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OSPHRONEMUS EXODON, A NEW SPECIES OF GIANT GOURAMY WITH EXTRAORDINARY DENTITION FROM THE MEKONG

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ABSTRACT

Osphronemus exodon new species is a large, highly specialized herbivorous fish (Pisces: Belontiidae) known only from the Mekong River and its tributary system the Se San-Se Khone in southern Laos and northeastern Cambodia. It differs from the three other known species of giant gouramy (genus *Osphronemus*) in juvenile and adult coloration, dorsal and anal fin spine and ray counts, and in its enlarged and externalized jaw teeth, unique for the family Belontiidae and the percomorph suborder Anabantoidea. *Osphronemus exodon* may be the only naturally occurring species of *Osphronemus* in the Mekong basin.

INTRODUCTION

The Southeast Asian belontiid fish genus *Osphronemus* Lacepède, 1801 has a wide natural distribution in Thailand, Malaysia, and the islands of Sumatra, Java, and Borneo. Nearly all of this range is occupied by the common giant gouramy *Osphronemus goramy* Lacepède, 1801, the only species known for well over 200 years, and widely distributed by introductions beyond its natural range (ROBERTS, 1992).

Two new species of *Osphronemus* have been described recently that are known only from Borneo. *Osphronemus septemfasciatus* Roberts, 1992 occurs in the Baram and Tinjar basins of Sarawak; Kapuas and Mahakam basins of Kalimantan Barat and Kalimantan Timur (western and eastern Indonesian Borneo); and probably in Sabah. *Osphronemus laticlavius* Roberts, 1992 is known only from the Kinabatangan and Segama basins of Sabah. These two Bornean species and *O. goramy* differ in coloration (juvenile and adult), dorsal and anal fin meristics, and head and body shape (especially in large adults).

Now another new species of *Osphronemus* is described, from a restricted area in the Mekong basin from just above the great waterfalls at Khone or Lee Pee ("The Spirit Trap") in southernmost Laos (near the border with Cambodia) south to Stung Treng in northeastern Cambodia. The new species, which differs most strikingly in its greatly enlarged and partially externalized jaw teeth, was first brought to my attention by Ian Baird, who photographed a large fish caught in October 1993 near Ban Hang Khone, a Laotian fishing village on Khone Island some 4 km below the great waterfalls (for an account of artisanal fisheries and fish ecology at Ban Hang Khone, see ROBERTS, 1993). In February 1994 I conducted a market survey of fish species at Stung Treng, an important Cambodian town situated at the confluence of the Mekong and Se San-Se Khone rivers, 60 km below Lee

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Pee Waterfalls. At least 50 specimens of the new species were observed in the market, of which a number were preserved and are utilized in the present description. A single small juvenile was collected in a rocky section of the Se Khone River 7 km upstream from Stung Treng. Information about food habitats and ecology was obtained by direct observation of gut contents and several interviews with local fishermen. The local name for the species is trey romir in Cambodian, pa haet in Lao. Both names mean rhinoceros fish. According to local fishermen the species gets as big as 10 kg. The largest one observed by me (holotype described below) was a little over 4 kg.

Type specimens of the new species are deposited in the Naturhistoriska Riksmuseet, Stockholm (NRM), Zoological Reference Collection of the National University of Singapore (ZRCS), Thailand Institute for Scientific and Technological Research, Bangkok (TISTR), and the California Academy of Sciences, San Francissco (CAS).

Osphronemus exodon new species

Figures 1–6

Holotype.—NRM 28231, 455 mm (not sexed), Stung Treng market, Cambodia, February 1994, T.R. Roberts.

Paratypes.—NRM 28232, 230 mm, same data as holotype; ZRCS 37463, 4: 119–425 mm, same data as holotype; TISTR 2665–6, 2: 318–335 mm, same data as holotype; ZRCS 37464, 4: 266–322 mm, Mekong R. at Takam on Don Som (Som Island), just opposite Kinnak and 12 km above Lee Pee Waterfalls, southern Laos, 7–28 February 1994, T.J. Warren; CAS 81553, 2: 122–131 mm, same data as ZRCS 37464; CAS 81551, 74.3 mm, rapids in Se San 7 km upstream from Stung Treng, 5 Feb. 1994, T.R. Roberts.

Diagnosis. *Osphronemus exodon* differs from the other three known species of *Osphronemus* in having oral teeth increasingly enlarged and externalized in large adults, a condition apparently unique within anabantoid fishes. In the largest specimens examined, over 400 mm in standard length, all of the jaw teeth are enlarged, especially those in the outermost rows, which lie on the external surface of the jaws entirely outside the mouth when it is shut (Figures 3–4). Coloration of juveniles and/or adults also is diagnostic. Small juveniles have 6 or 7 vertical bars and a supra-anal dark oval spot, none of which are retained by adults and subadults; this coloration is similar to that in small juveniles of *O. septemfasciatus,* but different from that in small *O. goramy* and *O. laticlavius* (Table 1). Juveniles over about 100 mm have a reddish or orangish stripe on the lower part of the head and breast, a feature not observed in any other species. Adult coloration is highly distinctive, with no two individuals being alike, but all having extensive dark (almost black) areas ventrally and pale areas dorsally. Several large specimens (especially those from Stung Treng market) with large and irregular red blotches that superfically at least look very much like bloodied bruises (Fig. 2). The overall coloration is very unlike that observed in subadults or adults of the other species. Meristic characters, especially counts of spines and rays in the dorsal and anal fins, also distinguish *O. exodon* from other species of *Osphronemus* (Table 1).

Figure 1. *Osphronemus exodon,* 180 mm paratype with juvenile coloration.

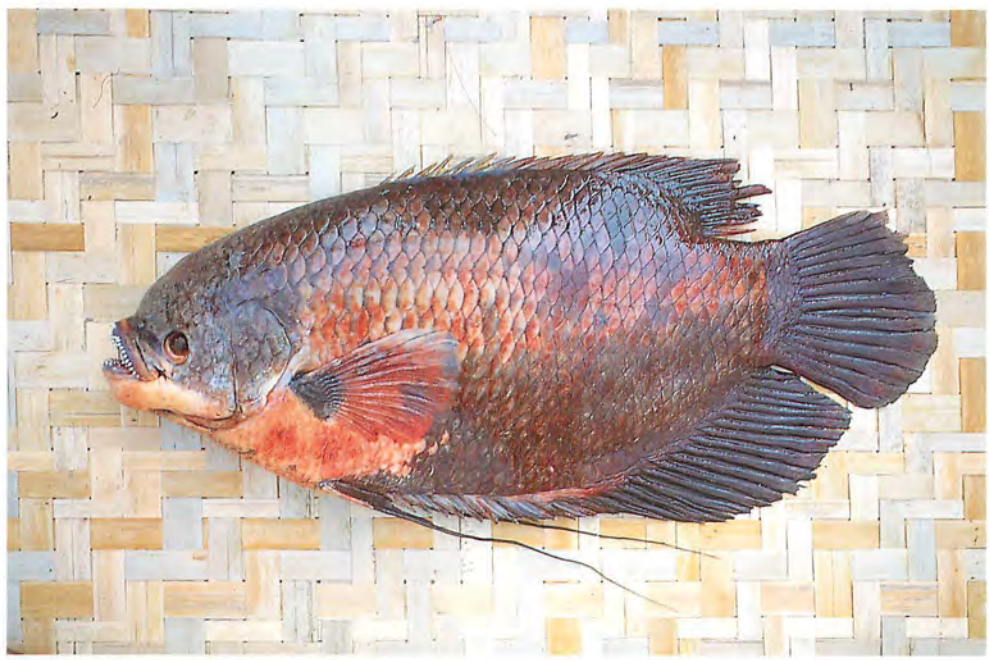

Figure 2. *Osphronemus exodon,* 455 mm holotype, lateral view.

Figure 3. *Osphronemus exodon,* 455 mm holotype, close up of head.

Figure 4. *Osphronemus exodon,* 455 mm holotype, frontal view of open jaws and specialized oral dentition.

Figure 5. *Osphronemus exodon,* 400 mm specimen, dorsal view of gill arches.

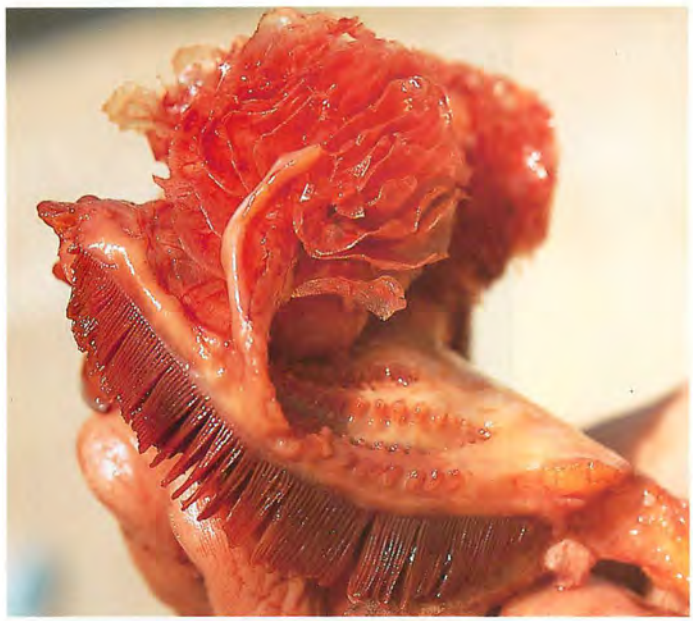

Figure 6. *Osphronemus exodon,* 400 mm specimen, lateral view of left suprabranchial labyrinth (aerial respiratory organ).

Figure 7. Rapids in Se San, collection site of smallest juvenile paratype of *O. exodon* (5 February 1994).

Figure 8. Fruits of *Crateva nurvala* (Capparidaceae), overhanging Mekong backwater inhabited by large *O. exodon* (5 February 1994).

Table 1. Characters distinguishing species of *Osphronemus*.

	exodon	*goramy*	*laticlavius*	*septemfasciatus*
Juvenile coloration:				
vertical bars	6-7 complete	8-10 complete	3-5 incomplete	6-7 complete
orangish-red stripe	present	absent	absent	absent
Adult coloration:				
sexual dichromatism	none	none	marked	none
juvenile bars	lost	lost	lost	kept
supra-anal spot	lost	lost	males retain	lost
Meristics:				
dorsal fin spines	14-16	11-14	13-14	14-16
dorsal fin rays	10-11	12-14	10	11-12
anal fin spines	11-13	10-11	11-12	10-12
anal fin rays	17-19	20-23	16-18	18-20
pectoral fin rays	13-14	14-16	14-15	15-16
gill rakers	9	11-13	8-9	11-13
transverse scales	5-6.1.12-13	6-7.1.12-13	4-5.1.9-12	5-7.1.11-13
Others:				
externalized teeth	yes	no	no	no
larger anal fin	no	yes	no	no
grooves anteriorly	no	no	no	yes

Description. As in all members of the genus *Osphronemus*, smaller juveniles of *O. exodon* have a sharply pointed snout (with teeth not noticeably enlarged or projecting) and a color pattern including a black mark at base of pectoral fin, a black blotch or supra-anal mark over posterior portion of anal fin base, and a series of more or less pronounced vertical bars. The 6 or 7 bars are much more noticeable or better defined in the 74.3-mm and 119-mm paratypes than they are in the 180-mm paratype illustrated in Fig. 1, but are not so sharply defined as the 8–10 vertical bars characteristic of juvenile *O. goramy* (see ROBERTS, 1992, fig. 1). In all of my specimens of *O. exodon* over 180 mm the vertical bars and supra-anal mark are not evident. However, the large specimen (exact size unknown) photographed by Baird had 5 incomplete dark vertical bars on dorsoposterior part of body.

In larger specimens (subadults and adults) of *O. exodon* the acutely pointed snout of juveniles is modified by the broadening of the mouth and the development of a moderate round prominence on the snout above the mouth. This change in head morphology is similar to, but not quite the same as, changes in snout or head morphology that occur in the other species of the genus. In large adults of *O. goramy* the snout becomes extremely prominent, much more bulbous than in the other species. In large *O. septemfasciatus* the snout is almost vertically inclined anterior to the eyes (ROBERTS, 1992, fig. 3a), while in large *O. laticlavius* there is a small but definite hump placed almost directly over the eye (ROBERTS, 1992, fig. 4b, c). Large *O. septemfasciatus* also develop several longitudinal

grooves on the posterior portion of the head and continuing onto the adjacent anteriormost part of the body which do not occur in the other species (ROBERTS, 1992, fig. 3a).

Osphronemus have scales in lateral series (from upper angle of gill opening to end of hypural fan) ranging from 31 to 34. This corresponds closely to the total number of vertebrae (hypural half centrum counted as one), 30–31 (ROBERTS, 1992: 352, table 1). *Osphronemus exodon* has 31–32 lateral scales (vertebral counts unavailable). Scales in transverse series are more variable, depending on body depth. *Osphronemus exodon, O. goramy,* and *O. septemfasciatus,* with body depth 1.8–2.1 times in standard length, have the highest counts, while the relatively slender *O. laticlavius,* with body depth only 2.2–2.3, has the lowest numbers of transverse scale rows (Table 1).

Osphronemus exodon agrees with *O. septemfasciatus* and *O. laticlavius* in having a relatively small anal fin, its posterior border failing to extend posteriorly far enough so that it is aligned with the posterior border of the caudal fin as in *O. goramy* (ROBERTS, 1992).

Gill arches were dissected from a 400-mm specimen (not a paratype) of *O. exodon* (Fig. 5). The gill rakers are broad-based and plate-like, the distal margins armed with small teeth. Gill rakers on the leading edge of the first gill arch relatively small and few in number, only 9 (mediad 2 or 3 rakers rudimentary). Counts of total gill rakers on the leading/trailing edges of the 1st through 4th gill arches (left side) are 9/15; 15/19; 18/20; and 20/20. The leading edge of the 5th arch (lower pharyngeal tooth bearing element) has 19 rakers. Upper (on 4th and 5th arches) and lower (on 5th arch only) pharyngeal teeth pedicellate, with strong conical tips pointed posteriorly on upper pharyngeal toothplates and anteriorly on lower pharyngeal toothplates, as in numerous Cichlidae and Anostomidae. Lower pharyngeal teeth progressively larger posteriad, but not so greatly enlarged as outermost jaw teeth (condition of pharyngeal dentition in other species of *Osphronemus* unknown). The suprabranchial aerial repiratory organ, as in the other species of *Osphronemus,* is highly developed, with numerous complexly folded and highly vascularized lamellae (Fig. 6).

Food habits. Gut contents of the larger specimens of *O. exodon* preserved at Stung Treng were examined. All had the entire gut packed with macerated leaves of higher terrestrial plants. In two fresh specimens the pulpy mass had a distinctly sweet (sugary) taste. According to several local fishermen, large trey romir are exclusively vegetarian, feeding on leaves (including grass), fruits, and flowers. Some fishermen stated that big fish stay on the edge of the flooded forest during the high water months of July–October, but others said they went deep inside. One who seemed to know the species particularly well indicated that it fed on the leaves, fruits and flowers of most of the higher plants in the flooded forest drowned by high water. The hard fruits of *Crateva nurvala* Hamilton (plai tonnir in Khmer) were specificially pointed out by other fishermen as important food during low water periods. In February 1994 I observed masses of plai tonnir as low as 50 cm above the water level in a backwater of the Mekong a few km above Stung Treng said to be inhabited by trey romir (Fig. 7). Several fishermen agreed that plai luvia (the fig of *Ficus variegata* Bl.) is an important food item. Other fruits indicated as food were plai katkhao (not identified) and plai tamung (a sour fruit, not identified). One of the fishermen at Stung Treng said that young trey romir feed on ants. Fishermen at Ban Hang Khone said that pa men (here identified as *O. exodon*) enters the flooded forest during high

water, and that it feeds on various fruits and on filamentous algae growing on tree trunks (ROBERTS, 1993: 50).

At Takam, just above Lee Pee Waterfalls in southern Laos, *O. exodon* are caught mainly in January–April, when fishermen can see them hovering just below the surface near shore in quiet backwaters. They angle for the fish with a small hook baited with shrimp. Gut contents of two large fish caught at Takam consisted almost entirely of dark green to black sludge consisting of large amounts of filamentous algae and of fine debris of higher plants. One of the fish had remains of a large grasshopper and two dipteran larvae. Both had moderate numbers of a fluke, up to 6 mm long, with a large but simple aboral sucking disc.

Reproductive behavior. Several anabantoid fishes are oral brooders, such as the pike-like members of the genus *Luciocephalus* and at least one species of the so-called chocolate gouramies, genus *Sphaerichthys*. In the species rich genus *Betta,* some species are bubble nesters but others are oral brooders. So far as known none of the species of giant gouramy are oral brooders, but very little is known about reproductive biology. Only scanty accounts of reproduction are available for *O. goramy,* based on populations introduced into India and the Philippines. A brief summary may be given here. A small nest of plant fibers, with little or no froth, is constructed 6 to 10 inches below the water surface by one or both members of a mating pair. Up to 1000 eggs are spawned into the nest, which is then guarded by the male. Eggs and nestlings are either neutrally bouyant or bouyant. In case eggs or young float out of the nest, they may be returned to the nest by oral transport of the guarding male. The young may feed on small organisms that multiply in decomposing plant fibers of the nest. For further details and citation of original papers, see BREDER & ROSEN, 1966: 573–575.

All fishermen familiar with trey romir interviewed at Stung Treng in February 1994 indicated that it is not an oral brooder. One fisherman provided the following information on reproduction. Spawning occurs in open water with no current near shore in late April, when the water level is lowest. Males and females have the same coloration all year round and when spawning, but spawning males are smaller and more slender than spawning females. Spawning behavior is similar to that of the snakehead fishes *Channa striata* and *C. micropeltes* but occurs in more open water. Eggs float to the surface but there is no bubble nest. One parent, the female [?] guards the eggs and young. Aggregations of young are often broken up by boatmen unaware of their presence.

According to fishermen at Takam spawning occurs in March and April. A nest is made of leaves and roots of a plant named gohk kai. The size of the nest is quite small (indicated by cupping the hands together) and is held together by a sticky substance that irritates the skin. They have not observed the eggs after spawning but have seen the young clustering around the nest in April.

A female *O. exodon* of 1.24 kg caught at Takam in February 1994 had ovaries weighing 56 g with 7,800 eggs mostly to 2 mm diameter.

Distribution. *Osphronemus exodon* is known only from the Mekong basin from just above Lee Pee or Khone Waterfalls southward to Stung Treng in northeastern Cambodia, and from the Se San—se Khone tributaries of the Mekong near Stung Treng. Here the shores of the Mekong and Se San—Se Khone are forested and the streambed is largely

rocky. It probably occurs further south in the Mekong mainstream to Kratie, below which the streambed becomes much less rocky. The species apparently also inhabits at least part of the Se San—Se Khone, the largest tributary of the Mekong River in Cambodia. Fishermen interviewed at Phnom Penh and at Siem Reap, at the northern end of the Great Lake of the Tonle Sap, are not familiar with it.

Osphronemus exodon apparently does not occur sympatrically with *O. goramy*. All of the approximately 50 specimens of *Osphronemus* observed during the February 1994 Stung Treng market survey were *O. exodon*. Although *O. goramy* has been recorded from the Lower Mekong basin of Laos and Cambodia, it is doubtful that it occurs there at all. It was recorded in a checklist of Cambodian freshwater fishes by D'AUBENTON (1963: 20), from the Lower Mekong in a checklist of Indochinese freshwater fishes by KOTTELAT (1989: 20, 27), and from the Mekong of southernmost Laos by TAKI (1974: 186, fig. 176) and by ROBERTS (1993: 35). But D'AUBENTON worked in the Stung Treng area, so his record may well be based on *O. exodon*. KOTTELAT's record presumably is compiled from D'AUBENTON (1963). TAKI's report of juvenile *O. goramy* from Kinnak, is in fact based on *O. exodon*. And my record from Ban Hang Khone is based on two small specimens (not preserved) with juvenile coloration noted at the time that is now considered diagnostic of *O. exodon*.

It is noteworthy that *Osphronemus* is not mentioned in either of two recent publications in Vietnamese, one on the freshwater fishes of South Vietnam (MAI DINH YEN, et al., 1992) and the other on the fishes of the Mekong delta (TRUONG THU KHAO & TRAN THI THU HUONG, 1993). There seem to be no published records of naturally occurring *Osphronemus* from the Middle or Upper Mekong basin (SMITH, 1945; KOTTELAT, 1989), and I did not observe the species during extensive fieldwork on Middle Mekong fishes from 1970 through 1993. *Osphronemus goramy* formed a minor part of the fisheries catch in Nam Ngum Reservoir near Vientiane in 1980–82 (ANON., 1984), but I believe that it was introduced into the reservoir, and that it was probably introduced into Laos even before the reservoir was built. It seems that the only well documented reports of naturally occurring *Osphronemus* from the entire Mekong basin are the present ones of *O. exodon*.

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