FURTHER REVISIONAL NOTES ON THE BELONIDAE

by

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Introduction

In my recent revision of the Belonidae (Mees, 1962) a number of problems had to remain unsolved because of lack of material, and in particular because of a number of named forms the type specimens had not been available. The revision was called "preliminary" for that reason.

Thanks to the co-operation of colleagues in several countries I have been able, on a round-the-world tour which lasted from February to August, 1962, to examine nearly all the types of what I had previously had to regard as species dubiae, and other type specimens, which show that in a few instances the synonymy presented in my paper is erroneous. A serious error in the key also became obvious (see under *Belone punctulata*).

Though, inevitably, a few problems remain to be solved, it is now possible to give a reasonably exact count of the number of genera, species and subspecies in the family. I recognise two genera: *Potamorrhaphis* with one species, and *Belone* with 23 species and 5 subspecies. This compares with estimates of from sixty to a hundred species given in literature.

Acknowledgements

It is a pleasant duty to acknowledge the help from the colleagues who made it possible for me to examine so many type specimens: Dr. J. W. Böhlke (Academy of Natural Sciences, Philadelphia), Miss E. Hahn (Macleay Museum, Sydney), Dr. D. Kähsbauer (Naturhistorisches Museum, Wien), Dr. W. Klausewitz (Natur-Museum und Forschungs-Institut Senckenberg, Frankfurt), Dr. G. A. Mead (Museum of Comparative Zoölogy, Cambridge, Mass.), Dr. D. E. Rosen (American Museum of Natural History, New York), Dr. G. von Wahlert (Staatliches Museum für Naturkunde, Stuttgart). With particular gratefulness I remember the great hospitality extended by Dr. L. P. Schultz and his staff during my stay at the United States National Museum, Washington.

Without financial assistance from the Frank M. Chapman Memorial Fund my visit to the United States would have been impossible, and I want to

express my appreciation of the fact that, though this fund is for ornithological research, its Trustees did not object to my limited time in the U.S. being partly spent on ichthyology.

The family Belonidae

The statement that systematically the Belonidae are a well-known group seems justified inasmuch as it is unlikely that many more species remain to be discovered. It is interesting to note that since 1904, nearly sixty years, only one valid species (*Belone brasiliensis*) has been described, though 25 names have been added to the synonymy. I believe therefore that the systematic list on p. 325 is almost complete and will undergo only minor changes in future.

A noteworthy point that reflects a change of thought that has occurred round the turn of the century, and against which only now a healthy and overdue reaction is setting in, is the craze of creating genera. Whilst up to and including the year 1904 six genera had been proposed in the Belonidae, fourteen have been added since—though only one valid species has been found in this period. The result is that now for the twenty-four known species of the Belonidae, twenty generic names have been proposed. While there is always a certain amount of subjectivity involved in the limitation of genera, the way I have disposed of genera may seem somewhat radical and requires perhaps some explanation. My criteria for their acceptance or rejection have been based on the following considerations: in ichthyology our species concept is almost purely morphological, and no two species are morphologically identical, so that the existence of morphological differences in itself does not automatically justify the creation of a new genus—if it did, genus and species would be the same, and the genus in classification would become meaningless (Mees, 1960, p. 48). A genus, therefore, should ideally be based on a complex of characters which is shared by a group of species, and serves to distinguish them from similar groups within the next higher unit, the family. Some species, of course, are so aberrant, that the erection of a monotypic genus for them is justified. Therefore I have rejected all nominal genera based on a single morphological character, which leaves only *Belone* and *Potamorrhaphis*. All other genera proposed are one-character genera, recognition of which would obscure relationships as further explained below. *Tylosurus* for example was based on a species with a keel on the caudal peduncle and with a tail with a long lower lobe. If this is taken as a generic criterion, *Belone platyura* would have to be included in it, as was done with the species in the West Indies. If, however, the presence of gill-rakers is taken as the generic criterion, as has been done

with the genus *Belone,* in the restricted sense of modern literature, *B. platyura* would have to be placed in *Belone,* as has been done by authors dealing with the species in the Indo-Pacific. A slender body occurs in *B. hians,* for which *Ablennes* has been created, but also in *B. anastomella,* and in *B. megalolepis*; the former of these two is related to *B. ciconia* (generic names *Lewinichthys* and *Raphiobelone* are available) rather than to *B. hians*; the latter would, on the basis of having gill-rakers, have to be placed in *Belone* (the name *Petalichthys* is also available). It seems perfectly clear therefore that not a single one of the one-character-genera that have been proposed is a natural one, they all include a different set of not particularly closely related species, hence nothing is gained, and actual relationships are obscured, by their recognition.

Some characters, which at first might be considered of systematic value, seem to be due to convergence. I have already drawn attention to the long cheeks of freshwater species (Mees, 1962, p. 6). Another one is the shape of the tail: five species have tails with a long lower lobe as shown in fig. 1 of my previous publication; these are *B. appendiculata, B. hians, B. imperialis, B. marisrubri,* and *B. platyura.* These five, in contradistinction to the other members of the genus, are truly oceanic, and have a very wide distribution. Four are circumtropical, the fifth, *B. appendiculata,* has an Indo-Pacific distribution, ranging from the Red Sea to Hawaii; as it is rare its actual range may even be greater. Previously I erroneously included *B. punctulata* in this group, but that species has a lunate tail and seems to be partial to coastal waters; in comparison with the five species just mentioned it has a rather restricted range.

An interesting point that remains to be confirmed is that of regularities in geographic variation. I have mainly paid attention to the easy character of number of finrays, but far more material is needed to find out the amount of geographic variation in each species, even of this simple character, and to substantiate the apparent similarities in different species (for example the Eastern Pacific populations of *B. imperialis, B. marisrubri* and *B. platyura* all seem to be characterized by a lower number of rays than that of their representatives elsewhere). Only after this has been done can research into the factors underlying these variations take place.

It will be noted that in my revisions the species are listed alphabetically, a procedure that may well meet with criticism. Actually it is a frank admission that I have failed in the synthesis. Also I believe that the actual relationships are very different from what has hitherto been suggested. Of course I do have an ill-founded opinion on some species; I think that *B. anastomella, B. ciconia* and *B. incisa* are fairly closely related; that (on the

basis of the scapular blotch) *B. fluviatilis* may have been derived from *B. scapularis* which in its turn, seems close to *B. houttuyni* and that *B. bellone* and *B. megalolepis* are related; but this is all speculation.

Potamorrhaphis Günther

Potamorrhaphis Günther, 1866, Cat. Fish. Brit. Mus., vol. 6, p. 234, 256 — based on *Belone taeniata* Günther and *Belone scolopacina* Valenciennes, both of which are synonyms of *Belone guianensis* Schomburgk (the name was originally introduced at some undefined level below the genus, probably as a subgenus though this is not clearly stated).

Diagnosis. — Characterized by the dorsoventrally flattened beak; the position of the ventrals, which are implanted farther caudalwards than in any species of *Belone,* much nearer to the caudal peduncle than to the hindborder of the opercle; the shape of the caudal peduncle, which is very slender, much deeper than wide; the rather weak and, compared to *Belone,* somewhat degenerated caudal fin, and the very long dorsal and anal fins, which one may guess have taken over part of the propellor function of the tail. Origin of A behind origin of D: in *Belone* D and A are either opposite each other, or the origin of D is behind the origin of A.

Potamorrhaphis guianensis (Schomburgk)

Belone Guianensis Schomburgk, 1843, Fishes of British Guiana, pt. 2, p. 131, pl. I — river Padauiri, British Guiana.

Belone scolopacina Valenciennes, 1846, in Cuvier & Valenciennes, Hist. Nat. Poiss., vol. 18, p. 318 — la Mana, Cayenne.

Belone (Potamorrhaphis) taeniata Günther, 1866, Cat. Fish. Brit. Mus., vol. 6, p. 256 — River Capier, Brazil.

Potamorrhaphis eigenmanni A. de Miranda Ribeiro, 1915, Arch. Mus. Nac. Rio de Janeiro, vol. 17, p. 13 — Caceres e ... Rio Jaurú (Porte Esperidiao), Brazil.

Diagnostic characters. — The more important characters have been given in the generic diagnosis, to which the following particulars can be added.

D 29-32, A 25-28; no gill-rakers; opercle about 1.2 in cheeks (in contradistinction to all freshwater-inhabiting species of *Belone* in which the cheeks are very much longer than the opercles); a dark longitudinal band, originating behind P on the sides; origin of A under 4th or 5th ray of D.

Material examined, seven specimens, varying in standard length from 176 to 212 mm. As I have examined only the largest specimens from the samples available, it is likely that the species does not grow very large and remains smaller than any species of *Belone.* Schomburgk (1843) states that it "seldom exceeds fifteen inches in length".

Distribution. — Fresh water of north-eastern South America: the Guianas (Schomburgk, 1843), Brazil (Rio Urubu: specimens examined), Bolivia (Chichirota: specimens examined; Lagoons Rogoagua: specimens examined).

Discussion. — The reason that I recognise this monotypic genus is that, contrary to all other genera proposed in the Belonidae, it is not based on one single character, but differs in a number of characters from all other species of the group (as indicated in the diagnosis). It is curious that of all proposed genera this is the one of which the validity should have been denied by later workers.

P. eigenmanni was separated on account of having a lower number of finrays (D 28, A 25) and scales than *P. guianensis* (D 33-36, A 29-31). Squamation, however, is a variable character in many species of the Belonidae, and in finray numbers my material is about intermediate, which suggests that the specimens examined by A. de Miranda Ribeiro represent extremes in variation rather than two different species.

Belone Cuvier

Additional synonym:

Pseudotylosurus Fernández Yépez, 1948, Mem. Soc. Cienc. Nat. La Salle, vol. 8, p. 72 — type by original designation and monotypy *Pseudotylosurus brasiliensis* Fernández Yépez = *Belone brasiliensis* (Fernández Yépez).

Correction:

Djulongius Whitley, 1935, Rec. Austr. Mus., vol. 19, p. 223 — type by original designation and monotypy *Belone melanotus* Bleeker = *Belone imperialis melanota* Bleeker.

As *B. melanota* is at most a subspecies of *B. imperialis*, the genus *Djulongius* has the same taxonomic type species as the genus *Tylosurus*.

Pseudotylosurus was based on a single character, the shape of the scales; in other respects its type species is remarkably similar to *Belone microps*. As I have rejected other genera based on one single character, it seems better not to accept *Pseudotylosurus* either.

Belone brasiliensis (Fernández Yépez)

Pseudotylosurus brasiliensis Fernández Yépez, 1948, Mem. Soc. Cienc. Nat. La Salle, vol. 8, p. 73 — Porto de Moz, Brazil (in the title of the paper the name is spelt *Pseudotilosurus brasilensis*).

Diagnostic characters. — D 15-16, A 17, very similar to *Belone microps*, and also with small eye (about 3.8 in postorbital part of head), long cheek (opercle 2.0 in cheek), and broad, depressed, caudal peduncle, but differs by the peculiar nature of its scales, which are small, not covering the whole body, and each provided with a little spine as correctly described by Fernández Yépez in the original description.

Material examined, two specimens: the type (M.C.Z. no. 8797), which has a standard length of 217 + x mm (tip of snout broken), and one (U.S.N.M. no. 167714) of 170 mm standard length, 183 mm total length.

Distribution. — Known only from the type locality: Porto de Moz, and from Rio Paranapura, Yurimaguas, both in Brazil.

Discussion. — The two specimens examined are the only ones hitherto known of the species. In my earlier paper, before having seen material, I suggested that *P. brasiliensis* might be only an aberration of *B. microps,* but, though the position is still uncertain, I now believe that my earlier view was erroneous and that Fernández Yépez was quite right when he described *P. brasiliensis* as a new species. Nevertheless, the situation is far from clear; though *Belone microps* is reported to be widely distributed in South America east of the Andes, I have seen material from the Guianas only. On the other hand the only two freshwater *Belone* from Brazil I have seen were both *B. brasiliensis.* This led me to wonder if, perhaps, the two species have separated ranges and all records of *B. microps* or *B. amazonica* from eastern South America might be referable to *B. brasiliensis.* However, at my request Dr. Kähsbauer examined the type of *Belone amazonica* from Pará, Brazil, in the Vienna Museum, and he reports that it has ordinary scales without spines so that *B. amazonica* has correctly been regarded as a synonym of *B. microps.* There remains a possibility that the presence of spines is a sexual character, or may be seasonal, but at present it seems dangerous to accept such a hypothesis. Also I must state that, though I have examined specimens, including the types, of both *B. microps* and *B. brasiliensis,* I have never been able to make a direct comparison, so that there may be other differences, besides squamation, which I have overlooked. *B. brasiliensis* seems to have a slightly higher number of fin-rays than *B. microps microps,* but according to Dr. Kähsbauer the type of *B. amazonica* has D 14-15, A 17. Only the examination of more material from eastern South America can bring a final solution.

Belone exilis exilis Girard

Additional synonym:

Strongylura tahitiensis Fowler & Bean, 1923, Proc. U.S. Nat. Mus., vol. 63 (19), p. 10 — Tahiti (locality probably erroneous, see discussion).

Type specimen, U.S.N.M. no. 83424, Wilkes Exploring Expedition, Tahiti, D 16, A 19, standard length 515 mm, length of orbit 15 mm, eye 2.8 in postorbital part of head, opercle entirely scaled, beak does not close at base, no pectoral spot.

Discussion. — As Fowler (1949), co-author of *Strongylura tahitiensis,* had placed the name in the synonymy of *Belone platyura,* I saw no need to query his identification. Examination of the type revealed, however, that it has nothing to do with *B. platyura* and is a normal specimen of *Belone exilis.* As it has no dark tips to the pectoral fins, it must be assigned to

the nominate race rather than to *B. e. stolzmanni*. It is unexpected to find an individual of *B. exilis* so far out of its range as hitherto known, and as the same pertained to *"Strongylura fijiense"* = *Belone gavialoides,* hitherto only recorded from Australian waters, described from the same collection made during the Wilkes Exploring Expedition, I became suspicious: was there a chance that the specimens had been mislabelled? Examination of the paper (Fowler & Bean, 1923) makes it at once clear that the labelling has, indeed, been carried out in a most careless way. Of the new or allegedly new species described in the report, one is without locality, another from "Singapore, Maui, or Samoa", a third one again "from Peru?". In the discussion of *Rasborella dubia* we find: "Although the locality is given as "Oahu or Fiji?" such is evidently entirely erroneous, and the species may have been procured in the Old World, possibly the Indo-Malayan region?". Two of the three Belonidae were labelled as originating from Fiji, whereas an accompanying list noted them as being from Fiji or Samoa. This all inevitably leads to the conclusion that no reliance can be placed on the localities attached to material collected by the Wilkes Exploring Expedition.

Belone exilis stolzmanni Steindachner

I have failed to trace the type of *B. stolzmanni*: it could not be found in the museums of Vienna, Stuttgart and Frankfurt. Dr. Kähsbauer mentioned, however, that many thousands of bottles with fish in the cellars of the Vienna Museum have not yet been sorted out and catalogued, and that the type may possibly be amongst them.

In the U.S.N.M. I examined specimens ascribed to this race, and they did differ from *B. exilis* by having dusky, pigmented tips to the pectorals, as indicated by Jordan & Fordice (1887). Though I am reluctant to recognise a race on the basis of so slight a character, especially as there does not seem to exist any geographical boundary that might explain the existence of two races, I have no option but to recognise it.

With reference to Fowler's (1944) identification of *B. stolzmanni* with *Belone platyura,* on which I have commented before (Mees, 1962, p. 25), it may be worth noting that Steindachner (1878) gives the following proportions: "Stirne in der Mitte mit seichter Grube, seitlich flach und nur sehr schwach gestreift, an Breite der Augenlänge gleich, welche circa 14 mal in der Gesammtlänge des Kopfes, oder 3 mal in dem hinter dem Auge gelegenen Kopftheile enthalten ist".

An eye-size of three times in the postorbital part of the head is correct for *Belone exilis,* but is not at all true for *B. platyura,* which has a much larger eye, of 1.35-2.10 in postorbital part of head.

Belone gavialoides de Castelnau

Addition synonym:

Strongylura fijiense Fowler & Bean, 1923, Proc. U.S. Nat. Mus., vol. 63 (19), p. 13 — Fiji (locality probably erroneous).

Some particulars on the type of *Strongylura fijiense* are: D 22, A about 19, standard length 453 mm, tail no longer present so that total length cannot be measured, eye 3 in postorbital part of head, eye 1.6 in bony interorbital, U.S.N.M. no. 83421, Wilkes Exploring Expedition, Fiji Isl.

The type is a normal specimen of *B. gavialoides,* also as regards structure of the upper surface of the head. For comments on the locality of provenance of this specimen I refer to the discussion given under *Belone exilis exilis.*

Belone hians Valenciennes

I have examined the type of *Ablennes pacificus* Walford (U.S.N.M. no. 101049) from Zihuatanijo, west coast of Mexico, and it has D 23, A 25, the same as a specimen from Batavia recorded in my previous paper. On the basis of finray count there is, therefore, no reason to separate the eastern Pacific population nomenclaturally.

Belone houttuyni (Walbaum)

Additional synonym:

Tylosurus euryops Bean & Dresel, 1884, Proc. U.S. Nat. Mus., vol. 7, p. 168 — Jamaica.

Type specimen of *Tylosurus euryops,* U.S.N.M. no. 32073, ex Kingston Mus., Jamaica, D 16, A 18, standard length 285 mm, eye large, 2.1 in postorbital part of head, upper part of opercle scaled, opercle 1.6 in cheek.

The type does not seem to be different in any way from *Belone houttuyni,* except that the eye is remarkably large; in a series of thirty specimens of the latter, ranging from much smaller to much larger than the type of *T. euryops,* I found that the eye was 2.8 to 3.8 in postorbital part of head. The type, however, shows some malformations, especially on the skull, near the brain, and on the snout, and I regard it as possible that these have been responsible for its aberrant proportions as regards eye-size. Berry & Rivas (1962) have also concluded that *T. euryops* is a synonym.

Belone imperialis (Rafinesque)

Diagnostic characters. D 22-26, A 19-24 (within this range there is variation according to race); no gill-rakers, but there are some rudiments; eye 2.2 to 2.5 in postorbital part of head; cheek and opercle about equal in length; teeth fairly fine, straight, often slightly directed backwards; maxilla

near base slightly elevated and slightly constricted: a useful character that is particularly evident in large specimens; bony upper surface of head with a squarish to rectangular depression which extends forwards as a shallow groove with irregular edges; anterior from this a narrow oval patch of scales (fig. 1a); caudal peduncle roundish; carina present; tail forked with a long lower lobe; origin of D opposite 2nd to 5th ray of A; base of V slightly closer to base of C than to hind border of orbit.

In my earlier paper I regarded *Belone melanota* Bleeker as specifically different from *B. imperialis* (Rafinesque), an opinion based on an alleged difference in elevation of the basal part of the maxilla, and slight differences in sculpture of the upper surface of the skull (Mees, 1962, p. 9, 38). Even so, I was bound to admit that the figures of the heads did: "not bear out these differences very well". Examination of further material has convinced me that *B. melanota* is no more than a subspecies of *B. imperialis*. The differences in bone structure noted previously seem to consist mainly in the fact that the specimen of *B. melanota* illustrated has these parts more worn and less distinct. The species is circumtropical in distribution and can be divided in three races.

Belone imperialis imperialis (Rafinesque)

Esox imperialis Rafinesque-Schmaltz, 1810, Caratteri (etc.), p. 59 — Sicilia.

Diagnostic characters. — D 23-26, A 20-23.

Distribution. — Tropical and subtropical Atlantic, and Mediterranean. Tortonese (1963) has given a summary of occurrences in the Mediterranean.

Discussion. — From the Bibliothèque Nationale in Paris I received a photocopy of the relevant pages of Cirino's (1653) work, to which Mongitore (1743) referred, and which therefore is partly the basis of the description of *Esox imperialis* Rafinesque. After a description of the ordinary garfish with lavish reference to the classics, Cirino has the following passages: "Distinguit belonem piscem hunc Aristotelis Rondeletius tempore forsan partus argumento suasus, & Serpentem marinum exhibet, ab Italis *Diauolo di mare* dictus: Bellonius vero Magnum a paruo secernit, & Siculorum diuiosem indigitat, nam paruus simpliciter *acuchia* nuncupatur, maior vero *Acughia Imperiale*: prestat enim magnitudine, & sapore vt imperialis mensa sit digna: in Oceano vigent ea longitudine, vt sesquipedales capiantur; Piscis est longus, tenuis, acuto rostro, & laeui, vt inferior maxilla superiore sit longior, & os absque dente, licet ab Oppiano dentatum credatur, tantummodo asperitate protenditur: caput virescit ad trianguli deductum sorina, oculos magnos, ac rotundos boni coloris, & post meatus ad audiendum, vel odorandum promit; quatuor branchias duplices, duabus pinnis praeditas:

duasque brueues ventri ad igatas pinnas, & aliam ab vmbilico ad caudam vsq. protensam praefert: ipsaque cauda in duas rupta pinnas bifurca videtur: caret squamis, dorso est caeruleo, ventre albo, spina dorsi viridi: interiora longa continet, & intestina sine appendicibus; in hepate vesicam fellis, & cor angulatum habet: Rondeletius rimam in venetr, quaerit, de qua Aristoteles, & ex eo Athenaeus exacte scribit, & ne in re euidenti errore decipiamur; habet acus rimam hanc in vtero, & laeui pellis tegumine occulitur: rumpitur in partu, & tandem saetu egresso coalescit: taque ne alium piscem inquirat, haec Rondeletius animaduertat: non enim de piscibus Oceani quaeritur, sed de Acu, cuius captura in portu Messanae, & vbique praestat".

This has very little that is new in it, though it may be seen that Mongitore copied several sentences from Cirino. Because of the reference to Bellonius (Belon), I also consulted the work of that author (Belon, 1553, pp. 163-164), but the fish described and figured by him as *Acus* is definitely *Scomberesox,* and there is no reference to an Aguglia imperial or to the harbour of Messina. An interesting point, however, is that Belon gives the classical name as Bellone (with double "ll"). Though Belon was not a very good latinist (cf. Stresemann, 1951), it shows that Bellone has been used for a fish in pre-Linnaean literature; therefore the arguments I put forward for the retention of Linnaeus' original spelling (Mees, 1962, p. 19) have to be modified though the conclusion remains the same.

Belone imperialis melanota Bleeker

Belone melanotus Bleeker, 1850, Nat. Tijdschr. Ned. Ind., vol. 1, p. 94 — Batavia.
Strongylura auloceps Fowler & Bean, 1923, Proc. U.S. Nat. Mus., vol. 63 (19), p. 12 — Fiji or Samoa = Fiji (but even this locality perhaps erroneous, see the discussion of *B. e. exilis*).

Diagnostic characters. — D 24-26, A 22-24.

Distribution. — Indian Ocean and western Pacific, east to the Bismarck Archipelago and the east coast of Queensland. The record from Fiji by Fowler & Bean (1923) should not be taken as proof of the occurrence of this species as far east as Fiji.

Discussion. — It is doubtful that the slight difference in average finray numbers is enough to maintain *B. i. melanota* as distinct from the nominate race. I feel, however, that additional differences may exist and, for the time being, am reluctant to synonymise *melanota* with *imperialis.*

Examination of the type of *S. auloceps* revealed that it does not, as I surmised, belong to *B. marisrubri,* but to *B. i. melanota.* It is a specimen of 717 mm standard length, U.S.N.M. no. 83422, D 24, A 22. This confirms that the number of rays in the dorsal fin can be as low as 24 in the subspecies *B. i. melanota.*

Previously I dismissed Marshall's (1951) claim that some specimens of *B. i. melanota* obtained at Magnetic Island would constitute a new record for Australia because Macleay (1881) listed specimens from Cape York and Port Darwin. The Cape York material, from the Chevert Expedition, had previously been recorded by Alleyne & Macleay (1877), also as *Belone melanotus*. Naturally enough, I thought that Macleay's description was based on his own material, and therefore I stated: "The fin formulae presented by Macleay, D 24-26, A 22-24, leave no reasonable doubt about the correctness of his identification". When visiting the Macleay Museum in December 1960, however, I examined the jar with five specimens from Cape York, labelled *Belone melanotus* and found them all referable to *B. marisrubri*. Further I discovered that Macleay's (1881) description agrees word for word with that by Günther (1866) from which it has evidently been copied. I do not know if any other records of *B. melanota,* prior to Marshall's, are correct.

It is now quite clear to me that the fish kept as "type" in the British Museum, actually is the specimen after which the plate in the Atlas Ichthyologique has been drawn.

Belone imperialis pacifica Steindachner

Belone pacifica Steindachner, 1876, Sitzungsber. Akad. Wiss. Wien, vol. 77 (for 1875), p. 93 — Panama und Acapulco.

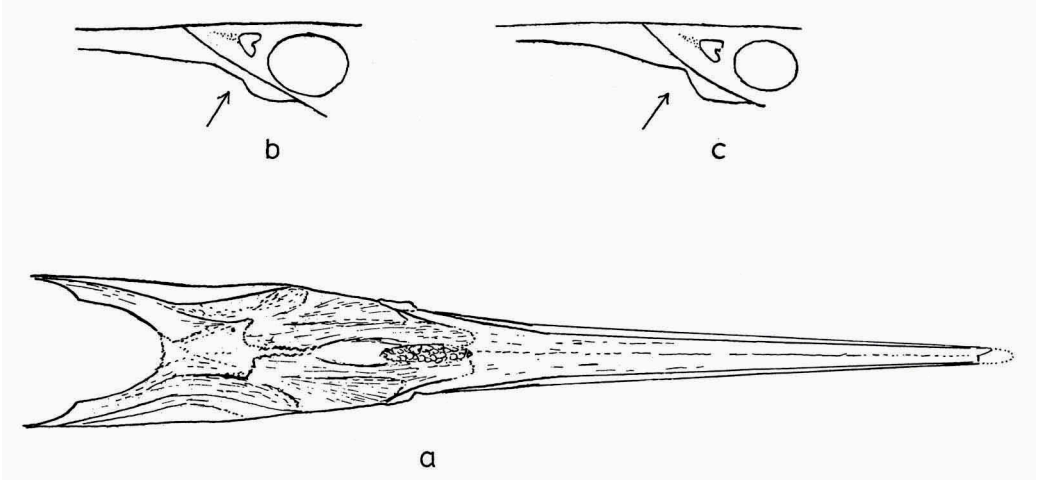

Fig. 1. a, *Belone imperialis pacifica* Steindachner, upper surface of head of type specimen showing bone sculpture; b, *Belone exilis* Girard, base of maxillary and lacrimal of specimen with closed mouth; c, *Belone scapularis* (Jordan & Gilbert), base of maxillary and lacrimal of specimen with closed mouth.

Diagnostic characters. — D 22, A 19-20. This subspecies can be distinguished from the other two races by a slightly lower number of rays in D and A. There is probably some overlap with the nominate race, not brought out here because of scantness of material, for a specimen mentioned by Meek & Hildebrand (1923) had D 23, A 21.

Material examined, three specimens, varying in standard length from 476 to 671 mm.

Distribution. — Only known from the Pacific coast of Central America: Panama and Acapulco (Mexico).

Discussion. — *Belone pacifica,* a name left out of discussion in my earlier paper because no material was available, is a valid subspecies. Dr. Kähsbauer was so kind to send me a specimen which is kept as the type in the Vienna Museum. It has, attached to the tail, a label bearing the number 5549, and a separate label with the notes: "*Belone pacifica* Steind. Type. Panama/Acapulco coll. Steind. 1874 T. Coll. Musei Vindobonensis Pisces 59802". The specimen may be a cotype rather than a holotype as Steindachner did not mention on how much material *B. pacifica* was based, though he did state that it was very common. In order to eliminate a possible source of confusion, I designate this specimen as lectotype.

Even though Steindachner may have found the species locally common, it is certainly not so in collections. Jordan & Fordice (1887) did not know it, and Meek & Hildebrand (1923) had only a single individual. There is no material in the collections at Leiden, Amsterdam, or the British Museum. The two additional specimens examined by me are in the U.S. National Museum (Panama, leg. Gilbert, U.S.N.M. no. 29300).

Belone marisrubri marisrubri (Bloch & Schneider)

Additional synonym:

Belone melanochira Poey, 1860, Memorias, vol. 2, p. 294 — no locality = Habana.

Though the name *melanochira* is listed in the index of my revision and is discussed in the text, it has unfortunately disappeared from the synonymy at some stage in the proof.

Belone punctulata Günther

With my key (Mees, 1962, pp. 6-11), it is impossible to identify this species, as, basing my opinion on unsufficient and damaged material, I believed that it belonged in the group with tails with long lower lobe. In the U.S. National Museum I examined a number of specimens from northern Australia (Yirrkala and Port Bradshaw in Arnhem Land, N.T.; Groote Eylandt), taken in 1948 during the U.S.N.M. Arnhem Land Expedition, and their tails are lunate with the lower rays slightly the longer,

or, in small individuals, even more or less truncate. Also I found that the condition in which the lower jaw ends in a firm fleshy point is not the usual one: most specimens have a lower jaw with a strong square tip, which includes the tip of the upper jaw. A keel on the sides of the caudal peduncle is present, but not well developed. Small specimens have the posterior rays of D long and pigmented blackish, and have the central rays of C also partly pigmented black. [1]) The finray numbers can be amended to D 21-22, A 19-21. The sketch of the upper surface of the skull given in my earlier paper (Mees, 1962, fig. 6) shows a rather abraded individual, usually more sculpture is visible. However, the general pattern, with the wide median groove, remains always the same. When trying to identify the species from the key, one will end up under no. 20, where it should be added as follows:

20. c. D 21-22, A 19-21, snout relatively broad and short, lower jaw protruding with a firm fleshy point or a squarish tip, enclosing the upper jaw; teeth straight; radiation on head only on the sides of the interorbital, leaving an open deep groove which does not narrow anteriorly; eye 3.0-3.2 in postorbital part of head.

The labels of the U.S.N.M. material show that it was collected in coastal waters and creek mouths. The number of specimens taken suggests that *Belone punctulata* is rather common off the coasts of northern Australia. Apart from the old specimen unsatisfactorily labelled as originating from N.E. Australia, listed by me (Mees, 1962, p. 63), the species had not previously been recorded from Australia.

Belone scapularis (Jordan & Gilbert)

Tylosurus scapularis Jordan & Gilbert, 1882, Bull. U.S. Fish. Comm., vol. 1, (1881), p. 307 — Panama.

Tylosurus jordani Starks, 1906, Proc. U.S. Nat. Mus., vol. 30, p. 781 — Guayaquil, Ecuador.

Diagnostic characters. — D 13-14, A 14-17, no gillrakers, eye 3.6 to 4.0 in postorbital part of head; opercle 1.25 to 1.50 in cheek, the beak does not close near the base, lower edge of maxilla, when beak is closed, nowhere concealed by lacrimal (fig. 1c), body roundish, near V equally wide as deep; a silvery lateral band which is wide between D and A, but is very narrow anteriorly; a black spot above implantation of P, V very small, 0.6 to 0.7 of length of cheeks.

Material examined, four specimens, varying from 301 to 367 mm in standard length.

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1) The elongated dorsal fin is a character well known to occur in several species of *Belone*; my earlier remark that the shortening of the posterior lobe in larger specimens would be a process perhaps caused by wear (Mees, 1962, p. 49) is erroneous, as is clear from the careful study of Breder & Rasquin (1952).

Distribution. — Tropical portion of the West coast of America from Panama to Peru.

Discussion. — This species is very similar to *B. houttuyni,* but differs by its small ventrals, by having the interorbital groove clearly depressed (in *B. houttuyni* it is hardly depressed), and as easy character by the presence of a black blotch above the pectoral fin. These differences are slight and there might be a case for giving *B. scapularis* subspecific status only. The reason that I have not done so is because of the historical-zoogeographical speculation this would lead to: while all other species which occur on both the Atlantic and Pacific coasts of America are circumtropical in distribution, and can have colonized the American West coast coming from the West, acceptance of *B. scapularis* as conspecific with *B. houttuyni* would mean a connection dating back to before the emerging of the Isthmus of Panama. Even if *B. scapularis* and *B. houttuyni* have a common origin, they have now been separated for so long that I regard it as likely that they are different species.

As *B. houttuyni* and *B. scapularis* do nowhere occur together, the two are unlikely to be confused. The species *B. exilis,* on the other hand, does occur together with *B. scapularis,* and on finray counts alone they cannot be separated. There again the black pectoral spot of *B. scapularis* will assist in identification; moreover the difference in length of ventrals can be expressed as follows: *B. exilis,* V nearly as long as cheek, 0.9 to 1.0 length of cheek; *B. scapularis,* V 0.6 to 0.7 length of cheek. Another character that is usually reliable is that *B. exilis* has the whole basal portion of the maxilla broadly exposed (fig. 1b), while in *B. scapularis* the lower edge comes very near to the edge of the lacrimal (fig. 1c).

Doubtful name

Belone koseirensis Klunzinger

Belone Koseirensis Klunzinger, 1871, Verh. zool.-bot. Ges. Wien, vol. 21, p. 579 — Rothes Meer.

The type material cannot now be found in the museums at Vienna, Stuttgart, or Senckenberg, Frankfurt a. M., so that the identity of *B. koseirensis* cannot be established. I feel certain however, that *B. koseirensis* is not a valid species, but was based on juveniles of some well-known garfish, perhaps *Belone marisrubri.* It is unlikely that in a well-worked region as the Red Sea a member of the genus *Belone* would have escaped rediscovery for ninety years.

A LIST OF THE BELONIDAE

Potamorrhaphis Günther

Potamorrhaphis guianensis (Schomburgk)

Belone Cuvier

Belone anastomella Valenciennes
Belone appendiculata Klunzinger
Belone bellone (Linnaeus)
Belone brasiliensis (Fernández Yépez)
Belone cancila (Hamilton-Buchanan)
Belone ciconia Richardson
Belone exilis Girard
    Belone exilis exilis Girard
    Belone exilis stolzmanni Steindachner
Belone fluviatilis Regan
Belone gavialoides de Castelnau
Belone hians Valenciennes
Belone houttuyni (Walbaum)
Belone imperialis (Rafinesque)
    Belone imperialis imperialis (Rafinesque)
    Belone imperialis melanota Bleeker
    Belone imperialis pacifica Steindachner
Belone incisa Valenciennes
Belone krefftii Günther
Belone marisrubri (Bloch & Schneider)
    Belone marisrubri marisrubri (Bloch & Schneider)
    Belone marisrubri fodiator (Jordan & Gilbert)
Belone megalolepis Mees
Belone microps Günther
    Belone microps microps Günther
    Belone microps angusticeps Günther
Belone notata Poey
Belone platyura Bennett
Belone punctulata Günther
Belone scapularis (Jordan & Gilbert)
Belone strongylura van Hasselt
Belone urvillii Valenciennes

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