the lake shore (Fig. 3). Some of the latter villages are moved to different locations at different time of the year.

The lake waters are generally black waters (pH 4.0-5.5) as a result of deep peat deposits around the lake system. In fact, as a result of the topography (location and altitude) and of the connections with the Kapuas, there is great geographical and temporal variability in the water quality of different lakes. Generally, the lakes further away from the Kapuas and at a higher altitude have permanent black waters (e.g. Danau

Seriang), while the lakes which are closer to the Kapuas exhibit fluctuations between black waters in the dry season when fed by water from upstream lakes and turbid, brownish water in the wet season when Kapuas waters enter the area. The Kapuas itself changes from blackwater to murky, brown water depending on the rains in the hills or the Lakes area (as observed in early June 1995 in Sintang). Water temperatures fluctuate between 24 and 34°C, with an annual average of 29.5°C.

Vegetation maps usually indicate the Lakes Area as being covered by freshwater and peat swamp forests (e.g. Whitmore, 1984), but this is erroneous. The main vegetation type in the area is flooded forest, that is forest which is dry during a part of the year during which growth occurs. Swamp forest and peat swamp forests occur on soils which are permanently water-logged and they are found at the base of the hill slopes. The above account is largely derived from Giesen (1987, 2000) and Giesen & Aglionby (2000).

The Kapuas Lakes area is surrounded by low hills. In the Neogene (Tertiary), the Lakes Area was covered by the sea. When land emerged, the upper Kapuas was draining into the Lupar River (in Sarawak). Later, the Kapuas Mountains formed (in the north of the Lakes area) and the upper Kapuas became connected to the Melawi-lower Kapuas river, crossing the Kucing-Semitau hills near Semitau (van Bemmelen, 1949). This is very distinct on topographic maps and is evidenced by the very shallow ridge (about 25 m) between the north-western part of the Lakes Area and the Lupar basin, the disproportion between the very short upper Lupar River and its long and broad lower course, and the Kapuas cutting

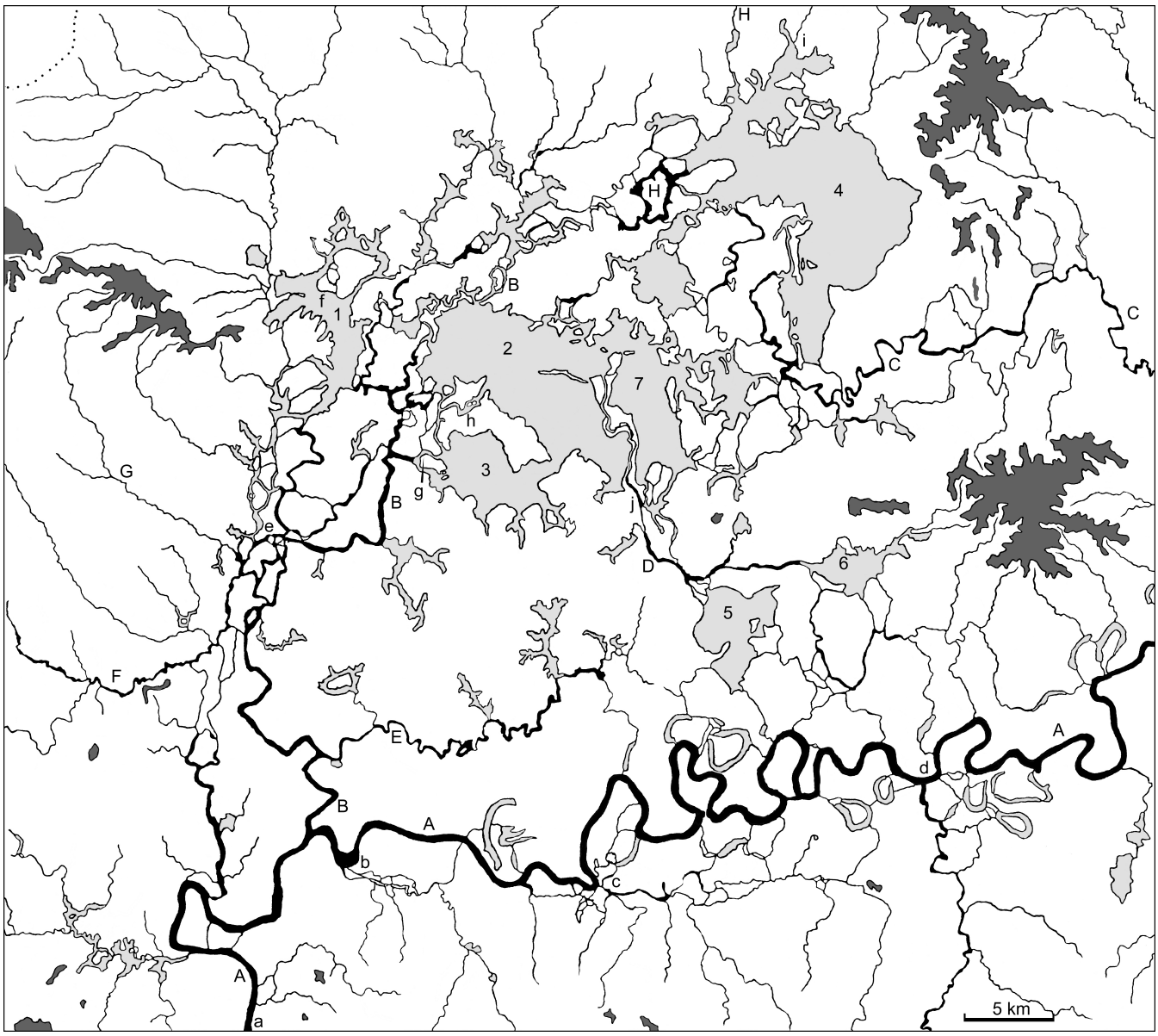

Fig. 1. The Kapuas Lakes, Kalimantan Barat, Borneo, Indonesia. Very simplified hydrographic network, most streams and small lakes omitted. Main lakes or lakes cited in text: 1, Seriang; 2, Sentarum; 3, Pengembung; 4, Luar; 5, Bekuan; 6, Sekawi; 7, Genali. Main streams or streams cited in text: A, Kapuas; B, Tawang; C, Embaluh Leboyan; D, Belitung; E, Tengkidao; F, Empanang; G, Piyam; H, Sumpa. Main villages, villages cited in text or villages were data was obtained: a, Semitau; b, Suhaid; c, Selimbau; d, Jongkong; e, Kenelang; f, Pulau Majang; g, Pengembung; h, Tekenang; i, Lanjak; j, Sekolat. Pale stippling: lakes; dark stippling: altitude over 100 masl.

straight across a low hill range downstream of Nanga Silat. This connection possibly explains the range of *Rasbora tuberculata* (see below), presently known only from the Lakes area and Bako in Sarawak.

The maze of lakes, channels and flooded forest offers a variety and a cyclical succession of habitats for fishes and other aquatic organisms. Besides the fishes reported here, other noteworthy aquatic animals are crocodilians of which DSNP hosts at least two species, *Tomistoma schlegeli* (of which we have seen some recently caught by fishermen) and *Crocodylus porosus* (of which we have seen a photograph of a ca. 5-6 m individual found dead and floating, taken in Sungai Kenelang in 1989).

Exploration (and knowledge) of the fish fauna of the Kapuas lakes started with Ida Pfeiffer who in 1851 discovered the Kapuas Lake district when crossing the Lupar - Kapuas watershed, arriving from Kuching (Pfeiffer, 1856; Lebzeller, 1910). The fishes she collected were reported on by Bleeker (1852). Other collections from western Borneo by Einthoven, Andresen, Stevens, van Kappen, Thepass, Sigal, Rebentisch, Kroesen were reported by Bleeker (1851, 1853a, 1855, 1857, 1858, 1859a-c, 1860a). Fishes collected by Martens along the Kapuas and in the Lakes Area (Pulau Majang, Danau Seriang) are listed by Martens (1876). Bleeker's *Atlas ichthyologique des Indes orientales néêrlandaises* (1862-78) summarises what was then known on the fish fauna of present-day's Indonesia.

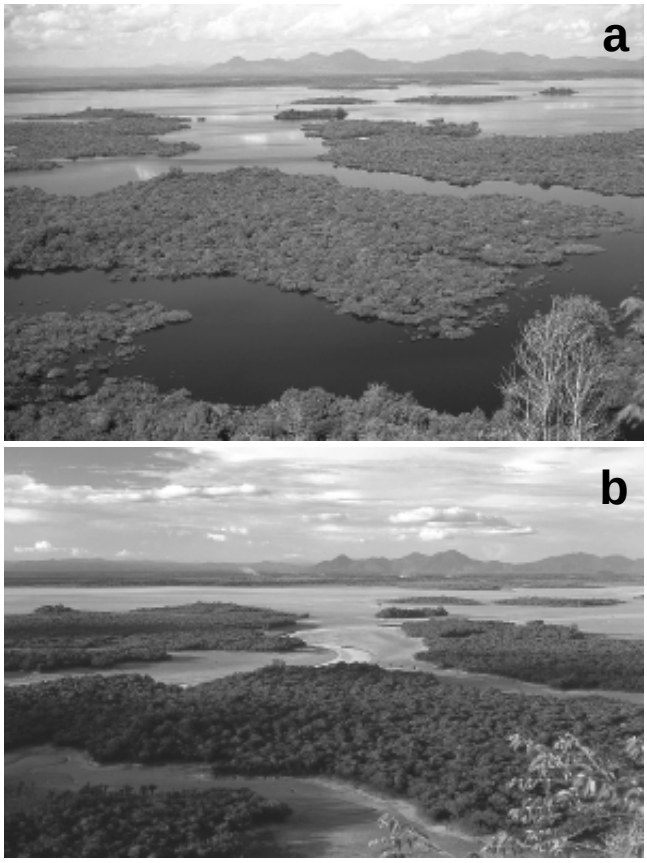

Fig. 2. Danau Sentarum at Bukit Tekenang. a, high water level; b, low water level (photographs Wim Giesen).

Later, ichthyological research by Chaper (see Chaper, 1894a, b) and Büttikofer (see Büttikofer, 1897; Molengraaff, 1895; Nieuwenhuis 1900, 1904-07) in Kalimantan Barat resulted in publications by Vaillant (1893, 1902) and Popta (1904, 1905, 1906). Weber & de Beaufort (1911-1962) compiled all the available information on Indonesian fishes (both marine and freshwaters) in their 11-volumes *Fishes of the Indo-Australian Archipelago*. The two volumes most concerned with freshwater fishes, volumes 2 and 3, appeared in 1913 and 1916, respectively.

More recent published work on the fishes of western Kalimantan is limited to Imaki et al. (1981), Banarescu & Bianco (1984) and especially Roberts (1989) who compiled most known data on the local fish fauna. Kottelat and co-workers added several species to the Kapuas fish fauna and revised the systematics of several groups (references listed in text). Kottelat et al. (1993) and Kottelat & Whitten (1996) provide an identification guide to the 964 named inland fishes of western Indonesia, mostly accompanied by illustrations.

The aquatic fauna plays an important role for the 3000 fishermen living in the 20 villages within DSNP, and the local fisheries is reviewed in Dudley (2000). As part of the management of DSNP, we have conducted surveys and investigations on the fishes, whose results are presented here. The purpose of this paper is to present results of surveys conducted in this area between 1993 and 1995, to briefly report the fish diversity and discuss some taxonomic problems encountered, and to present raw biological information. Although many of our observations are still superficial and not supported by quantified data, we believe that they are worth publishing as for the vast majority of the reported species there is not the slightest data on ecology, feeding, habitat, reproduction or migration. Also, as there is no perspective of future support for continuing research on this topic, our observations would then remain unavailable for potential future users.

MATERIAL AND METHODS

Field work on fish and fisheries in DSNP were conducted (within the pre-1999 boundaries) from April to July 1993 by EW; this included the collection of information on fish distribution, fish habitats, feeding habits and fisheries. A fish survey of DSNP and adjacent waters was conducted in September 1993 by MK and EW, and from September to December 1993 and May to August 1994 by EW. Additional information was obtained during a site visit in June 1995 by MK and EW.

Fishes were obtained by our own collecting with means of push-net, castnet and seine net, by inspection of fishermen's catches and local markets. Ichthyocides could not be used as this seemed inadvisable in a wildlife reserve area where one has to fight against (illegal) fish poisoning as a fishing method. Fishermen's catches were mostly identified in the field and only small subsamples of each species were preserved to confirm identifications. Some species of which only very large

specimens were obtained could not be preserved; none of the large specimens presented identification difficulties. Samples have been preserved and stored in the reference collection established in Danau Sentarum National Park Field Centre (DSFC). Additional material of some species have been deposited in the Museum Zoologicum Bogoriense, Bogor (MZB). Other abreviations used: CMK, collection of first author; RMNH, Nationaal Natuurhistorisch Museum, Leiden; ZRC, Zoological Reference Collection of the Raffles Museum of Biodiversity Research, National University of Singapore.

Much of this article is based on a substantial amount of published and unpublished material and information gathered by the authors over the last 15 years in Southeast Asia. Identifications and nomenclature follow Kottelat et al. (1993), Kottelat & Whitten (1996) and Weber & de Beaufort (1911-1962), except where noted. This paper is largely derived from a report written by MK in 1993. The nomenclature has been updated to include discoveries made since.

Co-ordinates were obtained by GPS readings. We call "Kapuas Lakes Area" the stretch of the Kapuas main river extending from Semitau upriver to Empangau and all its tributaries (and their drainage) entering it along this stretch (Fig. 1). This includes all of the DSNP and the areas upriver in the same drainage. The logic of doing so is that at different seasons, different species migrate from and to the lakes from downriver or upriver for feeding or spawning and that species not obtained by us within DSNP during our surveys may be present at other times of the year. Available information on these movements based on interviews of selected experienced fishermen are detailed below.

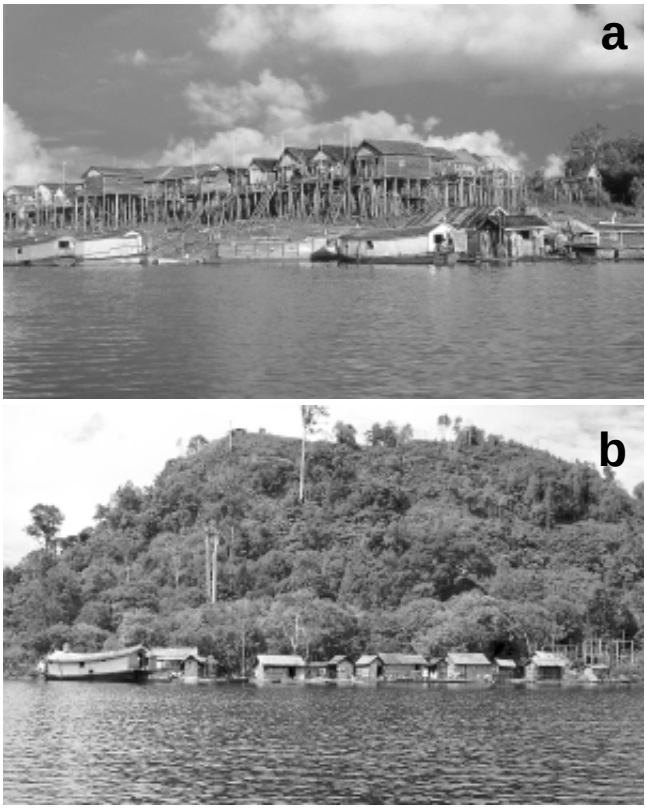

Fig. 3. Villages in Kapuas Lakes Area: a, Nanga Pengembung, on piles; b, Bukit Tekenang, on boats.

RESULTS

Two hundred and five species have been observed during the survey and 212 species are now definitively recorded from the Lakes Area based on the present survey, existing collections, data in Roberts (1989), Kottelat (1991a, b) and Kottelat et al. (1993). 146 species are definitively known from within DSNP boundaries, 44 (29 %) of them not recorded prior to the present survey. (As our work was conducted in 1993-95, by 'boundaries', we mean the boundaries before 1999 extension of DSNP). [A reviewer commented that most of our new records are not new as these species are listed, e.g., by Jeanes & Meijaard, 2000, Dudley, 2000. These lists are largely compiled on our unpublished reports and we consider it justified to consider that these are new records resulting from our work and recognised as such by us].

One then undescribed genus (*Hyalobagrus*) has been obtained during the survey. Eleven species then new to science were collected (*Sundasalanx platyrhynchus*, *Osteochilus partilineatus*, *Parachela cyanea*, *Puntius trifasciatus*, *Rasbora tuberculata*, *Gastromyzon embalohensis*, *Homaloptera yuwonoi*, *Hyalobagrus leiacanthus*, *Akysis fuscus*, *Betta enisae*, *B. pinguis*), which have since been described from our material or by others based on material they collected in adjacent areas (Ng & Kottelat, 1996, 1998; Kottelat, 1995c, 1998, unpubl.; Tan & Kottelat, 1998; Rachmatika, 1998; Siebert, 1997). In addition, more work is still needed to determine the status of nine species known to be or that may turn out to represent additional new species (*Barbonymus* aff. *balleroides*, *Eirmotus* aff. *octozona*, *Puntioplites* sp., *Neogastromyzon* aff. *nieuwenhuisi*, *Acantopsis* cf. *dialuzona*, *Hemibagrus* cf. *nemurus*, *Gymnochanda* cf. *filamentosa*, *G.* cf. *flammea*, *Pseudogobiopsis*, new species). This means that 9.5 % of the species observed by the survey were new or cannot be immediately identified, and illustrates our poor knowledge of this important food resource. Seven nominal species earlier considered as synonyms of widely distributed ones have since been shown to be specifically distinct (*Chitala hypselopterus*, *Diplocheilichthys jentinkii*, *Mystus castaneus*, *Ompok binotatus*, *O. rhadinurus*, *Silurichthys marmoratus*, *Polynemus kapuasensis*) (Ng & Ng, 1997; Ng, 2002a, b; Motomura & van Oijen, 2003; Tan & Kottelat, unpubl.; present publication). Despite this apparent high rate of new discoveries, the Kapuas basin hosts what can be considered as the best known fish fauna of Borneo and probably Indonesia, and suggests how much exploratory work is still needed to get an accurate overview of Indonesian fish diversity.

Jeanes & Meijaard (2000) list 266 species from the same area, largely based on our data then available as project's reports, with the addition of records from various sources, unpublished and of unknown reliability. Many of these additions are duplicates or triplicates, as they are based on different versions of our reports. These additions include:
- species otherwise previously recorded only from distant drainages known to have a high endemicity rate; they are unlikely to be present in DNSW and seem to be

misidentifications. *Crossocheilus nigriloba* [? = *C.* cf. *langei*], *Labiobarbus* cf. *sumatranus* [? = *L. leptocheila*], *Leptobarbus melanotaenia*, *Osteochilus pentalineatus* [= *O. partilineatus*], *Puntius* aff. *binotatus* [= *P. banksii*], *Rasbora* cf. *lateristriata* [? = *R. hosii*], *Thynnichthys vaillanti*, *Tor douronensis*, *Gastromyzon punctulatus* [? = *G. embalohensis*], *Nemacheilus pfeifferae* [? = *N. kapuasensis*], *N. selangoricus* [= *N. spiniferus*], *Pangio agma* [= *P. semicincta*], *P. kuhlii* [? = *P. semicincta*], *Mystus baramensis*, *M. planiceps*, *Pangasius nieuwenhuisii*, *Acrochordonichthys* cf. *melanogaster*, *A. rugosus*, *Glyptothorax platypogon*, *G. platypogonides*, *Clarias batrachus*, *Betta akarensis* [? = *B. enisae*], *B. anabatoides*, *B. fusca*, *Channa orientalis*, *Mastacembelus armatus*, *Macrognathus keithi*;

- species present in adjacent drainages, whose presence cannot be excluded, but which were not recognised on photographs we showed to fishermen. In the absence of unambiguous evidence of correct identification, these species are not included here. *Notopterus borneensis* [= *Chitala borneensis*], *Luciosoma setigerum* [? = *L. trinema*], *Osteochilus hasseltii* [? = *O. kappenii*], *Puntius hexazona* [? = *P. rhomboocellatus*], *P. tetrazona* [= *P. anchisporus*], *Rasbora argyrotaenia*, *C. teysmanni*, *Pristolepis* cf. *grootii*, *Achiroides leucorhynchus*, *Chonerhinos amabilis*, *C. silus*;

- species of doubtful identity, names known to be invalid, ghosts (unnamed species which are probably equivalent with species we list but whose identity cannot even be guessed for lack of information). *Puntius eugrammus* [= *P. trifasciatus*], *Rasbora* new species 2, *Homaloptera weberi*, *Nemacheilus* new species, *Silurichthys* new species, *Akysis polystaphilodon* [sic], *Polistonemus longipectoralis* [? = *Polynemus kapuasensis*], *Betta* cf. *bellica*;

- marine (!) and estuarine species whose habitat does not exist in DSWR. *Corica soborna*, *Arius polystaphilodon*, *A. thalassinus*, *Toxotes chatareus* [? = *T. microlepis*], *Synaptura* cf. *panoides* [? = *Achiroides melanorhynchus*], *Tetraodon nigroviridis*;

- cultivated species. *Barbonymus gonionotus*, *Hypophthalmichthys molitrix*;

- records with erroneous locality data: *Parosphromenus ornaticauda*.

This totals to 55 (21 %) erroneous or unlikely records in a list of 266 species, demonstrating (if need be) the limitations of the exercise and the misleading and detrimental conclusions which could be reached by using such data.

Four additions (*Hampala bimaculata*, *Osteochilus borneensis*, *Hemiarius stormii*, *Channa melanopterus*) may be likely but considering the problems mentioned above, we decided not to include them, pending reliable confirmation.

Although species rich, DNSP actually has a quite 'generalised' Kapuas fauna, which inhabits the lowlands and large, murky large rivers. Within the Kapuas Lakes area, the most stenotopic species generally occur only at the edge of DNSP or outside (black water species, e.g., *Puntius trifasciatus*, *Rasbora* spp.). As DNSP centers on wetlands, thus lowlands by definition, many interesting and stenotopic rheophilic fish species present in the drainage occur only outside the protected area. This is not to deny DNSP value as a spawning and nursery site for numerous species living there or migrating between the Kapuas and DSNP, but the biodiversity value of DSNP would have been much greater if other habitat types (e.g. rapids and black water areas) could have been included. In the absence of maps, it is not clear to us whether the 1999 boundaries and buffer zone include such habitats.

Although present within the pre-1999 boundaries of DSNP, we have not been able to find or access forest streams and hill streams. Giesen (1987, 2000) reports on peat swamp forests (his Tall Swamp Forests) with peat depth up to 4 m, especially to the north of DSWR. Streams in the north-western area flow very dark water, indicating a probable origin in peat swamps. Some aquatic habitats with structures and physiognomy somewhat similar to those of forest streams and peat swamps were sampled (Fig. 4), but they do not correspond to the structure of these habitats elsewhere in Southeast Asia. They look similar at some season but are not perennial and they do not harbour the fish communities of forest streams and peat swamps. Normal water level fluctuation for streams in peat swamps and swamp forests include floods and drought, but the conditions exhibited in the areas we visited are so extreme that none of the fish species or genera specialised for life in peat swamps and forest streams can survive: droughts are to the extreme that the

Fig. 4. Stream on floored forest floor; habitat looking similar to forest stream, but not perennial and with muddy bottom.

Fig. 5. Small fish harvested by traps and used to feed caged *Channa micropeltes*.

whole lakes and forest floor are dried out and covered by a hard crust of dry mud, without peat, without leaf litter. On the other extreme, floods up to 10 m make the whole forested area like a lake, for several months. The actual result is a cyclical succession of 3 very different habitats over large areas (lakes, swamp forest-forest streams, dry land, forest streams-swamp forest, lakes) with two extremes (lakes and dry land) very inhospitable for forest or peat-swamp fishes. In the middle of the basin, true forest or peat-swamp fishes have apparently no way to adapt to these drastically changing conditions.

With the almost complete absence of true aquatic vegetation in the lakes proper, it is clear that the main nutrient supply is exogenous to the aquatic system. The main source is the forest which is extensively flooded every year. Although we have no data for this precise area, experience with similar conditions elsewhere in Southeast Asia (e.g. Taki, 1978), earlier accounts for the area by Vaas (1952) and observations of local fishermen indicate that when the forest is flooded fish move laterally to feed and reproduce in the forest (most fish are reported to breed in October-December) and the fry and juveniles find there enough food for a massive and quick initial growth. Therefore, conservation of fish diversity and fisheries productivity is absolutely dependant on the conservation of the flooded forest.

In more marginal areas, at a slightly higher elevation, in areas with permanent forest streams (that is areas not becoming part of the lakes during the wet season), forest and landscape conservation is also the key element to protecting the fish biodiversity. In all Southeast Asia, foothill forest streams host the most diversified fish fauna because the alternance of pools, runs and riffles under the forest cover ensures a great variety and complexity of habitats for a maximum diversity. Forest loss means removal of shelters and sources of habitat complexity, removal of food sources, increased water temperature (meaning decreased oxygen supply), increased siltation (meaning disappearance of the boulders, stones and fauna dependant on them, but also removal of spawning grounds for many species and habitats for the larvae), and so on.

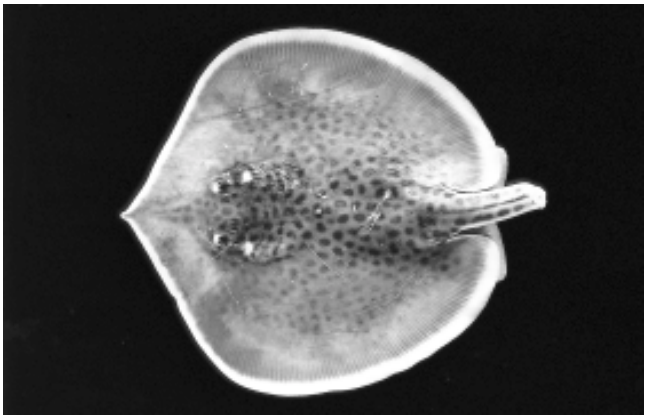

Fig. 6. *Himantura signifer*, CMK 11850, 158 mm DW; Borneo: Barito basin.

Several fish species (notably small *Chromobotia macracanthus*) are collected in relatively large numbers for the aquarium trade, but it is not clear whether their populations is very affected by this side-fisheries. Its impact can in no way be compared to the harvest of large quantities of any small-sized fish for feeding the caged toman (*Channa micropeltes*) (Fig. 5). However, as we know so little on the ecology and population size of most species, it is important to monitor the evolution of their populations. Of main concern are *Chromobotia macracanthus, Syncrossus hymenophysa, Epalzeorhynchos kalopterus*. It seems that *Balantiocheilos melanopterus* was earlier also an item for this trade and is now locally extinct for not precisely known reasons. *Scleropages formosus* is listed on CITES Appendix 1 and is notoriously the object of illegal trade in this area.

Recent trends in international pet trade make Ringau (*Datnioides microlepis*) and Belida (*Chitala* cf. *lopis*) fishes of potential interest as several species are now becoming very popular in Japan and Taiwan, two countries which absorb most of the trade for expensive fishes (the European and North American markets are less important for this trade). As these fishes are of great fisheries value in the Lakes Area, attention might need to be paid to this as a potential source of problems or conflicting interests between the local fishermen and aquarium fish collectors. It should be noted, however, that the most demanded *Datnioides* species are the New Guinean *D. campbelli* and the Thai *D. pulcher*, which has a different pattern consisting of very regular and broad black bars. The Kapuas *D. microlepis*, with its irregular pattern and narrow bars, does not reach high prices, at least at present. Similarly, the local *Chitala* cf. *lopis*, with its plain colouration is less attractive than the Thai or Malayan populations/species.

Finally, one should note that fishermen report at least three species as being now extirpated in the Lakes Area: *Notopterus notopterus, Balantiocheilos melanopterus*, and *Neobarynotus microlepis*. Interestingly, the three are said to have become extirpated at about the same period (1975-1977) and no precise cause can be given although fishermen suggest one or several of the following causes: overfishing for food, overfishing for the aquarium trade, droughts, and forest fires which affected water quality. At least one species is reported as no longer reaching the large size which it used to reach earlier*: Macrochirichthys macrochirus*. The cause is reported to be the use of certain mesh size in the dry season (see below).

Comments on identification and biology. **–** We include here comments on problems encountered with the identification of the different species, sources used for identification if other than those cited in Material and methods, and information on their biology. Asterisks (*) indicate species recorded from within DSNP boundaries.

FAMILY DASYATIDAE

Himantura signifer Compagno & Roberts

Local name: pari (Melayu).

***Remarks.* –** Observed in catches in Selimbau, Semitau, Suhaid and Sintang. Fishermen reported that this species occurs only in the Kapuas mainstream and the lower Tawang and that it is more common during the dry season. They know of two species of stingrays in the Kapuas. The second species apparently is *Pastinachus sephen* (Forsskal) which they recognised in Kottelat et al. (1993: pl. 3) on the basis of body shape and ventral skin fold along the tail. *Pastinachus sephen* has not yet been recorded from the Kapuas but in Sumatra it is known to enter the Indragiri at least as far as Renggat (Taniuchi, 1979). In Nanga Suhaid, some people also mentioned a 'batik' (spotted or marmorated) stingray; this might be a juvenile of the present species (we have seen a 158 mm disk width individual [CMK 11850] from the Barito, Central Kalimantan, which has a clearly spotted pattern; Fig. 6).

Himantura signifer is usually caught by *acar* or *kacar*, a line with several hooks baited with small fish and hauled by boat.

FAMILY OSTEOGLOSSIDAE

* *Scleropages formosus* (Müller & Schlegel)

Local names: siluk, kelesa, khayangan, peyang (Melayu), siluk (Iban).

***Remarks.* –** Although protected by law and listed by CITES Appendix I, *S. formosus* is the object of trade in the Lakes Area where the famous red variety occurs. The species is now being bred in captivity by several companies in Pontianak (and elsewhere in Southeast Asia) and Indonesia is allowed to export a given number of captive bred individuals per year. As a result of the captive breeding, most exported individuals are juveniles and interestingly this coincided with a change of trade practices in the Lakes Area in the early 1990s. In 1995, fishermen reported that adults were released and that they grow the juveniles (up to 80 per batch according to local fishermen) occasionally obtained from the mouthbrooding parent. This possibly indicates that: 1) the adults are no longer an interesting trade item, and 2) a part of the juveniles exported as captive-bred (as well as the smuggled ones) originate from the wild. The trade is mainly towards East Asian countries (Japan, Hong Kong, Taiwan, Singapore). Exact figures are not available to us, but, for example, in 1994 unconfirmed reports (or rumours) in the Asian aquarium fish trade were that 100,000 individuals entered Japan, most of them illegally. This figure is probably exaggerated. We have not been in a position to follow the evolution of this trade since that period.

The fish is occasionally caught by jermal (Fig. 10), but as it is a nocturnal species it is most commonly caught by using torch and hand-net. In recent years, through influence by the aquarium fish trade, the fish has been improperly known as 'arwana', derived from the name of the South American arowana (*Osteoglossum bicirrhosum*).

Several colour varieties (wild and cultivated) of *S. formosus* are recognised in the aquarium trade. Pouyaud et al. (2003) have recently recognised these varieties as representing four species, which they named. This is based on reported morphological and molecular differences. Their published results suffer from a number of flaws. The data are poorly organised and extremely time consuming to compare; table 5 is missing and replaced by a duplicate of table 4; the sequences are not recorded in Genebank; the 'morphological' analysis is a mere morphometric study; the argument switches from five colour varieties to four species without telling who is who (the reader is left to find it out by himself via the captions of some figures); etc.

The whole argument is based on 14 *S. formosus*, 8 *S. macrocephalus*, 6 *S. aureus* and 7 *S. legendrei*, of which only 14, 1, 1, and 0, respectively, have reliable locality data, a very serious limitation to such a study. Experience shows that with fishes of that commercial value, any individual not obtained directly from the wild or from a local food-fish market has to be considered as of dubious origin; localities associated with such material are too often purposely erroneous and misleading. Further, the material in the aquarium trade is supposed to be captive-bred (whether true or not is another question). Stocks of different origins are often kept together and, by law, part of the off-springs have to be released in the wild. Whether done or not, where are the fish released, how long do they remain in the wild before being recaptured, are unanswered questions, but the result is that there is no way to track which stock has been released where. In addition, any specimen bred or kept for some time in captivity is useless for morphometric study.

There is no morphological differences between Pouyaud et al.'s four nominal species. The reported differences are merely different combinations of 4 morphometric values and the authors do not provide description of morphological characters, except for the posterior extent of the maxilla mentioned in the diagnoses and which does not agree with the figures. The dendrogram of the partial cytochrome b sequences shows very minimal difference and very low bootstrap values for all 'species' and that the green variety (Pouyaud et al.'s *S. formosus*) would be paraphyletic.

Surprisingly (or interestingly), Pouyaud et al. record the presence of three species in the Kapuas basin, two of them in sympatry (but not syntopy) in the Lakes Area.

While it has been suspected for some time that some of the colour varieties of *S. formosus* could represent distinct species, the data (and their organisation) in Pouyaud et al. allows neither to confirm nor to negate this suspicion and the question remains open. It might be that *S. legendrei* could be a distinct species, but this requires a more robust demonstration. Considering the trade for *S. formosus*, its being listed by CITES Appendix I and various national and international legal instruments, we consider it premature to follow Pouyaud et al. and, awaiting unambiguous data, we prefer to recognise a single species. The taxonomy of endangered species should avoid publications with impacts potentially detrimental to sound conservation. Ambiguous publications are a serious

concern as they may lead to the erroneous perception that the problem is solved and make it difficult to obtain permits and funding for other, in depth studies. This case is being further investigated by MK.

FAMILY NOTOPTERIDAE

* *Chitala hypselonotus* (Bleeker)

Local names: belida (Melayu, Iban).

Remarks. – Fishermen reported a single species of Notopteridae as presently occurring in the Kapuas lakes, but they said that a second species was found there until about 1977. They recognised it as *Notopterus notopterus* (Pallas) on plate 3 of Kottelat et al. (1993). They presume that its extinction might be due to overfishing. They used the name *belida labuan* for this second species.

Belida is common throughout the Kapuas basin. The juveniles are found in forest streams while the adults prefer lakes and large rivers. The largest observed specimen measured 1000 mm TL and weighed 15 kg. Stomach contents include fish and crustaceans. Shrimps and large *Betta* are usually used as bait. Belida is an important food fish and is the main ingredient for *krupuk* (fish-flavoured crackers); the skin is occasionally used to produce leather used for purses.

A definitive identification of the present species is not possible now. The family had been revised by Roberts (1992b) who considered all *Chitala* reported from Indonesia to represent a single species, *C. lopis*. The species recognised by earlier authors were partly based on details of colouration which Roberts interpreted as different growth phases of a single species. He recognised the following 'phases':

- maculosus 'phase': entire body and fins covered with numerous small round spots; 150-270 mm SL;
- borneensis 'phase': numerous irregular oblique rows of very small spots on anal and posterior part of body and a black spot on pectoral base; 300-600 mm SL;
- hypselonotus 'phase': no mark except for a black spot on pectoral base; over 600 mm SL;
- lopis 'phase': no mark; only size given: 250 mm SL.

Data in Roberts (1992b) do not actually support very well this interpretation and our field experience (and especially the material obtained in DSNP) contradicts it. Out of the 36 examined specimens listed by Roberts, he provides information on the coloration of only 7. The sizes he gives for them disagree with those he gives in the text, as follow:

'phase'	Roberts' text	Roberts' material	our observations
maculosus	150-270	157, 161, 237	157-161
borneensis	300-600	233, 245, 417	140-500 mm
hypselonotus	over 600	750	165-1000 mm

For the lopis 'phase' he only mentions "a very few specimens including one about 250 mm SL from southern Thailand not listed in the material examined". Among the material examined by Roberts and for which he does not give the colour phase are at least 4 specimens from the Kapuas collected by the first author (CMK 6865, 1, 165 mm SL; CMK 6990, 3: 222-285 mm SL), all of which exhibits Roberts' hypselonotus colour pattern, but considerably smaller than the size range he gives. Beside, we have seen a specimen from Pahang drainage, Malay Peninsula (not preserved; photograph in ZRC provided by Kelvin Lim) about 150 mm SL and one from Sarawak (CMK 10988) 140 mm SL which exhibit the borneensis colour pattern.

Clearly, specimens of all four 'phases' are known within the

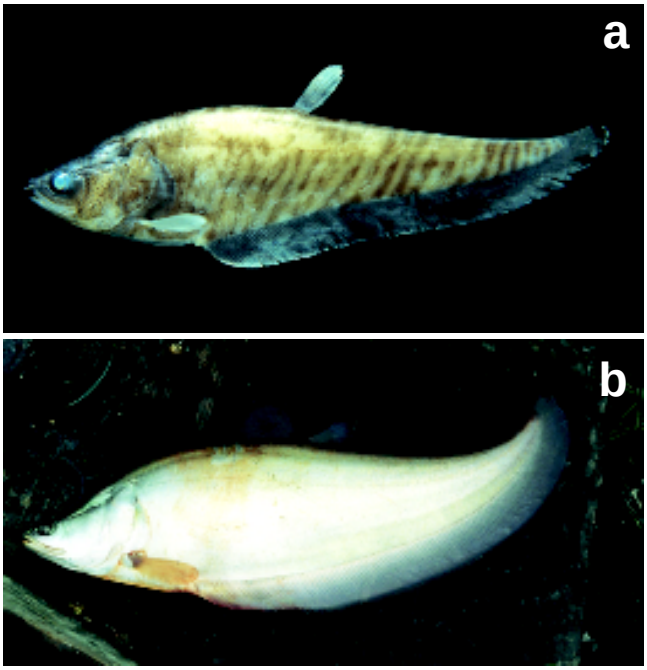

Fig. 7. *Chitala hypselonotus*, Borneo: Kapuas basin; a, DSFC uncat., 107 mm SL; b, ca. 750 mm SL, not preserved.

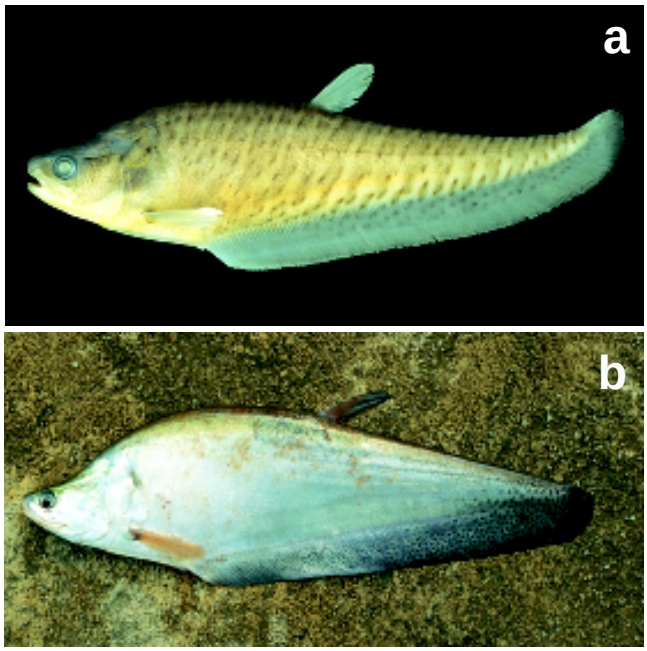

Fig. 8. *Chitala borneensis*, Borneo: Sungai Niah; a, CMK 10988, 140 mm SL; b, ZRC 37989, 393 mm SL, caudal area damaged.

range 230-250 mm SL, and all but the lopis 'phase' are known within the range 150-250. This does not fit with a theory of ontogenetic colour changes of a single species.

Interestingly, all the known specimens with the maculosus or borneensis pattern are from the Meklong basin of Thailand, the Malay Peninsula, Sumatra, Sarawak, Sambas and the Barito, but none is known from the Kapuas. All the specimens (probably more than 100 in the size range 165-1000 mm SL) we observed in the Kapuas basin have the hypselonotus pattern of Roberts, except the two smallest individuals (106 and 137 mm SL; Fig. 7) which have oblique cross bars on the body, a colour pattern not mentioned by Roberts.

According to aquarium fish collectors and exporters in Java, specimens from Java have no trace of any colour pattern and have a different nape shape than the Sumatra and Borneo specimens. We have not yet been able to obtain comparative specimens from Java to confirm this observation; and the species is said to be possibly extinct on Java.

Although it is still premature to reach definitive conclusions, it is obvious that at least 2 and may be up to 4 species of *Chitala "lopis"* occur in Southeast Asia. With the available data, they seem to be difficult to distinguish when only adult material is available, but juveniles differ in colour pattern. The barred type of the Kapuas and the spotted patterns (maculosus and borneensis phases of Roberts) of Sumatra, Malay Peninsula, Sarawak and Barito are two species. The Javanese and the Indochinese populations apparently are two additional species.

We tentatively recognise the following four species (the names are tentative and should be confirmed by fresh collections from the different type localities):

Chitala lopis (Bleeker, 1851), endemic to Java ?; juveniles and adults plain ?;

Chitala borneensis (Bleeker, 1851) (Fig. 8); Sumatra (Jambi, Palembang), Borneo (Sarawak, Sambas, Barito) and Malay Peninsula; juveniles with scattered small blotches (as illustrated by Bleeker, 1870: pl. 275), becoming organised into oblique rows or stripes in adults; adults probably never plain; *Notopterus maculosus* Bleeker, 1851 is a simultaneous synonym and the first reviser (Bleeker, 1875: 147) gave precedence to *N. borneensis* as the valid name.

Chitala hypselonotus (Bleeker, 1852) (Fig. 7); Sumatra and Borneo; juveniles with oblique cross bars, adults plain with a black dot at pectoral base;

Chitala sp. (a still unnamed species); Malay Peninsula, Central Thailand, lower Mekong; juvenile with a few small scattered blotches on body, adults plain with a black spot at pectoral base.

A more conservative hypothesis would be to tentatively recognise two species: *C. lopis* (including *C. hypselonotus*) and *C. borneensis* (including *Chitala* sp.).

Considering the great economic importance of belida, the large quantities caught, and the reported decrease of several populations, it would be important to solve this problem soon.

FAMILY CLUPEIDAE

* *Clupeichthys bleekeri* Hardenberg

Local name: bilis (Melayu).

***Remarks.* –** More common during the wet season (October-May). Found in river and streams with clean and moderately fast waters.

FAMILY ENGRAULIDIDAE

* *Lycothrissa crocodilus* (Bleeker)

Local name: silauari (Melayu).

***Remarks.* –** Usually found in rivers and at the confluence with small streams, and in lakes. Feeds on small fish.

* *Setipinna* cf. *melanochir* (Bleeker)

Local name: silauari (Melayu).

***Remarks.* –** Observed in catches in Danau Pengembung, but no material could be preserved for further identification.

FAMILY SUNDASALANGIDAE

* *Sundasalanx platyrhynchus* Siebert & Crimmen

Local name: linut (Melayu).

***Remarks.* –** Two species of *Sundasalanx* occur in the Kapuas main river (Kottelat, 1991b; Siebert, 1997). Although the family has only been recently recognised and named (Roberts, 1981), its members can be locally abundant and in some rivers of eastern Borneo, they even can be the most abundant species (pers. obs.). Their small size and transparent body explain why they are often overlooked or considered as larvae of other fishes.

Linut are known by the local fishing communities and they are caught with a kind of dipnet with very fine meshes (*pesat*). They are most common during the wet season, especially November-December. They inhabit rivers with moderate to fast water with a muddy bottom. During the day they are found usually in water deeper than 1 m, close to the bottom (usually just over the layer of loose ooze of the bottom of muddy rivers); at night they school near the surface along the shores. They are used to flavour a local kind of sago crackers (*bakwan*). The crackers (about 5 cm diameter) are covered with linut, deep fried and eaten with sugar and garlic sauce.

FAMILY CYPRINIDAE

**** Amblyrhynchichthys truncatus* (Bleeker)**

Local name: kedukul (Melayu).

***Remarks.* –** Reported to be present all the year but more common in the wet season, to occur in lakes and main rivers and to reproduce around December (as most fishes in the area) and to feed on algae and insect larvae.

**** Balantiocheilos melanopterus* (Bleeker)**

Local name: ketutung, tutung (Melayu).

***Remarks.* –** Reported from Pengembung by Roberts (1989) but not obtained during our survey. According to fishermen, they inhabit rivers with moderate to fast current and feed on small fish, crustaceans and insect larvae. The catches decreased dramatically after 1975 and the fish is now rare or extirpated. No exact cause for the population decrease could be given, but fishermen suggest that overfishing for the aquarium trade or forest fires in 1975 (responsible for organic pollution and increased turbidity) might be the cause. Although an important aquarium fish, it seems that all individuals of *B. melanopterus* exported from Indonesia are captive bred (F. Yuwono, pers. comm.). It is not known whether wild populations still survive. In Thailand too, the local populations are reported to be extirpated and the captive stock used by the aquarium-fish farms reportedly was imported from Indonesia (MK was told this as early as 1980). The only area where the species apparently survives is the lower Mekong in Cambodia. The conservation status of this species deserves serious monitoring. The aquarium-fish trade has sometimes been considered as responsible for the extinction of local populations; in most cases, including the present one, this seems unlikely as the species also disappeared where there was no harvesting. The aquarium trade certainly may play a role in the decline of some species (e.g., *Scleropages formosus*), but it should not be used to mask much larger-scale impacts that decimate populations (e.g., forest fires, dams, logging, agriculture).

A single specimen about 100 mm total length was caught by gill net on 9 December 1993 in Bukit Tekenang (EW could only examine the head and the tail). The taste is reported to be bitter and the flesh is not much esteemed.

**** Barbichthys laevis* (Valenciennes)**

Local name: kungkum (Melayu).

***Remarks.* –** Fishermen reported that this species is absent from the lakes during the dry season; it is then present mainly in the Kapuas mainstream and the lowermost reaches of the main tributaries; they assume that it spawns in the Kapuas. Herbivorous but stomachs also contained fish (probably *Rasbora* spp.) and crustacean remains.

***Barbonymus* aff. *balleroides* (Valenciennes)**

Local name: unknown.

***Remarks.* –** Identified as *Puntius bramoides* (Valenciennes) by Roberts (1989: 61). According to Fang (1943: 400) the correct name for the species is *B. balleroides*. According to Kottelat (1995b: 407), the Borneo populations represent a still undescribed species. Earlier placed in *Barbodes*, but this generic name has to be replaced by *Barbonymus* (Kottelat, 1999: 595).

***Remarks.* –** Fishermen reported that the adults occur only in the Kapuas where they reproduce. The juveniles enter the smaller rivers when the river flow reverses. They usually follow drifting wood (as reportedly most juvenile fishes do when moving upriver from the Kapuas at that time). They feed on aquatic plants and insects.

***Barbonymus collingwoodii* (Günther)**

Local name: kepiat (Iban).

***Remarks.* –** A species restricted to streams with fast flowing and relatively cold waters, over stones and gravel, in upland areas (Sungai Lanjak, Sungai Entebuluh at Keluwin). Fins yellow in life.

**** Barbonymus schwanenfeldii* (Bleeker)**

Local name: tengadak (Melayu).

***Remarks.* –** Fishermen reported that this species is present all year round in the area but moves from the lakes to the rivers, in deep waters during the dry season. The largest observed specimen was 400 mm TL. The examined stomachs contained plants, insects and fish remains. This species is occasionally collected as aquarium fish.

**** Chela maassi* (Weber & de Beaufort)**

Local name: lipi (Melayu).

***Remarks.* –** New record for DSNP. Reaches a maximum size of 40 mm SL. Quite common in forest creeks without current, swamp forest and vegetation along river banks. Feeds on insect larvae and crustaceans.

***Cosmochilus falcifer* Regan**

Local name: unknown.

***Remarks.* –** Not obtained during our surveys, but observed in the market in Sanggau in June 1994. Fishermen reported that the species occurs only in the Kapuas main river and larger tributaries and that it migrates upriver in the dry season to reproduce for example around Putussibau or Nanga Pinoh.

* *Crossocheilus cobitis* (Bleeker)

Local names: bantak batu, seluang batu (Melayu).

***Remarks.* –** Although a very common species easily collected in rivers from under the logs on which floating houses are built, this species had not been recorded before from DSNP. The systematics of the genus is still confused. Our specimens agree with *C. cobitis* as described by Bleeker (1863) and Weber & de Beaufort (1916) as well as with the key of Roberts (1989), but they disagree with Roberts' figure of *C. cobitis*. According to our experience, *C. oblongus* is a larger species occurring in fast flowing water and rapids, over stones and gravel. In life it is bluish grey with a bluish white belly (white when preserved), as shown in Kuhl and van Hasselt's manuscript drawing (reproduced in Roberts, 1993: 55). *Crossocheilus cobitis* is a smaller species occurring in quieter waters; in life it is yellowish or greenish brown with dark belly (peritoneum obviously black or dark brown in preserved specimen). Feeds on algae and insect larvae.

Crossocheilus cf. *langei* Bleeker

Local name: unknown.

***Remarks.* –** Roberts (1989: 32) records the presence of three species of *Crossocheilus* in the Kapuas basin. He was not sure of the distinctness of one of them and he tentatively identified it as *C. nigriloba* Popta (1904) which was then known only from Popta's description. Material of *C. nigriloba* obtained in 1991 in the Mahakam shows a very diagnostically patterned lower caudal lobe (see Kottelat et al., 1993: pl. 84); *C. nigriloba* is a distinct, valid species, possibly endemic to the Mahakam basin (Kottelat, 1995b: 408).

Roberts considered the very dark, sharply margined lateral stripe extending about to two-thirds of length of middle caudal-fin rays as diagnostic. We have a series of juveniles from Sungai Lanjak whose identity is uncertain. They are somewhat similar to Roberts's specimens in having the lateral stripe extending on the middle caudal rays, but they differ in that extension being at most to about one half (missing in two specimens). As our specimens are smaller than those of Roberts (CMK 11675, 7, 35.9-40.4, vs. 42.9-50.9 mm SL), we cannot exclude that the difference might be size related.

In addition, these Lanjak specimens are distinguished from our Kapuas *C. cobitis* in having a conspicuous area of black pigments between anus and anal-fin origin, a character mentioned as diagnostic of *C. langei* by Bleeker (1860c) and Alfred (1971: 100).

Crossocheilus oblongus Kuhl & van Hasselt

Local names: bantak batu, seluang batu (Melayu), tebelian (Iban).

***Remarks.* –** See *Crossocheilus cobitis* above for comments. This species has been obtained in upland streams.

* *Cyclocheilichthys apogon* (Valenciennes)

Local names: mata merah, emperas (Melayu), engkaras (Iban).

***Remarks.* –** Very common and widely distributed throughout the year, but more abundant in the dry season. Inhabits rivers, small streams, lakes and swamp areas with grassy vegetation. Stomach contents include fish and insect remains.

* *Cyclocheilichthys armatus* (Valenciennes)

Local names: buin, kampras (Melayu), engkaras (Iban).

***Remarks.* –** Feeds on small fish (*Rasbora* spp.) and prawns (aquarium observations).

* *Cyclocheilichthys heteronema* (Bleeker)

Local name: paku (Melayu).

***Remarks.* –** New record for DSNP. A small species easily recognised by its fimbriated barbels. Probably because of its small size and lack of any colour mark, this species tends to be overlooked in most faunal inventories and is considered as rare (e.g. Doi & Taki, 1994). It actually seems to be quite common in most rivers over muddy substrate but has also been collected in forest streams. When shown the photographs in Kottelat et al. (1993) which show all the diagnostic characters, fishermen say that the species does not occur in the Lakes Area. It has been observed in the Kapuas and the main rivers and enters the Lakes Area in the wet season (October-May).

* *Cyclocheilichthys janthochir* (Bleeker)

Local names: jajau, majau (Melayu).

***Remarks.* –** A brilliantly coloured species apparently restricted to areas with very black (but relatively clear) water; collected only in the northern part of DSNP during our surveys. Feeds on aquatic insects. Occasionally exported by the aquarium trade.

* *Cyclocheilichthys repasson* (Bleeker)

Local names: buin (Melayu), buing (Iban).

***Remarks.* –** Although fairly common, this species had not been reported before from DSNP. Feeds on insect larvae and prawns.

Diplocheilichthys jentinkii (Popta)

Local names: palau batu (Melayu), kulung, palau batu (Iban).

***Remarks.* –** This species has been placed in *Labeo* by Weber & de Beaufort (1916) and *Osteochilus* by Roberts (1989), as a synonym of *L. rohitoides* and *O. pleurotaenia*, respectively. Roberts (1989) and Karnasuta (1993) treated *O. jentinkii* and *O. rohitoides* as junior synonyms of *O. pleurotaenia*. Kottelat & Lim (1996: 229) accepted this synonymy and commented that their Bornean material differs in mouth structure from what is known in the genera *Labeo* and *Osteochilus* and retained the genus *Diplocheilichthys* as a valid genus, as already done by Bleeker (1860b). Comparisons of topotypes of *D. pleurotaenia* (from Sumatra) and "*O*". *jentinkii* (from Borneo) has shown that they are congeneric but not conspecific (Tan & Kottelat, unpubl.).

***Remarks.* –** This species has only been collected in Sungai Entebuluh at Keluwin, north-east of Lanjak, where it is apparently restricted to fast flowing waters.

* *Eirmotus* aff. *octozona* Schultz

Local names: berbaju (shared with several small, barred barbs), tebalang (Melayu), bengah (Iban).

***Remarks.* –** New record for DSNP. Inhabits mostly forest streams and swamp forest, mostly but not exclusively with black waters. Seems to prefer deeper and cooler water layers and is often overlooked because of its small size, deeper habitat and superficial similarity with other species (e.g. *Puntius anchisporus*).

* *Epalzeorhynchos kalopterus* (Bleeker)

Local names: seluang hantu, seluang batu, seluang merah (Melayu), tebelian (Iban).

***Remarks.* –** Very common, especially at the end of the wet season (April-May). Often collected from the lower surface of floating objects (boats, floating houses) with *Crossocheilus cobitis* and *Syncrossus hymenophysa*. Commonly caught for export as aquarium fish.

* *Hampala macrolepidota* Kuhl & van Hasselt

Local names: langkung, adung, dungan, juak (juvenile only) (Melayu), adung (Iban).

***Remarks.* –** Widely distributed in all habitats, but more common during the dry season. Feeds on small fish and prawns. An important food fish.

Kalimantania lawak (Bleeker)

Local name: unknown.

***Remarks.* –** Obtained from the Kapuas mainstream over muddy substrate.

* *Labeo chrysophekadion* (Bleeker)

Local name: temunit (Melayu), kak' (Iban).

***Remarks.* –** Fishermen reported that the species is very common in the lakes in the dry season, reaching a maximum size of 50 cm TL and a weight of 5 kg, that only smaller specimens are present in the wet season and that it spawns in the lakes or close vicinity. The examined stomachs contained aquatic insects, crustaceans, small fish and detritus. An important food fish.

* *Labiobarbus festivus* (Heckel)

Local name: kujam, kujam merah (Melayu).

***Remarks.* –** This species has been collected only in black and clear waters during our surveys, but fishermen reported it to be present everywhere in the Lakes Area, all year round, but more common in the wet season. Feeds on detritus and insect larvae.

* *Labiobarbus leptocheila* (Valenciennes)

Local name: kujam putih (Melayu).

***Remarks.* –** Fishermen reported this species to prefer upriver, cooler areas; this is partly contradicted by our collections which are mostly from main rivers. The examined stomachs contained detritus and insect larvae.

* *Labiobarbus ocellatus* (Heckel)

Local name: bauk tadung (Melayu).

***Remarks.* –** Fishermen reported this species as present everywhere, all the year, more common in the wet season. The examined stomachs contained detritus and insect larvae.

* *Leptobarbus hoevenii* (Bleeker)

Local name: jelawat (Melayu).

***Remarks.* –** Fishermen reported that this species is most common in the Kapuas mainriver and not common in the lakes, but somewhat more common in Pulau Majang where it reproduces in December, that larger specimens are caught in the Kapuas and that juveniles (locally called *bundung*) enter the Tawang and the lakes at the beginning of the wet season.

This is one of the most popular food fish. Most local people grow them in cages. The juveniles are caught by special traps. The caged fishes are fed with vegetal matters, fruits, small fish. One of its favourite food is the fruit of the swamp forest tree *Xanthophyllum florescens* (family Polygalaceae), known locally as *tengkurung jelawat* (jelawat being the name of *L. hoevenii*). Largest seen specimen was 800 mm TL.

**** Leptobarbus melanopterus* Weber & de Beaufort**

Local names: piam, piyam (Melayu, Iban).

***Remarks.* –** Inhabits rivers and streams of the swamp forest, usually found in backwaters. Examined stomachs contained insect, crustacean and plant remains. A popular food fish.

***Lobocheilos bo* (Popta)**

Local name: unknown.

***Remarks.* –** Only known from fast flowing waters in upland areas. The systematics of the genus *Lobocheilos* is still very confused and the present identification is tentative.

***Luciosoma spilopleura* Bleeker**

Local name: unknown.

***Remarks.* –** Not obtained in the Lakes Area during our survey, but obtained in Semitau and Silat in 1990. Roberts (1989: 44) reports that his specimens were all collected in high gradient rivers with rocky, stony, or gravel bottom. Specimens from Semitau were obtained at night around floating houses and specimens from Silat were small juveniles obtained from the Kapuas mainriver among flooded grasses.

**** Luciosoma trinema* (Bleeker)**

Local names: kenyuar (Melayu), nyenyuar (Iban).

***Remarks.* –** Widely distributed and very common during the dry season. Feeds on insects and small fishes (e.g. *Rasbora* spp.).

**** Macrochirichthys macrochirus* (Valenciennes)**

Local name: belantau (Melayu).

***Remarks.* –** Fishermen reported that this species occurs in the lakes and rivers all the year although more common in the dry season and that it returns to the Kapuas in the wet season to reproduce. It usually reaches up to about 350 mm TL, but specimens up to 1 m are known (see also Roberts, 1989: 45) although these have been very rare after the 1960s. Fishermen assume that only small ones are left because the large ones are easily caught by gill nets which are used everywhere during the dry season. It feeds on small fish. It is usually consumed smoked.

***Mystacoleucus marginatus* (Valenciennes)**

Local name: unknown.

***Remarks.* –** Not collected during our surveys, but fishermen reported that it occurs in the upper part of the Lakes Area (e.g. Nanga Tanggit, etc.). It prefers fast flowing, clear water.

**** Neobarynotus microlepis* (Bleeker)**

Local name: bubuk (Melayu).

***Remarks.* –** Reported from Pengembung by Roberts (1989) as *Cyclocheilichthys microlepis* on the basis of specimens collected in 1976. Fishermen reported that this species is locally extinct since about 1975-77 (see *Balantiocheilos melanopterus* above for possible causes). It used to occur in the lakes and main rivers all the year and to spawn in December.

***Osteochilus enneaporos* (Bleeker)**

Local name: unknown.

***Remarks.* –** Apparently restricted to upland areas with fast flowing waters.

**** Osteochilus intermedius* Weber & de Beaufort**

Local name: menyadin (Melayu).

***Remarks.* –** Inhabits rivers and small streams in the swamp forest.

***Osteochilus kahajanensis* (Bleeker)**

Local name: palau (Melayu, Iban).

***Remarks.* –** Obtained from upland streams over stony and gravel bottom, with clear and fast flowing water.

**** Osteochilus kappenii* (Bleeker)**

Local name: palau (Melayu).

***Remarks.* –** Fishermen reported that this species is very common at all seasons in the whole Lakes Area. It has usually been misidentified in the field as *O. hasseltii* (Valenciennes), a species otherwise widely distributed in western Indonesia and Southeast Asia, but absent from the middle and upper Kapuas.

**** Osteochilus melanopleura* (Bleeker)**

Local name: kelabau (Melayu).

***Remarks.* –** Fishermen reported that this is a species very common everywhere in the lakes and rivers, not migrating, and reproducing in December. The largest measured specimen was 500 mm TL. An important food fish.

**** Osteochilus microcephalus* (Valenciennes)**

Local name: bantak (Melayu).

***Remarks.* –** Common everywhere.

**** Osteochilus partilineatus* Kottelat**

Local names: engkarit, karit (name shared with other striped barbs) (Melayu).

***Remarks.* –** New record for DSNP. Collected only in black and clear waters in forest streams.

**** Osteochilus schlegelii* (Bleeker)**

Local names: kelabau putih, kebali, kebali batu (Melayu).

***Remarks.* –** Fishermen reported that this species occurs everywhere all the year, but not in black waters. This last statement is contradicted by our observations.

**** Osteochilus spilurus* (Bleeker)**

Local name: bantak batu (Melayu).

***Remarks.* –** Although common and abundant in creeks and small water bodies in the forest, this species had not been reported before from DSNP.

**** Osteochilus triporos* (Bleeker)**

Local names: menyadin (Melayu), riu' (Iban).

***Remarks.* –** Fishermen reported that this species is present in the lakes and rivers, and that it moves upriver in the dry season to headwaters where it reproduces. We observed it mostly in blackwater streams.

***Osteochilus waandersii* (Bleeker)**

Local names: bantak batu (Melayu), bantak surik (Iban).

***Remarks.* –** Fishermen reported that this species occurs more upriver and that it enters the lakes in the wet season. Specimens we examined were from upland streams.

***Oxygaster anomalura* van Hasselt**

Local name: unknown.

***Remarks.* –** We have not obtained this species within DSNP during our surveys. Fishermen reported that the species inhabits the lake shores and rivers where they are covered by forest, which is confirmed by our observations outside DSNP. Fishermen reported that *O. anomalura* is insectivorous, while *Parachela oxygastroides* which has a similar appearance is piscivorous.

**** Parachela cyanea* Kottelat**

Local name: lipi (Melayu).

***Remarks.* –** Collected mainly in the northern part of DSNP and seems to prefer black and clear waters.

**** Parachela hypophthalmus* (Bleeker)**

Local names: lipi, kaca (Melayu), entebuloh (Iban).

***Remarks.* –** Identification follows Weber & de Beaufort (1916) and Kottelat et al. (1993), although both disagree with the species described and figured by Bleeker (1863). Bleeker figured a fish with a blackish longitudinal band in each caudal lobe. Our material has a plain caudal fin, as does most material we have seen. We have seen material from Jambi (Sumatra) with faint black caudal stripes but they were not very well fixed.

On the same plate, Bleeker (1863) figured *P. oxygastroides* with a plain caudal. All specimens we have seen of this species have a dark submarginal stripe in each caudal lobe. The corresponding text mentions the plain caudal of *P. oxygastroides* and striped one of *P. hypophthalmus*. This interversion of colour patterns between what is described by Bleeker and all subsequent authors seem suspicious and we checked Bleeker's different accounts of both species.

Bleeker (1852) described *Leuciscus oxygastroides* on the basis of 9 specimens 50-148 mm TL from material from Borneo (Kalimantan Selatan: river Kusan River at Prabukarta), Sumatra (river Musi in Palembang) and Java (Batavia [Jakarta]). Fins are described as yellowish-hyaline with posterior margin more or less brownish to blackish.

Bleeker (1860c) described *C. hypophthalmus* on the basis of 2 specimens 155 and 165 mm TL. He guessed they were from Palembang (Sumatra) but was no longer sure because he had first identified them as *C. oxygastroides* and had stored them in the same jar as his material of that species. These two specimens were not part of the type series of *C. oxygastroides* (they are too large). The caudal fin is described as "caudali dimidio basali utroque lobo fuscescente" [on caudal, darkish extends halfway from base on the lobes].

In the same publication, Bleeker redescribed *C. oxygastroides* on the basis of 6 specimens 90-148 mm TL. He listed the same localities as in his 1852 original description and added Sambas (Borneo). This means that out of the 6 specimens then in his possession, only 5 were syntypes and that all specimens less than 90 mm TL had disappeared. The caudal fin is described as "caudali utroque lobo medio frequenter fascia longitudinali diffusa fuscescente" [on caudal, diffuse darkish longitudinal stripes extends on middle of lobes].

In 1864, the caudal fin of *C. hypophthalmus* had become "lobes with blackish longitudinal stripes" in the key and "caudali dimidio basali utroque lobo fuscescente" in the text and that of *C. oxygastroides* "without stripes" in the key and "caudali utroque lobo medio frequenter fascia longitudinali diffusa fuscescente" in the text.

We have examined the paralectotype of *C. hypophthalmus* (RMNH 4985, 120 mm SL, TL unknown as caudal fin is broken); there are no traces of pigments on the caudal fin. We have also examined 6 specimens catalogued as paralectotypes of *C. oxygastroides* (RMNH 8061, 1, 87.1 mm SL, TL unknown; RMNH 4984, 5, 37.1-119 mm SL, all with broken caudal fin). Probably not all are part of the type series. The three smaller specimens are in very poor state and are possibly not conspecific with the large ones. One of them is possibly *P. cyanea*. The two largest ones seem to be what we call *P. oxygastroides*, but there is no trace of pigment on the caudal fin.

It is possible that Bleeker at some stage confused elements of the colour pattern of the two species, when writing the text or when taking notes to prepare the plates. Alternatively, he might have based his comments on species which have not been recognised since. Also, there are indications that more species of *Parachela* remain to be recognised and that a revision of *Parachela* is obviously needed.

Present everywhere at all seasons. Feeds on small fishes, insects and crustaceans.

* *Parachela oxygastroides* (Bleeker)

Local name: kelampak (Melayu), entebuloh (Iban).

***Remarks.* –** See discussion above, under *P. hypophthalmus*.

Fishermen reported that this species is present everywhere at all seasons and that it is piscivorous.

Paracrossochilus vittatus (Boulenger)

Local names: seluang batu (Melayu), enseluai batu (Iban).

***Remarks.* –** Inhabits fast flowing, clear waters over stony or gravely substrate.

* *Pectenocypris balaena* Roberts

Local name: seluang malam (Melayu).

***Remarks.* –** New record for DSNP. A small fish particularly abundant in shallow areas with black water, particularly in the heath forest along north-western margin of DSNP. Plankton feeder with about 150-180 gill-rakers used to filter phytoplankton (Roberts, 1989: 58). They have been collected only in open areas, usually with flooded grasses. They are locally very abundant and in one station they accounted for about 25% of the daily castnet and trap catch (estimated 50 kg; Fig. 5) of a single fisherman. This catch consisted only of small fishes (up to about 50 mm) used to feed caged *Channa micropeltes*.

* *Puntioplites bulu* (Bleeker)

Local name: tengalan (Melayu, Iban).

***Remarks.* –** Fishermen reported that this species occurs everywhere at all seasons, that it spawns in rivers and that it feeds on insects, crustaceans, small fish and organic matter. A common food fish.

* *Puntioplites waandersii* (Bleeker)

Local name: umpan (Melayu).

***Remarks.* –** Fishermen reported that this species occurs everywhere at all seasons, that it spawns in rivers and that it feeds on insects, crustaceans, small fish and organic matter. A common food fish.

Puntioplites sp.

Local name: unknown.

***Remarks.* –** A single specimen 74.0 mm SL (Fig. 9) observed during the dry season (June). It apparently represents an unnamed species, characterised by its blunt snout and plain body. Local fishermen do not appear to know this fish.

* *Puntius anchisporus* (Vaillant)

Local name: berbaju (shared with other barred barbs) (Melayu).

***Remarks.* –** Common everywhere, particularly along shores with submerged vegetation.

Puntius banksi Herre

Local name: bangas (Melayu).

Fig. 9. *Puntioplites* sp., CMK 11520, 74.0 mm SL; Borneo: Kapuas basin.

***Remarks.* –** Earlier considered as a synonym of *P. binotatus* (Valenciennes), valid following Kottelat & Lim (1996: 232). Known from Sarawak and the Kapuas basin. Has been collected in a variety of small streams in lowland and foothills, usually with clear water.

* *Puntius endecanalis* Roberts

Local name: Berbaju (shared with other barred barbs).

***Remarks.* –** New record for DSNP. Inhabits flooded forest along lake shores.

**Puntius everetti* Boulenger

Local names: berbaju, telotong (Melayu).

***Remarks.* –** Inhabits forest streams in the foothills zone, usually in clear, slowly to fast flowing waters (but there, prefers the quieter areas along the shores); commonly found in shallow waters (less than 5-15 cm), such as puddles in the forest.

Puntius kuchingensis Herre

Local name: bangas (Melayu).

***Remarks.* –** Material identified as *P. lateristriga* (Valenciennes) from the Kapuas basin and from Sarawak has a distinctive colour pattern (especially a conspicuous row of spot as along lateral line and a short horizontal streak from upper extremity of gill opening) and are treated as a distinct species. The earliest available name is *P. kuchingensis* Herre (1940). *Puntius lateristriga punctatus* Banarescu & Bianco (1984) is a synonym.

Occurs in pools in clear water streams in the forest and the foothills, usually in clear water over sandy to rocky substrate.

* *Puntius lineatus* (Duncker)

Local names: engkarit, karit (shared with other striped barbs) (Melayu).

***Remarks.* –** New record for DSNP. Quite common in clear, black waters. See Kottelat (1993) for a description and discussion. This species probably represent a still unnamed genus.

* *Puntius rhomboocellatus* Koumans

Local name: berbaju (shared with other barred bards) (Melayu).

***Remarks.* –** New record for DSNP. Usually inhabits black water streams in forested areas.

* *Puntius trifasciatus* Kottelat

Local names: engkarit, karit (shared with other striped barbs) (Melayu).

***Remarks.* –** This is the species called *P. eugrammus* in Roberts (1989) and Kottelat et al. (1993). Examination of the *P. eugrammus* of earlier authors has shown that it actually consists of two species (Kottelat, 1996: 309).

Common in the black, clear waters but has not been collected in the central Lakes Area.

* *Rasbora bankanensis* (Bleeker)

Local name: seluang (Melayu).

***Remarks.* –** Although it is the most abundant and most common fish in the Kapuas basin, this species has not previously been recorded from DSNP. Very abundant around floating houses in large rivers.

Rasbora borneensis Bleeker

Local name: seluang buluh (Melayu).

***Remarks.* –** Collected only in the Kapuas mainstream. Reported to enter the lakes in the wet season.

Rasbora caudimaculata Volz

Local name: seluang engkrunyuk (Melayu), enseluai (Iban).

***Remarks.* –** A fast swimming species from forest creeks, usually over sandy substrate.

* *Rasbora cephalotaenia* (Bleeker)

Local name: seluang (Melayu), enseluai (Iban).

***Remarks.* –** New record for DSNP. A species occurring in larger streams and rivers with black water. It is reported to be present in the Lakes Area in all seasons, but to be more abundant at the beginning of the dry season.

* *Rasbora dorsiocellata* Duncker

Local names: engkruyuk, seluang nyanyak (Melayu), enseluai (Iban).

***Remarks.* –** One of the most commonly collected species in DSNP, present in almost all collections, but nevertheless not reported before.

*** *Rasbora dusonensis* (Bleeker)**

Local names: seluang (Melayu), enseluai (Iban).

***Remarks.* –** New record for DSNP although common along shores in large rivers.

*** *Rasbora gracilis* Kottelat**

Local name: seluang badar (Melayu).

***Remarks.* –** New record for DSNP although common in forest streams and clear black waters.

***Rasbora hosii* Boulenger**

Local name: unknown.

***Remarks.* –** Earlier identified as *R. sumatrana*, a species now considered endemic to Sumatra. Members of this species group prefer small creeks with flowing water, often over stony substrate.

*** *Rasbora kalbarensis* Kottelat**

Local name: seluang (Melayu).

***Remarks.* –** New record for DSNP although common in forest streams and clear black waters, but not abundant. Seems to be among the few species which benefit from human disturbance and usually common in small streams which had been affected by human activities or in recently cleared areas. Not yet recorded in the central Lakes Area.

*** *Rasbora pauciperforata* Weber & de Beaufort**

Local name: rita' (Melayu).

New record for DSNP although common in forest streams and clear black waters.

***Rasbora sarawakensis* Brittan**

Local name: seluang (Melayu).

***Remarks.* –** Apparently prefers moderately fast flowing waters in small forest streams.

*** *Rasbora subtilis* Roberts**

Local name: seluang (Melayu).

***Remarks.* –** New record for DSNP. The most common species in most localities along lake shores and in shallow, open areas. They are locally very abundant and in one station they accounted for more than 50% of the daily castnet and trap catch (estimated 50 kg) of a single fisherman.

Identification of this species and *R. trilineata* has been somewhat problematical as the original description (Roberts, 1989: 75) is partly misleading. Roberts describes the lateral line as incomplete while his illustration shows it to be complete, as confirmed by examination of his material. The number of scale rows around the caudal peduncle seems to be the easiest diagnostic character, 14-16 in *R. subtilis*, vs. 12 in *R. trilineata*.

*** *Rasbora trilineata* Steindachner**

Local names: seluang engkrunyuk, seluang minyak (Melayu).

***Remarks.* –** New record for DSNP. See comments for *R. subtilis* above. This species seems to prefer habitats in forest.

***Rasbora tuberculata* Kottelat**

Local name: unknown.

***Remarks.* –** This species reaches about 27 mm SL and has been collected in Sungai Pala, a small forest creek in a hilly area, over stony substrate. The species is otherwise known only from Bako, Sarawak.

*** *Rasborichthys helfrichii* (Bleeker)**

Local names: seluang bulu (Melayu), enseluai bulu (Iban).

***Remarks.* –** Inhabits lakes, rivers and streams. Most common around May, moves to the Kapuas in the dry season.

*** *Rohteichthys microlepis* (Bleeker)**

Local name: kapas (Melayu).

***Remarks.* –** Common in the Kapuas, the lakes and the main rivers, but moves towards the Kapuas in the dry season.

*** *Thryssocypris ornithostoma* Kottelat**

Local name: seluang panjang (Melayu).

***Remarks.* –** Known only from the Kapuas and its main tributaries. Fishermen reported that it enters the Lakes Area in the wet season and returns to the Kapuas in the dry season. Feeds on insects.

*** *Thryssocypris smaragdina* Roberts & Kottelat**

Local name: seluang panjang (Melayu).

Remarks. **–** A single specimen has been observed in fishermen catches from Sungai Tawang at Nanga Empanang, together with *T. ornithostoma*.

* *Thynnichthys polylepis* Bleeker

Local names: bauk ketuk, bauk pipih (Melayu).

Remarks. **–** Fishermen reported that this species is common everywhere at all seasons. In several lakes (e.g. in September 1993 and June 1995 in Danau Baru near Mawan, an oxbow lake along the Kapuas), it constitutes the vast majority of the catches of all fishermen operating with castnets or gillnets. Stomachs contain insect and fish remains.

* *Thynnichthys thynnoides* (Bleeker)

Local name: entukan (Melayu).

Remarks. **–** Fishermen reported that this species occurs everywhere at all seasons but is abundant only in the dry season.

FAMILY BALITORIDAE

* *Barbucca diabolica* Roberts

Local name: unknown.

Remarks. **–** Largest known size 34 mm SL. Obtained from *tabung* (a trap made of bamboo; see *Chromobotia macracanthus* below).

Ellopostoma megalomycter (Vaillant)

Local names: engkrunyuk, seluang engkrunuk (Melayu).

Remarks. **–** Adults have been collected in the Kapuas and the main rivers over muddy substrate. In May 1990, juveniles about 15 mm SL have been observed in a black water stream, among shore vegetation. In June 1995, a specimen about 23.3 mm SL have been observed in an oxbow lake along the Kapuas.

Gastromyzon embalohenis Rachmatika

Local name: unknown.

Remarks. **–** Lives in fast flowing waters in the uplands, usually under stones and boulders.

* *Homaloptera nebulosa* Alfred

Local name: susuh batang (Melayu).

Remarks. **–** Inhabits forest streams, usually with some current.

Homaloptera ophiolepis Bleeker

Local names: susuh batang (Melayu), lelekat (Iban).

Remarks. **–** Lives in fast flowing waters in the uplands, usually under logs or in log crevices.

Homaloptera orthogoniata Vaillant

Local name: susuh batang (Melayu).

Remarks. **–** Inhabits forest streams, usually with some current and wood debris. Fishermen reported that it is occasionally found in Sungai Tawang at the end of the dry season (April-May).

Homaloptera stephensoni Hora

Local name: susuh batang (Melayu).

Remarks. **–** Inhabits streams with fast or moderately fast current, on stony substrate.

Homaloptera yuwonoi Kottelat

Local name: unknown.

Remarks. **–** See Kottelat (1998: 267) for description. Inhabits upland, fast flowing streams, among gravel.

Homaloptera zollingeri Bleeker

Local name: unknown.

Remarks. **–** Inhabits streams with fast or moderately fast current, on stony substrate.

* *Nemacheilus kapuasensis* Kottelat

Local name: ikan batu (Melayu), memayur (Iban).

Remarks. **–** New record for DSNP. Usually inhabits streams with gravel or stony substrate and a moderate current. Juveniles have been collected over a muddy substrate under forest cover in DSNP. Feeds on insect larvae.

Nemacheilus lactogeneus Roberts

Local names: ikan batu (Melayu), memanyur (Iban).

Remarks. **–** Known only from the Kapuas and its main tributaries, over muddy substrate.

***Nemacheilus saravacensis* Boulenger**

Local names: ikan batu (Melayu), memanyur (Iban).

***Remarks.* –** Inhabits forest streams, usually over sandy bottom with wood debris.

**** Nemacheilus spiniferus* Kottelat**

Local names: ikan batu (Melayu), memanyur (Iban).

***Remarks.* –** Obtained in a variety of habitats from clear forest streams to main rivers, but most frequent in clear waters with a moderate current over sandy or gravel substrate. Feeds on insect larvae.

***Neogastromyzon* aff. *nieuwenhuisi* Popta**

Local names: dekat (Melayu), lelekat (Iban).

***Remarks.* –** Inhabits fast flowing streams over stony substrate.

***Vaillantella cinnamomea* Kottelat**

Local name: unknown.

***Remarks.* –** Obtained from accumulations of leaf litter in sheltered areas of fast flowing streams, with clear water, in forest.

***Vaillantella euepiptera* (Vaillant)**

Local name: unknown.

***Remarks.* –** Obtained from accumulations of leaf litter in sheltered areas of fast flowing streams, with clear water, in forest.

FAMILY COBITIDAE

***Acanthopsoides molobrion* Siebert**

Local name: unknown.

***Remarks.* –** New record for DSNP. Collected in the mud in main rivers.

***Acanthopsoides robertsi* Siebert**

Local name: unknown.

***Remarks.* –** Collected in the sand in forest and upland streams, in moderate to fast current.

***Acantopsis* cf. *dialuzona* van Hasselt**

Local name: unknown.

***Remarks.* –** Known only from the Kapuas and its main tributaries over muddy substrate.

**** Chromobotia macracanthus* (Bleeker)**

Local names: ulang uli (Melayu), entebiring (Iban).

***Remarks.* –** Widely distributed and particularly common at the end of the wet season (April-May). In the dry season, moves to the Kapuas, its main tributaries but also to the affluents of the lakes. Reproduces in the wet season (November-December), reportedly upriver (e.g. Tangit, Leboyan) in flooded forest. The largest observed specimens were about 300 mm TL. They reportedly start reproducing at about 200 mm. *Chromobotia macracanthus* is the most important freshwater aquarium fish exported from Indonesia; some 2,400,000 have been exported from Pontianak in 1995 (Aglionby, 1995). In 1987, the Ministry of Trade imposed a ban on the export of specimens over 150 mm TL in order to safeguard breeding stocks.

Large specimens are caught by *jermal* (Fig. 10) or by gillnet, but most are caught by *tabung* (Fig. 11), a bundle of longitudinally split bamboo about 60 cm long. The *tabung*

Fig. 10. Jermal: a fishing method using a net closing the whole width of a stream, with a hole and a bag in the middle (a); a long, horizontal net (b) is sunken upstream of the first net and is regularly pulled out and emptied through the hole.

are left in the water and checked everyday; they are simply shaken over the boat to recover the fish.

* *Kottelatlimia pristes* (Roberts)

Local name: emplunyu (Melayu).

***Remarks.* –** New record for DSNP although very common in the mud or leaf litter on the bottom of most forest streams. In the dry season, when the lakes dry out, they survive in small water bodies (*kerinan*) until the lakes are flooded again.

Originally described as a species of *Lepidocephalichthys*. Nalbant (1994: 377) considered that *L. katik* Kottelat & Lim, 1993 (of which he had examined no material) is not congeneric with other species of *Lepidocephalichthys*. This was already implied by Kottelat & Lim (1993a: 212) who refrained from naming this genus as its phylogeny was being reviewed by another colleague.

Most of the characters used by Nalbant (1994) to diagnose his genus *Kottelatlimia* are reductive or paedomorphic characters associated with the small size of the species (e.g. large head, small eye, unbranched suborbital spine [lateralethmoid], naked head, reduced vertebrae number) and useless at diagnosing evolutionary lineages. The only character of some use is the serrated second pectoral ray which is a synapomorphy shared with *L. pristes* and at least one undescribed species; this apparently escaped Nalbant who left *L. pristes* in *Lepidocephalichthys*.

Fig. 11. Tabung, a bundle of longitudinally split bamboo, mainly used to trap *Chromobotia macracanthus*, *Syncrossus hymenophysa* and *Epalzeorhynchos kalopterus*.

Pangio anguillaris (Vaillant)

Local name: ikan cacing (Melayu).

Pangio doriae (Perugia)

Local name: ikan cacing (Melayu).

***Remarks.* –** New record for DSNP. Collected among leaf litter in slow flowing streams under forest cover.

Pangio malayana (Tweedie)

Local name: ikan cacing (Melayu).

***Remarks.* –** New record for Borneo and Indonesia. Previously known only from the Malay Peninsula, this species had earlier been synonymized with *P. kuhlii*. Kottelat & Lim (1993b: 231) have shown that it is a distinct species. It can be immediately distinguished from *P. kuhlii* in the field by the background colour (yellowish, slightly translucent, vs. pinkish white) and by the colour of the bars (brown, vs. black) and their shape (forming small saddles restricted to the dorsal half, vs. extending on almost the whole body depth). The Kapuas specimen differs from the Malayan ones by having the black blotch at caudal fin base extending somewhat on the fin in a blotch with indistinct margin (vs. fin entirely hyaline, and blotch with distinct margin). These differences are probably not significant, but more material is needed to check this identification.

* *Pangio oblonga* (Valenciennes)

Local name: ikan cacing (Melayu).

***Remarks.* –** Inhabits streams with muddy bottom, among shore vegetation or leaf litter. Caught in *pesat* (lift net) or *tabung* (bamboo trap). Not eaten but used to feed caged fishes.

Pangio semicincta (Fraser-Brunner)

Local name: ikan cacing (Melayu).

***Remarks.* –** Inhabits forest streams with muddy bottom and dense shore vegetation. Not obtained by us in DSNP, but fishermen reports its presence in Sungai Belitung in Nanga Sekulat. This species has earlier been considered as a synonym of *P. kuhlii*, a decision reluctantly followed by Kottelat & Lim (1993b: 229). Recent material obtained from Java has shown that the two species are distinct (Kottelat, 1995a).

***Pangio shelfordii* (Popta)**

Local name: ikan cacing (Melayu).

***Remarks.* –** Inhabits forest streams with muddy bottom and leaf litter accumulations. See Kottelat & Lim (1993b: 244) for discussion of geographic variation in this species.

***Pangio superba* (Roberts)**

Local name: ikan cacing (Melayu).

***Remarks.* –** Inhabits forest streams with muddy bottom and leaf litter accumulations.

*** *Syncrossus hymenophysa* (Bleeker)**

Local names: engkadik (Melayu), pansik, pansek (Iban).

***Remarks.* –** Widely distributed in lakes, rivers and streams. Usually found close to submerged trees or logs, or under floating logs and houses. Occurs as well in upland streams over stony substrate. Reproduces in small streams in the swamp forest. Juveniles 11-19 mm SL were found in Sungei Baru near Jongkong on 30 October 1993. Caught for the aquarium trade and frequently used as a bait on *ulur* or *rabai* (hook).

FAMILY BAGRIDAE

*** *Bagrichthys hypselopterus* (Bleeker)**

Local name: patik layar (Melayu).

***Remarks.* –** Inhabits the Kapuas and the main rivers, over muddy substrate, in deep waters with swift current. In DSNP, known only from Sungai Tawang. Fishermen reported that it is most common in the wet season and rare in the dry season, that it spawns in the Kapuas and feeds on insects and small fishes.

*** *Bagrichthys macropterus* Bleeker**

Local name: ikan pisang (Melayu).

***Remarks.* –** Inhabits the Kapuas and the main rivers, but does not enter the lakes. Fishermen reported that it is most common in the wet season, rare in the dry season and that it spawns in the Kapuas.

*** *Bagrichthys micranodus* Roberts**

Local name: ikan pisang (Melayu).

***Remarks.* –** Inhabits the Kapuas and the main rivers, but does not enter the lakes. Fishermen reported that it is most common in the wet season, rare in the dry season and that it spawns in the Kapuas.

*** *Bagroides melapterus* Bleeker**

Local name: ikan pisang (Melayu).

***Remarks.* –** Inhabits the Kapuas and the main rivers, but does not enter the lakes. Fishermen reported that it is most common in the wet season, rare in the dry season and that it spawns in the Kapuas.

*** *Hemibagrus* cf. *nemurus* (Valenciennes)**

Local names: baung, patik.

***Remarks.* –** Earlier identified as *H. nemurus* (Valenciennes). Recent studies (Ng, pers. comm.) have shown that *H. nemurus* is a complex of species and that the real *H. nemurus* is restricted to Java and central and eastern Borneo. Fishermen consider that two kinds (species ?) of *H.* cf. *nemurus* are present in DSNP, but could not show us specimens of both kinds. It is possible that the second 'kind' is *H. bongan* (Popta), known from adjacent tributaries of the Kapuas (Ng, pers. comm.).

Present all the year, everywhere. Fishermen reported that it reproduces 2 or 3 times in the year. Feeds on prawns, small fishes and worms. An important food fish. Ripe ovaries are dried separately and eaten.

***Hemibagrus olyroides* (Roberts)**

Local name: patik kerapak (Melayu).

***Remarks.* –** Fishermen reported that this species inhabits upper reaches of main rivers among wood debris and sunken trees and logs.

***Hemibagrus wyckii* (Bleeker)**

Local name: baung burai (Melayu).

***Remarks.* –** Inhabits large rivers over muddy substrate with fast water. Reaches 710 mm SL. Fishermen reported that it feeds on small fishes and that it is common in the area during the dry season. An important food fish.

*** *Mystus castaneus* Ng**

Local name: rik (Melayu).

***Remarks.* –** This is the species earlier called *M. micracanthus*; it was re-identified as *M. nigriceps* (Roberts, 1993: 29, 1994: 252). Ng (2002b) showed that *M. nigriceps* is restricted to

Java and southern Sumatra and that the Kapuas species belongs to *M. castaneus*.

Present all the year, everywhere. Fishermen reported that it spawns 2 or 3 times in the year.

* *Mystus singaringan* (Bleeker)

Local names: landin (Melayu), lelandin (Iban).

***Remarks.* –** This is the species earlier called *M. nigriceps*, but this name actually is the name of another fish. The correct name of the species is *M. singaringan* (Roberts, 1993: 29, 1994: 252).

Present all the year, everywhere. Fishermen reported that it spawns 2 or 3 times in the year.

Hyalobagrus leiacanthus Ng & Kottelat

Local name: unknown.

***Remarks.* –** Earlier identified as "*Pelteobagrus*" *ornatus*.

Collected from the Kapuas mainriver over muddy bottom by castnet.

* *Pseudomystus myersi* (Roberts)

Local names: ikan pisang, ikan anak pisang (Melayu).

***Remarks.* –** New record for DSNP. Inhabits rivers and streams with muddy substrate and leaf litter. This species has earlier been placed in the genus *Leiocassis*; nomenclature follows Mo (1991: 140).

Pseudomystus cf. *stenomus* (Valenciennes)

Local names: ikan pisang (Melayu), gerigit (Iban).

***Remarks.* –** A single specimen from Sungai Entebuluh at Keluwin in the collection at the Field Centre is tentatively identified as this species. Its state of preservation does not allow a more accurate identification.

FAMILY SILURIDAE

* *Belodontichthys dinema* (Bleeker)

Local name: tebirin (Melayu).

***Remarks.* –** Fishermen reported that this species inhabits the Kapuas, the lakes, and the rivers at all seasons, that it reproduces in the Kapuas in December. Published records indicate a size of up to 550 mm TL, but the largest specimen examined was 700 mm TL. Examined stomachs contained mainly fish remains. Usually consumed as smoked fish (locally called *salat*).

* *Ceratoglanis scleronema* (Bleeker)

Local name: lais tunggul, lais timah (Melayu).

***Remarks.* –** Fishermen reported that this species is usually found in rivers and major streams with moderate to fast current, but that it is most frequent in the Kapuas main river. It is more common during the dry season and the beginning of the wet season. Examined stomachs contained fish and prawns. Usually collected by gill-net.

Hemisilurus heterorhynchos (Bleeker)

Local name: lais timah (Melayu).

***Remarks.* –** Fishermen reported that this species is usually found in rivers and major streams, but is more frequent in the Kapuas main river. It is present in the lakes in low numbers, particularly during the dry season and the beginning of the wet season. Examined stomachs contained small fish and prawns. Usually processed as smoked fish.

Hemisilurus moolenburghi Weber & de Beaufort

Local name: unknown.

***Remarks.* –** Fishermen reported that this species occurs only in the Kapuas main river.

* *Kryptopterus bicirrhis* (Valenciennes)

Local name: lais tipis (Melayu).

***Remarks.* –** Obtained in the Kapuas main river. Reported to prefer fast-flowing water and usually found along the shores. In DSNP, it is usually found at the end of the wet season (April-May). Feeds on small fishes and prawns.

* *Kryptopterus cryptopterus* (Bleeker)

Local name: lais juara (Melayu).

***Remarks.* –** Inhabits rivers and major streams. It is found in the lakes at the beginning of the dry season (late May-June) and fishermen reported that it moves to the Kapuas in the wet season. Feeds on small fishes and prawns.

Kryptopterus lais (Bleeker)

Local name: lais tipis (Melayu).

***Remarks.* –** A common species in the lakes and main rivers. Reported to be more common in the wet season (October-May). Feeds on small fishes and prawns. Usually processed as smoked or salted fish.

* *Kryptopterus limpok* (Bleeker)

Local name: lais jenggot, lais kera (Melayu).

***Remarks.* –** Reportedly a common species in the lakes and main rivers, but not observed in the 1993 survey. Reported to be more common in the dry season. Feeds on small fishes and prawns. Usually processed as smoked or salted fish.

* *Kryptopterus minor* Roberts

Local name: lais kaca, lais tipis (Melayu).

***Remarks.* –** This species has been obtained only in the Kapuas mainriver during our survey, but fishermen reported that it also occurs all the year in the Tawang and other rivers but is more common at the beginning of the dry season (April-May). It feeds on insect larvae and small invertebrates.

* *Kryptopterus schilbeides* (Bleeker)

Local name: lais buluh (Melayu).

***Remarks.* –** Inhabits rivers. Fishermen reported that this species is most abundant in the wet season. Feeds on small fishes.

* *Micronema apogon* (Bleeker)

Local name: lais jungang (Melayu), lai' jungang (Iban).

***Remarks.* –** Fishermen reported that this species inhabits the Kapuas main river and the lakes, that it is present in the lakes year-round, but is more common in the wet season, and that it spawns in the Kapuas and in the Sungai Leboyan in August. The largest examined specimen was 320 mm TL.

* *Micronema micronemus* (Bleeker)

Local name: lais bangah (Melayu).

***Remarks.* –** New record for DSNP. Fishermen identify this species under this name given to no other species, but they also say that this species actually is the juvenile of *K. apogon*. This should be checked when enough material becomes available. The species is reportedly more common in the wet season (October-May); it inhabits the lakes and main rivers.

* *Ompok binotatus* Ng

Local name: anak lais (Melayu), lelipai (Iban).

***Remarks.* –** Earlier identified as *Ompok sabanus* Inger & Chin (1959) (Ng, 2002a).

Inhabits small streams and swamp forest. Feeds on small fish, fry and aquatic insects.

* *Ompok eugeneiatus* (Vaillant)

Local name: lais nipah (Melayu).

***Remarks.* –** Fishermen consistently identify this species as Lais nipah in the field, but also recognised the *Kryptopterus palembangensis* (not obtained during the surveys) on plate 34 in Kottelat et al. (1993) under the same name.

Inhabits rivers, streams and flooded forest. Fishermen reported that it is most abundant in the wet season.

* *Ompok rhadinurus* Ng

Local name: lais butu, lais pendek mulut (Melayu).

***Remarks.* –** Earlier identified as *Ompok hypophthalmus* (Bleeker) (Ng, 2003).

Inhabits lakes, rivers and swamps. Fishermen reported that this species is present in the lakes and rivers at all seasons, but is more abundant in the dry season (late May-September). Feeds on small fishes and prawns.

* *Silurichthys phaiosoma* (Bleeker)

Local name: anak lais (Melayu), indai lelipai (Iban).

***Remarks.* –** Inhabits black water streams. Feeds on aquatic insects.

Silurichthys marmoratus Ng & Ng

Local name: anak lais (Melayu), indai lelipai (Iban).

***Remarks.* –** Inhabits streams in lowland and upland areas.

* *Wallago leeri* Bleeker

Local name: tapah (Melayu).

***Remarks.* –** Fishermen reported that this species is present in the lakes at all seasons, but that adults move to the Kapuas and the mouth of the Tawang to reproduce. Roberts (1989) reports that fishermen along the Kapuas (but does not indicate where) state that this species earlier formed large migratory

schools. Fishermen in the Lakes Area reported that only juveniles smaller than 15 cm are schooling, but not adults. This seems to be the largest fish in DSNP. Different fishermen indicate maximum sizes of 1.5, 2 (value most commonly given) or 3 meters. The largest observed specimen during our survey was 670 mm SL. An important and popular food fish, usually eaten fresh or processed as salted fish.

Tapah fry (30 mm SL) has been observed at the mouth of small streams connected to large rivers, where the bottom is muddy and with overhanging vegetation. Feeds on fish and prawns; fishermen reported that adult also prey on small aquatic mammals such as rats, etc.

FAMILY SCHILBIDAE

* *Pseudeutropius brachypopterus* (Bleeker)

Local name: nuayang tebal (Melayu), riu' pate' (Iban).

***Remarks.* –** Inhabits rivers and lakes. Fishermen reported that this species occurs at all seasons but is more abundant in the late dry season (August-September). Reproduces in the Lakes Area around August-October. The fry has been observed in the Tawang, particularly in areas near the Kapuas. Feeds on insect larvae and small invertebrates. Not eaten locally, used to feed caged fishes.

* *Pseudeutropius moolenburghae* Weber & de Beaufort

Local name: Nuayang tipis (Melayu), riu' pate (Iban).

***Remarks.* –** Inhabits rivers and lakes. Fishermen reported that this species occurs at all seasons. Feeds on insect larvae and small invertebrates. Not eaten locally, used to feed caged fish.

* *Laides hexanema* (Bleeker)

Local name: lais juara, seladang (Melayu).

***Remarks.* –** Inhabits large rivers. Uncommon in the Lakes Area where it has been found only in the dry season. During the wet season they move to areas near the Kapuas main river. Feeds on small fishes.

FAMILY PANGASIIDAE

* *Pangasius humeralis* Roberts

Local name: unknown.

***Remarks.* –** One specimen identified in the collection at the Field Centre.

Pangasius lithostoma Roberts

Local name: lais benguk (Melayu).

***Remarks.* –** Fishermen recognise this species in plate 35 in Kottelat et al. (1993) and have a specific local name for it; they say that it occurs only in the Kapuas.

* *Pangasius macronema* Bleeker

Local name: langu (Melayu).

***Remarks.* –** New record for DSNP. Inhabits main rivers and occurs in the Lakes Area in the dry season. Feeds on small fish and prawns. Juveniles about 60 mm SL obtained in Pengembung in September 1993 are tentatively identified as this species on the basis of anal-fin ray counts and tooth patches, but these may change with growth. No juvenile of any other species of *Pangasius* is available for comparison, so that this identification is tentative.

* *Pangasius nasutus* Bleeker

Local name: seladang (Melayu).

***Remarks.* –** Inhabits main rivers and common in the Lakes Area in the dry season (late May-September). Fishermen reported that in the wet season, this species moves to the Kapuas or the upper Leboyan and upper Tawang and that it migrates from these headwaters to the Kapuas to spawn. An important food fish, usually caught by hook and line, often in using soap as bait. Said to reach 800 mm TL. Feeds on fishes.

* *Pangasius polyuranodon* Bleeker

Local name: duara, juara (Melayu).

***Remarks.* –** Inhabits lakes and rivers, more common in the lakes in the wet season (October-December). Examined stomachs contained fish remains.

FAMILY AKYSIDAE

Acrochordonichthys chamaeleon (Vaillant)

Local name: lakut, kebingkung (Iban).

***Remarks.* –** Identification follows Ng & Ng (2001). Inhabits in streams of upland area with relatively fast waters, usually among submerged vegetation or under logs.

Akysis fuscus Ng & Kottelat

Local name: unknown.

***Remarks.* –** Inhabits streams of the upland area with relatively fast waters, usually in the deepest section of the stream.

**** Breitensteinia cessator* Ng & Siebert**

Local name: dekat (Melayu).

***Remarks.* –** Identification follows Ng & Siebert (1998). Inhabits main rivers. Reportedly collected only during the dry season or the beginning of the wet season (June-October).

***Parakysis anomalopteryx* Roberts**

Local name: unknown.

***Remarks.* –** Collected in lowland streams, among leaf litter, under forest cover, in shallow water.

FAMILY SISORIDAE

***Bagarius yarrelli* Sykes**

Local name: unknown.

***Remarks.* –** Fishermen know this species but reported that it occurs only in the Kapuas main river, but has not been collected in the Tawang.

***Glyptothorax major* (Boulenger)**

Local name: kalakotai (Melayu).

***Remarks.* –** The name *G. major* is used here following Roberts (1989) and Kottelat et al. (1993), although as pointed by Kottelat & Lim (1996: 242) this is likely to be a misidentification (Ng & Kottelat, in prep.). During our surveys, this species has been obtained only in the Hulu Leboyan at Keluwin, in fast flowing waters and near Semitau in forest streams. It is expected to occur also in forest streams within DSNP.

FAMILY CLARIIDAE

***Clarias leiacanthus* Bleeker**

Local name: kelik (Melayu).

***Remarks.* –** Seems to prefers streams with some current.

**** Clarias meladerma* Bleeker**

Local name: kelik (Melayu).

***Remarks.* –** New record for DSNP. Fishermen reported that this species occurs in forest swamps.

FAMILY CHACIDAE

**** Chaca bankanensis* Bleeker**

Local name: tuka, entuka, beliung (Melayu), kebingkung (Iban).

***Remarks.* –** Inhabits swamp forest and streams with soft bottom, usually among leaf litter and aquatic vegetation. Present at all seasons, but more commonly caught in the dry season.

FAMILY ARIIDAE

**** Cephalocassis melanochir* (Bleeker)**

Local name: gugup (Melayu).

***Remarks.* –** New record for DSNP. Inhabits rivers and lakes. Fishermen reported that it occurs in the lakes early in the dry season and then moves back to the Kapuas for spawning. Feeds on small fishes and crustaceans.

**** Hemipimelodus borneensis* (Bleeker)**

Local name: gugup (Melayu).

***Remarks.* –** New record for DSNP and the Kapuas basin. A single specimen is present in the collection at the Field Centre. Reportedly occurs in the lakes only in the dry season.

FAMILY HEMIRAMPHIDAE

**** Hemirhamphodon pogonognathus* (Bleeker)**

Local name: kenyulung, julung-julung (Melayu).

***Remarks.* –** New record for DSNP. This species, which in most areas is very common in forest streams, has been seen only at a few opportunities in DSNP.

FAMILY BELONIDAE

**** Xenentodon canciloides* (Bleeker)**

Local name: kenyulung, julung-julung (Melayu).

***Remarks.* –** Present all the year everywhere. Used to feed caged fishes.

FAMILY SYNGNATHIDAE

**** Doryichthys boaja* (Bleeker)**

Local name: penyucuk telinga buaya, sumpit buaya (Melayu).

***Remarks.* –** Fishermen reported that this species occurs only in rivers, near the banks, among vegetation. More frequent in the late wet season (April).

* *Doryichthys martensii* (Peters)

Local name: penyucuk telinga buaya (Melayu).

***Remarks.* –** New record for DSNP. Inhabits forest streams.

FAMILY SYNBRANCHIDAE

* *Monopterus albus* Zuiew

Local name: belut (Melayu).

***Remarks.* –** Inhabits swamps, water holes (*kerinan*), etc. Although commonly eaten elsewhere, this species is seldom consumed locally.

FAMILY CHANDIDAE

* *Gymnochanda* cf. *filamentosa* Fraser-Brunner

Local name: anak senara, senara (Melayu).

***Remarks.* –** New record for DSNP. This species is apparently widely distributed but due to its very small size (usually less than 20 mm SL) and transparent body, it is probably overlooked or misidentified as the juvenile of larger glassfishes. This species is listed as *G. filamentosa* in Roberts (1989: 160) but it actually needs to be compared with typical material from the Malay Peninsula. It might be a distinct species.

* *Gymnochanda* cf. *flammea* Roberts

Local name: anak senara, senara (Melayu).

***Remarks.* –** New record for DSNP. This species is distinguished from the previous one by details of the serration on the head, body shape, the red fins of the male and the relative length and strength of the anal spines (slender, 2nd longer than 3rd in *G.* cf. *flammea*, vs. strong, 3rd longer than 2nd in *G.* cf. *filamentosa*. The description of *G. flammea* is so lacunary that we are presently unable to decide whether our material is conspecific.

* *Paradoxodacna piratica* Roberts

Local name: senara (Melayu).

***Remarks.* –** New record for DSNP. The most abundant glassperch in DSNP. Inhabits rivers and streams. Feeds on scales of other fishes (Roberts, 1989: 160). Used to feed caged fishes.

* *Parambassis apogonoides* (Bleeker)

Local name: senara (Melayu).

***Remarks.* –** Inhabits rivers, streams and lakes. Fishermen reported that this species is present at all seasons, is most common in the dry season (June-September) and spawns in September-October. Used to feed caged fishes.

* *Parambassis macrolepis* Bleeker

Local name: senara (Melayu).

***Remarks.* –** Inhabits rivers, streams and lakes. Fishermen reported that this species is present at all seasons, is most common in the dry season (June-September) and spawns in September-October. Used to feed caged fishes.

* *Parambassis wolffii* (Bleeker)

Local name: senara (Melayu).

***Remarks.* –** Inhabits main rivers and lakes. Fishermen reported that this species is present at all seasons, is most common in the dry season (June-September) and spawns in September-October. Used to feed caged fishes.

FAMILY DATNIOIDIDAE

* *Datnioides microlepis* Bleeker

Local name: ringau (Melayu).

***Remarks.* –** Fishermen recognise two morphs, black bars and red bars which are probably different phases of the same individuals (the red phase could be the nocturnal colour pattern also exhibited by stressed individuals; during the night, most of the bars faint and only the margins of the bars are more or less distinct and most of the body becomes greyish or brownish to blackish). Fishermen reported that this species is present at all seasons, is more abundant in the dry season (June-September), does not migrate, spawns in April-May and that there is no parental care to the young. The largest observed specimen was 500 mm SL (ca. 650 mm TL). Feeds on fishes and crustaceans; examined stomach also contained plant remains.

FAMILY TOXOTIDAE

* *Toxotes microlepis* Günther

Local name: sumpit (Melayu).

***Remarks.* –** New record for DSNP. Inhabits rivers and streams with dense shore vegetation. Fishermen reported that this species enters the Tawang from the Kapuas only in the wet season (late October-May). Feeds on insects.

FAMILY NANDIDAE

**** Nandus nebulosus* (Gray)**

Local name: patung rimba, patung dundu (Melayu), emplekung (Iban).

***Remarks.* –** Inhabits small streams and flooded forest. Most commonly caught in the dry season (June-September). Feeds on small fishes and crustaceans.

FAMILY PRISTOLEPIDIDAE

**** Pristolepis fasciata* (Bleeker)**

Local name: patung (Melayu), empatung (Iban).

***Remarks.* –** Fishermen recognise two kinds of patung: a plain yellow one in the lake and a barred one in swamp forest. We collected a single species in both kinds of habitats, but the presence of *P. grootii* (Bleeker), a species usually collected in more acidic waters, could be expected. It is also possible that the second species reported by the fishermen actually is *Belontia hasseltii*.

Identification follows Weber & de Beaufort (1936) and Kottelat et al. (1993). Three species of *Pristolepis* are usually recognised, *P. marginata* (Jerdon) from Peninsular India, *P. grootii* from the Sundaic area, and *P. fasciata* from Southeast Asia. In fact, the systematics of the genus, both at the generic and species level, should be reviewed. A rapid comparison of material from various areas suggest that several species are masquerading under the name *P. fasciata* (the Indochinese and Mahakam populations seem especially distinctive).

FAMILY POLYNEMIDAE

**** Polynemus kapuasensis* Motomura & van Oijen**

Local name: kurau, tenggulu (Melayu).

***Remarks.* –** Fishermen reported that this species occurs in the rivers (but not the lakes) in the wet season, that it returns to the Kapuas or the mouth of the Tawang in the dry season, and that it spawns in the Kapuas.

***Polynemus macrophthalmus* Bleeker**

Local name: unknown.

***Remarks.* –** Fishermen reported that this species occurs only in the Kapuas and reaches a length of about 700 mm TL. We saw a single specimen on the market at Sintang.

FAMILY ELEOTRIDIDAE

**** Oxyeleotris marmorata* Bleeker**

Local name: ketutuk, kedebuk, bodo-bodo, ikan bodo (Melayu), kedebuk (Iban).

***Remarks.* –** This species is present everywhere at all seasons, but is rarer in the Kapuas. Fishermen reported that it spawns in the lakes during the wet season. The largest observed specimen was 800 mm TL, at Nanga Sekolat. This is the largest known gobioid fish. The next largest known gobioids are specimens of the same species 515 mm SL (625 mm TL) from Thailand (Wongratana, 1988) and about 540 mm TL from the Baram River, Sarawak (reported as *Gigantogobius jordani* by Fowler, 1905). An important food fish reaching good prices alive on the international market.

FAMILY GOBIIDAE

**** Pseudogobiopsis* new species**

Local name: unknown.

***Remarks.* –** A new species collected only on sandy substrate in a black water forest stream.

FAMILY HELOSTOMATIDAE

**** Helostoma temminkii* Cuvier**

Local name: biawan (Melayu), bawan (Iban).

***Remarks.* –** Present all the year in the lakes and main rivers. Fishermen reported that it reproduces in September-October. Processed as dried or salted fish; ripe ovaries are collected separately and eaten.

FAMILY OSPHRONEMIDAE

**** Belontia hasselti* (Cuvier)**

Local name: sepat (Melayu).

***Remarks.* –** A single specimen has been obtained at Sekolat.

**** Betta dimidiata* Roberts**

Local name: empala (Melayu), emplasek (Iban).

***Remarks.* –** New record for DSNP. Very abundant in leaf litter in forest streams and swamp forest. When the flooded forest dries, this is the last fish to survive in the dry stream beds and in the holes with just a few centimetres of water (Fig. 12).

* *Betta enisae* Kottelat

Local name: empala (Melayu), emplasek (Iban).

***Remarks.* –** Identification follows Kottelat (1995c). New record for DSNP. Inhabits forest streams with slow current and swamp forest, in shore vegetation and leaf litter. Used as bait.

Betta pinguis Tan & Kottelat

Local name: empala (Melayu), emplasek (Iban).

***Remarks.* –** Identification follows Tan & Kottelat (1998). Inhabits forest streams with slow current and swamp forest, in shore vegetation and leaf litter. Used as bait.

Betta taeniata Regan

Local name: empala (Melayu), emplasek (Iban).

***Remarks.* –** Inhabits forest streams with moderate current and clear water, in shore vegetation.

* *Luciocephalus pulcher* (Gray)

Local name: emplunyu, plunyu (Melayu).

Fig. 12. Dry stream bed with holes in which *Betta dimidiata* survives the dry season.

***Remarks.* –** New record for DSNP. Inhabits streams and flooded forest, among dense vegetation.

* *Osphronemus goramy* La Cepède
Osphronemus cf. *septemfasciatus* Roberts

Local name: umil, kaloi (Melayu), kali, kali tembaga, kali manyam (Iban).

***Remarks.* –** Roberts (1992a) recognises two species of giant gouramis in the Kapuas basin, based on details of colour pattern and fin-ray counts, most of them with some overlap. Most of our material has values which could belong indifferently to one or the other species and it seems that more work is needed to clear the systematics of this genus. It seems that the colour of the caudal fin of the juveniles shows some variation and might possibly be an additional diagnostic character: some have a plain black fin while others have a hyaline fin. Fishermen reported that a single kind (with black caudal fin) occurs in the lakes and rivers, and state having seen the hyaline fin form only in the Kapuas. Some large sun-dried specimens seen in Semitau could be *O. septemfasciatus*.

Inhabits rivers and streams, among vegetation. Often found near or under floating houses. Most common in the dry season (June-September). Examined stomachs contain fish, crustaceans and plant remains.

* *Sphaerichthys vaillanti* Pellegrin

Local name: sepat, ensepat (Melayu).

***Remarks.* –** New record for DSNP. Apparently a rare species occurring in small creeks with plenty of wood debris in which they camouflage by their mimicry of a dead leaf, colouration (especially of stressed individuals) and swimming position. Apparently, they are commonly caught in pairs. More common in the dry season (June-September).

* *Trichogaster leerii* (Bleeker)

Local name: sepat, ensepat (Melayu), engkribang (Iban).

***Remarks.* –** Inhabits swamps and streams, usually among dense vegetation.

Trichogaster pectoralis (Regan)

Local name: sepat siam (Melayu).

***Remarks.* –** This species had been introduced in DSNP in 1954 (Giesen, 1987) in order to increase the fisheries productivity. Considering the very high existing productivity, the logic of this reasoning seems neither sound nor obvious. However, this fish did not establish in DSNP and now can only be found in some swampy areas along the Kapuas main

river so that this ill-advised introduction has apparently had no impact on the native fauna. Tilapia (*Oreochromis* sp.) had also been introduced at the same time on the same ground and had disappeared completely.

FAMILY CHANNIDAE

**** Channa bankanensis* (Bleeker)**

Local name: runtuk (Melayu).

***Remarks.* –** New record for DSNP. A relatively small snakehead (reaching up to about 25 cm TL) occurring only in blackwater streams. The most common snakehead in peat swamps.

**** Channa lucius* (Cuvier)**

Local name: runtuk (Melayu).

***Remarks.* –** New record for DSNP. A common species in forest streams.

**** Channa marulioides* (Bleeker)**

Local name: piyang (Melayu).

***Remarks.* –** New record for DSNP. Fishermen reported that this species is present all the year in swamp forest, and that it spawns in November-December (which is contradicted by our obtaining a school of juveniles about 100 mm SL, assumed to be about 2-3 months old) in September. Both juveniles and adults do not exhibit the chevron-shaped bars exhibited by specimens from the Malay Peninsula (cf. illustration in Kottelat et al., 1993: pl. 79) and more work is needed to decide if they are conspecific or not. Largest examined specimen was 480 mm TL.

**** Channa micropeltes* (Cuvier)**

Local name: toman, anak toman (Melayu).

***Remarks.* –** A very important food fish, kept in cages in very large quantities. In the dry season, when most fishermen are catching large fishes with gillnets, toman are fed with the heads of larger fish. In other seasons they are fed whole, smaller fish. The quantities of small fishes (Fig. 5) caught every day to feed toman is a potential source of future problems and populations of small fishes should be monitored to see how they develop. Fishermen reported that this species spawns in November-December in small streams with dense vegetation. Largest examined specimen was 600 mm TL.

**** Channa pleurophthalmus* (Bleeker)**

Local name: kerandang (Melayu).

***Remarks.* –** Fishermen reported that this species reproduces in October-December and that it occurs only in areas with black and clear waters. The juveniles, about 40 mm SL, whose colour pattern had not been reported in scientific literature before our surveys, have 4-6 black longitudinal stripes on a pale or reddish background (Fig. 13).

**** Channa striata* (Bloch)**

Local name: delak, telak (Melayu), gabus (Indonesian).

***Remarks.* –** Inhabits swamps and lakes. Largest examined specimen was 500 mm TL.

FAMILY MASTACEMBELIDAE

**** Macrognathus tapirus*, new replacement name**
(Fig. 14)

Local name: tilan kelokoi, tilan engkrunyuk (Melayu), luda' (Iban).

***Remarks.* –** Roberts (1980) revised the genus *Macrognathus* and in 1986 he added several species to the genus (see Roberts, 1986). He identified material from the Kapuas as *M. aculeatus* (Bloch). At the same time, he commented that "the coloration in Bloch's plate 159 of *Ophidium aculeatum* apparently is imaginary, for it cannot be matched with that of any known species". The coloration on Bloch's plate corresponds exactly to the text of his description (p. 72). Roberts also commented that the huge rostrum, the low number of dorsal-fin spines and the type locality of his Kapuas species identifies it with *M. aculeatus*.

Roberts' argument is not convincing. The fish on Bloch's figure is missing the oblique body bars figured by Roberts, has a shorter snout, an almost plain brown anal fin, and 14

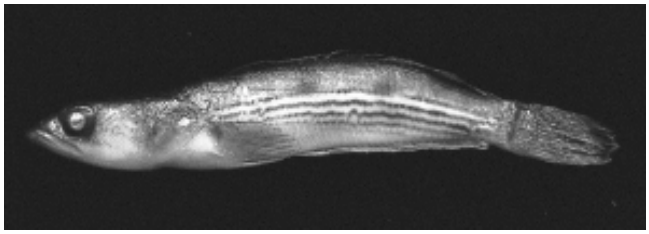

Fig. 13. *Channa pleurophthalmus*, DSFC uncat., 46.8 mm SL; Borneo: Kapuas basin: Pulau Majang.

Fig. 14. *Macrognathus tapirus*, CMK 5422, 105 mm SL; Borneo: Kapuas basin.

dorsal spines. Bloch reported his material as coming from "East Indies" which at that time was usually meaning Java and Moluccas. As no mastacembelid is known from Moluccas, we accept Java as the origin of the species. Comparison of our Javanese material (Fig. 15) with samples from Kapuas (Fig. 14) shows that they differ as follow: body plain brown or with very faint oblique bars, with narrow interspaces usually reduced to irregular lines on posterior part of body (vs. with contrasted bars, interspaces about equal to bar width, on whole body, in Kapuas material); anal and dorsal fins almost plain brown (vs. hyaline with dark marks continuing the bars in anal fin, and with stripes in dorsal fin); 2-4 ocelli about double eye diameter, posterior ocelli not continuing with body bars and with complete white ring (vs. ocelli about equal to eye diameter, continuing body bars, white ring usually not complete); 21-25 rostral toothplates (vs. 36-55); pectoral-fin rays (21-23, vs. 22-29 [data from Roberts, 1980: 388]).

Roberts (1980: 390) already noted the difference in colour pattern and he commented that his Javanese specimens were at the lower range for the counts of rostral toothplates (38-42 vs. 36-55) and pectoral-fin rays (22-23, vs. 22-29). Data in Roberts (1980) is very difficult to use, as the examined material is not listed and the counts of all specimens are lumped, without sorting them by origin. For example, he states that his 10 specimens from Java have 38-42 tooth plates, it is impossible to know how they fit in his Table 1. In any case, our toothplate counts are lower than those of Roberts and this may indicate a different way of counting.

Roberts did not provide any morphometric data. We found that our samples differ in head proportions as follows: HL (head length) 15.2-17.7 % SL (vs. 19.7-24.0); snout length 4.6-5.6 % SL (vs. 7.1-8.8), 30-35 % HL (vs. 10.5-11.2); proboscis length 5.1-6.2 % SL (vs. 10.5-11.2), 34-39 % HL (vs. 47-53), 1.01-1.32 times snout length (vs. 1.28-1.49). For all characters, in both populations, largest values were observed in smallest individuals and there is no overlap. [SL is measured from tip of upper jaw to end of hypural complex, snout length from tip of upper jaw to upper extremity of gill opening, and proboscis length from tip of proboscis to tip of upper jaw.]

We conclude that these populations are not conspecific. As the Javanese material agrees with the original description, we retain the name *M. aculeatus* for it. The exact geographic range of the Kapuas species is not known, but we have seen conspecific material from Jambi (Sumatra). The holotype of

Fig. 15. *Macrognathus aculeatus*, neotype, ZRC 49866, 161 mm SL; Java: Brantas basin.

Mastacembelus paucispinis Fowler (1939: 75) from Peninsular Thailand shows all the characters listed above for the Kapuas species and would be available if it were not a primary junior homonym of *Mastacembelus paucispinis* Boulenger (1899: 55). We propose here *Macrognathus tapirus* as a new replacement name for *M. paucispinis* Fowler.

Etymology: tapirus, neotropical and Southeast Asian mammals with a long snout; a noun in apposition.

Ophidium aculeatum Bloch (1786) was based on material and literature records by Nieuhoff (1682), Willughby (1686), Ray (1710), Müller (1773-76). Willughby, Ray and Müller were copied from Nieuhoff. Bloch's specimen is (are) lost (they are not listed by Paepke [1999]) and there are no known specimens preserved by Nieuhoff. Eschmeyer (1998) lists ZMB 1420 as syntype but this in fact is a syntype of *M. aral* (Schneider, 1801), a different species (Roberts, 1980: 388; Paepke, 1999: 98). The confusion surrounding the identity of *M. aculeatus* and several similar-looking species can only be cleared by the designation of a neotype and the fixation of a type locality (ICZN art. 75.3.1). Specimen ZRC 49866 is designated as the neotype of *O. aculeatum* Bloch. [*Ophidium aculeatum* Bloch should not be confused with *O. aculeatum* Basilewsky, 1855, a junior primary homonym, now called *Sinobdella sinensis* (Bleeker, 1870)].

Macrognathus aculeatus has an appearance similar to *M. siamensis* (Günther) from the Chao Phraya and Mekong basins, but it differs as follow: rostral tooth plates (21-25, vs. 7-14 in *M. siamensis*; Roberts, 1980: 387); no ocellus on caudal fin base (vs. ocellus present in most specimens).

Fishermen reported that this species occurs at all seasons in rivers but is rare in lakes. Found among leaf litter or dense vegetation, over muddy substrate. Feeds on insects and crustaceans.

Material examined. – *M. aculeatus*: ZRC 49866, neotype, 161 mm SL; CMK 9233, 11, 107.2-178 mm SL; Indonesia: Java: Java Timur: Kali Brantas basin: channelled stream through drained (formerly swampy) area at Campurdarat south to Tulungagung; 8°10'S 111°20'E. - CMK 9187, 1, 146 mm SL; Indonesia: Java: Java Timur: Kali Brantas at Tanggung Kramat; 7°28'S 112°14'E. - CMK 9207, 1, 133 mm SL; Indonesia: Java: Java Timur: Kali Brantas basin: canal at Ngareman; 7°34'S 112°05'E.

M. tapirus: CMK 10278, 2, 53.4-112 mm SL; Indonesia: Borneo: Kalimantan Barat: Kapuas basin: Sungai Semalah, a tributary of Sungai Embaluh Leboyan entering it at Nang Semalah; 0°52'16"N 112°17'37"E. - CMK 5422, 1, 105 mm SL; Indonesia: Borneo: Kalimantan Barat: Kapuas basin: Sungai Letang near Kampung Kandung Suli; 0°37'42"N 112°15'15"E. - CMK 11894, 1, 136 mm SL; Indonesia: Sumatra: Riau: Sungai Bengkwan, Batang Kuantan, downriver of Rengat. - CMK 11282, 2, 99.4-138 mm SL; Indonesia: Sumatra: Jambi: swamp near Rantau Panjang. - CMK 11106, 1, 153 mm SL; Indonesia: Sumatra: Jambi: Sungai Kumpeh Hulu in Arang Arang. - CMK 4734, 1, 179

mm SL; Indonesia: Sumatra: Jambi. - CMK 11439, 1, 104 mm SL; Indonesia: Sumatra: Sumatera Selatan: Sungai Simpang, tributary of Sungai Niru, upstream of Muara Niru.

**** Macrognathus maculatus* (Valenciennes)**

Local name: tilan kapar (Melayu).

***Remarks.* –** Inhabits streams in upland and lowland areas. Usually caught by *tabung*. Feeds on insects and crustaceans.

**** Mastacembelus erythrotaenia* Bleeker**

Local name: tilan belaban (Melayu), tilan sabang (Iban).

***Remarks.* –** Present all the year in the lakes and rivers. Fishermen reported that it spawns in September-October (in October 1993, fishermen were collecting ripe ovaries which are prepared separately).

**** Mastacembelus unicolor* Valenciennes**

Local name: tilan kelokoi (Melayu).

***Remarks.* –** Observed mainly in upland streams but reported to be present in lakes in the dry season (June-September).

FAMILY CYNOGLOSSIDAE

***Cynoglossus kapuasensis* Fowler**

Local name: kenilah, ikan lidah (Melayu).

***Remarks.* –** Fishermen reported that this species occurs only in the Kapuas main river.

***Cynoglossus waandersi* (Bleeker)**

Local name: kenilah, ikan lidah (Melayu).

***Remarks.* –** Fishermen reported that this species occurs only in the Kapuas and the lower course of the main tributaries.

FAMILY SOLEIDAE

**** Achiroides melanorhynchus* (Bleeker)**

Local name: kenilah, ikan lidah (Melayu).

***Remarks.* –** Fishermen reported that this species occurs mainly in the Kapuas and that it moves to the lakes and the Tawang only in the dry season. Feeds on small fishes and crustaceans.

FAMILY TETRAODONTIDAE

**** Auriglobus nefastus* (Roberts)**

Local name: buntal mas, buntal lemas (Melayu).

***Remarks.* –** Earlier placed in *Chonerinos*; see Kottelat (1999) for nomenclatural discussion. Fishermen reported that only one species of *Auriglobus* occurs in DSNP and all the examined specimens belong to the present species. Fishermen reported that it occurs only in the main rivers and reproduces in September. This species is discarded when caught.

**** Monotrete leiurus* (Bleeker)**

Local name: buntal (Melayu).

***Remarks.* –** The systematics of *Monotrete* is still confused. We identify here as *M. leiurus* a species characterised by a conspicuous red ocellus in juveniles, which may be retained until about 70 mm SL. In larger individuals, the ocellus becomes a dark brown blotch, circled by a series of dark brown blotches of about same size. Very large specimens (over 150 mm SL) tend to become plain brown.

Inhabits streams and rivers of the uplands and lowlands, but reportedly occurs in the lowlands only in the dry season (June-September).

**** Monotrete palembangensis* (Bleeker)**

Local name: buntal (Melayu).

***Remarks.* –** Fishermen reported that this species reaches up to 300 mm TL, that it is present at all seasons in the rivers and lakes, but is common in the lakes in the dry season and moves out in the wet season, and that it reproduces in September-October in both the lakes and rivers but prefers habitats with grasses and shores. Despite most puffers being poisonous elsewhere, this species is locally eaten, possibly indicating that its food in the lakes does not include organisms feeding on phytoplankton secreting toxins. The fish are kept alive until processing, and the skin and internal organs are removed before cooking.

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