

# A PRELIMINARY REVISION OF THE BELONIDAE

by

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## INTRODUCTION

Difficulties with the identification of some West-Indian Belonidae and an investigation into the merits of the generic name *Strongylura* as against *Tylosurus* led to a revision of the Belonidae, the result of which is published here. As will be seen on the following pages, this revision is by no means final; many problems remain to be solved, much synonymy given here is doubtful, lack of material prevented me from investigating the possible presence of slight geographic variation in the widely distributed species; some apparently valid species are left out altogether (I listed their names on p. 5) because no material has been available, and other names remain doubtful as it has not been possible to examine the type specimens. There is also the possibility that in a few instances I have too recklessly united species — or at least geographically representative forms — which in future may be found to be valid subspecies.

Nobody can be more aware of all these shortcomings than I am, but I had to consider the fact that I was leaving Leiden, and rather than run the risk that the notes hitherto assembled would never be published, I chose to present them even in an incomplete form. Considering the great confusion the nomenclature and systematics of the Belonidae are in at the moment, I believe that these notes, however preliminary they may be, will be useful to students of the group.

The Belonidae form a well-defined natural group consisting (as my investigations show) of not over about 30 species. Because of its smallness one is inclined to wonder if this group really deserves family status. Though for the moment I follow an authority as Berg (1940, 1955) in considering them a family, the fact that the Hemiramphidae have many characters in common with the Belonidae (even the green bones) shows that it may be justified to reduce these two groups to sub-family status.

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1) Present address: Western Australian Museum, Perth, Western Australia. This paper was originally finished in the first part of 1958, before I left for Australia. As publication was delayed, some notes and references to recent literature have been added, and the results of an examination, in June 1958, of certain type specimens and other material in the Australian Museum, Sydney, have been incorporated.

In this revision only the recent members of the family are dealt with. A number of fossil species have been described from the Lower Oligocene and later, mainly from Europe, but also from America; these have not been considered, and their names have not been listed in the index.

Provisionally I accept the following genera.

1. *Belone* Cuvier, 1817 — discussion follows.
2. *Potamorrhaphis* Günther, 1866 — the only species of the genus, *P. guianensis* (Schomburgk, 1843), is easily distinguished from all species of *Belone* by the large numbers of rays, D 30, A 25.
3. *Pseudotylosurus* Fernández Yépez, 1948a — type and only species, *P. brasiliensis* Fernández Yépez. Known from the type only, which differs from all other species by its spine-bearing scales<sup>1</sup>).

As of neither *Potamorrhaphis* nor *Pseudotylosurus* I have personally examined material, no further discussion of the two species belonging to these genera will be given. The genus *Belone*, with the majority of its species, however, will be treated more extensively below.

#### ACKNOWLEDGEMENTS

This study is the result of work on the identification of a large collection of West Indian sea fishes brought together by Dr. J. S. Zaneveld, Dr. P. Wagenaar Hummelinck, and collaborators, in the years 1954-55, and presented by Dr. Hummelinck to the Leiden Museum. It is based upon the collections of the Rijksmuseum van Natuurlijke Historie, Leiden; Zoölogisch Museum, Amsterdam, and British Museum (Natural History), London.

Gratefully I remember the great hospitality I received in the British Museum, where especially Dr. E. Trewavas and Mr. A. C. Wheeler saved no effort to make my stays a success.

The manuscript was read and criticized by Prof. H. Boschma and Dr. M. Boeseman, both of whom I have to thank for corrections and useful sug-

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1) As the description by Fernández Yépez (1948a) leaves a few problems unanswered, such as whether the spines are present on all parts of the body, and because spines are a unique character in the Belonidae, I asked Dr. Schroeder at the Museum of Comparative Zoölogy for some additional information about it. He kindly wrote me (20 and 27.III. 1958): "I examined M. C. Z. No. 8797 for the scale character you are interested in and can report that this specimen does have a spine on almost all of its scales, both along the sides and below, of a type about as pictured by Yépez. The spine arises obliquely from the scale.....some of the scales have 2 spines, with a common base".

In view of the general agreement in characters (besides squamation) which evidently exists between *Pseudotylosurus brasiliensis* and *Belone microps* I regard it as possible that the former, known only from its type specimen collected nearly hundred years ago, is a sport of the latter.

gestions. Dr. Boeseman has also greatly assisted in getting the dates of publication of Bleeker's "Atlas Ichthyologique" straight; he added the interesting information regarding the different artists and printers employed by Bleeker.

Mr. J. J. Hoedeman has allowed me to work in the Zoölogisch Museum, Amsterdam, where several problems could be solved.

For information about specimens in their care I am moreover indebted to Professor J. Guibé and Madame Bauchot (Muséum National d'Histoire Naturelle, Paris), Dr. W. C. Schroeder (Museum of Comparative Zoölogy, Cambridge, Mass.), and Professor W. Schüz (Staatliches Museum für Naturkunde, Stuttgart).

For the first of my two stays in London, in November-December, 1957, I received financial support from the A. M. Buitendijk Fonds, while the second, in March, 1958, was made possible by a grant from the Jan Jooster Pelkwijk Fonds.

#### KEY TO THE SPECIES OF BELONE

In the key only those species have been considered which I have been able to examine personally. There are several nominal species about which, though they are probably valid, I have not been able to form a definite opinion. The species, which have been omitted for this reason are:

*Belone koseirensis* Klunzinger, 1871, p. 579 — Rothes Meer.

*Belone pacifica* Steindachner, 1876, p. 93 — Panama und Acapulco.

*Tylosurus scapularis* Jordan & Gilbert, 1882b, p. 307 — Panama <sup>1)</sup> .

*Tylosurus eurypops* Bean & Dresel, 1884, p. 168 — Jamaica (perhaps a synonym of *Belone houttuyni*).

*Tylosurus jordani* Starks, 1906, p. 781 — Guayaquil, Ecuador.

*Strongylura fijiense* Fowler & Bean, 1923, p. 13 — Fiji.

It must also be realised that both in the key and in the descriptions, ray numbers, relative proportions, etc. are given as found in the material actually examined. As of some species but few specimens were available, it is very likely that their range of variation in these characters is greater than indicated; when using the key, this should be kept in mind and be allowed for.

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1) I have examined one specimen ascribed to *scapularis*, from Panama (BM 1903.5.-15.302), which I did not manage to differentiate from *houttuyni*. However, according to Meek & Hildebrand (1923) *scapularis* has smaller ventral fins, a character to which I failed to pay attention. The specimen examined has D 15, A 17, not different from *houttuyni*. Until I have been able to examine more specimens and to check on the character of the ventral fins, I prefer not to give a definite opinion on the validity of *scapularis*.

The key, of course, is somewhat artificial, serving a practical purpose only. Nevertheless there is one character, used under nr. 4 to separate freshwater species from marine species, that deserves to be more closely examined. It comes down to this: the two species with well-developed gillrakers, *B. bellone* and *B. megalolepis*, have their cheeks shorter than the opercles; all other species have the cheeks relatively longer, nearly always decidedly longer than the opercles. In marine species, the opercles are up to about 1.6 in the cheeks. Finally in the freshwater species, the opercles are relatively much shorter, usually only half the length of the cheeks. The interesting point is that all species, though evidently not particularly closely related, share this character; it occurs in the freshwater species of eastern and western South America, of New Guinea, and of southeastern Asia. Very long cheeks are also recorded in the freshwater species *Pseudotylosurus brasiliensis* by Fernández Yépez (1948a, 1948b). It is difficult to explain this fact, the only suggestion I can make is that rivers may be richer in oxygen and that consequently the movements of breathing can be weaker than in the sea. On the other hand, it may have to do something with feeding.

1. a. Developed gillrakers present on first hypobranchial . . . . . 2
- b. No developed gillrakers on first hypobranchial . . . . . 4
2. a. About twenty well-developed gillrakers present, besides a number of rudiments . . . . . 3
- b. Five or six developed gillrakers present, besides rudiments, caudal peduncle much wider than deep, with a very broad dermal carina, D 12-16, A 17-20, circumtropical . . . . . *platyura*
3. a. D 17-18, A 22, scales large, about 73, South Africa . . . . . *megalolepis*
- b. D 16-18, A 20-22, scales smaller, about 200-270<sup>1)</sup>, Mediterranean and eastern Atlantic . . . . . *bellone*
4. a. Opercles more than 1.7 in cheeks, freshwater species . . . . . 5
- b. Opercles not over 1.6 in cheeks, marine species (normally). . . . . 9
5. a. Caudal peduncle much wider than deep, eye small, over 4 in postorbital part of head (in species of less than 25 cm standard length the eye may be slightly larger, up to about 3.7 in postorbital part of head) . . . . . 6
- b. Caudal peduncle deeper than wide or roundish, eye larger, not over 3.5 in postorbital part of head . . . . . 7
6. a. D 12-15, A 15, freshwater of South America east of the Andes . . . . . *microps*
- b. D 16, A 19, probably freshwater of South America west of the Andes . . . . . *angusticeps*
7. a. D 16-18, A 19-20, curiously shaped lateral line on caudal peduncle (fig. 2), no silvery band on the sides, heavily built, depth 1½ to 2 times width of body, no black spot above P, freshwater of Queensland and New Guinea . . . . . *krefftii*
- b. A silvery band on the sides, which is broad between D and A . . . . . 8
8. a. D 15-16, A 16-18, opercles entirely scaled, black spot above origin of P, origin of D above 5th to 7th ray of A, rivers in Colombia and Ecuador west of the Andes . . . . . *fluviatilis*

1) According to Fowler (1936); nearly all specimens I have seen had lost their scales and I have not been able to personally count any.

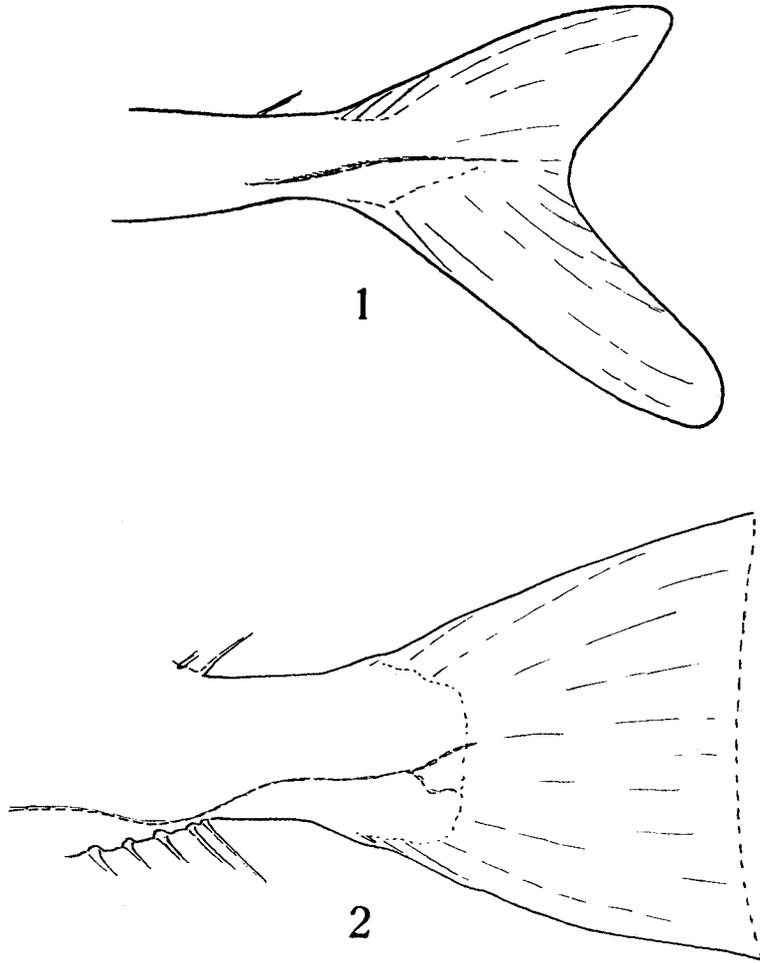
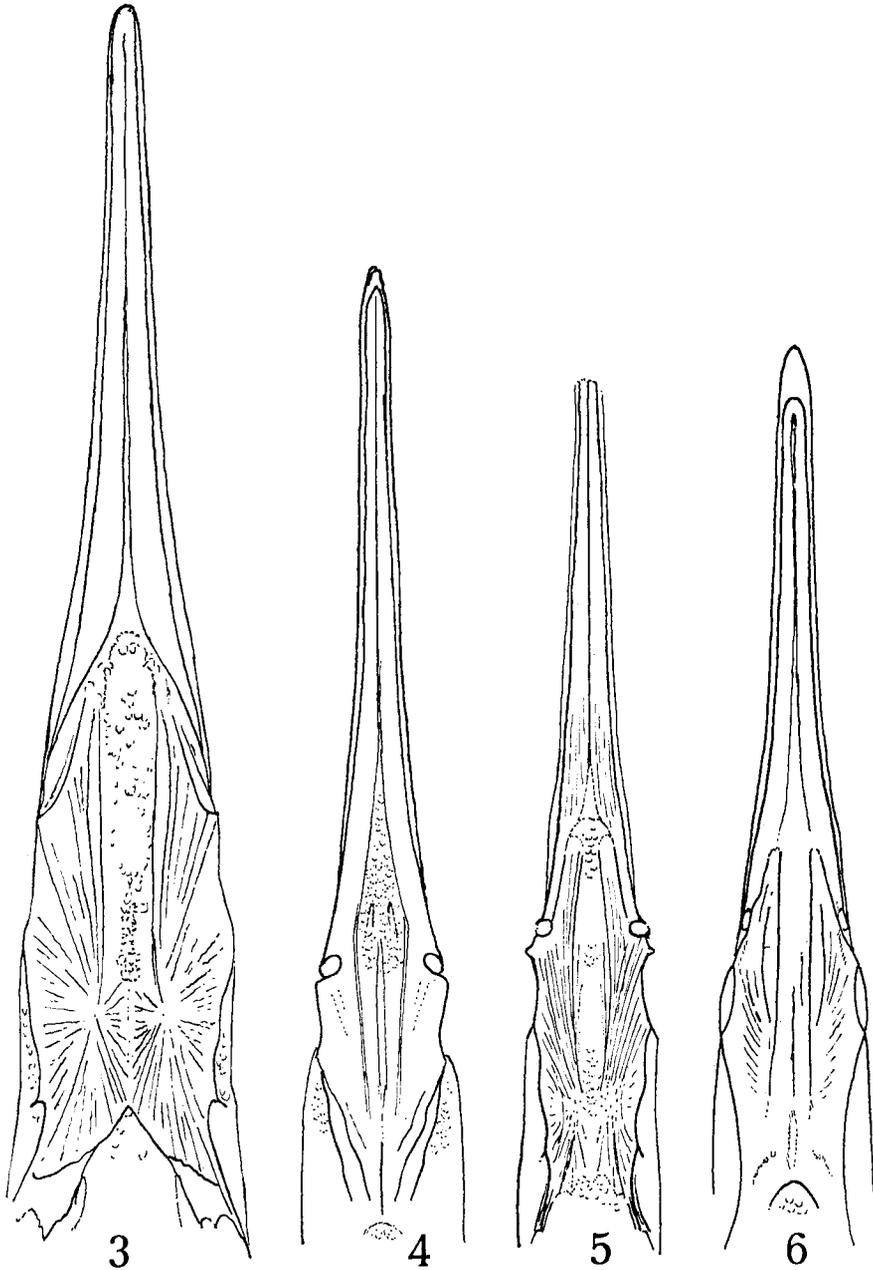


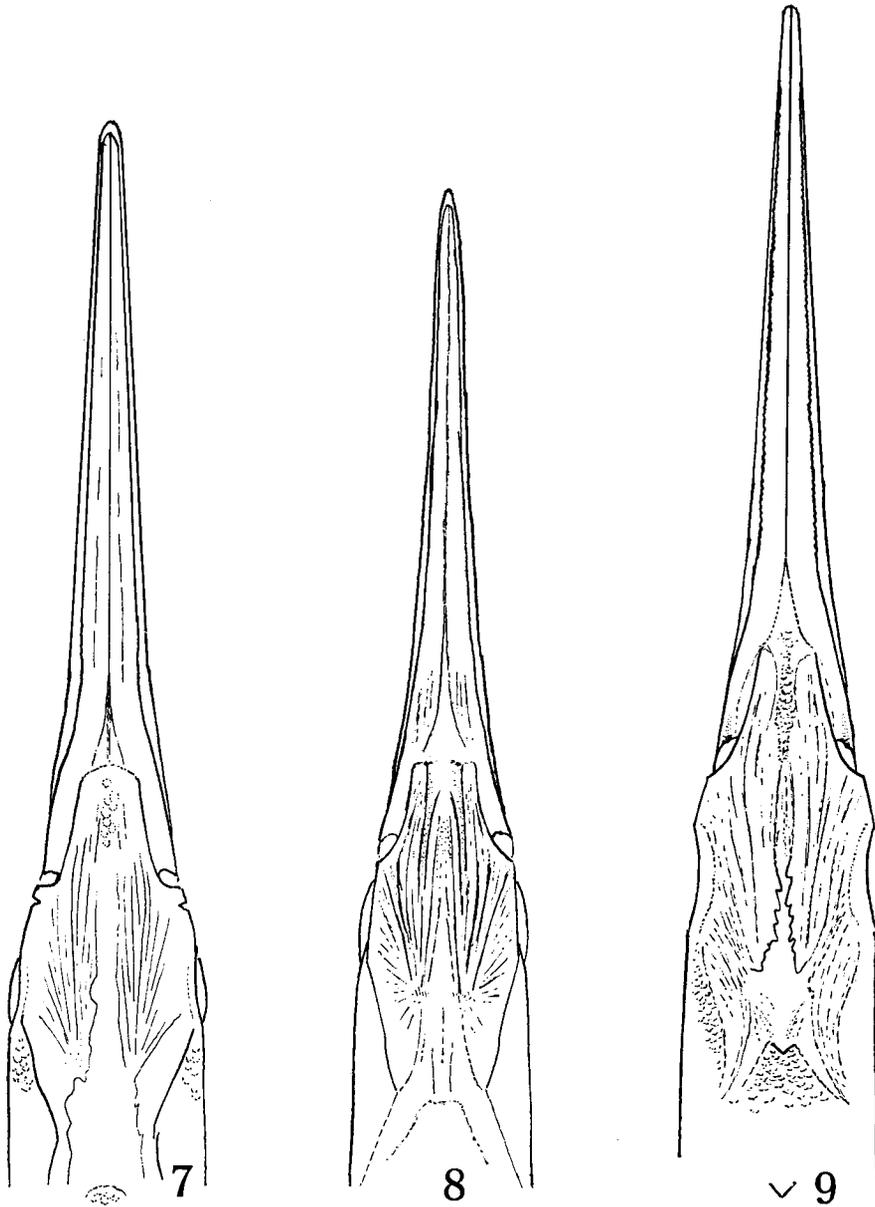
Fig. 1. Tail of *Belone appendiculata* Klunzinger, showing the long lower lobe characteristic of garfishes of the high seas (Java, RMNH nr. 1883); fig. 2. Tail of *Belone krefftii* Günther, showing course of lateral line (Dutch New Guinea, RMNH, recently collected).

- b. D 15-17, A 15-18, opercles not scaled, no black spot above origin of P, origin of D usually opposite A, sometimes above 2nd to 4th ray of A, rivers of south-eastern Asia, including Sumatra and Borneo . . . . . *cancila*
- 9. a. Caudal fin with a long lower lobe (as in fig. 1), dermal keel usually present . . . . . 10
- b. Caudal fin rounded, truncate, or lunate, sometimes lower rays longer than upper rays, but not shaped as in fig. 1 . . . . . 15
- 10. a. D 25-26, A 23-24, a conspicuous appendage at the tip of the lower jaw, Indo-Pacific . . . . . *appendiculata*
- b. No appendage at tip of lower jaw . . . . . 11



Figs. 3-6. Upper surfaces of heads, showing bone structure; fig. 3. *Belone gavioloides* de Castelnau (New South Wales, BM nr. 83.11.29.82); fig. 4. *Belone ciconia* Richardson (Aden, RMNH nr. 12379); fig. 5. *Belone incisa* Valenciennes (Batavia, RMNH nr. 12140); fig. 6. *Belone punctulata* Günther (Balikpapan, ZMA).

11. a. Carina absent, D 23-27, A 25-28, teeth vertical, premaxillaries strongly elevated at base, body very slender, width more than twice in height, circumtropical . . . *hians*  
 b. Carina present, A not over 24 . . . . . 12
12. a. D 19-20, A 17-18, radiation on head as in fig. 8, tropical Pacific coasts of America . . . . . *fodiator*  
 b. D at least 20 (rarely 19), A at least 20 . . . . . 13
13. a. D 21-22, A 21, snout relatively broad and short, lower jaw protruding with a firm fleshy point, enclosing the upper jaw, teeth straight, radiation on head only on the sides of the interorbital, leaving open a deep groove which does not narrow anteriorly (fig. 6), East Indian Archipelago (known from Singapore to the Philippines and New Guinea) . . . . . *punctulata*  
 b. Not as previous . . . . . 14
14. a. D (19) 20-24, A 20-22, fairly long pointed snout with strong teeth which are curved forwards in small specimens but straighten out at a body length of about 50 to 60 cm when they also become thicker, radiation on head fanning out anteriorly, no deep median groove, upper jaw gradually becoming more slender towards the point, beak without elevation near base of premaxillaries, snout straight (fig 8), circumtropical except west coast of America . . . *maris-rubri*  
 b. D 25-26, A 22-24, teeth straight, vertical at all lengths, striae on upper surface of skull leave a wide but shallow median depression with a narrow, irregular shaped, small groove in the centre (fig. 9); upper jaw near base distinctly curved, with a distinct notch, upper jaw rather slender, Indo-Pacific *melanota*  
 c. D 23-26, A 20-23, teeth vertical at all lengths, radiation on upper surface of head rather similar to that of *maris-rubri*, but only directed forwards, no radiation sideways and backwards (fig. 7); upper jaw narrow; very close to *melanota*, but upper jaw slightly less elevated, and moreover gradually elevated without a notch, in large specimens (over 50 or 60 cm) there is a slight constriction in the upper jaw near the base, as against the slightly tapering snout of *maris-rubri*; snout usually relatively longer (about three times postorbital part of head, against only about 2½ times in *maris-rubri*, but there is overlap), Atlantic and Mediterranean . . . . . *imperialis*
15. a. Caudal rounded, the central rays longest, with one caudal near the base, a distinct black spot, scales on anterior part of back relatively large, no keel, a silvery band on the sides, eye small, 2½ to 4 in postorbital part of head, D 13-15, A 15-17, Indo-Pacific . . . . . *strongylura*  
 b. No black spot near base on caudal, caudal usually not rounded but lunate or truncate . . . . . 16
16. a. D 12-14, A 13-16, no keel, body fairly stout and roundish, scales rather large, opercles not scaled . . . . . 17  
 b. D 13-17, A 16-19, keel present or absent, body slender, not stout and round, scales smaller, opercles scaled, Atlantic and eastern Pacific . . . . . 18  
 c. D at least 17, A at least 20, no keel, Indo-Pacific and Australia . . . . . 19
17. a. D 12-13, A 13-16, scales about 135, distance of V to base of caudal much greater than distance of V to opercle, East Indies (including Philippines) . . . *urvillii*  
 b. D 13-14, A 14-15, scales about 152, base of V much closer to base of caudal than to margin of opercle, only known from the West Indies . . . *notata*
18. a. D 14-16, A 17-18, a distinct keel present, opercles entirely scaled, on the sides a silvery band, which is very wide between D and A, western coast of America from California south to Peru . . . . . *exilis*  
 b. D 13-17, A 16-19, specimens of up to about 35 cm length have no keel, larger specimens usually have the lateral line on the caudal peduncle slightly elevated, though not forming a dermal fold, which gives the appearance of a slight keel;



Figs. 7-9. Upper surfaces of heads, showing bone structure.  
Fig. 7. *Belone imperialis* (Rafinesque) (St. Maarten, RMNH, coll. Hummelinck); fig. 8. *Belone maris-rubri maris-rubri* (Bloch & Schneider) (Kamaran, Red Sea, RMNH nr. 15954); fig. 9. *Belone melanota* Bleeker (East Indies, RMNH nr. 6940, largest specimen).

base of maxillary not covered by lacrimal<sup>1)</sup>, opercles for the greater part scaled, though scales usually weak or absent on the posteroventral part of the opercles, widely distributed on both sides of the Atlantic, but not in the European Atlantic

- . . . . . *houttuyni*
19. a. Origin of D above 3rd to 5th ray of A . . . . . 20  
 b. Origin of D above 7th to 10th ray of A . . . . . 21
20. a. D 18-20, A 21-23, teeth vertical or slightly directed backwards, interorbital with on both sides strong radiations, which leave in the middle a deep groove open, which widens anteriorly (fig. 5), moreover upper surface of snout also striated, origin of D opposite 4th, sometimes 5th ray of A, eye 2.0 to 2.4 in postorbital part of head, western tropical Pacific . . . . . *incisa*  
 b. D 21-22, A 20-22, teeth almost vertical, perhaps slightly directed backwards, interorbital with two strongly radiating centres (fig. 3), origin of D opposite 3rd to 4th ray of A, eye 3.0 to 3.3 in postorbital part of head, base of maxillary covered by lacrimal, Australian seas . . . . . *gavialoides*
21. a. D 17-21, A 23-27, teeth usually directed backwards, interorbital without strong striation, origin of D above 7th to 10th ray of A, eye 2.7 to 3.6 in postorbital part of head, body not very slender, in large specimens depth of body below origin of D not over twice width of body at the same place, in small specimens depth relatively less, skull, seen from above, not very narrow, Indo-Australia . . . . . *ciconia*  
 b. D 17-20, A 22-24, teeth usually more or less directed backwards, interorbital without strong striation, origin of D above 8th or 9th ray of A, eye 3.0 to 3.4 in postorbital part of head, body very slender, in small specimens depth of body at origin of D twice its width, in larger specimens considerably more slender, depth 2.5 to 3 times width (in one specimen nearly 6 times width), eastern Asia . . . . . *anastomella*

### Genus *Belone* Cuvier<sup>2)</sup>

*Belone* Cuvier, 1817, p. 185 — type by monotypy *Esox bellone* Linnaeus.

*Strongylura* van Hasselt, 1824, p. 374 — type by monotypy *Strongylura caudimaculata* van Hasselt = *Belone strongylura* van Hasselt (note 1).

*Tylosurus* Cocco, 1833, p. 18 — type by monotypy *Tylosurus cantraini* Cocco = *Esox imperialis* Rafinesque (reference copied<sup>3)</sup>).

*Athlennes* Jordan & Fordice, 1887, p. 342, 345, 359 — introduced as a subgenus, type by original designation and monotypy *Belone hians* Cuvier & Valenciennes, raised to generic status by Jordan & Evermann, 1896, p. 717.

1) The lacrimal is usually called preorbital in systematic literature, but in agreement with Gregory (1933), I prefer to use the more specific name of lacrimal.

2) The name *Ramphistoma* Rafinesque, 1815, is apparently not applicable (cf. Regan, 1911, I have not investigated this matter). *Belone* appears already in Oken (1816) but this work has been suppressed (Hemming, 1956b).

3) Giorn. Sc. Lett. Sicilia 42, 1833, No. 124, p. 18. This is the reference as given by Sherborn (1924) and several other authors, but I note that Jordan & Fordice (1887) quote the same description as: "*Tylosurus* Cocco, "Lettere in Giornale Sci. Sicilia, xvii, 18, 1829". Also I am in doubt how Cocco actually named the species, usually one finds quoted *Tylosurus cantraini* or *Tylosurus Cantrainii*, but Sherborn calls it *Tylosaurus cantraine*. *Tylosaurus* is the name of an extinct reptile of the family Mosasauridae, hence I suggest a misprint in Sherborn's work. I much regret that I did not have an opportunity of examining Cocco's paper.

*Ablennes* Jordan & Fordice, emendation of *Athlennes*, emended by decision of the International Commission on Zoological Nomenclature (cf. Stiles, 1912).

*Petalichthys* Regan, 1904, p. 129 — type by monotypy *Petalichthys capensis* Regan = *Belone megalolepis* Mees.

*Stenocaulus* Ogilby, 1908, p. 91 — type by original designation *Belone krefftii* Günther; introduced as a subgenus, later raised to generic status by Whitley (1938) and others.

*Eurycaulus* Ogilby, 1908, p. 91 — type by original designation *Belone platyura* Bennett; introduced as a subgenus.

*Xenotodon* Regan, 1911, p. 332 — based on *Esox cancila* Hamilton-Buchanan and *Belone canceloides* Bleeker; as the latter is a synonym of the former, *E. cancila* becomes the type species of the genus by monotypy.

*Platybelone* Fowler, 1919a, p. 2 — type by original designation *Belone platyura* Bennett; introduced as a subgenus.

*Tropidocaulus* Ogilby, 1920, p. 45 — nomen novum for *Eurycaulus* Ogilby (1908), nec Fairmaire, 1868, Coleoptera; here Ogilby uses the name in a generic sense not as a subgenus.

*Thalassosteus* Jordan, Evermann & Tanaka, 1927, p. 651 — type by original designation *Belone appendiculata* Klunzinger.

*Busuanga* Herre, 1930, p. 132 — type by original designation *Tylosurus philippinus* Herre = *Belone punctulata* Günther.

*Lewinichthys* Whitley, 1933, p. 67 — type by original designation *Belone ferox* Günther = *Belone ciconia* Richardson.

*Lhotskia* Whitley, 1933, p. 67 — type by original designation *Belone macleayana* Ogilby = *Belone gavialoides* de Castelnau.

*Raphiobelone* Fowler, 1934, p. 322 — type by original designation *Raphiobelone dammermani* Fowler = *Belone ciconia* Richardson.

*Djulongius* Whitley, 1935, p. 223 — type by original designation *Belone melanotus* Bleeker.

*Dorybelone* Fowler, 1944, p. 215 — type by original designation *Belone stolzmanni* Steindachner (but probably misidentified, = *Belone platyura* Bennett). Unless and until the International Commission on Zoological Nomenclature takes a different decision, *Belone stolzmanni* Steindachner must be regarded as the type species of *Dorybelone*, notwithstanding the fact that Fowler's description applies to *Belone platyura*.

*Deltatylosurus* Martin, 1954, p. 4 — type by monotypy *Deltatylosurus guayoensis* Martin = *Belone microps* Günther. z

The genus *Belone*, in the broad sense accepted here, has repeatedly been split. For the suppression of the many monotypic genera usually erected on trivial grounds or even without apparent reason (cf. *Djulongius* Whitley, 1935), no apology is necessary. They were created in the years that a group of zoologists felt compelled to place every species into its own genus. Discussions of these monotypic genera will be found in the text dealing with the species for which they were created.

It is necessary, however, to discuss the genus *Strongylura*, as it is nowadays generally recognised, even by those who do not go so far as Fowler (1934) who divided the Belonidae in two subfamilies, the Strongylurinae and the Beloninae, and as Smith (1949), followed by Marshall (1951), who carried the inflation of the higher systematic categories so far that he split

the garfishes in several separate families (of which he mentioned Petalichthyidae and Tylosuridae).

When van Hasselt (1824) described *Strongylura*, he did not state why he considered it necessary to place his *Belone strongylura* in a new genus, whereas Cocco's *Tylosurus* was based on the presence of a keel on the caudal peduncle, a character that nowadays (for reasons unknown to me) is not considered to be of generic value (cf. Jordan & Fordice, 1887, p. 342). The distinction between *Belone* and *Strongylura* is now, as far as I am aware, exclusively based on the presence (*Belone*) or absence (*Strongylura*) of gillrakers. In my opinion far too much systematic importance is attached to this character, not only by those who consider it necessary to base sub-families or families on it, but even by those who base a generic division on it. It is true that the ordinary garfish *Belone bellone* has about twenty well-developed gillrakers. A second species, *Belone platyura*, has on the outer hypobranchial five or six fairly well developed gillrakers besides a number of rudiments. Several other species (among them *Belone krefftii*), only show some knob-shaped rudiments of gillrakers, whereas the remainder of the species, including *Belone strongylura*, have practically smooth-surfaced hypobranchials. If the genus *Strongylura* is recognised it is very difficult to decide whether *B. platyura* would have to be placed in *Belone* or in *Strongylura*. Instructive in this connection is that in literature dealing with the West Indian fauna this species is generally known as *Strongylura ardeola* (exceptions are Norman, 1935, and Fowler, 1936), whereas in literature dealing with the East Indian waters the same species is universally named *Belone platyura*. More about this is said in the discussion of *Belone platyura*.

The existence of species intermediate as regards development of gillrakers makes it advisable not to attach generic value to their presence or absence.

### ***Belone anastomella* Cuvier & Valenciennes**

*Belone anastomella* Cuvier & Valenciennes, 1846 (Aug.-Sept.), p. 331 — Chine<sup>1</sup>).

*Belone gracilis* Temminck & Schlegel, 1846 (Oct.-Dec.), p. 246 — le Japon.

*Belone esocina* Basilevsky, 1855, p. 260 — in Mari provinciam Shandun'ensem alluente.

Diagnostic characters. D 17-20, A 22-24; no gillrakers; eye fairly small, 3.3-3.5 in postorbital part of head; bony interorbital slightly wider than length of orbita (orbita 1.1-1.2 in bony interorbital); teeth more or less vertical; though the maxillary is not much arched at the base, nevertheless the beak can not be completely closed; head above striated, and skull towards the sides rounded; body slender; sides with a silvery lateral band; caudal

1) See note 2.

peduncle without a keel; C truncate or slightly lunate; origin of D above 8th ray of A.

As regards fin-formula my specimens agree with other published figures, but Tortonese (1939) mentions for three specimens caught at Yokohama D 18-20, A 24-26, which is slightly higher. Evidently more material is needed for working out the whole range of variation in numbers of finrays.

Material examined, twelve specimens, varying in total length from 21.6 to 70½ cm, standard length 20.2 to 64½ cm.

Distribution. The known distribution includes the Seas of China and Japan, the coast of eastern Siberia, but not the Philippines or the Indian Archipelago; I presume that Günther's record of India is due to confusion with *ciconia* (see discussion).

Discussion. *Belone gracilis* Temminck & Schlegel (1846) has generally been placed in the synonymy of *B. hians*, but Boeseman (1947) identified the type specimens with *B. anastomella*, remarking that "Several of these characters differ more or less from the description and the plate in the Fauna Japonica, which seem rather inaccurate. The specimens but slightly differ in a few of the just mentioned characters from the cited descriptions". Boeseman also comments upon the fact that the figure in the "Fauna Japonica", though accurately copied from a drawing sent by Bürger (not Burger as Boeseman incorrectly writes: letters from Bürger in the archives of the Leiden Museum clearly show that Bürger always wrote his name with an Umlaut), "... in some characters disagrees with our specimens...".

Actually, the description by Temminck & Schlegel, which is little more than a translation of Bürger's manuscript notes written in Dutch, and also their plate, evidently concerns *Belone hians*; not only does the number of rays in D and A agree with *hians*, but the figure clearly shows the swollen base of the maxillary and the deeply forked caudal fin with the long lower lobe, which is also mentioned in the description. I can not refrain from recalling the fact that Schlegel (1884, p. 37-38) has claimed responsibility for all vertebrate parts of the "Fauna Japonica", with the exception of the land mammals — if Schlegel had been a modest man he might have acknowledged the fact that actually he has done little more than translate Bürger's notes.

Nevertheless, there is little doubt that the two stuffed specimens of *B. anastomella* in our collection actually represent the two individuals mentioned in the last paragraph of Temminck & Schlegel's description, so that, notwithstanding their incorrect description, *B. gracilis* Temminck & Schlegel has to be placed in the synonymy of *B. anastomella* and not in that of *B. hians* as usually has been done hitherto. I have not found specimens of

*hians* collected by Bürger in our collection, so that the specimen after which Bürger compiled his description and figure was probably not preserved.

*Belone ciconia* Richardson (1846) has usually been relegated to the synonymy of this species, but incorrectly, and the species *anastomella* has, as far as I am aware, not been recorded from south of Shanghai. I have examined the specimen from "India" mentioned by Günther (1866); the specimen is small (total length 33 cm, standard length 30 cm) and in bad condition, it is labelled: "India, G. R. Waterhouse", and it seems fairly slender for *ciconia*, the depth under the origin of D being 14½ mm, the width 6 mm. I am not able to say positively to which of the two species it belongs, it may either be a *ciconia* (most likely), or it is an *anastomella* with a wrong locality attached to it. At any rate it is not justified, on the basis of this sole specimen, to extend the range of *anastomella* to India.

The type locality of *B. anastomella* was given as China by Cuvier & Valenciennes, and in the light of the knowledge that two very similar species occur along the China coast, *anastomella* and *ciconia*, a restriction of the type locality is desirable. Trying to find out where M. Gernaërt or Gernaart, who collected the type specimen, has resided, I found in Cuvier & Valenciennes (1839, p. vij):

"M. Gernaart, consul de France à Macao, nous a aussi donné de nombreux poissons de la mer de Chine, dont quelques-uns sont déjà cités dans ce volume".

Thus, we arrive at the somewhat surprising conclusion that *anastomella* has the same type locality as *ciconia*, and that this type locality is a good deal farther south than *anastomella* has ever been found with certainty. I am very much inclined to believe that *anastomella* is actually identical with *ciconia* which would leave the northern species at present known as *anastomella* without an applicable name (unless one accepts *B. esocina* for it). Unfortunately I have not been able to personally examine the type specimen of *anastomella* in the Muséum National d'Histoire Naturelle, but Madame Bauchot has done so for me and wrote (15.IV.1958) that under the origin of D the rump is 32 mm deep against 12½ mm wide. This slenderness, height 2½ times width, would point to the specimen really belonging to the northern species, and therefore I provisionally maintain the name *anastomella* for the northern species.

Basilevsky's (1855) description of *Belone esocina* is so incomplete as to be almost worthless; I place the name in the synonymy of *anastomella* on geographical grounds only, no other species of the family having been recorded from Shantung.

**Belone appendiculata** Klunzinger (Fig. 1)

*Belone appendiculatus* Klunzinger, 1871, p. 580 — Rothes Meer.

Diagnostic characters. D 25-26, A 23-24; presence of gillrakers not ascertained; orbits twice in postorbital part of head and equal to bony interorbital; teeth nearly vertical, fairly weak; maxillary definitely arched at base, and not straight but with a distinct notch connected with the forehead; base of maxillary entirely covered by the lacrimal; a conspicuous appendage at the tip of the lower jaw (see Günther's, 1909, good illustration); caudal peduncle about equally wide as deep, with an average sized blackish keel; tail forked with a long lower lobe; contrary to Günther (1909) and Fowler (1928) who copied Günther, I do not find that the head is smooth above ("Oberfläche des Kopfes flach" Günther wrote), and Klunzinger's description much more closely agrees with the individual here described: "Kopfvorn gegen den Schnabel etwas gesenkt. Stirne und Scheitel flach, in der Mitte mit schmaler seichter Längsfurche, unbeschuppt, knochig streifig". In my specimen, the striae are radiating anteriorly, closing the fairly narrow groove which is present on the posterior part of the head.

Material examined, two specimens, of which one stuffed is further mentioned below.

Distribution. Apparently an Indo-Pacific species, hitherto recorded from the Red Sea, Jayakar near Muscat, Java<sup>1</sup>), New Guinea (Bramble Cay), Solomon Islands, and Honolulu; everywhere rare.

Discussion. Apart from the mandibular appendage, this is a thoroughly typical member of the genus, and unless one wants to follow those authors who consider it necessary to put every single species in its own monotypic genus, there is not the slightest excuse for maintaining *Thalassosteus* for it. It may be remarked that the description of this genus by Jordan, Evermann & Tanaka (1927), to say the least, is unconvincing, it reads:

"This genus is an ally of *Tylosurus*, with which it agrees in general characters, differing especially in the presence of a very peculiar bony keel on the lower side of the tip of the lower jaw. This keel is about half deeper than long, its length about 1.7 in eye. The bones in this genus are all intensely green in life, the color more intense than in any other of the *Belonidae*. The dorsal and anal are many-rayed, the anterior lobe of each high and falcate".

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<sup>1</sup>) A single stuffed specimen, labelled "Kuhl & Van Hasselt, Java, RMNH nr. 1883", total length 75 cm, standard length 68 cm, snout (from top to orbita) 132 mm, orbita 27 mm, bony interorbital 27 mm, postorbital part of head 52 mm, origin of D above 3rd ray of A.

To begin with, characters common to many members of a family and not at all peculiar to one species or genus (the remark about the many-rayed and falcate D and A) should not be mentioned in a generic diagnosis. Furthermore, the diagnosis was based on a single specimen, bought in the market at Honolulu, and therefore the authors should have stated how they could ascertain what the bone-colour in life was. They also incorrectly ascribe the authorship of the name *appendiculata* to Günther instead of to Klunzinger.

Neither Bleeker (1871) (note 3), nor Weber & de Beaufort (1922) list this species though the stuffed specimen mentioned above must have been present in Leiden since a long time; as the species has been recorded from localities in both the Indian and the Pacific Ocean, its occurrence in the Indian Archipelago is not unexpected.

Hitherto only large specimens are known. Klunzinger (1871) mentions material from 47-100 cm in length, Günther's is "36 Zoll", the specimen procured by Jordan, Evermann & Tanaka was 105 cm, and the Java fish is 75 cm.

### **Belone bellone** (Linnaeus)

[*Esox*] *Bellone* Linnaeus, 1758, p. 314 — in *Oceano Europaeo*.

*Belone acus* Risso, 1826, p. 443 — (not available).

*B[elone] vulgaris* Fleming, 1828, p. 184 — United Kingdom.

*Belone rostrata* Faber, 1829, p. 152 — Island.

*Hemiramphus europaeus* Yarrell, 1837, p. 507 — Felixtow, Suffolk.

*Belone gracilis* Lowe, 1839, p. 86 — Madeira.

*Hemiramphus balticus* Hornschuch in Hornschuch & van der Hoeven, 1843, p. 299 — Kiel.

*Hemiramphus Behnii* van der Hoeven in Hornschuch & van der Hoeven, 1843, p. 300 — Kiel.

*Belone vulgaris* Cuvier & Valenciennes, 1846, p. 296 — l'Océan européen.

*Belone II radiata* Budge, 1848, p. 384 — no locality = probably North Sea.

*Hemiramphus ? obtusus* R. Q. Couch, 1848, p. 1978 — Mount's Bay (Cornwall).

*Belone Linnei* Malm, 1866 (or 1877: "Malm, Fauna, p. 553" cf. Day, 1880-1884, vol. II, p. 147) — (not available).

*Belone euxini* Günther, 1866, p. 252 — Black Sea.

*Belone cornidii* Günther, 1866, p. 255 — coast of Portugal.

Diagnostic characters. D 16-18, A 20-22; gillrakers well developed, about 5 + 1 + 18-22, besides rudiments, rather slender; small specimens have fine teeth, larger specimens have much larger teeth; teeth in young specimens often slightly curved forwards, later vertical; number of teeth on middle part of maxilla normally 8 to 11 in an orbit's length; vomerine teeth usually present (perhaps absent in small specimens?); upper jaw slightly arched near base; upper surface of skull rounded; opercle decidedly longer than cheek; no keel on caudal peduncle; caudal forked with lower lobe usu-

ally the longer, but the lobes pointed, not rounded as in a number of other species of the genus.

Material examined, 23 specimens, varying in standard length from 30 to 70 cm.

Distribution. Known from the northeastern Atlantic, north to Iceland (Faber, 1829) and, occasionally, the White Sea (Svetovidov, 1955); Baltic, Mediterranean and Black Sea; south to the latitude of Mauritania, where repeatedly recorded from the Baie du Lévrier.

Discussion. Recently the discussion on the validity of geographical races from the Black Sea and the Mediterranean was reopened by Svetovidov (1955), who believes to be able to distinguish three races as follows:

1. *Belone belone belone* (Linné). D II. 14-17 (probably misprint for D II. 14-17), A II. 17-20, vomerine teeth nearly always present, teeth of the interior row on both jaws well developed, rather widely spaced, in the middle of upper jaw 7 to 12 teeth in a longitudinal diameter of the eye, usually 9-11; Atlantic Ocean, Baltic, occasionally White Sea.

2. *Belone belone euxini* Günther. D II. 14-17, A II. 17-21, vomerine teeth very often present, teeth on the inner row of both jaws larger and wider spaced, on middle part of upper jaw 6-10, usually 7-8 teeth. Black Sea and Western part of Sea of Asov.

3. *Belone belone acus* Risso. D II. 14-16, A II. 18-20, teeth weak, on vomer usually absent, teeth on inner row of both jaws weak, often sessile, in middle of upper jaw 8-19, usually 10-16 teeth in an eye's diameter. Mediterranean and adjacent parts of Atlantic.

My own findings do not agree with those of Svetovidov; first about the vomerine teeth.

Svetovidov's material consisted of 11 specimens of *belone*, varying in length from 70 to 75 cm, and a single one of 94 cm, weight up to 1 kg; of these 11 specimens, only one lacked vomerine teeth. Of *euxini* 27 specimens were examined, of which 16 had vomerine teeth; they measured up to 60 cm, the majority 30 to 40 cm, weights 20 to 70 gr. Of *acus* out of 8 specimens, 6 lacked vomerine teeth; length 40 to 70 cm, weight up to 2 kg. As regards *acus*, however, it is not quite clear whether the author has personally examined specimens, or has compiled data from literature. The recorded weight of *acus*, of up to 2 kg, has almost certainly been taken from literature, as it is most unlikely that specimens of no more than 70 cm would attain this weight, while a specimen of *belone* of 94 cm weighed only 1 kg.

In my opinion some criticism is possible; to begin with, specimens of similar sizes should have been compared, for, though lack of material prevented me from ascertaining this beyond doubt, there are indications that large

specimens nearly always have vomerine teeth, whereas in small specimens these may still be absent. As regards the difference in size of teeth, small specimens from all parts of the range of the species often have densely implanted very fragile teeth; these apparently increase in size later. The number of teeth in an eye's diameter is, as far as my measurements go, 8-11 in four specimens from the Black Sea (including the type of *euxini*), 11 in one from Syra, Greece; 9 in one from Haifa; 14 in a small specimen with fine teeth from Malta; 9 and 9 in two from Zara; 9 in one from Lisbon; 8-10 in three from London.

Moreover, the name *acus* Risso given by Svetovidov is preoccupied by *Sphyraena acus* La Cepède: though the latter name cannot be identified specifically, there is no doubt that it is a *Belone*. If Svetovidov's views are accepted, the name *acus* should therefore be replaced by *gracilis* Lowe. Personally, however, I see no basis for recognising geographical races in the species; such geographical variation as may be present in the characters indicated by Svetovidov is too slight to be expressed in nomenclature.

It is surprising that, in all recent literature known to me, with but a single exception (Bertin, 1946), the species is called *Belone belone* (L.), for Linnaeus (1758) actually described it as *Esox Bellone*. In my opinion *Bellone* cannot be dismissed as a misprint, it was retained in several other editions and translations of the *Systema Naturae*; moreover the word may have been derived from either of two sources. *Belōnē* (βελόνη) in Greek was the name of a kind of fish with a pointed snout, though it is by no means certain that it is the name of the garfish; *Bēllōnā* on the other hand is the name of a war goddess, who was armed with a spear. It may be that Linnaeus, when he gave the name, did not have in mind the ancient name for a fish, but the name of the spear-bearing goddess. I note that Lesueur (1821) wrote the generic name *Belona* instead of *Belone*, he may have held the same opinion. My conclusion is therefore that there is no convincing evidence that *Bellone* is a misprint, and that it cannot be automatically emended. Therefore the European garfish must be known as *Belone bellone* (Linnaeus).

The fact that young of this species have the maxilla undeveloped, so that they show a superficial resemblance to Hemiramphidae, has caused a lot of discussion and has contributed considerably to the synonymy (Yarrell, 1837; Lowe, 1839; J. Couch, 1842; van der Hoeven, 1843; Hornschuch & van der Hoeven, 1843; R. Q. Couch, 1848). Though the true identity of these larvae has now been recognised for well over a century, the juveniles of several other species have recently been described and named on the basis of similar characters (see p. 24 and 42-43).

**Belone cancila** (Hamilton-Buchanan)

*Esox cancila* Hamilton-Buchanan, 1882, p. 213, 380, p. XXVII fig. 70 — ponds and smaller rivers of Gangetic provinces.

*Belone Graii* Sykes, 1839, p. 60; 1841, p. 367, pl. 63 fig. 4 — Mota Mola River, at Poona.

*Belone canciloïdes* Bleeker, 1853, p. 454 — Pontianak, in flumine Kapuas, Pangaboelang, provinciae Lampong, Sumatrae austro-orientalis, in fluviis.

*Esox (Belone) Hindostanicus* Falconer, 1868, p. 589 — nullahs and stagnant waters at Suharunpoor.

Diagnostic characters. D 15-18, A 15-19; no gillrakers; eye rather small, 2.5 to 3.0 in postorbital part of head; cheeks long as in other freshwater species, opercles 1.7 to 2.0 in cheeks; base of maxillary not entirely covered by lacrimal; a silvery lateral band; no carina on caudal peduncle; tail truncate; origins of D and A usually opposite each other, but in a very few of the examined specimens D originates slightly in advance of A, and in many specimens D originates slightly behind the origin of A, above the 2nd or 3rd anal ray.

Material examined, 22 specimens, varying in total length from 14.2 to 29.5 cm, standard length 13.0 to 27.0 cm.

Distribution. Rivers of India, Ceylon, Burma, Malaya, Siam (Bangkok), Sumatra and Borneo.

Discussion. Perhaps it is justified to recognise *canciloïdes* as a valid race. When Bleeker (1853) described his alleged species, he noted: "Deze soort heeft in habitus het meest van *Belone cancila* CV. van de zoete wateren van Hindostan, doch is voldoende herkenbaar aan de lengte van bek en kop, de hoekig bolle staartvin, de achter de eerste aarsvinstralen beginnende rugvin, den ongekielden staart, enz." Günther (1866) gives as only important difference between *cancila* and *canciloïdes* the position of the dorsal fin, of which he states in *canciloïdes*: "The first dorsal ray is opposite the third or fourth of the anal fin". Personally I found that in specimens from India and Burma, D and A always are opposite each other. Specimens in which D originates decidedly behind A are confined to the southeastern part of the range of the species (*canciloïdes*). Unfortunately, I have examined but few specimens of *canciloïdes* and in several of these D and A are also opposite each other or practically so. Instructive are five specimens from R. Tembeling, Malay Peninsula, leg. Kloss, BM nr. 1922.4.19.95-99; of this lot, in two specimens D is exactly opposite A, in two specimens the origin of A is under the 2nd ray of D (therefore D is in advance of A, a situation only found in typical *cancila*), and in one the origin of D is above the 3rd ray of A (typical for *canciloïdes*). Whether or not this is a question of two

subspecies intergrading, I am unable to judge, not knowing the range of variation found in Sumatra and Borneo.

Myers (1960) has recently drawn attention to the synonym *Esox Hindostanicus*.

Regan (1911) created for *B. cancila* the special genus *Xenentodon*. It is based on a difference in the pharyngeals, a difference that is well illustrated by Weber & de Beaufort (1922, figs. 48 and 51). As I have not anatomically studied any member of the Belonidae, I am not able to judge the systematic value of this character, but now that the number of species of *Xenentodon* has been reduced to one, there is, at least from a practical point of view, nothing to be gained by admitting the genus, and as in external morphology *B. cancila* is a normal garfish, I think it advisable not to retain the genus.

**Belone ciconia** Richardson (Fig. 4; Pl. 1, figs. 1, 2)

*Belone ciconia* Richardson, 1846 (early), p. 264 — Canton.

*Belone leiurus* Bleeker, 1850, p. 94 — Batavia.

*Belone tenuirostris* Blyth, 1858, p. 287 — Sandheads, at the mouth of the Hughli.

*Belone ferox* Günther, 1866, p. 242 — Sydney.

*Belone natalensis* Günther, 1866, p. 243 — Port Natal.

*Raphiobelone dammermani* Fowler, 1934, p. 322 — Taal Anchorage, Luzon.

Diagnostic characters. D 17-21, A 23-27; no gillrakers; eye rather small, 2.7 to 3.6 in postorbital part of head; teeth usually directed backwards, but variable and sometimes almost vertical, straight; bases of maxillaries partly free, not entirely covered by lacrimal; upper surface of head without very strong stiae (fig. 4); a vertical black streak over the posterior part of the cheek; a silvery lateral band on the body which becomes wide posteriorly; caudal peduncle roundish or slightly compressed, without carina; tail truncate; origin of D above 7th to 10th ray of A.

Material examined, 21 specimens, varying in total length from 31 to 77 cm, standard length 28 to 71½ cm.

Distribution. Indo-Australia, where known from all parts of the Indian Ocean, the Indian Archipelago, the Philippines, New Guinea and eastern Australia; recorded from as far north as Formosa (Chen, 1951) and Guam (Fowler, 1928), and from near Canton.

Discussion. Günther (1866, p. 249) placed the name *ciconia* with a query in the synonymy of *anastomella*, where it has remained since. Jordan & Starks (1903, p. 532) noted in their discussion of *Tylosurus anastomella* that: "It is not certain that the name *anastomella* is prior to *ciconia*, but the description is better". These quotations show that there have been two difficulties as regards the name *ciconia*, the first being doubt about the identity

of the species described by Richardson, the second about the date of publication, whether or not it had been published prior to Cuvier & Valenciennes's name *anastomella*, both works (Cuvier & Valenciennes and Richardson) having been published in 1846.

Fortunately both questions can be solved. As regards the priority question, Cuvier & Valenciennes (1846, p. viij), in the introduction of their work which is dated April, 1846, write: "M. Richardson a poursuivi en Angleterre la publication des riches matériaux rapportés par le Sulfur . . . Il a donné un rapport fort intéressant sur l'ichthyologie des mers de Chine et du Japon. Ce sont de précieux documens à ajouter à ceux que ce savant a déjà fourni à l'ichthyologie". This makes it evident that *B. ciconia* has priority over *B. anastomella*.

Remains the problem of the identity of *ciconia*. Richardson's description is not very satisfactory, but it was entirely based on Reeves's plate nr. 186. Fortunately Richardson's own copy of Reeves's plates, and also a second set of these plates, are present in the British Museum (Natural History), where I had the opportunity to examine them. Though one of the two plates is a copy of the other, they do not fully agree in particulars (numbers of rays in D and A), a fact I shall try to explain below. Through the courtesy of Mr. Wheeler I am able to reproduce the two figures (Pl. I, figs. 1, 2). The important features in both fishes are (as also mentioned by Richardson), the fact that the origin of D is considerably behind that of A, being above the 7th or 8th ray of A, the absence of a keel on the caudal peduncle, the slightly lunate caudal fin, and the rather small eye, which is more than 3 times in the postorbital part of the head. In Richardson's plate I count D 21, A 31, in the other plate D 19 and A 28. Now the small eye and particularly the place of origin of D so far backwards, show that the plates can represent only either of the two species hitherto known as *anastomella* and *leiura*. The only difference exists in the length of the anal fin. Whereas the D 19 and D 21 both fall within the range of variation I found in specimens ascribed to *leiura*, and at least the D 19 is also within the range of variation of *anastomella* (D 17-20 in the few specimens I examined), the anal fins are shown considerably longer than in either of these species. The reason is evident: the Chinese artist correctly drew the origin of D above the 7th or 8th ray of A in both drawings. To make D and A end at the same place, opposite each other, he was forced, having drawn all rays at about the same distance apart, to make the anal fin at least 7 or 8 rays longer than D.

There is no doubt whatever that the plates represent either *anastomella* or *leiura*. But the difference between these two species can, as far as I have

been able to ascertain, only been seen in dorsal view, not in lateral view, so that from the plates it is impossible to reach a definite conclusion. Fortunately, however, there are in the British Museum collection two specimens in spirits from the Reeves collection, and also one stuffed specimen. Particularly as *anastomella* and "*leiura*" have never been shown to co-occur anywhere and may be geographical representatives of the same species, it is almost certain that they belong to the same species as the fish represented on the drawing. These specimens were listed by Günther (1866) as *anastomella*.

As regards this identification I cannot agree with Günther, for though the bodies of the two specimens are fairly slender, they are not too slender for *leiura* (depth below origin of D twice its width in both specimens), and they have the fairly broad skulls characteristic of *leiura*. I do not hesitate, therefore, to assign them to *leiura*. The stuffed specimen I have not personally examined, but Mr. Wheeler has compared it for me with both species and wrote (20.III.1958) that it doubtless agrees with *leiura* and not with *anastomella*.

There is also a geographical element. *B. leiura* is known to the north only as far as Formosa; *anastomella* on the other hand is a northern species which is apparently common in Japan and in the Yellow Sea. The southernmost record I have is from Shanghai. It is very unlikely that the species goes as far south as Macao, where Reeves resided. In view of the fact that Reeves's extant specimens all belong to *leiura*, and that *anastomella* is not even known to occur at Canton and Macao, I feel justified in claiming *ciconia* to be an older name for *leiura*, which it must replace. Perhaps I might have made an effort to identify it with *anastomella* if this would have assisted in stabilizing current nomenclature, but as I have shown above, *ciconia* also antedates *anastomella*, so that a nomenclatorial change was anyhow unavoidable.

The two cotypes of *Belone natalensis* Günther (1866) are thoroughly normal specimens of *ciconia*; Smith (1949, p. 130) already reduced the name to a synonym. Before examination of the type specimen, I expected *Belone ferox* Günther (1866) to be a valid species, and it came as rather a surprise to me that the type appeared identical with *ciconia*. There are only three specimens from eastern Australia which I have been able to examine, they have D 21, A 26 (type), D 21, A 27, and D 21, A 27; in literature (Ogilby, 1893; Whitley, 1933) the number of rays is given as D 21-22, A 25-26. Since writing this I have examined a specimen in the Australian Museum (labelled *Strongylura terebra*), from Lindeman Island, Queensland, regd. no. I. A. 6597 which has D 20, A 24; this is very low for the east coast of Australia. In the specimens from the Indian Ocean and the western part of the Indian

Archipelago on the contrary I found D 17-20, A 23-25, slightly but distinctly lower. A single recently-taken specimen from near Merauke, southern Dutch New Guinea, in the Leiden collection has D 21, A 25. Though the evidence is admittedly slight, this suggests a gradual increase in ray-numbers when moving to the southeast rather than any abrupt change and for this reason I prefer for the moment not to subspecifically distinguish the specimens from eastern Australia.

Not having examined the type material, it is with some hesitation that I add *Raphiobelone dammermani* Fowler (1934) to the synonymy of *ciconia*, but "this well-marked genus" (Fowler, 1934) appears to agree with *Belone ciconia* in almost all important characters: D 20, A 25, origin of D above 9th ray of A, slenderness, silvery lateral band, truncate tail, eye rather over three times in postorbital part of head, etc. In his description Fowler confusingly says "Eye rather large", in the figure it is comparatively small. There remain only two characters that would separate *dammermani* from *ciconia*, viz. the caudal peduncle, said to be broadly depressed, its width much greater than its depth, and the short upper jaw. Both are probably juvenile characters: in *Belone bellone*, as is wellknown, the upper jaw is often considerably shorter than the lower jaw, such specimens have been called *B. gracilis* Lowe (1839). I have seen specimens of *B. bellone* of much larger size than the type of *Raphiobelone dammermani* (which is only 162 mm), which still have a short upper jaw. The largest specimen labelled "*gracilis*" in the British Museum (BM 37.12.19) is 43 cm in total length, its snout to the tip of the upper jaw is 89 mm, to the tip of the lower jaw 109 mm; it does not differ in any other respect from normal specimens of *B. bellone*.

Very recently Kamohara (1957, 1958) recorded this species, under the name of *Tylosurus leiurus*, from Urado Bay, Kochi, Prov. Tosa, Japan. Though Kamohara (1957) gave a fairly comprehensive description of his material, no characters are mentioned which would distinguish his specimens from *anastomella*, reference to which species is altogether omitted. Therefore I feel obliged, as long as no actual comparison has been made, to query Kamohara's identification. This question is particularly important in the case of these two very similar species, as hitherto there is no proof that anywhere they occur together; in other words, it is quite well possible that *anastomella* is a geographical representative of *ciconia* which in future will be found to deserve subspecific status only. On the basis of the evidence at present available to me, I feel disinclined to extend the range of *ciconia* nearly 1000 km north of Formosa to include southern Japan.

**Belone exilis exilis** Girard

*Belone exilis* Girard, 1854, p. 149 — San Diego.

Diagnostic characters. D 14-16, A 17-18; no gillrakers on first hypobranchial; eye rather small, 3.2 in postorbital part of head; base of maxillary for the greater part visible, not covered by lacrimal; opercle entirely scaled; a silvery lateral band over the entire length of the body, anteriorly narrow, but very broad under D; carina on caudal peduncle; tail forked, with upper and lower lobes equal; origin of D above 5th ray of A.

Material examined, three specimens, varying in total length from 29½ to 54 cm, standard length 26½ to 48 cm.

Distribution. Known from off the Californian coast, from San Francisco to Magdalena Bay.

Discussion. As this is the only species occurring off the coast of California, it has remained gratifyingly clean of synonyms unless the colour characters used to separate *stolzmanni* might prove to be invalid.

**Belone exilis stolzmanni** Steindachner

*Belone Stolzmanni* Steindachner, 1878, p. 397 — Stiller Ocean bei Tumbez.

*Tylosurus sierrita* Jordan & Gilbert, 1882, p. 458 — Mazatlan.

*Strongylura peruana* Fowler, 1919a, p. 3 — Callao Bay, Peru.

Diagnostic characters. I have not examined specimens of this form, which must be very close to *B. exilis*; but according to Jordan & Fordice (1887, p. 349) it differs in "the marked coloration of the pectorals". The colour characters are probably sufficient to uphold *stolzmanni* as a subspecies, at any rate I am not in a position to judge its validity.

Distribution. Pacific coasts of tropical America from Mazatlan south to Peru.

Discussion. I am in doubt about the identity of *Strongylura peruana* Fowler, but as Fowler (1919a) especially states that his species is very close to *B. exilis*, and as he does not even mention *stolzmanni* or *sierrita*, the existence of which names he apparently overlooked, I consider it likely that *peruana* is a synonym.

Fowler's (1944) interpretation of *B. stolzmanni* would make this name a synonym of *B. platyura* but at present I am not prepared to accept this change as it does not seem to be well founded. It may be noted that Fowler (l.c., p. 413) first gives a description of *Belone platyura* which he incorrectly calls *Dorybelone stolzmanni*, and subsequently claims that specimens listed as *stolzmanni* by previous authors must have been misidentified because their descriptions do not agree with his material. It is also difficult to understand

why Fowler in his description of *Dorybelone* entirely failed to mention *Belone platyura* or the genus *Platybelone* created by himself for that species.

As is apparent from the publications of Fowler (1945) and Hildebrand (1946) — the last-mentioned author incorrectly states that only a single species of garfish is known from Peru — this part of the world is very insufficiently known as far as the Belonidae are concerned.

### **Belone fluviatilis** Regan

*Belone fluviatilis* Regan, 1903, p. 626 — rivers of N.W. Ecuador.

Diagnostic characters. D 15-16, A 16-18; no gillrakers; teeth vertical or very slightly backwards; eye 2.9 to 3.4 in postorbital part of head; cheeks long, about double the length of the opercles; opercles entirely scaled; a black blotch above base of P; a silvery lateral band which anteriorly is narrow, and posteriorly becomes wide; origin of D above 5th to 7th ray of A.

Material examined, five specimens, varying in total length from 37½ to 49½ cm, standard length 34 to 45 cm.

Distribution. Rivers of Ecuador and Colombia west of the Andes. Localities of specimens examined are: Rio Calcina, Colombia; Andagoya, R. San Juan, Colombia; R. Sapayo, N.W. Ecuador; Rio Durango, N.W. Ecuador, 350 ft. Eigenmann (1922) mentions a number of additional localities.

Discussion. In its description this species was compared with *Belone scapularis* from which, however, it may be distinguished at once by its long cheeks, a character not mentioned by Regan (1903); in the single specimen of *scapularis* I could examine the length of the cheek was only 1.3 times that of the opercle.

### **Belone gavialoides** de Castelnau (Fig. 3)

*Belone gavialoides* de Castelnau, 1873, p. 142 — Fremantle [recte: Fremantle].

*Belone Groeneri* Klunzinger, 1880, p. 414 — P. Darwin.

*Belone gracilis* Macleay, 1881, p. 243 — Port Jackson.

*Belone macleayana* Ogilby, 1886, p. 53 — nomen novum for *Belone gracilis* Macleay, nec *Belone gracilis* Lowe, 1839; nec *Belone gracilis* Temminck & Schlegel, 1846.

*Tylosurus impotens* Ogilby, 1908, p. 89 — Moreton Bay, Queensland.

*Belone staigeri* Whitley, 1933, p. 67 — Moreton Bay.

*Belone tyrannus* Whitley, 1933, p. 67 — Moreton Bay.

*Belone vorax* Whitley, 1933, p. 67 — Moreton Bay.

*Tylosurus howesi* Whitley, 1933, p. 67 — Moreton Bay.

*Tylosurus thomasonia jacobus* Whitley, 1933, p. 67 — Moreton Bay<sup>1)</sup>.

1) There is every reason to reject this name as being not binary.

It is quite obscure to me what purpose Whitley (1933) had in mind when he validated the nomina nuda of Saville-Kent and others. Whitley includes *Tylosurus thoma-*

Diagnostic characters. D 21-22, A 20-22; no gillrakers; eye 3.0 to 3.3 in postorbital part of head and about 1.7 in bony interorbital; teeth rather irregular, perhaps directed slightly backwards; beak practically closes at base; base of maxillary almost entirely covered by lacrimal, only a narrow lower edge free; upper and lower jaws of about the same length; characteristic pattern on upper surface of head, with striae radiating from two centres (fig. 3); opercles not scaled; body slender; if a silvery band has been present, this was no longer visible in the material examined; no keel on caudal peduncle, but lateral line there well developed; tail lunate, with lower rays perhaps slightly the longer; P with dark tip; origin of D above 3rd or 4th ray of A.

Material examined, five specimens, varying in total length from 48 to 72 cm, standard length 44 to 65 cm.

Distribution. Australian waters. Coasts of Queensland and New South Wales, Western Australia and, if the synonymy as quoted above is correct, also Port Darwin, Northern Territory.

Discussion. The synonymy as given above is in need of confirmation as an almost total lack of material from Australia made it impossible for me to arrive at any definite conclusions. It is quite well possible that I have gone too far in placing all the names listed in the synonymy of *B. gavioloides*.

The description given above was drawn up mainly after two specimens in the British Museum, both misidentified as *Belone ferox* Günther, and originating from Port Jackson and New South Wales (without exact indi-

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*sonia jacobus*, without giving a proper reference, but accidentally I found Napier's (1928) book, from which I quote the following passage:

"We had seen, too, an occasional "Long Tom" or "Skip-Jack", a fish whose scientific name I am glad to say I did not have thrust upon me, for I am sure it would have been some polysyllabic absurdity, as impossible to pronounce as to remember. 1) But "Long Tom" suits him down to the ground — or to the water. For he is a long, thin, pike-like chap, clad in a livery of silvery green, who skims along the surface of the waves with the tip of his tail just hidden beneath the water, and his head held most pridefully upright. How he does it I know not; but in this almost vertical position he covers quite a distance before his natural element reclaims him." and a footnote: "1) I knew it! A scientific acquaintance, reading these notes in MS., tells me the unfortunate beast has been labelled — libelled I say — with the ridiculous name of *Tylosurus*. As my informant seemed proud of this crime, I place it on record here to shame him — if possible. And *Tylosurus*, mind you, is only the poor thing's family title. What his Christian name is even my scientist didn't dare tell me. So we'll let it go at *Tylosurus Thomasonia Jacobus*."

Perhaps it is a waste of time to give this name so much attention, but I have to point out that, Whitley's statement to the contrary, it is definitely not a nomen nudum. On the other hand the name was evidently given by a person who had not the slightest understanding of scientific nomenclature, and I have no hesitation in rejecting it as being non-binary.

cation of locality); they measure 67 cm and 70½ cm respectively in total length; their finray numbers, D 21, 21, and A 20, 20, are slightly different from the number (D 22, A 23) given by de Castelnau (1873) for the type of *B. gavioloides*; on the other hand Whitley (1945) records for two specimens from Dirk Hartog Island and Point Cloates D 21, A 21. Again, having not seen any material from Western Australia, I am not able to judge if the Western Australian species is perhaps different from an eastern Australian species, but de Castelnau's description fits the specimens examined fairly well, and particularly the fact that de Castelnau mentions: "...upper part of the head flat and impressed with two large radiating impressions... an elongated space in front of the eyes is covered with small scales", causes that I assign my eastern Australian specimens with some confidence to *B. gavioloides*.

This view being taken, I consider it likely that the description of *B. gracilis* Macleay pertains to the same species. *Tylosurus impotens* was placed in the synonymy of *Belone macleayana* (nomen novum for *B. gracilis* Macleay) by Ogilby (1918), McCulloch (1929) and Whitley (1933); I follow them without comment. The five names introduced by Whitley (1933) are objective synonyms of *Tylosurus impotens*. Remains *Belone groeneri*. Whitley (1945, p. 13) placed the name in the synonymy of *B. gavioloides* and he may well be right. On the other hand, Port Darwin lies decidedly in the tropics, and there is a possibility that some other species (*B. punctulata*?) might be concerned. According to Klunzinger (1880) the type of *B. groeneri* is in the Stuttgart Museum. I have written to Professor Schüz for information about the specimen, to which he answered (22.II.1958):

"Wie Sie wissen, haben wir leider Material der Studiensammlung im Krieg verloren. Da die Alkohol-Präparate zum grossen Teil erhalten blieben, hofften wir, Ihnen trotzdem dienen zu können. Nun ist der Umzug unseres Alkohol-Kellers in die neuen Räume noch nicht möglich gewesen, und die engen Regale sind so unübersichtlich voll gepackt, dass wir eine endgültige Durchsicht erst im Lauf des Sommers vornehmen können. Wir haben uns zwar in zwei Arbeitsgängen bemüht, alle Teile durchzusehen, in denen *Belone* stehen könnte, doch war dieser Versuch erfolglos".

Therefore, it is, for the moment, impossible to clear the status of *B. groeneri* beyond doubt, but the type is likely to turn up again before long, so that its identity may be finally settled.

In the Australian Museum I examined three additional specimens; one from Lake Macquarie, N.S.W. (regd. no. 1.1140), D 21, A 21; one from the Northern Territory (I.B. 475), D 21, A 20; and one from Hayman Island, Queensland (I.A. 6010), D 22, A 22. The specimen from the Northern

Territory forms a confirmation of the occurrence of the species in that area, and of the synonymy of *groeneri* with *gavialoides*.

***Belone hians*** Cuvier & Valenciennes (Pl. I, fig. 3)

*Belone hians* Cuvier & Valenciennes, 1846, p. 321, pl. 548 — côtes de Bahia.

*Belone melanostigma* Cuvier & Valenciennes (ex Ehrenberg MS), 1846, p. 334 — Massawah.

*Belone schismatorhynchus* Bleeker, 1850, p. 95 — Batavia.

*Belone maculata* Poey, 1860, p. 290 — no locality (= Havana).

*Mastacembelus fasciatus* Bleeker, 1873, p. 154 — China (no locality is given in the original description, but based on "peintures chinoises de poissons").

*Tylosurus caeruleofasciatus* Stead, 1908, p. 3 — Port Stephens.

*Ablennes pacificus* Walford, 1936, p. 4 fig. 1 — W. coast of Mexico.

Diagnostic characters. D 23-27, A 25-28; no gillrakers; a long and pointed snout with vertical teeth; base of maxillary strongly elevated, consequently the mouth cannot nearly be entirely closed; body slender, more than twice as high as wide; no elevated carina on caudal peduncle; tail forked with long lower lobe; body in preserved specimens usually with more or less visible vertical bands.

Material examined, ten specimens varying in total length from 12.3 to 85.5 cm, standard length 11.2 to 77.5 cm.

Distribution. Tropical seas, known from both sides of the Atlantic, Red Sea, Indian Ocean, Indian Archipelago and Pacific Ocean, north as far as Japan.

Discussion. The now almost universally accepted genus *Ablennes* (in the original description *Athlennes*, which was emended by decision of the International Commission on Zoological Nomenclature, cf. Stiles, 1912) was originally introduced as a subgenus (Jordan & Fordice, 1887), and therefore Herre (1953, p. 147) is not quite right when he cites: "*Athlennes hians* Jordan & Fordice, Proc. U.S. Nat. Mus., vol. 9, p. 342, 1887". On the page referred to by Herre the said authors only list: "ATHLENNES, subgenus nova (*hians*)", whereas on p. 357, not mentioned by Herre, an elaborate discussion on the species is given under the name *Tylosurus hians*. However this may be, the distinguishing characters of the genus, as given in literature, are only the slender build and the elevation of the premaxillaries near the base. As elevated maxillaries are also found, though slightly less pronounced, in *Belone melanota*, *B. appendiculata*, *B. bellone* (which has, however, a somewhat different structure of these parts), and indications of these elevations are found in other species, there is no reason to raise the importance of this character to the generic level. This would leave for the genus *Ablennes* only the slender build with depth of body twice its width. Quite apart

from the fact that this in itself would in my opinion certainly not justify generic distinction, there are other species which, if not equal, at least approach *B. hians* in slenderness of build. Kamohara (1958) actually included a second slender species in the genus under the name of *Ablennes anastomella*.

Bleeker (1873) named a number of species of fishes on the basis of drawings (p. 113): "Les matériaux ayant servi de base au mémoire actuel sont les belles peintures chinoises de poissons, dont j'ai parlé dans la „Notice sur les peintures chinoises de Cyprinoïdes déposées au Musée de l'université de Groningue par M. J. Senn van Basel" et qui m'ont été confiées, sur la proposition de M. le professeur Salverda, par la générosité de M. le professeur Enschedé, bibliothécaire de la dite université". Amongst these is *Mastacembelus fasciatus* Blkr. (note "cc"), diagnosed as follows (p. 154): "Corpus altitudine 13 circ. in ejus longitudine. Capitis pars praeocularis 4 fere in longitudine totius corporis. Pinnae, dorsalis et analis sub-aequales, antice quam medio et postice multo altiores, caudalis biloba. Corpus maculis fuscis in series 2 longitudinales dispositis, maculis serie superiore dorsalibus anterioribus fascias transversas simulantibus, maculis serie inferiore lineae ventrali approximatis rotundis. D. 20? A. 18?". Dr. Boeseman has found the original drawing amongst Bleeker's notes and manuscripts in the Leiden Museum, and it represents without any doubt a *Belone* (Pl. I, fig. 3). The colour is whitish, with two yellow longitudinal bands; beak green, upper surface of head red; D, A and V yellowish-green, distally becoming slate blue; P and C darker. The species it not easy to determine; the drawing has evidently been made by an artist who, though he may have been reasonably skilled, had no idea of the requirements of western science, and the characters this fish shows, D about 19, A about 17, origin of D opposite origin of A, caudal fin forked with both lobes equal, are not found in any known species, hence I do not attach much significance to them. However, the cross-bands and markings are shown very clearly, and as only *Belone hians* has bands like that I regard it as justified to assign *Mastacembelus fasciatus* to its synonymy. Supporting evidence for this identification is found in the apparent absence of a carina on the caudal peduncle, and in the fact that the origins of D and A are opposite each other. In *B. hians* the origin of D is only slightly behind that of A; in the other common Chinese species *B. anastomella* and *B. ciconia* the origin of D is so far behind that of A that it is unlikely that the Chinese artist would have failed to observe it. The matter of the identity of *Mastacembelus fasciatus* Bleeker is not really of great importance as the name is a homonym of *Belone fasciata* Cuvier & Valenciennes.

*Tylosurus caeruleofasciatus* Stead has been recognised as a synonym by previous authors, though others, notably Whitley, stubbornly maintain the name to this day. In the very full description Stead does not make any comparison with other species, apart from the following: "I might add that, judging by published descriptions . . . this species will be found to be most nearly allied to the somewhat tropical *Tylosurus schismatorhynchus* (Bleeker)". The fact that *schismatorhynchus* was "somewhat tropical" apparently effectively ruled out in Stead's mind the possibility that it might be identical with *caeruleofasciatus*.

Schultz (1943) has already shown that *Ablennes pacificus* Walford is a synonym, though subsequently Fowler (1944) maintained the name as a subspecies; it is also a homonym when the genus *Ablennes* is no longer recognised, being preoccupied by *Belone pacifica* Steindachner, 1876. That the Atlantic and Indian specimens belong to one species was recognised fairly early; apparently Steindachner (1876, p. 92) was the first to record it from the Pacific, from Acapulco; its Pacific range was subsequently extended to include the Hawaiian Islands by Jenkins (1903) and Snyder (1904), but it remained for Günther (1909) to include *schismatorhynchus* Bleeker into the synonymy of *hians* and thus to extend the range of the species right through the Indian Archipelago and the Indian Ocean to the Red Sea.

I have not examined enough specimens to be able to state to what extent geographical variation occurs in numbers of finrays. In my material I found the following numbers (Table I):

TABLE I

	D	A
West Indies	25	26
	25	27
	25	28
Red Sea	24	26
	23	25
Batavia	24	25
	24	25
Moluccas	24	26
	24	26
Siam	24	26
Japan	27	25

When considering these figures in combination with published figures, I do not think that there is enough variation to justify the acceptance of subspecies, though West Indian specimens apparently average slightly higher than East Indian specimens, and examination of more material from Japan might be rewarding.

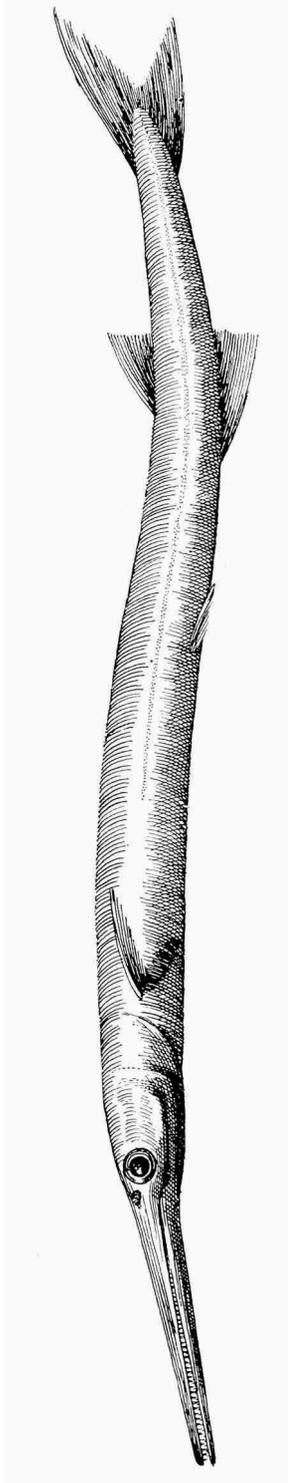


Fig. 10. *Belone houttuyni* (Walbaum), copied from Houttuyn, 1765, pl. LXX fig. 2  
(5/6 x original size).

**Belone houttuyni** (Walbaum) (Fig. 10)

*Esox Houttuyni* Walbaum, 1792, p. 88 — based on Houttuyn (1765, p. 250, pl. LXV, fig. 2), no locality = in den americanischen Gewässern (Stadius Müller, 1774, p. 341).

*Esox marinus* Walbaum, 1792, p. 88 — based on Schoepf (1788, p. 177), aus den Neu-Yorkischen Gewässern.

[*Esox Belone*] Var. a. *Marinus* Bloch & Schneider, 1801, p. 391 — based on Schoepf (1788, p. 177) and probably also on Walbaum, though his work is not mentioned.

[*Esox Belone*] Var. b. *Houttuyni* Bloch & Schneider, 1801, p. 391 — no locality, no reference, but evidently based again on Houttuyn's description, of which they became aware through Walbaum.

*Esox longirostris* Mitchill, 1817, p. 322 — Hudson River (description not available).

*Belona truncata* Lesueur, 1821, p. 126, pl. — New York.

*Belone Almeida* Quoy & Gaimard, 1824, p. 226 — la baie de Rio de Janeiro.

*Belone Senegalensis* Cuvier & Valenciennes, 1846, p. 312 — Sénégal.

*Belone ardeola* Cuvier & Valenciennes, 1846, p. 315 — Martinique.

*Belone timucu* Cuvier & Valenciennes, 1846, p. 316 — Rio de Janeiro, Cayenne, type locality here restricted to Rio de Janeiro, lectotype the type of *B. almeida* Quoy & Gaimard, which makes *timucu* Cuvier & Valenciennes (nec Walbaum) an objective synonym of *almeida*.

*Belone galeata* Cuvier & Valenciennes, 1846, p. 319 — Cayenne.

*Belone cigonella* Cuvier & Valenciennes, 1846, p. 323 — Porto-Ricco.

*Belone scrutator* Girard, 1859, p. 30, pl. 13, fig. 1 — Braros Santiago; Saint Joseph's Island, Texas (reference copied).

*Belone subtruncata* Poey, 1860, p. 295 — la baie de la Havane.

*Belone depressa* Poey, 1860, p. 296 — no locality = Habana.

*Belone capensis* Günther, 1866, p. 247 — Cape of Good Hope.

*Belone diplotaenia* Cope, 1871, p. 481 — St. Martins.

*Tylosurus sagitta* Jordan & Gilbert, 1884, p. 25 — Key West.

Diagnostic characters. D 13-17, A 16-19; no gillrakers; eye fairly small, 2.8 to 3.8 in postorbital part of head (eye in large specimens relatively smaller than in small specimens, though there is no strict correlation); teeth slightly directed backwards; base of maxillary only for a small part covered by lacrimal; opercles scaled (scales usually less distinct or absent on the postero-ventral part of the opercle: the majority of the species with which confusion is possible have a naked or hardly scaled opercle); a broad silvery band on the sides of the posterior part of the body; caudal peduncle usually roundish, without a true keel, but in large specimens the lateral line is slightly elevated on the caudal peduncle; tail lunate; ventrals much closer to caudal peduncle than to cheeks; origin of D above 6th or 7th ray of A.

Material examined, thirty specimens varying in total length from 15.0 to 71.5 cm, standard length 13.5 to 65 cm.

Distribution. Atlantic coasts of America from New York to Rio de Janeiro, West Indies, Atlantic coasts of Africa from Senegal south to the Belgian Congo and probably to the Cape.

Discussion. For this species two old names are available, *houttuyni* and *marina*, the history of both of which will be fully dealt with below. The name

*houttuyni*, as used here, replaces *almeida*, *timucu*, and other names found in literature.

The history of the name *houttuyni* is the following. Houttuyn (1765, p. 250) gave a fairly good description of a garfish, which I fully quote here, while Houttuyn's figure is reproduced herewith (fig. 10).

"Ik geef hier, uit myn Verzameling, de Afbeelding van een Snipvisch, die vrij groot is, als zynde, met de Snoet, ongeveer een Rynlandschen Voet lang, en de Kop, van agter de Kieuwendekzelen af gerekend, met den Bek, vier Duimen. De Zydstreep, in dit Voorwerp, is zeer duidelijk verzilverd, de Kleur voor 't overige geelagtig en byna doorschynende, staande de Rugvin tegen de Aarsvin over. In de Rugvin zyn door my geteld 13, in de Borstvinnen 11, in de Buikvinnen 6, in de Aarsvin 15 en in de Staartvin 14 Straalen. Het schynt my derhalve toe, dat de Snipvisschen tot deeze Soort behooren".

Houttuyn does not say whence he received his specimen, but fortunately Stadius Müller (1774, p. 342) emends this omission:

"Das Exemplar aus dem Houttuinischen Cabinet, dessen Abbildung Tab. IX. fig. 2. vorkommt, ist einen Schuh lang, wovon der Kopf mit dem Schnabel allein vier Zoll austrägt. Die Anzahl der Finnen trifft mit der vorigen Beschreibung fast überein, nur waren in der Rückenflosse dreyzehn statt vierzehn, und in der Brustflosse eilf statt zwölf Finnen. Der Aufenthalt ist in den americanischen Gewässern".

There is little doubt that Stadius Müller has received the information about the provenance of the specimen directly from Houttuyn. The specimen was named by Walbaum (1792, p. 88) (note 4) who gave a diagnosis in the following words:

"Esox, *Houttuyni*, pinna dorsii radiis 13. *Snipfisch*. *Hist. Nat.* I. P. 8 p. 250. tab. 65 fig. 2. D. 13. P. 11. V. 6. A. 15. C. 14.

Corpus elongatum pedale. Caput cum rostro tereti unciarum 4. Color flavidus. Linea lateralis argentea, aspectabilis. P. D. pinnae ani opposita. P. C. farcipata".

Bloch & Schneider (1801, p. 391) also mention the species as:

"Var. *b. Houttuyni*. Corporis colore flavido, linea laterali argentea".

These later authors apparently overlooked the fact that Stadius Müller had provided the specimen with a locality, and perhaps this is the reason that the name *houttuyni* has been forgotten; in later years only Cuvier & Valenciennes (1846, p. 298) seem to have known Houttuyn's description.

Though Houttuyn states that: "de Rugvin tegen de Aarsvin over", the figure shows that the origin of D is distinctly behind the origin of A.

The second old name, *marinus*, was based on Schoepf (1788):

"*Esox*.

*Sea Pike, Sea Snipe*, zu Neuyork.

Es scheint dieser Fisch dem *Esox Belone* L. zunächst verwandt zu seyn; es weichen aber die Flossenstralen in ihrer Zahl von des Ritters Angabe beträchtlich ab.

Der Kopf ist sowohl oben über die Stirne her, als auch an den Seiten sehr platt. Der Körper ist lang gestreckt und rund. Der Rücken grün, der Bauch weis. Beyde Kiefer verlängern sich in einen gezänelten oder mit Zähnen besetzten Schnabel. Die Kiemenhaut hat elf oder zwölf Stralen.

Die Rückenflosse 9; die Brustfl. 12; Bauchfl. 8-9; Afterfl. 14; Schwanzfl. 17-18 Stralen. — Sie sind mir nur etwas über einen Fuss lang vorgekommen".

Named was Schoepf's species by Walbaum (1792):

"*Esox, marinus*, radiis pinnae dorsalis novem. *The Sea-Snipe. Schoepfii* in *Schriften N. F. VIII. 177. Br. 11-12. D. 9. P. 12. V. 8-9. A. 14. C. 17-18.*

Caput super frontem & in lateribus planissimum. Corpus praelongum, teres. Utraque maxilla in rostrum longum dentatum producta. Longitudo pedem aliquanto superat".

Bloch & Schneider (1801), like Walbaum, considered the species a variety of their *Esox Belone*; under that species they wrote:

"Var. a) *Marinus*, pinnae dorsalis radiis 9. *The Sea-Snipe. Schoepf. Schrift. der Berl. Gesell. naturf. Freunde VIII. 177.*

B. 11. P. 12. V. 8. 9. A 14. C. 17. 18. D. 9.

Habitat in America septentrionali".

About the identity of the names *houuttuyni* and *marinus* there cannot be much doubt. Houttuyn's description is a good one for the species, and with the knowledge that his specimen came from the American waters, there is no reason at all for doubt. Moreover, if the material I have examined is representative for the abundance of the species, it is the commonest garfish of the Western Atlantic. It is true that on the western coasts of America there are several more species (*B. scapularis*, *B. exilis*) which more or less closely agree with *houuttuyni*, but it is very improbable that Houttuyn would have received material from there; all the Dutch trade in those years was directed to the eastern part of America and the West Indies.

As regards *marinus*, Schoepf's description does not make much sense, particularly the fin formula (D 9, A 14) is unlike any known species of garfish. The locality New York, however, makes it more or less certain that the present species was meant, which is, as far as I am aware, the only common species so far North. This was also the opinion of De Kay (1842) and other authors: in fact the name *marinus* has been much used for the

species. Therefore I consider both the names *houuttuyni* and *marinus* applicable and, as they have been published simultaneously and on the same page by both Walbaum and Bloch & Schneider, there is apparently a free choice. The reason that I prefer the name *houuttuyni* is largely the subjective one that I like to honour my countryman Houttuyn. Moreover his description was published earlier and is better than Schoepf's description. On the other hand, *marinus* has been widely used, whereas I am not aware that anybody has ever used the name *houuttuyni* subsequent to its appearance in literature. This, however, I do not consider a drawback; many names in the genus *Belone* have so often been misused that it is perhaps an advantage to have a set of nomenclatorially clean names available to replace them.

Several authors, such as Günther (1866), who distinguished them as *B. truncata* and *B. guianensis*, Jordan & Fordice (1887), who distinguished them as *Tylosurus marinus* and *T. almeida*, etc., thought that the species can be divided in a northern and a southern race, but I find neither in the number of finrays (Günther), nor in the relative size of the eye (Jordan & Fordice) any significant difference between the various populations. As Houttuyn's plate shows a specimen with a small eye (eye about 3.7 in post-orbital part of head), it is identical with the *almeida* of authors.

From Africa the species has but rarely been recorded; apparently the first to list the species from Africa was Boulenger (1905) who, without any comment, recorded it from Spanish Guinea. Fowler (1936) knew of no subsequent records, but Poll (1953, p. 172 fig. 70) described and figured material from Banana, Belgian Congo, good enough to make it certain that his specimens belong to the species.

Actually the species is probably fairly common in western Africa; I have examined several specimens from Nigeria (BM 1956.9.6.65; 1953.4.28.145; 1923.7.10.16-17). Also Cuvier & Valenciennes's description of *Belone senegalensis* can, without much doubt, be referred to the present species, and the specimen from Sierra Leone recorded by Günther (1866, p. 254) is certainly *houuttuyni* (specimen BM 61.8.14.28 examined). Of the two specimens from Liberia called *Belone senegalensis* by Steindachner (1894), I examined one (RMNH nr. 5333) and it also belongs to *houuttuyni*. It came as a surprise to me to find that the type of *Belone capensis* Günther (1866), BM 1845.11-8.17, is also a perfectly normal specimen of *houuttuyni*<sup>1)</sup>. The locality "Cape of Good Hope", attached to the specimen is farther south than I am at present prepared to accept, but as to the north the species

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1) I have not examined the stuffed cotype, and to eliminate a possible source of confusion I select the spirit specimen as lectotype.

ranges to New York in certain times of the year, its occurrence so far south is quite within the limits of possibility.

In placing *Belone ardeola* in the synonymy of this species, I differ from current opinion, as since Jordan and Fordice (1887) the name *ardeola* is generally accepted for the West Indian populations of *Belone platyura*. The reasons that I believe this to be wrong are the following. When Cuvier & Valenciennes (1846) described *ardeola*, they emphasized its similarity to *Belone truncata* Lesueur (1821), and proved to know also the accounts of Schoepf (1788), Mitchill (1817) and De Kay (1842), so that, particularly with the good description and the plate of De Kay at hand, it seems impossible for Cuvier & Valenciennes to have mis-understood the identity of *truncata*. Therefore, when Cuvier & Valenciennes state of *ardeola* that: "Celle-ci est une espèce tellement voisine de la précédente, que j'ai hésité long-temps à l'en séparer", it seems most unlikely that they would have had the very dissimilar *platyura* before them. An additional argument in favour of my identification is that the finray formula of *ardeola* is given as D 15, A 18. As the table on p. 64 shows, among the 28 specimens of *platyura* from the West Indies that I examined, there is not a single one that has more than 14 dorsal rays. Though this does not preclude the possibility of an occasional individual reaching this number, it is rather far-fetched to believe that Cuvier & Valenciennes's single specimen happened to be such an exceptional individual. On the other hand the fin ray formula of the specimen is perfectly normal for *houuttuyni*. Jordan & Fordice (1887), when they introduced the nomenclature hitherto used, did not know *platyura* from personal examination; they clearly stated that their nomenclature, as regards this species, was provisional and it is to be regretted that it has been indiscriminately accepted by later authors. *Belone cigonella* Cuvier & Valenciennes (1846) was also described as very close to both *truncata* and *ardeola*. Its finray formula is D 15, A 18; therefore this name is another synonym of *houuttuyni*. It may be remarked that Cuvier & Valenciennes called the tails of these species truncate, which is correct for *houuttuyni*, but *platyura* has a tail with a much prolonged lower lobe. For all these reasons it is with some confidence that I place the names *ardeola* and *cigonella* in the synonymy of *houuttuyni*; a definite conclusion is no longer possible as the types apparently are lost (Jordan & Fordice, 1887).

*Belone galeata* Cuvier & Valenciennes (1846) has never been properly placed (the type is lost, cf. Jordan & Fordice, 1887), until Puyo (1949, p. 161) identified it with a species frequenting river estuaries in Cayenne, the type locality of *galeata*. Puyo's description makes it quite clear that his *galeata* is identical with *houuttuyni*. The number of anal rays as given by

Puyo is rather low, D 13-14, A 13-15, but Cuvier & Valenciennes gave for the type specimen D 15, A 17, which perfectly agrees with *houttuyni*.

*Belone diplotaenia* Cope (1871), another name that has been infesting literature for half a century, was placed in the synonymy by Fowler (1919b).

The majority of the material with exact locality examined by me, is from river mouths, coastal lagoons and similar localities; as Puyo (1949) also noted, the species seems to have a preference for brackish water.

### **Belone imperialis** (Rafinesque) (Figs. 7, 11)

*Esox Imperialis* Rafinesque-Schmaltz, 1810, p. 59 — Sicilia.

*B[elona] carriaca* Lesueur, 1821, p. 127 — Carribean sea at Basseterre, near the island of Guadaloupe.

*Tylosurus Cantrainii* Cocco, 1833, p. 18, tab. 1 fig. 4 — Messina 1).

*Belone gerania* Cuvier & Valenciennes, 1846, p. 325 — Martinique.

*Belone latimana* Poey, 1860, p. 292 — no locality = Habana.

*Belone altipinna* Poey, 1860, p. 293 — no locality = Habana.

*Belone Jonesii* Goode, 1877, p. 295 — the Bermudas.

*Belone Jonesii* Günther, 1879a, p. 151 — the Bermudas.

Diagnostic characters. D 23-26, A 20-23, very close to *B. m. maris-rubri*, but small specimens can be distinguished by their vertical and straight teeth; large specimens by the beak being more slender and slightly constricted near the base, while, moreover, the beak is slightly arched at the base and does not entirely close; radiation on upper surface of head also different (fig. 7), all striae being directed more or less forwards, not radiating as in *maris-rubri*. Specimens with more than 24 rays in D can at once be placed with this species, and not with *maris-rubri*, as the large series I measured of the latter show fairly conclusively that that species never exceeds 24 rays in D. Differs from *melanota*, to which it is even closer, in the gradually arched base of the maxillaries (which is somewhat notched in *melanota*), and in certain details in the sculpture of the upper surface of the skull. The figures do not bear out these differences very well, but in *melanota* there is a narrow, irregular groove in the middle, which is continued fairly far forwards, whereas in *imperialis* the much less distinct groove shows as a triangle with irregular sides, and is not far continued forwards.

Material examined, eleven specimens, varying in total length from 45 to 90 cm, standard length 41 to 82 cm.

Distribution. Tropical and subtropical western Atlantic from Massachusetts (Fowler, 1919a) and the Bermudas to Brazil, West Indies, Mediterranean and western Africa (fig. 11). Because of the confusion in literature between this species and *maris-rubri*, only localities whence I have personally examined material are shown.

1) See footnote 3 on p. 11.

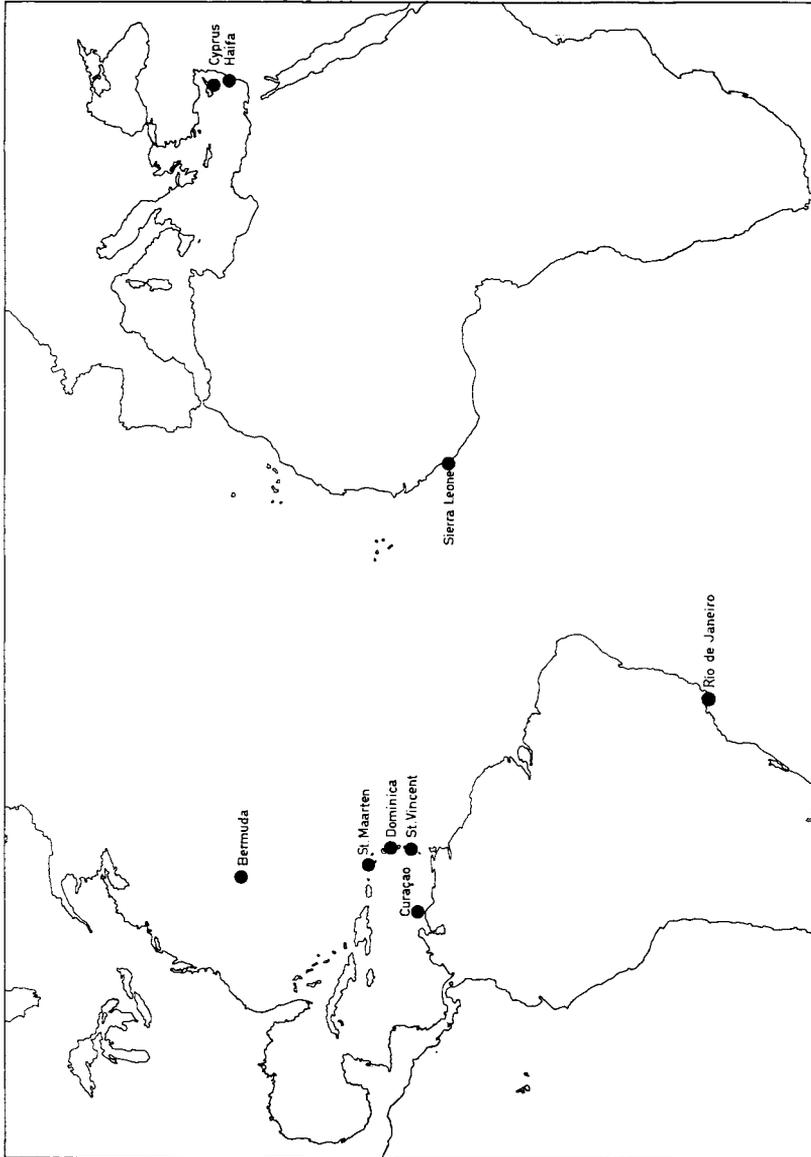


Fig. 11. The distribution of *Belone imperialis* (Rafinesque), from material personally examined. The locality Rio de Janeiro is inexact; there is in the Leiden Museum a specimen, received from the museum of Rio de Janeiro, which is labelled: "Brazil", so that it may have been caught elsewhere off the Brazilian coast.

Discussion. This species occurs in literature mainly under two names, *acus* Lacépède and *carribaea* (all authors subsequent to Lesueur wrote *caribbaea* or *caribaea*, but there is no reason to accept an altered transcription, as Lesueur clearly states that his fish came from the Carribbean sea; Carribean is certainly a correct alternate spelling for the area now usually called Caribbean).

As regards the synonymy as presented here, it is not without hesitation that I have introduced the name *imperialis* for the species as Rafinesque's (1810) description and figure leave much doubt:

"*Esox Imperialis*. — Nero cerulescente, mascelle con denti lunghi, l'inferiore più lunga, ale dorsale ed anali con 30 raggi — *Aguglia imperialis* Mong., *Sic. ric. 2. p. 74*. — Il genere *Esox* di Linneo è stato diviso da Lacepede in quattro generi *Esox*, *Sphyrena*, *Synodus* e *Lepisosteus*, io propongo di dividere nuovamente in due il suo genere *Esox*, lascerò questo nome alle specie marine che hanno il corpo tetragono con due linee laterali da ogni lato come nel genere *Esocetus*, le mascelle lunghe e strette, le ale dorsali lunghe giungendo dall'ano fino alla coda e falciformi &c mentre formerò un nuovo genere col nome di *Lucius* della specie fluviatili che hanno il corpo cilindrico, una sola linea laterale, le mascelle larghe e le dorsali ed anali corte e rotondate; la presente specie s'annovera fra il vero genere *Esox* ed è ben diversa dall' *E. Belone* dai caratteri indicati: E'un poco più grande e più grosso del medesimo ed a ragione dei denti si rassomiglia un poco all' *E. Chirocentrus* di Lacepede: hà le ale pettorali con 12 raggi, l'adominali con 7, la coda con 12 e la membrana branchiale con 12".

In the figure, I count D 33, A 36; eye about twice in postorbital part of head; tail symmetrically deep lunate; origin of D exactly opposite A.

As can be seen from the foregoing, the number of rays in D and A is much higher than it should be, and higher than in any species of *Belone*; on the other hand, it seems beyond doubt that a garfish is described, which is different from the ordinary *B. bellone*, and as there are only two species in the Mediterranean, there is little doubt as to its identity as *imperialis*.

Rafinesque refers to Mongitore (1743, p. 74) who has the following paragraph on the subject.

#### "Aguglie"

"Lat. Acus: v'ha in Sicilia di due maniere: una è di mediocre lunghezza: altra maggiore, che per la sua eccellenza è chiamata Imperiale: La sua estensione non trapassa palmi tre. Il suo colore è celestre: mostra la figura di serpe: e in cima ha un lungo rostro, acuminato; da cui piglia il nome: se n'ha abbondanza, come scrive il Cirino de Venat. lib. 2 cap. 21.n-222. fol. 321. nel porto di Messina: ma ben aggiunge, esser frequente altrove: Cujus

captura in portu Messanae, & ubique paestat: infatti s' ha ne' mari di Palermo, e nel suo Molo in gran copia".

Unfortunately Cirino's work has not been available to me, but I feel fairly safe in identifying the species under discussion with *Esox Imperialis*, as was done previously by Bonaparte (1849). If this name is rejected, the species should perhaps receive the name *cantrainii* rather than *carribaea* because the latter name might just as well apply to *maris-rubri*.

About the identity of *Belone gerania* Cuvier & Valenciennes there has been some doubt; Jordan & Fordice (1887) placed it in the synonymy of *raphidoma* (= *maris-rubri*), but the number of rays as given by Cuvier & Valenciennes (1846), D 25, A 21, shows convincingly that the present species was described, the number of dorsal rays being too high for *maris-rubri*. The *Belone caribaea* of Cuvier & Valenciennes (1846) was described as having D 23, A 21, which could apply to both *maris-rubri* and *imperialis*, but according to Jordan (1887) the specimens in the Paris museum have D 25, A 22, so that their identification with *imperialis* is beyond doubt. *Belone latimana* Poey (1860) was described as having D 25, A 23, and therefore I agree with Jordan & Fordice (1887) that this is another synonym of *imperialis*. *B. altipinna* Poey was described as having D 24, A 23, and is doubtless, as Jordan & Fordice pointed out, identical with *imperialis*; A 23 is too high for *maris-rubri*. As regards *B. Jonesii* Goode, I follow previous revisors in placing it in the synonymy of the present species. Of *B. Jonesii* Günther I have examined the type so that its identity is certain; Günther (1879b) acknowledged the fact that his *Belone Jonesii* is identical with the species described two years earlier by Goode (1877) under that name.

Metzelaar (1919) took pains to show that *Belone acus* is a species distinct from *B. carribaea* (incorrectly written *caribbaea* by him), this contrary to Jordan & Fordice, who suggested that *acus* and *carribaea* might be identical. I have examined Metzelaar's specimens, and the fish he called *acus* is a *maris-rubri*, whereas his *caribbaea* is *imperialis*, and therefore was identified correctly according to current literature.

### **Belone incisa** Cuvier & Valenciennes (Fig. 5)

*Belone incisa* Cuvier & Valenciennes, 1846, p. 335 — grand Océan indien.

*Belone leiuroides* Bleeker, 1851, p. 478-479 — Billiton.

*Tylosurus terebra* Whitley, 1927, p. 8, pl. 1 fig. 6 — Michaelmas Cay, Great Barrier Reef, off Cairns, Queensland.

*Raphibelone robusta* Schultz, 1953, p. 164 — Rongelap Atoll, off Yugui Island.

Diagnostic characters. D 18-20, A 21-23, no gillrakers; eye rather large, 2.0 to 2.4 in postorbital part of head; teeth vertical or slightly directed backwards; upper surface of head with a very characteristic strong radiation,

upper surface of snout also definitely striated (fig. 5); body long and slender with a silvery lateral band; no dermal keel on caudal peduncle; origin of D opposite 4th or 5th ray of A.

In general appearance this species is fairly close to *B. ciconia* and *B. anastomella*, but it can be easily distinguished by its larger eye, more anterior position of D, and striation on the head.

Material examined, fifteen specimens varying in total length from 22.9 to 69.5 cm, standard length 21.3 to 63.0 cm.

Distribution. Indian Archipelago, Philippines, ? Japan (Tokyo), New Guinea and north Queensland, and apparently the whole western tropical Pacific. The record for Japan is apparently a new one; I found a large specimen, misidentified as *Belone anastomella*, in the British Museum (BM 1923.2.26.172, leg. Jordan, Tokyo, Japan); unfortunately, like most Belonidae I have seen in collections, it is insufficiently labelled according to modern standards: the label should state clearly whether it has been caught by the collector, or has merely been bought in a market, in which case it may have been brought in from far afield. I have not found records from the Indian Ocean.

Discussion. Subsequent to the original description, Weber (1913) was the first to identify *Belone incisa* from actual specimens. Later Weber & de Beaufort (1922) placed *B. leiuroides* in its synonymy in which they were doubtless right. Cuvier & Valenciennes's description with: "le dessus du bec, comme les os du crâne et le surscapulaire, sont ciselés", combined with the fin formula D 19, A 22, which is the commonest combination found in the species, leaves no doubt. The type specimen was collected during the circumnavigation of the world by d'Urville, and as this expedition was for a considerable time in the waters of New Guinea and the Indian Archipelago, it may, in the absence of records from the Indian Ocean, be assumed that Cuvier & Valenciennes's "grand Océan indien" included the Indian Archipelago.

Whitley's (1927) description of *Tylosurus terebra* had already convinced me that this name is a synonym of the present species, and I found further confirmation in the British Museum, where there is a specimen, collected and identified by Whitley, under the name of *terebra*, which is identical with *incisa* (BM 1933.1.25.14). Subsequent examination of the type in the Australian Museum proved this synonymy.

In nearly all Schultz's specimens of *Raphiobelone robusta*, the jaws had broken off; moreover I refer to the discussion of *R. dammermani*, given on p. 24. For the rest no characters are given in the description that would distinguish this alleged species from *incisa*; according to its descrip-

tion it has D 18-21 (22?), A 21-22, eye 2.0-2.3 in postorbital part of head, origin of D over 4th ray of A, etc. Therefore I consider it a safe assumption that the name *robusta* pertains to juveniles of *incisa*. If *R. robusta* might, after all, be found to be valid, it would need renaming, being preoccupied in the genus *Belone* by *B. robusta* Günther (1866).

### **Belone krefftii** Günther (Fig. 2)

*Belone krefftii* Günther, 1866, p. 250. — Australia.

*Stenocaulus perornatus* Whitley, 1938, p. 233 — upper Sepik River.

Diagnostic characters. D 16-18, A 19-20; gillrakers rudimentary; eye fairly small, 2.8 to 3.3 in postorbital part of head, about equal to width of bony interorbital; teeth sharp and vertical, straight; base of maxillary only for a small part covered by the lacrimal; jaws comparatively heavy, the mandibula ends in a blunt tip; body heavy; lateral line with a characteristic shape, leading downwards above the end of A, and going upwards again on the caudal peduncle; no keel on caudal peduncle, but lateral line distinct on this part; caudal slightly truncate, lower lobe not longer than upper lobe (fig. 2); origin of D above 3rd ray of A.

Material examined, four specimens, varying in total length from 20 to 70 cm, standard length 18 to 63 cm.

Distribution. Known from fresh water in northern and eastern Australia (cf. Günther, 1866, and McCulloch, 1929), and New Guinea, where it is known to occur in the Jamoer Meer, Mimika Rivier, Lorentz-Rivier, Toe-ba near Bivak-Eiland, Rawah Wan 12 km upstream from Tanah Merah, and the upper Sepik River. I have examined material from the Jamoer Meer, Roeba, and from near Tanah Merah. The first and last mentioned of these three localities have not previously been recorded in literature, they are included on the strength of specimens recently taken by Dr. Boeseman and Dr. Brongersma during their 1954/1955 New Guinea Expedition.

Even in the latest list (Munro, 1957), New South Wales is included in the range of the species. This apparently goes back on Krefft who seems to have recorded it from the Hunter River (cf. Ogilby, 1886, I have not traced the original reference). As there are no subsequent records from New South Wales, I feel justified in querying the occurrence of the species in that state. McCulloch (1921, 1927) already remarked that the species had been recorded from New South Wales "on unreliable authority". On the other hand the Northern Territory can be included in the range as the Australian Museum has a small specimen from Katherine. Moreover, Rendahl (1922) listed two specimens from Daly River, western Northern Territory, a record apparently overlooked by subsequent authors.

Discussion. The genus *Stenocaulus* was diagnosed (Ogilby, 1908, p. 91) with the following words: "Body short and deep, strongly compressed, the caudal peduncle without a trace of a lateral keel". Indeed, as stated above, the body at least in large specimens, is heavier than is usual in the genus, though its width of about  $1\frac{1}{2}$  times in its depth, does not deviate from proportions in some other species. The absence of a lateral keel is of course not of generic value as at least half the number of species, including the type species of the genus *Strongylura*, is devoid of a keel. I cannot consider this to be a character of generic value.

*Stenocaulus perornatus* was diagnosed in an extraordinarily offhand way (Whitley, 1938); in the description no comparison was made with *B. krefftii*, nor indeed, with any other species of the family, and all the characters mentioned perfectly fit *B. krefftii*. This equally pertains to Whitley's (1939) later and more elaborate description of the same specimen. In the circumstances I do not consider it justified to recognise the species as distinct, though it must be kept in mind that Whitley's specimen represents the first record from the northern part of New Guinea, from a river which drains to the north. On the other hand it is not unlikely that the species sometimes ventures out in sea near the coast to swim from one river to the next.

Since writing the preceding paragraph I had an opportunity to examine the type of *Stenocaulus perornatus*. Morphologically this specimen is identical with *B. krefftii*, but it differs by having a number of dark spots on head and body. However, according to Whitley (1957), who quoted from Marshall, black spots occur also in undoubted *krefftii* from Queensland as a postmortem discoloration, hence their systematic value is problematic.

### **Belone maris-rubri maris-rubri** (Bloch & Schneider) (Fig. 8)

[*Esox belone*] Var. *Maris rubri* Bloch & Schneider, 1801, p. 391 — Red Sea (no locality given, but based on *Esox belone* Forskål, 1775, p. 67).

*Belona Crocodila* Lesueur, 1821, p. 129 — Isle of France.

*B[elone] Coromandelica* van Hasselt, 1823, p. 130 — Vizagapatam (no locality given, but based on Russell, 1803, pl. 175).

*B[elone] Timucoides* van Hasselt, 1824, p. 374 — Vizagapatam (no locality given, but based on Russell, 1803, pl. 175).

*Belone Choram* Rüppell, 1837, p. 72 — im rothen Meere.

*Belone Raphidoma* Ranzani, 1842, p. 359, Tab. XXXVII — in mari brasiliensi.

*Belone fasciata* Cuvier & Valenciennes (ex Ehrenberg MS), 1846, p. 329 (alternate name for *crocodila*) — Massawah.

*Belone annulata* Cuvier & Valenciennes, 1846, p. 447 — Célebes, etc.

*Belone gigantea* Temminck & Schlegel, 1846, p. 245 — mers du Japon.

*Belone melanurus* Bleeker, 1849, p. 11 — in Freto Madurae prope Kammal et Surabaya.

*Belone cylindrica* Bleeker, 1852, p. 13 — Batavia, Surabaya, Kammal, in mari. Sibogha, Sumatrae occidentalis.

- Belone brachyrhynchus* Bleeker, 1854, p. 61 — Sindangole (Halmheira).  
*Belone crassa* Poey, 1860, p. 291 — no locality = Habana.  
*Belone robusta* Günther, 1866, p. 242 — Red Sea, Egypt.  
*Tylosurus gladius* Bean in Goode & Bean, 1882a, p. 239 — nomen nudum.  
*Tylosurus gladius* Bean in Goode & Bean 1882b, p. 430 — Pensacola, Florida.  
*Strongylura auloceps* Fowler & Bean, 1923, p. 12 — Fiji or Samoa = Fiji (cf. Fowler, 1959).  
*Esox aaveri* Curtiss, 1938, p. 40 — Lagoon near Tautira, Tahiti.

Diagnostic characters. D 20-24, A 19-22; no gillrakers; teeth in small specimens distinctly curved forwards; in specimens of about 50 to 60 cm length the teeth straighten out and in specimens of over two feet they are always perfectly vertical; snout straight, base of maxillary not appreciably arched; radiation on upper surface of skull fanning out anteriorly (fig. 8); caudal peduncle with a distinct keel; caudal fin forked with a long lower lobe. The characters distinguishing this species from *B. imperialis* and *B. melanota* are given in the key and in the descriptions of these species.

Material examined, 64 specimens varying in total length from 16.1 to 107 cm, standard length 14.2 to 96 cm.

Distribution. All tropical seas except the eastern Pacific Ocean near the American west coast, where replaced by the subspecies *fodiator*.

Discussion. The first definite record of this species in literature, as far as I know, is that by Forskål (1775, p. 67): "ESOX BELONE; *Maris Rubri*; linea laterali juxta abdomen; & pinnis pone excisis. *Rad. B. 14. D. 22. P. 13. V. 7. A. 21. C. 15.* Arab *Chaerman* خرمان vel *Choram*". Nobody has ever doubted the identity of the species described by Forskål, and the ray numbers leave no doubt; but as Weber & de Beaufort (1922) pointed out, the name *Belone choram* was only introduced by Rüppell (1837). This does not mean, however, that I agree with Weber & de Beaufort and with all other modern authors, that now *Belona crocodila* Lesueur (1821) becomes the oldest name available for the species, for Bloch & Schneider (1801) already based a name on Forskål's description, and their name *maris-rubri*, which apparently has not been used since its introduction, is the oldest name available. It is difficult to believe that all later authors have overlooked the wellknown work of Bloch & Schneider, and probably Cuvier & Valenciennes (1846) just ignored the name, like *marinus* and *houttuyni*, because it was introduced as applying not to a species but to a variety. According to modern principles of nomenclature, however, these names are perfectly valid.

Chronologically the following name for the species is *Belona crocodila* Lesueur (1821), its description with D 22, A 21, and: "If we might judge from the imposing aspect of the individual which we saw, this species ap-

pears to attain a very considerable magnitude. It is distinguished ...by a very strong conic straight pointed snout, the bony plates of which are strongly radiated in order to protect the head...", leaves no doubt about its identity.

The names given by van Hasselt, *coromandelica* and *timucoïdes*, are since Bleeker (1871) generally placed in the synonymy of *B. melanota*, as nomina nuda; among others this was done by Weber & de Beaufort (1922) and Herre (1953). These same authors do, however, recognise *strongylura* van Hasselt as a valid name. As the quotations of van Hasselt's (1823, 1824) papers on p. 67 show, there is not the slightest argument in favour of this discrimination, and if the synonymy as nowadays accepted was correct, the name *melanota* would have to be replaced by *coromandelica*. Fowler (1938) is one of the few authors who apparently have personally consulted van Hasselt's (1824) description; he therefore accepts the name *Strongylura timucoïdes* (van Hasselt), and correctly mentions that this name is based on Russell (1803). Doubtless following former authors, he continues, however, to consider the older name *Belone coromandelica* van Hasselt (which he used in earlier publications, cf. Fowler, 1919a) a nomen nudum. *Belone melanotus* Bleeker he regards as a synonym.

Van Hasselt's names are based upon Russell's (1803) figure 175; in the text Russell mentions a finray formula of D 23, A 21, P 15, whereas on his plate I counted D 24, A 21. Whichever of these numbers may be correct, they convincingly show that the fish, which moreover does not show arched maxillaries but has a straight rostrum, does not agree with *Belone melanota*, but with *B. maris-rubri*, so that the synonymy as given by all recent authors is incorrect.

Rüppell (1837) himself considered *Belone choram* identical with the species described by Forskål. Rüppell mentioned D 20-23, A 19-22, and a not very strongly developed dermal keel on the caudal peduncle. According to Rüppell, *B. choram* can be distinguished from Russell's Wahlah Kuddera (Russell, fig. 175) "durch den Mangel einer doppelten Seitenlinie, deren Russell in seiner Abbildung und Beschreibung erwähnt; auch findet Verschiedenheit in der Strahlenszahl statt, und am Forskålischen *Belone* finde ich eine kurze Carina an dem Ende der Seitenlinie, daher unstreitig beide Fische verschiedene Arten sind".

As regards the double lateral line, admittedly mentioned by Russell, it is evident that what Russell took to be a lateral line, actually is the boundary between the dark colour of the back and the silvery colour of the sides. In preserved specimens there often happens to occur a slight skinfold in this place, which has some resemblance to a lateral line. The finray formula as given by Russell, D 23, A 21, perfectly agrees with Rüppell's figures. Any-

how, the name *choram* is based on specimens topotypical of *B. maris-rubri*, of which it is an evident synonym.

The following name, *Belone raphidoma* Ranzani (1842), is now in general use for a species in the western tropical Atlantic and the West Indies. Ranzani's description with D 22, and particularly the figure, showing teeth which are distinctly curved forwards, leave no doubt whatever that *raphidoma* is identical with *maris-rubri*. Hitherto the fact that the West Indian species is identical with a wide ranging eastern species, had not been recognised, but I have examined large series from both the East and the West Indies, and find the populations indistinguishable. A further discussion of the curved teeth will be given below.

*Belone fasciata* Cuvier & Valenciennes (1846) needs not be discussed; *B. annulata* Cuvier & Valenciennes (1846), however, is a name that has come into general use, it was described as having D 24, A 21, with a fairly distinct carina on the caudal peduncle, and: "Je crois qu'il faut rapporter à cette espèce le *Wahla kuddera* de Russel. Je n'aurai aucun doute sur ce rapprochement, si l'auteur avait donné un peu plus de longueur aux derniers rayons de la dorsale; car les nombres de cette nageoire et ceux de l'anaie conviennent très-bien à ceux de nos individus".

*Belone gigantea* Temminck & Schlegel (often, lately by Herre, 1953, the authorship of this name is ascribed to Schlegel alone, but as there is no indication in the said publication that only one of the authors is responsible, both must be considered authors of the name) was described with the following words: "...pour se rapprocher, à l'égard de ses formes, de la *Belone Choram* de Rüppell... et du *Wahlah Kuddera* de Russell, Pl. 175. Elle paraît cependant s'éloigner de ces deux espèces par la partie postérieure de sa dorsale plus développée que d'ordinaire...".

*Belone melanurus* Bleeker had, according to its description, D 23, A 21, and: "carina caudali brevi", whereas *Belone cylindrica* Bleeker was a new description, based on better material, of the same species. Its ray numbers are given by Bleeker (1852) as D 2/20 ad 2/22, A 2/18 vel 2/19, and "maxillis vix hiantibus dentibus caninis antrorsum spectantibus". Bleeker (1871) himself already recognised these two names as synonyms of "*annulatus*".

The names *crassa* and *melanochira*, given by Poey (1860), were placed in the synonymy of "*raphidoma*" by Jordan & Fordice (1887) and I fully agree with their assignation. As the names have not been used since, a full discussion is not necessary.

*Belone brachyrhynchos* Bleeker (1854) was maintained by Bleeker (1866, 1871), though Günther (1866) placed it in the synonymy of *annulata* (= *maris-rubri*). Weber & de Beaufort (1922) suggested that *brachyrhynchos*

is a synonym of *incisa*. In the British Museum I have been able to examine the holotype of *brachyrhynchus*, it has a length of 161 mm, D 21, A 21. These figures fall in the range of variation of *maris-rubri*: the teeth are curved forwards, the keel on the caudal peduncle is not yet developed, the rays of D and A are weak and very long, the sculpture of the head suggests *maris-rubri*, and I have no doubt that it is a juvenile of the species.

*Belone robusta* Günther (1866) was described as having D 19-20, A 22; no comparison was made with previously described species. A discussion of the types of this alleged species will be given below.

*Tylosurus gladius* Bean (in Goode & Bean, 1882b), with D 23, A 21, has already been placed in the synonymy of *T. crassus* or *T. raphidoma* (= *Belone maris-rubri*) by Jordan (1884) and Jordan & Fordice (1887).

The last name to be added, as far as I am aware, was *Strongylura auloceps* Fowler & Bean (1923), which was described in the following words: "It approaches *S. choram* (Forskål) and *S. crocodila* (Le Sueur) in a general way, but the sculpturing on the head above is more prominent... The entirely scaled opercles are also features not noticed in the other species".

As the extensive synonymy shows, I have united many nominal species for the first time. Several of them have already been briefly discussed, but some others need a more elaborate discussion. In the Indian Archipelago and the Philippines two species are currently recognised: Weber & de Beaufort (1922) call them *Tylosurus annulatus* and *Tylosurus crocodilus*, whereas Herre (1953) uses the names *Tylosurus crocodilus* and *Tylosurus giganteus*. The difference between the opinions and nomenclature of Weber & de Beaufort (1922) and Herre (1953) only consists of the fact that the last-mentioned author has replaced *annulatus* by *giganteus* (cf. note 5).

Weber & de Beaufort (1922) list as difference between the alleged species *annulatus* (= *giganteus*) and *crocodilus* that the first has the canines in the upper jaw curved forwards, whereas the second has them vertical. Here it must be noted, however, that these authors were not able to identify any specimen they personally examined as *crocodilus*, so that their description was entirely compiled from literature (Günther, 1866; Klunzinger, 1871; Day, 1878).

In this connexion the discovery that the curved teeth are not a lasting character in the species is most interesting. Comparison of specimens of different length convincingly showed that all small individuals of the species have teeth which are distinctly curved forwards — a character most useful for identification of all specimens up to a length of about half a metre, as no other species of the group has it. In individuals of 50 to 60 cm total length, however, the teeth begin to straighten out, whereas in specimens of

over two feet they are always vertical. Moreover in specimens of over this size, the teeth become thicker and stronger, whereas also the body becomes heavier. This causes large individuals to look superficially different from small individuals, but the fact that in individuals of 50 to 60 cm length all kinds of intermediate stages between curved teeth and purely vertical teeth are found, puts an end to all doubt.

Another difference between several alleged species, and one which often has been stressed, is the length of the posterior rays of D and A. This again appears to be a question of age. Small specimens have these rays very long and weak, whereas in large individuals these rays are much shorter, a process perhaps caused by wear.

From the description quoted, it is evident that all forms here synonymized agree in number of rays in D and A, with the exception of *Belone robusta* Günther (1866), which is unique in having A longer than D. Before having examined the types, I expected *robusta* to be a different species, but during a visit to the British Museum I was able to examine the cotypes and all other material identified as *robusta*. The types are in a very bad condition:

Cotype BM 1859.6.11.5 Egypt, purch. of M. Parzudaki. Dried specimen, which looks very much like *Stockfish*: the whole belly has been cut open, and intestines and backbone have been removed; the remaining part of the body, largely consisting of flesh, has been dried flat; the anal fin is entirely lacking, has apparently been cut away. I noted of this specimen: total length 70 + x cm, standard length 66 cm, D ca. 20, A —, keel on caudal peduncle, eye 22 mm, postorbital part of head about 60 mm, eye 2.6 in postorbital part of head, snout, upper jaw 160 mm, lower jaw broken, teeth straight, vertical, interorbital 33 mm.

Other cotype, Red Sea, J. Burton Jr., dry, the right hand side of a skin, stretched over a wooden form, with half a head detached from the remainder. Total length 75 cm, standard length 69 mm, D 20, A 22, keel present, eye 21 mm, postorbital part of head 59 mm.

In both specimens the number of rays in D is difficult to ascertain, and the number given is doubtful, it might be 21, but the A 22 for the second specimen is undeniable. In the meantime, it must be noted that Günther's statement D 19-20 is probably incorrect. In the specimens of *maris-rubri* from elsewhere I almost always found  $D > A$ , but the type of *B. brachyrhynchos* Bleeker has  $D = A$ , and on measuring a number of specimens (many of them labelled as *robusta*) in the British Museum, I found (cf. Table II) that especially in the Red Sea the number of rays in D may fall slightly lower than elsewhere. The same was noted by Günther (in Playfair & Günther, 1866) for specimens from Zanzibar, whence I have not seen

TABLE II

Atlantic					Red Sea					Indo-Australian Region				
A					A					A				
19	20	21	22	23	19	20	21	22	23	19	20	21	22	23
19					19					19				
20					20	1	2	1		20				
21					21	2				21		2		
D					D					D				
22	1	1	2		22	1				22	5	6	1	
23		1	3		23	1				23	5	11	6	
24					24					24		7	5	

Geographical variation in finray-numbers of dorsal and anal fins in *Belone maris-rubri maris-rubri* (Bloch & Schneider).

material. This difference, however, even if it will be confirmed by more material, is not sufficient for subspecific separation, as the ray numbers given by Forskål (1775) and Rüppell (1837) are perfectly normal for any part of the range. The sculpture of the head in the cotypes of *robusta* is identical to that of *maris-rubri*. At any rate, *maris-rubri* was described from the Red Sea, as were *choram* and *fasciata*, so that *robusta* can never be more than a synonym. As explained above, the name is based on very badly preserved material, and perhaps, as regards finformula, on an accidental extreme of normal variation. Klunzinger (1871) admittedly described differences in colour and habits between *B. choram* (= *maris-rubri*) and *robusta* but his description was evidently copied from Günther (1866) and this causes me to mistrust his field-notes also. The name *robusta* has usually been confined to the Red Sea, though Regan (1908), followed by Gilchrist & Thompson (1917), mentioned a specimen from Kori Bay, Zululand. Barnard (1925) has already re-identified the specimen as "*Tylosurus choram* (Forskål)" (= *maris-rubri*); he had the wrong idea, however, that true *robusta* was something different.

As regards *Strongylura auloceps* Fowler & Bean (1923), this was claimed to differ merely in the more prominent sculpture of the head; I do not, in the absence of other evidence in favour of its validity, consider this character of much importance.

#### ***Belone maris-rubri fodiator* (Jordan & Gilbert)**

*Tylosurus fodiator* Jordan & Gilbert, 1882a, p. 459 — Mazatlan.

*Strongylura galapagensis* Fowler, 1944, p. 304 — Abingdon Island, Galápagos Archipelago.

Diagnostic characters. D 19-20, A 17-18; very close to the nominate race,

but differs by the definitely smaller number of rays in D and A. I am not able to say positively, whether or not this form has curved teeth when young, as only two specimens could be examined, the smallest measuring 53 cm in total length; this specimen has vertical teeth. Sculpture of the head entirely as in *maris-rubri*.

Material examined, two specimens from Mazatlan, leg. Jordan (Hopkins Expedition), BM 95.5.27.249-50. total length 53 cm, standard length 47 cm, snout 96 mm, eye 15 mm, postorbital part of head 40 mm, of which cheeks 21½ mm, opercle 18½ mm, interorbital 22 mm, D 20, A 17, origin of D between 2nd and 3rd ray of A, teeth vertical, straight; and: total length 102 cm, standard length 92 cm, snout 163 mm, eye 24 mm, postorbital part of head 79 mm, of which cheek 43 mm, opercle 36 mm, interorbital 43 mm, D 19, A 18.

Distribution: Pacific coast of America from Cape San Lucas (Osburn & Nichols, 1916, p. 152) and Mazatlan, to the Galapagos Islands.

Discussion. When describing *Tylosurus gladius*, a synonym of *B. maris-rubri maris-rubri*, Bean (in Goode & Bean, 1882b) suggested already that his allegedly new species was: "...closely related to *T. fodiator* Jor. & Gilb., described from Mazatlan, differing from it chiefly in its longer jaws and greater number of fin-rays". Jordan & Fordice (1887, p. 353) more succinctly noted about *fodiator* that: "It represents on the Pacific coast the *raphidoma* [= *B. maris-rubri maris-rubri*] of the Atlantic". After examination of two specimens as listed above, I am convinced that the close similarity of these two representative forms justifies their reduction to subspecific status. It will be most interesting to investigate the respective ranges of the two forms in the eastern Pacific: hitherto *fodiator* is only known from near the American coast, whereas *maris-rubri* is known to range widely in the Pacific, at least as far east as Tahiti (Herre, 1936, under the name of *Tylosurus melanotus*; Seale, 1906), Fiji (Seale, 1902), Samoa (Steindachner, 1900; Jordan & Seale, 1906, p. 207); Marshall Islands (Schultz, 1953) and Hawaii (Seale, 1902; Jenkins, 1903, etc.). Perhaps the difference in numbers of rays is sometimes bridged, for Meek & Hildebrand (1923) mention for their material of *fodiator*, D 19 to 22, A 16-20.

When Fowler (1944) described *Strongylura galapagensis* he apparently overlooked the name *fodiator* of which *galapagensis* is evidently a synonym.

#### ***Belone megalolepis* nomen novum**

*Petalichthys capensis* Regan, 1904, p. 129 — Port Elizabeth.

Diagnostic characters. D 17-18, A 22; gillrakers long, about 20 well-developed on first hypobranchial, besides a number of rudiments; teeth fine;

base of maxillary somewhat arched as in *B. bellone*; upper surface of head as in *B. bellone*, laterally rounded, but narrower than in that species; cheeks shorter than opercles; origin of dorsal above about 6th ray of anal; scales very large, about 73 transverse series in standard length (in one specimen). This species is apparently rare in collections and I have examined but two specimens, the individual measurements of which are given below.

Individual measurements of specimens examined.

Type, Port Elizabeth, leg. Duge, BM 1890.9.25.14, total length 33 cm, standard length  $30\frac{1}{2}$  cm, snout 73 mm, eye  $7\frac{1}{2}$  mm, postorbital part of head  $17\frac{1}{2}$  mm, D 18, A 22, upper jaw about 11 mm shorter than lower jaw, greatest depth of body  $19\frac{1}{2}$  mm against a width of  $6\frac{1}{2}$  mm.

One specimen, Pondoland, July 1919, leg. E. C. Chubb, BM. total length 36 cm, standard length  $32\frac{1}{2}$  cm, snout 77 mm, eye 10 mm, postorbital part of head 21 mm, of which cheek 8 mm, opercle 13 mm, interorbital 8 mm, scales in standard length about 73 transverse rows, D 17, A 22, origin of D above 6th ray of A, depth of body below origin of D  $20\frac{1}{2}$  mm, width  $8\frac{1}{2}$  mm.

Distribution. Only known from the coast of South Africa, from Table Bay to Natal (Norman, 1922; Barnard, 1925), and apparently not very common.

Discussion. The name *capensis* is preoccupied in the genus *Belone* by *B. capensis* Günther, 1866, a synonym of *B. houttuyni*, for which reason I have renamed it as above. The type, when described by Regan (1904), was not compared with *Belone* but only with *Scombresox*; subsequently Regan (1911) found its true affinities, and the difference presented in his key: "Body very strongly compressed", as against "Body scarcely or moderately compressed" in *Belone*, is the only difference I have ever seen pointed out between *Belone bellone* and "*Petalichthys*". As a matter of fact the species is not so slender as Regan surmised; the type shows very flat, it is in a jar with very strong spirits and is very stiff; the second specimen, however (which Regan did not yet have) is much less slender as the measurements listed above show. It falls easily within the range of variation of the genus *Belone* (which includes slender species as *anastomella* and *hians*), and if this greater slenderness were the only character in which "*Petalichthys*" differed from *B. bellone*, I would not give it more than subspecific status. The type is entirely devoid of scales, its flanks shining silvery, but the second specimen is covered with large scales (about 73), which are rather loosely attached and easily come off. The presence of these scales, in my opinion, settles the problem of specific diversity as in *B. bellone* the number is very much higher (200 to 270 according to Fowler, 1936).

It might perhaps be argued that the size of the scales (the species with the next largest scales, *urvillii*, has about 130 rows) is sufficient to maintain for the species a separate genus, but I do not think so and especially as in this group the range of variation in even one species can be great (see *B. bellone*), and as the other species range in their scale numbers from 125 to 400, I do not consider it convenient to maintain the species in its own monotypic genus; it is evidently the southern representative of *B. bellone* from which, however, it differs sufficiently to be given full specific rank. Smith (1949) created for the species a separate family, but evidently Smith's ideas of what the collective systematic units should stand for, greatly differ from mine.

***Belone melanota*** Bleeker (Fig. 9)

*Belone melanotus* Bleeker, 1850, p. 94 — Batavia, in mari.

Diagnostic characters. D 25-26 (sometimes 24?), A 22-24; teeth vertical at all ages; base of maxillary arched, so that the beak does not entirely close at the base; a distinct sculpture on the upper surface of the head, with all striae directed forwards, and a narrow, irregular, median groove, which is particularly distinct in large specimens (fig. 9); a black carina present on the caudal peduncle; caudal forked with a long lower lobe.

This species is very close to *B. maris-rubri*, from which it may be distinguished by its vertical teeth in all body-lengths, the slightly larger number of rays in D and A, the upper jaw which is definitely arched near the base, and the different sculpture on the upper surface of the head with all striae directed forwards instead of radiating as in *maris-rubri*.

Material examined, six specimens, varying in total length from 48 to 69 cm, standard length 44½ to 63½ cm.

Distribution. From South and East Africa (Smith, 1949, 1955) through the Indian Ocean, the Malay Archipelago and the Philippines (Herre, 1928b) to Japan (Jordan and Starks, 1903; Kamohara, 1958), and in the South Pacific area to the Bismarck Archipelago (Whitley, 1935), and Australia.

A specimen obtained at Magnetic Island, Queensland, in August, 1949, was claimed by Marshall (1951) to constitute a new record for Australia, but Macleay (1881) already listed specimens from Cape York and from Port Darwin. The fin formulae presented by Macleay, D 24-26, A 22-24, leave no reasonable doubt about the correctness of his identification. McCulloch's (1929) *Tylosurus coromandelicus* also evidently pertains to the present species.

Many of the records from the central and eastern part of the Pacific Ocean must be looked upon with some suspicion; the fish described by Fowler (1928) under the name of *Strongylura choram* certainly is the present species as shown by the reference to the numbers of fin rays: D 25, A 23, which is too high for *B. maris-rubri*, but I am not entirely convinced that the description given really pertains to the specimen in the B. P. Bishop Museum, and moreover the specimen apparently has no definite locality of provenance. The fishes from Papeete recorded by Herre (1936) under the name of *Tylosurus melanotus*, belong doubtless to *B. maris-rubri* as already explained in the discussion of that species.

Discussion. Whitley (1935) thought it necessary to place this species in a genus of its own but he did not present any character which would differentiate it from other genera, diagnosing his new genus *Djulongi* as follows:

"Cheeks scaly; operculum naked. Intermaxillaries but slightly swollen. Gill rakers obsolete. Body robust. Dorsal and anal fins long and almost opposite. Caudal peduncle not very strongly depressed and with only a small keel, formed by the lateral line, on each side. Caudal fin strongly forked".

It is evident that this description would more or less fit the majority of species of Belonidae, and I see no reason to recognise *Djulongi*.

Bleeker (1866) evidently was wrong when he synonymized his *melanotus* with *crocodila* and a few years later he went back to using the name *melanotus* (Bleeker, 1871), following Günther (1866) in doing so, though his synonymy indicates that at that time he did no longer have a clear idea about this species. I may add that I consider it likely that Bleeker's (1869) plate which is inscribed *Mastacembelus choram*, may pertain to *B. maris-rubri* and not to the present species, for it does not show an arched upper jaw, and the fin formula D 24, A 22 points also to its belonging to the last mentioned species, though it may fall within the range of variation of *melanota* of which I have examined but few specimens. From the foregoing remarks it is evident that *melanota* is a good species, and therefore Smith (1949) was not justified in stating that: "A number of specimens will doubtless show Nos. 229 [his *Tylosurus crocodilus* = *Belone maris-rubri*] and 230 [his *Tylosurus melanotus* = *Belone melanota*] to be the same species".

As regards the number of rays in D, there is in the British Museum a specimen, purchased from Bleeker, which is kept as the type of the species. In it, I counted D 24, but the last part of D is damaged and probably there have been 25 rays in D. Notwithstanding the fact that this specimen shows pencil stripes on various parts of its body, a proof that Bleeker has measured it, it cannot be the type, nor even a cotype, for in the description Bleeker

(1850) states that he has three specimens, varying in length from 380 to 600 mm, whereas the BM specimen has a length of about 69 cm. It may also be noted that Günther (1866) did not list the specimen as the type, though in other cases he did do so (cf. *Belone macrolepis* which really is the type) (note 6). In order to stabilize nomenclature in this species I select as lectotype a specimen 61 cm in length, RMNH nr. 6940. There are in Leiden several specimens from Bleeker's collection, also some smaller specimens, and as Bleeker never put a year of collecting on his bottles, every selection of a lectotype remains guesswork. Nevertheless, there is a good chance that the lectotype really is one of the original cotypes; the fact that it is a few millimetres longer than Bleeker's maximum measurement can hardly be an objection, as such differences are often found when measuring Bleeker's specimens after their preservation for about a century.

Apparently Bleeker (1871) was also the first to place *Belone coromandelica* and *Belone timucoïdes* van Hasselt in the synonymy of *B. melanota*, in which he has been followed by many later authors, including Weber & de Beaufort (1922), and Herre (1953), whereas others (Jordan & Starks, 1903; Roxas & Martin, 1937), on the evidence presented by Bleeker, replaced *melanota* by *coromandelica* or by *timucoïdes* (Fowler, 1938b). This question has already been fully discussed on a previous page, so that I can confine myself to stating that in my opinion *melanota* is the earliest name for the species and that there are not even doubtful earlier names which might be interpreted as pertaining to this species.

Fowler (1928, 1949) confusingly and erroneously listed this species under the name *Strongylura choram* (Rüppell), but recently he has corrected this (Fowler, 1956).

### ***Belone microps microps* Günther**

*Belone microps* Günther, 1866, p. 237 — Surinam, British Guiana.

*Belone amazonica* Steindachner, 1876, p. 94 — Amazonenstrom bei Pará, Manacapuru und Tajapuru.

*Deltatylosurus guayoensis* Martin, 1954, p. 5 — en un cano del Orinoco cerca de la Mision de Guaya, en el Territorio Delta Amacuro, Venezuela.

Diagnostic characters. D 12-15, A 15; no gillrakers; head about 3 in total length; eye very small, 3.8 to 5 in postorbital part of head (in one small specimen of 142 mm length, the eye was 3.8 in postorbital part of head; in 5 specimens varying from 25 to 43 cm total length, the eye was more than 4 in postorbital part of head); caudal peduncle over twice as wide as deep, with a silvery lateral band, but without a sharp keel.

Material examined, nine specimens, varying in total length from 14.2 to 43 cm, standard length 13 to 40 cm.

Distribution. Apparently confined to freshwater, both in estuaries and far upstream; known from the Guianas, and from the basins of the Amazon and the Rio Paraná (cf. MacDonagh, 1938. I have not seen this publication, but quote from the Zoological Record for 1938).

Discussion. The old material of this species in the Leiden Museum was partly labelled under the name of *Belone timucu*; this material includes specimens from Suriname sent by Dieperink, and a specimen originating from Bleeker's collection, also from Suriname, which is listed as *Mastacembelus timucu* in Hubrecht's (1879) catalogue, in group X, nr. 41, p. 40.

When Steindachner (1876) described *Belone amazonica*, he was already more or less convinced that this species was identical with *Belone microps*. None of the authors who subsequently used the name *amazonica* (*amazonicus*) compared material from the Amazon with specimens from the Guianas and the size of the eye as described by Steindachner: "...das Auge 4mal... in dem hinter dem Auge gelegenen Kopftheile enthalten", is within the range of variation found in the specimens examined from Suriname. Therefore the main character on which Steindachner believed it justified to distinguish between the two allegedly different species, is invalid and I am convinced that the synonymy as presented above is correct. Unfortunately I have not been able to personally examine specimens originating from the Amazon basin.

As regards the recently described *Deltatylosurus guayoensis*, Martin's (1954) careful description agrees in every detail with *Belone microps*, a species not mentioned by Martin and apparently overlooked by him. There can be no reasonable doubt that the name given by Martin is a synonym.

### ***Belone microps angusticeps* Günther**

*Belone angusticeps* Günther, 1866, p. 238 — Coast of Ecuador.

Diagnostic characters. D 16, A 19. Except for its fin formula, the type specimen is identical with *microps*.

Material examined, one, the type specimen, BM 1860. 6.16.181, leg. Fraser, no locality on label, but according to Günther (1866, p. 238) from the coast of Ecuador. Total length 25.8 cm, standard length 24 cm, head 78 mm, snout 50 mm, eye 6 mm, postorbital part of head 22½ mm, interorbital 5½ mm, caudal peduncle 3 mm deep against 7 mm wide; origin of D above 3rd ray of A, C damaged, perhaps slightly less deeply forked than in *microps*; a deep groove in the upper surface of the head, as in *microps* of similar size; a silvery band, very wide on the posterior part of the body.

Distribution. Only known from the type locality, which is vague.

Discussion. This form apparently is known from the type only, and its locality of provenance has only been given in rather broad terms. In view of the fact that *microps* is a freshwater species, it may inhabit the rivers of Ecuador west of the Andes. Though the specimen examined is in all other respects identical with *microps*, its fin formula differs so much from the ray numbers found in the nominate race, that it seems entirely justified to maintain it as a distinct race.

### ***Belone notata* Poey**

*Belone notata* Poey, 1860, p. 293 — Habana.

*Strongylura notata forsythia* Breder, 1932a, p. 3 — Lake Forsyth, Andros Island, Bahamas.

Diagnostic characters. D 13-14, A 13-15; no gillrakers; teeth vertical; the lower jaw ends in a small fleshy point; base of maxillary entirely covered by lacrimal; upper surface of head broad, with a groove which is narrow and deep between the eyes, to become shallower and wider anteriorly; opercles in the few specimens I examined apparently unscaled, though I note that Breder's (1932a) figure shows a scaled operculum; body cylindrical with large scales (from origin of P to base of C, 152 transverse rows in one specimen); a silvery lateral band, anteriorly narrow, posteriorly widening out as in other species; no keel on caudal peduncle, but lateral line distinct; caudal lunate, with the lower rays slightly the longer; D and A shorter than in any other West-Indian species, originating opposite each other; V much closer to base of C than to posterior margin of opercle (about equal to distance to base of P).

Material examined, four specimens as listed below.

Distribution. Apparently confined to the West Indies where, according to Jordan (1884), Jordan & Fordice (1887) and Jordan & Evermann (1896), it is at least locally very common. As this species is not represented in the collections of either the Leiden or the Amsterdam Museum, and as the British Museum has only four specimens, I am inclined to consider it decidedly local.

Discussion. With some hesitation I place *forsythia* in the synonymy. Breder separated *forsythia* on account of certain differences in measurements; he found that in rather good series the snout was, relative to the remainder of the head, decidedly shorter in the specimens from Lake Forsyth, and that there is no overlap.

I have measured only four specimens of *B. notata* and it is bold to draw conclusions from such a limited material; nevertheless I present here the particulars.

One specimen, Charlotte Harbour, Gulf of Mexico, leg. J. A. Henshall, BM 83.12.14.150, total length 35 cm, standard length 31 cm, snout 82 mm, eye 14 mm, postorbital part of head 28 mm, interorbital nearly 15 mm, D 13, A 13, scales 152 rows; total length of head 124 mm, eye + postorbital part of head 2.95 in head, eye 2.0 in postorbital part of head, eye 1.07 in interorbital.

Three specimens, Key West, Fla., leg. Jordan, BM 104, 481, 398.

Nr. 104. Total length 38 cm, standard length 34½ cm, snout 101 mm, eye 13 mm, postorbital part of head 31½ mm, interorbital 14½ mm, D 14, A 15; total length of head 145½ mm, eye + postorbital part of head 44½ mm, eye + postorbital part of head 3.27 in head, eye 2.42 in postorbital part of head, eye 1.11 in interorbital.

Nr. 481. Total length 30½ cm, snout 81 mm, eye 11 mm, postorbital part of head 26½ mm, interorbital 12 mm, D 14, A 15; total length of head 118½, eye + postorbital part of head 37½ mm, eye + postorbital part of head 3.16 in head, eye 2.41 in postorbital part of head, eye 1.09 in interorbital.

Nr. 398. Total length 28½ cm, standard length 26 cm, snout 77½ mm, eye 10 mm, postorbital part of head 22½ mm, interorbital 10 mm, D 14, A 14; total length of head 110 mm, eye + postorbital part of head 32½ mm, eye + postorbital part of head 3.38 in head, eye 2.25 in postorbital part of head, eye 1.0 in interorbital.

Thus my figures show that as regards relative length of eye + postorbital part of head, the specimen from Charlotte Harbour would have to be considered *forsythia*. This is already sufficient evidence to postpone acceptance of *forsythia* until larger series from different parts of the range of the species have been measured. Breder also claims the red coloration of *forsythia* to be paler than in *notata*. Having examined discolored specimens, I am not in a position to judge the validity of this character, but such a difference might easily be caused by external factors and therefore I do not attach too much value to it.

### **Belone platyura** Bennett

*Belone platyura* Bennett, 1832, p. 168 — Mauritius.

*Belone platura* Rüppell, 1837, p. 73, pl. 20 fig. 1 — Massaua.

*Belone carinata* Cuvier & Valenciennes, 1846, p. 324 — pris pendant la traversée de Guayaquil, aux îles Sandwich.

*Belone trachura* Cuvier & Valenciennes, 1846, p. 339 — Ascension.

*Belone lovii* Günther, 1866, p. 236 — Cape de Verde Islands.

*Belone persimilis* Günther, 1909, p. 349 — von den Sandwich- und Tonga-Inseln, von Yap und der Nordwest-Küste Australiens.

*Tylosurus pterurus* Osburn & Nichols, 1916, p. 152, fig. 6 — Carmen Island (off Baja California).

*Strongylura tahitiensis* Fowler & Bean, 1923, p. 10 — Tahiti.

*Platybelone dorsalis* Whitley, 1932 (20 April), p. 335 — north-western Australia.

*Strongylura longleyi* Breder, 1932b (December), p. 12 — Dry Tortugas.

*Esox teatae* Curtiss, 1938, p. 41 — lagoon near Tautira, Tahiti.

Diagnostic characters. D 12-16, A 17-20; five or six developed gillrakers on first hypobranchial besides a number of rudiments; eye large, 1.35 to 2.10 in length of postorbital part of head; teeth small and fine, weaker than in most other species of the genus; snout long and fragile; head 2.65 to 3.2 in total length; upper surface of skull with striae above the orbitae, and in the middle a wide, entirely scaled, open trace, anteriorly widening, which is hardly or not at all excavated; caudal peduncle strongly depressed, much wider than deep, with a sharp, almost leaf-shaped keel; the lateral line passes underneath the carina, this contrary to the majority, if not all, other species, where the lateral line passes over the sharp edge of the keel itself; caudal fin forked with a long lower lobe.

Material examined, 58 specimens as listed below.

Distribution. Apparently distributed over all tropical seas.

Discussion. As far as I could ascertain there is only one species of garfish with such a broad flat carina; therefore the oldest description cited here, that of Bennett (1832), doubtless pertains to the species:

“Bel. dorso subplano; caudâ depressâ, (altitudine latitudinis dimidio subaequali); pinna caudali bifurcâ; pinnis dorsali analique subelongatis, anticè falcatis, anali longiore: suprâ plumbeo-virescens, infrâ dimidiatim argenteo-flavicans. D. 14. A. 18. P. 12”.

The description by Rüppell (1837) with D 12-13, A 16-17 and also with mention of the broad carina, has always correctly been identified with the species under discussion. But with the chronologically following names *cignonella*, *carinata*, and *ardeola* (all Cuvier & Valenciennes, 1846) it is different. As far as *carinata* is concerned, Cuvier & Valenciennes especially mention: “l'élargissement des carènes latérales de la queue, ce qui rend cette partie du corps tout-à-fait déprimée et beaucoup plus large que haute...”. Combined with finray numbers D 15, A 17, there can in my opinion be no reasonable doubt about its identity with *platyura*, an identity already suggested by Günther (1866, p. 236) and Bleeker (1871, p. 51). As regards *ardeola*, a name that, incidentally, is being used almost universally for the species by authors who work on the West Indian marine fauna, the description does not convince me and also former authors expressed doubt (Jordan & Fordice, 1887; Jordan & Evermann, 1896, p. 713, neither of whom had seen material, and Evermann & Marsh, 1900, p. 99: “...it seems to agree with the brief des-

cription given by Cuvier & Valenciennes of their *Belone ardeola* and also of their *B. cigonella*...).

The name *B. cigonella* is quite as doubtful and, as I have pointed out in the discussion of that species, I am inclined to think that both names pertain to *Belone houttuyni*.

*Belone trachura* Cuvier & Valenciennes (1846, p. 339) is stated to have a strongly depressed tail, to the carina of which the lateral line does not contribute: there can be no doubt that *trachura* is another name for *B. platyura*. A discussion on the desirability of recognising *trachura* as a race, as has been done by Norman (1935, p. 5), will be given below.

*Belone lovii* Günther is a synonym and has since long been recognised as such. I have examined the type.

*Tylosurus pterurus* Osburn & Nichols (1916) is a species which apparently has not been mentioned in literature since its description; the description with illustration is good enough to fully convince me that *pterurus* is another synonym of *platyura*. The cited authors give D 13, A 16, a very broad and carinated caudal peduncle, and an eye which measures 1.7 times in the postorbital part of the head; no reference to *platyura* or "*ardeola*" or to any other species is made in the description.

*Strongylura tahitiensis* Fowler & Bean (1923) was placed in the synonymy of *Belone platyura* by Fowler (1949) himself, so that there is no reason to discuss this name.

*Platybelone dorsalis* Whitley (1932) is an illuminating example of careless and reckless naming. Günther (1909, p. 350) gave a list with finray numbers as counted in some specimens of his *Belone persimilis* (a synonym that will be discussed below); he listed five specimens, four from various South Sea islands, with D 13-14, A 18-19, and one from N.W. Australia with D 16, A 19. Whitley (1932) commented on this specimen (which he has never examined!) as follows: "*Platybelone dorsalis*, sp. nov. ...Included in Günther's original description of the Hawaiian *Belone persimilis* is an atypical north-western Australian specimen which requires a new name. Günther notes it as having D 16; A. 19; diameter of orbit, 11 mm.; interorbital space, 9.5 mm.; postorbital, 23 mm. Length, 17 inches. The increased number of dorsal rays is the main character distinguishing the Australian species". Apart from the fact that Whitley's remark that the increased number of dorsal rays is the main character distinguishing the Australian species is not justified as it is the only character (as far as the evidence available to Whitley went) in which it differs from the other specimens listed by Günther, I must add that I have examined the type specimen (which Whitley did not) and found it to have 14 dorsal rays. On several other occasions I

found that Günther has been rather careless when counting ray numbers, if not, indeed, the number of 16 as given in his publication is a mere misprint.

The specimens listed by Fowler (1944) as *Dorbybelone stolzmanni* (Steindachner) evidently belong to *Belone platyura*, and I prefer to follow previous workers in associating *stolzmanni* with *exilis*.

Both in the Pacific (*Belone persimilis* Günther, 1909) and in the West Indies (*Strongylura longleyi* Breder, 1932b) alleged species have been described on the basis of a slightly smaller eye. When comparing specimens one does undeniably find rather strong differences in size of the eye, which might lead one to believe that two species are involved. I have tried to solve the problem as to whether or not two species occur with a different size of the eye, by measuring a number of specimens as listed in Table III. My expectation was that if two species were involved, which perhaps would overlap in relative eye size, plotting would result in a bimodal curve, whereas when only one species, with a variable eye size is involved, a normal curve would be found. When taking together from the table the figures appearing in the last column, we find the following:

eye, times in postorbital part of head:

1.30-1.39	1.40-1.49	1.50-1.59	1.60-1.69	1.70-1.79	1.80-1.89
1	4	4	10	16	6
1.90-1.99	2.00-2.09	2.10-2.19			
4	3	1			

Allowing for the fairly small number of specimens, originating from many different populations, the curve is perfectly normal. Breder (1932b) suggested the existence of a difference in relative length of the head, but here also I failed to find any irregularity. Because the long and thin snouts are often broken in preserved material (tips lacking) accurate measurements of the total length of the head, including the snout, could be taken from part of the material only.

Norman (1935) has already suggested that *longleyi* might be a synonym of "*ardeola*", whereas Schultz first (1943, p. 54) placed *persimilis* in the synonymy of *platyura*, but subsequently (Schultz, 1953, p. 160) resurrected it, giving the alleged differential characters. As can be seen my range of variation, in a larger series than Schultz had at hand to base his conclusions on, includes the ranges of variation of both his species.

An additional argument for rejecting a different small-eyed species is the fact that over the whole range of the species small-eyed and large-eyed forms occur together, and share the geographical variation in the number of fin-rays (which will be discussed below). It is very hard to believe (though, of



finrays. The western Indian Ocean is apparently inhabited by individuals identical with the West Indian ones; I have not examined material, but Bennett's type from Mauritius had D 14, A 18 (Bennett, 1832). In the Red Sea finray numbers seem to average lower than anywhere else; I have examined but a single specimen (originating from Rüppell's collection), but according to Rüppell (1837) the ray numbers are D 12-13, A 16-17, a curious agreement with *B. maris-rubri* in which also individuals of the Red Sea tend to have less rays than those from elsewhere. Specimens from the Indo-Pacific average much higher, and approach the population from St. Helena and Ascension, bridging the gap that otherwise might justify recognition of *trachura*. Perhaps specimens from the eastern Pacific average lower again, I note that the type specimen of *Tylosurus pterurus* Osburn & Nichols (1916) was described as having D 13, A 16, but I have not personally examined material from that region.

It must be concluded that, though the geographic variation of this widely distributed species is most interesting and deserves to be more fully studied, it is impractical to recognise subspecies.

### ***Belone punctulata* Günther (Fig. 6)**

*Belone punctulata* Günther, 1872, p. 670 — Manado.

*Tylosurus philippinus* Herre, 1928a, p. 31, pl. 2 — Coron, Busuanga (also Tandubas Island and Sitankai, both in the Sulu Province).

Diagnostic characters. D 21-22, A 21; no gillrakers; teeth vertical; snout relatively broad and short, lower jaw protruding with a fleshy point which encloses the tip of the upper jaw; upper surface of skull with a deep median groove which does not become narrower anteriorly (fig. 6), a not very pronounced dermal keel on caudal peduncle; tail forked with a long lower lobe.

Material examined, five specimens, varying in total length from 26½ to 52 cm, standard length 24½ to 46½ cm.

Distribution. Apparently not uncommon in the southern Philippines, where Herre collected a number of specimens (Herre 1928a, 1928b, 1934); also in the Indian Archipelago where known from Singapore (Herre, 1940), Balikpapan (Weber & de Beaufort, 1922; specimen examined), Manado (Günther, 1872, type, examined), New Guinea, and N.E. Australia (BM 71.9.-13.37). The New Guinea record is based on a specimen from the Humboldt Bay, Oct.-Nov. 1954, RMNH; recently Munro (1958) has recorded the species from Papua and the Bismarck Archipelago.

Discussion. The type still shows the small dark dots after which Günther named the species; in no other specimen these spots are present so that they

TABLE III  
Individual measurements of specimens of *Belone platyura* Bennett from  
various parts of its range

loc	mus. nr.	total l. cm	stand. l. cm	D	A	eye mm	interorb. mm	postorb. mm	eye in postorb. mm
?									
West Indies	RMNH	—	22.5	14	18	—	—	—	1.75
"	RMNH 9324	29.2	27.2	13	18	10.5	8.5	17	1.62
"	"	32.5	30.5	14	18	12	9	20	1.67
"	"	33+x	30+x	14	18	12	10	21.5	1.79
Bonaire	RMNH 18606	34	32	13	18	10	10	21	2.10
"	"	32.7	30.5	12	17	12	10	20	1.67
"	RMNH 19564	32	30	13	18	9.5	8.5	18.5	1.95
"	ZMA	32.5+x	30.5+x	13	19	13	—	22.5	1.73
"	"	32	30	14	18	12	10	20	1.67
"	"	33.5	31	13	17	11	9.5	20	1.82
St. Eustatius	"	24.8	26.3	13	18	—	—	—	—
Curaçao	"	32.3	30	14	18	—	—	—	—
"	"	33	31	13	17	—	—	—	—
"	"	29.3	27	14	19	—	—	—	—
"	"	31.5	29.5	13	17	—	—	—	—
"	"	29.9	27.3	14	18	—	—	—	—
"	"	28.2	26	13	18	—	—	—	—
"	"	30	27.5	14	18	—	—	—	—
"	RMNH	—	23.8	14	18	—	—	—	—
"	"	—	22.0	13	18	7	6+	14	2.00
Cayman Is.	BM 1939.5.12.4	28 (+3)	26 (+3)	13	19	8.5	7+	16.5	1.94
Tobago	BM 1920.12.22.32-3	32.8	30.5	13	19	11.5	9	19.5	1.70
"	"	35.3	33	14	19	11.5	9.5	19.5	1.70
Dominica	BM 66.1.22.88-89	30.8	28.7	14	19	9.5	7.5	16.5	1.74
"	"	31.3	29.2	13	18	9	7	16.5	1.83
St. Lucia	BM 1931.4.21.3	32.6	30.5	13	18	9	8	17	1.89
Bahamas	BM 1938.12.12.30	31	28.5	13	18	8	6	15.5	1.94
St. Vincent	BM 1934.4.5.1	28	26	13	18	7.5	6	15.5	2.07

West Indies

loc.	mus. nr.	total l. cm	stand. l. cm	D	A	eye mm	interorb. mm	postorb. mm	eye in postorb. mm
St. Helena	BM 1946.5.23.18-19	46	43	15	19	14	11	24	1.71
"	"	45	42	15	20	14	11	25	1.71
"	BM 1946.5.23.20	47	44	15	19	12	10	25	2.08
"	BM 67.11.28.13-14	45.5	42	15	20	14	11.5	25	1.78
"	"	42.5	39.5	16	19	13.5	11	23.5	1.74
Ascension	BM 79.5.14.472	44.5	41	16	19	15	12	25.5	1.70
"	BM 90.2.26.175	39	36.3	14	19	14.5	11.5	24	1.66
"	BM 1932.2.19.1-5	45	41.5	15	19	15.5	13	26	1.68
"	"	41	38.5	15	19	12.5	9	21	1.68
"	"	37.5	35	15	19	11.5	9	20	1.74
"	"	39.5	36.5	15	19	12.5	9.5	21	1.68
"	"	36.5	33.5	15	19	12	9.5	20.5	1.71
"	BM 1908.7.24.9	39.3	36.5	15	20	12.5	10	21.5	1.72
St. Vincent	BM 35.5.11.1-2	38	35	14	18	13	11	21	1.62
"	"	36.5	33.5	14	18	13	10	20.5	1.58
Cape Verde	BM 66.4.10.1	36.4	33.5	13	18	14.5	11	21	1.45
Red Sea	BM 1860.11.9.70	39	35.7	13	17	15	13.5	24	1.60
Cocos-Keeling	BM 1949.11.29.54-56	35.5	33	15	18	13	10.5	20	1.54
"	"	37	34.5	14	18	13.5	11	20	1.48
"	"	39	36	14	18	14.5	12	22.5	1.55
Ind. Arch.	BM 62.5.2.8	31.7	29	14	17	12	10	18	1.50
Flores	ZMA	31	29	15	19	10	9	17.5	1.75
N.W. Australia	BM 55.9.19.1087	42.5 + x	40	14	19	11.5	—	22.5	1.96
Yap	BM (no number)	35.2	32.5	13	18	11	9	20	1.82
Ponape	BM 81.10.20.92	47.5	44	15	19	15.5	12.5	23	1.48
Rotuma	BM 97.8.23.187	31.5	29	15	19	9	7.5	16	1.78
Tonga	BM 77.12.10.38	35.3	33	15	18	12.5	9.5	18	1.44
Hawaii	BM 1883.12.15.96-97	47	44	14	19	15.5	15	28	1.81
"	"	41	38.5	14	19	12.5	—	23	1.84
Sandwich Isl.	BM 83.12.15.98	49.2	46	14	20	20	18	27	1.35

<sup>5</sup>

must represent an aberrant character or may be due to some artificial influence, just as in *Belone krefftii*.

Herre's (1928a, 1928b) excellent description and plate of *Tylosurus philippinus*, later changed to *Busuanga philippina*, leave no doubt whatever that his species is identical with *punctulata*; moreover, I have been able to directly compare a Philippine specimen identified as *philippina* by Herre himself with the type of *punctulata*. It is difficult to understand why Herre described his specimens as new, as he repeatedly referred to Weber & de Beaufort's (1922) work in the synonymies of his paper on Philippine garfishes (Herre, 1928b), and the species does key out quite easily in Weber & de Beaufort's book.

The genus *Busuanga* created by Herre (1930) for this species: "distinguished from other genera of the Belonidae by the anterior extremity of the mandible, which extends beyond the snout and terminates in a thick, spongy, somewhat flexible tip, much thicker than the rest of the mandible and forming a continuation of the upper profile of the beak", is altogether superfluous. Like so many ichthyologists Herre utterly confuses generic and specific characters.

### ***Belone strongylura* van Hasselt**

[*Belone*] *strongylura* van Hasselt, 1823, p. 130 — Vizagapatam (based on *Esox* maxillis longissimis, dentatis; corpore alepidoto; cauda rotunda, Russell, 1803, p. 61, fig. 176).

*Strongylura caudimaculata* van Hasselt, 1824, p. 374 — Vizagapatam (based on Russell, 1803, fig. 176).

*Belone caudimacula* Cuvier, 1829, p. 285 — Vizagapatam (based on Russell, 1803, fig. 176).

*Belone oculata* Cuvier & Valenciennes, 1846, p. 333 — Pondichery (nomen nudum).

*Belone saigonensis* Sauvage, 1879, p. 208 — Saigon (Cochinchine), Mé-kong.

Diagnostic characters. D 13-14, A 15-17; eye fairly small, varying with size of the body, but in well developed specimens usually 3 or more times in postorbital part of head; slender with long jaws and thin teeth; a silvery band over the sides; no keel on caudal peduncle; tail rounded with near the base a black spot. Particularly the black dot on the tail is diagnostic and serves to distinguish the species at once from all other species; even in material preserved for over one hundred years it is distinct, though in large specimens it is slightly less clear than in smaller ones.

Material examined, 21 specimens, varying in total length from 14.0 to 48.5 cm, standard length 12.8 to 43.5 cm.

Distribution. Indian Ocean and Indian Archipelago, including New Guinea (Regan, 1914) and the Philippines. Apparently not yet found in the

Western Indian Ocean; it does occur in the Persian Gulf (Blegvad & Løppenthin, 1944), but has, as far as I am aware, not been reported from the Red Sea or from the east coast of Africa.

Discussion. As this species, as explained above, is very easily recognizable, its synonymy has fortunately remained limited, while Bleeker (1866) already introduced the name given by van Hasselt (1823). Remains only to note that Günther (1866) lists the species twice, once under the name of *Belone caudimaculata* Cuv. (errore! it should be either *caudimacula* Cuvier, or *caudimaculata* van Hasselt) and once as *Belone strongylurus* (v. Hass.), apparently without realizing that *caudimacula* Cuvier and *caudimaculata* van Hasselt are objective synonyms of *strongylura* van Hasselt, all being based on the same figure of Russell (1803, fig. 176). Weber & de Beaufort (1922) placed Günther's *caudimaculata* in the synonymy of *strongylura*; not, however, on the basis of the nomenclatorially correct argument that one is an objective synonym of the other, but because they do not consider the points of difference enumerated by Günther between the two alleged species of sufficient importance to maintain them both. In their synonymy Weber & de Beaufort (1922), and therefore also Herre (1953), who evidently copied much of his synonymy from them, overlooked the name *Strongylura caudimaculata* van Hasselt, 1824.

The species is the type of the genus *Strongylura* van Hasselt, 1824. Though already nearly forty years ago Fowler (1919a) showed that the generic name *Tylosurus* Cocco (1833) had to be replaced by it, the change is only now beginning to become generally accepted. Particularly it is surprising to find how later authors (Weber & de Beaufort, 1922; Herre, 1953, etc.) without comment continue to use the name *Tylosurus* for the gillrakerless garfishes, when they apparently knew Fowler's (1919a) publication and correctly referred to his names in their synonymy as *Strongylura*.

This controversy about the generic name caused me to consult the original description of *Strongylura* van Hasselt (1824). I found the following:

“La famille des *Esoces* m'a fourni deux *Belone*; savoir, la *B. Timucoïdes*, pl. 175, de Russel, et une qui est figurée pl. 176, aussi de Russel, à laquelle pourrait convenir le nom de *Strongylura caudimaculata*”.

As all van Hasselt's letters have earlier been published in the *Algemeene Konst- en Letter-Bode* (van Hasselt, 1824, refers in his text to van Hasselt, 1823) (note 7), I also examined that magazine and found:

“De Familie der *Esoses*, heeft mij gegeven 2 Belonen, *B. Coromandelica* Cuv., Russel, T. 175 en een die afgebeeld is in Russel, Tab. 176 en voor welke de naam *strongylura* geschikt zoude zijn”.

Evidently some change has been made in the translation (note 1), per-

haps Fowler (1919a) is right in assuming that the name *caudimaculata* was introduced to avoid tautonomy (though the name *coromandelica* was also changed) and at any rate the reference to Russell (1803) fully validates both names from a nomenclatorial point of view. More about the names *coromandelica* and *timucoïdes* is to be found in the discussion of *B. maris-rubri*.

*Belone saïgonensis* is a synonym; its description already makes this evident and, moreover, I have examined a cotype (incorrectly labelled as "type"), BM 1883.7.4.52.

### **Belone urvillii** Cuvier & Valenciennes

*Belone Urvillii* Cuvier & Valenciennes, 1846, p. 330 — îles de Vanikoro.

*Belone macrolepis* Bleeker, 1856, p. 225 — Nias.

Diagnostic characters. D 12-13, A 13-16; no gillrakers; eye 2.3 to 2.8 in postorbital part of head, interorbital equal to eye or slightly wider; teeth rather weak, slightly directed backwards; skull with a fairly wide median groove, which anteriorly becomes wider; body cylindrical; scales large, 125 to 135; no caudal keel; tail slightly truncate; insertion of D in relation to A apparently very variable, in the three specimens of the species I examined, in one the origin of D was opposite the 6th ray of A, in one opposite the origin of A!

Material examined, three specimens, varying in total length from 24.8 to 44.0 cm, standard length 22.4 to 40.0 cm.

Distribution. This species is apparently rare, Bleeker never obtained more than a single specimen, and Herre (1928b) also calls it rare. It is known from various parts of the Indian Archipelago, from the Philippines, eastern New Guinea (Duncker & Mohr, 1926), and from Vanikoro. I have examined specimens from Raha at Moena, from Nias (type of *macrolepis*), and from Culion, Philippine Islands.

Discussion. Bleeker (1866, 1871) already suggested that his *macrolepis* might be identical with *B. urvillii*. Cuvier & Valenciennes's description of *urvillii* fits *macrolepis* fairly well, but unfortunately no mention of the number of scales, one of the best characters for distinguishing the species, is made. Madame Bauchot (in litt. 15.IV.1958) has kindly supplied me with information about the type of *urvillii*: "Nous possédons également dans nos collections le type de *Belone urvillii* C.V., rapporté par Quoy et Gaimard de Vanikoro. Les numérations sont les suivantes: A: 15-D: 13- Ecailles de la ligne latérale 125. Le corps est cylindrique sur la première moitié de sa longueur". These additional particulars on the type specimen leave no doubt whatever in my mind that *urvillii* is the same as *macrolepis*, which, as a consequence, it must replace.

The only species *urvillii* is rather close to, is the West Indian *B. notata* Poey, but, as indicated in the key, these two species can readily be distinguished by their different place of insertion of the ventrals.

## DOUBTFUL NAMES

**Sphyraena acus** La Cepède

*Sphyraena acus* La Cepède, 1802-1803, tome X, p. 59, 62 footnote 5, 65, also tome IX, pl. 1, opposite p. 7 — no locality, but based on a drawing by Plumier and therefore probably from Martinique, at least from the West Indies or northern South America.

On p. 59 of La Cepède's work quoted above, we find the following description of "La sphyrène aiguille":

"Six ou sept rayons à la première nageoire du dos; un rayon aiguillonné et vingt-quatre rayons articulés à la seconde; un rayon aiguillonné et vingt-trois rayons articulés à l'anale; la caudale en croissant; la corne supérieure de la caudale plus longue que l'inférieure; les mâchoires très-étroites, pointues, et deux fois plus longues que la tête proprement dite".

On p. 62, footnote 5, there is added:

"*Sphyraena acus*.

*Acus americana*, rostro longiori. Plumier, *manuscripts de la Bibliothèque nationale déjà cités*".

On p. 65 he adds to the description:

"La seconde dorsale et la nageoire de l'anus de la sphyrène aiguille sont échanrées de manière à représenter une faux. La mâchoire inférieure dépasse celle d'en haut. Chacune de ses mâchoires est armée d'une cinquantaine de dents étroites, crochues, longues, presque égales, et correspondantes aux intervalles laissés par les dents de l'autre mâchoire.

Nous devons à Plumier la connaissance de ces trois dernières sphyrènes".

And in a footnote on the same page:

"8 ou 9 rayons à la membrane des branchies de la sphyrène aiguille".

The figure is not very helpful, only it is pretty apparent that what La Cepède believed to be the first dorsal fin, really is one of the ventrals, and it is evident that the species described really belongs to the Belonidae, and not to the Sphyraenidae.

This has already been discovered by Cuvier & Valenciennes (1829, p. 338) from whose work I copy:

"L'illusion était moins excusable pour le second, que M. de Lacépède (t. V, pl. 1, fig. 3) nomme *sphyrène aiguille*. C'est une orphie ployée et un peu contournée, de manière que ses ventrales paraissent l'une à droite, l'autre à gauche. C'est l'une de ces ventrales que M. de Lacépède a regardée comme une première dorsal, et sur une méprise aussi aisée à rectifier il

s'est empressé d'établir une espèce. La forme seule des mâchoires, le nombre et l'égalité de leurs dents, auraient dû le désabuser".

Cuvier & Valenciennes (1846, p. 319), in the discussion of *Belone galeata* (= *Belone howttuyni* Walbaum), state that:

"L'espèce désignée par M. de Lacépède sous le nom de *Sphyrène aiguille*, t. V, pl. 1, fig. 3, est évidemment du genre Orphie, mais tout-à-fait impossible à déterminer. Elle a été copiée de Plumier. A cause de la grosseur du bec, on pourrait la rapporter au poisson dont nous parlons ici".

At this the question was left for some time, but the issue was raised again by Jordan & Fordice (1887, p. 356), who in a discussion of *Tylosurus acus* (= *Belone imperialis*) thought that: "It is probable also, as Dr. Bean has already noticed, that the *Sphyræna acus*, roughly figured by Lacépède, is the same species. The long snout separates it from *raphidoma*, the small eye from *T. caribbaeus*, and the long fins and other characters distinguish it from the other West Indian species. The species should then, without much doubt, be designated as *Tylosurus acus*".

Jordan & Fordice's action has been followed by many subsequent students, with the result that in the West Indies *Belone imperialis* (Rafinesque) is generally called *Belone* (or *Tylosurus*, or *Strongylura*) *acus* (Lacépède). Personally I regard this identification as extremely doubtful. Jordan & Fordice have drawn more conclusions from La Cépède's rough sketch than is permissible; though it seems likely that it is a species with long dorsal and anal fin, so that Cuvier & Valenciennes's suggestion, as quoted above, is improbable, the argument of the size of the eye is not sufficient to decide if *B. hians*, *B. maris-rubri*, or *B. imperialis* was depicted. It may be added that if one wants to stress the importance of the fin-formula, the D 25 and A 24 are slightly too high for *maris-rubri*, and do not entirely agree with any species I have examined. The number of rays probably can at most be taken as approximately correct, and therefore the species must be considered unidentifiable.

### ***Belona argalus* Lesueur**

*Belona argalus* Lesueur, 1821, p. 125, plate — near the Island of Guadaloupe.

In the description the finray numbers are given as D 16, A 19; in the figure one counts D 27, A 22. As it is apparent that the description is based on the figure (cf. p. 124: "The drawings of several species which I have made in the West Indies and the United States... It is from descriptions, and the comparisons of four different drawings from nature, made in different places, that I now consider myself authorized to distinguish three new species..."), it is evident that a mistake has been made.

The fish figured on the plate shows a very depressed caudal peduncle of the type only occurring in *Belone platyura*, with which species the shape of the caudal fin also agrees, whereas the large eye (2 in postorbital part of head) is also indicative of *platyura*; and Fowler (1919b, 1936), as a consequence, listed the species here called *B. platyura*, under the name of *argalus*. The reason that I am not prepared to recognise in *argalus* an older name for *platyura* lies, besides in the high number of finrays in D and A shown in the figure, in the fact that Lesueur in his description does not clearly mention the very broad caudal carina. He only writes: "...the tail laterally carinated... Lateral line... continued along the middle of the tail upon the carina". Of the following species he describes, *truncata*, he writes however: "Base of the caudal fin depressed and carinated as in the preceding species...". As the last-mentioned species was collected near New York and as in both description and figure the finray numbers and the size of the eye ( $3\frac{1}{2}$  in postorbital part of head) agree with *houttuyni*, we may deduce that the carina on the tail of *argalus* must more or less agree with that of *houttuyni*. Hence I consider it too far fetched to assume that Lesueur would not have noticed the very flat and strongly distinct carina of *platyura*; moreover in *platyura* the lateral line does not run over the carina, but is below it. At any rate we enter in so many suppositions that it is advisable to reject *argalus* altogether. We might as well assume that the finray numbers given in Lesueur's description are erroneous and those of the drawing are about correct, in which case *argalus* might be identical with species as *B. hians* or *B. imperialis*. Also I want to point out that the finray numbers D 16, A 19 are rather high for *B. platyura* in the West Indies. Perhaps the most likely explanation of the many discrepancies in text and figure is that both are composite, assembled from different field notes and sketches.

As regards the views of previous revisors, Cuvier & Valenciennes (1846) only knew the species from Lesueur's description, which they largely copied; Günther (1866, p. 234, footnote) did not know the species and listed the name without comment; Jordan & Fordice (1887, p. 361) suggested that *argalus* might be identical with their *ardeola* (= *platyura* in this revision), without effectuating the change. On this evidence Fowler apparently based his opinion of the applicability of *argalus*. With diffidence for a much older and more experienced systematist, I cannot refrain from remarking that Fowler rather often has introduced old and somewhat obscure names, when others have only carefully suggested that a certain identification might be possible. See also my comments on his use of the name *indica*, following below.

**Belona indica** Lesueur

*Belona Indica* Lesueur, 1821, p. 130 — Indian Ocean.

The salient characters of this species as described by Lesueur, are: "...its obliquely truncated caudal fin, slightly scolloped with arrounded lobes, and the lower one longer: the dorsal and anal fins are likewise similar in form, placed exactly opposite each other...", and: "P. 14. — V. 5 D. 19. — Caudal 14.", and: "...there is no visible keel".

Evidently there is some mistake or misprint in the number of rays in D and A; this makes it uncertain if the 19 pertains to D or to A. Whether or not this is a species with a forked tail and long lower lobe is not apparent from the description, I am inclined to think that it is not, for of *Belone crocodila*, Lesueur (1821, p. 129) wrote, describing the tail: "...lunulated with the lower lobe much longer than the upper".

Therefore neither the number of finrays nor the shape of the tail is clear from the description, whereas the remark that there is no visible keel would suggest that this species is not identical with *B. maris-rubri*, *B. melanota*, *B. appendiculata* or *B. punctulata*.

Cuvier & Valenciennes (1846) at the end of the discussion of *B. annulata* remarked the following:

"C'est dans l'une de ces espèces indiennes qu'il faudra chercher le *Belona indica* de Lesueur, décrit en 1821 sur ses notes prises pendant son voyage autour du monde fait en 1803. L'individu qui avait été déposé, au retour de l'expédition de Baudin, dans le Muséum d'histoire naturelle, ne s'y trouve plus, et comme la description est fort incomplète, il est impossible d'arriver maintenant à une détermination précise".

Günther (1866) and Bleeker (1871) placed *B. indica* with a query in the synonymy of *annulata*, without, however, replacing the latter name by the former, showing that they felt not at all certain about its identity; probably they followed Cuvier & Valenciennes in provisionally attaching *indica* to *annulata*, though it is evident from Cuvier & Valenciennes's words quoted above that they did not intend to suggest that *indica* is identical with *annulata*.

Jordan & Starks (1903) attach the name to their *Tylosurus giganteus*, noting it as "*indicus*, about the pertinence there is some doubt".

Fowler (1922 and subsequent publications), without any comment or explanation, introduced the name *indica* for the species hitherto named *gigantea* or *annulata*. Personally I do not consider it likely that *indica* of Lesueur really pertains to the species usually called *gigantea* or *annulata*, but I want to point out that if this identification were correct, *indica* would be identical with *crocodila*, described in the same work by Lesueur, which has page

priority and has been much more widely used. The type of *indica* is lost and therefore its identification will forever be uncertain.

### **Esox timucu** Walbaum

*Esox Timucu* Walbaum, 1792, p. 88 — Brazil (based on Marcgrav, 1648, p. 168).

Marcgrav's (1648) description, on which Walbaum's name is based, reads as follows:

"TIMVCV Brasiliensibus; *Peixe agulha* Lusitanis: piscis duos pedes longus, corpore tereti instar anguillae. Rostrum habet osseum, tres vel quatuor digitos longum, acuminatum, utrobique dentibus minimis refertum: inferior rostri pars paulo longior superiori, & id quod prominet molle, non osseum; caret lingua. Oculos habet rotundos, crystallinos, circulo argenteo: sex pinnae, nimirum duas oblongas postbranchiales, duas junctas in infimo ventre ante anum parvas, post anum unam quae fere ad exortum caudae porrigitur & similem huic oppositam in dorso; Cauda pinna quasi bisecta constat. Caret squamis, sed tegitur cute. Summitas capitis & rostri ac dorsi cum medietate laterum olivacei est coloris: inferior medietas cum ventre argentei. Per utrumque autem latus secundum longitudinem linea tendit virescens, distinguens olivaceum ab argenteo. Pinnarum color respondet parti cui appositae sunt. Edulis est. Capitur in mari & fluviis salsis. Boni est saporis, praesertim frixus butyro; caro ejus non est spinosa".

Marcgrav's figure is not very helpful, for though without any doubt it represents a *Belone*, few characters that might assist in identifying the species can be taken from it. The only important points are that A is inserted farther back than D (and this may be an error in the drawing!), and that the tail is forked with a longer lower lobe.

Usually Marcgrav's Timucu has been identified with the species here called *B. houttuyni*. Cuvier & Valenciennes, who apparently were not aware of Walbaum's description, named a *Belone timucu* on the basis of actual specimens, which they believed to be identical with Marcgrav's Timucu:

"C'est, à n'en pas douter, l'espèce que Marcgrav a décrite sous le nom que nous lui conservons: si la figure annexée à cette description est moins facilement reconnaissable que plusieurs autres de cet auteur, la caractéristique que l'on peut tirer de la ligne verte étendue de long des flancs et si positivement indiquée dans le texte, ne peut laisser aucun doute à cet égard. Je ne trouve pas cependant l'original de la figure citée dans le recueil des peintures du prince Maurice de Nassau, conservé dans la Bibliothèque royale de Berlin".

The name *timucu* Walbaum was, as far as I am aware, re-introduced by Jordan & Evermann (1896); previously Jordan & Fordice (1887) did not

venture to place it with certainty, though they doubtfully referred Marcgrav's Timucu to their *Tylosurus almeida* (= *Belone houttuyni*).

Jordan & Evermann (1896), followed by many subsequent authors, among whom Breder (1932b) may be mentioned, accept both *Tylosurus timucu* (Walbaum) and *Tylosurus marinus* (Walbaum); from their key it appears that they ascribe to the former a "Caudal peduncle compressed, deeper than broad, without trace of keel along the lateral line...", and to the latter a "Caudal peduncle more or less depressed, or, at least, with more or less developed dermal keel along the lateral line...". As I have stated in the description of *houttuyni*, the presence or absence of a slight keel on the caudal peduncle in this species is a matter of size. On what grounds Breder (1932b) decided to name one of his specimens *timucu*, and all others *marinus*, I do not know; admittedly he gives an elaborate description of *timucu* (which, however, is not very useful), but he does not describe his *Strongylura marina*, nor are any comparative notes between the two alleged species given in his publication.

Longley & Hildebrand (1941) came with a new idea about the identity of Walbaum's *timucu*; apparently Longley considered *timucu* to be the species *Belone platyura*, currently known as *Strongylura ardeola*. Bleeker evidently identified *timucu* with *Belone microps*; see the discussion on p. 56.

Personally I think that much can be said in favour of the identification made by Cuvier & Valenciennes and Jordan & Evermann; I am not able to judge the value of the colour characters mentioned by Cuvier & Valenciennes in favour of their identification, but from the material examined it is evident to me that *houttuyni* is the commonest species of garfish in coastal waters of Brazil, which makes it likely that Marcgrav described this species. There is no certainty, however, and the figure seems to show a specimen with a tail with long lower lobe, which *houttuyni* does not have. The advantage of the identification of *timucu* with *houttuyni* would be that, as the names *marinus*, *timucu*, and *houttuyni* are given by Walbaum (1792) in the same publication and on the same page, *timucu* might be relegated to the synonymy of *houttuyni*. As it is, however, I do not think it useful to try and identify Marcgrav's description and figure with any known species.

If Walbaum's publication is suppressed for nomenclatorial purposes (see note 4), his name would of course be disposed of.

## NOTES

Note 1 (p. 11, 67)

Dr. Boeseman has drawn my attention to a footnote appearing in the Bulletin des Sciences Naturelles (Ferussac), vol. 2, 1824, p. 206:

“(1) C'est à M. le Dr. Boié que nous devons la traduction de plusieurs des lettres de MM. Kuhl et Van Hasselt. Il a bien voulu revoir celle des autres, et enrichir ces lettres de renseignements précieux sur la synonymie des espèces qui y sont citées en rectifiant le texte de l'original hollandais, quelquefois inexact. Les zoologistes nous sauront gré de leur avoir fait connaître ces lettres intéressantes de deux savans si dignes de leurs regrets, et qui ont tant fait pour la science. M. le Dr. Boié va les remplacer à Java, où les vœux de tous les naturalistes l'accompagneront.”

This makes it likely that Boie is actually responsible for the introduction of the name *Strongylura* in a generic sense and for the other alterations in nomenclature in the french version of van Hasselt's paper. As, however, this is not mentioned in the text, the authorship of these names must continue to be ascribed to van Hasselt.

Note 2 (p. 13)

Originally I was inclined to follow Bailey (1951, 1957) in ascribing the authorship of volume XVIII of the “Histoire Naturelle des Poissons” to Valenciennes alone, and the International Commission on Zoological Nomenclature has since ruled in support of Bailey's proposals (Opinion 580, Bull. Zool. Nomencl., vol. 17, pp. 148-152. Later, mainly for the sake of simplicity, I preferred to refer to the work as “Cuvier & Valenciennes”. This does not mean dissention from the decision of the Commission, but when I learned of this ruling this paper was in press, which made it impractical to alter the numerous references in the text.

Note 3 (p. 17)

The date of appearance of volume VI of Bleeker's “Atlas Ichthyologique” is usually quoted rather unsatisfactorily as “1866-1872”. The presence of a copy of the work in original wrappers, and of a number of letters pertaining to the successive instalments (livraisons) makes it possible to date them more exactly.

As regards the general plan of the work, I refer to Bleeker's (1881b) paper on the subject, that should be consulted by anybody interested in the “Atlas Ichthyologique”. The first instalment is also accompanied by a note (Avis essentiel) which contains the following information:

“D'après le Prospectus de cet Atlas, chaque livraison de 12 planches serait accompagnée de quatre feuilles de texte, et la prix de chaque feuille serait 25 cents de Hollande.

Depuis il a paru qu'il sera nécessaire d'ajouter à chaque livraison de plan-

ches cinq feuilles de texte au lieu de quatre. — Cette modification cependant n'influera pas sur le prix de l'ouvrage, vu que l'auteur a décidé que chaque feuille de texte sera délivrée au prix de 20 cents de Hollande au lieu de 25 cents et même, que, s'il sera nécessaire d'ajouter plus de cinq feuilles aux livraisons, ces feuilles supplémentaires seront délivrées gratis."

This information is important, because, though the original wrappers are present in the Leiden copy, many plates and parts of the text have evidently been interchanged between the various wrappers, their contents being loose so that it is quite easy to remove parts from one wrapper and put them back in another. This is the reason that of a few parts I have not been able to ascertain the exact contents. As will be seen, the plates continued fairly consistently to be published in series of 12, but the text tended to increase very much beyond the original plans.

As regards the dates of publication, there are three sources of information. To begin with, every instalment shows the year of publication on its cover. Secondly there is the information contained in the "Zoological Record", in which the year of publication, and often also information on the contents of each instalment is given. Thirdly, for the first 18 instalments it is possible more strictly to limit the dates of issue. Bleeker used to present a copy of every instalment to His Majesty the King; in the archives of the Leiden Museum there are copies of a number of letters, addressed by Bleeker to the librarian of His Majesty's private library, written to accompany each new instalment sent to the royal library.

Also there is a series of letters from the royal librarian to Bleeker, in which the receipt of each instalment is acknowledged. Neither series of let-

1) After plate 246 another lithographer was employed.

2) During this period, extending from 1869 (livraison 21) to 1875 (livraison 28), Bleeker evidently had difficulties in finding a satisfactory lithographer. While the plates included in livraisons 1-20 were all prepared by C. W. Mieling, Bleeker subsequently employed P. W. M. Trap (pls. 241-246, livr. 21), the Koninklijke Nederlandsche Steendrukkerij (pls. 247 (= Sombresoc. 1) — 258, livr. 21; pl. 247, though not showing the usual indication, obviously should be ascribed to this firm), P. W. M. Trap (pls. 259-278, livr. 22, 23, 24 partly), Emrik & Binger (pls. 279 (= Perc. 1)-290, livr. 24,25 partly), P. W. M. Trap (pls. 291-324, livr. 25-27), Faddegon & v. Hogezaand (pls. 335-336, livr. 28 partly), Emrik & Binger pls. 337-420, livr. 29-36). It may be clear that the given reference of the plates 240-300 to the livraisons 20-25 is slightly arbitrary, but it seems evident that the discontinuities in the employments of the lithographers do not always coincide with the livraisons. The reconstruction for this period is principally based on the fact that each issue used to contain 12 plates, and on the sets of numbers still together found in the loose-leaf copy in the Rijksmuseum van Natuurlijke Historie.

## Reconstruction of the publication dates of the Atlas Ichthyologique instalments

No.	Date	Pages (reconstr.)	Plates (reconstr.)	Pages RMNH copy	Plates RMNH copy
1	bef. 4 June '62	1-20	1-12	1-20	1-12, 15-24, 26-32, 45-46, 167
2	bef. 4 June '62	21-40	13-24	21-40	12-14, 33-36
3	bef. 4 June '62	41-80	25-36	41-80	25, 102-108, 111, 145
4	8 July 1862	81-120	37-48	81-120	37-44, 47-48
5	2 Oct. 1862	121-160	49-60	—	—
6	26 Nov. 1862	161-168, I-32 (II)	61-72	161-168, I-32 (II)	61-68, 146-151
7	27 Jan. 1863	33-64	73-84	33-64	73-84
8	3 April 1863	65-96	85-96	65-96	85-96, 390
9	bef. 8 Oct. '63	I-XXI, title-pag. I	97-108	97-112, I-XXI, title-pags. I, II	69-72, 97-99, 165- 166, 168, 173-180
10	bef. 8 Oct. '63	97-112, title-pag. II	109-120	121-160 (I)	49-50, 113-120
11	aft. 8 Oct. '63	I-48	121-132	I-48	109-110, 121-132, 164, 182-185
12	24 Febr. 1864	49-88	133-144	49-88	101, 133-144
13	1864	89-120	145-156	89-92, I-40 (IV)	100, 152-156, 169-172
14	25 June 1864	121-150, title-pag. III	157-168	93-150, title-pag. III	157-161
15	21 Sept. 1864	I-40	169-180	—	162-163
16	19 Dec. 1864	41-72	181-192	41-72	181, 186-192
17	8 Febr. 1865	73-112	193-204	73-112	193-196, 200-204
18	19 April 1865	113-132 title-pag. IV, I-16	205-216	113-132, title-pag. IV, I-16	205-216
19	1865	17-56	217-228	17-56	217-228, 279-280
20	1865	57-96	229-240 (246?) <sup>1)</sup>	57-96	229-240, 247
21	1869	97-152, title-pag. V	241 (247?) - 258?	97-152, title-pag. V	248-258
22	1870	I-20	259? - 270?	I-16, 61-100; 17- 20 are missing	197-199, 277, 281- 282, 285-288
23	1870	21-40	271? - 276?	21-40	259-270
24	1871	41-60	277-288? <sup>2)</sup>	41-60	241-246, 271-276
25	1872	61-100	289? - 300	—	—
26	1872	101-140	301-312	101-140	301-312, 395
27	1875	141-170, title-pag. VI	313-324	141-170, title-pag. VI	313-324
28	1875	I-20	325-336	I-20	325-336
29	1875	21-40	337-348	21-40	337-348, 361
30	1875	41-80	349-360	41-80	349-360
31	1876	81-120, title-pag. VII	361-370	title-pag. VII	278, 291-300, 362-370
32	1876	I-48	371-380	I-48	371-380
33	1877	49-96	381-390	49-96	51-60, 112, 283-284
34	1877	97-156, title-pag. VIII	391-400	97-156, title-pag. VIII	391-394, 396-400
35	1877	I-40	401-410	I-40	401-410
36	1878	41-80	411-420	41-80, 81-126 (VII)	411-420

ters is complete, and particularly in the case of the second series of letters. It is evident that they must have been written several days after the actual date of publication of the instalment mentioned in them. Nevertheless, the dates on the letters are the earliest dates that can be ascertained for the publication, and these dates are listed on p. 77 — actually, therefore, the instalments must have appeared a few days earlier than the dates given. Bleeker's first letter dated 4 Juni, 1862, covers the first three instalments, so that the dates of publication of the first two instalments could not be ascertained.

As far as the part on Belonidae is concerned, my figures show that volume VI of the "Atlas Ichthyologique", which bears on the title-page the date "1866-1872", actually was published from 1869 to 1875, and that the plates of the Belonidae (pls. CCXLVII-CCLVIII; Scombres I-XII) apparently appeared in 1869 and the text on Belonidae in 1871.

Note 4 (p. 34, 74)

The names given by Walbaum (1792) are in general use, and for the moment I accept them.

The International Commission on Zoological Nomenclature (Stiles, 1910) has given an Opinion on part of Walbaum's volume, on Klein's genera contained in it, only. Hemming (1956a) brought this Opinion into discussion again; he correctly stated that Walbaum's work is one part out of a series of five, and that it would be unsatisfactory to suppress one volume out of a series; therefore he asked for a reconsideration: "...it would clearly be undesirable — because both illogical and confusing — to place on the *Official Index* the title of a single volume which does not stand by itself as an independent work but which is in fact, if not in actual name, only one volume of a larger work consisting of five volumes".

Apparently, Hemming had the incorrect impression that Opinion 21 covers the whole volume III of Walbaum. Actually Walbaum's volume has 723 pages. Klein's genera are given in a special part of the book, titled: *Nova Genera Kleinii* (p. 579-587), being nothing but an abstract of Klein's work; this is followed by the bulky chapters *Nova Genera Linnaei* (p. 587-633), *Gronovii*, etc. I do not consider myself qualified to give an opinion as to whether or not the whole series of volumes should be suppressed, but it is evident that Opinion 21 can hardly be taken as a basis to do so.

If Walbaum's names are rejected the species should be known as *Belone houttuyni* (Bloch & Schneider, 1801).

Note 5 (p. 48)

Bleeker (1871) apparently was the first to compare "*annulatus*" and the

types of "*gigantea*"; he concluded that these alleged species are identical and placed the latter in the synonymy of the former, indicating in this way that he considered *annulata* to have priority. Jordan & Starks (1903, p. 530) arrived at the opposite conclusion, though they failed to mention on what evidence their opinion was based; they listed the species as *Tylosurus giganteus* (Schlegel), quite unsatisfactorily commenting that: "According to Bleeker the type of *giganteus* examined by him in the Leyden Museum is identical with *annulatus*. The name *giganteus* is apparently the earlier of the two...". Weber & de Beaufort (1922), on the other hand, listed *annulata* as being published in 1846, *gigantea* in 1847, and as a consequence called the species *annulata* again. Herre (1928b) revived the name *Tylosurus giganteus*, justifying himself fairly extensively:

"The name *giganteus* takes precedence over *annulatus*. My copy of *Pisces, Fauna Japonica*, is dated 1842. According to Sherborn and Jentink, parts X to XIV, including pages 173 to 169 [misprint for 269], of *Pisces*, were published in 1846. In the same year Valenciennes published *annulata*, on page 332 in the edition used by me. As *gigantea* appears on page 245 it precedes Valenciennes's name".

I fail to follow Herre's line or reasoning expressed in this quotation and the evidence available shows that volume XVIII of Cuvier & Valenciennes's "*Histoire Naturelle des Poissons*" was published in August or September, 1846 (cf. Sherborn, 1925), whereas of the "*Fauna Japonica, Pisces*" the following particulars were supplied by the Rijksarchief, The Hague. These are the dates on which the instalments were redistributed by the state, so that their true dates of appearance are somewhat earlier, though probably not more than a few days. The dates of appearance, as received from this source are:

Instalment	1			11 February	1843
"	2,	3,	4	19 March	1844
"	5,	6		18 December	1844
"	7,	8		11 October	1845
"	9,	10		1 May	1846
"	11,	12		26 August	1846
"	13			22 October	1846
"	14			12 January	1847
"	15			26 June	1847
"	16			19 July	1850

It is necessary to point out that the pagination by Sherborn & Jentink

(1895) cannot be entirely correct, for these authors wrote: X-XIV, pp. 173-269, 1846, and pp. 270-324, 1850. Apart from the fact that apparently an instalment was issued in June, 1847, which is not mentioned by Sherborn & Jentink, I found that the pages 269 and 270 are printed on the same sheet so that they cannot possibly have been published at different times. Esaki (1935) also noted this discrepancy in Sherborn & Jentink's figures, and he concluded that instalment XIV ended with p. 268. The copy of the work belonging to the Leiden Museum clearly shows, however, that the demarcation is between the pages 272 and 273. This is evident from the colour and texture of the paper (the part published later is less yellowish), and from the way this part has been cut at the binding, namely at a size slightly different from that of the instalments published earlier.

The preceding discourse was unavoidable for obtaining an idea about the date of publication of p. 245 of the "Fauna Japonica, Pisces", on which *Belone gigantea* is described; it has been ascertained that the five instalments (X to XIV) together contribute exactly one hundred pages of text (173 to 272). Whereas the plates of the "Fauna Japonica" were issued very regularly in sets of ten, the text appeared in irregular parts. Nevertheless it is likely that page 245 belonged to one of the last two instalments, probably that of 22 October, and at any rate, as long as no proof of the contrary has been given, it must be accepted that volume XVIII of Cuvier & Valenciennes was published earlier.

Note 6 (p. 55)

In view of the fact that there has apparently arisen an opinion that "the types of the Bleeker collection are in the British Museum" it is perhaps useful to give here some particulars about these collections.

The first point that is quite apparent is that the bulk of the material assembled by Bleeker has come to the Leiden Museum; already in 1850 correspondence between Bleeker and Temminck, director of the museum, started whereas on November 6th, 1852 the first collection of fishes, numbering 2496 specimens, was shipped, and in a letter dated Batavia, 13 April 1856, Bleeker states that 10150 fishes had already been sent; subsequently several more collections were received, about which the documents, accompanying letters and lists, are present in the archives of the Rijksmuseum van Natuurlijke Historie, ultimately increasing the number sent to over 12000 specimens (Bleeker, 1881a, p. 31). Finally, in March 1877, he offered his whole private collection for sale to the museum; the letter in which the offer is made, apparently is no longer present in the archives, but we have a copy of Schlegel's answer, dated Leiden, 28 March 1877, in which

Schlegel proposes to assign the curator Hubrecht to the task of cataloguing Bleeker's collection, as a basis for a proper estimation of its value. In a letter dated 30 March 1877, Bleeker answers that he agrees with Schlegel's proposal and shall give all possible facilities to Hubrecht.

On January 24th, 1878, before the work of cataloguing was completed, Bleeker died. Hubrecht subsequently completed the catalogue (Hubrecht, 1879) which was the basis for an auction of the collection. To this purpose Hubrecht has divided the collection in 5 portions, numbered A-E; and all interesting specimens are assembled in collection A, the collections B-E only meant to contain duplicates. As the greater part of Bleeker's collection, which numbered 26500 individuals in 2297 species, was contained in portion A, which was acquired by the Leiden Museum, there is no doubt that by far the most important part of Bleeker's collections is now in Leiden.

This does not mean that there are not large collections assembled by Bleeker in many other museums, Bleeker (1881b) mentions the:

"...musées zoologiques de Paris, de Bonn, de Heidelberg, de Darmstadt, de Stuttgart, de Munich, de Würzburg, de Vienne, de Göttingue et de Copenhague".

Bleeker's main object when presenting these collections was apparently to receive "recognition of merits": he has not done too badly as a list of honorary memberships, medals, etc., which he acquired during his life, and written by himself, shows; perhaps his best score was his elevation to Austrian nobility under the name of Peter Ritter von Bleeker on 21 January 1858.

Curiously the British Museum is not mentioned in Bleeker's papers just referred to, though there is no doubt that a number of his specimens, including types, really did come to the British Museum, as acknowledged in the introductions to several volumes of the "Catalogue of Fishes", for example by J. E. Gray (in Günther, 1866, p. vii).

Often it is extremely difficult to find out which specimens of a given species described by Bleeker are the types, as, at least in the large collection present in the Leiden Museum, the majority of the specimens do not bear an indication of the year of collecting, whereas the localities have often been indicated in a general way: "Indische Archipel". Further Bleeker had the habit of adding subsequent material to his original lots. A thorough revision of Bleeker's material in the Leiden Museum would certainly be most useful but unfortunately it is difficult to visualize that this work will ever be done in view of the fact that it would probably take many years.

It is also necessary to state that Bleeker apparently has thrown away type material when afterwards he received larger and better specimens of the

species; therefore it is by no means certain that all his types are still extant.

Since writing the preceding paragraphs I came across some papers (Günther, 1895; Boulenger, 1906) which throw more light upon the question of Bleeker's type specimens in the British Museum. Günther's notes make it evident that a large proportion of the types of the species described in the first four volumes of the "Atlas Ichthyologique" are in the British Museum. However, in a number of cases one wonders if these really represent the type specimens (on which the name was based), or the specimens after which the plates in the "Atlas Ichthyologique" were drawn. The word "type" or "typical specimen" certainly was used in a looser sense formerly than it is nowadays. In my experience the specimens listed as types in the "Catalogue of Fishes in the British Museum", really are types or cotypes, but the specimens not listed there as such, almost certainly are not. Especially Boulenger (1906) has used the word "type" too carelessly, as shown by a comparison of the following two statements about Bleeker's collections: "...consequently the British Museum does not contain any types of the families described by him in the later volumes of the 'Atlas'" (Günther, 1895: the volumes referred to are all, except the first four); and: "The fishes received from Dr. Bleeker during the years 1859-1867 included all the types of the species described and figured by him in the first four volumes of the "Atlas Ichthyologique", and also the types of many species described in the later volumes" (Boulenger, 1906).

In view of this confusion great care must be taken when selecting lectotypes; several selections of recent years appear to me to have been made without sufficient consideration. To mention just one, in a publication I happen to have at hand, Arnold's (1956) "type" of *Oxybelis gracilis* Bleeker was not listed as such by Günther (1862) and ought to be rejected.

One might wonder why Colonel Bleeker (1881a) omits all mention of his dealings with the British Museum. The only possible explanation I can think of is that Bleeker considered it a stain on his character that he had sold his material for money instead of presenting it in exchange for medals and honorary memberships of learned societies as he usually did.

Note 7 (p. 67)

The name and volume number of the magazine in which van Hasselt's (1823) publication appeared, is nearly always misquoted.

Relevant bibliographical particulars on the magazine are that it commenced to appear in 1788 and was continued till 1861; at least about 1823 two volumes a year were brought out, each with its own pagination, and named "I. deel" and "II. deel"; there was no consecutive numbering of the volumes.

Contrary to nearly all literature references, van Hasselt's paper did not appear in volume (deel) I, but in volume II, the title of which is: Algemeene Konst- en Letter-Bode, voor het Jaar 1823, II. deel. As shown above it is absolutely necessary to quote the indication "voor het Jaar 1823", as there appeared every year a volume II. There is a hyphen between Letter and Bode, which is also overlooked by all authors. The number of the part in which van Hasselt's letter was published is No. 35. "Vrijdag den 29sten Augustus". This weekly had 52 Nos. a year, numbered from 1 to 52; with No. 27 ("Vrijdag den 4den Julij"), deel II begins with a new pagination.

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\*) The part of Poey's work in which species of *Belone* are described is usually accepted as having been published in 1861, but in view of Poey's explicit statement (p. 427 of his work) that the pages 97-336 were published in July, 1860, I consider 1860 the correct year of publication.

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#### EXPLANATION OF PLATE I

Fig. 1. *Belone ciconia* Richardson, photostat copy of a Chinese fish painting in the Reeves collection (British Museum, Natural History), not Richardson's copy.

Fig. 2. *Idem*, Richardson's copy, "iconotype" (plate on which the species was based).

Fig. 3. *Mastacembelus fasciatus* Bleeker, photostat copy of a Chinese fish painting (RMNH, Leiden), "iconotype" of the species.

