



## The types of *Osteoglossum formosum* Müller & Schlegel, 1840 (Teleostei, Osteoglossidae)

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### Abstract

The designation of a neotype for *Scleropages formosus* (Müller & Schlegel, 1840) by Pouyaud *et al.* (2003) triggered a search for the type specimens of the species, which were found in the collections of the Naturalis Biodiversity Center, Leiden (RMNH) and the Natural History Museum, London (BM(NH)). The publication date of the species is corrected. Moreover, detailed data on the day of capture and the type locality were uncovered. An English translation of the major part of the original Dutch description is provided, and a number of neglected colour descriptions and figures of *S. formosus* are discussed. Lastly, a lectotype is designated.

**Key words:** *Scleropages formosus*, Asian Arowana, neotype, lectotype, RMNH collection

### Introduction

Pouyaud *et al.* (2003) described three new species of *Scleropages*, distinguished from *S. formosus* (Müller & Schlegel, 1840) by colouration, molecular data and morphometric characters. However, the significance of the morphological and molecular analysis was questioned by Kottelat & Widjanarti (2005) who considered it premature to follow Pouyaud *et al.* and continued to recognize a single species: *S. formosus*. Roberts (2012), in a description of a new *Scleropages* species from the Malay Peninsula, followed Kottelat & Widjanarti (op. cit.) and placed *S. aureus* Pouyaud, Sudarto & Teugels, 2003, *S. legendri* Pouyaud, Sudarto & Teugels, 2003, and *S. macrocephalus* Pouyaud, Sudarto & Teugels, 2003 in the synonymy of *S. formosus*.

Pouyaud *et al.* (2003) also redescribed *S. formosus* and designated a neotype for this species. Apparently, the last action was based on information on the types in Eschmeyer *et al.* (1998), although Pouyaud *et al.* (2003) cited the wrong volume.

According to the qualifying conditions of the Code (Art. 75.3) a neotype should only be designated when there is an exceptional need, and only when that need is stated expressly, and when the designation is published with a number of particulars, including (Art. 75.3.1) a statement that the neotype is designated with the express purpose of clarifying the taxonomic status or type locality of a nominal taxon. Such a statement is lacking in Pouyaud *et al.* (2003). According to Art. 75.3.4, the authors' reason for believing the name-bearing type specimen(s) to be lost or destroyed, and the steps taken to trace it or them, must be stated with the designation. Pouyaud *et al.* (2003) give no details on this point. Furthermore, Art. 75.3.5 requires evidence that the neotype is consistent with what is known of the former name-bearing type from the original description and other sources.

Although Pouyaud *et al.* (2003) mention the original description of *S. formosus* in the references, no details of morphometric or meristic measurements, description of the colouration or comments on the original colour plate are given. Therefore, the designation of a neotype for *S. formosus* by Pouyaud *et al.* (2003) does not meet the requirements of the Code. More important, and missed by Pouyaud *et al.* (2003), the designation of a neotype is unnecessary because the types are still extant.

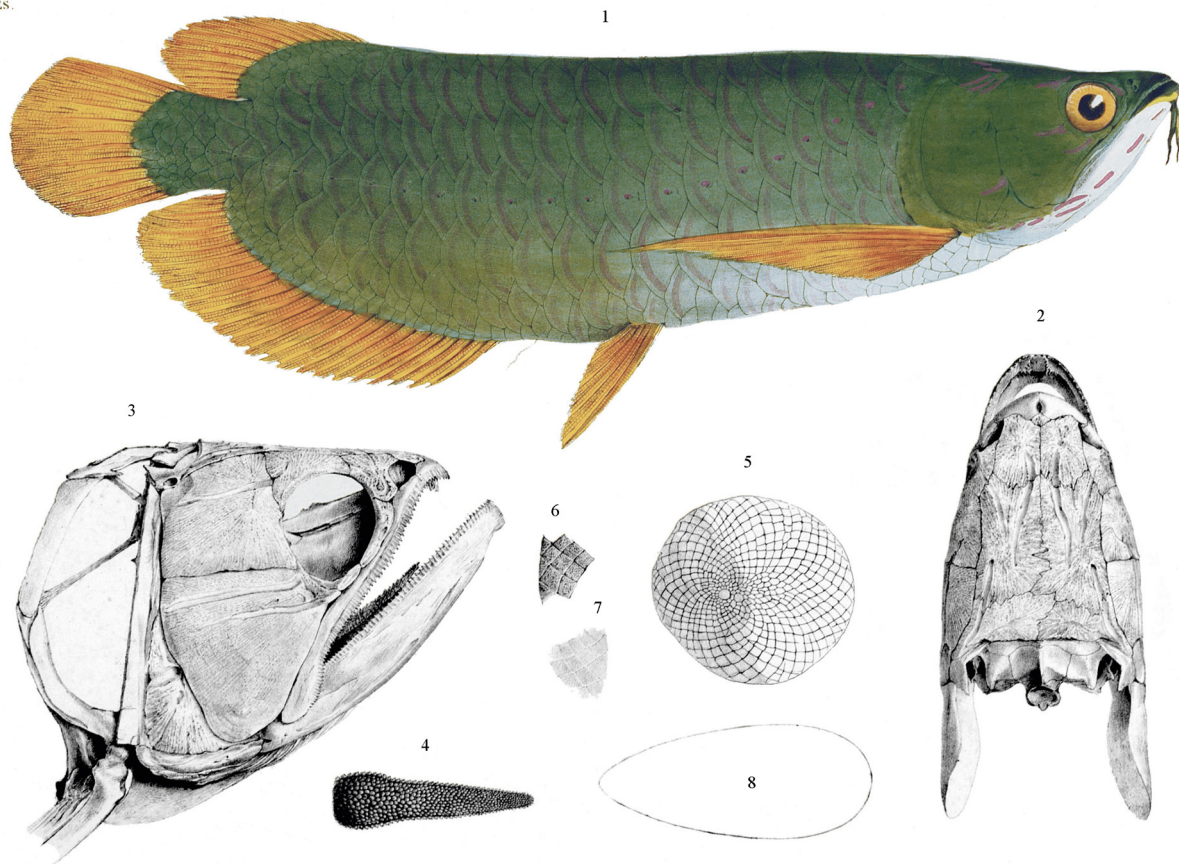
## Inducement to the selection of a neotype

Eschmeyer *et al.* (1998: 601) gave the following information:

“*formosum*, *Osteoglossum* Schlegel & Müller 1839–44: 7, Pl. 1 [Verh. Natuur. Gesch. Leiden No 2; ref 19739] Barito R., Borneo. No types known. Valid as *Scleropages formosus*...”

PISCES.

TAB. I.



**FIGURES 1–8.** *Osteoglossum formosum* Müller & Schlegel, 1840. From Müller & Schlegel 1840–1845, reproduced at ca.  $\frac{1}{2}$  of original size, with original captions. 1. *Osteoglossum formosum*; a little more than half of the natural size; 2. Dorsal view of the skull; natural size; 3. Lateral view of the skull; natural size (gill cover removed); 4. Central bony element of the tongue; natural size; 5. Lateral view of scale from the centre of the flank, showing the mucus canal of the lateral line; natural size (the light part shows the hidden area, the dark part the exposed area); 6. A small piece of the exposed part of the scale; enlarged; 7. A small piece of the hidden part of the scale; enlarged; 8. Outline of the body in a transverse section.

This paragraph contains a number of errors: 1. The names of the authors are transposed; 2. The year of publication should be 1840. Husson & Holthuis (1955), in “The dates of publication of the *Verhandelingen over de natuurlijke geschiedenis der Nederlandsche overzeesche bezittingen*”, show that the species description was published in 1845, although the accompanying plate was published in 1840. Because this plate (see Figs. 1–8), with a coloured habitus figure bears the name *Osteoglossum formosum*, the species name was validly published in 1840; 3. The page on which the name is first mentioned in Müller & Schlegel (1845) is not 7, but 1. Pouyaud *et al.* (2003) partly corrected these errors, but followed Eschmeyer *et al.* (1998) on two other points in which they were mistaken. The type locality given in the original description is not just Barito River, but “lakes along the Doeson River”. Details on the type locality could be found in other literature (see below). A more serious error of Pouyaud *et al.* (op. cit.) is the blind acceptance of the statement concerning the types. Eschmeyer *et al.* (1998: 9) state in the introduction of their Catalogue: “We provide statements such as ‘Not found’ or ‘No types known’ when that is the best information available to us”. Consequently, this statement does not mean that the types *are* lost, but only that they could not be located during Eschmeyer’s visits to the museums, or by the curators and collection managers he

consulted with while preparing the catalogue. Authors who intend to designate a neotype should always make a renewed attempt to locate the types.

In the current online version of the *Catalogue of Fishes* (Eschmeyer 2013) most of the above mentioned inaccuracies have been corrected. The *Catalogue* is an invaluable reference, but it should not be treated as primary literature.

### The description of *Osteoglossum formosum*

Because the description of *Osteoglossum formosum* was published in Dutch, and therefore not easily accessible to most ichthyologists, it is important to provide an English translation. Apart from the species description, the paper of Müller & Schlegel contains a Dutch redescription of the genus *Osteoglossum*. This was judged necessary by Müller & Schlegel because the definition of this genus had to be broadened in order to include their new species. As the Asiatic Osteoglossinae nowadays are placed in *Scleropages* Günther, 1864, we have refrained from translating this part. In the original text the Latin names were not written in italics.

“Description of a new freshwater fish from Borneo *Osteoglossum formosum*,  
by Sal. Müller and Herm. Schlegel. (Plate 1.)

According to Agassiz and G. Cuvier the genus *Osteoglossum* was introduced by Vandelli (\*), on the basis of the only known species belonging to it, from the Amazon River in South America. Spix, who obtained this species during his journeys, at first named it *Ischnosoma bicirrhosum* (+), which Agassiz later replaced by *Osteoglossum bicirrhosum* (§); which Cuvier changed again to *Osteoglossum Vandellii* (^).

\* Probably described in the Transactions of the Academy of Lisboa, which we do not have at our disposal.

+ Spix & Agassiz, Selected genera et species Piscium, Tab. 25.

§ Op. cit, p. 47.

^ Règne animal, second edition, II, p. 328.

During our journeys in the southern part of Borneo we found in 1836 related to this American species, a second, new species, which we named after its beautiful colour. This species in form and structure is a very similar to *Osteogl. Vandellii* or *bicirrhosum*, but deviates from the old species, apart from some other less apparent characters, especially by the difference in colouration and also because its dorsal fin is much smaller, and its caudal fin instead of being united with the anal fin, is separated from it. As a consequence of these differences, the generic characters, which were described by our predecessors only on the basis of the then known single species, have changed considerably and will have to be determined again. We will do so after we have gotten a bit more acquainted with the still undescribed species from Borneo.

The largest specimens that we have at our disposal have a length of 0.58 m, the smallest about 0.37 m. The dorsal outline of the fish runs almost straight from the tip of the snout to the dorsal fin, and only from this point onwards is slightly bent; the ventral outline, on the contrary, near the anal fin makes a slight curve, it slightly ascends from the ventral fins to the gill cover, but from there till the tip of the lower jaw it ascends steeply. Behind the dorsal and anal fins the tail is patch shaped [?] extended and soon passes into a small caudal fin. The body is becoming shallower to the front; but its greatest depth is found between the ventral and anal fins, and the ratio body depth/ body length is  $\frac{1}{4}$ . The body is strongly compressed; the ratio body width /body height is  $\frac{1}{2}$ . The back is almost as broad as the middle of the flank, but ventrally the body is tapering rather acutely. The head is of an average size; its length fits about four times in the total length of the specimen. The dorsal surface of the head runs almost in a straight line towards that of the back; its ventral outline on the contrary, ascends forwards so very steeply, that it, just like the mouth opening, forms an angle of about 45 degrees with the dorsal outline of the head. Dorsally the head is a bit rounded towards both sides; the width at the nasal openings is almost half of the width of the caudal part of the head, where the ratio head width / head length is  $\frac{1}{2}$ . The snout is very short and in lateral view is shaped like a triangle with sides hardly longer than the diameter of the eye. The nasal openings, of which the upper one on every side is slightly larger and a little more caudally situated than the lower one, are situated between the tip of the snout and the eyes, but a bit closer to the eyes. The eyes are situated laterally, but very close to the dorsal outline of the head; they are perfectly circular, and their diameter is about  $\frac{1}{5}$  of the

total head length. The mouth is very large, the length of the mouth opening occupies more than  $\frac{3}{5}$  of the total head length. The cheeks are formed by two bony plates (the caudal infraorbital bones); behind the lower one the preoperculum appears in the shape of an irregular square; and behind this, the operculum can be seen in the shape of an elongated semi round disk, which at the caudal edge is provided with a broad membrane to firmly close the gill opening. All these bony elements have perfectly smooth edges, and their surface, like that of all other bony elements of the head can be called smooth rather than rough because at a short distance one does not perceive the small irregularities that are built up from grains and fine lines. On top of the head these irregularities are a little more distinct than those on the sides of the head. Besides these irregularities one can see on the head of this species just like on the head of *Ost. Vandelli*, various grooves covered by a membrane. The grooves on top of the head are the deepest. One of these grooves is situated before the nasal opening and another one behind the nasal openings; these are a small and S-shaped. Five other ones, a little larger and more irregularly S-shaped, are situated on either side of the forehead above the eyes, in a semi-circle around the root of the upper surface of the snout. In this centre of the forehead, two long grooves can be seen that run from the front to the back and a bit obliquely outwards, a similar groove is present behind these ones on each side of the head and another one behind and above the eye. Two more grooves are present rostrally on the second large cheek plate: another one on the preoperculum, and four on the external side of the lower jaw. The three scales that lie against the nape, at their bases join in a membrane, which has also two grooves on either side. The external one of these grooves caudally branches into arms of which one proceeds on the outer rim of the central scale, and the other proceeds on the lateral scale. From under the ventral rim of this last scale appears a broad membrane that covers the upper rim of the gill cover and the upper cheek plate. The lower jaw is rather strong and its tip is provided with a membrane that ends in two barbels, which have a length equal to snout length.

The scales of this fish (fig. 5) are very large and cover each other for about three fifths of their length. The scales in the middle of the body are almost perfectly round; those on the back and belly have an irregular oval shape. The caudal edge of the scales is round or shaped like an irregular meandering line; the outline usually has three sides which however are usually so faint, that the corners they form are indistinct. The scales are divided in numerous small patches by a multitude of curved lines that cross each other perpendicularly. The inner surface of the scales is smooth. The outer surface, on the larger caudal part, where the scales cover each other, is provided with very fine line-like elevations (fig. 7), whereas the free outer part is provided with grain-like elevations (fig. 6). The holes, which form the openings of the mucus canal of the so-called lateral line, are very large (fig. 5). The lateral line begins at the scale that lies behind the upper edge of the gill cover, and then slopes downward on the anterior smaller part of the body and then continues almost in the middle of the fish to the root of the caudal fin where it disappears. The scales, which are situated along the belly, along the bases of the dorsal and anal fins, and on the caudal peduncle, are much smaller than the other ones, much more irregularly shaped and on the basis of the fins form a kind of sheath in which the fins can move.

The pectoral fins are placed far forward and downward, opposite the incision that is present between the operculum and the suboperculum, so that anteriorly the branchiostegal membrane covers their roots. They are inserted almost horizontally, and their movements usually are made in that direction. The scales covering their bases form, as mentioned above, a kind of sheath, in which they move. These fins, which extend until the ventral fin bases, are provided with seven rays that decrease so much in length from the outside to the inside, that the last one is three times as short as the first one. The first ray is very thick, strong, undivided and hard; the following ones in their first half are split into main branches and these further on our split in several side branches. The ventral fins are placed a little closer to the tip of the snout than tip of the caudal fin. They lie very close to each other, immediately next to the ventral line. They are relatively not very large, and their movements are made in a perpendicular direction. They are provided with five rays of which the anterior most one is undivided and more than twice as long as last one. The anal fin occupies the caudal two fifths of the body length before the caudal peduncle. It is of a medium-size. Its rays, 27 in number, are directed backwards and a bit downwards. The first ray is almost one-fourth shorter than the second one. From the second until about the 22nd ray the length is about equal, but from then on they regularly decrease in size so that the last ray is equal in size to the first ray. The first and second rays are undivided; the next ones, as usual near the tip split into two main and several side branches. The dorsal fin is placed very far backwards, and opposite the posterior, smaller part of the anal fin, with which part it compares in length and reach. Its rays, 18 in number, are directed backwards, but the first one is directed a bit upwards, and the first three rays are undivided. The caudal fin can rather be called small than large, because its length plus the caudal peduncle is only  $\frac{1}{5}$  of the total length of the fish. At the end it is strongly

rounded and it is composed of 14 large rays, of which the two outer most are undivided and accompanied by a very short ray on the outside of their bases; for this reason one could also count 16 rays.

The anal opening in the shape of a slit is situated close to the anal fin. The branchiostegal membrane is provided with 15 rather short rays. The edges of the jaws are cutting, along their entire length packed with a series of rather small teeth, the free tips of which are very sharp and somewhat inward curved. Rostrally on the lower jaw two patches of similar shaped teeth are placed opposite the transversely placed series of teeth on the vomer. From these teeth a rather broad band, densely packed with acutely pointed teeth, runs along the outer edge of the palatine bones extending backwards. This band at a third of its length mixes with a large patch of very fine granulated teeth that occupies the entire surface of the palate. The inner side of the gill arches as well as the gill rakers are covered with densely packed small teeth. The same is true for the surface of the hard element that supports the tongue, but the tooth-like elevations of this part, especially in the centre, are larger and rounded at their tips (fig. 4) The tongue has an elongated shape, as one can see from this element which serves as a support, it tapers a little rostrally and it is rounded at its tip. The element itself is edged with a fleshy margin, which is almost half of its width.

The live colours of this fish are very beautiful. The main colour is a fine darker grass green, turning yellowish on the head, and from the belly forwards it becomes lighter, turning into white on the lower jaw. The membrane covering the tip of the lower jaw and the barbels are green with a yellow edge, this yellow continues along the inner side of the barbels. The large scales in the centre of their free halves are decorated with a pale, dirty purplish band shaped like a curved line. The mucus grooves on the head and the mucus holes on the scales, under which the lateral line canal is situated, are purplish rose red. The fins are unicoloured and splendid [orange yellow]; the iris of the eye dirty orange yellow.”

Müller and Schlegel continue with an extensive and detailed description of the skeleton, including the neurocranium and the other bony elements of the head. As these data seem irrelevant for the description of the species, the translation of this part is not included.

The description ends with the following paragraph:

“The fish in question is very common in some of the lakes along Doeson River in the southern part of Borneo, especially between 1° and 2° south latitude. It is caught in large quantities with nets by the local people and eaten fresh as well as dried. Its meat is not very nice and rather dry. The inhabitants of Koewala-pattai and its environs know this species under the name of *Tangalasa*.”

### **The type specimens of *Osteoglossum formosum***

As both authors of the description of *O. formosum* were connected to the Rijksmuseum van Natuurlijke Historie in Leiden, the location of the types must first of all be sought in the Leiden Museum. Salomon Müller, the collector of the specimens, was a member of the Natuurkundige Commissie, a committee of persons appointed to study and collect natural history objects in the Dutch East Indies (Fransen *et al.* 1997) and Hermann Schlegel at that time was curator of Vertebrates. Müller & Schlegel (1845) do not give an exact number of specimens on which they based their description. They state only: “The largest specimens that we have at our disposal *have* a length of 0.58 m, the smallest about 0.37 m.” This means that there were at least three syntypes.

The collection of the Naturalis Biodiversity Center contains the following specimens of *Osteoglossum formosum* collected by S. Müller (Figs 9, 10):

Stuffed specimens (Fig. 9A, B):

RMNH.PISC.D.1646, 430 mm TL

RMNH.PISC.D.1647, 453 mm TL

Specimens preserved in alcohol (Fig. 10A, B)

RMNH.PISC.3386a, 475 mm TL

RMNH.PISC.3386b, 370 mm TL

Skeletal preparations (Fig. 10C):

RMNH.PISC.Sk.366, 580 mm TL



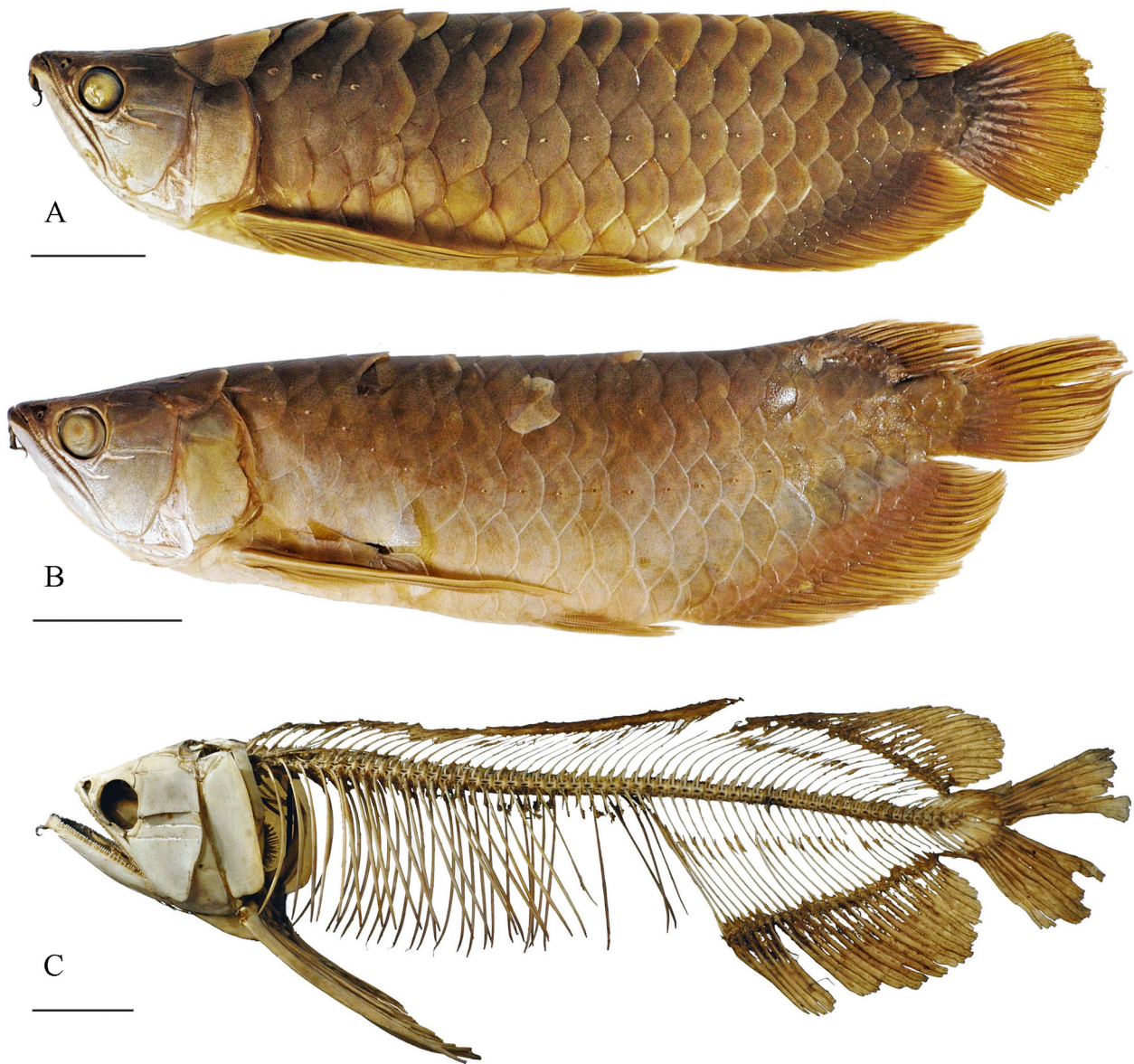


**FIGURE 9.** Type specimens of *Osteoglossum formosum* Müller & Schlegel 1840. A. RMNH.PISC.D.1646, 430 mm TL. Paralectotype. This is an aberrant specimen as the ventral fins are missing; B. RMNH.PISC.D.1647, 453 mm TL. Paralectotype. Scale equals 5 cm.

As Müller & Schlegel (1840) also figured a head skeleton, the RMNH skeletal collection was searched for specimens collected by Müller. One specimen, RMNH.PISC.Sk.366, has an old label glued underneath the pedestal with the text: “*Osteoglossum formosum* Verh. N. Ind.; Müller; Borneo”. This specimen, also mentioned in Van Lidth de Jeude (1898: 35), measures 580 mm TL. We consider it to be a syntype. It has a damaged caudal fin skeleton and lacks the ventral fins, but is otherwise in good condition (see Fig. 10C). However, this specimen differs in many details from the head of the skeleton figured by Müller and Schlegel. Therefore we conclude the figure must have been based on a second dissected specimen. We have not been able to find this specimen in the RMNH collections.

In his Catalogue of Fishes, Günther (1868: 378), under *O. formosum*, mentions one specimen in the BM(NH) collection: “Skin in spirits. Borneo. From the Leyden Museum.” As this might be the skin of one of the RMNH skeletons and therefore type material, we contacted the Natural History Museum in London. Mr Campbell reported that this specimen BM(NH) 1846.2.16.34, is a complete skin *with the head skeleton still attached*, and was purchased in 1846 from Mr G.A. Frank, a well known dealer in natural history objects from Amsterdam. Many duplicate specimens of the Leyden museum found their way to other museums via Frank (Fransen *et al.* 1997: 234). Because Günther mentions that this specimen came from Schlegel, and the RMNH at the time did not possess any other specimens of *O. formosum* than the material collected by Müller, and the specimen with a TL of 375.5 mm is in the size range of *O. formosum* given by Müller & Schlegel (1845), we conclude this is another syntype. Therefore the description of *O. formosum* must have been based on at least six specimens, five of which are still preserved in Leiden, and one in London.

In the caption of Fig. 1 of Plate I, Müller & Schlegel (1844) state: “*Osteoglossum formosum*; a little more than half of its natural size.” As the total length of the drawn specimen is 315 mm, the specimen should be slightly less than 63 mm. Remarkably, this makes the skeleton RMNH.PISC.Sk.366 the most likely specimen from which the habitus was drawn.



**FIGURE 10.** Type specimens of *Osteoglossum formosum* Müller & Schlegel 1840. A. RMNH.PISC. 3386a, 475 mm TL. Lectotype; B. RMNH.PISC.3386b, 370 mm TL. Paralectotype; C. RMNH.PISC.S.366, 580 mm TL, Paralectotype, mirror image. Scale equals 5 cm.

### The type locality

With regard to the type locality, Müller & Schlegel (1845: 6) mention only: “The fish in question is very common in some of the lakes along Doeson River in the southern part of Borneo, especially between 1 and 2 degrees southern latitude.”

Subsequent authors have translated Doeson River as Barito River. However, Müller (1847: 339), in a description of his collecting trip in Southern Borneo, gives more detailed information on the names of the river [translated]:

“The large river of Banjermasing has various names in different parts of its course. The lower part, from its discharge in the sea until Kampong Pekoempai or Fort Marabahan, the natives usually give the names Soengi Bandjar or Soengi Baritto; above Fort Marabahan until about Dano Babai, it is called Soengi Pekoempai; whereas above Dano Babai until Soengi Tohop it carries more specifically the name Soengi Doeson, and finally, above the last mentioned point where the main direction of its course is westwards, the river is known under the name Soengi Moeroeng. The name Doeson is most often heard from the inhabitants of Banjermassing and its surroundings, and the European officers usually apply this name to the whole river, a custom that will be followed by us as well.”

In the same paper (Müller 1847: 358) we find detailed information on the type locality [translated]:

“On August 26 [1836] when we stayed at the Kampong Kwâla-pattai, [east longitude 115, Lat. 2 S.] we made excursions in the surroundings when we visited a small lake, Dano Mahoeroeng, which is situated about half an hour upwards from the river Doeson, not far distant from its left bank and connected to the large river mentioned above by a narrow canal. There we encountered two fishermen who by means of common local cast nets (djala) had caught many Osphronemidae (mainly *Helostoma Temminckii* and *Ophiocephalus planiceps*), a few cyprinids and several specimens of the beautiful new fish that we have described and depicted under the name *Osteoglossum formosum*.”

Therefore the type locality of *Scleropages formosus* is Lake Mahoeroeng, a small lake connected by a narrow canal to the river Pekoempai.

Thus, not only the exact type locality of the specimens is known, but even the day of capture.

### Remarks on *S. formosus* by early authors

Valenciennes (in Cuvier & Valenciennes 1846: 304), not having access to a specimen of *S. formosus*, gives a summary of the characters described by Müller & Schlegel (1840-1845). The description of the colouration is not copied from the original description, but based on his own observations of the colours of their figure (see Fig. 1).

Bleeker (1851: 436) described a specimen (222 mm TL) from the river Sambas, NW Borneo. After the description he wrote [translated]:

“In the specimens of *Osteoglossum formosum* Müller & Schlegel (1844) from the lakes along the Doeson river in *South East Borneo* the body depth fits 4 times in its length, its width fits 2½ times in its length, its barbels are about as long as the snout, the dorsal fin has 18 rays of which only the first 3 are undivided, and the caudal fin together with the caudal peduncle fits 5 times in the total length, whereas this in my specimen fits only 4½ times in the TL. These differences, which partly might be explained by the difference in age, do not give me the right to consider my specimen from the *Sambas* as a separate species.”

Bleeker did not comment on the differences in colouration. He describes the body colour of his specimen from the Sambas as green, the belly as silvery and all fins and fin rays as golden or dark brownish. Possibly Bleeker in Batavia did not possess a coloured edition of Müller & Schlegel (1840). Bleeker mentioned *O. formosum* in at least eight other publications (Weber & de Beaufort 1911: 283), but in all of them the name appears only in species lists.

In his “Atlas Ichthyologique” Bleeker (1870-1875, Vol. VI: 145, Pl. CCLXXVI) states that Müller & Schlegel (1844) published a very detailed description and a beautiful figure. However, he was of the opinion that the figure did not properly reflect the habitus of the species. Bleeker’s own description was based on 11 specimens from Sumatra, Banka and Borneo. Bleeker did not examine specimens from the type locality. The specimen figured in the *Atlas* (see Fig. 11A) is quite different from that in Müller & Schlegel (1840), especially in colouration. In the *Atlas* Bleeker describes the colouration as follows [translated]:

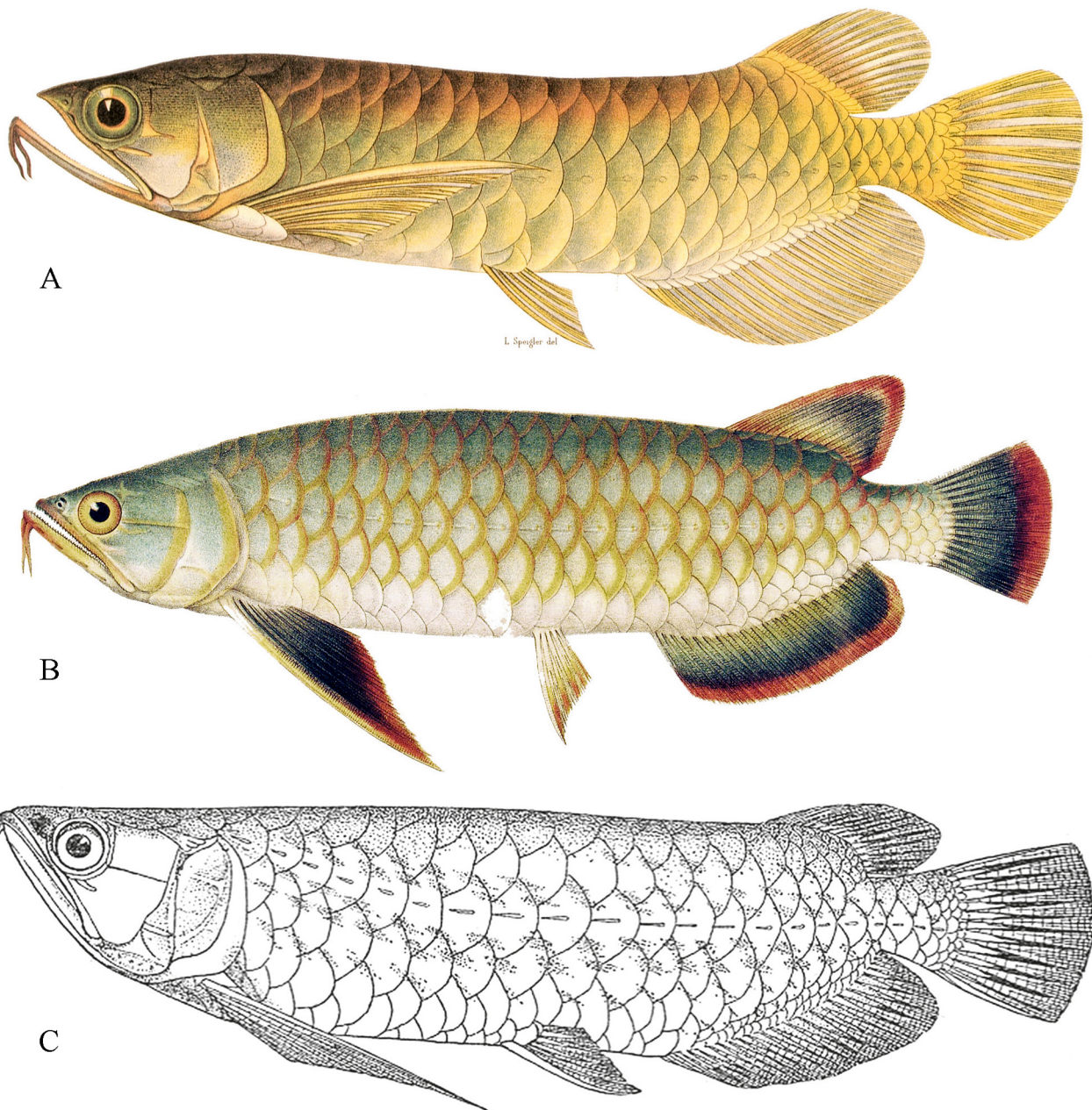
“Body colour, dorsal part dark olive green, ventral part silvery or golden. Inner part of iris golden, outer part beautiful green. Barbels golden or brown. Fin rays yellow or golden, fin membranes pearl coloured or bluish hyaline.”



Apparently Bleeker considered *O. formosum* a very variable species.

Günther (1868: 378), in his account of *O. formosum*, gives no details of the colouration. Von Martens (1876: 304) characterized this species as follows [translated]:

“*Osteoglossum* is the most beautiful fresh water fish of Borneo, with a length of 0.62 m, with large scales, a lustre of gold along the free margin; the short dorsal fin is set backwards as in our pike, the pectoral fins long and acute, a strong barbel on the lower jaw; the vertical fins and the pectorals blackish with a broad orange red seam, the belly with a sharp keel, which is not formed by one scale as in the herring but by two scales. Near the lake Danau Sriang this fish was named Silo.”



**FIGURE 11.** Habitus figures of *Scleropages formosus* (Müller & Schlegel 1840) from the literature. A. From Bleeker (1870, Tab. 276), specimen from Borneo, 335 mm TL; B. From Martens (1876, Pl.13), specimen from Lake Sriang, Borneo, ca 620 mm TL; C. From Weber & de Beaufort (1910, Fig. 7), 430 mm TL. Mirror image. Probably ZMA.PISC.100740, from Djambi, Sumatra.

From a colour plate of a specimen from lake Sentarum published with this description (see Fig. 11B) it is clear that the colouration of von Marten’s specimens differs greatly from the specimens of Müller & Schlegel (Fig. 1) and Bleeker (Fig. 11A).

According to Weber & De Beaufort (1913: 13), the colouration of *S. formosus* is dorsally dark green, the sides and ventral sides silvery or golden green, sometimes with longitudinal rows of oblique dark patches, shining through the lateral scales (shown in their black & white drawing of the species). Fin membrane bluish, the rays golden brown. According to Dr Isbruecker (Zoological Museum Amsterdam, now Naturalis Biodiversity Center), the ZMA collection holds only two specimens that were present before 1913; one from Borneo (from Bleeker's collection) and one collected in Palembang, Sumatra, in 1908. These are the localities marked with an explanation mark in Weber & De Beaufort (1913: 13). The authors thus did not see live specimens and their colour description must have been compiled from descriptions of previous authors.

It is remarkable that none of the early authors commented on the differences in colouration and/or body shape in specimens from different areas. In "The Asian Arowana", a book for dragon fish hobbyists, Goh & Chua (1999) present photographs of a number of colour varieties, again diverging from the earlier published colour figures. Pouyaud et al. (2003: 288) analysed "36 specimens representing all known colour varieties (except the Cross Back Golden) that died since 1998 after being caught by fishermen or kept and bred in tanks either by Indonesian governmental research institutions or by private fish farmers." The examined material was a mixture of wild and cultivated specimens. Unfortunately, type series of their new species are also composed of wild specimens, descendants of a wild brood stock, and offspring of private strains. It is also regrettable that the authors chose juvenile specimens to represent two of the three new species as well as for the neotype. Pouyaud et al. (2003) did not compare the colours of their new species with those of the figures by early authors mentioned above, with one exception. They proposed to restrict *S. formosus* to the "Green variety" on the basis of the colour description of Weber & De Beaufort (1913), which is cited in full. When the last mentioned description is compared with the colour figure from Müller & Schlegel (1840) it is clear that they are quite different. If Pouyaud et al. (2003) had checked the original figure, they would have noticed that it does not compare to the colouration of specimens of the "Green variety". In certain characters Pouyaud et al. "Silvers" seems a better match.

### **Derivation of the name *formosum***

In their redescription of *S. formosus* under the heading "Etymology and common names" Pouyaud et al. (2003: 296) incredibly state: "*Formosus*: Given by Müller & Schlegel (1839-1844) referring to its occurrence in Formosa [Taiwan]...." As can be seen in this translation of the description, Müller & Schlegel only possessed specimens from Borneo; they used the Latin word for beautiful, gracious (= *formosus*) to name their new species.

### **Designation of a lectotype**

As all six syntypes of *Osteoglossum formosum*, were gathered by one collector, on one afternoon, in a small lake, chances that more than one species are contained in the types are small. However, as nominal species of *Scleropages* are still being described from the area, it seems in the interest of stability of nomenclature to designate a lectotype. From the two RMNH alcohol preserved syntypes of *Osteoglossum formosum* Müller & Schlegel, 1840 (RMNH. PISC.3386) we selected the larger (475 mm TL) specimen as the lectotype (Fig. 10A). This specimen, like all others was caught by S. Müller on August 26, 1836, in lake Mahoeroeng, close to the river Pekoempai, Borneo. The five remaining syntypes are now considered paralectotypes.

### **Conclusion**

Various authors of descriptions of specimens of *S. formosus* (Müller & Schlegel, 1840) failed to study the early literature on this species. As a result, the large variation in external characters and colouration remained unnoticed. Due to the recent interest in this species for the aquarium trade, a more detailed study of the variation, including a molecular study, was carried out by Pouyaud et al. (2003). These authors, however, based their study on a relatively small sample of recent material, neglecting the fact that well-documented material from a number of localities is available in various natural history museums. Pouyaud et al. designated a neotype for *S. formosus*, but overlooked

the fact that well-preserved type material of *Osteoglossum formosum* is available. Therefore, their designation of a neotype is invalid.

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## References

- Bleeker, P. (1851) Vijfde bijdrage tot de kennis der ichthyologische fauna van Borneo, met beschrijving van eenige nieuwe soorten van zoetwatervisschen. *Natuurkundig Tijdschrift voor Nederlandsch Indië*, II, 415–442.
- Bleeker, P. (1875-1876) *Atlas Ichthyologique des Indes orientales Néerlandaises. Vol. IV. Pleuronectes, Scombrésoces, Clupées, Clupésoces, Chauliodontes, Saurides*. F. Muller, Amsterdam, 170 pp.
- Eschmeyer, W.N. (1998) Introduction. In: Eschmeyer, W.N. (Ed.), *Catalogue of Fishes*, Vol. I. California Academy of Sciences, San Francisco, pp. 1–12.
- Eschmeyer, W.N., Ferraris, C.J. Jr, Hoang, M.D. & Long, D.J. (1998) Part I. Species of Fishes. In: Eschmeyer, W.N. (Ed.), *Catalogue of Fishes*, Vol. I, California Academy of Sciences, San Francisco, pp. 25–958.
- Eschmeyer, W.N. (Ed.) (2013) Genera, Species, References. Available from: <http://research.calacademy.org/research/ichthyology/catalog/fishcatmain.asp> (Accessed 7 October 2013)
- Fransen, C.H.J.M., Holthuis, L.B. & Adema, J.P.H.M. (1997) Type catalogue of the Decapod Crustacea in the collections of the Nationaal Natuurhistorisch Museum, with appendices of pre-1900 collectors and material. *Zoologische Verhandelingen Leiden*, 311, i–xvi, 1–344.
- Goh, W. & Chua, J. (1999) *The Asian Arowana*. Singapore, Dragon Fish Industry, 97 pp.
- Günther, A. (1864) On a new Generic Type of Fishes discovered by the late Dr. Leichardt in Queensland. *Annals and Magazine of Natural History*, XIV, 195–197.
- Günther, A. (1868) *Catalogue of the Fishes in the British Museum*, VII, I–xx, 1–512. London.
- Husson, A.M. & Holthuis, L.B. (1955) The dates of publication of “Verhandelingen over de natuurlijke geschiedenis der nederlandsche overzeesche bezittingen”, edited by C.J. Temminck. *Zoologische Mededelingen Leiden*, XXXIV (2), 17–24.
- International Commission on Zoological Nomenclature (1999) *International Code of Zoological Nomenclature*, Fourth Edition. London, i–xxix, 1–306 pp.
- Kottelat, M. & Widjanarti, E. (2005) The fishes of Danau Sentarum National Park and the kapuas Lakes area, Kalimantan Barat, Indonesia. In: Kottelat, M & Yeo, D.C.J. (Eds.), Southeast Asian Freshwater Fish Diversity. *The Raffles Bulletin of Zoology*, Supplement 13, pp. 139–174.
- Martens, E. von (1876) *Die Preussische Expedition nach Ost-Asien. Nach amtlichen Quellen. Zoologischer Teil*. Berlin, iii–xii, 1–412 pp.
- Müller, S. (1847) Reis in het zuidelijke gedeelte van Borneo. In: Temminck, C.J. (Ed.), *Land en Volkenkunde. Verhandelingen over de natuurlijke geschiedenis der Nederlandsche overzeesche bezittingen, door leden der Natuurkundige commissie in Indië en andere schrijvers*. S. & J. Luchtmans & C.C. van der Hoek, Leiden, pp. 321–446.
- Müller, S. & Schlegel H. (1840-1845) *Beschrijving van een nieuwen Zoetwatervis van Borneo, Osteoglossum formosum*. Verhandelingen over de natuurlijke geschiedenis der Nederlandsche overzeesche bezittingen, Leiden, 1–7, Pl. 1.
- Pouyaud, L., Sudarto & Teugels, G.G. (2003) The different colour varieties of the Asian Arowana *Scleropages formosus* (Osteoglossidae) are distinct species: morphological and genetic evidence. *Cybium*, 27 (4), 287–305.
- Roberts, T.R. (2012) *Scleropages inscriptus*, a new fish species from the Tananthayi or Tenasserim River basin, Malay Peninsula of Myanmar (Osteoglossidae: Osteoglossiformes). *Aqua, International Journal of Ichthyology*, 18 (2), 113–118.
- Van Lidth de Jeude, Th.W. (1898) *Museum D'Histoire Naturelle des Pays Bas Tome X<sup>2</sup>. Seconde partie. Catalogue Osteologique des Poissons, Reptiles et Amphibies*. E.J. Brill Ltd, Leiden, pp. 1–54 + 1–52 + 1–11.
- Weber, M. & Beaufort, L.F. de (1911) *The fishes of the Indo-Australian Archipelago. Vol. I. Index of ichthyological papers of P. Bleeker*. E.J. Brill Ltd, Leiden, v–xi, 410 pp.
- Weber, M. & Beaufort L.F. de (1913) *The fishes of the Indo-Australian Archipelago. Vol. II. Malacopterygii, Myctophoidea, Ostariophysii: I Siluroidea*. E.J. Brill Ltd, Leiden, 404 pp.