

THE TYPES OF BLEEKER'S INDO-PACIFIC ELOPOID AND CLUPEOID FISHES

by

P. J. P. WHITEHEAD, British Museum (Natural History), London,

M. BOESEMAN, Rijksmuseum van Natuurlijke Historie, Leiden,

and

A. C. WHEELER, British Museum (Natural History), London

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ABSTRACT

Pieter Bleeker described 72 new species and 10 new genera of elopoid and clupeoid fishes from the Indo-Malayan Archipelago. From amongst the Bleeker material in the Rijksmuseum van Natuurlijke Historie in Leiden and the British Museum (Natural History) in London, it has been possible to find the holotypes or designate lectotypes or putative neotypes for almost all these species. The types are fully described, with notes on synonymies and affinities. Of the species listed, 24 are considered senior synonyms, and 5 Bleeker genera are accepted.

INTRODUCTION

The growing economic importance of elopoid and clupeoid fishes in the Indo-Pacific region has generated an increasing number of publications dealing with systematic as well as biological problems in these two groups. To stabilize the nomenclature there is urgent need to fix and describe the types of the several hundred nominal species from this area. The present work deals with one of the most important (and prolific) writers in this respect, Pieter Bleeker (1819-1878).

In a series of papers between 1848 and 1872, Bleeker described 72 new species (plus two manuscript names) and 10 new genera (plus two manuscript names) of elopoid and clupeoid fishes from numerous localities throughout the Indo-Malayan Archipelago (map, fig. 1). Fowler (1941), whose work stands as the most comprehensive recent review of all Indo-Pacific species, recognised in these groups 3 Bleeker genera and 28 Bleeker species as senior synonyms; we recognise 5 genera and 24 species (see Table III). However, considerably more revisionary work is required before the number can be stated with complete certainty.

Bleeker did not designate types, but nevertheless he appears to have attached more importance to those specimens on which his original

descriptions were based, retaining these in his personal collection and selling or donating duplicates (but apparently also rejecting type material when he had acquired better preserved specimens -Mees, 1962: 81). The only contemporary reference to Bleeker 'types' was made by Günther (Catalogue of the fishes in the British Museum, 1862-1870) following the purchase by the British Museum of a part of Bleeker's personal collection. However, Günther's 'selections' are often doubtful since he did not have access to Bleeker's main collection. Subsequent 'selections' (e.g. Bertin, 1940; Whitley, 1958) have usually suffered the same drawback. The present work results from a thorough examination of Bleeker material in the British Museum (Natural History) and the Rijksmuseum van Natuurlijke Historie in Leiden.

Keys and notes on synonymies have been added here, both to aid future revisions and to establish the basis on which the Bleeker species have been identified. Certain genera are particularly unsettled, but will remain so until at least the Valenciennes clupeoid type specimens have been subjected to a similar intensive study.

THE BLEEKER COLLECTIONS

In order to clarify the methods by which types have been recognised or designated, a short account must be given of the history of the Bleeker collections ¹). The Leiden and London collections will be dealt with separately, as also collections in other museums.

a. Leiden.

After two unsuccessful attempts to join the staff of the Rijksmuseum van Natuurlijke Historie in Leiden, Bleeker joined the Army and spent 18 years in Batavia (1842-1860) as Army Surgeon, making extensive collections of fishes in his spare time. Between 1852 and 1860 he sent twelve shipments (over 11,000 specimens) to Leiden. The correspondence between Bleeker and Schlegel (who succeeded Temminck as Director of the Leiden Museum in 1858) strongly suggests that Bleeker sent only duplicates, keeping the typical series in his own personal collection. In a letter to Bleeker in 1860, Schlegel refers to Bleeker's personal collection, which must "contain the types of your works". The earlier Bleeker specimens (i.e. duplicates) are in Leiden and the labels (copied from old labels) give a date prior to 1879.

¹) A fuller account has been prepared by Dr. Robert R. Rofen but is still in manuscript; we are indebted to him for permission to use this manuscript. See also Mees (1962: 80). Other details derived from Hubrecht (1879), Bleeker (1878, 1881) and material in the archives of the Leiden Museum.

Bleeker returned to Holland in 1860, and on his retirement in 1863 he lived in The Hague, housing his enormous collection of some twenty-six thousand specimens in the attic of his house. Apart from the sale of specimens to the British Museum (see below) Bleeker's personal collection appears to have remained complete until after his death in 1878.

Prior to his death, Bleeker negotiated with Schlegel (March 1877) for the disposal of his collection to the Museum. Hubrecht, Curator of the ichthyological and herpetological collections at Leiden, conferred with Bleeker but it is not known to what extent the subsequent splitting of the collection into series was done in collaboration with Bleeker before the latter's death in 1878. Hubrecht was certainly mainly responsible for the subsequent division of the 26,500 specimens (2,287 species) into fifteen approximately systematic groups, and into five series (A-E).

The specimens were sold by public auction in Leiden at 10 a.m. on the 1st December 1879 at the Café Zomerzorg. Series A was believed to contain the types of the species, and all fifteen A series were bought by the Leiden Museum. Of the B series, groups VI, XIV and XV were bought by the Amsterdam Museum and the remainder went unsold. The C and D series were bought by E. Gerrard for the British Museum, and the E series remained unsold. Possibly all unsold lots went eventually to the Leiden Museum. A printed Auction Catalogue was issued with a brief foreword by Hubrecht. A copy is in the Leiden Museum and a photocopy in the British Museum (Natural History).

The important A series specimens are now in Leiden, and in the first instance type specimens should be found amongst them. The A series jars are now recognisable by the following criteria:

1. Most have pasted on the outside a thin strip bearing the auction number and the name of the species snipped from the Auction Catalogue.
2. Most have a large external label in Bleeker's hand.
3. Most are still in the original jars used by Bleeker.
4. All have an internal (modern) label bearing the date 1879.

The elopoid and clupeoid fishes were placed by Hubrecht in Group XII, the B series of which were not sold to Amsterdam and may therefore have eventually been given to Leiden. There appears to be no method of recognising B series jars at Leiden except that they would not bear the snipped catalogue name but might otherwise resemble the A series. The same might be true of the unsold E series. During examination of the Leiden material no B or E jars were positively recognised as such, but some were suspected.

The number of specimens in the A series jars does not always agree with the number stated in the Auction Catalogue. This may be attributed to external counting of specimens in very dark preserving liquid, or to later removal of deteriorating specimens (of which no contemporary record exists for the groups presently discussed). Within the jars the state of preservation often varies so that specimens can be sorted into different lots depending on their degree of flexibility, colour and general condition. Bleeker evidently combined batches from different localities, presumably to conserve storage space. But owing to the division of the material at the time of the auction, the number of specimens in each 'preservation lot' does not usually tally with the number of specimens recorded by Bleeker from each locality.

Further clues to the identification of type material are provided by the condition of certain specimens. In some fishes the right side of the head has been cut longitudinally through the maxilla and across the operculum. Often the first gill arch has been severed. These seem to have been specimens which were more thoroughly examined by Bleeker. It is curious that, having done this, Bleeker did not discover the importance of gillraker counts as a systematic character in clupeoid fishes.

A second, much rarer, indication that a particular specimen was one on which Bleeker based his description is the occurrence of definite tears in the anal fin membrane at every tenth ray in species with a long anal fin, e.g. in *Harengula hypselosoma*, p. 52; see also p. 131, 145.

Some specimens bear traces of pencil marks and in such cases the fish so exactly corresponds in size with the illustration in the Atlas that the specimen must be presumed the model for the drawing. The pencil marks are usually vertical lines at the origins of the dorsal and anal fins and tips of pelvic fins. In some specimens the posterior borders of the operculum, preoperculum and suboperculum have been outlined, and occasionally the lower edge of the maxilla. The marks are mainly found in specimens which are still scaled, but sometimes (e.g. *Engraulis pfeifferi*, plate 1) were made on scaleless specimens. Possibly the pencil marks were made during correction of the Atlas figures.

Finally, some of the British Museum specimens are accompanied by a pencilled note (on lined paper) indicating a unique specimen or the equivalence of two names. These appear to have been sent with the specimens, and in some cases help to establish the type status of the specimen.

Amongst Bleeker's papers at Leiden is a manuscript list entitled "Catalogus Piscium, Mammalium, Reptilium et Avertebratorum Collectionis Bleekerianae" in Bleeker's hand. In the section dealing with the clupeoid and

elopoid species, the names used, their order of appearance, and the number of specimens listed agrees almost invariably with those of the Atlas, although he has also included "Species extra-archipel." The number of specimens shown agrees with the totals given in the Auction Catalogue only where the latter agree with the totals in the Atlas. There are some curious features concerning this list.

- a. Thirteen species are underlined in blue pencil. In each case only a single specimen is shown, and in each case this single specimen was the one sent to the British Museum in 1867. Other unique specimens which were not sent to London are not underlined in the list. This implies that the list was made before the material was sent to London, and that Bleeker (or Hubrecht) indicated which names were to be omitted from the Sale Catalogue, probably as a result of checking the list against material actually on the shelves.
- b. Although a single specimen of almost all the species shown on the list was sent to London, in less than a dozen cases is the Sale Catalogue total less than that shown on the list (or in the Atlas). In some instances the discrepancy between the list and the Sale Catalogue is more than one, suggesting that either Bleeker sent some of his personal specimens elsewhere than to the British Museum, or that a few deteriorating specimens were removed before the Sale Catalogue count.
- c. In about half the cases (58 out of 98) the totals in the list and in the Sale Catalogue are identical. This could be taken to mean that the list was made after the British Museum material had been sent, not before. This hypothesis is rejected, however, because the Atlas totals should, in that case, be one more than those shown on the list and in the Sale Catalogue. The explanation seems to be that Hubrecht may have used this list to compile the Sale Catalogue and that he must have accepted the totals without actually checking the numbers. This is very obvious where only a few specimens were present (e.g. *Corica pseudopterus*, 2 specimens on list but one already sent to the British Museum).

We conclude from all this that the list most likely represents a catalogue compiled by Bleeker just before, during or immediately after his Atlas revisions, but before he had sent the specimens to the British Museum; it was certainly completed after Bleeker had abandoned the system of nomenclature which he had temporarily adopted for the captions to the Atlas figures. It is curious, however, that the British Museum specimens, apparently sent after the list was made, were accompanied by labels bearing not the Atlas system of names as used in the list, but the names as used in the Atlas

figures, i.e. pre-dating those of the list. Possibly the British Museum specimens were labelled at the time that the Atlas figures were being prepared but were set on one side and not dispatched until after the list had been made.

It is unlikely that Hubrecht, in checking the Bleeker specimens for the auction, counted every specimen in every bottle, and the fact that the totals in the list so often repeat the totals in the Atlas strongly suggests that in fact Hubrecht probably did not count the specimens at all but relied on the list. He must, therefore, have been unaware that the list included the specimens already sent to the British Museum. It was probably Hubrecht who underscored the missing bottles in blue as a result of a general check along the shelves.

Although the evidence is not conclusive, it seems that the British Museum specimens were sent after Bleeker had revised the species for the Atlas, or at least during the process of revision, and that they can be taken as 'selected' by Bleeker himself. If, as Mees (1962: 77) suggests, the Atlas text was not published until 1872, then Bleeker may well have continued to improve on and amend his descriptions between 1867 and 1872, and it may have been at this time that he then recorded "Longitudo speciminis descripti..." for some of the unique specimens by then in the British Museum. However, the species proposed after 1867 (i.e. in the Atlas) may have been based only on material in Holland.

The Bleeker material in the Atlas came from 74 localities in the Indo-Australian Archipelago (map, fig. 1 and p. 18); unfortunately these localities are not stated on the labels to the bottles. We have included here one genus (*Etrumeus*) and one species (*Sardinella zunasi*) which Bleeker based on Japanese material. In addition, Bleeker described two clupeoids from outside the Indo-Pacific region (*Stolephorus surinamensis* = *Anchoviella surinamensis* from Surinam, and *Alausa platycephalus* = *Ethmalosa fimbriata* (Bowdich) from West Africa). The types of both are in Leiden, and they will be dealt with in a future publication.

b. London.

The British Museum registers show that nine lots of Bleeker specimens were purchased between 1858 and 1880, comprising 1,786 species. The first lot, a general collection bought through a Mr. G. A. Frank, was evidently one of the many collections of duplicates sold to European museums by Bleeker before his return to Holland (Bleeker, 1881). However, the remaining lots, except for the last, were the ones derived from Bleeker's personal collection and believed to contain types. They appear to have been

sent by systematic groups after Bleeker had completed the manuscript of the relevant group for the Atlas. In some cases the pencilled note which accompanies the specimen gives a name which corresponds to the name used in Bleeker's manuscript list to Günther, with or without the equivalent name used in the Atlas text. By design (or chance) the groups usually arrived in time for Günther to include them in his next volume of the Catalogue of the fishes in the British Museum, although volume 5 was delayed while the manuscript was revised to take account of the siluroid types sent by Bleeker (Günther, 1864: v).

Günther, in the introduction to volume 3 of the Catalogue, mentions a visit to Schlegel in Leiden and he may well have met Bleeker at that time. Bleeker himself visited Günther in London during his visits to European museums in 1861-1862 and in his letters (Archives of the British Museum) speaks of a proposed visit in July 1864. Whether their relationship was particularly cordial, or whether Bleeker considered the British Museum a more remunerative repository for his specimens, is not known; certainly Schlegel encountered difficulty in raising funds. However, the result was that Günther was able to claim Bleeker type specimens in volumes 5, 6, 7 and 8 of his Catalogue as a result of purchases from Bleeker.

There are two curious features regarding the specimens bought by the British Museum. In the first place there is no mention by Bleeker (1878, 1881) in his autobiography or elsewhere of these transactions. Secondly, there is a footnote by Günther in the Introduction to the first (and only) volume of the Catalogue of the fishes in the British Museum by Boulenger (1895) stating that the British Museum bought type specimens only up to those included in volume 4 of the Atlas. Thereafter (1872) Bleeker apparently wrote offering only those species of which he had more than two specimens, and the British Museum did not avail itself of this offer. The British Museum should not therefore have types of species included in the later volumes of the Atlas, and yet Günther had already claimed, amongst others, the clupeoid types (volume 6 of the Atlas). This is to some extent clarified by a note (Boulenger, 1906: 547) in a history of the collections: "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".

The explanation seems to be that, at least for the clupeoid fishes, Bleeker was quite willing to send type specimens of those species which in the Atlas he placed as junior synonyms, but that, possibly on the advice of Schlegel, he usually kept in his own collection the types of his senior synonyms. This

is of considerable interest, and if correct, is an important aid to the identification of the types of junior synonyms, which at Leiden have sometimes been combined in the same jars as the types of senior synonyms.

In listing Bleeker material, Günther usually used the junior synonym, and the specimens are labelled and registered in the same way. Although the clupeoid volume of the Atlas did not appear for some years after, so that Günther was not necessarily aware of Bleeker's intentions regarding synonymy, the impression gained from the British Museum Bleeker collections is that they were registered with the names under which they were received. It is therefore possible to assume that Bleeker for the most part deliberately selected specimens previously labelled under the junior synonym, particularly since he was at that time reviewing the group for the Atlas.

The main Bleeker collection of elopoid and clupeoid fishes bought by the British Museum was that registered in November 1867. Out of a total of 367 species, 72 species were clupeoids or elopoids, and from these Günther claimed the types of 30 Bleeker species; ten of these type designations are here considered erroneous. He also claimed 13 syntypes, but five of these are erroneous. He considered 12 specimens to be non-typical; five are in fact types.

The final Bleeker collection bought by the British Museum included 209 species and was registered in 1880. Although not stated in the register, this undoubtedly represents the auction material. Since Gerrard had bought the C and D series, apparently for the British Museum, it is curious that this acquisition was so small. Thus according to the Auction Catalogue, the C series included 80 elopoid and clupeoid species, and the D series 79, but not a single elopoid or clupeoid appears in the register. It seems likely that this was the occasion when the Trustees of the British Museum declined to buy further Bleeker specimens, rather than earlier. It may have been at this time that Day procured the specimens which later went to Australia.

Amongst the collection of early letters kept in the Zoological Department of the British Museum (Natural History), are some written to Günther by Bleeker. These include some of the lists of specimens made out by Bleeker, and some interesting points are raised.

- i. The clupeoid fishes (82 species, Nos 155-236) are included in a list of 367 species of various groups (eels comprise the other large group). The list is undated but all these specimens were registered by the British Museum in November, 1867; it can be noted that registration probably followed shortly after receipt of the material, since the 220 cyprinoid fishes given on a list dated April 1866 were registered in May 1866.

The clupeoid fishes were, therefore, probably sent in September or October 1867.

- ii. The clupeoid names given in the list correspond neither with those given in the Atlas nor with those given in Bleeker's 'Catalogus Piscium ...' (described above), and the order of names is also different. The order also differs from that used in the register of the British Museum, but for the most part the names agree. In general, the clupeoid generic names in the list correspond with Bleeker's pre-Atlas usage (i.e. *Meletta*, *Rogenia*, *Spratella*, as in the 'Enumeratio' cited below). An equivalent name is given in a number of cases, and these correspond with the manuscript notes which accompany the specimens in some cases.
- iii. Amongst the clupeoid fishes a number of new names are used which seem to have been abandoned by Bleeker, probably as a result of the Atlas revision (new name in bold face).

172. *Clupeoides macassariensis* Blkr. = **Leptoclupea macassariensis** Blkr.

184. *Spratelloides argyrotaenia* Blkr. = **Leptoclupea argyrotaenia** Blkr.

200. *Alausa brachysoma* Blkr. = *Harengula (Paralosa) sumatrana* Blkr.

205. *Engraulis crocodilus* Blkr. = *Stolephorus (Odontengraulis) crocodilus* Blkr.

- iv. In a letter to Günther dated May 23rd 1866, Bleeker included the following, "224 exemples de Poissons (Cyprins, Scombresox, etc. à 10 Shill £ 112". We have been unable to find any other correspondence dealing with the sale of the specimens or the arrangements made.
- v. In only two cases in the entire list (367 species) are the types indicated as such (No. 232. *Notopterus borneensis* Blkr typ. and *Notopterus maculosus* Blkr. typ. = *Notopterus borneensis* Blkr.). It would seem, therefore, that Günther's type designations were made quite independently and were presumably based on a review of Bleeker's papers.
- vi. Together with Bleeker's letters and lists is a separate list (not in Bleeker's hand) which is entitled "Specimens of fish from Dr Bleeker's Collection, desired by the British Museum. The numbers are taken from Dr Bleeker's 'Enumeratio Specierum' ". Under the heading 'Clupeoids' some 68 species are indicated by serial numbers (between 1708 and 1802, no names given). The 'Enumeratio' is an earlier list by Bleeker (1859a).

Of 68 species requested, 4 were not sent, but 11 unrequested species were added (all missing from the 'Enumeratio'). In Leiden there is a manuscript copy of the 'Enumeratio' entitled "Specierum Piscium hucusque in Archipelago indico observatarum Enumeratio nova revisa auctore Petro Bleeker (1869) — Plane revidenda 1877". In this revised version Bleeker added new localities and emended some of the names. In this connection it is interesting that he sometimes reversed his earlier decisions, for example reverting to *Pellona* in place of *Ilisha* (see also note on *Paralosa*, p. 83).

- vii. Finally, in the list containing the clupeoid fishes, Bleeker inserts a brief note advising caution in unpacking since some of the packages are very small. He then adds "Les spécimens sont, sans exception, les meilleurs de mon cabinet, ce qui s'applique du reste à *tout l'envoi*, à tout les familles." This reinforces our view that the specimens sent to London were carefully and individually selected by Bleeker, particularly since a number of them were those on which the Atlas plates were based.

The sale of specimens to the British Museum may have contributed significantly to the financing of the Atlas. Indeed, this could have been the basis on which Bleeker negotiated with the British Museum. Schlegel might later have advised Bleeker that depletion of his personal collection would reduce its value should the Leiden Museum be in a position to buy the remaining specimens. This would account for Bleeker's reticence regarding the British Museum sale as well as his later decision to send only those species of which he had more than two specimens.

c. Other museums.

As already stated, there is no evidence that Bleeker parted with specimens from his own personal collection after his return to Holland in 1860, except in the case of the British Museum sale. Neither is there any evidence that he did so before this date. He certainly built up duplicate collections for sale to the Leiden museum, and it can be presumed that he did the same for presentation to other museums (Paris, Bonn, Heidelberg, Darmstadt, Stuttgart, Munich, Würzburg, Vienna, Göttingen, Copenhagen. — Bleeker, 1881).

It is therefore most unlikely that Bleeker specimens in other museums are from the type series. The Paris museum possesses a number of Bleeker specimens, claimed as types by Bertin (1940), but these specimens could all have been, and probably are, duplicates. This applies, of course, to Bleeker's

own material; types contained in material on loan from other institutions were always stated by Bleeker to have been returned.

Similarly, Whitley (1958) claimed that some Bleeker types were included in the Day collection which Ramsey bought for the Australian Museum. These are almost certainly specimens from Bleeker's duplicate series. Nine clupeoids are involved, but in no case is there any evidence that they came from the type series.

TYPE DESIGNATIONS

In a few cases the holotype can be recognised, either because no later specimens were ever collected, or as a result of a process of elimination based mainly on total lengths. But in the majority of cases the species was described from a number of specimens, and often the entire syntypical series is mixed with later material. With the splitting of the material into series and the loss or miscounting of specimens, it is rarely possible to recognise the syntypes by the number of specimens showing a preservational peculiarity.

We have, therefore, preferred to concentrate on the selection of lectotypes and putative neotypes and, unless the majority of the syntypical series can be recognised with certainty, have not indicated paralectotypes. We feel that a conception of Bleeker's species is more truly arrived at by designation of one specimen as the type coupled with consideration of all the material he had available at the time he compiled the Atlas (i.e. at least all the A series material), rather than through the designation of a fraction of the syntypical series, and this with reservations and doubts. In effect, the selection of a lectotype or a putative neotype from a collection such as Bleeker's is in most cases merely the recognition of the only specimen which, because of its size, can with some confidence be considered a member of the original type series. For this reason we feel justified in selecting putative neotypes for junior synonyms.

The present paper is in part revisionary, but until the types of many other nominal Indo-Pacific species have been as critically examined it would be unwise to do more than indicate putative neotypes. Caution is especially necessary amongst the many nominal species of *Sardinella* and *Herklotsichthys*. At the present time most of Bleeker's A series jars appear to contain a homogenous series, but this may not always be considered true.

The International Rules of Zoological Nomenclature allow the selection of a lectotype from the syntypical series (Article 74), or the designation of a neotype where the syntypical series is lost or destroyed (Article 75). In the case of the Bleeker material it sometimes happens that the syntypes

(or most of them) are patently present, but cannot be recognised as such. Cox (1960) proposed a new definition of the neotype concept to cover such occasions, suggesting that a neotype could be selected when the original type material was not only lost or destroyed, but "cannot be identified with certainty". Lockett (1965) adopted Cox's definition when designating neotypes from the Pickard Cambridge collection of spiders, a collection posing problems similar to those encountered with the Bleeker material.

Although no decision has yet been taken by the International Commission regarding Cox's neotype definition (and the propriety of Lockett's use of it), we have here proposed putative neotypes (*sensu* Cox) because no other alternative exists under the present rules. It seems likely that some modification to the present neotype definition will eventually be adopted to cover cases where the syntypal material is unrecognisable as such²).

BLEEKER'S CLASSIFICATION

It is of interest to compare the classification used by Bleeker in the Atlas with the system used here. The latter is based mainly on Whitehead (1963a), in which the elopoids and clupeoids are separated at subordinal level. More recent work (Greenwood et alii, 1966) separates the two at super-ordinal level, but the rank accorded to these two groups will probably remain controversial for some time. However, the main interest in the present comparison lies in the lower divisions of Bleeker's system.

Bleeker divided his group Clupées into two families. The first, the Pseudo-clupeoidei, approximates to the suborder Elopoidae used here, but with the exclusion of *Chanos* (as recommended by Gosline, 1960). Like Bleeker, Fowler (1941) and others have placed *Megalops* with *Elops* in the family Elopidae, but the presence of intracranial diverticula of the swimbladder in the former both links it with the clupeoids and justifies at least familial separation from *Elops*.

Bleeker's second family, the Clupeoidei, corresponds exactly to the suborder Clupeoidei used here, but differs somewhat in the rank accorded to the various divisions within it. Thus Bleeker considered the gizzard shads a distinct subfamily (Dorosomatiformes), but the modern subfamily Pristigasterinae was relegated to a tribe of the subfamily Clupeiformes. Fowler (1941) also separated the gizzard shads at family level, but most recent

2) One of us (M.B.) prefers a different solution of the problem. Alternative proposals to the Commission have been prepared (Whitehead & Boeseman, 1966).

TABLE I

BLEEKER'S CLASSIFICATION IN ATLAS	EQUIVALENTS USED HERE ³⁾
GROUP CLUPÉES	ORDER ISOSPONDYLI (in part)
A. FAM. PSEUDOCLUPEOIDEI	A. Sub. ord. ELOPOIDEI
1. LUTODEIRIFORMES (<i>Chanos</i>)	(<i>Chanos</i> excluded)
2. CONORHYNCHIFORMES (<i>Conorhynchus</i>)	1. Sup. fam. ALBULOIDAE (<i>Albula</i>)
3. ELOPIFORMES (<i>Elops</i>) (<i>Megalops</i>)	2. Sup. fam. ELOPOIDAE a. Fam. Elopidae (<i>Elops</i>) b. Fam. Megalopidae (<i>Megalops</i>)
B. FAM. CLUPEOIDEI	B. Sub. ord. CLUPEOIDEI
1. CHIROCENTRIFORMES (<i>Chirocentrus</i>)	1. Sup. fam. CHIROCEN- TROI- DAE a. Fam. Chirocentridae (<i>Chirocentrus</i>)
2. DUSSUMIERIAEFORMES (<i>Dussumieria</i> , <i>Spratelloides</i>)	2. Sup. fam. CLUPEOIDAE a. Fam. Dussumieriidae (<i>Dussumieria</i> , <i>Spratelloides</i>)
3. CLUPEAEFORMES a. Clupeini (<i>Clupea</i> , but excluding sub- genus <i>Clupeoides</i>) (<i>Corica</i> and subgenus <i>Clupeoides</i>) (<i>Alosa</i>)	b. Fam. Clupeidae i. Subfam. Clupeinae (<i>Herklotsichthys</i> , <i>Sardinella</i> , <i>Escualosa</i>) ii. Subfam. Pellonulinae (<i>Corica</i> , <i>Clupeoides</i> , <i>Clupeichthys</i>) iii. Subfam. Alosinae (<i>Hilsa</i>) iv. Subfam. Pristigasterinae (<i>Pellona</i> , <i>Ilisha</i> , <i>Opisthopte-</i> <i>rus</i> , <i>Raconda</i>) v. Subfam. Dorosomatinae (<i>Nematalosa</i> , <i>Anodontostoma</i>)
4. DOROSOMATIFORMES (<i>Dorosoma</i>)	
5. STOLEPHORIFORMES a. Engraulini (<i>Stolephorus</i> , <i>Engraulis</i> , <i>Setipinna</i> , <i>Lycotrichsa</i>)	c. Fam. Engraulidae i. Subfam. Engraulinae (<i>Engraulis</i> , <i>Stolephorus</i> , <i>Thrissina</i> , <i>Thryssa</i> , <i>Setipinna</i> , <i>Lycotrichsa</i>)
b. Coilianini (<i>Coilia</i>)	ii. Subfam. Coilinae (<i>Coilia</i>)

³⁾ Based partly on Whitehead, 1963a.

authors place them in a subfamily of the Clupeidae (Whitehead, 1962; Svetovidov, 1963). The Clupeini, the second of Bleeker's tribes of the Clupeae-formes, contained a mixed assortment of genera, now split between the subfamilies Clupeinae, Pellonulinae and Alosinae. Günther (1868) went so far as to place all members of the Alosinae in the genus *Clupea*; Bleeker kept the genera *Clupea* and *Alosa* separate. Bleeker placed his three pellonuline species in the genus *Clupea*, but this is understandable since he was not acquainted with the more numerous and diverse members of the Pellonulinae in West African freshwaters. Finally, Bleeker's division of the Stolephoriformes (= Engraulidae) into two 'tribes' corresponds with modern practice.

Some years earlier, Bleeker (1859a) had compiled a complete classification of all fish genera (including fossils). The clupeoid section shows several differences from that given in the Atlas. The order Clupeae is split into two tribes, the Pseudoclupeini and the Clupeini, but the round herring genera *Dussumieria* and *Etrumeus* are included in the former, combined with *Elops* and *Megalops* in the family Elopsidae. In the second tribe, Bleeker gives a single family, the Clupeoidei, split into two subfamilies, the Chatoesiformes (i.e. Dorosomatiformes of the Atlas) containing *Chatoessus*; and the Clupeiformes, containing the remaining clupeids and engraulids as well as the round herring *Spratelloides*.

The Atlas system is an improvement on the earlier one, reflecting (in the clupeoids at least) a better grasp of the group. The Atlas classification is fairly close to the modern one, differing mainly in the emphasis placed on the smaller divisions as a result of Bleeker's more limited knowledge of clupeoids from outside the Indo-Malayan area.

FIGURES

Few of Bleeker's papers are illustrated, but in the Atlas he provided a figure for almost all the species listed. The elopoid and clupeoid fishes were drawn by L. Speigler, with P. W. M. Trap executing the lithography. Fifty-five of the Atlas figures are reproduced here: for each the modern name is given, with in brackets the name used in the Atlas captions, the Atlas plate number and the total length of the figure (diagonal to tip of upper caudal lobe). All are here enlarged or reduced to the same size.

The names used in the captions to the plates in the Atlas often differ from those in the Atlas text, and represent an earlier system. The inclusion of *Megalops macropterus* and *Ilisha macrogaster* (both published in 1866) gives a clue to the dating of the plates. Mees (1962: 77) gave 1870 as a tentative

date for the clupeoid plates (plates 259-276), but by that time Bleeker should surely have decided on the Atlas text system of nomenclature. On the other hand the publication of the plates was certainly delayed some time owing to financial difficulties and the problem of finding a new lithographer (Bleeker, 1878; Mees, 1962). The Zoological Record for 1870 and 1871 (compiled by Günther) refers each time to the appearance of part of the clupeoid plates.

BLEEKER'S LOCALITIES

The following are the localities in the Indo-Australian Archipelago from which Bleeker's elopoid and clupeoid specimens were collected. Modern spelling (Times Atlas, 1959) given in parenthesis. On the map (fig. 1) these localities are indicated, mainly by numbers on each island corresponding with the numbers in the following list.

A. PINANG (PENANG)

B. SINGAPURA (SINGAPORE)

C. BINTANG (BINTAN): Rio (Riau)

D. SUMATRA

1. Benculen (Bangkahulu) 2. Lahat 3. Lematan-Enim (Muaraenim)
4. Padang 5. Palembang 6. Priaman (Pariaman) 7. Siboga (Sibolga)
8. Telokbetong (Telukbetung) 9. Tiku or Ticu 10. Trussan (Tarusan)
11. Bengkalis I.

E. NIAS

F. BANGKA

1. Blinju (Belinju). 2. Karanghadji 3. Muntok 4. Pankalpinang 5. Tandjong-biat (Cape Biat) 6. Toboali

G. BILITON (BELITUNG)

1. Tjirutjup (Tjerutjuk)

H. JAVA

1. Anjer 2. Banjuwangi 3. Bantam (Banten) 4. Batavia (Djakarta)
5. Besuki 6. Cheribon (Tjirebon) 7. Djunkulon (Udjung Kulon) 8. Pasuruan 9. Perdana 10. Prigi 11. Rembang 12. Samarang (Semarang). 13. Surabaya (Surabaja) 14. Tegal 15. Tjilatjap 16. Tjiringin

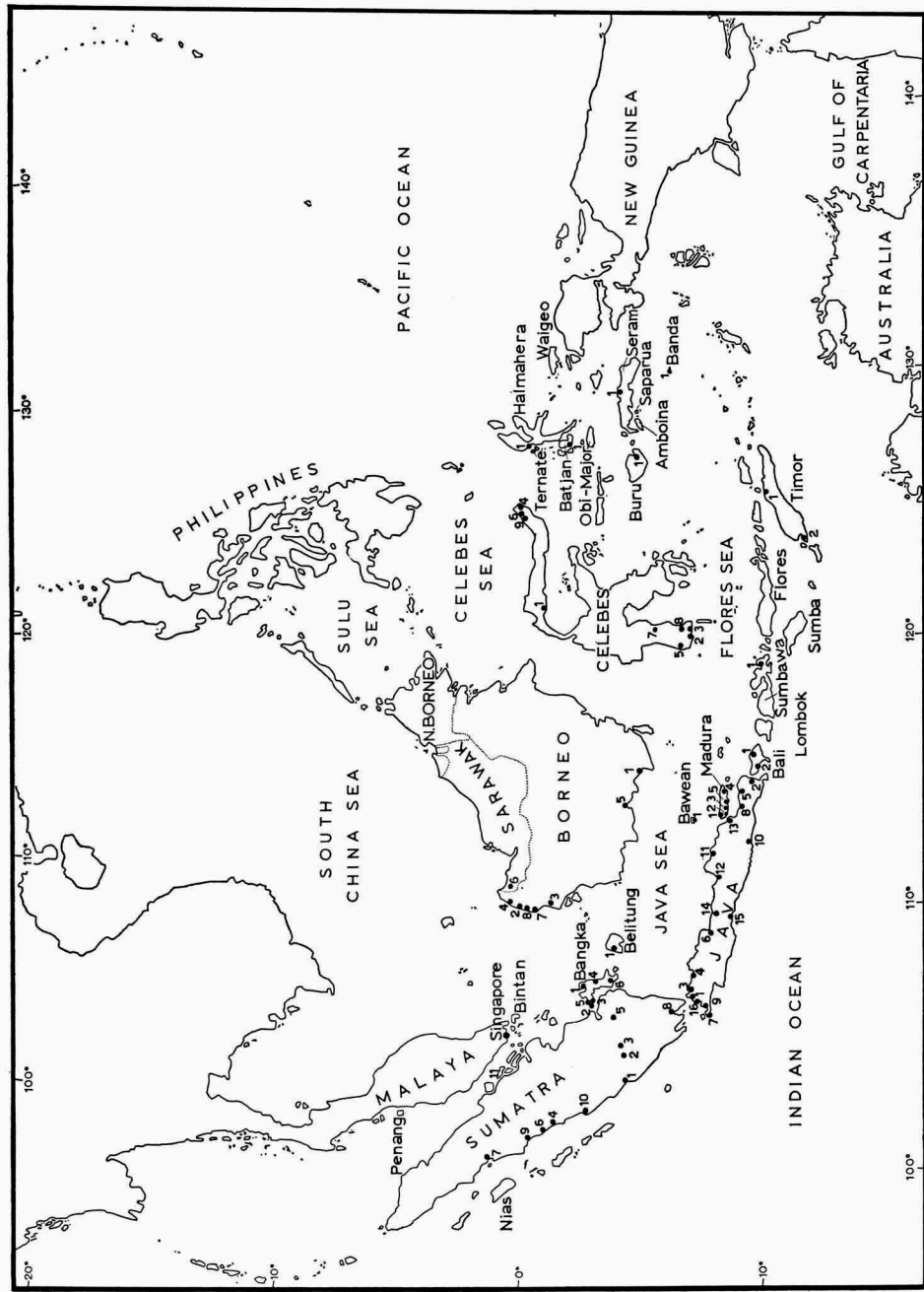


Fig. 1. Sketch-map of islands from which Bleeker's material was collected (see text for key to locality numbers for each island).

I. MADOURA (MADURA)

1. Bangcallang (Bangkalan)
2. Kammal
3. Sampang
4. Sumanap (Sumenep)
5. Tandjung

J. BAWEAN

1. Sancapura (Sangkapura)

K. BALI

1. Boleling (Buleleng)
2. Djembrana

L. SUMBAWA

1. Bima

M. TIMOR

1. Delhi (Dili)
2. Kupang.

N. BORNEO

1. Bandjermasin
2. Pamangkat
3. Pontianak
4. Sambas
5. Sampit
6. Sarawak
7. Singiduri or Sungiduri
8. Singkawang

O. CELEBES

1. Badjoa (Badjo)
2. Bonthain
3. Bulucomba (Bulukumba)
4. Klabatdiatas
5. Macassar (Makasar)
6. Manado
7. Pompanua (Pampanua)
8. Sindjai
9. Tombariri (Tanawanko)

P. TERNATA (TERNATE)

Q. HALMAHEIRA (HALMAHERA)

1. Sindangole (Sidangoli)

R. BATJAN

1. Labula

S. OBI-MAJOR

T. BOURU (BURU)

1. Kajeli

U. CERAM (SERAM)

1. Wahi

V. AMBOINA (AMBON)

W. BANDA

1. Neira (Bandaneira)

X. SAPARUA

Y. NOVA GUINEA (NEW GUINEA)

Z. WAIGIOU (WAIGEO)

MEASUREMENTS, ABBREVIATIONS, DATING

The following measurements require comment.

- a. Total length: all Bleeker's length measurements are total lengths, not standard lengths. Unfortunately, the caudal tips are rarely preserved, and since total length is often the principal means of relating specimens to the type series, some estimate must be made. We have done this by placing the fish on a smooth surface, expanding the caudal and sketching in plausible caudal lobes. Total length was then taken from the tip of the snout (or lower jaw if it projects) to the middle of an arc between the probable caudal tips. Where the original length of the fish is known with certainty, the accuracy of this method has usually been confirmed. However, when a single specimen with damaged caudal lobes was the only material available for an original description, Bleeker may (exceptionally) have measured the actual length, not being acquainted with the exact shape of the caudal fin.
- b. Head length: longest measurement (often a diagonal).
- c. Snout and upper jaw length: from tip of snout.
- d. Body depth: at deepest point, usually under dorsal origin.
- e. Gillrakers: number on lower part of first arch unless stated otherwise; comparisons between gillraker and gill filament lengths also on lower part of first arch.

The following abbreviations have been used: S.L., standard length; tot. l., total length; n.r., not recorded; Br. St., branchiostegal rays; D, dorsal rays; P, pectoral rays; V, pelvic rays; A, anal rays ('spines' in Roman capitals, unbranched rays in lower case Roman numerals; final divided dorsal and anal rays counted as one if articulating on single pterygiophore); BMNH., British Museum (Natural History), London; RMNH., Rijksmuseum van Natuurlijke Historie, Leiden; MNHN., Muséum National d'Histoire Naturelle, Paris; AMS., Australian Museum, Sydney.

Volume 6 of the *Atlas Ichthyologique* has usually been dated 1872-75. Mees (1962), who reconstructed the Atlas dates, included the elopoid and clupeoid sections of volume 6 in three livraisons, 25 (61-100), 26 (101-140) and 27 (141-170), published in 1872, 1872 and 1875 respectively. In the Atlas (vol. 6: 169), Bleeker mentions the postponement of the 27th livraison (owing to difficulties with the plates) until the end of 1874. In fact, according to the livraison pagination given by Mees, only two pages of the clupeoid section are carried over into livraison 27; since no new Bleeker names are

affected, we have felt it preferable to cite the entire elopoid and clupeoid section of the Atlas as 1872, but the plates as 1870 where new names are introduced, e.g. *Leptogaster* — see p. 70.

In certain cases it is important to know exactly when Bleeker examined and counted his elopoid and clupeoid specimens for the Atlas revision. If he did this immediately before sending the specimens to the British Museum (1867), then the latter can be regarded as individually selected and identified by Bleeker himself. The British Museum specimens were certainly sent after the Atlas plates were drawn (i.e. several bear pencil marks), perhaps shortly afterwards since some are accompanied by a note (in Bleeker's hand) giving the name according to the Atlas plates and not the Atlas text. It would appear, therefore, that Bleeker revised the group in about 1866-1867 and had the plates drawn, and then at some time between 1867 and 1872 he revised his system of nomenclature, apparently too late to alter the names which he had used for the Atlas plates. In some cases (e.g. *Chupalosa bulan* — see Whitehead, 1964b) Bleeker evidently did not have the British Museum specimen when he wrote the Atlas description. So for those species proposed for the first time in the Atlas (e.g. *Opisthopterus valenciennesi*) it is questionable that the British Museum material could have been included amongst the syntypes.

As noted by Weber & De Beaufort (1911), Bleeker arranged his papers according to the date on which he completed them. As a result, in the period 1849-1852 there are several pairs of papers whose date of publication is the reverse of their order of completion, with the corollary that the number of syntypes and the type localities must be taken from the second of the two papers written by Bleeker (this occurs in species Nos 10, 19, 28, 39, 42, 50, 54, 57, 59, 60, 70 and 71). We have accepted here the order of publication given by Weber & De Beaufort (1911). This strict adherence to publication dates has not affected the nomenclature and has had only slight effect on lectotype selections.

Some of Bleeker's new names are nomina nuda, having been published in lists of species without descriptions; they are included in our synonymies but their status is indicated in the text (e.g. species Nos 35 and 39).

ELOPIDAE

Bleeker proposed no new names in the Atlas, referring all his material to *Elops saurus* L.

MEGALOPIDAE

Megalops Lacepède, 1803

Megalops Lacepède, 1803, Hist. Nat. Poiss. 5: 289 (Type: *Megalops filamentosus* Lacepède = *Clupea cyprinoides* Broussonet).

Bleeker (1866a) reviewed the genus *Megalops* and included three of his own Indo-Pacific species. In the Atlas (1872: 85) he recognised four species, *M. macropterus* Blkr., *M. kundinga* (Ham. Buch.), *M. filamentosus* Lacep. and *M. cyprinoides* (Brouss.), distinguished by small differences in body depth, maxilla length and anal finray number. Günther (1868) placed all in a single species, *M. cyprinoides*, and later authors have agreed.

1. **Megalops macrophthalmus** Bleeker, 1851 (pl. 2 fig. 1)

= *Megalops cyprinoides* (Broussonet, 1782)

Megalops macrophthalmus Bleeker, 1851, Natuurk. Tijdschr. Ned. Ind. 1: 421 (Batavia, Java; a single fish, 317 mm tot. l.; Br. St. 26, D 18, P 15, V i 9, A 25).

Atlas: in synonymy of *M. cyprinoides*, of which 2 fishes, 317 and 555 mm tot. l., Java and Celebes.

Auction Catalogue: as *M. cyprinoides*, 2|0|0|0|0 (p. 45, no. 6).

RMNH: 1 fish, 395 mm S.L. (520 mm tot. l.), A series⁴), RMNH 7136; caudal fairly well preserved, total length underestimated by not more than about 5 mm.

BMNH: 1 fish, 245 mm S.L. (estimated 317 mm tot. l.), BMNH 1867. 11.28.68, one of four Bleeker specimens of *Megalops* mentioned by Günther (1868: 472); although listed by Günther as *M. cyprinoides*, it was registered as *M. macrophthalmus*. In all four cases the bottles bear an additional external label with the original species name in pencil, now only faintly legible⁵).

Type. — The Leiden specimen is too large to be the holotype, but rather smaller than the second of the two fishes listed under *M. cyprinoides* in the Atlas. However, the British Museum specimen agrees so closely in size and meristic counts with Bleeker's first description that there is little doubt that it is the holotype. The head is cut horizontally on the right side, and there are faint pencil marks. This is probably the figured specimen (Atlas, pl. 270

4) Unless stated, all recorded Leiden specimens are from the A series.

5) Nine other clupeoid bottles bear similar external labels (the remainder all relabelled after the war). The old labels may have accompanied the specimens and have been used as temporary labels until Günther had examined the collection more carefully.

fig. 4), but the drawing is slightly larger (250 mm S.L.). There are no A series specimens at Leiden which are near to 317 mm tot. l.

Description. — Holotype, a fish 245 mm S. L. (303 mm tot. l. from tip of lower jaw — estimated 317 mm but caudal tips damaged). Head cut on right side; vertical pencil lines below dorsal origin, and at caudal base on left side; horizontal pencil lines marking scale lines above anal on left side. BMNH 1867.11.28.68.

Br. St. 27, D iv 14, P i 14, V i 9, A iv 21, lateral line scales 36 (estimated, some now missing), gillrakers on lower part of first arch 30.

In percentages of standard length: body depth 26.6, head length 30.3; snout length 7.1, eye diameter 9.7, upper jaw length 16.8, lower jaw length 16.6, length of gular plate 10.3; pectoral length 19.3, pelvic length 11.2, length of anal base 18.0; pre-dorsal distance 54.6, pre-pelvic distance 54.5, pre-anal distance 75.8.

Body moderately compressed, width a little over twice in depth. Eye large, $1\frac{1}{4}$ in post-orbital distance. Maxilla reaching to just beyond vertical from posterior margin of pupil; two supra-maxillae, the anterior split into three elements on right side, normal on left. Teeth small, villiform, in both jaws and on vomer, palatines, pterygoids and tongue. Gular plate slightly longer than eye diameter.

Gillrakers $\frac{4}{5}$ length of corresponding gill filaments, absent on posterior face of 3rd epibranchial; isolated toothed plates on posterior faces of first three epibranchials. Pseudobranch not exposed, probably absent.

Dorsal origin slightly nearer to caudal base than to snout, last ray filamentous, tip now broken. Pectoral failing to reach pelvic base by $\frac{3}{4}$ eye diameter. Pelvic slightly in advance of dorsal, nearer to pectoral base than to anal origin; the latter nearer to pelvic base than to anal base.

Scales large, absent on back in front of dorsal, lateral line well-developed.

Colour. — Lower $\frac{2}{3}$ of flanks silvery, above this light brown. Median caudal margin dark, otherwise fins hyaline.

2. *Megalops macropterus* Bleeker, 1866

= *Megalops cyprinoides* (Broussonet, 1782)

Megalops macropterus Bleeker, 1866, Ned. Tijdschr. Dierk. **3**: 284 (Java, Sumatra, Singapore, Bintang, Celebes, Amboina; four fishes, 190-390 mm. tot. l.; Br. St. 24-25, D iv 14-15, P i 13-14, V i 9-10, A iv 23-24).

Atlas: as *Megalops macropterus*, 4 fishes, 190-390 mm tot. l., Java, Sumatra, Singapore, Bintang, Celebes, Amboina.

Auction Catalogue: as *M. macropterus*, 4/0/0/0 (p. 45, no. 4).

RMNH: 3 fishes, 139, 156 and 195 mm S.L. (188, 206 and 255 mm tot. l., estimated), RMNH 7134.

BMNH: 1 fish, 285 mm S.L. (about 365-370 mm tot. l., estimated), BMNH 1867.II 28.69. Listed as *M. macropterus*, specimen 's' by Günther (1868: 272).

Types: — The British Museum specimen is closest to the size of the largest of the four specimens described. In addition, it has the right side of the head cut and there are faint pencil marks on the left side of the body. It is almost certainly the figured specimen; the Atlas figure (pl. 273 fig. 2) shows a fish of 390 mm tot. l. (with lower jaw extended). The smallest of the Leiden specimens is the same size as Bleeker's smallest described fish. It is possible that the three Leiden and one London fish are all syntypes, the count for the Auction catalogue being based on the Atlas number (4) rather than on an actual count.

The British Museum specimen is here selected as lectotype.

Description. — Lectotype, a fish 285 mm S.L. (353 mm tot. l. from tip of lower jaw — estimated 365-370 mm but caudal tips damaged). Head cut horizontally on right side; faint pencil lines on flank below dorsal base and on scales two rows below lateral line, also vertical line at caudal base and oblique pre-orbital line; right flank with two vertical slits. BMNH 1867.II.28.69.

Br. St. 26, D vi 14, P i 14, V i 9 (right) i 10 (left), A iv 23, gillrakers on lower part of first arch 34, scales 32.

In percentages of standard length: body depth 28.6, head length 26.7; snout length 6.5, eye diameter 7.9, upper jaw length 16.3, lower jaw length 15.8, gular plate length 9.8; pectoral length 16.4, pelvic length 12.6, length of anal base 19.7; pre-dorsal distance 50.8, pre-pelvic distance 51.2, pre-anal distance 70.5.

Body moderately compressed, width about $2\frac{1}{4}$ in depth. Eye $1\frac{2}{3}$ in post-orbital distance. Maxilla reaching to beyond posterior border of eye and beyond articulation of lower jaw; two supra-maxillae. Teeth small, villiform, present in both jaws and on vomer, palatines, pterygoids and on tongue. Gular plate longer than eye.

Gillrakers slightly longer than corresponding gill filaments, $\frac{1}{2}$ eye diameter, absent on posterior face of 3rd epibranchial; isolated toothed plates on posterior faces of first three epibranchials. Pseudobranch not exposed, probably absent.

Dorsal origin about equidistant between snout tip and caudal base, last ray filamentous, 27.5 per cent of standard length. Pectoral failing to reach

pelvic base by one eye diameter. Pelvic under 3rd unbranched dorsal ray, nearer to pectoral base than to anal origin; the latter much nearer to pelvic base than to caudal base.

Scales large, absent along back before dorsal fin, lateral line well-developed.

Colour: — Lower $\frac{2}{3}$ of flanks silvery, above this light brown. Fins hyaline.

3. *Megalops oligolepis* Bleeker, 1866

= *Megalops cyprinoides* (Broussonet, 1782)

Megalops oligolepis Bleeker, 1866, Ned. Tijdschr. Dierk. 3: 292 (presumed new species based on juvenile of *Elops cundinga* Cantor, 1850).

Atlas: in synonymy of *M. cyprinoides* — no specimens.

Auction Catalogue: nothing listed as '*oligolepis*'.

RMNH: no specimens labeled '*oligolepis*'.

BMNH: a skin from Cantor's collection is listed by Günther (1868: 472) but, in spite of an intensive search, it cannot now be found.

Type. — Cantor (1850) considered that confusion of the Indian Ocean and Atlantic species of tarpon rendered the species names of Broussonet, Bloch, Lacepède, etc., inadmissible, and he therefore used the name *Elops cundinga* (Ham. Buch.) for his Penang specimens. One of these, a juvenile of $4\frac{1}{8}$ inches, he reported as having only 29 scales (38-41 in the remainder), and it was for this specimen that Bleeker proposed the name *Megalops oligolepis*.

Günther (1868: 472) re-examined this fish, giving a count of 37 scales (which Bleeker (1872: 85) later accepted) and placing it in *Megalops cyprinoides*. Lacking the specimen, Günther's count and identification must be accepted; the high branchiostegal number given by Cantor rules out the possibility that this was a juvenile gizzard shad, which the filamentous last dorsal ray otherwise suggests.

ALBULIDAE

Bleeker proposed no new species of *Albula* and placed all his material in *Conorhynchus glossodon* (Forskål) ⁶ in the Atlas (= *Albula vulpes* (L.)).

CHIROCENTRIDAE

Chirocentrus Cuvier, 1829

Bleeker recognised two species of *Chirocentrus* in the Atlas, *C. dorab* (Forskål) and *C. hypselosoma* Bleeker, the latter distinguished by the following characters: deeper body (depth $5\frac{1}{2}$ in S.L.; cf. 7 times), deeper head

⁶ The unusual but more correct spelling Forsskål (Lemche, 1965) is not adopted here.

(height $1\frac{1}{3}$ in length; cf. $1\frac{2}{3}$ times), deeper caudal peduncle (peduncle length/depth ratio $2\frac{1}{3}$; cf. 3), longer head ($5\frac{2}{3}$ in S.L.; cf. 6 times), and larger scales.

Most subsequent authors have accepted only a single species of *Chirocentrus*. But Hardenberg (1930) re-examined the question and added vertebral number, upper jaw length, pectoral finray number, and gillraker number to the list of characters distinguishing *C. hypselosoma* from *C. dorab*. However, he found larger scales in *C. dorab* than in *C. hypselosoma*, and assumed an error by Bleeker. Fowler (1941: 724) accepted Hardenberg's results and resurrected *Chirocentrus nudus* Swainson as a senior synonym of Bleeker's *C. hypselosoma*. Swainson (1839) based his species on Wahlah of Russell (1803: 78, pl. 199). Russell's figure shows a fish with a deep body (depth 5.9 times in S.L.) and long head (5.3 times in S.L.), characters which point to *C. hypselosoma* rather than *C. dorab*. Since Swainson's description of *C. nudus* comprises only vague statements regarding body proportions, and since Russell's figure and meristic counts contain nothing which would distinguish the Wahlah from *C. hypselosoma*, it must be assumed that *C. nudus* Swainson is a senior synonym of *C. hypselosoma*.

Hardenberg's study has not been followed by any full Indo-Pacific revision and his material was derived solely from the Indo-Malayan Archipelago. Nevertheless, his results supported a difference in the eggs of *Chirocentrus* found by Delsman (1930), and for the present at least the rather deeper-bodied *C. nudus* can be recognised as distinct (see also Whitehead, 1966).

4. *Chirocentrus hypselosoma* Bleeker, 1852 (pl. 2 fig. 2)

= *Chirocentrus nudus* Swainson, 1839

Chirocentrus hypselosoma Bleeker, 1852, Nat. Tijdschr. Ned. Ind. 3: 71 (Singapore and Samarang; a single fish, 415 mm tot. l.; Br. St. 8, D 16-17, P 14, V i 6, A 34).

Atlas: 5 fishes, 180-480 mm tot. l., Java, Pinang, Singapore, Bangka, Borneo, Celebes, Batjan, Obi-major.

Auction Catalogue: as *C. hypselosoma*, 2|1|0|0|0 (p. 45, no. 9).

RMNH: 3 fishes, 142, 320 and 320 mm S.L. (largest fishes 415 and 415 mm tot. l. estimated, caudal tips broken in both cases), last fish with head cut. RMNH 7104 and 24958.

BMNH: 1 fish, 324 mm S.L. (total length 410 mm but caudal tips damaged — estimated 415-420 mm), BMNH 1867.11.28.1. Listed as *Chiroc. hypselosoma* from Bleeker's collection by Günther (1868: 476). Head not cut,

but a three inch longitudinal cut along right flank. Jar with additional external label with faint pencilled name.

Type. — The British Museum specimen, although approximately the same size as the holotype, is eliminated because of its high dorsal and low anal counts (D iv 14, A iii 28). Of the three Leiden specimens, the first is too small and the second has a very low anal count (26, of which the first ray may be the third unbranched ray to give a count of 28 in all) and a low pectoral count (P i 11). However, the third Leiden fish not only agrees closely in size and meristic counts (see below), but also has the head cut. This fish can be identified as the holotype. The Atlas figure (pl. 269 fig. 3) is about 425 mm tot. l., but none of the specimens show pencil marks.

Description. — Holotype, a fish 320 mm S.L. (estimated 415 mm tot. l. but caudal lobes damaged), RMNH 7104. Head cut on right side. Specimen in rather soft condition.

Br. St. 7, D iv 13, P i 13, V i 6, A iii 30, gillrakers on lower part of first arch 16 (both sides).

In percentages of standard length: body depth 16.6, head length 17.7; snout length 4.1, eye diameter 3.8, upper jaw 10.3, lower jaw 9.7; pectoral length 11.7, pelvic length 2.3, length of anal base 21.5; pre-dorsal distance 68.5, pre-pelvic distance 50.3, pre-anal distance 70.1.

Body strongly compressed, scales absent, tips of ribs exposed ventrally giving erroneous impression of serrated belly (Swainson and other authors were misled by this preservation artifact). Two prominent canines in upper jaw, two large, ten moderate and four small canine teeth in lower jaw. Maxilla just reaching lower anterior angle of pre-operculum.

Pectorals with well-developed axillary scales, $\frac{4}{5}$ length of fin. Pelvic fins very small. Anal origin under first branched dorsal ray.

Body now naked (Swainson, 1839: 294, was again misled into thinking this species to be scaleless).

Colour. — Silvery on flanks, light brown along back, fins hyaline.

Note. — The holotype is more slender than Bleeker states for this species in his key in the Atlas, but is still deeper than Bleeker indicates for *C. dorab*. However, it agrees with Hardenberg's (1930) diagnosis for *C. hypselosoma* although two of Hardenberg's thirty-four specimens of *C. dorab* were deeper than this; in gillraker count it also agrees with Hardenberg's figure of 16-17 modal count for *C. hypselosoma* (14-15 for *C. dorab*).

DUSSUMIERIIDAE

Bleeker recognised three Indo-Pacific round herring genera, *Dussumieria*, *Etrumeus* and *Spratelloides*. All three possess a W-shaped pelvic scute, and recent work (Poll, Whitehead & Hopson, 1965) suggests that these are the only Indo-Pacific genera which should be included in the Dussumieriidae.

Dussumieria Valenciennes, 1847

Bleeker recognised two species in the Atlas, *D. acuta* Valenciennes and *D. hasseltii* Bleeker, placing *D. elopsoides* Bleeker in the synonymy of the former. Recognition of type material of the two Bleeker species is complicated. Bleeker (1849) based *D. elopsoides* on an unknown number of specimens from four localities, giving a single size measurement of 185 mm total length. Two years later (Bleeker, 1851a), he listed two specimens only, 115 and 145 mm (still from four localities) and proposed a new species, *D. hasseltii*, based on twenty fishes, 80 to 160 mm total length. Neither here nor subsequently is there any reference to a specimen of 185 mm, which would be a very large specimen. [In 10 specimens of *D. acuta* from the Eastern Mediterranean, caudal length averaged 23.3 per cent of standard length, so that Bleeker's specimen would have been about 150 mm standard length; out of 151 specimens in the British Museum, few are over 140 mm standard length and the largest is 148 mm]. In the next reference to *D. elopsoides* (Bleeker, 1852c) two specimens are again listed, this time 115 and 155 mm. Finally, in the Atlas and in the Auction Catalogue, 29 specimens of *D. elopsoides* are listed (under *D. acuta*), 120-165 mm, but (respectively) only 5 and 2 specimens of *D. hasseltii*.

Clearly Bleeker removed at least 15 of his 20 original *D. hasseltii* specimens, and these can only have been placed with the *D. elopsoides* (i.e. *D. acuta*) specimens. Conversely, he considered some of his original *D. elopsoides* specimens to be *D. hasseltii* when he first proposed the latter species (Bleeker, 1851a and Atlas: 95). In addition, both species must have been added to in the intervening years, since he had 2 + 20 specimens in 1851, and 29 + 5 at the time of the Atlas review.

In these circumstances, it seems preferable to look for type material in the British Museum since these will be specimens selected by Bleeker during his final revision for the Atlas. The fact that Günther (1868) lists the two British Museum specimens as types of *D. elopsoides* and *D. hasseltii* suggests that Bleeker may have given some indication on this.

Both *D. elopsoides* and *D. hasseltii* are considered synonyms of *D. acuta* (Whitehead, 1963b).

5. *Dussumieria elopsoides* Bleeker, 1849 (pl. 3 fig. 1)= *D. acuta* Valenciennes, 1847

Dussumieria elopsoides Bleeker, 1849, Verh. Bat. Gen. 22: 12 (Madura Strait near Kammal and Surabaya, Java Sea near Batavia and Samarang, etc.; no number, 185 mm tot. l., presumably maximum; Br. St. 15, D iii 18, P i 12, V i 7, A i 13 — A14-17 in Bleeker 1851a and 1852c).

Atlas: as *D. acuta*, 29 fishes, 120-165 mm tot. l., Java, Madura, Sumatra, Pinang, Singapore, Bintang, Banka, Borneo, Celebes, Batjan, Amboina.

Auction Catalogue: as *D. acuta*, 17/3/3/3/3 (p. 45, no. 10).

RMNH: 1 fish, 89.0 mm S.L. (115 mm tot. l.) and 15 fishes, 59-125 mm S.L., all RMNH 7129, eight with heads cut.

BMNH: 1 fish, 124.0 mm S.L. (probably 155 mm tot. l. but caudal tips broken), BMNH 1867. 11.28.17. Left side of head cut horizontally. Considered type of *D. elopsoides* by Günther (1868) and Whitehead (1963b).

Type. — In addition to the reasons given above for considering the British Museum specimens of *Dussumieria* to be from the type series, the BMNH specimen of *D. elopsoides* agrees in size with the larger of the two measurements given by Bleeker in 1852c (the 145 mm of 1851a may have been an error). The fish has a cut head which further suggests that it was part of the type series. It is approximately the size of the largest of the 16 Leiden fishes, but since it has already been considered a type there seems little object in selecting a Leiden specimen. It is therefore designated lectotype. The Atlas figure of *D. acuta* (pl. 271 fig. 1) shows a slightly larger fish (about 130 mm S.L.).

Description. — Lectotype, a fish 124.0 mm S.L. (150 mm tot. l. but caudal tips broken and probable tot. l. 155 mm), BMNH 1867.11.28.17. Head cut horizontally on left side. In good condition, but two circular areas of skin removed above anal fin on right side. Metal tag round caudal peduncle [28.17].

Br. St. 15, D iv 17, P i 12, V i 6, A iii 13, gillrakers on lower part of first arch 23.

In percentages of standard length: body depth 20.8, head length 26.9; snout length 8.8, eye diameter 7.1, post-orbital distance 9.2, inter-orbital width 5.6, upper jaw length 8.7, lower jaw length 12.4, operculum height 11.3; pectoral length 12.3, pelvic length 8.5, length of anal base 8.5; pre-dorsal distance 55.0, pre-pelvic distance 64.5, pre-anal distance 84.0.

Body subcylindrical, belly rounded, scales shed. Snout pointed, longer than

eye. Maxilla not quite reaching anterior margin of eye, lower edge toothed; two supra-maxillae, the posterior about $\frac{1}{3}$ width of expanded portion of maxilla. Articulation of lower jaw below vertical from anterior border of pupil. Small conical teeth in both jaws and on tongue.

Pseudobranch present, about $\frac{4}{5}$ eye diameter. Gillrakers slender, $\frac{1}{2}$ eye diameter, present on posterior face of 3rd epibranchial. Cleithral lobe large.

Dorsal equidistant between caudal base and anterior border of eye. Pelvic below 6th branched dorsal ray, slightly nearer to pectoral base than to caudal base. Anal origin a little nearer to caudal base than to pelvic base.

A W-shaped pelvic scute present.

Colour. — Upper third of body light brown, rest of flanks silvery; fins hyaline.

Note. — The lectotype agrees in meristic counts with Bleeker's first description except in the anal count (iii 13, cf. i 13). It can be noted that a Leiden specimen of 115 mm tot. l. (RMNH 7129) has an anal count of iii 12, the first unbranched ray being rather small, and this fish may therefore have been the specimen from which the first count was made. In the second description of *D. elopsoides* (Bleeker, 1851a) the anal count is given as 14-17, with which the lectotype agrees. There are always three unbranched anal rays in *Dussumieria* (Whitehead, 1963b: 319).

6. *Dussumieria hasseltii* Bleeker, 1851 (pl. 3 fig. 2)

= *D. acuta* Valenciennes, 1847

Dussumieria hasseltii Bleeker, 1851, Nat. Tijdschr. Ned. Ind. 1: 422 (Batavia, Cheribon, Samarang, and Surabaya; 20 fishes, 80-160 mm tot. l.; Br. St. 15, D 20-21, P 13-14, V i 7, A 15-16).

Atlas: as *D. hasseltii*, 5 fishes, 102-170 mm tot. l., Java, Madura, Sumatra, Singapore, Celebes, Batjan, Obi-major, Amboina.

Auction Catalogue: 2/0/0/0/0 (p. 45, no. 11).

RMNH: 2 fishes, both 133.0 mm S.L. (160.0 mm tot. l.), RMNH 7128.

AMS.: 1 fish, listed as cotype (AMS B7757).

BMNH: 1 fish, 134.0 mm S.L. (162 mm tot. l.), BMNH 1867.11.28.21. Head not cut. Considered type of *D. hasseltii* by Günther (1868) and Whitehead (1963b).

Type. — In the Atlas Bleeker writes: „Ma description antérieure du *Hasseltii* ayant été prise en partie sur des individus de l'*acuta*, celle que je donne ici devra la remplacer”. This final description of *D. hasseltii* was based

on 5 specimens, 102-170 mm, whereas only 2 specimens are listed in the Sale Catalogue. It seems likely that the British Museum specimen is one of the missing three. Günther claimed it as a type and may well have done so following some indication given by Bleeker. Certainly it was sent to the British Museum at a time when Bleeker was re-describing the species after recognising that the original description was based on mixed material. The British Museum specimen corresponds closely in size with the Atlas figure (Pl. 271 fig. 2), but no pencil marks are visible, possibly because all the scales have been shed. It is here chosen as putative neotype, there being insufficient evidence of its origin for a lectotype designation to be made. The Australian Museum 'cotype' is most likely one of a series of duplicates obtained from Bleeker by Day (Whitley, 1958).

Description. — Putative neotype, a fish 134.0 mm S.L. (162 mm tot. l., caudal tips complete), BMNH 1867.11.28.21. Head uncut. Metal tag round caudal peduncle [28.21.].

Br. St. 17, D iv 16, P i 13, V i 6, A iii 13, gillrakers on lower part of first arch 22.

In percentages of standard length: body depth 20.9, head length 26.4; snout length 9.0, eye diameter 6.7, post-orbital distance 10.1, inter-orbital width 5.8, upper jaw length 8.7, lower jaw length 13.1, operculum height 11.2; pectoral length 11.4 (tips broken), pelvic length 7.1, length of anal base 8.8; pre-dorsal distance 59.0, pre-pelvic distance 65.0, pre-anal distance 83.0.

Body subcylindrical, belly rounded, scales shed. Snout pointed, longer than eye. Maxilla almost reaching vertical from anterior border of eye, lower edge toothed; two supra-maxillae, the posterior just under $\frac{1}{2}$ width of expanded portion of maxilla. Articulation of lower jaw just in advance of vertical from eye centre. Small conical teeth in both jaws and on tongue.

Pseudobranch present, not quite equal to eye diameter. Gillrakers slender, just over $\frac{1}{2}$ eye diameter, three short rakers on posterior face of 3rd epi-branchial. Cleithral lobe large.

Dorsal equidistant between caudal base and posterior margin of pre-operculum. Pelvic below 4th branched dorsal ray, slightly nearer to caudal base than to pectoral base. Anal origin slightly nearer to caudal base than to pelvic base.

A W-shaped pelvic scute.

Colour. — Upper third of body light brown, rest of flanks silvery; fins hyaline, but faint dark border to caudal.

Note. — This specimen agrees with Bleeker's original description in meristic counts except for a slightly higher branchiostegal ray count (right side only, left damaged).

7. [**Elops javanicus** Bleeker, 1849]

= *Dussumieria acuta* Valenciennes, 1847

'*Elops javanicus* K. v. H.' Bleeker, 1849, Verh. Bat. Gen. **22**: (9) 12 (in synonym of *Dussumieria elopsoides*).

Bleeker appears to have taken the name *Elops javanicus* from a MS drawing of Kuhl and Van Hasselt in his possession at that time. The same, or perhaps another MS drawing, seems to have been in the possession of Valenciennes, who considered it identical to his *Sardinella leiogaster* (Valenciennes, 1847: 271), an opinion not shared by Bleeker (1849). A similar difference of opinion arose over a Kuhl and Van Hasselt figure of '*Macrura*' (Whitehead, 1965a: 142).

Since *Elops javanicus* was only published as a synonym, the name is invalid. Van Hasselt (1823) referred to this fish but published no name: "van dit laatste genus [i.e. *Elops*] heb ik eene species, die van de vorige verschilt, door kortere bovenkaak en door iets vreemds onder de *Elophen*; de Radii branchiostegi 14 in getal, daar gewoonlijk 30 en meer gevonden worden".

Part of the locality data for *D. elopsoides* given by Bleeker may have been derived from notes by Kuhl and Van Hasselt.

Etrumeus Bleeker, 1853

Etrumeus Bleeker, 1853, Verh. Bat. Gen. **25**: 58 (Type: *Clupea micropus* Temminck & Schlegel, monotypic).

Bleeker correctly separated this genus from *Dussumieria*. In the most recent review of *Etrumeus* (Whitehead, 1963b) a single species was recognised, *E. teres* (DeKay). *Etrumeus* was not included by Bleeker in the Atlas.

Spratelloides Bleeker, 1851

Spratelloides Bleeker, 1851, Nat. Tijdschr. Ned. Ind. **2**: 214 (Type: *Clupea argyrotaenia* Bleeker, generic name in faunal list without diagnosis); Bleeker, 1852, Verh. Bat. Gen. **24**: 29 (generic diagnosis).

Bleeker recognised two species of *Spratelloides* in the Atlas, *S. delicatulus* (Bennett) (in the synonymy of which he placed his *Clupea macassariensis*) and *S. gracilis* (Temminck & Schlegel) (in the synonymy of which he placed his *Clupea argyrotaeniata*). He distinguished the two mainly on the presence or absence of a silver lateral stripe. Fowler (1941) used the generic

name *Stolephorus* Lacepède and included two further species, but in the most recent revision (Whitehead, 1963b) only two species are accepted, and the name *Stolephorus* is shown to belong to an engraulid genus (Whitehead, 1963c).

8. *Clupea macassariensis* Bleeker, 1849 (pl. 3 fig. 3)

= *Spratelloides delicatulus* (Bennett), 1831

Clupea macassariensis Bleeker, 1849, J. Ind. Arch. **3**: (69) 72 (Macassar; no number, no size; D ii 9, P i 11, V i 7, A i 8).

Clupeoides macassariensis: Bleeker, 1852, Verh. Bat. Gen. **24**: 17 (Macassar; 5 fishes, 60-70 mm tot. l.; Br. St. 6, D ii 9, P i 11, V i 7, A i 8).

Atlas: as *Spratelloides delicatulus*, 33 fishes, 50-80 mm, Singapore, Bangka, Celebes, Halmahera, Ternata, Amboina, Saparua, Banda.

Auction Catalogue: as *Clupeoides macassariensis*, 10/0/0/0/0 (p. 45, no. 15).

RMNH: 31 fishes, 29.5 and 43.1-67.2 mm S.L. (34.8 and 51.2-80 mm tot. l.), RMNH 7126 and 24957.

BMNH: 1 fish, 64.4 mm S.L., 73.5 mm tot. l. (estimated 76.8 mm, caudal tips broken), listed by Günther (1868: 464) as "From Dr Bleeker's Collection", BMNH 1867.11.28.34.

Type. — It is not possible now to distinguish the five specimens from the second of Bleeker's descriptions, and even then there would be no indication which or how many came from the original collection. Clearly, any specimen between 60 and 70 mm is possible and this is a case where the extension of the neotype concept proposed by Cox (1960) can be justifiably used. There is a suitable Leiden specimen which can be selected as putative neotype. The British Museum specimen is too big.

Description. — Putative neotype, a fish 58.3 mm S.L. (69.2 mm tot. l. — estimated 70.0, caudal tips slightly broken), head not cut, scales mostly shed, RMNH 7126.

Br. St. 7, D ii 11, P i 11, V i 7, A ii 8, gillrakers on lower part of first arch 30.

In percentages of standard length: body depth 18.6, head length 24.8; snout length 6.9, eye diameter 6.5, upper jaw length 8.7, lower jaw length 10.8; pectoral length 13.8, pelvic length 10.3, length of anal base 7.7; pre-dorsal distance 49.8, pre-pelvic distance 56.9, pre-anal distance 83.8.

Body subcylindrical, belly rounded, a single W-shaped abdominal scute at pelvic base. Maxilla reaching to anterior border of eye; two supra-maxillae, the posterior paddle-shaped, upper and lower profiles meeting the anterior shaft at approximately the same point (i.e. *Sardinella* shape —

p. 39). Lower jaw slightly projecting. Gillrakers slender, $\frac{3}{4}$ eye diameter, about $1\frac{1}{4}$ times length of longest gill filaments. Cleithral lobe well developed. Pseudobranch exposed, $1\frac{1}{4}$ times eye diameter. Fronto-parietal region smooth, no wedge-shaped striated area. Posterior frontal fontanelles short (0.9 mm), rather narrowly divided by the anterior extension of the supra-occipital (Whitehead, 1965b, fig. 3a).

Dorsal origin nearer to snout than to caudal base by about $\frac{3}{4}$ eye diameter. Pelvic base below 8th branched dorsal ray, nearer to pectoral base than to anal origin by one eye diameter. Anal origin nearer to caudal base than to pelvic base by $1\frac{1}{4}$ times eye diameter.

Colour: — Upper $\frac{1}{2}$ of body light brown, remainder of flanks silver, or golden where scale cover retained. Orange mark on posterior part of iris. A prominent brown mark just above anterior shaft of 2nd supra-maxilla. Fins hyaline, but caudal with two dark horizontal lines on either side of the midline, joined at caudal base.

Note. — One of the Leiden fishes has the right side of the head cut and would have been identified as one of the original syntypes except that it exceeds 70 mm total length. The following data were recorded for this specimen: 65.0 mm S.L.; approx. 80 mm tot. l.; D iii 10, P i 11, V i 7, A ii 8, gillrakers 24.

In percentages of standard length: depth 18.3, head 23.7; snout 6.3, eye diameter 6.1, upper jaw 8.0, lower jaw 10.2; pectoral length 12.3, pelvic length 8.6, length of anal base 8.0; pre-dorsal 46.0, pre-pelvic 55.2, pre-anal 79.0.

The name '*Clupeoides macassariensis* Blkr. = *Leptoclupea macassariensis* Blkr.' appears as number 172 in Bleeker's manuscript list to Günther. Bleeker must have later decided against introducing another generic name.

9. *Clupea argyrotaeniata* Bleeker, 1849 (pl. 3 fig. 4)

= *Spratelloides gracilis* (Temminck & Schlegel, 1846)

Clupea argyrotaeniata Bleeker, 1849, J. Ind. Arch. 3: 72 (Macassar; no number, no size; Br. St. (n.r.), D i 9, P i 15?, V i 7, A i 12-13).

Spratelloides argyrotaenia: Bleeker, 1852, Verh. Bat. Gen. 24: 29 (Macassar; 7 fishes, 62-70 mm tot. l.; Br. St. 6, D 12, P 16?, V i 7, A 13-14).

Atlas: as *Spratelloides gracilis*, 24 fishes, 50-82 mm tot. l., Celebes, Ternata.

Auction Catalogue: as above, 16|2|2|2|2 (p. 45, no. 12).

RMNH: 15 fishes, 40.6-65.5 mm S.L. (46.3 — approx. 77 mm. tot. l.), RMNH 7127 and 24956. None with heads cut.

AMS: as *Clupea argyrotaeniata* Bleeker, cotypes (AMS B7960).

BMNH: 1 fish, 72 mm S.L. (82 mm tot. l.), BMNH 1867.11.28.47. Claimed by Günther (1868: 465) as "Type of *Clupea argyrotaeniata*" but it exceeds the size range of the second description. The lectotype designation by Whitehead (1963b) was based on a curatorial error and should be ignored.

Type. — As in the case of the previous species, there is now no means of distinguishing Bleeker's original specimens, and a neotype designation must be resorted to. The British Museum specimen is too large, but there is a suitable Leiden fish of about 72 mm tot. l. The Australian Museum 'cotypes' probably date from a subsequent, duplicate series.

Description. — Putative neotype, a fish 62.4 mm S.L. (69 mm total length, caudal tips broken, estimated about 72 mm), an ovigerous female, belly cut. Scales shed, pectoral tips damaged, head not cut, RMNH 7127.

Br. St. 7, D ii 10, P i 12, V i 7, A iii 9, gillrakers on lower part of first arch 31.

In percentages of standard length: body depth 15.1, head length 22.4; snout length 7.2, eye diameter 7.8, upper jaw length 8.8, lower jaw length 11.2; pectoral length 12.8 (estimated), pelvic length 8.6, length of anal base 9.1; pre-dorsal distance 51.2, pre-pelvic distance 57.9, pre-anal distance 83.0.

Body subcylindrical, belly rounded, a single W-shaped abdominal scute at pelvic base. Maxilla reaching to anterior eye border. Two supra-maxillae, the posterior with the lower part of the expanded portion larger than the upper part (as in *Herklotsichthys*). Lower jaw slightly projecting. Gillrakers slender, $\frac{3}{4}$ eye diameter, $1\frac{1}{2}$ times length of longest gill filaments. Cleithral lobe well developed. Pseudobranch with basal part of filaments covered by membrane, equal to eye diameter. Fronto-parietal region smooth. Posterior frontal fontanelles broadly divided anteriorly by a wedge of bone, the fontanelles 2.05 mm in length.

Dorsal origin equidistant between snout tip and caudal base. Pelvic base below last dorsal ray, equidistant between pectoral base and last anal ray. Anal origin nearer to pelvic base than to caudal base by $1\frac{1}{3}$ eye diameter.

Colour. — Body light brown, pale along belly; a prominent midlateral silver stripe, as broad as eye, from gill opening to caudal base. Fins hyaline.

Note. — Bleeker himself (Atlas), and most subsequent authors, have considered this species a synonym of *S. gracilis* (Temminck & Schlegel), but Schultz & Welander (1953) recognised it as distinct on the grounds of differences in finray, gillraker and scale counts. But although minor variations in meristic characters occur between specimens from various parts of the vast range of this species (Red Sea to Japan), only the Samoan

population can be clearly distinguished (as *S. gracilis atrofasciatus* — see Whitehead, 1963b).

The name '*Spratelloides argyrotaenia* Blkr. = *Leptoclupea argyrotaenia* Blkr.' appears as number 184 in Bleeker's list sent to Günther (see p. 12). Since *Clupea argyrotaenia* Bleeker is the type species of Bleeker's genus *Spratelloides*, it is curious that Bleeker even considered another generic name. There is no record that the name *Leptoclupea* was ever published, and Bleeker had evidently decided against it when the Atlas plates were made.

CLUPEIDAE

Bleeker's Indo-Malayan specimens are representative of all five of the subfamilies found in the Indo-Pacific region. Bleeker did not distinguish either the Alosinae or the Pellonulinae from the Clupeinae, but placed the Pristigasterinae as a 'tribe' within the latter (Table I).

The five subfamilies can be distinguished by the following key.

1. Lower jaw normal, dentary not flared outwards
 - A. Upper jaw without median notch
 - i. Anal fin short, less than 30 rays; jaws about equal
 - a. Two supra-maxillae Clupeinae
 - b. One supra-maxilla Pellonulinae
 - ii. Anal fin long, more than 30 rays; lower jaw projecting strongly Pristigasterinae
 - B. Upper jaw with distinct median notch Alosinae
2. Lower jaw with dentary flared outwards; mouth inferior; stomach gizzard-like Dorosomatinae

CLUPEINAE

The Bleeker type material can be placed in three modern genera, *Herklotsichthys*, *Sardinella* and *Escualosa* (= *Kowala* auct., now placed in the Clupeinae, not the Pellonulinae — Whitehead, 1964b). Like his contemporaries, Bleeker had considerable difficulty with species of these genera. Unwisely, but perhaps with little choice initially, Bleeker followed the system of genera established by Valenciennes (1847), which was based mainly on dentition. Bleeker's conception of the clupeid genera is most clearly set out in his review of the clupeoids (Bleeker, 1852d). The inadequacies of this system led Valenciennes to place the European sprat in two different genera and to propose the genus *Rogenia* for the young of the best known European clupeid, the herring. By the time that he compiled the Atlas, however, Bleeker had considerably reduced his number of genera (reaction against Valencien-

TABLE II
A synopsis of Bleeker's Atlas species of *Clupea*

Atlas name	original name	name recognised here
1. <i>Clupea (Harengula) dispilonotus</i>	<i>Harengula dispilonotus</i> Blkr., 1852	subfam. CLUPEINAE <i>Herklotsichthys</i>
2. <i>Clupea (Harengula) schrammi</i>	<i>Alausa schrammi</i> Blkr., 1849	
3. <i>Clupea (Harengula) mobuccensis</i>	<i>Harengula mobuccensis</i> Blkr., 1853	2. <i>H. punctatus</i> (Rüpp.)
4. <i>Clupea (Harengula) kumzei</i>	<i>Harengula kumzei</i> Blkr., 1856	
5. <i>Clupea (Harengula) dubia</i>	on <i>Sardinella lineolata</i> Val., 1847	<i>Sardinella</i>
6. <i>Clupea (Harengula) lemuru</i>	<i>Sardinella lemuru</i> Blkr., 1853	
7. <i>Clupea (Harengula) brachysoma</i>	<i>Sardinella brachysoma</i> Blkr., 1852	1. <i>S. aurita</i> Val.
8. <i>Clupea (Harengula) hypselosoma</i>	<i>Harengula hypselosoma</i> Blkr., 1855	
9. <i>Clupea (Harengula) bulan</i>	<i>Clupalosa bulan</i> Blkr., 1849	2. <i>S. brachysoma</i> Blkr.
10. <i>Clupea (Harengula) perforata</i>		
11. <i>Clupea (Harengula) kowal</i>	<i>Spratella kowala</i> Blkr., 1851	3. <i>S. bulan</i> (Blkr.)
12. <i>Clupea (Harengula) gibbosa</i>	<i>Clupea gibbosa</i> Blkr., 1849	
13. <i>Clupea (Harengula) fimbriata</i>	on <i>Spratella fimbriata</i> Val., 1847	4. <i>S. jussieu</i> (Lacep.)
— not listed —	<i>Harengula zumasi</i> Blkr., 1854	
14. <i>Clupea (Harengula) sundaica</i>	<i>Spratella fimbriata</i> Blkr., 1852	5. <i>S. fimbriata</i> Val.
15. <i>Clupea (Harengula) melanurus</i>	<i>Harengula melanurus</i> Blkr., 1853	
16. <i>Clupea (Harengula) atricauda</i>	<i>Harengula (Paralosa) valenciennesi</i> Blkr., 1868	6. <i>S. zumasi</i> (Blkr.)
17. <i>Clupea (Amblygaster) clupeioides</i>	<i>Amblygaster clupeioides</i> Blkr., 1849	
18. <i>Clupea (Amblygaster) leiogastroides</i>	<i>Sardinella leiogastroides</i> Blkr., 1854	7. <i>S. melanura</i> (Cuvier)
19. <i>Clupea (Amblygaster) leiogaster</i>	on <i>Sardinella leiogaster</i> Val., 1847	
20. <i>Clupea (Clupeoides) argyrotaenia</i>	<i>Rogenia argyrotaenia</i> Blkr., 1852	8. <i>S. clupeioides</i> (Blkr.)
21. <i>Clupea (Clupeoides) borneensis</i>	<i>Clupeoides borneensis</i> Blkr., 1851	
22. <i>Clupea (Clupeoides) potamophilus</i>	<i>Clupeoides hypselosoma</i> Blkr., 1866	9. <i>S. sirm</i> (Walb.)
		<i>Escualosa</i>
		subfam. PELLONULINAE
		<i>Clupeoides</i>
		1. <i>C. borneensis</i> Blkr.
		2. <i>C. hypselosoma</i> Blkr.

nes' system led Günther (1868) to combine over sixty species in the genus *Clupea*: only two remain — Whitehead 1965c).

Bleeker combined species of *Herklotsichthys* and *Sardinella* in the genus *Clupea* (together with three species of Pellonulinae). A synopsis of Bleeker's genus *Clupea* is given in Table II. Not until the revision of Regan (1917a) were the genera *Herklotsichthys* and *Sardinella* clearly differentiated, and even then some species were confused (Whitehead, 1964c). Recently Berry (1964) and Whitehead (1964b, 1964c) have proposed even more trenchant characters to differentiate these two genera.

The three genera of the Clupeinae dealt with here can be separated by the following key.

- A. Posterior margin of gill opening irregular in outline (i.e. with large cleithral lobe, and two dermal outgrowths on vertical part of cleithrum); flanks wholly silver.
 - 1. Fronto-parietal striae few (3-6); lower part of 2nd supra-maxilla longer than upper and reaching further anteriorly; final two anal rays not greatly enlarged, about same length as third from last; vertical scale striae continuous across scale. *Herklotsichthys*
 - 2. Fronto-parietal striae many (7-14); lower part of 2nd supra-maxilla as long as upper, the dorsal and ventral profiles meeting the anterior shaft at about the same point; final two anal rays markedly larger than third from last ray; vertical scale striae usually interrupted in centre of scale *Sardinella*
- B. Posterior margin of gill opening with smooth outline, no dermal outgrowths; silver stripe on flank *Escualosa*

Herklotsichthys Whitley, 1951

Herklotsichthys Whitley, 1951, Proc. Roy. zool. Soc. N.S.W. 1949-50:67 (Type: *Harengula dispilonotus* Bleeker) (replacement for *Herklotsella* Fowler, 1934, pre-occupied by *Herklotsella* Herre).

Bleeker included sixteen species in the subgenus *Clupea* (*Harengula*) in the Atlas (Table II). Of these, five are true members of *Herklotsichthys* (*C. moluccensis*, *C. kunzei*, *C. dubia*, *C. schrammi* and *C. dispilonotus*), the remainder being *Sardinella*. Bleeker's *Herklotsichthys* material comprises only two species, *H. dispilonotus* (Blkr.) and *H. punctatus* (Rüpp.).

Bleeker was the first to record the number of fronto-parietal striae (later mentioned by Weber & De Beaufort (1913) but not by Regan, 1917a), but he did not appreciate their possible generic significance, probably because his genera and subgenera were too firmly based on the criteria proposed by Valenciennes.

Fowler (1941) placed the Bleeker genera *Clupalosa* and *Paralosa* in the synonymy of *Harengula*, but they are both junior synonyms of *Sardinella* (Whitehead, 1964c).

The Bleeker species of *Herklotsichthys* can be separated by the following key.

1. Two black saddle-like spots on back, the first below and the second behind the dorsal fin; no dark spot at bases of unbranched dorsal rays . . . *H. dispilonotus* Blkr.
2. No saddle-like blotches, but a dark spot at bases of unbranched dorsal rays . . .
 *H. punctatus* (Rüppell)

10. **Harengula dispilonotus** Bleeker, 1852 (pl. 4 fig. 1)

= *Herklotsichthys dispilonotus* (Bleeker, 1852)

Harengula dispilonotus Bleeker, 1852, Nat. Tijdschr. Ned. Ind. **3**: 456 (Banka I; 3 fishes, 75-82 mm tot. l.; Br. St. 6, D 18-19, P 16-17, V i 7, A 17-18, scutes 25); Bleeker, 1852, Verh. Bat. Gen. **24**: 49 [copied].

Atlas: as *Clupea (Harengula) dispilonotus*, 3 fishes, 75-82 mm tot. l., Singapore, Bangka, Bawean.

Auction Catalogue: as *Clupea (Harengula) dispilonotus*, 2|0|0|0|0 (p. 45, no. 31).

RMNH: 2 fishes, 57.5-61.5 mm S.L. (74.5-approx. 82 mm tot. l.), RMNH 7101.

BMNH: 1 fish, 66.3 mm S.L. (82.0 mm tot. l., caudal tips very slightly damaged), BMNH 1867.11.28.28. Head not cut. Listed as "Type of the species" by Günther (1868: 429).

Type. — The two Leiden specimens and the single British Museum specimen exactly conform with the size range of Bleeker's original three fishes. *H. dispilonotus* is mentioned in five subsequent publications (Bleeker, 1852b, 1852d, 1859b, 1861 and 1872), either as a name only or accompanied by a copy of the original description. Since there are no other specimens, these three fishes must be the syntypes. The British Museum fish has already been selected as lectotype (Whitehead, 1964c: 279) and the other two are here designated paralectotypes. The lectotype is evidently the figured specimen, exactly agreeing in size with Bleeker's Atlas figure (pl. 261 fig. 3).

Description. — Lectotype, a fish 66.3 mm S.L. (82.0 mm tot. l., estimated 83 mm, caudal tips slightly damaged), BMNH 1867.11.28.28. Head not cut, but faint vertical pencil marks on left flank opposite anal origin and pelvic base. Tips of anal rays damaged.

Br. St. 6, D iv 15, P i 14, V i 7, A ii 14, gillrakers 15 on upper part of first arch, 36 on lower, scutes 15 + 12.

In percentages of standard length: body depth 33.0, head length 26.2; snout length 6.8, eye diameter 9.2, upper jaw length 11.5, lower jaw length

12.7; pectoral length 19.6, pelvic length 12.5, length of anal base 16.6; pre-dorsal distance 44.2, pre-pelvic distance 53.0, pre-anal distance 78.0.

Body compressed, depth greater than head length. Maxilla reaching to just behind vertical from anterior border of pupil, two supra-maxillae, the posterior conforming to the '*Harengula*' form (Whitehead 1964b, fig. 2A); lower edge of maxilla with fine teeth; articulation of lower jaw below vertical from anterior border of pupil. Bilobed dermal outgrowth on vertical portion of cleithrum; cleithral lobe large. Gillrakers slender, longer than corresponding gill filaments, about $\frac{1}{2}$ eye diameter. Pseudobranch without ventral ridge, about $\frac{4}{5}$ eye diameter. Operculum very faintly striated along lower edge. Fronto-parietal striae 5-6.

Dorsal origin much nearer to snout than to caudal base. Pectoral fins not reaching to pelvic base. Pelvic base below 5th branched dorsal ray, a little nearer to pectoral base than to anal origin; pelvic axillary scale almost length of whole fin. Anal origin a little nearer to caudal base than to pelvic base.

Scales large, many shed, with up to 5 uninterrupted vertical striae.

Colour. — Upper third of body light brown, remainder of flank silver. Two dark blotches on back, at bases of 10th-15th branched dorsal rays, and between end of dorsal and vertical from anal origin; no dark markings at bases of unbranched dorsal rays. Fins hyaline. (Both dark spots apparent in largest paralectotype; anterior spot only in smaller paralectotype).

Note. — The curious saddle-like blotches set this species apart. Relatively few specimens have been recorded, but all descriptions note this distinctive colouration, which seems to be retained in most preserved fishes. *Herklotsichthys dispilonotus* is otherwise most closely related to the wide-ranging *H. punctatus*, differing little in proportions or meristic counts.

11. *Alausa schrammi* Bleeker, 1849 (pl. 4 fig. 2)

= *Herklotsichthys punctatus* (Rüppell, 1837)

Alausa schrammi Bleeker, 1849, Verh. Bat. Gen. 22: 11 (Boleling, Bali; no number, 102 mm tot. l.; Br. St. 6, D 19, P 16, V 8, A 20).

Meletta schrammi: Bleeker, 1852, Verh. Bat. Gen. 24: 30 (4 fishes, 70-102 mm tot. l.; Boleling, Bali).

Atlas: as *Clupea (Harengula) schrammi*, 4 fishes, 70-102 mm tot. l., Bali.

Auction Catalogue: as *Clupea (Harengula) schrammi*, 4|0|0|0|0 (p. 45, no. 27).

RMNH: 3 fishes, 56-82.5 mm S.L., RMNH 7083 and 23302. All in poor condition, largest with head cut.

BMNH: 1 fish, 65 mm S.L. (73 mm tot. l. — estimated 75-78 mm, caudal

lobes damaged), BMNH 1867.11.28.32. Günther (1868: 412) claimed this specimen as "One of the typical specimens", but owing to its poor condition did not assign it to any of the species which he recognised.

Type. — Bleeker (1852: 31) refers to this species once again before its final mention in the Atlas, when he included four fishes, all from Bali, presumably the syntypes. The largest of the Leiden specimens seems to have measured about 100 mm tot. l. and can be designated lectotype, the remaining specimens being paralectotypes. It may be the figured specimen, matching in size the Atlas figure (pl. 272 fig. 3).

Description. — Lectotype, a fish 82.5 mm (approx. 100 mm tot. l. but caudal now damaged), RMNH 7083. Head badly damaged, cut horizontally on right side. Dorsal and anal fins damaged, counts depending on count of pterygiophore heads.

Br. St. (n.r.), D 12 (approx.), P i 14, V i 7, A 15 (approx.), gillrakers on lower part of first arch 29, scutes 16 + 13.

In percentages of standard length: body depth 18.1, head length 21.5 (approx.); snout length (damaged), eye diameter 6.3, upper jaw length (damaged), lower jaw length 10.9; pectoral length 10.1, pelvic length 6.7, length of anal base 14.2; pre-dorsal distance 42.5 (approx.), pre-pelvic distance 47.8 (approx.), pre-anal distance 76.2 (approx.).

Body compressed, depth about equal to head length. Bilobed dermal outgrowth on vertical portion of cleithrum, cleithral lobe present but small. Gillrakers present on posterior face of 3rd epibranchial. Operculum quite smooth. Fronto-parietal striae 4 or 5.

Pelvic below 1st or 2nd branched dorsal rays, nearer to pectoral base than to anal origin by an eye diameter.

Colour. — Upper third of body light brown, flanks silver.

Note. — There is little to distinguish *Alausa schrammi* Bleeker from *Herklotsichthys punctatus* (the holotype and 35 other Red Sea specimens described by Whitehead, 1965b). The lectotype of *A. schrammi* is slightly more slender (depth 18.1 per cent of S.L.; cf. 22.8-32.0) and has a shorter head (21.5 per cent of S.L.; cf. 25.6-31.4) but the latter may be due to damage. It also has one less pre-pelvic scute. However, *H. punctatus* has a wide range in the Indo-Pacific region and a certain amount of intraspecific variation might be expected.

12. *Harengula moluccensis* Bleeker, 1853 (pl. 4 fig. 3)

= *Herklotsichthys punctatus* (Rüppell, 1837)

Harengula moluccensis Bleeker, 1853, Nat. Tijdschr. Ned. Ind., 4: 609 (Ternate, Amboina, Ceram; 4 fishes, 110-128 mm tot. l.; Br. St. 6, D 17-19, P 14-15, V i 7, A 17-18, scutes 30).

Atlas: as *Clupea (Harengula) moluccensis*, 48 fishes, 58-155 mm tot. l., Sumatra, Nias, Singapore, Bali, Sumbawa, Celebes, Ternata, Batjan, Buro, Amboina, Saparua, Ceram, Timor.

Auction Catalogue: as *Clupea (Harengula) moluccensis*, 36/3/3/3 (p. 45, no. 24).

RMNH: 44 fishes, formerly in a single jar, now RMNH 7098 and 24955, but falling into two, perhaps three, preservational lots: a. 20 fishes, 48.5-67.5 mm S.L. (59-82 mm tot. l.); b. 1 fish, 71.0 mm S.L. (87.5 mm tot. l.) (possibly part of next series); c. 23 fishes, 89.2-117.0 mm S.L. (110-138 mm tot. l.) (a single specimen in this lot has head cut).

BMNH: 1 fish, 112 mm S.L. (135 mm tot. l., caudal tips damaged, estimated 137-8 mm tot. l.), BMNH 1867.11.28.27. Günther (1868: 427) claimed this as "Type of the species", but it is too large.

Type. — Once again it is impossible to distinguish Bleeker's original specimens, no four specimens in either of the two larger preservational lots standing out from the rest. However, the specimens in the first preservational lot are too small. Of the remainder, only one fish has the head cut and it can therefore be presumed part of the type series. It is here designated lectotype. It is somewhat smaller than that figured in the Atlas (pl. 263 fig. 2), which is about 142 mm tot. l. The British Museum specimen is also a little smaller than the Atlas figure.

Description. — Lectotype, a fish 100 mm S.L. (115.2 mm tot. l., estimated about 123 mm tot. l.), RMNH 7098. Head cut horizontally, caudal lobes damaged.

Br. St. 6, D iv 15, P i 14, V i 7, A iii 14, gillrakers on lower part of first arch 33, scutes 18 + 13.

In percentages of standard length: body depth 25.8, head length 26.9; snout length 7.3, eye diameter 8.7, upper jaw length 12.8, lower jaw length 12.8; pectoral length 17.2, pelvic length 13.2, length of anal base 14.3; pre-dorsal distance 47.3, pre-pelvic distance 55.3, pre-anal distance 79.8.

Body moderately compressed, depth about equal to head length. Second supra-maxilla with lower lobe of expanded portion larger than upper, showing typical '*Harengula*' form. Fronto-parietal striae 5.

Dorsal nearer to snout than to caudal base by $\frac{2}{3}$ eye diameter. Pelvic under 4th branched dorsal ray, midway between pectoral base and anal origin. The latter nearer to caudal base than to pelvic base.

Scales with four or five uninterrupted vertical striae; absent from anterior part of body, count not possible.

Colour. — Upper third of body grey-brown with narrow silvery line running along lower edge of dark area, separated from remaining silver part of flank by an equally narrow dark line. Fins hyaline.

Note. — This species must also be placed in the synonymy of *H. punctatus*, the type agreeing rather better with the description of *H. punctatus* given by Whitehead (1965b) than does the type of *Alausa schrammi*.

13. *Harengula kunzei* Bleeker, 1856 (pl. 5 fig. 1)

= *Herklotsichthys punctatus* (Rüppell, 1837)

Harengula kunzei Bleeker, 1856, Nat. Tijdschr. Ned. Ind. 12: 209 (Ternate; 2 fishes, 140-142 mm tot. l.; Br. St. 6, D iv 15-16, P ii 13, V i 7, A iii 14-15).

Atlas: as *Clupea (Harengula) kunzei*, 4 fishes, 135-142 mm tot. l., Ternata, Amboina.

Auction Catalogue: as *Clupea (Harengula) kunzei*, 3|0|0|0|0 (p. 45, no. 25).

RMNH: 4 fishes, RMNH 7097, 23738 and 24954, separable into two preservational lots: a. 2 fishes, 58.3-107.3 mm S.L. (about 71-135 mm tot. l.), scales absent; b. 2 fishes 106.0-110.5 mm S.L. (135.2-139.1 mm tot. l., caudal tips damaged, estimated 140-142 mm tot. l.), partially scaled, larger with head cut.

BMNH: 1 fish, 106 mm S.L. (134 mm tot. l.), BMNH 1867.11.28.30. Günther (1868: 427) claimed this as "Type of *H. kunzei*" but it is too small.

Types. — The two smaller Leiden fishes and the British Museum specimen are obviously later additions, presumably from Biliton (Bleeker, 1858, list only). The two larger Leiden fishes are clearly the syntypes, and the larger of the two, with the head cut, is here selected as lectotype. The latter may be the figured specimen, but is slightly smaller than the Atlas drawing (pl. 263 fig. 1).

Description. — Lectotype, a fish 110.5 mm S.L. (135.2 mm tot. l., caudal lobes broken, estimated 142 mm tot. l.), RMNH 7097. Head cut, scales partly lost.

Paralectotype, a fish 106.0 mm S.L. (139.1 mm tot. l., caudal tips very slightly broken, estimated 140 mm tot. l.), RMNH 23738. Head not cut, scales partly lost.

[In the next paragraphs the figures for the paralectotype are given in parenthesis].

Br. St. 6, D iv 15, P i 14 (15), V i 7, A iii 15 (first unbranched ray missing in lectotype), gillrakers on lower part of first arch 32 (36), scutes 18 (17) + 13.

In percentages of standard length: body depth 27.2 (29.4), head length 27.1 (29.4); snout length 7.5 (8.1), eye diameter 8.4 (9.6), upper jaw length 12.8 (13.8), lower jaw length 12.5 (14.3); pectoral length 18.6 (20.9), pelvic length 12.5 (14.1), length of anal base 12.9 (14.3); pre-dorsal distance 47.2 (50.0), pre-pelvic distance 53.5 (54.0), pre-anal distance 77.2 (79.5).

Body moderately compressed, belly not strongly keeled, its depth equal to head length. Second (posterior) supra-maxilla with lower part of expanded portion larger than upper, showing typical '*Harengula*' form. Cleithral lobe and bilobed dermal outgrowths on vertical part of cleithrum well developed. Fronto-parietal striae 4.

Dorsal height 18.4 per cent of S.L., dorsal origin a little nearer to snout than to caudal base. Pelvic base under 5th branched dorsal ray, nearer to pectoral base than to anal origin by $\frac{1}{2}$ eye diameter. Anal origin a little nearer to caudal base than to pelvic base.

Scales partly lost, no count possible; three or four uninterrupted vertical striae on unexposed portion of scale; exposed edge of scale finely denticulated.

Note. — This species can also be considered a junior synonym of *H. punctatus*. Bleeker (Atlas: 100) separated it from *C. moluccensis* on its longer head (less than 4 times in S.L.), but practically no difference is found here between the lectotypes of the two species.

14. *Clupea (Harengula) dubia* Bleeker, 1872

= *Herklotsichthys punctatus* (Rüppell, 1837)

Clupea (Harengula) dubia Bleeker, 1872, Atlas Ichthyol. Ind. Néerland. **6**: 108 (on *Sardinella lineolata* Val., 1847, Hist. Nat. Poiss. **20**: 197 — non *Clupea lineolata* Val.).

Atlas: no material.

Auction Catalogue: no material.

RMNH: no material.

BMNH: no material.

MNHN: 2 fishes, 95-105 mm S.L., ex Ceylon, MNHN 666; 1 fish, 125 mm, ex Moluccas, MNHN 3106. The first two were listed as 'paratypes' by Bertin (1940: 289), the last as a paratopotype.

Type. — Bleeker described *C. dubia* solely on Valenciennes' inadequate description. The larger of the two Valenciennes fishes is here chosen as lectotype and the smaller as paralectotype, of both *Sardinella lineolata* Val. and of *Clupea (Harengula) dubia* Blkr.

Description. — Lectotype, a fish 83.0 mm S.L. (approx. 103 mm tot. l.), scales mostly absent except beyond anal origin, MNHN 666.

Br. St. 6, D iv 16, P i 15 (both sides), V i 7, A iii 16, gillrakers on 1st arch 15 (upper) + 31 (lower), scutes 18 + 11 (17 + 13 in paralectotype).

In percentages of standard length: body depth 25.7, head length 29.4; snout length 7.7, eye diameter 10.0, upper jaw length 13.6, lower jaw length 13.9; pectoral length 20.5, pelvic length 13.5, length of anal base 14.4; pre-dorsal distance 47.7, pre-pelvic distance 55.7, pre-anal distance 77.1.

Body moderately compressed, its depth less than head length. Second (posterior) supra-maxilla with lower expanded portion larger than upper portion, i.e. typical '*Harengula*' form. Cleithral lobe and bilobed dermal appendages on vertical part of cleithrum well developed. Fronto-parietal striae 4. No teeth on palate, but present on tongue, pre-maxillae and dentaries; lower edge of maxilla finely serrated posteriorly.

Last anal ray somewhat enlarged, but penultimate ray scarcely enlarged.

Bertin (1940) was certainly correct in identifying the types as *Harengula punctata*.

Sardinella Valenciennes, 1847

Sardinella Valenciennes, 1847, Hist. Nat. Poiss. 20: 28 (Type: *Sardinella aurita* Valenciennes, designated by Gill, 1861, Proc. Acad. nat. Sci. Philad.: 35).

Fourteen of the twenty-two species included by Bleeker in the Atlas as members of the genus *Clupea* are *Sardinella* (plus one further species, *Harengula zunasi* Blkr., not listed in the Atlas). Nine are recognised here as senior synonyms, five of them described first by Bleeker.

Bleeker placed three of these fifteen species (see Table II) in his subgenus *Clupea* (*Amblygaster*) (*C. clupeoides*, *C. leiogastroides* and *C. leiogaster*). The remaining twelve species are combined in the Atlas with species of *Herklotsichthys* in the subgenus *Clupea* (*Harengula*); in the subsidiary divisions of the key, species of *Herklotsichthys* and *Sardinella* lie close together. However, the Atlas arrangement is certainly an improvement on the aggregate of previous Bleeker work on these fishes, where species were scattered amongst ten genera and subgenera (*Harengula*, *Alausa*, *Sardinella*, *Meletta*, *Clupeonia*, *Clupalosa*, *Spratella*, *Paralosa*, *Amblygaster* and *Clupea*). Repeated re-allocation of species to different genera not only produced a number of homonyms for which replacement names were required. It also seriously obscured many species, leading to such nomenclatural tangles as the '*Kowala*' problem (Whitehead, 1964b). There is still urgent need to unravel the synonymies constructed round such names ('*jussieu*' and '*melanura*' require particular attention).

A revision of the genus *Sardinella* has recently been published (Chan, 1965). Chan recognises sixteen species, where Fowler (1941) had included thirteen, but even now there is room for further studies on larger samples of material.

The following key distinguishes the *Sardinella* species included in the Bleeker material. Where ranges are given, these are derived partly from Chan (1965), partly from Whitehead (1965b), and partly from unpublished observations.

- A. Pelvic with 9 rays; pseudobranch long, with ventral ridge; epibranchial rakers curled upwards; gillrakers 68-258 (subgenus *Sardinella*) *S. aurita* Val.
- B. Pelvic with 8 rays; pseudobranch short, without ventral ridge; epibranchial rakers nearly straight; gillrakers 26-103
 - 1. A double row of pre-dorsal median scales; abdominal scutes strongly keeled; gillrakers 45-103 (subgenus *Clupeonia*)
 - a. Scales markedly eroded posteriorly, with perforations and horizontal ridges on exposed portion; body moderate or deep, 27-38 per cent of S.L.
 - i. Gillrakers 43-53; post-pelvic scutes 11-14 (15); depth 27-32 per cent of S.L. *S. zumasi* (Blkr.)
 - ii. Gillrakers 54-65; post-pelvic scutes 12-14; depth 33-38 per cent of S.L. *S. brachysoma* Blkr.
 - iii. Gillrakers 69-81; post-pelvic scutes 12-15; depth 28-33 per cent of S.L. *S. fimbriata* (Val.)
 - b. Scales faintly if at all eroded, perforated or horizontally striated; body usually moderate or slender
 - i. Depth 31-36 per cent of S.L.; gillrakers 49-62 *S. bulan* (Blkr.)
 - ii. Depth 22-31 per cent of S.L.
 - Caudal tips plain; gillrakers 47-61; post-pelvic scutes 14-16 *S. jussieu* (Lac.)
 - Caudal tips black; gillrakers 39-44; post-pelvic scutes 11-13 *S. melanura* (Cuv.)
 - 2. A single median row of pre-dorsal scales; abdominal scutes barely keeled; gillrakers 26-42 (subgenus *Amblygaster*)
 - a. A series of 10-20 dark blue spots along flank; maxilla reaching vertical from anterior eye border; gillrakers 38-42 *S. sirm* (Walb.)
 - b. No series of spots on flanks; maxilla not reaching vertical from anterior eye border; gillrakers 26-36
 - i. Depth 24-27 per cent of S.L.; gillrakers 26-30 *S. clupeoides* (Blkr.)
 - ii. Depth 22-24 per cent of S.L.; gillrakers 31-36 *S. leiogaster* (Val.)

15. ***Sardinella lemuru*** Bleeker, 1853 (pl. 5 fig. 2)

= *Sardinella aurita* Valenciennes, 1847

Sardinella lemuru Bleeker, 1853, Nat. Tijdschr. Ned. Ind. 4: 500 (Batavia; 12 fishes, 145-162 mm tot. l.; Br. St. 6, D 17-18, P 15-16, V i 8, A 13-16).

Atlas: as *Clupea (Harengula) lemuru*, 16 fishes, 130-162 mm, Batavia, Java.

Auction Catalogue: as *Clupea (Harengula) lemuru*, 12/1/1/1/1 (p. 45, no. 26).

RMNH: 1 fish, 127.9 mm S.L. (caudal broken, estimated 154 mm tot. l.), head cut; and 8 fishes, 108-130 mm S.L., six with heads cut, smallest split dorsally for vertebral count, all RMNH 7103.

BMNH: 1 fish, 132.0 mm S.L. (149.2 mm tot. l., caudal damaged, estimated 162 mm), head not cut, BMNH 1867.11.28.41. Listed by Günther (1868: 431) as "Type of the species".

MNHN: 1 fish, 111.4 mm S.L. (estimated 137.5 mm tot. l.), head not cut. Listed as cotype by Bertin (1940: 286).

Type. — The British Museum fish is the largest of the existing specimens and appears to have been the same size as the upper limit given by Bleeker. The head is not cut, but the specimen has already been considered a type and it is suitable for choice as lectotype.

Apparently Bleeker added 4 further but unrecorded specimens to the remaining 11 syntypes, but these cannot be distinguished amongst the Leiden material. The two smallest Leiden fishes are probably too small to have been syntypes. A Leiden fish of 119 mm seems to agree with the lower limit of the type series (tot. l. estimated).

Description. — Lectotype, a fish 132.0 mm S.L. (149.2 mm, estimated 162 mm tot. l.), caudal lobes damaged, head not cut, no pencil marks, belly slightly damaged behind pelvic fins, BMNH 1867.11.28.41.

Br. St. 5, D iv 15, P i 15, V i 8, A iii 14, gillrakers on lower part of 1st arch 132, scutes 19 + 14 (? one post-pelvic scute missing).

In percentages of standard length: body depth 22.3, head length 25.2; snout length 7.0, eye diameter 5.9, upper jaw length 10.0, lower jaw length 12.7; pectoral length 14.8, pelvic length 7.7, length of anal base 14.2; pre-dorsal distance 42.5, pre-pelvic distance 51.7, pre-anal distance 78.0.

Body moderately compressed, its width twice in its depth, belly rounded in front of pelvic fins, barely keeled. Upper jaw just reaching to anterior border of pupil; expanded portion of 2nd supra-maxilla of 'Sardinella' shape, pointed posteriorly. Cleithral lobe and bilobed dermal outgrowths on vertical portion of cleithrum well developed. Gillrakers slender, about equal to longest gill filaments, $\frac{3}{4}$ of eye diameter. Pseudobranch long, $1\frac{1}{4}$ times eye diameter, with well developed ventral ridge. Operculum with dark 'opercular spot' (absence of inner reflecting guanine layer), lower border of operculum forming an angle of 10-15° to the horizontal; suboperculum rectangular. Exposed portion of interoperculum crescent-shaped (as in fig.

5a, Chan, 1965). Fronto-parietal striae 8-9, the striated cuneiform areas meeting posteriorly in the midline.

Dorsal origin well in advance of midpoint of body, distance in front of dorsal base a little less than that behind it. Pectoral tips fail to reach vertical from dorsal origin by $\frac{1}{4}$ eye diameter; no pectoral axillary scale but groove to receive upper edge of fin. Pelvic base below 7th branched dorsal ray, slightly nearer to anal origin than to pectoral base; axillary scale present, $\frac{3}{4}$ length of fin. Anal origin nearer to caudal base than to pelvic base by $\frac{1}{2}$ eye diameter.

Scales partly lost, about 47 estimated in longitudinal series; exposed portions with very faint horizontal lines but no perforations, posterior edge of scale little eroded; unexposed portion with one complete and 3 or 4 interrupted vertical striae.

Colour. — Upper third of body light brown, rest of flanks silver, or gold where scale cover remains; fins hyaline; small area near postero-dorsal margin of operculum appearing black due to absence of silver pigment below.

Note. — The following counts were recorded for the largest Leiden fish which is close to the upper size limit of the type series (RMNH 7103):

D iv 13, P i 15, V i 8, A ii 13, gillrakers 171 on lower part of 1st arch, scutes 19 + 14.

Weber & De Beaufort (1913) considered *S. lemuru* Bleeker a synonym of *S. longiceps* Valenciennes, but Regan (1917a), Fowler (1941) and Chan (1965) showed that *S. longiceps* has a much longer head than *S. aurita* (2.95-3.44 in S.L.; cf. 3.66-3.84 in *S. aurita*; 3.97 in the lectotype described here). In addition, the present specimen has a crescent-shaped exposed portion of the inter-operculum (an approximate semicircular segment in *S. longiceps* — Chan, 1965, fig. 5b).

16. *Sardinella brachysoma* Bleeker, 1852 (pl. 5 fig. 3)

= *Sardinella brachysoma* Bleeker, 1852

Sardinella brachysoma Bleeker, 1852, Verh. Bat. Gen. 24: 19 (Batavia; 16 fishes, 115-152 mm tot. l.; Br. St. 6, D 17-18, P 15-16, V i 7, A 18-19, scutes 30).

Atlas: as *Clupea (Harengula) brachysoma*, 25 fishes, 115-152 mm tot. l., Java, Sumatra, Bangka.

Auction Catalogue: as *Clupea (Harengula) brachysoma*, 17/2/2/2/2 (p. 45, no. 21).

RMNH: 14 fishes, 92.8-115.2 mm S.L. (115-147 mm tot. l.), six cut on right side of head, RMNH 7089.

AMS: 1 fish, as *Clupea brachysoma* cotype (AMS I 129).

BMNH: 1 fish, 115 mm S.L. (144.6 mm tot. l.), head cut on right side, BMNH 1867.11.28.38. Claimed by Günther (1868: 423) as "Type of the species".

Type. — Although some further specimens were added to the original 16 fishes described (ex Banka and Sumatra, Bleeker 1860a, 1860b) the Leiden material must certainly contain a number of syntypes. However, the British Museum specimen is within the size range of the type series, has already been recognised as a type by Günther (1868: 423) and Regan (1917a), and there is at least as much if not more chance that it was selected from the type series by Bleeker, than that any particular member of the remaining A series in Leiden was part of the type series. The British Museum specimen is therefore chosen as lectotype.

Description. — Lectotype, a fish 115 mm S.L. (144.6 mm tot. l., caudal tips damaged, 149 mm estimated), head cut on right side, short vertical incision in flank above pectoral fin on same side; otherwise in good condition, scales adherent, BMNH 1867.11.28.38.

Br. St. 6, D iv 15, P i 15, V i 7, A iii 17, gillrakers on lower part of first arch 60, scutes 18 + 13, scales in longitudinal series 41.

In percentages of standard length: body depth 37.1, head length 24.7; snout length 6.5, eye diameter 7.1, upper jaw length 9.7, lower jaw length 10.3; pectoral length 17.0, pelvic length 10.5, length of anal base 15.1; pre-dorsal distance 43.5, pre-pelvic distance 52.8, pre-anal distance 77.6.

Body deep and strongly compressed, its width $2\frac{2}{3}$ times in its depth, belly sharply keeled. Upper jaw short, reaching just beyond vertical from anterior eye border; 2nd supra-maxilla of '*Sardinella*' shape, broken on right side; expanded portion of maxilla with several longitudinal ridges. Cleithral lobe and bilobed dermal outgrowths on vertical portion of cleithrum well developed. Gillrakers slender, about equal to corresponding gill filaments, $\frac{1}{2}$ eye diameter. Pseudobranch without ventral ridge, about $\frac{4}{5}$ eye diameter. Operculum narrow, its width $2\frac{1}{2}$ times in its height. Fronto-parietal striae 6.

Dorsal origin nearer to snout than to caudal base. Pectoral tips almost reaching vertical from dorsal origin; no pectoral axillary scale. Pelvic base below 4th branched dorsal ray, equidistant between pectoral base and anal origin; pelvic axillary scale equal to length of fin. Anal origin nearer to caudal base than to pelvic base by $\frac{1}{2}$ eye diameter.

Scales adherent, concealed portion with two or three uninterrupted vertical striae; exposed portion with many fine longitudinal ridges and lines of perforations, the margin of the scale being eroded.

Colour. — Upper $\frac{1}{5}$ of body light brown, rest of flanks golden; iris dark along upper periphery, golden along lower; fins hyaline, but dorsal finely speckled with light brown anteriorly.

Note. — *S. brachysoma* can be distinguished chiefly by its deep, compressed body and high gillraker count. In the 14 possible syntypes at Leiden (RMNH 7089), body depth ranged between 36.0 and 38.3 per cent of standard length (Mean 37.20). Gillrakers ranged between 54 and 60 (Mean 57.15). The following meristic counts were recorded in a 97 mm Leiden specimen (RMNH 7089): D iii 14, P i 14, V i 7, A ii 16, gillrakers 56, scutes 18 + 14, scales in longitudinal series 38 + 2 on the caudal fin.

The perforated and eroded but adherent scales are characteristic of this species, but occur also in *S. fimbriata* (Valenciennes) (Chabanaud, 1926, fig. 5). Chan (1965) separates the latter from *S. brachysoma* by its higher gillraker count (68-81), and this was borne out in 24 Red Sea specimens (60-72, Whitehead, 1965b). The Red Sea fishes were, however, more slender than Chan's specimens.

The lectotype has one more anal ray than is described, but the first unbranched ray is minute and may have been missed. The first unbranched dorsal ray is also minute.

17. **Harengula hypselosoma** Bleeker, 1855 (pl. 6 fig. 1)

= *Sardinella brachysoma* Bleeker, 1852

Harengula hypselosoma Bleeker, 1855, Nat. Tijdschr. Ned. Ind. 8: 427 (Amboina; 2 fishes, 165-166 mm tot. l.; Br. St. 6, D iv 14-15 or iii 15-16, P ii 13-14, V i 7, A iii 18-19, scutes 30 or 31).

Atlas: as *Clupea (Harengula) hypselosoma*, 4 fishes, 138-172 mm tot. l., Amboina.

Auction Catalogue: as *Clupea (Harengula) hypselosoma*, 3/1/0/0/0 (p. 45, no. 20).

RMNH: 1 fish, 97.5 mm S.L. (124 mm tot. l.), head cut, RMNH 23304 and 1 fish, 122 mm S.L. (approx. 164 mm tot. l.), head cut, RMNH 7114.

BMNH: 1 fish, 120.6 mm S.L. (163.5 mm tot. l., perhaps 165 mm originally), head not cut but pencil mark on left flank, BMNH 1867.11.28.29. Listed as "Type of the species" by Günther (1868: 431) and accepted as type by Regan (1917a).

Type. — Although Bleeker had two later specimens (Atlas: 104) these were 138 and 172 mm tot. l. The British Museum specimen and the larger of the two Leiden fishes are therefore the syntypes. The British Museum fish is best designated lectotype, not only because it has already been assumed

the type, but because it bears faint pencil markings on the left side and almost exactly corresponds in size with the Atlas figure (Plate 267 fig. 2, tot. l. 163 mm).

Description. — Lectotype, a fish 120.6 mm S.L. (163.5 mm tot. l., caudal tips virtually complete), head not cut, faint vertical pencil markings below dorsal origin, above anal origin and at caudal base; in good condition, scales adherent except along belly, BMNH 1867.11.28.29.

Paralectotype, a fish 122.0 mm S.L. (about 164 mm tot. l.), head cut on right side, lower jaw broken on both sides, scales adherent except along belly, membrane between anal rays broken at every 10th ray, RMNH 7114.

[In the description the figures for the paralectotype are given in parenthesis].

Br. St. 5, D iv 15 (15), P i 14 (15), V i 7, A iii 17 (18), gillrakers on lower part of 1st arch 64 (57), scutes 17 + 12 (19 + 13), scales in longitudinal series 41 (43) + about 7 scales on caudal.

In percentages of standard length: body depth 37.8 (37.0), head length 24.3 (25.7); snout length 6.0 (4.5, damaged), eye diameter 7.5 (7.4), upper jaw length 10.8 (11.3), lower jaw length 10.9 (10.7, broken); pectoral length 21.2 (21.4), pelvic length 11.8 (12.4), length of anal base 15.2 (16.0); pre-dorsal distance 45.2 (45.0), pre-pelvic distance 51.5 (53.0), pre-anal distance 78.8 (79.5).

Body strongly compressed, its width almost 3 times in its depth, belly sharply keeled. Upper jaw reaching almost to vertical from eye centre; second supra-maxilla of 'Sardinella' shape, posterior edge of expanded portion evenly rounded, not drawn to a point; expanded portion of maxilla with longitudinal ridges. Cleithral lobe and bilobed dermal outgrowths on vertical portion of cleithrum well developed. Gillrakers slender, a little longer than corresponding gill filaments, about $\frac{3}{4}$ eye diameter. Pseudobranch without ventral ridge, $\frac{3}{4}$ eye diameter. Operculum narrow, its width $\frac{2}{3}$ in its height. Fronto-parietal striae 6 (8).

Dorsal origin nearer to snout than to caudal base. Pectoral tips reaching just beyond vertical from dorsal origin; no pectoral axillary scale. Pelvic base below 5th (3rd or 4th) branched dorsal ray, nearer to pectoral base than to anal origin by $\frac{1}{2}$ eye diameter; pelvic axillary scale equal to fin in length. Anal origin nearer to caudal base than to pelvic base by $\frac{2}{3}$ eye diameter.

Scales adherent, with ridges, perforations and eroded posterior margin as in lectotype of *S. brachysoma*.

Colour. — Dorsal surfaces light brown, remaining $\frac{4}{5}$ of flanks golden;

iris silver, golden/orange along postero-ventral periphery; fins hyaline but some brown speckling on dorsal.

Note. — The descriptions given here leave no doubt that *Harengula hypselosoma* Bleeker is a junior synonym of *Sardinella brachysoma*, a conclusion already reached by Chan (1965).

The lectotype differs from the original description in having one less branchiostegal ray (but branchiostegal membrane damaged), and one (or two) less scutes.

Regan (1917a) tentatively placed *Kowala albella* Valenciennes, 1847 in the synonymy of *Sardinella brachysoma*; Fowler (1941) definitely considered the latter a junior synonym of *K. albella*, as also did Bertin (1940). However, the two Paris Museum specimens (MNHN 3231 and 665, 70.5 and 71.5 mm S.L.) are much more slender than *S. brachysoma* (depth 31.9 and 33.7 per cent of S.L.; cf. 36.0-38.3 in the specimens of *S. brachysoma* listed here), and one at least has a lower gillraker count (47; at least 50 in the other, but arches damaged). Neither specimen has the compressed, sharply keeled body of *S. brachysoma*. *K. albella* seems to belong to the *Sardinella bulan* complex of species, and may yet prove to be a senior synonym of *S. bulan*.

Clupalosa Bleeker, 1849

Clupalosa Bleeker, 1849, Verh. Bat. Gen. 22: 12 (Type: *Clupalosa bulan* Bleeker, monotypic).

Bleeker used the name *Clupalosa* only in the combination *Clupalosa bulan* (except for Plate 266 fig. 5 of the Atlas, which is captioned *Clupea* (*Clupalosa*) *kowal*, a name placed in the synonymy of *Clupea* (*Harengula*) *bulan* in the text). There is no indication in the original or subsequent (Bleeker, 1852d) diagnoses of the genus *Clupalosa* to indicate why Bleeker separated this species. Evidently, by the time he compiled the Atlas, Bleeker saw no reason either.

Fowler (1941), through a misinterpretation of Bleeker's species *Clupalosa bulan* (Whitehead, 1964b) placed *Clupalosa* in the synonymy of *Harengula* (i.e. *Herklotsichthys*). *Clupalosa* is in fact a junior synonym of *Sardinella* Valenciennes (Whitehead, 1964c).

18. **Clupalosa bulan** Bleeker, 1849 (pl. 6 fig. 2)

= *Sardinella bulan* (Bleeker, 1849)

Clupalosa bulan Bleeker, 1849, Verh. Bat. Gen. 22: 12 (Madura Strait near Bangcallang, Kammal and Surabaya, Java; Java Sea near Batavia and Samarang; number of fishes not mentioned, 145 mm tot. l.; Br. St. 6, D i 16, P i 14, V i 7, A i 18 or 19); Bleeker, 1852, Verh. Bat. Gen. 24: 30 ("longitudo speciminis unici" 145 mm tot. l.).

Atlas: as *Clupea (Harengula) bulan*, 1 fish, 145 mm tot. l., Java, Madura.

Auction Catalogue: not listed.

RMNH: no material labelled '*bulan*'.

BMNH: 1 fish, 110 mm S.L. (estimated 145 mm tot. l.), head cut, scales lost, BMNH 1867.11.28.37. Listed as "Type of *Clupalosa bulan*, Blkr., in bad state" by Günther (1868: 450).

Type. — The British Museum fish has been identified as the holotype (Whitehead, 1964b) since Bleeker recorded no further specimens. However, five original localities are mentioned, so that it would appear that at least 5 syntypes may have existed, of which 4 may have then been lost. The designation is therefore best made as lectotype.

Description. — Lectotype, a fish 110 mm S.L. (145 mm tot. l., estimated), caudal badly damaged, head cut on right side, opercular series on left side missing, oval of skin removed on caudal peduncle (left), scales missing, dorsal and anal finrays damaged, BMNH 1867.11.28.37.

Br. St. (damaged), D iv 14, P i 13, V i 7, A iii 16, gillrakers on lower part of first arch 58 (30 on upper part), scutes 18 + 14.

In percentages of standard length: body depth 31.8, head length 24.0; snout length 6.3, eye diameter 6.4, upper jaw length 10.3, lower jaw length (damaged); pectoral length (damaged), pelvic length (damaged), length of anal base 14.1; pre-dorsal distance 44.5, pre-pelvic distance 52.5, pre-anal distance 77.0.

Body strongly compressed, its width $3\frac{1}{5}$ times in its depth, belly sharply keeled. Upper jaw reaching nearly to vertical from eye centre; supra-maxillae missing on both sides; expanded portion of maxilla with a few longitudinal ridges. Cleithral outline of typical '*Sardinella*' pattern (Whitehead, 1964b, fig. 3a). Gillrakers slender, about $\frac{1}{2}$ eye diameter. Pseudobranch without ventral ridge, about $\frac{3}{4}$ eye diameter. Operculum narrow, its width $2\frac{3}{4}$ in its height. Fronto-parietal striae about 9.

Dorsal origin nearer to snout than to caudal base. Pelvic base below about 4th branched dorsal ray, equidistant between pectoral base and anal origin, the latter about equidistant between pelvic base and caudal base.

Colour. — Upper $\frac{1}{4}$ of body dark grey/brown; remainder of flanks silver.

Note. — The synonymy of this species, and particularly the part played by the name '*kowala*', has been examined elsewhere (Whitehead, 1964a). Fowler (1941), Chan (1965) and others have referred to this species as *S. perforata* (Cantor, 1850), but Bleeker's name has priority. As indicated earlier (p. 53), *Sardinella albella* Valenciennes may be this species.

19. *Spratella kowala* Bleeker, 1851= *Sardinella bulan* (Bleeker, 1849)

Spratella kowala Bleeker, 1851, Nat. Tijdschr. Ned. Ind. 2: 492 (Rio and Batavia; 26 fishes, 110-133 mm tot. l.; Br. St. 6, D 18-19, P 14-15, V i 7, A 18-20, scutes 30); Bleeker, 1852, Verh. Bat. Gen. 24: 28 (Batavia; 24 fishes, 110-133 mm tot. l.; counts as before).

Although the two above papers were published in this order, in fact the second of the two was Bleeker's first description of the species (written in December, 1850), the other paper (written in October, 1851) adding two further specimens from Rio (= Riouw). The type locality is nevertheless that of the first publication, i.e. Batavia and Rio. A similar situation arises with *Engraulis grayi*, and there also the only difference between the two descriptions is the addition of specimens from Rio (see also p. 22).

Atlas: as *Clupea (Harengula) perforata*, 22 fishes, 90-150 mm, Java, Sumatra, Pinang, Singapore, Bintang, Bangka, Amboina.

Auction Catalogue: as *Clupea (Harengula) perforata*, 18|1|1|1 (p. 45, no. 28).

RMNH: 18 fishes, 74-114 mm S.L., RMNH 7091 and 23479. These can be sorted into four lots: a. 1 fish, 114 mm S.L., head cut; b. 7 fishes, 92-108 mm S.L., a few with heads cut; c. 7 fishes, 74-86 mm S.L., a few with heads cut; d. 3 fishes 70-98 mm, distinguished from remainder by preservation condition, two with heads cut.

BMNH: 1 fish, 114 mm S.L. (143 mm tot. l.), BMNH 1867.11.28.44 (formerly labelled 43 — Whitehead, 1964a). Listed by Günther (1868: 424) as "*Type of Sp. Kowala*", and accepted as such by Regan (1917a).

Type. — The British Museum specimen is too large, as is also the largest of the Leiden fishes. Of the remaining Leiden specimens, those in the c. series are too small; two of the d. series are too small and from its appearance the third evidently belongs with this lot, all presumably being later additions. Only the seven specimens in the Leiden b. lot conform in size with the type series, and one fish, 133 mm tot. l., can be identified as most likely the largest of the type series. It has already been designated lectotype (Whitehead, 1964b).

Description. — Lectotype, a fish 104 mm S.L. (133 mm tot. l.), head cut, RMNH 7091.

Br. St. (n. r.), D iv 14, P i 13, V i 7, A iii 16, gillrakers on lower part of first arch 58 (30 on upper part), scutes 18 + 14.

In percentages of standard length: body depth 34.3, head length 26.0;

snout length 6.3, eye diameter 7.3, upper jaw length 10.0, lower jaw length 10.9; pectoral length 15.8, pelvic length 8.9, length of anal base 17.5; pre-dorsal distance 43.5, pre-pelvic distance 52.1, pre-anal distance 81.0.

Body proportions, colour, etc., closely resembling those described for *S. bulan*.

Note. — The rather complex synonymy surrounding the names *kowala*, *kowal*, *coval*, etc. has been examined elsewhere (Whitehead, 1964b). It can be noted that Bleeker labelled his Atlas figure of *Clupea (Harengula) bulan* as *Clupea (Clupalosa) kowal*, but that he considered the latter quite distinct from *Clupea (Harengula) kowal*, which was based on *Kowala thoracata* of Cantor.

20. ***Clupea gibbosa*** Bleeker, 1849 (pl. 6 fig. 3)

= *Sardinella jussieu* (Lacepède, 1803)

Clupea gibbosa Bleeker, 1849, J. Ind. Arch. 3: 72 (Macassar; no size or number; D ii 15, P i 15, V i 7, A i 20) (placed in synonymy of *Spratella tembang* in later publication — Bleeker 1852d — total 22 fishes, 84-185 mm; D 18-19, A 18-20).

Atlas: as *Clupea (Harengula) gibbosa*, 41 fishes, 84-185 mm tot. l., Java, Sumatra, Nias, Singapore, Bangka, Bali, Celebes.

Auction Catalogue: as *Clupea (Harengula) gibbosa*, 33|2|2|2|2 (p. 45, no. 22), 'tembang' material included.

RMNH: 26 fishes, 65-145 mm S.L. (78-166 mm tot. l.), RMNH 7100.

AMS: 1 fish, as *Clupea fimbriata gibbosa* cotype (AMS I 86).

BMNH: no Bleeker material was listed as '*gibbosa*'.

Type. — Bleeker gave no size range or number of specimens, so there is no certainty which or how many specimens belonged to the type series. Bleeker (1851b) placed *Clupea gibbosa* as a (junior) synonym of *Spratella tembang*, later (Bleeker, 1852d) adding an unknown number of specimens from Batavia to make a total of 22 fishes and a further 8 fishes from Macassar to make 30 (Bleeker, 1852f). His reason for giving the later name (i.e. *tembang*) priority over *gibbosa* is not clear (it was repeated by Günther, 1868: 426); there is no evidence that the name *gibbosa* was at that time pre-occupied in *Clupea* or any other clupeid genus. However, in the Atlas, *gibbosa* is finally given priority over *tembang* and the Auction material is labelled *gibbosa*.

Since Bleeker's first reference to *Spratella tembang* (Bleeker, 1851b) is in a list of fishes merely stating that "*Spratella tembang* Blkr. = *Clupea*

gibbosa Blkr.", and since the same type locality is given (Macassar), it is best accepted that *tembang* was a replacement name.

There is no certainty regarding the specimen or specimens used by Bleeker in his original description of *Clupea gibbosa*, and a neotype selection must be made. The best choice is the specimen in the British Museum claimed by Günther to be the type of *Spratella tembang* (see under next species). It has a cut head and was therefore certainly examined by Bleeker. Furthermore, it bears pencil marks and was evidently selected by Bleeker himself as representative for the Atlas figure (which it matches in size).

This specimen (BMNH 1867.11.28.46) is therefore chosen as putative neotype of *Clupea gibbosa*, as well as of the replacement name *Spratella tembang*. A description of the type is given under the next species.

Note. — Bleeker (1852d and Atlas) modified his original anal and dorsal counts, possibly as a result of a recount, from D ii 15 to D 18-19, and from A i 20 to A 18-20.

For the present it seems advisable to keep *S. jussieu* (Lac.) distinct from *S. fimbriata* (Valenciennes). Chabanaud (1926) gave a brief description of one of Valenciennes's Malabar syntypes, in which body depth was 31.2 per cent of S.L. and there were 67 gillrakers (in fact 77) on the lower part of the first arch (cf. 24 per cent and 50 gillrakers in the type of *C. gibbosa* and *S. tembang*). The differences separating *S. fimbriata* from *S. jussieu* in Indian waters have been tabled by Dutt (1961, 1962), and the comparison has been extended to Red Sea specimens (Whitehead, 1965b). Regan (1917a) and some later authors (but not Fowler, 1941) have preferred to use Bleeker's name *gibbosa* rather than the rather poorly defined *jussieu* of Lacepède (of which no type specimens now exist). Since the identification of species of *Sardinella* depends on several characters not mentioned in Lacepède's description of *Clupanodon jussieu*, and since there are no type specimens, it might be better to consider the latter a nomen dubium. *Spratella fasciata* Valenciennes, 1847, was another possible synonym, but Chabanaud (1926) counted only 32 gillrakers; the holotype is *Herklotsichthys punctatus*. *Spratella jussieu* Valenciennes, 1847, has 95 gillrakers and is a species close to *S. dayi* Regan. Bertin (1944) wrongly equated *C. jussieu* Lacepède with *C. jussieu* Valenciennes, and believed the latter identical to *C. fimbriata* Valenciennes, both having "environ 70 branchiospines" 7).

Chan (1965) retained the name *S. jussieu* (Lac.), and this seems advisable until a full revision of the genus is possible.

7) The clupeoid types of Valenciennes have now been examined and a full discussion of the *jussieu-jussieu-melonura* complex is in preparation.

21. *Spratella tembang* Bleeker, 1851= *Sardinella jussieu* (Lacepède, 1803)

Spratella tembang Bleeker, 1851, Nat. Tijdschr. Ned. Ind. 2: 214 (name only — see below); Bleeker, 1852, Verh. Bat. Gen. 24: 28 (Batavia, Macassar; 22 fishes, 84-185 mm tot. l.; Br. St. 6, D 18-19, P 14-16, V i 7, A 18-20, scutes 30-32); Bleeker, 1852, Nat. Tijdschr. Ned. Ind. 3: 774 (copied from above, but 30 in same size range).

Atlas: as *Clupea (Harengula) gibbosa*, 41 fishes, 84-185 mm tot. l.

Auction Catalogue: presumably included in '*gibbosa*' material (p. 45, no. 22).

RMNH: no A series material labelled '*tembang*', all presumably being included in the '*gibbosa*' jars.

MNH: 1 fish, 112 mm S.L., caudal damaged, MNHN 2040. This Paris fish was claimed as a type by Chabanaud (1926), but it is most unlikely to have belonged to the A series; as far as is known Bleeker never supplied typical material to museums other than the British Museum (see p. 13).

BMNH: 1 fish, 152 mm S.L. (175 mm tot. l., caudal tips damaged, estimated 182 mm), head cut, BMNH 1867.11.28.46. Listed by Günther (1868: 426) as "Type of *Sp. tembang*" and accepted as such by Regan (1917a). Also, 1 fish, 145 mm S.L. (180 mm tot. l. approx.), BMNH 1867.11.28.43. This is specimen b. of Günther (1868: 426), which he identified as *Clupea tembang*; it was apparently labelled by Bleeker as *Spratella fimbriata* (fide Günther) and that name appears in the register.

Type. — As already stated, the name *tembang* was almost certainly a replacement name for *gibbosa*, so that the putative neotype chosen for *Clupea gibbosa* is also the type of *Spratella tembang*.

Description. — Putative neotype, a fish, 152 mm S.L. (175 mm tot. l., caudal tips damaged, estimated 182 mm), head cut horizontally on right side and vertical incision on flank above pectoral fin, pencil marks on operculum and pre-operculum, above pelvic base and anal origin and at base of pectoral fin, belly slightly damaged, scales partly shed, BMNH 1867.11.28.46.

Br. St. 6, D iv 15, P i 14, V i 7, A iii 16, gillrakers on lower part of first arch 50, scutes 18 + 16.

In percentages of standard length: body depth 24.3, head length 23.0; snout length 6.7, eye diameter 5.9, upper jaw length 8.9, lower jaw length 10.0; pectoral length 14.5, pelvic length 7.7, length of anal base 12.5; pre-dorsal distance 42.5, pre-pelvic distance 46.5, pre-anal distance 74.8.

Body moderately compressed, its width only just over twice in its depth, belly less sharply keeled than in *S. bulan* or *S. brachysoma*. Upper jaw reaching to vertical from anterior pupil border; second supra-maxilla of '*Sardinella*' shape, expanded portion slightly pointed posteriorly (cf. *S.*

brachysoma); expanded part of maxilla with faint longitudinal striae. Cleithral lobe and bilobed dermal outgrowths on vertical portion of cleithrum well developed. Gillrakers slender, about $\frac{4}{5}$ length of longest gill filaments, just over $\frac{1}{2}$ eye diameter. Pseudobranch with very slight ventral ridge, almost equal to eye diameter. Operculum narrow, its width $2\frac{1}{2}$ times in its height; lower edge almost horizontal; suboperculum rectangular. Lower edge of suboperculum and posterior margin of last two branchiostegal rays forming a distinct right angle. Fronto-parietal striae 10.

Dorsal origin much nearer to snout than to caudal base, distance in front of dorsal base equal to distance behind. Pectoral tips not reaching vertical from dorsal origin; no pectoral axillary scale. Pelvic base below 3rd branched dorsal ray, nearer to pectoral base than to anal origin by $\frac{1}{2}$ eye diameter; pelvic axillary scales not present, possibly lost. Anal origin nearer to caudal base than to pelvic base by more than one eye diameter.

Scales partly lost, exposed portion with horizontal ridges and occasional minute perforations, hind border eroded; unexposed portion with 4 or 5 interrupted vertical striae; small scales extending to caudal margin.

Colour. — Upper third of body brown, rest of flanks silvery, or gold where scale cover retained. Fins hyaline, light brown spot at base of unbranched dorsal rays.

Note. — The name dates from Bleeker's "Ichthyologische fauna van Celebes" (Bleeker, 1851b: 214), where it is given in a list of fishes as "125 *Spratella tembang* Blkr = *Clupea gibbosa* Blkr" from Macassar. This satisfies the rules of the International Code for Zoological Nomenclature, being "the substitution of a new name for a previously established one" (Art. 16 (a) (iii) of the Code). But, as discussed earlier, the reason for this substitution is not clear since a replacement name was not required.

22. *Harengula zunasi* Bleeker, 1854

= *Sardinella zunasi* (Bleeker, 1854)

Harengula zunasi Bleeker, 1854, Nat. Tijdschr. Ned. Ind. 6: 417 (Nagasaki; 1 fish, 97 mm tot. l.; Br. St. 6, D 19, P 15, V i 7, A 17-18, scutes 32).

Atlas: not listed.

Auction Catalogue: as *Harengula zunasi*, 1/0/0/0/0 (p. 46, no. 71).

RMNH: 1 fish, 53 mm S.L., 67 mm tot. l., RMNH 7113.

BMNH: 1 fish, 75.5 mm S.L. (94.5 mm tot. l., caudal tips slightly damaged, estimated 97 mm), head cut, BMNH 1867.11.28.182. Listed as "Type of the species" by Günther (1868: 451). An internal (possibly contemporary) label reads "*Harengula zunasi* Blkr. = *Hareng.* (*Harengula*) *koval.* unic. Japon."

Type. — The British Museum specimen is evidently the holotype, agreeing with the original description in length and most meristic counts, and having a cut head. The single Leiden specimen is too small.

Description. — Holotype, a fish 75.5 mm S.L. (estimated 97 mm tot. l.), head cut horizontally on right side, scales partly lost, snout slightly damaged, BMNH 1867.11.28.182.

Br. St. 6, D iv 15, P i 15, V i 7, A ii 15, gillrakers on lower part of first arch 45, scutes 18 + 13.

In percentages of standard length: body depth 27.3, head length 26.6; snout length 6.5, eye diameter 7.5, upper jaw length 11.4, lower jaw length 12.2; pectoral length 19.4 (1st ray damaged), pelvic length 10.9, length of anal base 13.5; pre-dorsal distance 45.1, pre-pelvic distance 52.3, pre-anal distance 79.5.

Body fairly strongly compressed, its width 3 times in depth, belly sharply keeled. Upper jaw reaching vertical from anterior pupil border; 2nd supra-maxilla of '*Sardinella*' shape, expanded portion rather bluntly rounded posteriorly; expanded portion of maxilla with faint longitudinal ridges. Cleithral lobe and bilobed dermal outgrowths on vertical portion of cleithrum well developed. Gillrakers slender, $\frac{2}{3}$ eye diameter, about equal to longest gill filaments. Pseudobranch without ventral ridge, about $\frac{2}{3}$ of eye diameter. Operculum narrow, its width twice in its height, lower border at an angle of about 30° to the horizontal. Fronto-parietal striae 9.

Dorsal origin nearer to snout than to caudal base by a distance of $1\frac{1}{2}$ eye diameters. Pectoral tips reaching almost to dorsal origin; no pectoral axillary scale (lost?); pelvic base below 5th dorsal ray, nearer to pectoral base than to anal origin by $\frac{1}{2}$ eye diameter; no pelvic axillary scale (lost?). Anal origin nearer to pelvic base than to anal base by $\frac{1}{2}$ eye diameter. Final anal ray only slightly longer than third from last ray.

Scales partly lost, exposed portion without horizontal ridges or perforations, unexposed portion with 2-5 vertical striae, posterior two continuous across scale, remainder interrupted.

Colour. — Upper third of body dark brown, rest of flanks silver, or gold where scale cover retained. Fins hyaline. Iris orange postero-ventrally.

Note. — Regan (1917a) and Fowler (1941) placed this species in the genus *Harengula*, but it is clearly a species of *Sardinella* (supra-maxilla shape, many fronto-parietal striae, etc.).

S. zunasi resembles both *S. jussieu* and *S. fimbriata*. Although the holotype is under 100 mm in length, it is not merely a juvenile *S. jussieu*; the two can be distinguished on post-pelvic scute count (11-14 in *S. zunasi*; 14-16 in

S. jussieu). Dutt (1961) showed a progressive increase in gillraker numbers in larger individuals of *S. jussieu*, but this does not occur in *S. zunasi*; in 15 specimens of *S. zunasi* in the British Museum, covering the size range 47.0-120.5, the counts were 43 (1 fish), 44 (f. 2), 45 (f. 2), 46 (f. 1), 47 (f. 1), 48 (f. 1), 49 (—), 50 (f. 2), 51 (f. 1), 52 (f. 1), 53 (f. 3), with large and small fishes at all points in this range. From *S. melanura*, *S. zunasi* can be distinguished by its plain caudal, slightly deeper body, and higher gillraker count. The resemblance between *S. zunasi* and *S. fimbriata* is discussed under the next species.

23. ***Clupea (Harengula) sundaica*** Bleeker, 1872 (pl. 7 fig. 1)

= *Sardinella zunasi* (Bleeker, 1854)

Clupea (Harengula) sundaica Bleeker, 1872, Atlas Ichthyol. 6: 105 (Batavia, Anjer, Djunkulon, Bonthain; 29 fishes, 96-170 mm tot. l.; Br. St. 6, D iv 14-16, P i 14-16, V i 7, A iii 15-18).

Atlas: as above, 29 fishes, 96-170 mm tot. l., Java, Celebes.

Auction Catalogue: listed as *Harengula fimbriata*, 15|0|0|0|0 (p. 45, no. 32). The name *sundaica* does not appear and *H. fimbriata* is not listed under *Clupea (Harengula)* as were the other species of *Sardinella*. The number of specimens differs from both the Atlas total (29) and the number now extant at Leiden (26).

RMNH: labelled *C. fimbriata*, 1 fish, 133 mm S.L. (153 mm tot. l.), head cut, RMNH 7099; 25 fishes, 67-129 mm S.L., nine with heads cut, RMNH 23362.

BMNH: no material labelled *sundaica*.

Type. — Bleeker (1852d) listed 23 fishes, 96-170 mm tot. l., as "*Spratella fimbriata* CV." ex Batavia, with a further reference to this record (Bleeker, 1852f: 775). Afterwards (Atlas: 105) Bleeker reconsidered this identification and proposed the name *sundaica* for these specimens and for some further *S. fimbriata* from Bonthain in the Celebes (Bleeker, 1860c, no sizes or number; however, there seem to have been 6 Celebes specimens since a total of 29 is given in the Atlas).

All the Leiden specimens can be considered syntypes. From these, the largest specimen with the head cut can be chosen as lectotype. It is not clear why only 15 fishes were listed in the Auction Catalogue; this may have been an error for 25.

Description. — Lectotype, a fish 133 mm S.L. (153 mm tot. l. but caudal lobes slightly damaged), head cut on right side, no pencil markings, RMNH 7099.

Br. St. (n.r.), D iv 12, P i 14, V i 7, A ii 15, gillrakers on lower part of first arch 50, scutes 19 + 11.

In percentages of standard length: body depth 28.2, head length 24.4; snout length 6.9, eye diameter 6.7; pectoral length 15.8, pelvic length 9.4, length of anal base 14.1; pre-dorsal distance 44.3, pre-pelvic distance 51.3, pre-anal distance 80.0.

Body compressed, its width $2\frac{1}{2}$ times in its depth, belly keeled, scutes moderately prominent. Upper jaw reaching almost to vertical from anterior pupil border; expanded portion of 2nd supra-maxilla of 'Sardinella' shape, upper profile rising steeply anteriorly, lower profile evenly rounded. Cleithral lobe and bilobed dermal outgrowths on vertical portion of cleithrum well developed. Gillrakers slender, $\frac{3}{4}$ length of longest gill filaments, and just over $\frac{1}{2}$ eye diameter. Pseudobranch without ventral ridge, about equal to eye diameter. Operculum narrow, its width about $2\frac{1}{2}$ times in its height, lower border at an angle of about 10° to horizontal; suboperculum rectangular. Fronto-parietal striae 10-12.

Dorsal origin nearer to snout than to caudal base by $1\frac{1}{2}$ eye diameter. Pectoral tips failing to reach pelvic base by $1\frac{1}{4}$ eye diameter, failing to reach vertical from dorsal origin by about 1 eye diameter; no pectoral axillary scale, but a distinct groove into which first pectoral ray fits. Pelvic base below 2nd branched dorsal ray; axillary scale present, $\frac{3}{4}$ length of fin. Anal origin equidistant between caudal base and pelvic tip; last two anal rays much branched and almost twice length of third from last ray.

Scales partly lost, count not possible; exposed portions with definite horizontal ridges and lines of small perforations, posterior edge eroded; unexposed portion with a single continuous, and up to 10 incomplete vertical striae.

Colour. — Upper third of body brown, flanks silver or gold where scale cover retained. Fins hyaline except for brown pigment dotted at bases of first few dorsal rays. Eye with orange postero-ventral mark on iris.

Note. — In the Atlas (: 105), Bleeker made a comparison between two 150 mm specimens of his *Clupea sundaica* and *C. gibbosa*. He noted that the former had a deeper body (depth 3 times in S.L.; cf. $3\frac{2}{3}$ times), a head length less than body depth, and a more compressed body (width 3 times in depth; cf. 2 and a bit). Comparison of the types of *C. sundaica* and *C. gibbosa* does not entirely confirm Bleeker's findings. Thus the depth in the former is contained $3\frac{1}{2}$ times in S.L., and the head length in the latter is less

than body depth. However, the lectotype of *C. sundaica* is the more compressed of the two (width $2\frac{1}{2}$ times in depth; cf. just over twice).

As shown in the key, Bleeker's *C. sundaica* (i.e. *Sardinella zunasi*) can be distinguished from his *C. gibbosa* (i.e. *Sardinella jussieu*) on the form of the scales and numbers of gillrakers (but some overlap is present). *Sardinella zunasi* appears to be very closely related to *S. fimbriata*, differing mainly in having fewer gillrakers. The perforated and fimbriated scales are not apparent in small specimens of *S. zunasi*, but are quite apparent in British Museum Japanese fishes over about 100 mm S.L. *Sardinella zunasi* may perhaps be a more northerly form of *S. fimbriata*. Chan (1965) records its distribution as reaching south as far as Hong Kong. More southerly specimens may have been recorded as *S. fimbriata* if adult, or *S. jussieu* before the scales have become fully fimbriated and perforated.

24. **Harengula melanurus** Bleeker, 1853 (pl. 7 fig. 2)

= *Sardinella melanura* (Cuvier, 1829)

Harengula melanurus Bleeker, 1853, Nat. Tijdschr. Ned. Ind. 5: 245 (Ceram; 4 fishes, 116-131 mm tot. l.; Br. St. 6, D 18-19, P 15, V i 7, A 17-18) (non *Alausa melanura* Valenciennes).

Atlas: as *Clupea (Harengula) melanurus*, 23 fishes, 80-140 mm tot. l., Sumatra, Nias, Bali, Celebes, Ternata, Amboina, Saparua, Ceram, New Guinea.

Auction Catalogue: as *Clupea (Harengula) melanurus*, 8|1|1|1|1 (p. 45, no. 30).

RMNH: 6 fishes, 93.0-102.4 mm S.L., RMNH 7095; 3 fishes, 82 and 110-115 mm S.L., RMNH 23485.

BMNH: 1 fish, 106 mm S.L. (tot. l. 119.2 mm, caudal lobes broken, estimated 131 mm), head cut, BMNH 1867.11.28.31. Listed by Günther (1868: 427) under *Clupea atricauda* Günther as "Type of the species. Ceram. From Dr. Bleeker's Collection".

Type. — It is clear that Bleeker (1853, introduction and note on *H. melanura*) did not consider his fish to be the same as *Alausa melanura* Valenciennes, 1847, of which he already had a single Bali specimen of 132 mm (Bleeker, 1849: 10). However, it is unfortunate in this respect that the Valenciennes material is almost equally divided between a species of *Herklotsichthys* and a species of *Sardinella* (Whitehead, 1964c). Bertin (1940) and Fowler (1941: 596) placed Valenciennes' species in *H. vittatus* (Valenciennes), and considered *Clupea melanura* Cuvier, 1829 to be the

earliest description of a species of *Sardinella* with black caudal tips. It is equally unfortunate that *Herklotsichthys vittatus*, according to the most recent definition of that genus (Whitehead, 1946b), is the one species which most closely approaches *Sardinella* (at least in Red Sea specimens — Whitehead, 1965b)⁸).

It is likely that Bleeker was unaware of *Clupea melanura* Cuvier, a name which in any case was published without description but was based in part on Lacepède's *Clupanodon jussieu* (i.e. on Lacepède's fig. XI, 3).

Günther (1868) placed both Bleeker's and Valenciennes' species in the genus *Clupea*, and therefore proposed a new name, *C. atricauda*, to replace that of Bleeker. Günther based his description on a single Bleeker specimen (BMNH 1867.7.11.28.31) from Ceram, the type locality of Bleeker's *Harengula melanurus*. The specimen was registered as *Harengula melanurus*. Since the type(s) of a replacement nominal species must necessarily be the type(s) of the prior nominal species (Int. Code zool. Nomencl., Art. 72 [d]), it must be established that the British Museum specimen is one of the four original syntypes. This seems likely since it is stated to come from the type locality, it exactly matches the length of the largest syntype, and it has the head cut. Only one other specimen has the head cut, a Leiden fish exactly corresponding to the smallest of the syntypes. Unfortunately the British Museum specimen has broken caudal lobes and so does not show the black caudal tips so characteristic of the species. Günther (1868: 427) emphasizes (in italics) the latter character (which is still clearly visible in Günther's other two specimens, from Amboina), but states that the colour is absent in some specimens. This may or may not refer to the type since Günther considered *Clupea atricauda* doubtfully distinct from *C. tembang* (= *S. jussieu*, caudal tips at most dusky, not black).

The Leiden material (i.e. 9 fishes) evidently contains some additions to the type material, and of the six specimens within the size range described, there is no certainty which are true syntypes except the fish with the cut head. In the circumstances the British Museum specimen is perhaps best selected as lectotype, both of *Clupea atricauda* and of *Harengula melanurus*. In the following description, measurements for the Leiden probable syntype are included.

Description. — Lectotype, a fish 106.0 mm S.L. (119.2 mm tot. l., estimated 131 mm), head cut on both sides, caudal lobes damaged, vertical split on left side above anal fin, BMNH 1867.11.28.31.

8) A recent examination of the Valenciennes types has confirmed that *Alausa melanura* Val. and *Clupeonia vittata* Val. are both junior synonyms of *Sardinella melanura* (Cuvier).

Paralectotype, a fish 93.0 mm S.L. (109.7 mm tot. l., caudal tips broken, estimated 117 mm), head cut, RMNH 7095.

[In the description the figures for the paralectotype are in parenthesis].

Br. St. 6, D iv 15 (iv 15), P i 14 (i 14), V i 7, A iii 14 (iii 14), gillrakers on lower part of first arch 42 (44), scutes 19 (19) + 14 (15).

In percentages of standard length: body depth 27.7 (26.3), head length 27.6 (26.2); snout length 7.8 (7.6), eye diameter 7.4 (7.0), upper jaw length 11.5, lower jaw length 12.8; pectoral length 16.8 (17.4), pelvic length 11.1 (11.4), length of anal base 14.4; pre-dorsal distance 48.3 (45.0), pre-pelvic distance 56.0 (53.2), pre-anal distance 83.5 (80.2).

Body only moderately compressed, its width $2\frac{1}{5}$ times in depth, belly keeled but rather rounded. Upper jaw reaching to vertical from anterior pupil border, expanded portion of 2nd supra-maxilla of '*Sardinella*' shape, slightly angular posteriorly. Cleithral lobe and bilobed dermal outgrowths on vertical portion of cleithrum well developed. Gillrakers slender, longest about $\frac{2}{3}$ of eye diameter, a little longer than longest gill filaments. Pseudo-branch without ventral ridge, about $\frac{4}{5}$ of eye diameter. Operculum narrow, its width $2\frac{3}{4}$ times in its height, lower border at an angle of about 15° to horizontal; suboperculum rectangular. Fronto-parietal striae 9.

Dorsal origin nearer to snout than to caudal base by a distance equal to $1\frac{1}{3}$ eye diameter. Pectoral tips failing to reach vertical from dorsal origin by a distance of about one eye diameter; no pectoral axillary scale. Pelvic base below 6th branched dorsal ray, slightly nearer to pectoral base than to anal origin; no axillary scale (possibly lost). Anal origin nearer to caudal base than to pelvic base by $\frac{1}{2}$ eye diameter; final ray of anal much branched.

Scales partly lost, about 40 estimated in longitudinal series; exposed portions with very faint horizontal ridges, a few small perforations in scales nearer caudal base, posterior scale border slightly eroded; unexposed portion with a single complete and four incomplete vertical striae.

Colour. — Upper third of body dark brown, rest of flanks silver, or gold where scale cover retained. Fins hyaline, no black on remaining parts of caudal lobes (caudal tips distinctly black in Leiden specimen).

Note. — The following additional measurements were made on the five other Leiden specimens (RMNH 7095): body depth as a percentage of S.L. 22.8-24.4 (Mean 23.74), gillrakers on lower part of first arch 39 (f. 1), 40 (f. 1), 41 (f. 3). In all five specimens the caudal tips were black.

Chan (1965) described 28 specimens of *Sardinella melanura* from Fiji and the New Hebrides. His meristic counts differ slightly from those given here, with fewer dorsal and more anal rays (D 16-18, A 18-19) and fewer scutes (17-18 + 11-13). The low gillraker and post-pelvic scute counts given by

Chan are suggestive of *S. zunasi*, but all Chan's specimens had the distinctive black caudal tips of *S. melanura* (caudal tips plain in *S. zunasi*).

Subgenus **Paralosa** Bleeker, 1868

Paralosa Bleeker, 1868, Versl. Meded. Akad. Amsterdam (2) 2: 300 (Type: *Harengula* (*Paralosa*) *valenciennesi* Bleeker = *Clupea melanura* Cuvier, monotypic).

The name *Paralosa* is proposed in a list of fishes from Waigiou by the statement "*Harengula* (*Paralosa*) *valenciennesi* Blkr. = *Harengula melanurus* Blkr." No description is given, and the name is only used once more, in the caption to Plate 269 fig. 5 of the Atlas. In the text of the Atlas, the plate caption is cited in the synonymy.

Fowler (1941) listed *Paralosa* as a junior synonym of *Harengula* (i.e. *Herklotsichthys*), considering *Alausa melanura* Val. to be the type (= *Harengula vittata* (Val.) according to Fowler). Reasons for considering *Paralosa* a synonym of *Sardinella* have been discussed elsewhere (Whitehead, 1964c).

It is interesting to note that Bleeker labelled a specimen of *Hilsa kelee* as *Harengula* (*Paralosa*) *zeylanica*; this name was used in the Auction Catalogue but was never published elsewhere (see below, p. 83).

25. **Harengula** (**Paralosa**) **valenciennesi** Bleeker, 1868

= *Sardinella melanura* (Cuvier, 1829)

Harengula (*Paralosa*) *valenciennesi* Bleeker, 1868, Versl. Meded. Akad. Amsterdam (2) 2: 300 (Waigiou; no number, size or description).

As shown above, the name *H. valenciennesi* was proposed without description, presumably as a replacement name, although Bleeker did not use it again; even in the Atlas, the name *melanurus* is substituted for *valenciennesi* in the caption to Plate 269. Bleeker may not have been aware of Günther's intention to propose the name *atricauda* to avoid homonymy of the names *melanura* (of Bleeker and Valenciennes). The two replacement names appeared in the same year.

The type of this species is the lectotype of *Harengula melanurus* Blkr.

Amblygaster Bleeker, 1849

Amblygaster Bleeker, 1849, J. Ind. Arch. 3: 73 (Type: *Amblygaster clupeoides* Bleeker, monotypic).

Fowler (1941) and others have accepted *Amblygaster* as a subgenus of *Sardinella*, and more recently Chan (1965) has shown that members of *Amblygaster* can also be distinguished by possession of a single median

pre-dorsal row of scales (a double series in other species of *Sardinella*). A summary of the principal diagnostic characters is given here in the key (p. 47). In addition, the three species included in *Amblygaster* are larger and heavy bodied, and in general appearance are closer to *S. aurita* and *S. longiceps*, than to the more compressed species of *Sardinella*. The resemblance to species of *Sardinops* is particularly strong in *Sardinella* (*Amblygaster*) *sirm*, which has a series of dark spots along the flanks.

The three species of *Sardinella* (*Amblygaster*) can be separated by the key shown on p. 47.

26. ***Amblygaster clupeioides*** Bleeker, 1849 (pl. 7 fig. 3)

= *Sardinella clupeioides* (Bleeker, 1849)

Amblygaster clupeioides Bleeker, 1849, J. Ind. Arch. 3: 73 (Macassar; no lengths, or number of specimens; Br. St. 5, D iii 15, P i 16, V i 7, A i 16-17).

Sardinella clupeioides: Bleeker, 1851, Nat. Tijdschr. Ned. Ind. 2: 214 (Makassar, Boeloekomba); Bleeker, 1852, Verh. Bat. Gen. 24: 19 (Batavia and Macassar; 6 fishes, 110-203 mm tot. l.; Br. St. 6, D 18, P 16-17, V 7, A 17-18).

Atlas: as *Clupea* (*Amblygaster*) *clupeioides*, 16 fishes, 110-270 mm tot. l. (i.e. 10 more fishes added, from Sumatra and Bintang), Java, Sumatra, Bintang, Celebes, Macassar.

Auction Catalogue: as *Clupea* (*Amblygaster*) *clupeioides*, 12|1|1|1|1 (p. 45, no. 19).

RMNH: 1 fish, 160.0 mm S.L. (approx. 195 mm tot. l.), head cut, RMNH 7094; 5 fishes 91.4-129.2 mm S.L. (approx. 107-156 mm tot. l.), and 4 fishes, approx. 120-180 mm tot. l., bodies very flexible, RMNH 23307.

AMS: 1 fish, as *Clupea clupeioides* cotype (AMS I 93).

BMNH: no Bleeker material listed as '*clupeioides*'.

Type. — Ten of the original twelve A series specimens are extant in Leiden, and all lie within the first size range described (except one fish of 107 mm, but the error is small and the measurement only approximate). Four fishes can be separated on preservational condition but there is no evidence to show that these were either the original or later specimens. The second reference (Bleeker, 1851b) merely cites the name and there is no way of discovering the number of syntypes. However, one Leiden fish has a cut head, and since it is the largest specimen, near to the maximum given by Bleeker, and possibly from the type series, it is a suitable specimen for neotype designation. The Australian Museum specimen is presumably one from a duplicate collection obtained by Day.

Description. — Putative neotype, a fish 160.0 mm S.L. (estimated 195 mm tot. l.), caudal tips damaged, head cut horizontally on right side, vertical incision in flank above right pectoral, RMNH 7094.

Br. St. 6, D iv 15, P i 17, V i 7, A ii 14, gillrakers on lower part of 1st arch 28, scutes 17 + 13.

In percentages of standard length: body depth 27.3, head length 23.7; snout length 6.5, eye diameter 6.7, upper jaw length 7.7, lower jaw length 9.2; pectoral length 14.1, pelvic length 9.8, length of anal base 12.6; pre-dorsal distance 49.7, pre-pelvic distance 52.3, pre-anal distance 79.8.

Body moderately compressed, belly rounded, almost smooth. Maxilla not quite reaching to vertical from anterior eye border; 2nd supra-maxilla of 'Sardinella' shape, posterior border angular. Cleithral lobe and bilobed dermal outgrowths on vertical portion of cleithrum well developed. Gillrakers short, slender. Fronto-parietal striae 9-10.

Dorsal distinctly nearer to snout tip than to caudal base. Pelvic base below 2nd branched dorsal ray, equidistant between pectoral base and anal origin. Anal base nearer to caudal base than to pelvic base.

Scales partly lost, unexposed portion with one continuous and 3 interrupted vertical striae.

Colour. — Upper third brown, rest of flanks silver, no series of spots along flank; fins hyaline.

Note. — The present specimen differs from Bleeker's first description in having 6 not 5 branchiostegal rays, a character which Bleeker had included in the generic diagnosis of *Amblygaster*. However, Bleeker may have reconsidered his original count, because the count of 6 is given in his next description (Bleeker, 1852d) and also in the Atlas.

Weber & De Beaufort (1913), Regan (1917a) and subsequent authors have recognised this species as distinct from *S. sirm* (Walbaum), and have mostly placed *S. leiogaster* Valenciennes in the synonymy of *S. sirm*. Bertin (1944), claimed that *S. leiogaster* Valenciennes was identical to *S. clupeioides* (Bleeker) and should take priority; however, he gave no reasons beyond stating that the types of the two were identical. Chan (1965) accepted that *S. leiogaster* was not a synonym of *S. sirm*, but equally he maintained that it was distinct from *S. clupeioides*, having a more slender body (4.18-4.55 times in S.L.; cf. 3.71-4.20 in *S. clupeioides*), more gillrakers (31-34; cf. 26-30) and a dorsal origin equidistant between snout tip and caudal base. The putative neotype chosen here accords with Chan's diagnosis of *S. clupeioides*.

27. *Sardinella leiogastroides* Bleeker, 1854 (pl. 7 fig. 4)= *Sardinella sirm* (Walbaum, 1792)

Sardinella leiogastroides Bleeker, 1854, Nat. Tijdschr. Ned. Ind. 7: 255 (Manado, Celebes; 1 fish, 141 mm tot. l.; Br. St. 6, D 18, P i 16, V i 7, A 17, scales 45).

Atlas: as *Clupea (Amblygaster) leiogastroides*, 6 fishes, 55-141 mm tot. l., Celebes, Ternata, Amboina.

Auction Catalogue: as *Clupea (Amblygaster) leiogastroides*, 3|0|0|0 (p. 45, no. 17); evidently miscounted.

RMNH: 1 fish, 117.5 mm S.L. (132.2 mm tot. l., but caudal tips broken, probably 141 mm), head cut, RMNH 7093; 4 fishes, 36-88 mm S.L., RMNH 23364.

BMNH: 1 fish, 97.5 mm S.L. (110 mm tot. l., caudal tips damaged, but at most 115 mm), BMNH 1867.11.28.42. Listed as "Young, type of *S. leiogastroides*" by Günther (1868: 425). The specimen listed as (b) by Günther is also a Bleeker fish. It is 167 mm S.L. and was registered as "*Sardarella leucogaster*" (presumably *S. leiogaster* was intended) (BMNH 1867.11.28.40).

Type. — The smaller British Museum specimen is too small to have been the holotype, whereas the largest of the Leiden specimens is not only near to the size described but has a cut head; all the remaining Leiden specimens are too small. The largest Leiden fish bears pencil marks and matches the Atlas figure (pl. 272 fig. 2 — cited as 261 fig. 1 in text).

Description. — Holotype, a fish 117.5 mm S.L. (132.2 mm tot. l., estimated 141 mm when fresh), caudal tips broken, head cut horizontally on right side, anterior part of head now damaged and parts of dorsal and anal fins; pencil marks on flanks, RMNH 7093.

Br. St. (n. r.), D iii 15, P i 7, V i 7, A ii 14, gillrakers on lower part of 1st arch 35, scutes 17 + 14.

In percentages of standard length: body depth 21.2, head length 23.0⁹⁾; snout length 7.0⁹⁾, eye diameter 5.9, length of upper jaw 8.8, length of lower jaw 10.2; pectoral length 14.5, pelvic length 8.1, length of anal base 13.9; pre-dorsal distance 45.5, pre-pelvic distance 47.5, pre-anal distance 77.5.

Body moderately compressed, belly rounded, barely keeled. Maxilla reaching to just beyond vertical from anterior eye margin; 2nd supra-maxilla of '*Sardinella*' shape, diamond-shaped, posterior border angular. Cleithral lobe and bilobed dermal outgrowths on vertical portion of cleithrum well developed. Gillrakers slender, short. Fronto-parietal striae 12-13.

9) Anterior part of head damaged, measurements perhaps misleading.

Dorsal much nearer snout tip than caudal base. Pelvic base below 1st branched dorsal ray, slightly nearer to pectoral base than to anal origin. The latter much nearer to caudal base than to pelvic base.

Scales partly lost, about 41 in longitudinal series.

Colour. — Upper third brown, rest of flanks silver; fins hyaline. No spots on flanks.

Note. — Weber & De Beaufort (1913), Regan (1917a) and subsequent authors have agreed that this species belongs in the synonymy of *S. sirm*. The holotype agrees with the description of *S. sirm* given by Chan (1965) based on 50 specimens (including 35 from the Celebes) except in its rather lower gillraker count (35; cf. 38-42, mode 40). Chan (1965) records a count of 31-34 gillrakers for 8 specimens of *S. leiogaster*, but the holotype of *S. leiogastroides* can be distinguished from *S. leiogaster* by its slightly more slender body and dorsal origin nearer to snout than to caudal base.

Escualosa Whitley, 1940

Leptogaster Bleeker, 1870, Atlas Ichthyol. Ind. Néerland. **6**: 102, pl. 262, fig. 5 (Type: *Clupea (Leptogaster) argyrotaenia* Blkr. = *Kowala thoracata* Valenciennes) (nomen oblitum).

Kowala Regan, 1922, Ann. Mag. nat. Hist. (9) **10**: 588 (Type: *Kowala thoracata* Valenciennes designated by Regan, overlooking earlier designation by Gill) (non *Kowala* Valenciennes).

Escualosa Whitley, 1940, Aust. Zool. **9** (4): 402 (Type: *Clupea macrolepis* Steindachner = *Kowala thoracata* Valenciennes — Whitehead, 1964b).

Bleeker's name *Leptogaster* has been generally overlooked, but Norman (1957) cited it as a junior synonym of *Spratelloides*, misquoting the type as *Clupea argyrotaenia* Bleeker (a round herring, for which the original name was *Clupea argyrotaeniata* Bleeker, see p. 35). Fowler (1941: 639) misread the name as *Leiogaster* but did not place it in the generic synonymy of *Kowala*. *Leptogaster* complies with Article 16 (a) (vii) of the International Code, being an 'indication' (i.e. "publication of a new genus — or species-group name in connection with an illustration"). However, it has not been used as a senior synonym for over 50 years and is therefore a nomen oblitum (Article 23 [b]).

Following Mees (1962) we have dated *Leptogaster* from the date of publication of the Atlas plates (1870) and not of the Atlas text.

The replacement of *Kowala* sensu Regan by *Escualosa* Whitley for the species *E. thoracata* has been discussed elsewhere (Whitehead, 1964b). Bleeker incorrectly placed this species in the European genus *Rogenia*

Valenciennes, the type of which (*R. alba*) was a juvenile *Clupea harengus* (Bertin, 1940 and comments by Günther, 1868: 414). Not unnaturally, Bleeker proposed a new species name for his East Indian *Rogenia*.

28. ***Rogenia argijrotaenia*** Bleeker, 1852 (pl. 8 fig. 1)

= *Escualosa thoracata* (Valenciennes, 1847)

Rogenia argijrotaenia Bleeker, 1852, Nat. Tijdschr. Ned. Ind. 3: 457 (Muntok, Batavia; 47 fishes, 75-85 mm tot. l.; Br. St. 6, D 15-16, P 13-14, V i 7, A 17-19, scutes 26).
Rogenia argyrotaenia: Bleeker, 1852, Verh. Bat. Gen. 24: 25 (Batavia; 20 fishes, 75-85 mm tot. l.; meristic counts as before).

The second of these two papers is cited in the first, and the date given at the end of each paper is respectively June and May, 1852 (see also p. 22).

Atlas: as *Clupea (Clupeoides) argyrotaenia*, 54 fishes, 75-92 mm tot. l., Java, Pinang, Singapore, Bangka.

Auction Catalogue: as *Clupea (Clupeoides) argyrotaenia*, 42/3/3/3/3 (p. 45, no. 15).

RMNH: 40 fishes, 52.5-70.5 mm S.L. (67-87 mm tot. l.), RMNH 7088 and 23361. These specimens are separable into three batches based on preservational condition: a. 4 fishes, very flexible, body dark grey/brown, 60.7-61.5 mm S.L.; b. 32 fishes, less flexible, light brown, silver lateral stripe prominent, 52.5-70.5 mm S.L.; c. 4 fishes, exactly as above but heads cut, 61.5-64.5 mm S.L.

BMNH: 1 fish, 68.8 mm S.L. (80.2 mm tot. l., caudal damaged, estimated 85 mm), listed under *Clupea argyrotaenia* by Günther (1868: 423), "From Dr Bleeker's Collection". Head cut on right side (BMNH 1867.11.28.18).

Type. — There is no means of distinguishing the original 20 specimens except by assuming that those with cut heads belonged to this series. Of the five with cut heads, a Leiden fish of 63.5 mm can be chosen as a suitable lectotype; the fact that 20 syntypes were described increases the likelihood that this is one of them.

Description. — Lectotype, a fish 63.5 mm S.L. (estimated 83 mm tot. l.), head cut, scales gone, caudal tips broken, RMNH 7088.

Br. St. 5, D iv 12, P i 12 or 13, V i 6, A iii 16, gillrakers on lower part of 1st arch 31, scutes 18 + 11.

In percentages of standard length: body depth 32.5, head length 25.2; snout length 6.0, eye diameter 7.9, length of upper jaw 11.2, length of lower jaw 9.5; pectoral length 15.9, pelvic length 8.8, length of anal base 15.4; pre-dorsal distance 51.0, pre-pelvic distance 52.0, pre-anal distance 77.0.

Body strongly compressed, belly sharply keeled, scuted from isthmus to vent. The 1st supra-maxilla absent on both sides (present in type of *Kowala thoracata* Valenciennes and in other specimens — Whitehead, 1964b), 2nd supra-maxilla with expanded portion about twice as long as deep. No bilobed dermal outgrowths on vertical portion of cleithrum. Pseudobranch short. Fronto-parietal cuneiform striated area with 7-8 striae.

Dorsal at about midpoint of body. Pelvic base under 2nd unbranched dorsal ray, a little nearer to pectoral base than to anal origin. The latter slightly nearer to caudal base than to pelvic base.

Scales absent.

Colour. — Light brown, with silver lateral line along flanks; fins hyaline.

Note. — Bleeker recorded 8 pelvic rays, a count which does not occur in this genus (Whitehead, 1964b). In the specimen described here the outer half of the first pelvic ray on the right side has been separated from the inner half, as if counted separately by Bleeker. Since a count of 7 is common in species of *Sardinella* and *Herklotsichthys*, Bleeker may have assumed a similar count in his *R. argyrotaenia*. The count is not corrected in the Atlas, although there the branchiostegal count is increased from 5 to 6. The last anal ray is double in the present specimen, but since it stems from a single pterygiophore it is here counted as one ray. Regarded as two rays, the total anal count would match that given in the original description.

PELLONULINAE

With the removal of *Escualosa* to the Clupeinae, the Pellonulinae can be distinguished from the latter by the consistent absence of the 1st supra-maxilla (Whitehead, 1964b). Excluding the Australian 'double-armoured' genera (*Potamalosa* and *Hyperlophus*), there are three Indo-Pacific genera of the Pellonulinae, each containing Bleeker species.

The most recent review of these genera was that of Fowler (1941), which is unsatisfactory because he included *Escualosa* (as *Kowala*) and combined *Clupeoides* with it; and he combined *Corica* and *Clupeichthys* in spite of marked differences in dentition and jaw structure. The three genera can be separated by the following key.

1. Anal normal, last two rays not separate; jaw teeth small *Clupeoides*
2. Anal with last two rays detached, forming separate finlet.
 - a. Teeth small; lower jaw articulation below eye centre; upper jaw less than half head length *Corica*
 - b. Teeth enlarged, caniniform in both jaws; lower jaw long, its articulation behind eye centre; upper jaw at least half head length *Clupeichthys*

Clupeoides Bleeker, 1851

Clupeoides Bleeker, 1851, Nat. Tijdschr. Ned. Ind. 1: 274 (Type: *Clupeoides borneensis* Bleeker, monotypic).

Fowler (1941) distinguished five species, and placed them, together with *Escualosa thoracata*, in the genus *Kowala*. On described characters, *Clupeoides exilis* Fowler is indistinguishable from *C. borneensis* Bleeker; *C. hypselosoma* Bleeker differs only slightly from *C. borneensis*; but *Corica papuensis* Ramsay & Ogilby differs from all these in having a silver lateral band, as also does *Clupeoides venulosus* Weber & De Beaufort. The last two species also have more pre-pelvic scutes (12-14; cf. 9-11), but not as many as in *Escualosa thoracata* (18 in the types — Whitehead, 1964b). Hardenberg (1941) proposed yet another species, *Clupeoides multispinus* from New Guinea, closely resembling *C. borneensis* but with a lower dorsal count (13; cf. 16 in the putative neotype of *C. borneensis*).

The genus *Clupeoides* is badly in need of revision. The Bleeker material has been identified by the following key.

- A. No silver band along flanks; pre-pelvic scutes 8-11.
1. Dorsal rays 15-16.
 - a. Body depth 30.7 per cent of S.L. *C. borneensis* Blkr.
 - b. Body depth 26.7 per cent of S.L. *C. hypselosoma* Blkr.
 2. Dorsal rays 13 *C. multispinus* Hardb.
- B. Silver or metallic band along flanks; pre-pelvic scutes 12-14.
1. Body depth about 25 per cent of S.L. *C. papuensis* (Ramsay & Ogilby)
 2. Body depth 28-40 per cent of S.L. *C. venulosus* (Web. & De Bft.)

29. **Clupeoides borneensis** Bleeker, 1851 (pl. 8 fig. 2)

= *Clupeoides borneensis* Bleeker, 1851

Clupeoides borneensis Bleeker, 1851, Nat. Tijdschr. Ned. Ind. 1: 275 (Bandjermassing, in fluvii; 1 fish, 80 mm tot. l.; Br. St. 6, D 16, P 13, V i 7, A 17, scutes 18).

Atlas: as *Clupea (Clupeoides) borneensis*, 7 fishes, 41-80 mm tot. l., Borneo.

Auction Catalogue: as in Atlas, 5/0/0/0 (p. 45, no. 14).

RMNH: 6 fishes, 31.2-58.0 mm S.L. (39.1-75.0 mm tot. l.), none with head cut, RMNH 7115 and 23480.

BMNH: 1 fish, 53 mm S.L. (66 mm tot. l.), BMNH 1867.11.28.33. Listed as "Type of the species" by Günther (1868: 452).

Type. — The British Museum specimen is too small to have been the type, and so too are the Leiden specimens. If the Atlas total of 7 fishes included

the British Museum specimen, then apparently none have been lost; the Auction total seems to have been a miscount, probably made externally. The missing type is not amongst the Bleeker material in Paris listed by Bertin (1940).

Evidently the holotype has been lost and a neotype is required. The following specimen would be suitable, being the largest of the remaining fishes.

Description. — Putative neotype, a fish 58.0 mm S.L. (67.0 mm tot. l., caudal tips damaged, estimated 75 mm), head not cut, no pencil marks, jaws broken slightly, left pelvic missing, RMNH 7115.

Br. St. (n.r.), D iii 13, P i 12, V i 7, A iii 15, gillrakers on lower part of 1st arch 20, scutes 10 + 8.

In percentages of standard length: body depth 26.7, head length 21.3; snout length 5.5, eye diameter 6.5, length of upper jaw 9.5, length of lower jaw 10.2; pectoral length 15.2 (tip damaged), pelvic length 10.0 (tip damaged), length of anal base 14.6; pre-dorsal distance 50.5, pre-pelvic distance 49.9, pre-anal distance 72.5.

Body moderately compressed, width about $2\frac{1}{2}$ times in depth, dorsal origin near midpoint of body. Pelvic base just in front of vertical from 1st unbranched dorsal ray, slightly nearer to anal origin than to pectoral base. One supramaxilla, expanded portion corresponding to the '*Harengula*' shape.

Pre-maxilla toothless; lower edge of maxilla smooth.

Two final anal rays not separate from rest of fin.

Colour. — Light brown, no silver lateral stripe. The type is described as having black caudal tips. In the British Museum specimen, in which the caudal tips are preserved, there is no indication of black or even dusky pigmentation.

30. *Clupeoides hypselosoma* Bleeker, 1866 (pl. 8 fig. 3)

= *Clupeoides hypselosoma* Bleeker, 1866

Clupeoides hypselosoma Bleeker, 1866, Ned. Tijdschr. Dierk. 3: 293 (Bandjermassing, in fluviis; 1 fish, 57 mm tot. l.; Br. St. 6, D iii 12, P i 12, V i 7, A iii 13).

Atlas: as *Clupea (Clupeoides) potamophilus*, "Longitudo speciminis descripti 57''", Borneo.

Auction Catalogue: not listed.

RMNH: no specimens.

BMNH: 1 fish 41.5 mm S.L. (estimated 56 mm tot. l.), BMNH 1867. 11.28.35. Listed as "Type of the species, 2 inches long. Bandjermassing" by Günther (1868: 451).

Type. — The British Museum specimen is apparently the only Bleeker specimen in existence and must therefore be the holotype. Its estimated total length is very close to that described. It is probably the specimen figured in the Atlas (pl. 260 fig. 5).

Description. — Holotype, a fish 41.5 mm S.L. (52.3 mm tot. l., estimated 56 mm), head not cut, caudal lobes damaged, BMNH 1867.11.28.35.

Br. St. 6, D iii 12, P i 13, V i 7, A iii 14, gillrakers on lower part of 1st arch 19, scutes 8 + 7 (first post-pelvic scute now missing but included here in count).

In percentages of standard length: body depth 30.7, head length 26.7; snout length 7.0, eye diameter 8.9, upper jaw length 11.1, lower jaw length 12.7; pectoral length 18.5, pelvic length 14.5, length of anal base 18.1; pre-dorsal distance 53.0, pre-pelvic distance 52.5, pre-anal distance 73.0.

Body fairly strongly compressed, its width $2\frac{1}{3}$ times in its depth, belly keeled behind pelvic fins; scutes beginning under pectoral fin base. Maxilla reaching to vertical from anterior pupil border; a single supra-maxilla present, of '*Harengula*' shape. Gillrakers slender, a little longer than longest gill filaments, $\frac{1}{2}$ of eye diameter. Pseudobranch about $\frac{3}{4}$ eye diameter. No striated fronto-parietal cuneiform areas.

Dorsal origin about equidistant between snout tip and caudal base. Pectoral tips failing to reach vertical from dorsal origin by 1 eye diameter; no pectoral axillary scale, no groove above first pectoral ray. Pelvic base just before vertical from dorsal origin, nearer to anal origin than to pectoral base by $\frac{1}{4}$ eye diameter; no pelvic axillary scale. Anal origin nearer to pelvic base than to caudal by 1 eye diameter; final two anal rays not separate from fin.

Scales mostly present, about 34-35 in lateral series; exposed portion smooth, unexposed portion with a number of radiating striae, the posterior two joining in the scale centre.

Colour. — Light brown, a faint indication of a paler midlateral line; fins hyaline (caudal tips damaged).

Note. — The differences separating *C. hypselosoma* from *C. borneensis* are small. The chief difference is in the more slender body of the latter (26.7 per cent of S.L.; cf. 30.7); the former species is based on a much smaller fish, but usually the juveniles of clupeids are more slender than the adults. For the present it seems best to recognise *C. hypselosoma* as a distinct species.

31. **Clupea (Clupeoides) potamophilus** Bleeker, 1872

= *Clupeoides hypselosoma* Bleeker, 1866

Clupea (Clupeoides) potamophilus Bleeker, 1872, Atlas Ichthyol. 6: 101 (on *Clupeoides hypselosoma* Bleeker, 1866).

A replacement name required when Bleeker placed this species in *Clupea*, *Clupea hypselosoma* being preoccupied. Since *Clupeoides hypselosoma* was not described as a member of *Clupea*, and is not now included in *Clupea*, the replacement name becomes a junior synonym of *C. hypselosoma*. The type of *C. potamophilus* is the holotype of *C. hypselosoma*.

Corica Ham. Buch., 1822

Corica Hamilton-Buchanan, 1822, Fishes of the Ganges: 253, 283 (Type: *Corica soborna* Ham. Buch., monotypic).

This genus is also in need of revision. Fowler (1941) included four species, separated chiefly by small differences in scale and dorsal finray counts.

32. **Spratella pseudopterus** Bleeker, 1852 (pl. 9 fig. 1)

= *Corica soborna* Ham. Buch., 1822

Spratella pseudopterus Bleeker, 1852, Nat. Tijdschr. Ned. Ind. 3: 432 (Pamangat, S. W. Borneo; 2 fishes, 48-52 mm tot. l.; Br. St. 6, D 13-14, P 12-13, V i 7, A 14 + 2).

Atlas: as *Corica pseudopterus*, 2 fishes, 48-51 mm tot. l., Borneo.

Auction Catalogue: as *Corica pseudopterus*, 2/0/0/0/0 (p. 45, no. 13).

RMNH: 1 fish, 38.7 mm S.L. (48.2 mm tot. l.), head cut, RMNH 7116.

BMNH: 1 fish, 35.8 mm S.L. (46.8 mm tot. l.), head not cut, BMNH 1867.11.28.45. Listed as "One of the typical specimens" by Günther (1868: 452).

Type. — The Leiden and British Museum specimens are evidently the syntypes. The former is chosen here as lectotype, and the latter as paralectotype. The lectotype is probably the figured specimen (Atlas, pl. 260 fig. 3); Bleeker considered this figure a poor one (Atlas: 98).

Description. — Lectotype, a fish 38.7 mm S.L. (48.2 mm tot. l.), head cut horizontally on right side, scales mostly gone, first gill arches on both sides removed, RMNH 7116.

Paralectotype, a fish 35.8 mm S.L. (46.8 mm tot. l.), head not cut, scales mostly gone, BMNH 1867.11.28.45.

[In the description the figures for the paralectotype are in parenthesis].

In percentages of standard length: body depth 22.2 (22.1), head length 22.2 (22.6), snout length 6.5 (6.1), eye diameter 6.7 (7.5), length of upper

jaw 11.4 (11.1), length of lower jaw 11.7 (12.3); pectoral length 15.5 (14.8), pelvic length 10.9 (12.8), length of whole anal base (n.r.) (22.8); pre-dorsal distance 52.0 (51.8), pre-pelvic distance 52.0 (50.5), pre-anal distance 73.0 (70.0).

Body moderately compressed, its width $2\frac{1}{4}$ times in its depth, belly sharply keeled, scutes beginning behind pectoral fin base. Maxilla reaching almost to vertical from eye centre; a single supra-maxilla present, of '*Harengula*' shape. Gillrakers slender, $1\frac{1}{2}$ times length of longest gill filaments, about $\frac{3}{4}$ eye diameter. Pseudobranch small, about $\frac{1}{2}$ eye diameter. No striated cuneiform fronto-parietal areas. Posterior frontal fontanelles together forming an almost circular area (Whitehead, 1962, fig. 1g).

Dorsal origin nearer to caudal base than to snout tip by an eye diameter. Pectoral tips failing to reach vertical from dorsal origin by $1\frac{1}{2}$ eye diameters. Pelvic base just in front of vertical from 1st unbranched dorsal ray, nearer to anal origin than to pectoral base by $\frac{1}{2}$ eye diameter. Anal origin nearer to pelvic base than to caudal base by one eye diameter; final two anal rays separated from rest of fin by a distance equivalent to three intermediate finray bases.

Scales mostly missing, unexposed portion with a single vertical and a number of short radiating striae, the latter not reaching the centre of the scale.

Colour. — Light brown, a lighter band along flank which may have been silvery in life; fins hyaline.

Note. — Fowler (1941) included *C. pseudopterus* in the synonymy of *C. soborna* Ham. Buch., and there seems little reason to keep the two separate.

Clupeichthys Bleeker, 1855

Clupeichthys Bleeker, 1855, Nat. Tijdschr. Ned. Ind. 9: 274 (Type: *Clupeichthys goniognathus* Bleeker, monotypic).

Weber & De Beaufort (1913) and Fowler (1941) considered *Clupeichthys* a subgenus of *Corica*. But the jaws are very different in the two, and the divided anal fin is shared by another and more distantly related genus, *Spratellomorpha* (discussion in Poll, Whitehead and Hopson, 1965), suggesting that the latter character may not be of overriding importance. Bleeker himself included the single species in the genus *Corica* in the Atlas.

33. **Clupeichthys goniognathus** Bleeker, 1855 (pl. 9 fig. 2)

= *Clupeichthys goniognathus* Bleeker, 1855

Clupeichthys goniognathus Bleeker, 1855, Nat. Tijdschr. Ned. Ind. 9: 275 (Lahat, Sumatra, in fluviis; 1 fish, 83 mm tot. l.; Br. St. 6, D iii 11-12, P ii 9, A iii 14 + 2).

Atlas: *Corica goniognathus*, "Longitudo speciminis unici 83''", Sumatra.

Auction Catalogue: not included.

RMNH: no specimens.

BMNH: 1 fish, 64.6 mm S.L. (81.2 mm tot. l.), head not cut, BMNH 1867.11.28.36. Listed as "Type of the species" by Günther (1868: 453).

Type. — Allowing for slight damage to the caudal tips, the British Museum specimen almost exactly matches the length of the holotype. No other A series material exists. The holotype is evidently the figured specimen (Atlas, pl. 264 fig. 1).

Description. — Holotype, a fish 64.6 mm S.L. (81.2 mm tot. l., caudal tips very slightly damaged, estimated 83 mm), head not cut, no trace of pencil marks, scales mostly shed on anterior part of body, BMNH 1867.11.28.36.

Br. St. 6, D iii 12, P i 11, V i 7, A iii 14 + 2, gillrakers on lower part of 1st arch 16, scutes 10 + 7.

In percentages of standard length: body depth 25.3, head length 26.2; snout length 8.9, eye diameter 7.0, upper jaw length 14.2, lower jaw length 16.9; pectoral length 16.3, pelvic length 13.2, length of anal base 18.0; pre-dorsal distance 50.2, pre-pelvic distance 53.0, pre-anal distance 72.5.

Body moderately compressed, its width $2\frac{1}{2}$ times in its depth, belly sharply keeled, scutes beginning under pectoral fin base. Maxilla reaching to vertical from eye centre, expanded portion slender, about 6 times as long as deep, ventral edge toothed; a single (posterior) supra-maxilla present, of 'Harengula' shape but elongate, its depth about $\frac{1}{4}$ of its length. Lower jaw projecting well beyond upper. Pre-maxilla with a single outer and two or three inner series of caniniform teeth, some enlarged. Similar teeth on dentaries, vomer, pterygoids and on tongue. Gillrakers short, about $\frac{3}{4}$ length of longest gill filaments and $\frac{1}{2}$ eye diameter. Pseudobranch $\frac{4}{5}$ eye diameter. No striated cuneiform fronto-parietal areas. Posterior frontal fontanelles together forming a triangle.

Dorsal origin equidistant between snout tip and caudal base. Pectoral tips failing to reach vertical from dorsal origin by about one eye diameter. Pelvic base below 1st branched dorsal ray, nearer to anal origin than to pectoral base by one eye diameter. Anal origin nearer to pelvic base than to caudal base by $1\frac{1}{3}$ eye diameters; final two anal rays separated from rest of fin by a distance equivalent to three intermediate finray bases.

Scales absent on anterior part of body, unexposed portion with a single vertical and several smaller radiating striae, the latter not reaching the centre of the scale.

Colour. — Light brown with silver lateral stripe, especially prominent on posterior half of body; fins hyaline.

Note. — Weber & De Beaufort (1913, fig. 21) show an anterior as well as a posterior supra-maxilla. In the holotype, however, there is no anterior supra-maxilla. The dentition in *C. goniognathus* greatly resembles that in the West African genus *Cynothrissa*, especially in the development of additional series of pre-maxillary teeth behind the outer series. On the other hand, the separation of the final two anal rays recalls the dussumieriid *Spratellomorpha*. Reasons for considering the latter (and other members of the dussumieriid tribe Ehiravini) to be closely allied to, and perhaps members of the Pello-nulinae, have been put forward (Poll, Whitehead & Hopson, 1965).

ALOSINAE

The Indo-Pacific members of this subfamily have been revised recently (Whitehead, 1965a) and no key need be given here. Two genera are recognised, *Hilsa* and *Gudusia*, the former containing two subgenera, *Hilsa* (*Hilsa*) and *Hilsa* (*Tenualosa*).

The Bleeker material examined here comprises three species of *Hilsa*. Bleeker included six species in the Atlas, placing them in *Alosa* Cuvier; five of these he had himself described.

Hilsa Regan, 1917

Hilsa Regan, 1917, Ann. Mag. nat. Hist. (8) 19: 303 (Type: *Paralosa durbanensis* Regan).

Tenualosa Fowler, 1934, Proc. Acad. nat. Sci. Philad. 85: 246 (Type: *Alosa reevesii* Richardson).

(subgenus **Hilsa**)

34. **Alosa brevis** Bleeker, 1848

= ? *Hilsa kelee* (Cuvier, 1829)

Alosa brevis Bleeker, 1848, J. Ind. Arch. 2: 638 (Bima, Sumbawa I.; no number or sizes given; Br. St. 5, D i 17, P i 16, V i 7, A i 17?).

Alosa brevis: Bleeker, 1852, Verh. Bat. Gen. 24: 35 (copied).

The type (material) of *Alosa brevis* was apparently lost shortly after its description (Bleeker, 1872). Regan (1917b) doubtfully placed this species in the synonymy of *H. brachysoma* Bleeker, the latter considered here a synonym of *H. kelee*.

There are no Leiden specimens labelled *Alosa brevis*. In the Atlas (: 116), Bleeker kept the species distinct, but indicated its resemblance to his *Alosa brachysoma*, from which it differed in having a larger head (4 times

in tot. 1.; cf. 4¹/₂), more pectoral rays (17; cf. 13-14) and fewer anal rays (18?; cf. 20-21). The anal may have been damaged, but the pectoral count is rather high (15 in the lectotype of *Alausa kanagurta*).

35. ***Alausa kanagurta*** Bleeker, 1852 (pl. 10 fig. 1)

= *Hilsa kelee* (Cuvier, 1829)

Alausa kanagurta Bleeker, 1851, Nat. Tijdschr. Ned. Ind. 1: 160 (Banka, name only); Bleeker, 1852, ibid. 3: 445 (Banka, name only); Bleeker, 1852, Verh. Bat. Gen. 24: 34 (Batavia, Muntok; 10 fishes, 160-210 mm tot. 1.; Br. St. 6, D 17-18, P 14-15, V i 7, A 20-21, scutes 28-29).

Atlas: as *Alosa kanagurta*, 14 fishes, 150-210 mm tot. 1., Java, Sumatra, Bangka.

Auction Catalogue: as above, 6/2/2/2 (p. 45, no. 35).

RMNH: 4 fishes, 123.5-136.2 mm S.L. (160-175 mm estimated tot. 1.), RMNH 7110.

BMNH: 1 fish, 132 mm S.L. (165 mm tot. 1.), BMNH 1867.11.28.26. Listed as "type of *Alausa kanagurta*" by Günther (1868: 446).

Type. — The British Museum specimen is within the original size range described and can be designated lectotype. The four Leiden specimens may be all from the type series; at least four of the syntypes were evidently not included in the A series. There is no way of knowing whether the four additional specimens from Bantam, Pasuruan and Benculen (also Siam-Bleeker, 1865) were confused with the syntypes, except that at least one of them was below the original size range. The Atlas figure (pl. 265 fig. 5) shows a fish of 195 mm tot. 1., i.e. much larger than any of the specimens now extant.

Description. — Lectotype, a fish 132 mm S.L. (165 mm tot. 1., caudal tips damaged, estimated 170 mm), head not cut, no pencil marks, in very good condition, BMNH 1867.11.28.26.

Br. St. 6, D iv 14, P i 14, V i 7, A iii 18, gillrakers on lower part of 1st arch 135, scutes 16 + 13, scales 40 in lateral series.

In percentages of standard length: body depth 36.3, head length 32.2; snout length 7.5, eye diameter 7.9, length of upper jaw 13.9, length of lower jaw 17.1; pectoral fin length 19.2, pelvic fin length 10.5, length of anal base 16.7; pre-dorsal distance 48.5, pre-pelvic distance 54.5, pre-anal distance 78.6.

Body strongly compressed, its width 2¹/₂ times in its depth, belly sharply keeled. Maxilla to vertical from eye centre, expanded portion with longitudinal striae; two supra-maxillae; upper jaw with distinct notch in

centre. Pseudobranch with ventral ridge and groove, filaments decreasing in length rather rapidly (fig. 6B, Whitehead, 1965a). Gillrakers long and slender (with about 100 short serrae in two rows along inner margin of each raker), about 4 times length of gill filaments of outer hemibranch, $1\frac{1}{4}$ times eye diameter; gillrakers on 2nd-4th arches curled outwards. Gill filaments of outer hemibranch of 1st arch half length of those of inner hemibranch. Fronto-parietal cuneiform areas with 8-9 striae.

Dorsal origin nearer to snout tip than to caudal base by $1\frac{1}{4}$ eye diameter; low scaly sheath at base of fin. Pectoral tip below vertical from last unbranched dorsal ray, failing to reach to pelvic base; no axillary scale. Pelvic base below vertical from 4th branched dorsal ray, nearer to pectoral base than to anal origin by $\frac{1}{2}$ eye diameter; axillary scale present, about $\frac{3}{4}$ length of fin. Anal with low scaly sheath, its origin equidistant between pelvic base and caudal base.

Scales with horizontal ridges and a few perforations on exposed portion, a single continuous and 4-5 interrupted but sometimes overlapping vertical striae on unexposed portion. Caudal minutely scaled.

Colour. — Golden where scale cover present, brown on dorsal surfaces, no trace of spots on flanks. Tips of anterior dorsal rays dark brown, otherwise fins hyaline.

Note. — The priority of *Hilsa kelee* (Cuvier) has been discussed elsewhere (Whitehead, 1965a). *H. kanagurta* is the first name for which a type specimen is extant, and many authors have used it in preference to Cuvier's name (based solely on Russell's *Keelee*, for which a figure but no specimen exists).

Bleeker's first two references to the name *Alausa kanagurta* were in lists of fishes from Banka. No description is given, so the name must date from the third publication.

36. *Alausa brachysoma* Bleeker, 1853 (pl. 9 fig. 3)

= *Hilsa kelee* (Cuvier, 1829)

Alausa brachysoma Bleeker, 1853, Nat. Tijdschr. Ned. Ind. 5: 527 (Padang, Sumatra; 1 fish, 138 mm tot. l.; Br. St. 6, D 17-18, P 13-14, V i 7, A 20-21) (non *Sardinella brachysoma* Bleeker, 1852).

Clupea platygaster Günther, 1868, Cat. Fish. Brit. Mus. 7: 448 (replacement name for *Alausa brachysoma* Bleeker).

Atlas: as *Alosa brachysoma*, 1 fish, 138 mm tot. l., Sumatra.

Auction Catalogue: not listed.

RMNH: no material labelled *Alosa brachysoma*.

BMNH: 1 fish, 103 mm S.L. (138 mm tot. l.), head not cut, BMNH 1867.II.28.24. Listed under *Clupea platygaster* Günther as "Type of the species" by Günther (1868: 448).

Type. — The British Museum specimen is undoubtedly the holotype of *Alausa brachysoma* (as well as *Clupea platygaster*): it matches the Atlas figure (pl. 262 fig. 5) and bears pencil marks.

Description. — Holotype, a fish 103 mm S.L. (138 mm tot. l.), head not cut, horizontal incision along right flank, faint pencil marks on left side above anal origin, above last anal ray and outlining parts of pre-operculum and inter-operculum; scale cover complete, BMNH 1867.II.28.24.

Br. St. 6, D iv 14, P i 13, V i 7, A iii 18, gillrakers on lower part of 1st arch 105, scutes 18 + 13, scales in lateral series 40.

In percentages of standard length: body depth 43.7, head length 29.1; snout length 6.4, eye diameter 8.1, length of upper jaw 15.1, length of lower jaw 17.4; pectoral fin length 20.5, pelvic fin length 11.7, length of anal base 16.8; pre-dorsal distance 44.7, pre-pelvic distance 53.7, pre-anal distance 76.3.

Body deep and strongly compressed, its width $3\frac{1}{4}$ times in its depth, belly sharply keeled. Maxilla to vertical from eye centre, its exposed portion with longitudinal striae; two supra-maxillae; upper jaw with distinct notch in centre. Pseudobranch as in preceding specimen. Gillrakers long, slender, about $1\frac{1}{5}$ eye diameter, with about 100 short serrae in two rows along inner margin; gillrakers on 2nd-4th gill arches curled outwards. Gill filaments of outer hemibranch of 1st arch half length of those of inner hemibranch. Fronto-parietal cuneiform areas with 11-12 longitudinal striae; also, a bony plate in midline behind supra-occipital, with five longitudinal striae, converging posteriorly (not found in preceding specimen).

Dorsal origin nearer to snout than to caudal base by $2\frac{1}{4}$ eye diameters; low scaly sheath at base of fin. Pectoral tip just reaching to vertical from pelvic base; no axillary scale. Pelvic base below 6th branched dorsal ray, nearer to pectoral base than to anal origin by $\frac{2}{3}$ eye diameter; pelvic axillary scale present, about half length of fin. Anal fin with low scaly sheath, anal origin nearer to caudal base than to pelvic base by $\frac{1}{4}$ eye diameter.

Scales with very faint radial ridges around exposed border but very well developed perforations in one or two circumferential series, especially noticeable on upper part of flank; unexposed portion with a single continuous and three or more continuous or interrupted vertical striae. Caudal minutely scaled.

Colour. — Golden, with light brown along back. Anterior dorsal rays dusky along distal half, fins otherwise hyaline.

Note. — This specimen has an extremely deep body, at first sight unlike 'normal' *H. kelee*, and both Regan (1917b) and Fowler (1941) considered Bleeker's *A. brachysoma* a distinct species. But, as shown elsewhere (Whitehead, 1965a: 130, fig. 7A), there is considerable variation in body depth, even in samples from the same locality.

The present specimen also differs from the type of *Alausa kanagurta* in having fewer gillrakers (105, cf. 135); however, it is a smaller specimen, and gillraker number may increase with size of fish.

Hilsa kelee has a wide range of distribution (Durban to Siam) and small proportional and meristic variations probably occur. The present specimen lies clearly within the range of variation of *H. kelee* as at present defined (Whitehead, 1965a: 132).

Bleeker introduced a new name, *Harengula (Paralosa) sumatrana*, for this species in his manuscript list of fishes sent to Günther (see p. 12), but he did not use the name in any published work; it appears as a senior synonym in his revised manuscript version of the 'Enumeratio'.

37. [**Harengula (Paralosa) zeylanica** Hubrecht, 1879]

= *Hilsa kelee* (Cuvier, 1829)

Harengula (Paralosa) zeylanica Hubrecht, 1879, *Sale Catalogue*: 46.

Auction Catalogue: p. 46, no. 76 (on Bleeker manuscript name).

Bleeker may have intended publishing this name eventually, or he may have intended re-labelling the bottle. In any event, it is a nomen nudum.

The single specimen listed in the Auction Catalogue is a fish of 90.0 mm S.L., now in Leiden (RMNH 7495). It has been identified as *H. kelee* (Whitehead, 1965a). Like the type of *Alausa brachysoma*, it is a deep-bodied fish (depth 40.7% of S.L.) and this may have been the reason why Bleeker considered a new name for it. However, it is not clear why Bleeker placed it in the subgenus *Harengula (Paralosa)*, the type of which is the rather slender *Sardinella melanura* (Whitehead, 1964c). In his revised manuscript of the 'Enumeratio' of 1869 and 1877 (see p. 13), Bleeker placed six alosine species in the subgenus *Harengula (Paralosa)*, thus anticipating Regan's separation of the European and Indo-Pacific species (the latter placed in *Hilsa*). Unfortunately Bleeker had already indicated a species of *Sardinella* as type of *Paralosa* (Whitehead, 1964c).

38. **Alosa malayana** Bleeker, 1866

= *Hilsa kelee* (Cuvier, 1829)

Alausa ilisha: Bleeker, 1852, Verh. Bat. Gen. 24: 33 (Batavia; 7 fishes, 88-155 mm tot. l.; Br. St. 6, D 18-20, P 15, V i 7, A 20-21, scutes 28-29).

Alosa malayana Bleeker, 1866, Ned. Tijdschr. Dierk. 3: 294 (Java — Batavia, Bantam, Cheribon, Surabaya, Pasuruan; Sumatra — Padang); 6 fishes, 88-155 mm tot. l.; Br. St. 6, D iii 15 — iv 15-16, P i 14, V i 7, A iii 17-18, scutes 28-29) (based on *Alausa ilisha* of Bleeker, 1852).

Atlas: as *Alosa malayana*, 6 fishes, 88-155 mm tot. l., Java, Madura, Sumatra.

Auction Catalogue: as *Alosa malayana*, 2/1/10/0 (p. 45, no. 36).

RMNH: 2 fishes, 86.2-116.0 mm S.L. (112-148 mm tot. l.), RMNH 7108 and 23481.

BMNH: no Bleeker specimens labelled '*malayana*'.

Type. — The record shows a steadily dwindling number of specimens, from 7 original fishes in 1852, to 6 in 1866b and 1872 (Atlas), 4 in 1879 (Sale Catalogue) and now only two extant specimens at Leiden. On the other hand, Bleeker (1866b) added a number of new localities subsequently and proposed a new name for what he had originally identified as *Alausa ilisha*. The additional localities are curious because he did not include any further specimens.

The two Leiden fishes are evidently syntypes; the larger of the two is here selected as lectotype, and the other as a paralectotype.

Description. — Lectotype, a fish 116.0 mm S.L. (caudal tips broken, estimated 148 mm tot. l.), head not cut, RMNH 7108.

Br. St. 6, D iv 14, P i 14, V i 7, A ii 18 or iii 17, gillrakers on lower part of 1st arch (n.r.), scutes 16 + 13.

In percentages of standard length: body depth 39.5, head length 30.7; snout length 7.9, eye diameter 7.7, upper jaw 13.5, lower jaw 16.5; pectoral fin length 16.0 (tip broken), pelvic fin length 10.4, length of anal base 16.6; pre-dorsal distance 47.2, pre-pelvic distance 54.3, pre-anal distance 78.5.

Body compressed, belly sharply keeled. Maxilla, with 4-5 longitudinal striae on exposed portion, tip reaching to vertical from posterior pupil border; two supra-maxillae; upper jaw with distinct median notch. Gillrakers long, slender, a little greater than eye diameter. Pseudobranch with distinct ventral ridge and groove. Cleithral lobe large. Fronto-parietal cuneiform areas with about 10 longitudinal striae.

Dorsal origin nearer to snout than to caudal base. Pectoral without axillary scale. Pelvic base below 4th branched dorsal ray, equidistant between pectoral base and anal origin; axillary scale present, $\frac{3}{4}$ length of fin. Anal origin slightly nearer to caudal base than to pelvic base.

Colour. — Golden, brown on dorsal surfaces; fins hyaline.

Note. — The rather shorter maxilla in this specimen was believed a juvenile

character by Weber & De Beaufort (1913), but this fish is in fact slightly larger than the holotype of *Alausa brachysoma*. In the smaller of the two Leiden fishes (86.2 mm S.L.) the maxilla reaches only to eye centre. But as the proportional measurements show, the upper jaw in the lectotype of *A. malayana* is only fractionally smaller than in the lectotype of *A. kanagurta*.

39. *Alausa ctenolepis* Bleeker, 1852 (pl. 10 fig. 2)

= *Hilsa toli* (Valenciennes, 1847)

Alausa ctenolepis Bleeker, 1851, Nat. Tijdschr. Ned. Ind. **1**: 160 (Banka, name only); Bleeker, 1852, Nat. Tijdschr. Ned. Ind. **3**: 74 (Batavia, Muntok, Singapore; 3 fishes, 290-420 mm tot. l.; Br. St. 6, D 17-18, P 15-16, V i 6-7, A 18-20, scutes 28-29); Bleeker, 1852, Verh. Bat. Gen. **24**: 32 (Batavia, Muntok; 2 fishes, 310-420 mm; counts as before).

Atlas: as *Alosa toli*, 6 fishes, 290-570 mm tot. l., Java, Sumatra, Pinang, Singapore, Bangka.

Auction Catalogue: as *Alosa tali* (misspelt), 3/1/1/0/0 (p. 45, no. 34).

RMNH: 3 fishes, 232, 235 and 300 mm S.L. (310, 320 and 405 mm tot. l., estimated for first two fishes), RMNH 7111 and 25001.

BMNH: 1 fish, 312 mm S.L. (420 mm tot. l., estimated), head cut, BMNH 1867.11.28.23. Günther (1868: 447) listed this fish under *Clupea toli*, but surprisingly did not claim it as a typical specimen of *Alosa ctenolepis*, although it was registered under that name.

Type. — The British Museum specimen exactly corresponds in length with the larger of the three syntypes, and is here selected as lectotype. The smallest of the three Leiden fishes is probably another syntype. The Singapore specimen of 290 mm appears to have been lost, but it is also a syntype since Bleeker's second paper was published first (see p. 22). The largest Leiden fish most nearly matches the Atlas figure (pl. 266 fig. 4).

Description. — Lectotype, a fish 312 mm S.L. (418 mm tot. l., caudal tip very slightly damaged, 420 mm estimated), head not cut, oblique slit on right flank, no pencil marks, BMNH 1867.11.28.23.

Br. St. 6, D iv 14, P i 14, V i 7, A iii 15, gillrakers on lower part of 1st arch 95, scutes 17 + 12, scales in lateral series 38.

In percentages of standard length: body depth 32.6, head length 25.5; snout length 6.2, eye diameter 4.8, length of upper jaw 11.8, length of lower jaw 14.2; operculum, height 13.4, breadth 7.3; pectoral fin length 19.2, pelvic fin length 10.3, length of anal base 14.3, length of caudal fin 34.6; pre-dorsal distance 45.0, pre-pelvic distance 50.2, pre-anal distance 76.0.

Body fairly strongly compressed, its width about $2\frac{3}{4}$ times in its depth, belly keeled. Maxilla tip reaching to posterior border of eye, expanded portion without longitudinal ridges but a few faint striae; two supra-maxillae; upper jaw with distinct median notch. Pseudobranch $1\frac{2}{3}$ times eye diameter, without ventral ridge or groove. Operculum breadth 1.8 times in its height. Gillrakers long, slender, straight or slightly curved, $1\frac{1}{4}$ times eye diameter, $1\frac{1}{2}$ times longest filaments. Gill filaments of outer hemibranch of 1st arch $\frac{4}{5}$ length of those of inner hemibranch. Suboperculum with rounded posterior margin, lower border of operculum steeply inclined. Cleithral lobe barely apparent. Fronto-parietal area without striated wedges.

Dorsal origin nearer to snout than to caudal base by 3 eye diameters. Pectoral tip reaching to below 2nd branched dorsal ray; axillary scale present, half length of fin. Pelvic base below 7th branched dorsal ray, nearer to pectoral base than to anal origin by $\frac{1}{2}$ eye diameter; axillary scale present, $\frac{2}{3}$ length of fin. Anal with low scaly sheath, its origin equidistant between pelvic base and caudal base.

Scales with numerous horizontal ridges on exposed portion, but no perforations; unexposed portion with about 8 vertical, wavy striae. Caudal minutely scaled.

Colour. — Golden, brown on dorsal surfaces, fins hyaline.

Note. — This specimen agrees entirely with the diagnosis of *H. toli* given by Whitehead (1965a). Bleeker recorded i 6-7 pelvic rays, and in the Leiden specimen there are i 6 pelvic rays on the right side, i 7 on the left; the remaining meristic counts in the lectotype conform to the description.

Bleeker's first use of the name *Alausa ctenolepis* (see synonymy) was in a list of fishes from Banka. Since no description was given, the name was a nomen nudum and its use must date from Bleeker's next publication.

40. *Alausa macrurus* Bleeker, 1852 (pl. 10 fig. 3)

= *Hilsa macrura* (Bleeker, 1852)

Alausa macrurus Bleeker, 1852, Verh. Bat. Gen. **24**: 31 (Batavia; on a drawing 310 mm tot. l.; D 19, P 15, V i 7, A 21); Bleeker, 1853, Nat. Tijdschr. Ned. Ind. **4**: 501 (Batavia, 1 fish, 343 mm tot. l.; Br. St. 6, D iv 15-16, P ii 15, V i 7, A ii 17-18, scutes 28).

Atlas: as *Alosa macrurus*, 4 fishes, 280-520 mm tot. l., Java, Sumatra, Bancalis, Singapore, Borneo.

Auction Catalogue: as above, 2/1/0/0/0 (p. 45, no. 33).

RMNH: 1 fish 243.0 mm S.L. (342 mm tot. l. estimated); and 1 fish, 202 mm S.L. (280 mm tot. l.), RMNH 7112 and 24701. Also a fish of 420 mm tot. l. collected by Kuhl and Van Hasselt, labelled "*Clupea macrura*" but a second (old) label "*Clup. palasah* Cuv." (RMNH 1828).

BMNH: a fish, registered BMNH 1867.11.28.22, was listed by Günther (1868: 448) under *Clupea macrura* as "Adult: type of the species. From Dr. Bleeker's Collection". The specimen is now lost, and was not found when a manuscript list of types was compiled after the 1939-45 war.

Type. — The Kuhl and Van Hasselt specimen is too big to have been model for the drawing on which Bleeker first based the species. The drawing itself was never published; the name *Macrura* was published without description (Van Hasselt, 1823) and is therefore a nomen nudum. Fowler (1941) incorrectly gave *Macrura* Van Hasselt generic status. However, the larger of the two Leiden Bleeker fishes can be identified as Bleeker's first specimen; this fish has already been designated neotype (Whitehead, 1965a). Also, it matches the Atlas figure (pl. 264 fig. 4).

Description. — Neotype, a fish 243.0 mm S.L. (337 mm tot. l. but caudal tips damaged, 342 mm estimated), RMNH 7112.

Br. St. 6, D iv 15, P i 16, V i 7, A iii 17, gillrakers (n.r.), scutes 17 + 13, scales in lateral series about 42.

In percentages of standard length: body depth 33.3, head length 23.7; snout length 5.0, eye diameter 4.8, length of upper jaw 7.8, length of lower jaw 9.3; operculum, height 11.9, breadth 6.2; pectoral fin length 17.3, pelvic fin length 9.5, length of anal base 14.6, length of upper caudal lobe 37.5; pre-dorsal distance 47.4, pre-pelvic distance 51.0, pre-anal distance 76.0.

Body compressed, belly sharply keeled. Maxilla reaching to below anterior $\frac{1}{4}$ of pupil; two supra-maxillae; upper jaw with distinct notch. Operculum breadth 1.9 times in its height. Gillrakers long, slender, without distal knob (cf. Whitehead, 1965a, fig. 4B). Cleithral lobe little developed. No fronto-parietal striae but lateral margins of frontals with one or two longitudinal ridges.

Dorsal origin a little nearer to snout tip than to caudal base. Pectoral tip not reaching to pelvic base; axillary scale present, $\frac{3}{4}$ length of fin. Pelvic base below 4th branched dorsal ray, nearer to pectoral base than to anal origin by $\frac{1}{2}$ eye diameter; axillary scale no longer present. Anal origin nearer to caudal base than to pelvic base by $\frac{3}{4}$ eye diameter.

Colour. — Golden, fins hyaline but caudal dusky except along upper and lower edges.

DOROSOMATINAE

The Bleeker material contains only two gizzard shads, *Nematalosa nasus* (Bloch) and *Anodontostoma chacunda* (Ham. Buch.), both placed by Bleeker in the Atlas in the American genus *Dorosoma* (which differs from the Old World genera in possessing two supra-maxillae). A key to the Indo-Pacific genera and species is given in Whitehead (1962).

Anodontostoma Bleeker, 1849

Anodontostoma Bleeker, 1849, Verh. Bat. Gen. **22**: 15 (Type: *Anodontostoma hasseltii* Bleeker = *Clupanodon chacunda* Ham. Buch., monotypic).

Anodontostoma can be clearly separated from *Gonialosa* Regan (the second of the two Indo-Pacific dorosomatid genera lacking a filamentous last dorsal ray) by its straight, terminally tapering maxilla (tip expanded and curved downwards in *Gonialosa*). Two species recognised by Fowler (1941), *A. chanpole* (Ham. Buch.) and *A. chacunda* (Ham. Buch.), the former restricted to Bengal and little recorded in the literature. Regan (1917b) ignored the former entirely, but recognised *A. breviceps* (Peters) as distinct (tentatively placed in the synonymy of *A. chacunda* by Fowler, 1941). The genus is in need of revision.

41. **Anodontostoma hasseltii** Bleeker, 1849

= *Anodontostoma chacunda* (Ham. Buch., 1822)

Anodontostoma hasseltii Bleeker, 1849, Verh. Bat. Gen. **22**: 15 (Madura Straits near Kammal and Surabaya, Java Sea near Batavia, Samarang, etc.; no number, 135 mm tot. l.; Br. St. 5, D iii 15, P i 14, V i 7, A i 18, scutes 28, scales 34).

Atlas: as *Dorosoma chacunda*, 38 fishes, 60-165 mm tot. l., Java, Madura, Bali, Sumatra, Pinang, Singapore, Bintang, Bangka, Borneo, Celebes, Halma-hera, Amboina.

Auction Catalogue: as above, 26|3|3|3|3 (p. 46, no. 67).

RMNH: 12 fishes, separable into two preservational lots: a. 7 fishes, 37.5-67.7 mm S.L. (46.3-87.0 mm tot. l.), and b. 5 fishes, 82.7-105.5 mm S.L. (109.6-140.0 mm tot. l.), RMNH 7082 and 17775; also 9 fishes, 137-153 mm tot. l., originally included in RMNH 7082, but now removed to RMNH 17775; 2 fishes, 113.2-115.2 mm S.L. (148.5-149.8 mm tot. l. estimated), collected Bleeker but probably not A series, RMNH 3319; 7 fishes, 144.1-159.0 mm tot. l., probably not A series, RMNH 8033.

BMNH: no material labelled as '*chacunda*'.

Type. — The species is mentioned in several succeeding papers but not until 1852 is the number of specimens given (15 fishes, 80-153 mm tot. l., as

Chatoessus chacunda — Bleeker, 1852d). Larger and smaller fishes had by that time been added, however.

Amongst the A series material at Leiden there is a fish of 100 mm S.L., estimated to have been 135 mm tot. l. It is here selected as putative neotype.

Description. — Putative neotype, a fish 100 mm S.L. (132 mm tot. l., but caudal tips slightly damaged, 135 estimated), head not cut, RMNH 7082.

Br. St. 5, D iv 15, P i 15, V i 7, A ii 18, gillrakers (n.r.), scutes 17 + 11, scales in lateral series 40.

In percentages of standard length: body depth 47.0, head length 26.8; snout length 5.2, eye diameter 8.0, upper jaw length 9.1, lower jaw length 9.4; pectoral length 23.9, pelvic length 12.5, length of anal base 20.0; pre-dorsal distance 50.3, pre-pelvic distance 52.4, pre-anal distance 75.9.

Body strongly compressed, its width almost 3 times in its depth. Maxilla slender, not expanded distally, not strongly curved downwards; a single (posterior) supra-maxilla probably present originally but not visible now; lower jaw strongly flared outwards. Pseudobranch with ventral ridge and groove below it. Cleithral lobe present, moderately large.

Dorsal origin a little nearer to snout tip than to caudal base; last ray not elongated. Pelvic base below 6th branched dorsal ray, nearer to pectoral base than to anal origin by $\frac{1}{3}$ eye diameter. Anal origin nearer to caudal base than to pelvic base by $\frac{2}{3}$ eye diameter.

42. ***Chatoessus selangkat*** Bleeker, 1852 (pl. 11 fig. 1)

= *Anodontostoma chacunda* (Ham. Buch., 1822)

Chatoessus selangkat Bleeker, 1852, Nat. Tijdschr. Ned. Ind. 3: 458 (Muntok, Batavia; 4 fishes, 82-147 mm tot. l.; Br. St. 5, D iii 15, P i 15, V i 7, A ii 18, scutes 28, scales 40); Bleeker, 1852, Verh. Bat. Gen. 24: 47 (Batavia; 1 fish, 147 mm. tot. l.; counts as before).

Atlas: included in synonymy of *Dorosoma chacunda*, 38 fishes, 60-165 mm tot. l.

Auction Catalogue: not listed.

RMNH: no specimens labelled under this name, so presumably all *C. selangkat* material was included in jars labelled *C. chacunda* (see previous species).

BMNH: 1 fish, 119 mm S.L. (156 mm tot. l.), BMNH 1867.11.28.64. Listed as "One of the typical specimens of *Ch. selangkat*" by Günther (1868: 411) under the heading *Chatoessus chacunda* var: *selangkat*.

Type. — Günther (1868) claimed the British Museum fish as a typical specimen but it is 9 mm too long, an unlikely error of measurement. It is also

too deep-bodied to conform with Bleeker's diagnosis (depth $2\frac{2}{5}$ in S.L.; cf. $3\frac{1}{5}$ in *C. selangkat*). It is curious, therefore, that the specimen was sent to the British Museum as '*Chatoessus selangkat* Blkr. = *Dorosoma selangkat* Blkr.' in Bleeker's manuscript list.

Reversal of publication dates (see p. 22) gives the three subsequent Muntok specimens (Bleeker, 1852 b) syntypical status. But clearly, the original description (Bleeker, 1852d) was based on the single 147 mm Batavia fish, and this specimen was searched for.

Amongst the Leiden fishes labelled as '*chacunda*' (or '*hasseltii*'), the 12 specimens formerly in RMNH 7082 are too small (maximum 140 mm tot. l.); those in RMNH 17775 are too deep-bodied, although one specimen is 148 mm tot. l.; those in RMNH 3319 are also too deep-bodied; and finally a single fish amongst the 7 in RMNH 8033 is sufficiently slender, but it measures 151 mm tot. l. (caudal not damaged).

The Batavia specimen does not appear to be present, therefore, amongst the Leiden specimens. Bleeker separated the species from *C. chacunda* on its more slender body (depth $3\frac{1}{5}$; cf. $2\frac{4}{5}$ in S.L.), but at least one such slender specimen appears amongst an otherwise homogenous lot of *C. chacunda* (i.e. RMNH 8033). Bleeker's subsequent amalgamation of his material makes recognition of the three Muntok specimens uncertain. Until variations in body depth in this genus have been more thoroughly studied, *Chatoessus selangkat* will be accepted in the synonymy of *Anodontostoma chacunda*. In the Atlas, Bleeker himself finally considered it a junior synonym.

Bleeker included an Atlas figure labelled *Dorosoma chacunda* var. *selangkat* (pl. 261 fig. 5) as well as a figure of *Dorosoma chacunda* (pl. 261 fig. 6). The former (here pl. 11 fig. 1) closely matches the British Museum specimen in size but is even deeper-bodied (53 mm at dorsal origin; cf 49 mm in the specimen). The specimen is fully scaled, but there are no indications of pencil markings on the flank. In view of this, and the fact that the specimen so clearly contradicts Bleeker's diagnosis of the species, the British Museum fish would be unsuitable for selection as a type even though Bleeker seems to have selected it himself.

PRISTIGASTERINAE

Bleeker recognised three genera in the Atlas, *Ilisha*, *Opisthopterus* and *Raconda*, all currently accepted. However, *Ilisha hoevenii* Bleeker belongs in *Pellona*. Bleeker included respectively 10, 2 and 1 species in his three genera; we here accept 6, 2 and 1, with 1 species of *Pellona*.

Bleeker placed these genera in the tribe Pristigastrini of his division

(i.e. subfamily) Clupeiformes. The last world revision of the Pristigasterinae was that of Norman (1923), but for the Indo-Pacific species, the most recent review is that of Fowler (1941). Departures from either of these are discussed in the text. The genera dealt with here can be separated by the following key.

1. Hypo-maxillary bone present *Pellona*
2. Hypo-maxillary bone absent
 - a. Pelvic fins present *Ilisha*
 - b. Pelvic fins absent
 - i. Dorsal fin present; maxilla rounded posteriorly, not reaching beyond eye centre *Opisthopterus*
 - ii. Dorsal fin absent; maxilla tapering posteriorly, extending to gill cover or beyond *Raconda*

Pellona Valenciennes, 1847

Pellona Valenciennes, 1847, Hist. Nat. Poiss. **20**: 300 (Type: *Pellona orbignyana Valenciennes*, designated by Gill, 1861, Proc. Acad. nat. Sci. Philad.: 35).

Neosteus Norman, 1923, Ann. Mag. nat. Hist. (9) **11**: 17 (Type: *Pellona ditchela Valenciennes*, designated by Norman, 1924, Zool. Rec. (Pisces): 25).

P. ditchela is the only Indo-Pacific member of this genus, the remainder being Western Atlantic. At present, there appear to be no grounds for separating it from its South American congeners, a fairly uncommon situation amongst clupeoid fishes.

43. **Pellona hoevenii** Bleeker, 1852 (pl. 11 fig. 2)

= *Pellona ditchela Valenciennes*, 1847

Pellona hoevenii Bleeker, 1852, Verh. Bat. Gen. **24**: 21 (Batavia; 1 fish, 140 mm tot. l.; Br. St. 6, D 18, P 18, V 7, A 37); Bleeker, 1852, Nat. Tijdschr. Ned. Ind. **3**: 712 (Wahai, Batavia; 18 fishes, 70-165 mm tot. l.; counts as before.)

Atlas: as *Ilisha hoevenii*, 25 fishes, 85-182 mm tot. l., Java, Sumatra, Singapore, Celebes, Halmahera, Obi-major, Amboina, Ceram.

Auction Catalogue: as above, 17/2/2/2 (p. 45, no. 37).

RMNH: 16 fishes, RMNH 7118 and 24959, separable into five preservational lots: a. 1 fish 128.0 mm S.L. (162.5 mm tot. l.), head cut, very flexible; b. 4 fishes 87.5-121.5 mm S.L. (109-157 mm tot. l. estimated), stiff; c. 4 fishes, 74.5-82.2 mm S.L. (95.0-108.6 mm tot. l.), dorsal surfaces brown; d. 1 fish 70.7 mm S.L. (86.2 mm tot. l., caudal damaged), dorsal surfaces grey, flexible; e. 6 fishes, 51.0-65.6 mm S.L. (62.5-86.2 mm tot. l.), dorsal surfaces brown, flexible.

AMS: 1 fish, as *Pellona hoevenii* Bleeker type (AMS I 91).

BMNH: 1 fish, 133 mm S.L. (162 mm tot. l.), BMNH 1867.II.28.15. Listed as one of the typical specimens by Günther (1868: 456).

Type. — The British Museum specimen is too big to have been the holotype. The Leiden specimen in the preservational batch a. is too large, while c-e. are too small; the largest in batch b. is too large, and the next in size is too small (100.0 mm S.L., 135 mm estimated tot. l.). Should a neotype selection become necessary, the largest of the Leiden specimens, which has the head cut, is a suitable choice. It is almost certainly from the Wahi (Ceram) series next described by Bleeker (1852e).

Description. — Putative neotype, a fish 128.0 mm S.L. (162.5 mm tot. l., but caudal tips damaged, estimated 165 mm), head cut on right side, pectorals slightly damaged, body soft and flexible, RMNH 7118.

Br. St. 6, D iii 15, P i 16 (right) i 17 (left), V i 6, A iii 33 (final ray double), gillrakers on lower part of 1st arch 23, scutes 19 + 8.

In percentages of standard length: body depth 35.5, head length 30.0; snout length 7.8, eye diameter 11.2, upper jaw length 15.0, lower jaw length 16.0; pectoral fin length 17.2 (tip damaged, estimated 19.2), pelvic fin length 7.3, length of anal base 32.8; pre-dorsal distance 49.3, pre-pelvic distance 51.0, pre-anal distance 67.9.

Body strongly compressed, belly sharply keeled, scutes beginning on isthmus. Maxilla with fine serrae along lower border; hypo-maxilla present, fine teeth along lower edge, as also on pre-maxilla; two supra-maxillae present. Lower jaw strongly projecting. Gillrakers slender, $1\frac{1}{3}$ times as long as corresponding gill filaments, $\frac{1}{2}$ eye diameter. Cuneiform frontoparietal areas with three interrupted longitudinal striae.

Dorsal origin about midway between snout tip and caudal base. Pectoral tips failing to reach pelvic base, probably by about $\frac{1}{4}$ - $\frac{1}{3}$ of eye diameter in life. Pelvic base slightly in advance of 1st dorsal unbranched ray, exactly equidistant between pectoral base and anal origin. The latter below the 10th branched dorsal ray.

Note. — Norman (1923) and Fowler (1941) both placed this species in the synonymy of *P. ditchela*, and on described characters there is no reason to separate the two.

Clupea melastoma Bloch & Schneider has been tentatively identified with this species (Norman, 1923; Fowler, 1941). Bloch & Schneider's (1801) description gives a low anal count (34) which eliminates a species of *Ilisha*, and the remainder of the description is compatible with *Pellona ditchela*. The phrase "margine ossium maxillarum ensiformium anteriore toto crenulato" suggests the entirely toothed edge of the upper jaw found in *Pellona* but not

normally present in clupeids lacking a hypo-maxilla (i.e. *Ilisha*).

Fowler (1941), in a comprehensive synonymy of *Pellona ditchela* Valenciennes, lists 42 references to this species, of which only 10 include the name '*ditchela*'. The use of Bloch & Schneider's name for this species on grounds of priority would not, therefore, conflict greatly with usage.

Ilisha Richardson, 1846

Ilisha Richardson, 1846, Ichthyol. China Japan: 306 (Type: *Ilisha abnormis* Richardson = *Alosa elongata* Bennett — Whitehead, 1966).

This genus is in great need of revision, the last review of Indo-Pacific species being that of Fowler (1941), which added little to the revision by Norman (1923). The latter accepted a number of species on the basis of only one or two specimens, but larger samples will undoubtedly show that intra-specific variation is much greater than Norman presumed.

Bleeker recognised ten species in the Atlas (six accepted here), separating them chiefly on scale and scute counts, anal length and position of the dorsal origin relative to anal origin. The following key, used here to separate the Bleeker material, is modified from that of Norman (1923).

1. Anal origin in advance of or below dorsal origin; pre-pelvic scutes 26-27; gillrakers 17 *I. pristigastroides* (Blkr.)
2. Anal origin below middle of dorsal base (bases of 7th-11th branched rays)
 - A. Pre-pelvic scutes 22-27, post pelvic 10-14; gillrakers 23-24.
 - i. Body moderately deep, depth 30-34 per cent of S.L. *I. xanthoptera* (Blkr.)
 - ii. Body deep, depth 36.7 per cent of S.L. *I. macrogaster* Blkr.
 - iii. Body slender, depth 27.4 per cent of S.L. *I. elongata* (Bennett)
 - B. Pre-pelvic scutes 18-19, post-pelvic 7-9.
 - i. Body deep, depth 40.4 per cent of S.L.; gillrakers 25 *I. brachysoma* (Blkr.)
 - ii. Body more slender, depth 33.8 per cent of S.L.; gillrakers 21 *I. megaloptera* (Swain.)

44. **Pellona pristigastroides** Bleeker, 1852 (pl. 11 fig. 3)

= *Ilisha pristigastroides* (Bleeker, 1852)

Pellona pristigastroides Bleeker, 1852, Verh. Bat. Gen. **24**: 20 (Batavia; 1 fish, 185 mm tot. l.; Br. St. 6, D 17, P 15, V 6, A 50, scutes 35, scales 50.

Atlas: as *Ilisha pristigastroides*, 1 fish (on previous description), 185 mm tot. l., Java, Borneo.

Auction Catalogue: not listed.

RMNH: no specimens.

BMNH: 1 fish, 151 mm S.L. (182 mm tot. l.), head cut, BMNH 1867. 11.28.12. Listed by Günther (1868: 459) as "Type of the species".

Type. — The absence of specimens in Leiden, the fact that the Atlas refers to "Longitudo speciminis descripti 185''", and the size of the British Museum

specimen all indicate that the latter is the holotype. In addition, it exactly matches the Atlas figure (Pl. 269 fig. 1).

Description. — Holotype, a fish, 151 mm S.L. (182 mm tot. l., caudal tips slightly damaged, estimated 185 mm), head cut horizontally on right side, belly damaged near anal origin, scales partly shed, vertical pencil marks below pectoral base, above pelvic base, and above first and last anal rays, BMNH 1867.11.28.12.

Br. St. 6, D iii 15, P i 14, V i 5, A iii 44, gillrakers on lower part of 1st arch 17, scutes 26 + 11 (? 2 missing near anal origin).

In percentages of standard length: body depth 30.8, head length 22.9; snout length 5.6, eye diameter 6.2, length of upper jaw 12.1, length of lower jaw 12.1; pectoral fin length 17.2, pelvic fin length 2.5, length of anal base 41.1; pre-dorsal distance 53.2, pre-pelvic distance 39.8, pre-anal distance 55.0.

Body highly compressed, its width $3\frac{2}{3}$ times in its height, belly sharply keeled, scutes beginning at isthmus. Maxilla with fine serrae along lower edge, maxilla tip reaching to vertical from anterior pupil border; hypomaxilla absent, two supra-maxillae present, posterior with large expanded lower lobe (as in *Herklotsichthys*); pre-maxillae with a single series of small teeth, but with median edentulous area. Lower jaw strongly projecting, a single series of small teeth. Gillrakers moderately slender, $\frac{1}{2}$ eye diameter, $1\frac{1}{2}$ length of corresponding gill filaments. Pseudobranch small, lower part of filaments concealed, about $\frac{1}{2}$ eye diameter. Cuneiform fronto-parietal area with a concave wedge lacking striae, and a single prominent dorsal ridge.

Dorsal origin nearer to caudal base than to snout tip, equidistant between caudal base and eye centre; fin damaged slightly, branched rays 5 and 6 now missing. Pectoral tips reaching well beyond pelvic base. Pelvic base very slightly nearer to pectoral base than to anal origin; fin minute. Anal origin a little in advance of dorsal origin; base of fin covered by low scale sheath.

Colour. — Dorsal $\frac{1}{6}$ of body light brown, rest of flanks silvery. Fins hyaline.

Note. — Norman (1923) based his description of this species solely on the type, and Fowler (1941) merely reproduced Bleeker's description. The relatively advanced anal distinguishes this species from others.

45. *Pellona amblyuropterus* Bleeker, 1852

= *Ilisha pristigastroides* (Bleeker, 1852)

Pellona amblyuropterus Bleeker, 1852, Verh. Bat. Gen. 24: 21 (Batavia; 1 fish, 340 mm tot. l.; Br. St. 6, D 18, P 14, V 6, A 49, scutes 38, scales 50).

Atlas: as *Ilisha amblyuropterus*, 11 fishes, 201-381 mm tot. l., Java, Sumatra, Singapore, Borneo.

Auction Catalogue: as above, 7/1/1/1/1 (p. 46, no. 42).

RMNH: 7 fishes, differing slightly in preservation state: a. 1 fish, 280 mm S.L. (approx. 340 mm tot. l.), not flexible, flanks golden, dorsal surfaces dark brown; b. 2 fishes, more flexible, dorsal surfaces faint brown, flanks silvery, 287-290 mm S.L. (330-350 mm tot. l.); c. 3 fishes, 180-236 mm S.L. (220-280 mm tot. l.), flexible, flanks golden, back brown; d. 1 fish 161 mm S.L. (196 mm tot. l.), very flexible, flanks very silvery. RMNH 7120 and 25068.

BMNH: 1 fish, 292 mm S.L. (340 mm tot. l., estimated 360 mm), body moderately flexible, flanks golden where scale cover retained, BMNH 1867.11.28.9. Listed by Günther (1868: 459) as "From Dr. Bleeker's Collection".

Type. — If Bleeker measured an undamaged specimen, then the British Museum fish is too large to have been the holotype. It can, however, be recognised as the figured specimen, there being numerous pencil markings on the head and body. The Atlas figure (Pl. 262 fig. 4) measures 356 mm from tip of lower jaw to caudal tips, i.e. only very slightly smaller than the specimen.

The Leiden specimen in lot a. is now approximately 340 mm tot. l. and the damage to the caudal tips is not very great. The chances that it is the holotype are increased by the fact that it agrees in meristic counts with Bleeker's description (the British Museum specimen does not) and is the only specimen with a cut head.

Description. — Holotype, a fish 280 mm S.L. (340 mm tot. l. estimated), head cut, no pencil marks, caudal lobes slightly damaged, scale cover retained on lower part of body, RMNH 7120.

Br. St. 6, D iii 15, P i 13, V i 5, A iii 46, gillrakers on 1st arch 9 + 17, scutes 26 + 11, scales approx. 41-42 in longitudinal series.

In percentages of standard length: body depth 32.5, head length 24.2; snout length 4.7, eye diameter 6.6, length of upper jaw 12.9, length of lower jaw 12.8; pectoral length 19.8, pelvic length 3.4, length of anal base 39.3; pre-dorsal distance 56.7, pre-pelvic distance 43.8, pre-anal distance 59.5.

Body strongly compressed, its width just over four times in its depth, belly sharply keeled, scutes beginning at isthmus. Maxilla reaching to vertical from posterior pupil margin; no hypo-maxilla; two supra-maxillae, the posterior resembling that of *I. pristigastroides* in shape. Lower edge of maxilla with fine teeth, a single series of small teeth in both jaws as in *I. pristigastroides*. Lower jaw strongly projecting. Gillrakers moderately slender, $\frac{1}{2}$ eye diameter, $1\frac{1}{4}$ times length of longest gill filaments. Pseudo-

branch small, $\frac{1}{2}$ eye diameter, basal half of filaments covered. Cuneiform fronto-parietal area with a single prominent dorsal ridge.

Dorsal origin nearer to caudal base than to eye centre by one eye diameter. Pectoral tips reaching to just beyond pelvic base; axillary scale present, $\frac{1}{3}$ length of fin. Pelvic base nearer to anal base than to pectoral base by $\frac{1}{4}$ eye diameter; axillary scale present, about $\frac{1}{2}$ length of fin. Anal origin below 1st branched dorsal ray.

Colour. — Dorsal $\frac{1}{6}$ of body light brown, remainder of flanks silver, or golden where scale cover retained. Fins hyaline.

Note. — The following measurements were made on the specimen in the British Museum (BMNH 1867.11.28.9, 292 mm S.L., approx. 360 mm tot. l.).

D iii 15, P i 15, V i 5, A iii 44, gillrakers (lower limb) 17, scutes 27 + 13.

In percentages of standard length: depth 31.3, head 24.3; snout 6.1, eye 6.1, upper jaw 12.5, lower jaw 13.3; pectoral 18.8, pelvic 3.4, anal base 37.4; pre-dorsal 57.3, pre-pelvic 44.6, pre-anal 62.8.

This specimen differs little from the holotype. Both closely resemble the holotype of *I. pristigastroides*, differing mainly in having the dorsal and anal origins set slightly further back on the body (pre-dorsal 56.7-57.3 per cent of S.L.; cf. 53.2, pre-anal 59.3-62.8; cf. 55.0). One result is that the anal origin is in advance of the dorsal origin in *I. pristigastroides*, but below 1st branched dorsal ray in *I. amblyuropterus*. Since the holotype of the former is a much smaller fish, the difference in fin positions is probably not significant. In addition, the upper jaw is a little shorter in *I. pristigastroides* (12.1 per cent of S.L.; cf. 12.5-12.9). Norman (1923) separated the two species on these two small differences, but had only the two British Museum specimens at his disposal. Fowler (1941) followed Norman but had no specimens.

46. *Pellona xanthopterus* Bleeker, 1851 (pl. 12 fig. 1)

= *Ilisha xanthoptera* (Bleeker, 1851)

Pellona xanthopterus Bleeker, 1851, Nat. Tijdschr. Ned. Ind. 2: 439 (Sambas, Borneo; 1 fish, 246 mm tot. l.; Br. St. 6, D 16, P 16, V 7, A 50, scutes 37, scales 40?); Bleeker, 1852, Verh. Bat. Gen. 24: 49 (Sambas and Pamangkat, Borneo; 2 fishes, 150-246 mm tot. l.; counts as before).

Atlas: as *Ilisha xanthopterus*, 2 fishes, 246-362 mm tot. l., Borneo.

Auction Catalogue: as above, 2/0/0/0 (p. 46, no. 43).

RMNH: 2 fishes, 86-297 mm S.L. (101-353 mm tot. l.), RMNH 7119.

BMNH: 1 fish, 210 mm S.L. (estimated 245 mm tot. l.), upper caudal

lobe damaged, 1867.II.28.14. Listed as "One of the typical specimens, not in good state" by Günther (1868: 458).

Type. — The larger of the two Leiden fishes is presumably a later addition, recorded as 362 mm in the Atlas (pl. 265, fig. 3). The British Museum specimen, although now damaged, would have been about 246 mm in total length and is undoubtedly the holotype; it is not the figured specimen, which was 352 mm tot. l., i.e. matching the largest of the Leiden specimens.

Description. — Holotype, a fish 210 mm S.L. (245 mm tot. l., upper caudal lobe damaged but lower lobe almost complete), head cut on right side, possible pencil marks on right pre-operculum but none on body, scales almost entirely lost, pectoral tips and dorsal broken, BMNH 1867.II.28.14.

Br. St. (damaged), D ii 16, P i 14, V i 6, A iv 45, gillrakers on lower part of first arch 23, scutes 26 + 11.

In percentages of standard length: body depth 33.7, head length 25.2; snout length 5.6, eye diameter 9.0, upper jaw length 12.9, lower jaw length 12.5; pectoral fin length 19.0 (estimated 21.5), pelvic fin length (estimated) 4.8, length of anal base 36.5; pre-dorsal distance 52.3, pre-pelvic distance 47.4, pre-anal distance 61.8.

Body strongly compressed, its width $4\frac{1}{2}$ times in its depth, belly sharply keeled, scutes arising at isthmus. Lower jaw prominent, upper jaw reaching to vertical from anterior pupil margin; two supra-maxillae, the 2nd (posterior) with ventral portion much larger than dorsal portion. Teeth small, in single series along lower edge of maxilla, on dentary and along outer portion of pre-maxilla (absent from inner, median part of pre-maxilla). Gillrakers moderately slender, $\frac{1}{3}$ of eye diameter and a little longer than corresponding gill filaments. Pseudobranch little developed, its filaments fine, its length less than $\frac{1}{2}$ eye diameter. Cleithral lobe absent. Prominent ridges enclosing cuneiform fronto-parietal area, the latter with two poorly developed striae.

Dorsal origin equidistant between anterior eye border and caudal base. Pectoral tips damaged but probably reaching to level of pelvic tips but not to vertical below dorsal origin. Pelvic base nearer to pectoral base than to anal origin by $\frac{1}{2}$ eye diameter, in front of vertical from dorsal origin by $1\frac{1}{2}$ eye diameters. Anal origin under the 7th branched dorsal ray.

Colour. — Upper $\frac{1}{6}$ of body light brown, remainder of flanks silvery, gold where scale cover remains. Fins hyaline.

Note. — *I. xanthoptera* differs only slightly from *I. filigera* Valenciennes, 1847. According to Norman (1923), the latter has 18-19 gillrakers and 22 +

10-11 scutes (23 and 26 + 11 in the type of *I. xanthoptera*). For the present, *I. xanthoptera* is recognised as distinct.

47. ***Ilisha macrogaster*** Bleeker, 1866 (pl. 12 fig. 2)

= *Ilisha macrogaster* Bleeker, 1866

Ilisha macrogaster Bleeker, 1866, Ned. Tijdschr. Dierk. 3: 300 (Borneo; 1 fish, 150 mm tot. l.; Br. St. 6, D iii 14, P i 14, V i 5-6, A iii 45, scutes 36-37).

Atlas: as *I. macrogaster*, 1 fish (on previous description), 150 mm tot. l., Borneo.

Auction Catalogue: not listed.

RMNH: no specimens.

BMNH: 1 fish, 114.8 mm S.L. (138.3 mm tot. l.), head cut, BMNH 1867.11.28.20. Listed as "Type of the species, 5½ inches long" by Günther (1868: 458).

Type. — The British Museum specimen is evidently the holotype; the caudal lobes are now severely damaged, but they can be plausibly sketched in to make a fish of 150 mm tot. l.; the Atlas figure (pl. 271 fig. 4) is 145 mm tot. l. but this was probably an underestimate by the artist; it must certainly have been based on the single extant specimen.

Description. — Holotype, a fish 114.8 mm S.L. (138.3 mm tot. l., caudal lobes damaged, estimated 150 mm), head cut horizontally on right side, no pencil marks, scales shed except near pectoral, in fair condition, metal tag now detached [28.20], BMNH 1867.11.28.20.

Br. St. 6, D iii 14, P i 14, V i 6, A iii 46, gillrakers on lower part of 1st arch 24, scutes 25 + 11.

In percentages of standard length: body depth 36.7, head length 24.2; snout length 5.6, eye diameter 9.7, length of upper jaw 12.8, length of lower jaw 13.5; pectoral fin length 21.7, pelvic fin length 4.7, length of anal base 40.2; pre-dorsal distance 51.5, pre-pelvic distance 46.5, pre-anal distance 60.5.

Body deep and highly compressed, its width just over 4 times in its depth, belly sharply keeled, scutes beginning on isthmus. Upper jaw reaching to anterior border of pupil, lower edge of maxilla with fine teeth. No hypomaxilla. Two supra-maxillae, the posterior shaped as in the type of *P. schlegelii*. Lower jaw projecting strongly. Teeth small, in a single series in both jaws, median part of upper jaw edentulous. Gillrakers moderately slender, ½ eye diameter, 1½ times length of longest gill filaments. Pseudo-branch ⅓ eye diameter, basal portion of filaments covered by thin membrane. Fronto-parietal region with two narrowly separated ridges on each side,

converging posteriorly, lateral cuneiform areas without striae.

Dorsal origin slightly nearer to caudal base than to snout tip. Pectoral tips a little damaged but reaching beyond tips of pelvics, failing to reach vertical from dorsal origin by $\frac{3}{4}$ eye diameter; no axillary scale (probably lost). Pelvic fins minute, pelvic base slightly nearer to pectoral base than to anal origin. Anal origin below 10th branched dorsal ray.

Colour. — Upper $\frac{1}{4}$ of body light brown, remainder silver, or golden where scales retained. Fins hyaline.

Note. — Norman (1923) examined two specimens (including the holotype) and recognised this as a distinct species. Fowler (1941) followed Norman, but examined no specimens. Both authors separated *I. macrogaster* from the very similar *I. xanthoptera* because of the more prominent ventral scutes. In overall appearance the holotype of *I. macrogaster* shows a great resemblance to *I. brachysoma*, but it was described as having more scales, a character which cannot now be checked.

For the present, *I. macrogaster* can be recognised as distinct, but a larger series may well eliminate the small differences now separating it from *I. xanthoptera*.

48. **Pellona schlegelii** Bleeker, 1854 (pl. 12 fig. 3)

= *Ilisha elongata* (Bennett, 1830)

Pellona schlegelii Bleeker, 1854, Nat. Tijdschr. Ned. Ind. 6: 418 (Nagasaki; 1 fish, 356 mm tot. l.); Bleeker, 1854, Verh. Bat. Gen. 25: 118 (name only) (thereafter as *Ilisha elongata*).

Atlas: tentatively in synonymy of *Ilisha elongata*, of which 23 fishes, 141-402 mm tot. l., Java, Madura, Sumatra, Pinang, Singapore, Bangka, Borneo.

Auction Catalogue: as above, 15/2/2/2/2 (p. 46, no. 41).

RMNH: no specimens labelled '*schlegelii*', but 15 fishes labelled as '*elongata*', 115-325 mm S.L. (146-390 mm tot. l.), RMNH 7086.

BMNH: 1 fish, 282 mm S.L. (353 mm tot. l.), BMNH 1867.11.28.72. Placed in *Pellona elongata* (Bennett) and listed as "Type of *P. schlegelii*" by Günther (1868: 457). A second Bleeker specimen in British Museum, 259 mm S.L., registered as *Pellona affinis* (BMNH 1867.11.28.11) and listed by Günther (1868: 457) under *P. elongata*. This fish is *Ilisha elongata*.

Type. — The first British Museum specimen is assumed the holotype, being almost the same size as that described. Further references to this species by Bleeker (1860, 1873, 1879) show that he finally recorded (a) further specimen(s) from Jedo as '*schlegelii*'. The second British Museum fish bears pencil marks and is evidently the figured specimen (Atlas, pl. 259 fig. 3).

Description. — Holotype, a fish 282 mm S.L. (353 mm tot. l., upper caudal lobe very slightly damaged, probably 356 mm in life), head not cut, no pencil marks, scales partly shed, in fair condition, metal tag [28.72] attached to caudal peduncle, BMNH 1867.II.28.72.

Br. St. 6, D iv 15 (first unbranched minute), P i 15, V i 6, A iv 42 (or iii 43), gillrakers on lower part of first arch 23, scutes 25 + 14.

In percentages of standard length: body depth 27.4, head length 22.3; snout length 5.7, eye diameter 5.9, length of upper jaw 10.7, length of lower jaw 11.5; pectoral fin length 16.6, pelvic fin length 3.3, length of anal base 35.7; pre-dorsal distance 50.8, pre-pelvic distance 41.7, pre-anal distance 59.5.

Body moderately compressed, its width 3 times in its depth, belly sharply keeled, scutes beginning at isthmus. Maxilla finely toothed along lower edge, reaching to vertical from eye centre. No hypo-maxilla. Two supra-maxillae, the posterior with almost straight upper border and much expanded lower portion, tip a little pointed. Lower jaw projecting strongly. Teeth small, in single series in both jaws, median portion of upper jaw edentulous. Gillrakers moderately slender, $\frac{1}{2}$ eye diameter, about equal to longest gill filaments. Pseudobranch exposed, $\frac{2}{3}$ eye diameter. Fronto-parietal areas with two prominent ridges, on each side converging posteriorly, lateral cuneiform portions without striae.

Dorsal origin slightly nearer to caudal base than to snout tip. Pectoral tip damaged but almost reaching vertical above pelvic base; axillary scale present, $\frac{1}{2}$ length of fin. Pelvic fin minute, its base nearer to pectoral base than to anal origin by $\frac{1}{4}$ eye diameter; no axillary scale. Anal origin below 9th branched dorsal ray.

Colour. — Upper $\frac{1}{4}$ of body light brown, remainder silver, golden where scale cover retained. Fins hyaline.

Note. — Bleeker himself (Atlas: 119) and all later authors have identified this species with *I. elongata* (Bennett).

49. **Pellona brachysoma** Bleeker, 1852 (pl. 13 fig. 1)

= *Ilisha brachysoma* (Bleeker, 1852)

Pellona brachysoma Bleeker, 1852, Verh. Bat. Gen. 24: 22 (Batavia; 1 fish, 170 mm tot. l.; Br. St. 6, D 16, P 16, V 7, A 48, scutes 25, scales 35).

Atlas: as *Ilisha brachysoma*, 2 fishes 85-170 mm tot. l., Java, Sumatra, Singapore.

Auction Catalogue: as above, 2/0/0/0 (p. 45, no. 39).

RMNH: 1 fish, 81 mm tot. l. (estimated 85 mm), RMNH 7090.

BMNH: 1 fish, 125.3 mm S.L. (145 mm tot. l., caudal tips damaged,

estimated 170 mm), head cut, BMNH 1867.II.28.16. Listed as "One of the typical specimens" by Günther (1868: 456).

Type. — The British Museum specimen is undoubtedly the holotype. The Leiden specimen is the smaller of the two listed in the Atlas. The British Museum fish lacks pencil marks and is slightly larger than the Atlas figure (pl. 267 fig. 5), but must surely be the figured specimen.

Description. — Holotype, a fish 125.3 mm S.L. (145 mm tot. l., caudal tips damaged, 170 mm estimated), head cut on right side and longitudinal incision along right flank, dorsal slightly damaged, scales partly shed, no pencil marks, eroded metal tag sewn at caudal peduncle, BMNH 1867.II.28.16.

Br. St. 6, D iii 14 (first unbranched and first branched rays counted but now absent), P i 14, V i 6, A iii 44, gillrakers on lower part of 1st arch 25, scutes 18 + 7.

In percentages of standard length: body depth 40.4, head length 26.5; snout length 6.4, eye diameter 10.6, length of upper jaw 14.2, length of lower jaw 14.0; pectoral fin length 16.9, pelvic fin length 5.6, length of anal base 42.7; pre-dorsal distance 46.0, pre-pelvic distance 47.2, pre-anal distance 61.0.

Body strongly compressed, its width just over 4 times in its depth, belly sharply keeled, scutes beginning at isthmus. Maxilla reaching to vertical from anterior pupil border, its lower edge with minute serrae. No hypomaxilla. Two supra-maxillae, the posterior of the '*Herklotsichthys*' pattern. Lower jaw strongly projecting. Small teeth present in a single series in both jaws, median portion of upper jaw edentulous. Gillrakers moderately slender, just over $\frac{1}{3}$ eye diameter, twice length of longest gill filaments. Pseudo-branch small, exposed, $\frac{1}{2}$ eye diameter. Cuneiform fronto-parietal areas with two prominent dorsal ridges and two small lateral striae.

Dorsal origin nearer to snout tip than to caudal base by 1 eye diameter. Pectoral tips reaching just beyond pelvic base; axillary scale present, $\frac{1}{2}$ length of fin. Pelvic base below 13th branched dorsal ray, nearer to anal origin than to pectoral base by $\frac{1}{3}$ eye diameter; no axillary scale. Anal base below 11th branched dorsal ray.

Scales with one complete and four or more incomplete vertical striae.

Colour. — Dorsal $\frac{1}{5}$ of body brown, remainder of flanks silver, golden where scales retained. Fins hyaline.

50. *Pellona russellii* Bleeker, 1852 (pl. 13 fig. 2)

= *Ilisha megaloptera* (Swainson, 1839)

Pellona russellii Bleeker, 1852, Nat. Tijdschr. Ned. Ind. 3: 72 (Java, Madura, Pasuruan, Singapore; 5 fishes, 143-310 mm tot. l.; no counts); Bleeker, 1852, Nat. Tijdschr.

Ned. Ind. 3: 414 (name only); Bleeker, 1852, Verh. Bat. Gen. 24: 23 (Batavia, Samarang, Surabaya, Pasuruan, and Kammal, Tandjong, Madura I.; 3 fishes, 143-310 mm tot. l.; Br. St. 6, D 18-19, P 16-17, V 7, A 43-44, scutes 28-30, scales 45-50).

Atlas: in synonymy of *I. megalopterus*, 10 fishes 143-310 mm tot. l., Java, Madura, Singapore, Bintang, Bangka, Borneo, Amboina.

Auction Catalogue: as *I. megalopterus*, 6/1/1/1/1 (p. 46, no. 40).

RMNH: as *I. megalopterus*, 4 adults, 191, 160, 131, 131 mm S.L., and a juvenile (255, 208, 170, 170 and approx. 110 mm tot. l.), the first two in poor condition, the last lacking a head, RMNH 7493.

BMNH: 1 fish, 160.0 mm S. L. (212 mm tot. l.), head cut, BMNH 1867.11.28.13. Listed as "One of the typical specimens of *P. russellii*" by Günther (1868: 456).

Type. — The largest fish from the type series is no longer present and none of the present specimens corresponds to the smallest of the five syntypes. Although all but the juvenile Leiden fish could qualify as an intermediate syntype, the British Museum specimen is most likely to have been one because a) it is the only specimen with the head cut, and b) it was sent as '*Pellona russellii* Blkr. = *Ilisha megalopterus* Blkr.' Günther (1868:456) placed this species in *P. motius* (Ham. Buch.), apparently unaware of Bleeker's intention in the Atlas (and unaware too of Swainson's *Platygaster megalopterus*). The largest Leiden fish may be the figured specimen (Atlas, pl. 264 fig. 6).

Description. — Lectotype, a fish 160.0 mm S.L. (212 mm tot. l.), head cut horizontally on right side, vertical slit in flank above right pectoral fin, no pencil markings, scales partly shed, otherwise in fair condition, BMNH 1867.11.28.13.

Br. St. 6, D iii 15, P i 15, V i 6, A iii 40, gillrakers on lower part of 1st arch 21, scutes 19 + 9.

In percentages of standard length: body depth 33.8, head length 27.7; snout length 7.7, eye diameter 8.4, length of upper jaw 14.5, length of lower jaw 15.2; pectoral fin length 18.3 (tip slightly damaged), pelvic fin length 6.1, length of anal base 35.2; pre-dorsal distance 50.8, pre-pelvic distance 48.9, pre-anal distance 63.2.

Body very compressed, its width just over 4 times in its depth, belly strongly keeled, scutes beginning at isthmus. Upper jaw reaching to just beyond anterior pupil border, lower edge of maxilla with fine serrae. No hypomaxilla. Two supra-maxillae, the posterior shaped as in previous species. Lower jaw projecting strongly. Teeth present as single series in both jaws, but median portion of upper jaw edentulous. Gillrakers moderately slender,

$1\frac{1}{2}$ times length of longest gill filaments, $\frac{1}{3}$ eye diameter. Cuneiform fronto-parietal area with two prominent dorsal ridges on each side, each pair joined posteriorly, and a single lateral ridge.

Dorsal equidistant between snout tip and caudal base. Pectoral perhaps reaching pelvic base in life, now falling just short of vertical from pelvic base; axillary scale present, $\frac{2}{3}$ length of fin. Pelvic fins small, base nearer to anal origin than to pectoral base by $\frac{3}{4}$ eye diameter; no axillary scale. Anal origin below 11th branched dorsal ray; base of fin covered by low scaly sheath.

Scales with faint horizontal or radiating striae on exposed portion; a single complete and about four interrupted vertical striae on unexposed portion.

Colour. — Dorsal $\frac{1}{4}$ of body light brown, remainder of flanks silver, golden where scale cover retained.

Note. — *Platygaster megalopterus* Swainson, 1839 was based on the *Jangerloo* of Russell (1803: 73, fig. 191). There is nothing in Russell's description or figure incompatible with the present specimen. Bleeker did not again use the name *P. russellii*, placing this species in the synonymy of *Ilisha megaloptera* (Swainson) in the Atlas. Norman (1923) followed Bleeker but Fowler (1941) misused *Clupea melastoma* Cuvier, 1829, as a senior synonym. Cuvier linked this name with Russell's *Jangerloo*, but derived the name from *Clupea melastoma* Bloch & Schneider, 1801 (the latter most likely *Pellona ditchela* Valenciennes, i.e. anal count 34; 37-52 rays in species of *Ilisha* — see discussion, p. 92).

Opisthopterus Gill, 1861

Opisthopterus Gill, 1861, Proc. Acad. nat. Sci. Philad.: 38 (Type: *Pristigaster tardoore* Cuvier, orthotypic).

Bleeker (1866b and Atlas: 123) recognised two species, *O. tartoor* Gill and *O. macrognathus* Blkr., the former with a shorter maxilla (to anterior part of eye only; cf. to posterior part). Norman (1923) noted that in the British Museum Bleeker specimen of *O. macrognathus* the maxilla barely reaches to eye centre. He therefore placed the latter in the synonymy of *O. indicus* (Swainson) (i.e. *O. tardoore* of Cuvier — see below). Norman recognised a second Indo-Pacific species, *O. valenciennesi* Bleeker, distinguished by its more slender body and failure of the maxilla to project much beyond the posterior supramaxilla. Fowler (1941) followed Norman and the two species are recognised here, separable by the following key.

1. Maxilla projecting markedly beyond 2nd supra-maxilla; body depth about 3-3½ times in S.L. *O. tardoore* (Cuv.)
2. Maxilla projecting little beyond 2nd supra-maxilla; body depth about 3½-4 times in S.L. *O. valenciennesi* Blkr.

51. ***Opisthopterus macrognathus*** Bleeker, 1866 (pl. 13 fig. 3)

= *Opisthopterus tardoore* (Cuvier, 1829)

Pristigaster tardoore: Bleeker, 1852, Verh. Bat. Gen. **24**: 25 (Batavia; 13 fishes, 80-205 mm tot. l.; Br. St. 6, D 14-16, P 13-15, A 58-66, scutes 30-33, scales 50-60) (non *Opisthopterus tardoore*: Bleeker, 1872).

Opisthopterus macrognathus Bleeker, 1866, Ned. Tijdschr. Dierk. **3**: 299 (Java, Sumatra, Singapore, Borneo; 20 fishes, 120-225 mm tot. l.; Br. St. 6, D iii 13-14, P i 12, A ii 57-61).

Atlas: as *O. macrognathus*, 20 fishes, 120-225 mm tot. l., Java, Sumatra, Singapore, Borneo.

Auction Catalogue: as *O. macrognathus*, 16|1|1|1|1 (p. 46, no. 45).

RMNH: as *O. macrognathus*, 14 fishes, 66.5-169.0 mm S.L. (80-205 mm tot. l. estimated), RMNH 7125 and 24960.

BMNH: 1 fish, 166 mm S.L. (197.5 mm tot. l.), head cut, BMNH 1867. 11.28.7. Listed as "One of the typical specimens" by Günther (1868: 461).

Type. — Bleeker (1852a) added an unknown number of Sampit, and later (Bleeker, 1866b) Singapore specimens to his original collection of 13 *Pristigaster tardoore* from Batavia, but he removed an unknown number of the latter and described them (Bleeker, 1866b) as *Opisthopterus macrognathus*. To the latter he also added an unknown number of specimens from Sumatra, Singapore and Borneo. To add to the confusion, however, specimens of 80-174 mm are absent from the second description of *O. tardoore*, but are only in part included in the size range for *O. macrognathus* (120-225 mm tot. l.). The specimen(s) of 80-120 mm tot. l. do not reappear, even in the Atlas, but are now present in the Leiden jar labelled *O. macrognathus*. The latter species is not again mentioned until the Atlas.

The 14 surviving specimens of *O. macrognathus* now in Leiden exactly fit the original size range for *Pristigaster tardoore* of Bleeker (1852b), and since they are labelled "*Odontognathus macrognathus*" it must be assumed that Bleeker kept them distinct even though his later size descriptions are not accurate. The British Museum fish was sent as *O. macrognathus* and must have been selected as such by Bleeker. It has a cut head and is almost certainly part of the type series.

The largest of the Leiden specimens is here chosen as lectotype since it was close to or identical with the upper size limit described. The British Museum specimen is slightly smaller,

Description. — Lectotype, a fish, 169.0 mm S.L. (201 mm tot. l., caudal damaged, 205 mm estimated), right pectoral damaged, RMNH 7125.

Br. St. 6, D iii 10 (? 2 or 3 branched rays missing), P i 12, A iii 54, gill-rakers on lower part of 1st arch 28, scutes 33.

In percentages of standard length: body depth 30.5, head length 19.7; snout length 4.7, eye diameter 6.1, length of upper jaw 11.8, length of lower jaw 9.8; pectoral fin length 23.5, length of anal base 45.2; pre-dorsal distance 66.0, pre-anal distance 51.2.

Body highly compressed, its width $4\frac{1}{2}$ times in its depth, belly sharply keeled, scutes beginning at isthmus. Upper jaw longer than lower jaw, reaching to posterior pupil border, a little longer than distance between snout tip and posterior rim of eye. Maxilla finely toothed along lower edge. No hypo-maxilla. Two supra-maxillae, the posterior failing to reach the hind tip of maxilla by about 3 mm. Lower jaw strongly projecting. Small teeth in single series in both jaws, but median portion of upper jaw edentulous. Gillrakers moderately slender, $\frac{1}{2}$ eye diameter, about twice as long as longest gill filaments. Pseudobranch about $\frac{1}{2}$ eye diameter, exposed. Fronto-parietal region with a single prominent dorsal ridge on each side and three small striae laterally.

Dorsal origin above 14th branched anal ray, very much nearer caudal base than pectoral base. Pectoral fin with flattened first unbranched ray, its tip failing to reach vertical from anal origin by $\frac{1}{2}$ eye diameter; axillary scale present, about $\frac{1}{3}$ length of fin. Pelvic fins absent. Anal with low scaly sheath.

Colour. — Dorsal $\frac{1}{6}$ of body light brown, remainder of flanks silver, or golden where scale cover retained. Fins hyaline.

Note. — The maxilla reaches to about the posterior border of the pupil in the Leiden lectotype and in Bleeker's description; but to about eye centre in the British Museum specimen. Norman (1923) therefore placed *O. macrognathus* in the synonymy of *O. indicus* (Swainson). Apparently he overlooked *Pristigaster tardoore* Cuvier, 1829, which was also based on the *Tartoore* of Russell (1803). Fowler (1941) resurrected Cuvier's name, correctly, since it is a "bibliographic reference to a previously published ... figure" (Article 16 (a), Int. Code Zool. Nomencl., 1961).

Since the maxilla slopes obliquely downward, the vertical from its posterior tip is not easily related to parts of the eye. From a study of Indian material in the British Museum, it is clear that a certain amount of error can accompany this measurement. Bleeker was using for comparison his specimens of *O. tartoore* which in the Atlas he believed might differ from *O. tartoore* of Day (i.e. of India) and for which he proposed the name

O. valenciennesi. The maxilla reaches only to the anterior pupil border in the lectotype of *O. valenciennesi*. Günther (1868) recognised Bleeker's *O. macrognathus*, but equated Bleeker's *O. tartoor* with Russell's *Tartoore*. This may have confused subsequent authors.

52. **Opisthopterus valenciennesi** Bleeker, 1872 (pl. 14 fig. 1)

= *Opisthopterus valenciennesi* Bleeker, 1872

Opisthopterus tartoor: Bleeker, 1872, Atlas Ichthyol. 6: 123 (Batavia, Singapore; 11 fishes, 150-210 mm tot. l.; Br. St. 6, D iii 14, P i 14-15, A ii 58-64, scutes 30-33, scales 50-54).

Opisthopterus valenciennesi Bleeker, 1872, Atlas Ichthyol. 6: 124 (on the above).

Atlas: see above, Java, Singapore.

Auction Catalogue: as *O. tartoor*, 7/1/1/1/1 (p. 46, no. 44).

RMNH: as *O. tartoor*, 5 fishes, 150-185 mm S.L. (178-225 mm tot l.), RMNH 7124.

BMNH: 1 fish, 172.0 mm S.L. (211.0 mm tot. l.), head not cut, BMNH 1867.11.28.8. Listed by Günther (1868: 460) under *Pristigaster tartoor* as "From Dr. Bleeker's Collection"; 1 fish, 169 mm S.L. (204 mm tot. l., estimated 208 mm) BMNH 1965.9.24.1 (donated by Leiden Museum, formerly RMNH 7124).

Type. — All the specimens that Bleeker had available at the time of the Atlas revision must be considered the syntypes of *O. valenciennesi*. In fact, the first mentioned British Museum specimen had already been sent to England by the time that the Atlas was published (1872), but it remains possible that this fish was examined by Bleeker while he was preparing the revision since in many other cases the British Museum specimen is either the one used for the Atlas figure or was a unique specimen (see discussion, p. 9, 22).

The British Museum fish equals the maximum given in the Atlas, but the largest of the Leiden fishes exceeds this. Earlier, however, Bleeker (1866b) listed his specimens of *O. tartoor* as 11 fishes, 175-220 mm tot. l. The Atlas range seems to have been an error.

Amongst the seven remaining specimens there is one with a cut head (formerly Leiden Museum but donated to the British Museum) and this seems to be a better choice than the British Museum specimen. The latter possibly can be designated paralectotype. The remaining Leiden specimens are probably all from the syntypical series also; the largest matches the Atlas figure (pl. 263 fig. 5), which shows a fish of 223 mm tot. l.

Description. — Lectotype, a fish 169 mm S.L. (204 mm tot. l., estimated 208 mm, caudal tips broken), head cut on right side, no pencil marks, dorsal finrays damaged, scales mostly gone, BMNH 1965.9.24.1.

Measurements are also given (in parenthesis) for the British Museum specimen, a fish 172 mm S.L. (211.0 mm tot. l.), upper caudal lobe damaged, lower complete, head not cut, no pencil marks, pectoral tips damaged, scales mostly shed, BMNH 1867.11.28.8.

Br. St. 6 (6), D iii ? 12 (ii 15 or iii 14), P i 15 (i 15), A iii 56 (iii 62 or ii 63), gillrakers on lower part of 1st arch 25 (25), scutes 30 (30).

In percentages of standard length: body depth 28.3 (25.7), head length 20.1 (19.4); snout length 5.4 (5.3), eye diameter 6.3 (6.0), upper jaw length 9.6 (9.3), lower jaw length 9.4 (9.4); pectoral fin length 13.6, estimated 14.8 (11.9, 15.4 estimated), length of anal base 46.7 (43.5); pre-dorsal distance 60.3 (61.0), pre-anal distance 53.0 (53.3).

Body highly compressed, its width about $4\frac{1}{4}$ times in its depth, belly sharply keeled, scutes beginning at isthmus. Upper jaw about equal to lower jaw, reaching to just beyond anterior eye border, as long as distance between snout tip and posterior border of pupil. Maxilla finely toothed along lower edge. No hypo-maxilla. Two supra-maxillae, the posterior just failing to reach posterior tip of maxilla by only 1 mm. Lower jaw strongly projecting. Small teeth in single series in both jaws, but median portion of upper jaw edentulous. Gillrakers moderately slender, $\frac{1}{2}$ eye diameter, $1\frac{1}{2}$ times length of longest gill filaments. Pseudobranch $\frac{1}{2}$ eye diameter, exposed except for narrow membrane at base of filaments. Fronto-parietal region with three fine and continuous striae on each side, the two sets diverging posteriorly; one large and several smaller striae lateral to the former.

Dorsal origin above 13th branched anal ray, nearer to caudal base than to pectoral base by 1 eye diameter. Pectoral fin with flattened first unbranched ray, pectoral tip (estimated) failing to reach vertical from anal origin by about 3 ($2\frac{1}{2}$) eye diameters; axillary scale present, about $\frac{3}{4}$ length of fin. Pelvic fins absent. Anal origin nearer to caudal base than to snout tip by $\frac{1}{2}$ eye diameter.

Colour. — Dorsal $\frac{1}{7}$ of body light brown, remainder of flanks silver, or golden where scale cover retained. Fins hyaline.

Note. — In addition to the characters shown in the key, this species can be distinguished from *O. tardoore* in several further ways, (1) the maxilla is about 3 times as long as deep in its expanded portion (cf. 2 in *O. tardoore*), (2) the upper jaw is shorter (2.08 times in head; cf. 1.67 times in lectotype of *O. macrognathus*), (3) the jaws are almost equal (cf. upper jaw reaching

well beyond mandibular articulation in *O. tardoore*), (4) the pectoral fin is much shorter (less than head length; cf. $1\frac{1}{4}$ head length), failing to reach anal origin by more than 2 eye diameters (by up to 1 in *O. tardoore*).

Russell's figure of *Tartoore* (1803, pl. 193, lower figure), which formed the basis of both Cuvier's and Swainson's species, shows no detail of the maxilla and posterior supra-maxilla. But the drawing is certainly of the species accepted here as *O. tardoore*; it shows a fish with a deep body (3 times in S.L.) and a long pectoral fin (reaching almost to anal origin). Neither the Russell specimen, nor any types for Cuvier's or Swainson's species exist.

ENGRAULIDAE

Bleeker recognised 26 species of anchovy in the Atlas, which he placed in the subfamily Stolephoriformes, comprising two 'tribes', the Engraulini (*Stolephorus*, *Engraulis*, *Setipinna*, *Lycotrissa*) and the Coilianini (*Coilia*). Virtually the same system is used here, but with the tribes given subfamilial rank (Table I).

ENGRAULINAE

The Indo-Pacific genera are greatly in need of revision; in certain cases the nomenclature is confused and the genera require redefinition. The following key includes unpublished data.

1. Pelvic scute present but no pre- or post-pelvic scutes (tribe Engraulini) (a single Indo-Pacific genus) *Engraulis*
2. Abdominal scutes present, keeled (occasionally absent in *Stolephorus purpureus*) (tribe Stolephorini).
 - A. Scutes present between pectoral and pelvic fins only, with slender ascending arms; anal short, with less than 25 rays *Stolephorus*
 - B. Scutes present between isthmus or pectoral base and vent, with broad ascending arms; anal long, with more than 30 rays.
 1. Jaw teeth fine, close-set, not caniniform.
 - a. No pre-pectoral scutes or one or two followed by a gap; pseudobranch exposed; anterior supra-maxilla as long as expanded portion of posterior supra-maxilla *Thryssa*
 - b. Complete series of pre-pectoral scutes present; pseudobranch concealed by membrane; anterior supra-maxilla small or absent.
 - i. 1st pectoral ray normal, not filamentous; maxilla often extending to gill opening or beyond *Thryssa*
 - ii. 1st pectoral ray filamentous; maxilla short *Setipinna*
 2. Jaw teeth enlarged, caniniform *Lycotrissa*

Engraulis Cuvier, 1817

Engraulis Cuvier, 1817, Règne Animal 2: 174 (Type: *Clupea encrasicolus* Linnaeus, designated by Jordan, Tanaka & Snyder, 1913, J. Coll. Sci Tokyo 33: 38).

Bleeker in the Atlas equated *Engraulis* Cuvier with *Thryssa* Cuvier, and used the former for those species placed (e.g. by Fowler, 1941) in the genus *Thrissocles*. Amongst the Bleeker material, however, are specimens of true *Engraulis*, demonstrating that this genus is not strictly anti-tropical in its distribution. A number of Indo-Pacific specimens formerly consigned to *Stolephorus* in the British Museum collections have also proved to be members of *Engraulis* (Whitehead, 1964a). These may represent a small tropical form linking the three isolated species, *E. japonicus* Temminck & Schlegel, *E. australis* (White) and *E. capensis* Gilchrist. The most southerly record of *E. japonicus* is from Java (see below) and the most northerly record of *E. australis* is from the Capricorn Islands (Blackburn, 1950). It is possible that the two are linked by the tropical form represented here by Bleeker's specimens of *Engraulis zollingeri*.

Until the relationship between *E. japonicus* and *E. australis* has been more thoroughly examined, Bleeker's *Engraulis* specimens are assigned to *E. japonicus*. The name *Atherina japonica* Houttuyn, 1782, has now been suppressed (Bull. zool Nomencl. **22** (4): 218-219 — 1965) and the name *Engraulis japonicus* is correctly attributed to Temminck & Schlegel, 1846.

53. *Engraulis zollingeri* Bleeker, 1849 (pl. 14 fig. 2)

= *Engraulis japonicus* Temminck & Schlegel, 1846

Engraulis zollingeri Bleeker, 1849, J. Ind. Arch. **3**: 73 (Macassar, Celebes; 1 fish but no size — see Bleeker, 1866b; D ii 11, P i 12, V 7, A 17).

Atlas: as *Stolephorus zollingeri*, 10 fishes, 58-101 mm tot. l., Java, Sumatra, Bali, Celebes, Amboina.

Auction Catalogue: as above, 10/0/0/0 (p. 46, no. 48).

RMNH: 9 fishes, 48.0-74.5 mm S.L. (58-90 mm tot. l., estimated), RMNH 3506.

BMNH: 1 fish, 72.3 mm S.L. (87 mm tot. l., estimated, caudal tips damaged), BMNH 1867.11.28.61. Listed merely as "From Dr. Bleeker's Collection" by Günther (1868: 387).

Type. — Bleeker (1866b) records the loss of the original specimen on which the description was made, but lists ten further specimens, from Batavia, Padang, Boleling and Amboina as well as the type locality Macassar. Earlier (Bleeker, 1852d), he had repeated the original description, but added no new localities nor mentioned the size or number of specimens. No further specimens were apparently added until the Atlas. The Auction total of 10 is, therefore, a miscount (or direct copy from the Atlas total) since one of the ten specimens was by that time in London.

If we still possess all ten of the Bleeker specimens, then it is curious that none reach the maximum length of 101 mm given by Bleeker. Probably this was the size of the original holotype, noted at the time by Bleeker but not recorded in the first description. The Atlas figure (pl. 264 fig. 2) shows a fish of 75 mm S.L., virtually the same as the largest extant specimen (Leiden). This fish does not show pencil marks, possibly because most of the scales are now shed.

Some confusion has arisen because this species has been placed in *Stolephorus* by modern workers (see below). A type designation is needed to solve some of the nomenclatural problems involved, but because the relationship of this species to other members of *Engraulis* requires further revisional work, the designation made here will be of putative neotype.

The largest Leiden specimen is probably the figured specimen, but the fins are damaged, preventing dorsal and anal counts. The next largest fish for which complete counts are possible is the British Museum specimen. The smallest specimen corresponds with Bleeker's lower size limit, but it has a badly damaged head. The British Museum specimen is therefore chosen as type. It matches the Atlas figure in size (pl. 264 fig. 2).

Description. — Putative neotype, a fish 72.3 mm S.L. (81.8 mm tot. l. but caudal lobes broken, estimated 87 mm), belly slightly damaged, as also dorsal fin, scales lost, no pencil marks, head not cut, BMNH 1867.11.28.61.

Br. St. 14, D iii 10 or ii 11, P i 13, V i 6, A ii 14, gillrakers on lower part of 1st arch 26, pelvic scute present only.

In percentages of standard length: body depth 17.4, head length 27.6; snout length 4.8, eye diameter 6.0, upper jaw length 21.0, lower jaw length 19.0; pectoral fin length 11.4 (damaged, estimated 13.9), pelvic fin length 9.0, length of anal base 13.4; pre-dorsal distance 51.2, pre-pelvic distance 49.2, pre-anal distance 67.4.

Body little compressed, subcylindrical, its width about $1\frac{1}{2}$ times in depth, belly rounded, without scuted keel. Maxilla slender, not reaching to articulation of lower jaw, lower edge finely toothed; two supra-maxillae, posterior with expanded portion about as deep as maxilla, reaching posteriorly to tip of maxilla. Gillrakers slender, $\frac{7}{8}$ eye diameter and twice length of longest gill filaments; 7-8 gillrakers on posterior face of 3rd epibranchial. Pseudobranch present, exposed, $1\frac{1}{3}$ times eye diameter, extending posteriorly onto the inner face of operculum.

Anterior tip of muscular portion of isthmus almost reaching to posterior margin of branchiostegal membrane, urohyal exposed in between. No lateral bony or fleshy expansions on lower edge of urohyal, but a ventral bulge under anterior portion of isthmus.

Posterior frontal fontanelles virtually occluded, posterior tips of frontals joined in midline, not separated by supra-occipital. A single (pelvic) scute present, no pre-pelvic or post-pelvic scutes.

Dorsal origin nearer to snout tip than to caudal base by $\frac{1}{2}$ eye diameter. Pectoral tips broken, but probably failing to reach pelvic base by at least $1\frac{1}{2}$ eye diameters; axillary scale present, $\frac{4}{5}$ length of fin. Pelvic base in advance of dorsal origin (by about pupil diameter), nearer to anal origin than to pectoral base by $\frac{1}{2}$ eye diameter; axillary scale not present (? lost). Anal origin behind last dorsal ray by just over 1 eye diameter, nearer to pelvic base than to caudal base by 2 eye diameters.

Colour. — Body light brown all over except for prominent silver mid-lateral line, $1\frac{1}{4}$ times eye diameter at widest point. Head light brown dorsally, silver laterally; silver also on isthmus and between pectoral bases.

Note. — Authors have accepted *Engraulis zollingeri* as a member of *Stolephorus* (pre-pelvic scutes present), chiefly on the authority of the original description, which states "ventre inter pinnis pectorales, et ventrales cultrato", to which the words "spinulis aliquot gracilibus debilibus" are added in the Atlas for this species as for other species of *Stolephorus*. However, in Bleeker's (1866b) description of the ten specimens now extant, the original statement is rewritten as "ventre ante et post pinnae ventrales obtuse carinato spinis conspicuis nullis". Unfortunately the force of this statement is reduced because it is repeated on the next page for *Stolephorus heterolobus* (Rüppell), a species which quite clearly possesses sharp pre-pelvic scutes.

These inconsistencies raise the possibility that Bleeker's holotype of *Engraulis zollingeri* was indeed a species of *Stolephorus*. However, in the ten extant specimens the bellies are damaged and the ribs protrude. This is a fairly common occurrence in anchovies which have been poorly fixed, as the overall condition of the Bleeker specimens indicates. Thus Bleeker may have cursorily re-examined the specimens and assumed the presence of scutes when compiling the Atlas description. The fact that he does not cite scute number for species of *Stolephorus* in the Atlas tends to support this conclusion. Hardenberg (1933b) distinguished his *Stolephorus celebicus* from *S. zollingeri* because the former lacked scutes. It is tempting therefore to consider *S. celebicus* a member of *Engraulis*. Fowler (1941: 695) doubtfully cited a Philippine record of *E. japonicus* but the species evidently occurs there (Ronquillo, in litt., and a single British Museum specimen from Bulan). Hardenberg (1933b) also distinguished *S. celebicus* by its longer head (3.4-3.7 times in S.L.; 3.6 in type of *E. zollingeri*), by differences in fin formulae (D 14-15, P 15, A 13-14, D 13, P 14, A 16 in the type of *S.*

zollingeri), and by its more posteriorly placed anal origin (nearer to caudal base than to pectoral base by $1/2$ - $3/4$ pectoral fin length; by $1/2$ pectoral in type of *E. zollingeri*). Thus the only real difference lies in anal count. Unfortunately the type(s) of *S. celebicus* was (were) destroyed during the war. A single specimen labelled *S. celebicus* in Leiden (ex Java Sea, RMNH 17399) is a member of *Engraulis*. The only record of a species of *Stolephorus* lacking scutes is in *S. purpureus* Fowler, where Strasburg (1960) records five out of eleven specimens as scuteless (1-5 scutes in the remainder). *Stolephorus purpureus* is so far recorded only from Hawaii.

Records of *Stolephorus zollingeri* from Japanese waters (Hayashi & Tadokoro, 1962a, b) are clearly based on another Hawaiian engraulid, *S. buccaneeri* Strasburg (Whitehead, 1966). The latter is represented in the British Museum collections by many specimens from Hong Kong and some from Palau (Caroline Is.). Its presence in Indonesian waters would not be unexpected, but it was not found amongst the Bleeker material examined.

Stolephorus Lacepède, 1803

Stolephorus Lacepède, 1803, Hist. Nat. Poiss. 5: 381 (Type: *Stolephorus commersonii* Lacepède — comment on type designation by Whitehead, 1963d).
Anchoviella: Fowler, 1941, Bull. U.S. nat. Mus. 100: 696 (non *Anchoviella* Fowler, 1911).

In the Atlas, Bleeker recognised five species of *Stolephorus* (*S. heterolobus* (Rüppell), *S. indicus* (Van Hasselt), *S. commersonii* Lacepède, *S. tri* (Bleeker) and *S. zollingeri*). Except for the last, all are accepted nowadays. The last review of all Indo-Pacific species was that of Fowler (1941), based to some extent on a synopsis of the species by Hardenberg (1933a). Bleeker's material can be identified by the following key.

We are indebted to Dr. Innocencio Ronquillo for suggestions regarding the key to *Stolephorus* given here.

1. Anal origin under or behind last dorsal ray; muscular portion of isthmus not reaching to border of branchiostegal membrane *S. heterolobus* (Rüpp.)
2. Anal origin under dorsal base; muscular portion of isthmus reaching forward beyond hind border of branchiostegal membrane
 - A. Dorsal preceded by small spine *S. tri* (Blkr.)
 - B. No pre-dorsal spine
 - i. Maxilla tip reaching to anterior border of pre-operculum; posterior frontal fontanelles narrow, lateral borders straight *S. indicus* (Van Hass.)
 - ii. Maxilla tip reaching to gill opening; posterior frontal fontanelles broad, lateral borders sigmoid *S. commersonii* Lacep.

54. *Engraulis tri* Bleeker, 1852 (pl. 14 fig. 3)= *Stolephorus tri* (Bleeker, 1852)

Engraulis tri Bleeker, 1852, Nat. Tijdschr. Ned. Ind. 3: 435 (Sampit, Batavia; 20 fishes, 55-120 mm tot. l.; Br. St. 11, D I + iii 11-12, P i 11-12, V i 6, A iii 17-19); Bleeker, 1852, Verh. Bat. Gen. 24: 40 (Batavia; 17 fishes, 55-120 mm tot. l.; counts as before).

Atlas: as *Stolephorus tri*, 19 fishes, 55-120 mm tot. l., Java, Bangka, Borneo.

Auction Catalogue: as above, 15/1/1/1 (p. 46, no. 51).

RMNH: 13 fishes, 42.1 and 67.6-89.6 mm S.L. (52.2 and 88.0-110.7 mm tot. l.), RMNH 2222 and 24961.

AMS: 2 fishes, as *Engraulis tri* cotypes (AMS B7753-4).

BMNH: 1 fish, 85.2 mm S.L. (98.8 mm tot. l., caudal tips damaged, estimated 105 mm), metal tag tied to caudal peduncle [28.60], head not cut, faint vertical pencil mark on isolated scale just behind left pelvic tip and black (? pencilled) edge to last branchiostegal ray, BMNH 1867.11.28.60. Listed as "One of the typical specimens. From Dr. Bleeker's Collection" by Günther (1868: 389). Pencilled note in bottle in Bleeker's hand "*Engraulis tri* Blkr. = *Stolephorus (Thryssa) tri* Blkr.", corresponding to Bleeker's manuscript list sent to Günther (see p. 7).

Type. -- Bleeker added three further fishes from Borneo (Bleeker, 1852a) to make a total of 20, but recorded only 19 in the Atlas. This suggests that the British Museum specimen was not counted. It is not possible now to distinguish which were the three Sampit additions, since there is no difference in size range, but the British Museum specimen and the Leiden specimens must all be syntypes. The largest Leiden fish is chosen here as lectotype. The British Museum specimen is too small to have been the figured specimen (which must have been 91 mm S.L. and 113 mm tot. l.). The largest Leiden fish is almost this size.

It is possible that the British Museum specimen and the two Australian Museum 'cotypes' are the three Borneo specimens. If Bleeker kept them in a separate jar, they would have been an obvious choice as duplicates.

Description. -- Lectotype, a fish 89.6 mm S.L. (110.7 mm tot. l.), head not cut, in good condition, RMNH 2222.

Br. St. 12, D I + iii 11, P i 12, V i 6, A iii 19, gillrakers on lower part of 1st arch 20, pre-pelvic scutes 6.

In percentages of standard length: body depth 25.8, head length 24.6; snout length 4.1, eye diameter 6.0, length of upper jaw 24.6, length of lower jaw 16.8; pectoral fin length 16.5, pelvic fin length 9.3, length of anal base

17.7; pre-dorsal distance 54.5, pre-pelvic distance 44.9, pre-anal distance 62.4.

Body moderately compressed, its width about twice in its depth, belly moderately sharp. Maxilla pointed posteriorly, reaching to just beyond gill opening, projecting markedly beyond the posterior of the two supra-maxillae; lower edge of maxilla finely toothed. Lower jaw with fine, densely planted, small teeth. Muscular portion of isthmus reaching well forward of margin of branchiostegal membrane. Gillrakers moderately slender, a little longer than longest gill filaments, about $\frac{2}{3}$ eye diameter. Pseudobranch present, short, just over $\frac{1}{2}$ eye diameter, basal portion of filaments concealed by membrane.

Posterior frontal fontanelles broadly triangular, in length about $\frac{1}{3}$ eye diameter.

Scutes present between pectoral and pelvic fin bases, bearing fine posteriorly directed spines; a gap between 6th scute and pelvic scute; the latter without a spine on its basal plate (present in BM specimen, however).

Dorsal preceded by sharp spine, dorsal origin slightly nearer to caudal base than to snout tip. Pectoral tips not quite reaching pelvic base; axillary scale present, $\frac{2}{3}$ length of fin. Pelvic base midway between pectoral base and anal origin. Anal origin under 7th branched dorsal ray, about twice as close to pelvic base as to caudal base.

Colour. — Light brown, with prominent silver lateral stripe, equal to eye diameter at broadest point.

Note. — The Atlas figure (pl. 262 fig. 1) shows definite post-pelvic scutes (absent in all species of *Stolephorus*). Otherwise the figure is a reasonably accurate one.

55. *Engraulis balinensis* Bleeker, 1849

= *Stolephorus indicus* (Van Hasselt, 1823)

Engraulis balinensis Bleeker, 1849, Verh. Bat. Gen. 22: 11 (Boleling, Bali; no number, 82 mm tot. l.; Br. St. 11, D 15, P 14, V 7 + 1 latera versus curvat, A 19).

Atlas: in synonymy of *S. indicus*, of which 58 fishes, 40-145 mm tot. l.

Auction Catalogue: not listed.

RMNH: no specimens labelled as *E. balinensis*.

BMNH: no specimens registered as *E. balinensis*.

Type. — Bleeker (1852d) placed *E. balinensis* in the synonymy of his *E. russellii*, although the former had priority. The type(s) of *E. balinensis* should be amongst the 30 Leiden specimens of *E. russellii*, but none of these specimens matches exactly the length given by Bleeker (82 mm tot. l.) and only one fish (145 mm tot. l.) has the head cut. The British Museum specimen of *E. russellii* is also too large. Since *E. balinensis* is clearly a

synonym of *Stolephorus indicus*, and was recognised as such by Bleeker, a neotype designation is not necessary.

56. **Engraulis russellii** Bleeker, 1852 (pl. 14 fig. 4)

= *Stolephorus indicus* (Van Hasselt, 1823)

Engraulis russellii Bleeker, 1852, Nat. Tijdschr. Ned. Ind. 2: 472 (Rio; name only); Bleeker, 1852, Verh. Bat. Gen. 24: 38 (Batavia, Samarang, Boeling, Bali; 30 fishes, 40-145 mm tot. l.; Br. St. 11, D iii 13, P 14-16, V i 6, A ii 18-20).

Atlas: as *S. indicus*, 58 fishes, 40-145 mm tot. l., Java, Bali, Bawean, Sumatra, Pinang, Singapore, Bintang, Bangka, Celebes, Batjan, Ternata, Amboina.

Auction Catalogue: as *S. indicus*, 46/3/3/3 (p. 46, no. 49).

RMNH: labelled *E. russellii*, 30 fishes, 42.1 and 82.2-119.5 mm S.L. (caudal lobes damaged in all), largest with head cut, RMNH 7076 and 23363¹⁰).

BMNH: 1 fish, 116.8 mm S.L. (caudal lobes damaged, estimated 141 mm tot. l.), head not cut, no pencil marks, metal tag tied to caudal peduncle [28.57], BMNH 1867.11.28.57. Listed under *Engraulis russellii* as "From Dr. Bleeker's Collection" by Günther (1868: 391).

Type. — The largest of the Leiden specimens has a cut head and exactly matches Bleeker's upper size limit. It also matches in size the Atlas figure (pl. 259 fig. 2) and may be the figured specimen. This fish is chosen as lectotype in preference to the British Museum specimen, which is slightly smaller and does not have a cut head. The Atlas figure is incorrect in showing post-pelvic scutes.

Description. — Lectotype, a fish 119.5 mm S.L. (estimated 145 mm tot. l., caudal tips damaged), head cut on right side, body broken just before pelvic fins, RMNH 7076.

Br. St. 13, D iii 11, P i 14, V i 6, A iii 17, gillrakers on lower part of 1st arch 21, scutes 2 (? 2 missing).

In percentages of standard length: body depth 17.7, head length 23.9; snout length 4.9, eye diameter 7.0, length of upper jaw 18.8, length of lower jaw 15.8; pectoral fin length 12.0, pelvic fin length 7.4 (tips damaged), length of anal base 17.2; pre-dorsal distance 53.3, pre-pelvic distance 45.2, pre-anal distance 65.8.

Body only moderately compressed, its width about 1½ times in depth, belly almost rounded. Maxilla slightly pointed posteriorly, reaching to just

¹⁰) Discrepancy in number now extant and number given in Auction Catalogue due to removal of misidentified material.

beyond anterior margin of pre-operculum, projecting markedly beyond the posterior of the two supra-maxillae; lower edge of maxilla finely toothed. Lower jaw with fine, densely planted, small teeth. Muscular portion of isthmus reaching well forward of margin of branchiostegal membrane. Gillrakers slender, $1\frac{1}{3}$ times length of longest gill filaments, $\frac{1}{2}$ eye diameter. Pseudobranch present, $\frac{3}{4}$ eye diameter, basal $\frac{1}{3}$ of filaments concealed by membrane.

Posterior frontal fontanelles less broadly triangular than in *S. tri* (about twice as long as broad), just over $\frac{1}{3}$ eye diameter in length.

Scutes present between pectoral and pelvic fins, but belly damaged and perhaps 2 scutes missing (scutes 4 (f. 4), 5 (4) and 6 (1) in other Leiden specimens); scutes with sharp posteriorly directed spines (no spine on pelvic scute in British Museum specimen).

Dorsal not preceded by spine, dorsal origin nearer to caudal base than to snout tip. Pectoral tips not reaching pelvic base (axillary scale present in British Museum specimen, $\frac{1}{2}$ length of fin). Pelvic base about midway between pectoral base and anal origin. The latter just behind mid-point of dorsal base, about twice as close to pelvic base as to caudal base.

Colour. — Light brown, with silver lateral stripe, slightly narrower than eye diameter at broadest point.

Note. — Bleeker's first use of the name *Engraulis russellii* (see synonymy) is in a list of fishes from Rio. Since no description is given, the name must date from his next publication.

Thrissina Jordan & Seale, 1925

Thrissina Jordan & Seale, 1925, Copeia **141**: 30 (Type: *Clupea baelama* Forskål, 1775).

Considered a subgenus of *Thrissocles* (i.e. *Thryssa*) by Fowler (1941), *Thrissina* stands intermediate between *Stolephorus* and *Thryssa* (Whitehead, 1965b). The genus is monotypic according to all modern authors.

57. **Engraulis encrasicholoides** Bleeker, 1852 (pl. 15 fig. 1)

= *Thrissina baelama* (Forskål, 1775)

Engraulis encrasicholoides Bleeker, 1851, Nat. Tijdschr. Ned. Ind. **2**: 214 (Celebes; name only); Bleeker, 1852, Nat. Tijdschr. Ned. Ind. **3**: 173 (Batavia, Surabaya, Kam-mal, Kupang, 14 fishes, 86-120 mm tot. l.; Br. St. 12, D iii 12, P i 13, V i 6, A ii 24-26); Bleeker, 1852, Verh. Bat. Gen. **24**: 37 (1 fish ex Timor (Kupang) not yet included, otherwise as above).

Atlas: as *E. encrasicholoides*, 56 fishes, 55-138 mm tot. l., Java, Madura, Bali, Sumatra, Celebes, Timor, Ternata, Batjan, Amboina, Saparua, Ceram, Banda.

Auction Catalogue: as above, 44/3/3/3 (p. 46, no. 53).

RMNH: 45 fishes, separable into three lots: a. 11 juveniles 33.5-43.0 mm S.L. (39.6-53.5 mm tot. l.); b. 5 juveniles, 59.2-67.5 mm S.L. (approximately 73-82 mm tot. l.); c. 29 half-grown and adults, 66.5-102.0 mm S.L. (84.2-123.0 mm tot. l.). The two juvenile lots lack scales and are very flexible; they may be from the same original batch. RMNH 3536 and 23365.

AMS: 1 fish, as *Engraulis encrasicoloides* type (AMS I 88).

BMNH: 1 fish, 106.5 mm S.L. (130.7 mm tot. l., caudal tips damaged, estimated 133 mm), head not cut, very faint vertical pencil line above anal origin and possible pencil marks on head, especially along lower edge of maxilla, metal tag tied to peduncle [28.50], an ovigerous female, BMNH 1867.11.28.50. Listed as "One of the typical specimens" by Günther (1868: 388).

Type. — Although the British Museum specimen exactly matches the Atlas figure (pl. 263 fig. 4), it is too large to have come from the type series. Of the Leiden fishes, lots a. and b. are too small, and the two largest fishes in lot c. are too big. None of the specimens have cut heads, but the number of specimens described (14) gives a reasonable chance that a given specimen chosen as lectotype in fact came from the syntypical series. A specimen which appears to match Bleeker's maximum size is selected from the Leiden material.

The Australian Museum specimen was presumably from a later, duplicate collection.

Description. — Lectotype, a fish 96.5 mm S.L. (118.6 mm tot. l., caudal tips damaged, estimated 120 mm), head not cut, RMNH 3536.

Br. St. 13, D I + iii 12, P i 13, V i 6, A iii 24, gillrakers on lower part of 1st arch 20, scutes 7 + 9.

In percentages of standard length: body depth 23.8, head length 26.5; snout length 5.4, eye diameter 6.7, length of upper jaw 24.7, length of lower jaw 20.8; pectoral fin length 16.7, pelvic fin length 13.8, length of anal base 22.7; pre-dorsal distance 50.3, pre-pelvic distance 45.9, pre-anal distance 68.6.

Body moderately compressed, its width just over twice in its depth, belly not sharply keeled, scutes beginning behind pectoral base. Maxilla a little pointed posteriorly, reaching to just beyond articulation of lower jaw, projecting a little beyond the posterior of the two supra-maxillae; lower edge of maxilla finely toothed along whole length. Short, closely spaced teeth in lower jaw. Muscular portion of isthmus reaching well forward of margin of branchiostegal membrane. Gillrakers slender, $\frac{4}{5}$ of eye diameter and

about $1\frac{1}{2}$ times length of longest gill filaments. Pseudobranch present, exposed except for thin membrane covering basal $\frac{1}{4}$ of filaments, equal to eye diameter.

Posterior frontal fontanelles almost occluded but frontal tips separated in the midline.

Scutes present before and behind pelvic base but not before pectoral base; basal plate of scutes broad, with small spines (not needle-like, cf. *Stolephorus*).

Dorsal preceded by a small scute-like plate bearing a weakly developed spine (evidently missed by Bleeker originally, but "*parum conspicua*" in the Atlas); dorsal origin about equidistant between snout tip and caudal base. Pectoral tips almost reaching to pelvic base. Pelvic base slightly before dorsal origin, nearer to pectoral base than to anal origin; axillary scale present, just over $\frac{1}{2}$ length of fin. Anal origin behind last dorsal ray by one eye diameter, nearer to pelvic base than to caudal base.

Scales with up to 10 complete vertical striae; posterior border eroded, anterior border with several short horizontal striae, not reaching to centre of scale.

Colour. — Dorsal surfaces light brown, rest of flank silver. Fins hyaline.

Note. — In the Atlas (: 129) Bleeker distinguished his *E. encrasicholoides* from *E. baelama* by slight differences in scale count (36-38; cf. 40 in *E. baelama*), size of eye ($3\frac{1}{2}$ -4 in head; cf. 3), and anal length ($3\frac{1}{2}$ -4 in S.L.; cf. 3). More important, he states that in *E. baelama* there is a "*Carène prépectorale armée d'épines*". This is quite contrary to all present definitions of the genus (or subgenus) *Thrissina* (e.g. Fowler, 1941; Whitehead, 1965b). However, a Leiden A series specimen of *Thrissina baelama* of 106.8 mm S.L. (RMNH 7063, possibly the single Ceylonese specimen mentioned in the Atlas but slightly smaller than the Atlas figure, pl. 260 fig. 1, 139 mm tot. l.) has two small pre-pectoral scutes followed by a gap before the pre-pelvic series begins. Examination of British Museum material has shown that one or two pre-pectoral scutes occur in other specimens of *Thrissina baelama*, but not in those from the Red Sea (type locality) or from the Gulf of Aden, Mauritius and the Cocos Keeling Islands. The presence of such scutes may indicate a distinct form or subspecies of *T. baelama*, but more specimens are required.

Bleeker first used the name *Engraulis encrasicholoides* (see synonymy) in a list of fishes from Celebes. No description was given, and the name must date from the next publication.

Thryssa Cuvier, 1829

Thryssa Cuvier, 1829, Règne Animal 2: 176 (Type: *Clupea setirostris* Broussonet).
Thrissocles Jordan & Evermann, 1917, Genera of Fishes 1: 98 (Type: *Clupea setirostris* Broussonet).

A more complete generic synonymy and discussion of the validity of *Thrissa*, *Thryssa* and *Thryssus* has been given elsewhere (Whitehead, 1965b).

As already noted, Bleeker placed his species in *Engraulis*, with *Thryssa* Cuvier a junior synonym. In addition to *E. baelama* and *E. encrasicholoides*, he recognised seven other species (*E. kammalensis*, *E. poorawah*, *E. mystax*, *E. valenciennesi*, *E. dussumieri*, *E. setirostris*, and *E. purava*).

The genus *Thryssa* has long been in need of revision. Dr. S. Dutt is at present reviewing the several species found in Indian waters, and we are indebted to him for permission to use some of his data (particularly meristic counts).

The Bleeker material has been identified through the following key. Emphasis has been placed on the relative length of the maxilla, but as stated below, this character may yet prove subject to ontogenetic changes in some species.

- A. Maxilla reaching gill opening or just beyond
 - 1. Gillrakers 12-14 on lower part of 1st arch *T. hamiltonii* (Gray)
 - 2. Gillrakers 29 on lower part of 1st arch *T. kammalensis* (Blkr.)
- B. Maxilla reaching to base of pectoral or slightly beyond
 - 1. Anal rays 35-41; dorsal rays 13-16; gillrakers 14-16 *T. mystax* (Bloch & Schn.)
 - 2. Anal rays 43-49; dorsal rays 12-14; gillrakers 15-17 *T. purava* (Ham. Buch.)
- C. Maxilla reaching to pelvic base or beyond
 - 1. Maxilla to pelvic base; gillraker serrae of uneven lengths, in clumps
 *T. dussumieri* (Val.)
 - 2. Maxilla to anal origin; gillraker serrae of even length *T. setirostris* (Brouss.)

58. **Engraulis kammalensis** Bleeker, 1849 (pl. 15 fig. 2)

= *Thryssa kammalensis* (Bleeker, 1849)

Engraulis kammalensis Bleeker, 1849, Verh. Bat. Gen. 22: 13 (Madura Straits near Kammal and Surabaya; no number, 93 mm tot. l.; Br. St. 12, D I + iii 12, P i 11, V i 6, A ii 32, scales 32).

Atlas: as *Engraulis kammalensis*, 27 fishes, 60-112 mm tot. l., Java, Madura, Bali, Bangka, Sumatra, Singapore, Borneo, Celebes.

Auction Catalogue: as above, 19/2/2/2 (p. 46, no. 54).

RMNH: 17 fishes, separable into five lots: a. 1 fish 76.0 mm S.L. (about 93 mm tot. l.), very limp, no scales; b. 1 fish 47.3 mm S.L. (56.3 mm tot. l.); c. 6 fishes, 62.2-68.7 mm S.L. (81.3-84.8 mm tot. l.), stiff, scales lost;

d. 8 fishes, 68.1-74.1 mm S.L. (83.7-91.5 mm tot. l.), fewer scales lost, more flexible, light brown dorsally; e. 1 fish, 74.2 mm S.L. (94.2 mm tot. l.), still more flexible, scales entirely lost, light brown dorsally. RMNH 7067 and 24962.

AMS: 1 fish, as *Engraulis kammalensis* cotype (AMS B7650).

BMNH: 1 fish, 82.1 mm S.L. (approx. 100 mm tot. l.), BMNH 1867.11.28.56. (registered as *E. rhinorhynchus*).

Type. — The British Museum specimen is too large to have been a type of *E. kammalensis*. Amongst the Leiden fishes are four which are close to 93 mm tot. l. The first (single fish in lot e.) agrees in anal count with the original description (A ii 32), but has one less dorsal and pectoral ray (both sides counted). The second and third (two largest in lot d.) are the only ones in this lot which agree in pectoral count, but both have one less dorsal and one less anal ray. However, the single fish in lot a. agrees in all counts with the description, and the probability that it formed the basis of the original description is high. Since no number is given by Bleeker, it may be presumed that he had more than one original specimen, so the present fish must be designated lectotype. The Australian Museum cotype may have come from a later, duplicate series. The British Museum fish exactly matches the Atlas figure (pl. 265 fig. 2).

Description. — Lectotype, a fish 76.0 mm S.L. (approx. 93 mm tot. l., but caudal tips broken), belly damaged, pectoral tips broken, scales partly lost, RMNH 7067.

Br. St. 10, D I + iii 12, P i 11 (left) i 10 (right), V i 6, A ii 32 (or iii 31), gillrakers on lower part of 1st arch 29, scutes 13 (? + 5) + 8 (? + 1).

In percentages of standard length: body depth 28.4, head length 24.8; snout length 5.5, eye diameter 6.2, upper jaw length 23.4, lower jaw length 16.7; pectoral fin length 13.0 (broken at tip), pelvic fin length 8.3, length of anal base 30.2; pre-dorsal distance 49.0, pre-pelvic distance 44.5, pre-anal distance 64.3.

Body strongly compressed, its width about $3\frac{1}{2}$ times in its depth, belly sharply keeled, scutes beginning at isthmus. Maxilla reaching to just beyond gill opening, tapering but not sharply pointed posteriorly, projecting well beyond 2nd supra-maxilla, toothed along entire lower edge; anterior supra-maxilla absent (present in British Museum specimen, rectangular). Lower jaw with a single series of small, close-set teeth.

Gillrakers fine and slender, about twice length of longest gill filaments, $\frac{3}{4}$ eye diameter. Muscular portion of isthmus reaching well in advance of margin of branchiostegal membrane. Pseudobranch concealed by membrane

except for tips of longest filaments. Posterior frontal fontanelles open, about $\frac{1}{2}$ eye diameter in length.

Dorsal about midway between snout tip and base of caudal, preceded by a small spine. [Pectoral tips in British Museum specimen almost reaching pelvic base; axillary scale present, $\frac{1}{2}$ length of fin]. Pelvic base in advance of dorsal origin, nearer to pectoral base than to anal origin. Anal origin just behind last dorsal ray, a little nearer to pectoral base than to caudal base.

Colour. — Dorsal $\frac{1}{4}$ of body light brown, rest of flanks silver. Fins hyaline.

Note. — *T. kammalensis* can be separated from *T. hamiltonii* by its higher gillraker count (29 in the lectotype; cf. 12-14 in *T. hamiltonii*) and lower anal count (34; cf. 38-43) (figures from Dutt, in litt.). Fowler (1941) finds the anal origin slightly more advanced in *T. hamiltonii*.

59. *Engraulis rhinorhynchos* Bleeker, 1852

= *Thryssa kammalensis* (Bleeker, 1849)

Engraulis rhinorhynchos Bleeker, 1852, Nat. Tijdschr. Ned. Ind. **3**: 434 (Sampit, Batavia, Surabaja, Kammal; 24 fishes, 70-110 mm tot. l.; Br. St. 11, D I + iii 10-11, P i 11, V i 6, A iii 31-32, scales 35); Bleeker, 1852, Verh. Bat. Gen. **24**: 40 (Batavia, Surabaja, Kammal; 9 fishes, 80-110 mm tot. l.; counts as before).

Engraulis rhinorhynchos: Bleeker, 1852, Nat. Tijdschr. Ned. Ind. **3**: 445 (Banka; name only).

Atlas: in synonymy of *E. kammalensis*.

Auction Catalogue: included presumably in *E. kammalensis*.

RMNH: no specimens labelled *E. rhinorhynchos*.

BMNH: 1 fish, 82.1 mm S.L. (approx. 100 mm tot. l.). Registered as *E. rhinorhynchus* and listed under that species as "Typical specimen, 95 mm long. Java" by Günther (1868: 394).

MNHN: 1 fish, 87 mm tot. l., ex Banka (don. Bleeker, 1856) MNHN 1232 (see Bertin, 1940).

Type. — Bleeker included his *E. kammalensis* of the Madura paper in the synonymy of *E. rhinorhynchos*, but gave no hint why he was proposing a new name. He used the name in a number of papers up to 1861, and then placed it (correctly) in the synonymy of *E. kammalensis* in the Atlas. Günther (1868) gave *E. rhinorhynchos* priority, again for no apparent reason, since there was no question of homonymy. Similarly, Bleeker had given *E. russellii* Blkr., 1852, priority over *E. balinensis* Blkr., 1849 (see above, p. 114), and

Spratella tembang Blkr., 1851, priority over *Clupea gibbosa* Blkr., 1849 (p. 56).

Although the description of *E. rhinorhynchos* differs from that of *E. kammalensis* in branchiostegal and dorsal counts, the fact that the latter name was not used thereafter in any lists of fishes until the Atlas strongly suggests that Bleeker considered the two synonymous and was not proposing a new species. *Engraulis rhinorhynchos* must therefore be treated as a replacement name, and the type is the type of *E. kammalensis*.

60. **Engraulis grayi** Bleeker, 1851 (pl. 15 fig. 3)

= *Thryssa hamiltonii* (Gray, 1835)

Engraulis grayi Bleeker, 1851, Nat. Tijdschr. Ned. Ind. 2: 492 (Batavia, Rio; 23 fishes, 100-210 mm tot. l.; Br. St. 12-13, D I + iii 11-12, P i 11-12, V i 6, A iii 35-37, scales 40-45); Bleeker, 1852, Nat. Tijdschr. Ned. Ind. 3: 445 (Banka; name only); Bleeker, 1852, Verh. Bat. Gen. 24: 41 (Batavia; 20 fishes, 100-210 mm tot. l.; counts as before).

Atlas: as *Engraulis poorawah*, 35 fishes, 100-210 mm tot. l., Java, Sumatra, Singapore, Bintang, Banka, Borneo, Celebes, Batjan, Ceram.

Auction Catalogue: as above, 23/3/3/3 (p. 46, no. 55).

RMNH: as *E. poorawah*, 20 fishes, 105.0-161.0 mm S.L. (132.7-200.0 mm tot. l.), preservation condition similar in all except three, which are rather more limp, RMNH 7068 and 24963.

BMNH: no Bleeker specimens labelled either '*poorawah*' or '*grayi*'; 1 fish, 143 mm S.L. (175 mm tot. l. estimated), registered as *Engraulis hamiltonii* (not listed by Günther), BMNH 1867.11.28.51.

Type. — None of the Leiden fishes reach either the maximum or the minimum sizes given in Bleeker's original description, although only three specimens appear to have been lost since the auction. Twelve fishes were added to the 23 syntypes by the time of the Atlas, so that the chances of picking out one of the original syntypes are not high. However, the largest remaining fish has the right side of the head cut and is close to the size of the Atlas figure (pl. 259 fig. 5). It can be selected as lectotype.

The British Museum specimen has neither pencil marks nor a cut head, but may well have been a syntype.

Description. — Lectotype, a fish, 161.0 mm S.L. (200 mm tot. l.), in good condition, head cut horizontally on right side, RMNH 7068.

Br. St. 12, D I + iii 12, P i 12, V i 6, A iii 34, gillrakers on lower part of 1st arch 11 (both sides), scutes 17 + 10.

In percentages of standard length: body depth 29.0, head length 24.6;

snout length 4.7, eye diameter 5.3, length of upper jaw 23.8, length of lower jaw 18.1; pectoral fin length 18.1, pelvic fin length 7.0, length of anal base 30.4; pre-dorsal distance 55.8, pre-pelvic distance 41.0, pre-anal distance 63.5.

Body strongly compressed, belly keeled, scutes beginning at isthmus. Maxilla reaching to just beyond gill opening, tapering posteriorly, projecting well beyond posterior supra-maxilla (by 7 per cent of S.L.), toothed along entire lower edge; anterior supra-maxilla present on left side only. Lower jaw with a single series of small, close-set teeth.

Gillrakers fine and slender, present also on posterior face of 3rd epibranchial.

Dorsal with small spine preceding first unbranched ray; vertical from dorsal origin $\frac{2}{3}$ of the distance from the pelvic base to the anal origin. Pectoral tips reaching to half way along pelvic fins. Pelvic base nearer to pectoral base than to anal origin by $1\frac{1}{3}$ eye diameter. Anal origin behind last dorsal ray.

Colour. — Dorsal surfaces brown, flanks silver, a triangular suprascapular area with three major and several minor parallel, horizontal grey venules.

Note. — In the original description and subsequently, Bleeker placed *Thryssa hamiltonii* Gray, 1835 (based on a Hardwicke illustration) as a junior synonym of his *E. grayi*. His reason for proposing a new name is not clear. Fowler (1941) and others have equated the two, and have attributed a low gillraker count to *T. hamiltonii*, although this cannot of course be derived from the Hardwicke drawing (no type specimen exists).

If, as Fowler (1941) and Dutt (in litt.) accept, the maxilla always reaches only to the gill opening in *T. hamiltonii*, then Russell's *Poorawah* (Russell, 1803: 72, pl. 289) must be a different species. Bleeker (Atlas: 135) placed his *E. grayi* in the synonymy of *E. poorawah*. Clearly, Bleeker overlooked the longer maxilla in Russell's *Poorawah* when he equated it with his own *E. grayi* (to pectoral base according to Russell). The Hardwicke illustration of *Thryssa hamiltonii* (Gray, 1835, pl. 92 fig. 3) shows the maxilla projecting a little beyond the gill opening but not reaching the pectoral base i.e. as in the lectotype of *Engraulis grayi* Bleeker described here.

61. *Engraulis mystacoides* Bleeker, 1852 (pl. 16 fig. 1)

= *Thryssa mystax* (Bloch & Schneider, 1801)

Thryssa porava: Bleeker, 1849, Verh. Bat. Gen. 22: 14 (Bangcallang, Kammal, Surabaya; no number, 179 mm tot. l.; Br. St. 12, D i 13, P i 12, V i 6, A i 36, max. to pectoral base).

Engraulis mystacoides Bleeker, 1852, Verh. Bat. Gen. 24: 42 (Batavia, Samarang, Sura-

baja, Pasuruan, Tjilatjap, also Bangcallang, Kammal, Sumanap, Madura I.; 27 fishes, 80-185 mm tot. l.; Br. St. 12-14, D I + iii 11-12, P i 11-12, V i 6, A iii 33-35, max. to pectoral base).

Atlas: as *E. mystax*, 27 fishes, 80-190 mm tot. l., Java, Madura, Sumatra, Singapore, Bangka, Borneo.

Auction Catalogue: as above, 19/2/2/2/2 (p. 46, no. 56).

RMNH: as *E. mystacoides*, 13 fishes, 65.0-144.8 mm S.L. (81-183 mm tot. l., largest possibly 185 mm), RMNH 7069 and 24966.

BMNH: 1 fish, 139.4 mm S.L. (172 mm tot. l.), head not cut, metal tag tied to caudal peduncle [28.54], BMNH 1867.11.28.54. Listed as "From Dr. Bleeker's Collection as *Engraulis mystacoides*" by Günther (1868: 396).

Type. — The largest of the Leiden specimens has a total length of 183 mm, but this may have been 185 mm in life. Although further localities are added in the Atlas, the same total of specimens is given, suggesting that only the 27 syntypes were kept (but the size range is increased by 5 mm in the Atlas). The British Museum and the Leiden fishes should, therefore, all belong to the syntypical series. The largest Leiden fish is here chosen as lectotype. The British Museum specimen matches the Atlas figure (pl. 261 fig. 2), but it lacks pencil marks on the flanks.

Description. — Lectotype, a fish, 144.2 mm S.L. (estimated 185 mm tot. l.), in fair condition, RMNH 7069.

Br. St. 14, D I + iii 12, P i 12, V i 6, A iii 34, gillrakers on lower part of 1st arch 13 (left) 14 (right), scutes 17 + 11.

In percentages of standard length: body depth 25.7, head length 24.4; snout length 4.9, eye diameter 5.4, upper jaw length 27.2 (tip broken, estimated 28.0), lower jaw length 19.2; pectoral fin length 17.0, pelvic fin length 8.0, length of anal base 28.3; pre-dorsal distance 55.3, pre-pelvic distance 41.2, pre-anal distance 63.5.

Body fairly strongly compressed, its width $2\frac{1}{2}$ times in its depth, belly sharply keeled, scutes beginning at isthmus. Maxilla just reaching base of 1st pectoral ray (about 1 mm of tip missing), tapering and pointed posteriorly, projecting well beyond 2nd supra-maxilla (8.5 per cent of S.L. beyond), toothed along entire lower edge; anterior supra-maxilla present, small, oval. Lower jaw with a single series of small close-set teeth.

Gillrakers fine, slender, twice length of longest gill filaments, $\frac{3}{4}$ eye diameter; inner face of rakers with an even series of short serrae. Muscular portion of isthmus just reaching margin of branchiostegal membrane. Pseudobranch entirely covered by membrane. Posterior frontal fontanelles open, triangular, about $\frac{1}{2}$ eye diameter in length.

Dorsal preceded by small spine, dorsal origin nearer to caudal base than to snout tip, a little behind midpoint between pelvic base and anal origin. Pectoral fins reaching to about half way along pelvics. Pelvic base nearer to pectoral base than to anal origin by about 1 eye diameter. Anal origin just behind last dorsal ray, nearer to pectoral base than to caudal base.

Colour. — Upper $\frac{1}{5}$ of body light brown, remainder of flanks, silver; triangular suprascapular area with several faint horizontal lines. Fins hyaline.

Note. — Even in the smallest of the Leiden fishes (65.0 mm S.L.) the maxilla reaches to the base of the 1st pectoral ray. Otherwise there is little to distinguish this specimen from the lectotype of *T. grayi*. Maxilla length may show allometric growth in relation to pre-pectoral distance, but until this can be shown with certainty, it is best to regard *T. grayi* and *T. mystax* as distinct.

62. ***Stolephorus (Thryssa) valenciennesi*** Bleeker, 1866

= *Thryssa mystax* (Bloch & Schneider, 1801)

Engraulis mystax: Bleeker, 1852, Verh. Bat. Gen. **24**: 43 (Batavia; 1 fish, 120 mm tot. l.; Br. St. 13, D I + iii 10, P i 11, V i 6, A iii 37-38, scales 35, max. to pectoral base).

Stolephorus (Thryssa) valenciennesi Bleeker, 1866, Ned. Tijdschr. Dierk. **3**: 306 (Java, Sumatra, Singapore, Borneo; 19 fishes, 80-130 mm tot. l.; Br. St. 12-13, D I + iii 10-11, P i 11-12, V i 6, A iii 35-39, scales 35-36, max. to pectoral base).

Atlas: as *Engraulis valenciennesi*, 19 fishes, 80-130 mm tot. l., Java, Sumatra, Pinang, Singapore, Borneo.

Auction Catalogue: as above, 11|2|2|2|2 (p. 46, no. 57).

RMNH: 1 fish, 98.2 mm S.L. (approx. 123 mm tot. l.), RMNH 7071; 8 fishes, 50.2-80.8 mm S.L. (65-98 mm tot. l.), RMNH 24413.

BMNH: 1 fish, 100 mm S.L. (118 mm tot. l., caudal tips broken, estimated 125 mm), head not cut, metal tag sewn to peduncle [28.53], BMNH 1867. 11.28.53. Listed as "From Dr. Bleeker's Collection as *Engraulis mystax*" by Günther (1868: 396). A manuscript label with the specimen reads "*Engraulis mystax* Cuv.? Blkr. = *Stolephorus (Thryssa) valenciennesi* Blkr.", as in the list sent to Günther.

Type. — The Atlas and auction totals confirm that Bleeker received no additional specimens after 1866. The nine Leiden and single British Museum specimen should all, therefore, be syntypes. However, two of the Leiden specimens are too small (i.e. under 80 mm tot. l.). The Leiden fish of 98.2 mm S.L. is chosen here as lectotype. It is in good condition and its meristic counts match the description.

Description. — Lectotype, a fish 98.2 mm S.L. (approx. 123 mm tot. l.), head not cut, RMNH 7071.

Br. St. 14, D I + iii 10, P i 11, V i 6, A iii 37, gillrakers on lower part of 1st arch 16, scutes 16 + 9.

In percentages of standard length: body depth 29.4, head length 24.5; snout length 4.6, eye diameter 6.2, length of upper jaw 27.0, length of lower jaw 18.9; pectoral fin length 12.7 (tip broken), pelvic fin length 6.1 (tip broken), length of anal base 33.7; pre-dorsal distance 52.9, pre-pelvic distance 42.3, pre-anal distance 61.3.

Body strongly compressed, its width just over 3 times in its depth, belly sharply keeled, scutes beginning at isthmus. Maxilla reaching to pectoral base, tapering and pointed posteriorly, projecting well beyond 2nd supra-maxilla, toothed along entire lower edge; anterior supra-maxilla circular. Lower jaw with a single series of small, close-set teeth.

Gillrakers fine, slender, twice as long as longest gill filaments, $\frac{3}{4}$ eye diameter; inner face of rakers with an even series of short serrae. Muscular portion of isthmus reaching well forward of margin of branchiostegal membrane. Pseudobranch entirely covered by membrane. Posterior frontal fontanelles open, about $\frac{1}{2}$ eye diameter in length.

Dorsal fin preceded by a small spine, dorsal origin nearer to snout tip than to caudal base. [Pectoral tips reaching about $\frac{1}{3}$ along pelvic fins in British Museum specimen]. Pelvic base nearer to pectoral base than to anal origin by about 1 eye diameter. Anal origin a little before last dorsal ray, nearer to pectoral base than to caudal base.

Colour. — Upper $\frac{1}{5}$ of body light brown, remainder of flanks silver; faint horizontal venulose marks in supra-scapular region. Fins hyaline.

Note. — Bleeker separated this species in the Atlas from *T. mystax* by its lower scale count (35-36; cf. 45), shorter head ($4\frac{1}{4}$ - $4\frac{1}{3}$ in S.L.; cf. 4-4 and a bit) which was as deep as long (cf. longer than deep), and longer anal base ($2\frac{4}{5}$ -3 times in S.L.; cf. 3-3 and a bit). Scale counts cannot now be compared, but a difference of 10 scales is too large for individual variation. However, Fowler (1941) records 40-42 scale pockets in his specimens of *T. mystax*. Comparison of the lectotypes of *E. mystacoides* and *E. valenciennesi* confirms Bleeker's other differences, but the specimen of the latter is a smaller fish. Fowler (1941) considered *T. valenciennesi* distinct, but Dutt (in litt.) places it in the synonymy of *T. mystax*. For the present it seems preferable to unite the two species. On the data supplied by Dutt (in litt.), *T. purava* has a higher anal count (43-49; cf. 40 in the lectotype of *T. valenciennesi*) but a similar dorsal count.

63. ***Thryssa macrognathos*** Bleeker, 1849 (pl. 16 fig. 2)

= *Thryssa setirostris* (Broussonet, 1782)

Thryssa macrognathos Bleeker, 1849, Verh. Bat. Gen. 22: 14 (Madura near Bangcallang,

Kammal and Surabaya; no number, 108 mm tot. l.; Br. St. 12, D ii 10, P i 13, V i 6, A i 35, max. to anal origin).

Atlas: in synonymy of *E. setirostris*, 13 fishes, 70-170 mm tot. l., Java, Madura, Bali, Sumatra, Nias, Bangka, Celebes, Amboina.

Auction Catalogue: as above, 5/2/2/2 (p. 46, no. 59).

RMNH: as *E. setirostris*, 4 fishes, 125-167 mm tot. l., RMNH 7064 (no specimens labelled '*macrognathos*').

BMNH: 1 fish, 126.7 mm S.L. (approx. 156 mm tot. l., caudal tips broken), head cut, metal tag sewn to caudal peduncle [28.58], BMNH 1867.11.28.58. Listed as "From Dr. Bleeker's Collection" under *Engraulis setirostris* by Günther (1868: 398).

Type. — The four Leiden fishes and single British Museum Bleeker specimen are all too large to have been the original type(s). The first reference to the number of specimens (Bleeker, 1852d) gives 3 fishes, 108-144 mm tot. l., adds Batavia to the list of localities, and places *Thryssa macrognathos* in the synonymy of *Engraulis setirostris* (in which it thereafter remained). The British Museum fish and the largest of the Leiden fishes are too large even for the description of 1852. Since ten further fishes were added up to the time of the Atlas, there can be no certainty that any of the remaining Leiden specimens were from the type series. However, the species is well known, and its extremely long maxillae and large coronoid process in the lower jaw are unique in this genus. Should a neotype designation ever become necessary, the British Museum specimen is suitable because it has the cut head indicative of individual examination by Bleeker.

Note on *Engraulis dussumieri* Val.

Valenciennes (1848: 69) based this species on a note by Dussumier. Bleeker (1852d) identified 24 specimens from Batavia (90-140 mm tot. l.) as this species, distinguishing it from *Thryssa setirostris* by its shorter maxilla and anal base, longer head and deeper body (Atlas: 130). The long maxilla in this species suggests affinities with *Thryssa setirostris*, but *T. dussumieri* lacks the steeply rising coronoid process so characteristic of the latter. An affinity with *T. vitrirostris* (Gilchrist & Thompson) is suggested by the form of the gillrakers; in both species the serrae which lie along the inner edge of each raker are not even in length but are clumped into groups of longer serrae interspersed by shorter serrae.

The single British Museum Bleeker specimen (110 mm S.L., estimated 135 mm tot. l. — BMNH 1867.11.28.49) bears distinct pencil marks and

clearly matches the Atlas figure (pl. 260 fig. 2). There are 16 Bleeker specimens from the Auction in Leiden (RMNH 7065).

Setipinna Swainson, 1839

Setipinna Swainson, 1839, Nat. Hist. Animals **2**: 292 (Type: *Setipinna megalura* Swainson = *Clupea phasa* Ham. Buch., designated by Swain, 1882, Proc. Acad. nat. Sci. Philad.: 280).

Telara Günther, 1868, Cat. Fish. Brit. Mus. **7**: 400 (Type: *Clupea telara* Ham. Buch. = *Clupea phasa* Ham. Buch.)

Heterothrissa Günther, 1868, Cat. Fish. Brit. Mus. **7**: 401 (Type: *Engraulis breviceps* Cantor).

Bleeker in the Atlas placed his material in three of the five known species of *Setipinna* (*S. taty*, *S. melanochir* and *S. breviceps*); the two other species, *S. phasa* (Ham. Buch.) and *S. godavari* Rao, are known only from India or Burma. Günther (1868) and some later authors have placed the highly compressed forms with long lower jaws in a separate genus (*Heterothrissa*), and a revision of the species may show this to be justified. The end point in lower jaw elongation and shortening of the dorsal length of the head is found in *S. breviceps*, where the latter measurement is about 8-10 per cent of S.L. and the lower jaw projects beyond the snout. Jordan & Seale (1926) resurrected *Stethochaetus* Gronow to replace *Heterothrissa* Günther; Fowler (1941) was also misled. But as shown by Fraser-Brunner (1952) and Wheeler (1958), the type of Gronow's genus is an anabantid fish.

Bleeker's material has been identified by the following key.

1. Dorsal nearer to snout tip than to caudal base; gillrakers 13-18, with definite clumps of longer serrae on each raker; lower jaw not projecting.
 - i. G.r. ca. 18
 - a. Anal with 50-60 rays; pre-pelvic scutes 18-26 *S. taty* (Val.)
 - b. Anal with 72-75 rays; pre-pelvic scutes 15-16 *S. phasa* (Ham. Buch.)
 - ii. G.r. 13-16, A 49-58, scutes 17-22 *S. godavari* Rao
2. Dorsal midway between snout tip and caudal base, or nearer latter; gillrakers 11-13, at most a distal and proximal clump of serrae; lower jaw projects.
 - a. Anal with 44-50 rays *S. melanochir* (Blkr.)
 - b. Anal with 60 rays *S. breviceps* (Cantor)

64. **Engraulis telaroides** Bleeker, 1849 (pl. 16 fig. 3)

= *Setipinna taty* (Valenciennes, 1848)

Engraulis telaroides Bleeker, 1849, Verh. Bat. Gen. **22**: 13 (Madura, near Sampang, Kammal and Surabaya; no number, 112 mm tot. l.; Br. St. 12, D I + i 12, P i 12, V i 6, A i 48-51).

Engraulis taty: Bleeker, 1852, Verh. Bat. Gen. **24**: 36 (Batavia, Surabaya, Sampang, Kammal; 21 fishes, 100-145 mm tot. l.; Br. St. 12, D I + iii 10- ii 11, P i 13, V i 6, A iii 49-50).

Atlas: as *S. taty*, 24 fishes, 100-170 mm tot. l., Java, Madura, Sumatra, Pinang, Singapore, Bangka, Borneo.

Auction Catalogue: as *E. tati* (misspelt), 16/2/2/2/2 (p. 46, no. 61).

RMNH: 12 fishes, separable into three preservation lots: a. 1 fish, 118 mm S.L. (145 mm tot. l., estimated), dorsal parts slate grey, flexible; b. 4 fishes, 87-122 mm S.L. (112-148.5 mm tot. l., estimated), dorsal parts brown, flexible; c. 7 fishes, 84.0-125.0 mm S.L. (105-155 mm tot. l., estimated), dorsal parts brown, body hard, RMNH 7080 and 24964.

BMNH: 1 fish, 105.5 mm S.L. (132 mm tot. l., estimated), head not cut, no pencil marks, BMNH 1867.11.28.59. Registered and listed by Günther (1868: 401) as *Engraulis taty*. A manuscript note in the jar reads "*Engraulis taty* Val. = *Stolephorus (Setipinna) taty*".

Type. — Of the Leiden specimens, the fish in preservation lot a. is too large, as are also the fishes in lot c., except the smallest whose type status remains doubtful in view of the number of subsequent additions to the original material.

The smallest in lot b. matches the original length described. It is not clear, however, how many of the 21 fishes in the second description were new specimens from Batavia. The chances that the specimen chosen here as type in fact came from the syntypical series may not be as great as in previous cases, and there are some discrepancies in finray counts. For this reason the term putative neotype is preferred (*sensu* Cox).

The British Museum specimen is too large to have been the type.

Description. — Putative neotype, a fish 87.0 mm S.L. (107 mm tot. l., caudal lobes broken, 112 mm estimated), in fair condition, RMNH 7080.

Br. St. 12, D I + iii 11, P i 13, V i 6, A iii 50, gillrakers on lower part of 1st arch 18, scutes 21 + 9.

In percentages of standard length: body depth 30.3, head length 21.0; snout length 3.9, eye diameter 4.8, length of upper jaw 18.4, length of lower jaw 16.5; pectoral fin length 36.0, pelvic fin length 8.3, length of anal base 46.6; pre-dorsal distance 47.5, pre-pelvic distance 36.7, pre-anal distance 49.9.

Body highly compressed, its width $4\frac{1}{2}$ times in its depth, belly sharply scuted, scutes beginning at isthmus. Maxilla short, barely reaching to articulation of lower jaw, obliquely truncate posteriorly, projecting little beyond 2nd supra-maxilla, finely toothed along entire lower edge; 2nd supra-maxilla semi-circular, no sign of 1st supra-maxilla. Lower jaw with a series of fine, close-set teeth.

Gillrakers fine, slender, twice length of longest gill filaments, $\frac{3}{4}$ eye diameter; inner face of rakers with clumps of longer serrae interspersed with short serrae. Muscular portion of isthmus reaching to just in front

of branchiostegal membrane. Pseudobranch entirely covered by membrane. Posterior frontal fontanelles open, about $\frac{1}{2}$ eye diameter.

Dorsal fin preceded by small spine, dorsal origin nearer to snout tip than to caudal base. Pectorals with filamentous first ray which reaches beyond anal origin by 2 eye diameters; 2nd ray reaching to pelvic base. Pelvic base in front of dorsal origin, nearer to anal origin than to pectoral base by $\frac{1}{2}$ eye diameter. Anal origin under 1st branched dorsal ray. [Pectoral and pelvic axillary scales present in British Museum specimen].

Colour. — Upper $\frac{1}{5}$ of body brown, rest of flanks silver, golden where scale cover retained. Fins hyaline.

Note. — Authors, including Bleeker, have had no hesitation in assigning this species to *S. taty*, a widespread species recorded from India to Korea. In his key, Fowler (1941: 687) distinguished this species from either *S. melanochir* or *S. phasa* by its anal origin "well behind dorsal origin". In the present specimen, the 1st anal ray is below the 1st branched dorsal ray, but this appears to be a juvenile condition. In the British Museum specimen, for example, the anal origin is almost below the middle of the dorsal base. Similarly, the pectoral filaments are proportionately longer in the British Museum fish, reaching $\frac{2}{3}$ along the anal base.

A second British Museum specimen, 132 mm S.L. (BMNH 1867.II.28.63), of *S. taty* derives from the Bleeker collection of 1867. It was registered as *Engraulis telara* and listed by Günther (1868: 401) under that name.

65. *Engraulis melanochir* Bleeker, 1849 (pl. 17 fig. 1)

= *Setipinna melanochir* (Bleeker, 1849)

Engraulis melanochir Bleeker, 1849, Verh. Bat. Gen. 22: 13 (Kammal and Surabaya; no number, 225 mm tot. l.; Br. St. 12, D I + iii 13, P i 13, V i 6, A iii 38); Bleeker, 1852, Verh. Bat. Gen. 24: 36 (Surabaya, Kammal, Bandjermassing; 3 fishes, 90-225 mm tot. l.; Br. St. 12-13, D I + iii 11-13, P i 13, V i 6, A iii 48-50).

Atlas: as *Setipinna melanochir*, 22 fishes, 90-270 mm tot. l., Java, Madura, Sumatra, Borneo.

Auction Catalogue: as above, 10/3/3/3 (p. 46, no. 60).

RMNH: 12 fishes, 96.3-215.0 mm S.L. (approx. 112-255 mm tot. l.), RMNH 7079 and 24967.

BMNH: 1 fish, 212 mm S.L. (253 mm tot. l.), head not cut, pencil marks, metal tag round caudal peduncle [28.52], BMNH 1867.II.28.52. Listed as "One of the typical specimens" by Günther (1868: 400).

Type. — Although the British Museum specimen has pencil marks on the left flank and matches the Atlas figure (pl. 267 fig. 3), it is too large to have come either from the type series or from the additional Bandjermassing

material. The specimen of 225 mm appears to have been lost. The nearest to this length amongst the Leiden material are two fishes, 220 and 230 mm tot. l. The smaller of the two is chosen here as putative neotype since it shows obvious signs of having been examined; in particular, the anal fin membrane is torn after every tenth ray.

Description. — Putative neotype, a fish 180.0 mm S.L. (approx. 220 mm tot. l., caudal tips damaged), no pencil marks, head not cut, scales entirely shed, RMNH 7079.

Br. St. 14, D I + iii 12, P i 13, V i 6, A iii 46, gillrakers on lower part of 1st arch 11, scutes 19 + 9.

In percentages of standard length: body depth 32.2, head length 20.1; snout length 2.9, eye diameter 3.8, length of upper jaw 16.7, length of lower jaw 16.0; pectoral fin length 24.5, pelvic fin length 7.7, length of anal base 44.2; pre-dorsal distance 55.6, pre-pelvic distance 37.5, pre-anal distance 52.5.

Body highly compressed, its width 4 times in its depth, belly sharply keeled, scutes beginning at isthmus, more prominent behind pectoral base. Jaws equal, snout barely projecting beyond tip of lower jaw when mouth closed. Maxilla reaching to articulation of lower jaw, bluntly rounded posteriorly, projecting little beyond 2nd supra-maxilla; the latter thin, semi-circular, with fleshy membrane posteriorly; no anterior supra-maxilla. Upper and lower jaws with a single series of small teeth, more close-set in lower jaw.

Gillrakers fairly short, plate-like, broadly based, a little longer than longest gill filaments, almost eye diameter; inner face of rakers with scattered serrae of varying lengths; gillrakers absent on posterior face of 3rd epibranchial but this part of the arch with numerous fine and short serrae. Muscular portion of isthmus just reaching hind border of branchiostegal membrane. Pseudobranch concealed, perhaps absent. Posterior frontal fontanelles crescentic, almost occluded.

Dorsal origin behind anal origin and nearer to caudal base than to snout tip; preceded by small spine. Pectoral with filamentous 1st ray reaching to beyond pelvic tips and half way between base of pelvic and anal origin. [In British Museum fish, axillary scale present, about $\frac{3}{4}$ length of fin without filament]. Pelvic base nearer to pectoral base than to anal origin. Anal with scaly basal sheath, anal origin slightly before 1st unbranched dorsal ray.

Colour. — Dorsal $\frac{1}{5}$ of body brown, remainder of flanks silver, golden where scale cover retained. Fins hyaline.

Note. — The branchiostegal and dorsal counts are fairly close to Bleeker's

description, but the anal has 8 more rays. The anal counts for seven other Leiden specimens were 44, 45, 46, 47, 48, 49, 50 (one of each). Bleeker's count of iii 38 was evidently an error, which he corrected to iii 48-50 in his next description (Bleeker, 1852d). Weber & De Beaufort (1913) give 50-53 rays for this species, and Fowler (1941) 46-47 (branched) rays.

66. **Engraulis pfeifferi** Bleeker, 1852 (pl. 17 fig. 2)

= *Setipinna breviceps* (Cantor, 1850)

Engraulis pfeifferi Bleeker, 1852, Nat. Tijdschr. Ned. Ind. 3: 433 (Kapuas river, Pontianak, E. Borneo; 1 fish, 225 mm tot. l.; Br. St. 18, D I + iii 14, P i 12, V i 6, A iii 58, scutes 27).

Atlas: as *Setipinna breviceps*, 6 fishes, 108-306 mm tot. l., Pinang, Borneo.

Auction Catalogue: as above, 3/1/1/0/0 (p. 46, no. 62).

RMNH: 3 fishes, 155-245 mm S.L. (190-290 mm tot. l.), RMNH 7077 and 24965.

BMNH: 1 fish, 238 mm S.L. (285 mm tot. l., caudal tips broken), pencil marks on left flank, head not cut, BMNH 1867.11.28.55. Listed as "Type of *E. pfeifferi*" by Günther (1868: 402).

Type. — The British Museum specimen (Plate 1) is almost certainly that from which the Atlas figure (pl. 263 fig. 3) was made. It is, however, too large to have been the holotype. Amongst the Leiden fishes is one whose estimated total length appears to have been 225 mm. Since only two Leiden fishes are now missing, the chances that this specimen is indeed the holotype are fairly high, particularly since the finrays and branchiostegal rays show evidence of having been counted.

Description. — Holotype, a fish 195 mm S.L. (estimated 225 mm tot. l.), caudal tips broken, in good condition, RMNH 7077.

Br. St. 19, D I + iii 14, P i 12, V i 6, A iii 57, gillrakers on lower part of 1st arch 11, scutes 22 + 9.

In percentages of standard length: body depth 25.3, head length 17.9; snout length 2.8, eye diameter 2.2, upper jaw length 16.9, lower jaw length 17.4; pectoral fin length 15.5, pelvic fin length 7.5, length of anal base 52.5; pre-dorsal distance 50.5, pre-pelvic distance 30.2, pre-anal distance 42.2.

Body highly compressed, its width $4\frac{1}{2}$ times in its depth, belly sharply keeled, scutes beginning at isthmus. Lower jaw slightly longer than upper, projecting beyond snout, lower jaw at an angle of about 45° when mouth closed. Maxilla blunt posteriorly, reaching to articulation of lower jaw, toothed along entire lower edge, projecting little beyond 2nd supra-maxilla; the latter thin, plate-like, expanded anteriorly and tapering posteriorly; no

anterior supra-maxilla. Lower jaw with a single series of fine teeth, more close-set than in upper jaw.

Gillrakers fairly short, about twice length of longest filaments, $1\frac{1}{4}$ times eye diameter; gillrakers with broad base, plate-like, inner face with large tooth-like serrae at base and at tip, smaller serrae in between; no gillrakers on posterior face of 3rd epibranchial. Opercular series distorted from normal arrangement by elongation of lower jaw, operculum failing to cover gill opening, gill filaments of 3rd and 4th arches exposed. Muscular portion of isthmus not quite reaching to hind border of branchiostegal membrane. Pseudobranch minute, less than $\frac{1}{2}$ eye diameter, concealed by membrane. Posterior frontal fontanelles crescentic, almost occluded.

Dorsal origin about midway between snout tip and caudal base, well behind anal origin [above 10th branched anal ray in British Museum specimen]; dorsal preceded by well formed spine. Pectoral filaments broken, 2nd pectoral ray reaches beyond pelvic base [pectoral filaments reach halfway along anal in two other Leiden fishes; to anal origin but damaged in British Museum fish]. Pelvic a little nearer to pectoral base than to anal origin [axillary scale present in British Museum specimen]. Anal origin well in advance of 1st dorsal ray.

Colour. — Brown, a little silver round abdominal region. Fins hyaline [darker caudal fringe in British Museum fish].

Note. — The final anal ray is double, which may account for Bleeker's count of iii 58. The final branchiostegal ray is closely associated with the opercular series and was probably not counted by Bleeker. The remaining meristic counts confirm that this is the holotype.

In the Atlas (: 137) Bleeker accepted Günther's synonymy of this species with *Engraulis breviceps* Cantor, and subsequent authors have agreed.

Lycothrissa Günther, 1868

Lycothrissa Günther, 1868, Cat. Fish. Brit. Mus. 7: 399 (Type = *Engraulis crocodilus* Bleeker).

In the development of caniniform teeth in the lower jaw, *Lycothrissa* resembles the South American genus *Lycengraulis*. But the presence of scutes and a pre-dorsal spine show its affinities with the Indo-Pacific genera *Thryssa* and *Setipinna*. A single species only has been described.

In his manuscript list of specimens sent to Günther (see p. 12), Bleeker refers to *Stolephorus (Odontengraulis) crocodilus*. Bleeker did not publish the name *Odontengraulis*, probably because Günther's genus *Lycothrissa* was published shortly after.

67. **Engraulis crocodilus** Bleeker, 1850 (pl. 17 fig. 3)= *Lycothrissa crocodilus* (Bleeker, 1850)

Engraulis crocodilus Bleeker, 1850, Nat. Tijdschr. Ned. Ind. 1: 15 (Bandjermassing, in river; 1 fish, 176 mm tot. l.; Br. St. 12, D I + i 11, P i 13, V i 6, A iii 45, scutes 18).

Atlas: as *Lycothrissa crocodilus*, 4 fishes, 125-180 mm tot. l., Borneo.

Auction Catalogue: as above, 3|0|0|0|0 (p. 46, no. 46).

RMNH: 3 fishes, 102.8, 131.6 and 149.3 mm S.L. (largest estimated 176 mm tot. l.), RMNH 7015 and 24969.

BMNH: 1 fish, 130.9 mm S.L. (estimated 158 mm tot. l., caudal tips broken), head not cut, no pencil marks, metal tag tied to caudal peduncle [28.48], scales entirely shed, BMNH 1867.11.28.48. Listed as "Type of the species" by Günther (1868: 400).

Type. — The British Museum specimen is too small, but the largest of the Leiden fishes agrees with Bleeker's description in size and counts. It is undoubtedly the holotype and, since no specimens appear to have been lost, must also be the specimen figured in the Atlas (pl. 268 fig. 1). The remaining fishes came from the same locality but are not syntypes.

Description. — Holotype, a fish 149.3 mm S.L. (estimated 176 mm tot. l., caudal tips broken), scales entirely lost, RMNH 7015.

Br. St. 12, D I + iii 10, P i 13, V i 6, A iii 45, gillrakers on lower part of 1st arch 9 (left), 10 (right), scutes 8 + 11.

In percentages of standard length: body depth 22.5, head length 21.0; snout length 3.5, eye diameter 4.1, length of upper jaw 17.6, length of lower jaw 16.8; pectoral fin length 14.2 (tip broken), pelvic fin length 3.7 (tip broken), length of anal base 33.8; pre-dorsal distance 57.4, pre-pelvic distance 39.4, pre-anal distance 57.0.

Body fairly strongly compressed, its width $3\frac{3}{4}$ in its depth, belly sharply keeled, scutes beginning behind pectoral base, absent in front. Jaws about equal, lower jaw about equal with snout tip when mouth closed. Maxilla bluntly rounded posteriorly, reaching to articulation of lower jaw, with well-developed widely spaced caniniform teeth along entire lower edge; maxilla projecting little beyond 2nd supra-maxilla; the latter thin plate-like, expanded posteriorly, tapering anteriorly; no anterior supra-maxilla. Lower jaw with 2 short teeth at symphysis, 5 large caniniform teeth widely spaced along jaw and smaller caniniform teeth in between.

Gillrakers fairly short, slender, $1\frac{1}{4}$ times longest gill filaments, about $\frac{1}{2}$ eye diameter; gillrakers with fine serrae along inner edge, becoming larger distally; no gillrakers present on posterior face of 3rd epibranchial, but this area covered with fine denticulations. Muscular portion of isthmus

reaching almost to hind margin of branchiostegal membrane. Pseudobranch not exposed, possibly absent, posterior frontal fontanelles triangular, open, just over $\frac{1}{3}$ eye diameter in length.

Dorsal preceded by small spine, dorsal origin nearer to caudal base than to snout tip, behind anal origin [above 3rd branched anal ray in British Museum specimen]. Pectoral without filamentous 1st ray, pectoral tips estimated to reach to pelvic base. Pelvic base a little nearer to pectoral base than to anal origin. Anal origin much nearer to pectoral base than to caudal base.

Colour. — Upper $\frac{1}{4}$ brown, flanks silvery. Fins hyaline.

COILINAE

These rat-tailed anchovies not only show a marked departure from the normal engraulid form in general appearance, but also vary considerably within the single genus, *Coilia*, to which the dozen or so species are normally assigned. Thus, luminous organs are present in some (Haneda, 1961), pre-pectoral and even pre-pelvic scutes are absent in others, the maxilla may be short (as in *Setipinna*) or long (as in *Thryssa*), the caudal peduncle tapering to a point or truncate, and the otherwise stable pelvic count of 16 found in all other engraulids is increased to 19 in *Coilia ramcarati*.

Jordan & Seale (1926) proposed *Demicoilia* for species with truncated caudal peduncles, but Jones & Menon (1952) have shown this condition to be an artefact (at least in some instances), resulting from injury. A more likely generic division could be made on the presence or absence of luminous organs (see under *Leptonurus*, below). For the present work, however, we follow Fowler (1941) in placing all species in the genus *Coilia*. Bleeker, in the Atlas, placed his two species with long maxillae and pre-pectoral scutes in the subgenus *Chaetomus* McClelland, and Fowler (1941) followed this subgeneric division of the genus. These fishes also have a shorter lower jaw, with a large coronoid process.

Coilia Gray, 1831

Coilia Gray, 1831, Zool. Misc.: 9 (Type: *Coilia hamiltonii* Gray = *Mystus ramcarati* Ham. Buch.).

A full generic synonymy is given by Fowler (1941), who recognised 14 species. A revision of the species is urgently needed, and in particular a study of variation in pectoral filament number within each species. Authors have separated species on small differences in filament number, but this has not always proved satisfactory (e.g. in the *C. mystus* complex of species, Whitehead, 1966).

The Bleeker material has been identified in accordance with the following key, which differs from that given by Fowler in placing more emphasis on the luminous organs of *C. dussumieri* and the high pelvic count in *C. ramcarati*.

- A. Pearly spots (luminous organs) absent on flanks.
1. Pelvic rays i 9; free pectoral filaments 6; maxilla short, not reaching to gill opening *C. ramcarati* (Ham. Buch.)
 2. Pelvic rays i 6
 - a. Maxilla short, not reaching to gill opening; lower jaw slender
 - i. pre-pelvic scutes absent; free pectoral filaments 19 *C. reberenschii* Blkr.
 - ii. pre-pelvic scutes present (4 only); free pectoral filaments 10-14 *C. borneensis* Blkr.
 - b. Maxilla long, reaching to gill opening; lower jaw with high coronoid process
 - i. gillrakers 21-24; scutes 14-16 + 32-38 *C. macrognathos* Blkr.
 - ii. gillrakers 27-30; scutes 12-17 + 19-23 *C. lindmani* Blkr.
- B. Pearly spots (luminous organs) along flanks; free pectoral filaments 4-6; scutes 4-6 + 6-8 *C. dussumieri* Val.

68. *Coilia cantoris* Bleeker, 1853

= *Coilia ramcarati* (Ham. Buch., 1822)

Coilia cantoris Bleeker, 1853, Verh. Bat. Gen. **25**: 148, pl. 6 fig. 2 (Calcutta, Hooghly river; 1 fish, 105 mm tot. l.; Br. St. 9, D I + iii 10, P 6 fil. + 6, V i 6, A 83, scutes 6 + 9).

Atlas: mentioned only in notes on *C. reynaldi* on p. 141.

Auction Catalogue: not listed.

RMNH: no material labelled *C. cantoris*.

BMNH: 1 fish, 87.5 mm S.L. (91.2 mm tot. l., caudal severely damaged, possibly 105 mm when fresh), metal tag sewn above anal [266], BMNH 1867.11.28.266. Listed as "Type of the species (100 mm long), in bad state" by Günther (1868: 402).

Type. — The British Museum specimen exactly matches Bleeker's figure in standard length and is evidently the holotype since no other specimens were recorded.

Description. — Holotype, a fish 87.5 mm S.L. (91.2 mm tot. l., but caudal badly damaged), dorsal damaged, head not cut, BMNH 1867.11.28.266.

Br. St. 11, D I + iii 12, P 6 fil. + 6, V i 9, A iii 77, gillrakers on lower part of 1st arch 30, scutes 5 + 10.

In percentages of standard length: body depth 17.2, head length 19.8; snout length 3.8, eye diameter 4.8, length of upper jaw 16.9, length of lower jaw 14.7; pectoral length 11.3 (filaments broken), pelvic length 6.9 (tips broken), length of anal base 52.4; pre-dorsal distance 32.7, pre-pelvic distance 30.2, pre-anal distance 47.6.

Body moderately compressed, its width $2\frac{3}{4}$ times in its depth, belly sharply keeled, especially behind pelvic fins, scutes beginning half way between pectoral and pelvic bases. Maxilla reaching to just beyond articulation of lower jaw, pointed posteriorly, projecting a little beyond 2nd supra-maxilla, irregularly toothed along entire lower edge. Two supra-maxillae, the posterior (2nd) expanded posteriorly, curved downwards at tip, with slender shaft anteriorly; anterior (1st) supra-maxilla about 5 times as long as deep. Lower jaw with prominent knob at symphysis, slender along entire length, with a single series of small pointed teeth.

Gillrakers fine, slender, about $2\frac{1}{2}$ times length of longest gill filaments, $\frac{4}{5}$ eye diameter; no gillrakers on posterior face of 3rd epibranchial. Pseudo-branch equal to eye diameter, filaments minute. Muscular portion of isthmus reaching forward to border of branchiostegal membrane; scaled at least on posterior half.

Dorsal preceded by small spine, dorsal origin lying above middle of pelvic fins. Pectoral with 6 filamentous rays, now broken. Pelvic base almost twice as near to pectoral base as to anal origin. The latter behind dorsal base. Body tapering, but apparently truncated and regenerated posteriorly, caudal base 2.8 mm deep.

Colour. — Scales absent, body now a deep red/brown. Fins hyaline.

Note. — Fowler (1941), following Day (1878: 631), regarded *C. cantoris* as a distinct species. Day had examined the type but either looked at the wrong fish or badly miscounted, because he gives the pelvic rays as 7. The presence of 10 pelvic rays in the type clearly places this specimen in *C. ramcarati*, the only engraulid with a count differing from 7. This confirms the view of Jones & Menon (1952), who point out that the description of the type of *C. cantoris* by Day (1889) strongly suggests a juvenile *C. ramcarati*. Günther (1868) listed *C. cantoris* as a doubtful species, criticising Bleeker for describing a new species on a juvenile specimen.

Günther (1868: 402) considered *Coilia reynaldi* Val. as another doubtful species, but placed *C. reynaldi* of Bleeker in his synonymy of *C. ramcarati*. Bleeker had a single specimen of the former, which by then was in the British Museum (BMNH 1867.11.28.77). It clearly has more than six pectoral filaments (about 9, but fins damaged — 12 fide Bleeker), only 7 pelvic rays, and an anal count of iii 103. *Coilia reynaldi* is close to *C. borneensis* but Fowler (1941) considered the two species distinct (anal count lower in the latter).

Bleeker gave a pelvic count of i 6 in his description of *C. cantoris* and this is shown in his accompanying figure (pl. 6 fig. 2). However, the present

specimen closely matches the figure in size and it agrees exactly in scute count and is reasonably close in pelvic and anal count. It must be concluded that Bleeker either miscounted or assumed a normal pelvic count in this case, and that the specimen really is the holotype.

69. **Coilia rebentischii** Bleeker, 1859 (pl. 18 fig. 1)

= *Coilia rebentischii* Bleeker, 1859

Coilia rebentischii Bleeker, 1859, Act. Soc. Sci. Indo-Néerl. 5: 5 (Singkawang, Borneo; 1 fish, 125 mm tot. l.; Br. St. 7, D I + iii 11, P 19 fil. + 9, V i 6, A 94, scutes 2-3 + 9-10).

Atlas: as *Coilia (Coilia) rebentischii*, 1 fish (on previous description), 125 mm tot. l., Borneo.

Auction Catalogue: not listed.

RMNH: no material labelled *C. rebentischii*.

BMNH: 1 fish, 143 mm S.L. (caudal damaged, approx. 158 mm tot. l.), metal tag sewn to body above anal base [28.74], BMNH 1867.11.28.74. Listed, under *C. ramcarati*, as "Type of *C. rebentischii*" by Günther (1868: 403).

Type. — The British Museum specimen, although the only Bleeker specimen in existence, is much larger than Bleeker described. The Atlas description was evidently taken straight from the original, and the words "*Longitudo speciminis descripti 125*" suggest that the type was already in the British Museum. The type is accompanied by a pencilled note (on lined paper) reading "*Coilia (Coilia) [re] bentischii[i] [s]pec. typ. un [ici]*". There remains the possibility that the specimen has been placed in the wrong bottle, but none of the other Bleeker specimens is 125 mm tot. l. Finally, the doubt is removed when the specimen is compared with the Atlas figure (pl. 266 fig. 3), which it exactly matches in size. Clearly Bleeker miswrote the length.

Description. — Holotype, a fish 143 mm S.L. (145 mm tot. l., caudal damaged, estimated 158 mm), in fair condition, BMNH 1867.11.28.74.

Br. St. 9, D I + iii 10, V 19 fil. + 10, P i 6, A iii 93, gillrakers on lower part of 1st arch 26, scutes 1 + 11.

In percentages of standard length: body depth 17.3, head length 14.1; snout length 2.9, eye diameter 2.7, length of upper jaw 12.2, length of lower jaw 11.0; pectoral fin length 26.0, pelvic fin length 7.0, length of anal base 61.5; pre-dorsal distance 28.2, pre-pelvic distance 23.2, pre-anal distance 37.8.

Head broad, body moderately compressed, its width $2\frac{1}{2}$ times in its depth, belly rounded and scaled before pelvic fins, sharply keeled behind; pelvic scute present, but no scutes in front. Maxilla reaching to articulation of

lower jaw, not quite to gill opening, posterior tip broken off but apparently pointed in life, projecting a short distance beyond 2nd supra-maxilla; irregularly toothed along entire lower border. Posterior supra-maxilla expanded posteriorly, curved downwards at tip; anterior supra-maxilla absent (left side of head virtually undamaged). Lower jaw slender, with knob at symphysis; a series of fine pointed teeth.

Gillrakers fine, slender, $2\frac{1}{2}$ times length of longest filaments, $1\frac{1}{4}$ times eye diameter; no gillrakers on posterior face of 3rd epibranchial. Pseudo-branch attenuated, twice eye diameter in length but longest filaments only $\frac{1}{3}$ of pupil diameter (0.5 mm). Muscular portion of isthmus scaled except for anterior $\frac{1}{4}$, reaching forward to border of branchiostegal membrane.

Dorsal preceded by small spine, dorsal origin above middle of pelvic fin. Pectoral with 8 filaments apparently fused basally, and 11 further free filaments; tip of longest filament reaching to vertical above 5th branched anal ray. Pelvic base almost twice as close to pectoral base as to anal origin; in advance of dorsal origin by $1\frac{1}{2}$ times eye diameter. Anal origin behind vertical from dorsal base by 2 eye diameters. Posterior part of body tapering, base of caudal fin about 2 mm high.

Colour. — Body brown, a lighter brown band above anal and on belly; a paler midlateral line. Fins hyaline.

Note. — The absence of scutes in front of the pelvic scute and the number of free pectoral filaments (19) distinguish this species, which otherwise seems most closely related to *C. borneensis*. Apart from the holotype, only one other record is listed by Fowler (1941) (*Engraulis grayi* of Kner, 1865: 333).

70. *Coilia borneensis* Bleeker, 1852 (pl. 18 fig. 2)

= *Coilia borneensis* Bleeker, 1852

Coilia borneensis Bleeker, 1851, Nat. Tijdschr. Ned. Ind. 2: 58 (Bandjermassing; name only); Bleeker, 1852, Nat. Tijdschr. Ned. Ind. 3: 437 (Bandjermassing, Pamangkat; 9 fishes, 90-140 mm tot. l.; Br. St. 9, D I + iii 10-11, P 12-14 fil. + 6, V i 6, A 84-87, scutes 11); Bleeker, 1852, Verh. Bat. Gen. 24: 45 (Bandjermassing; 4 fishes, 90-120 mm; counts as before).

Atlas: as *Coilia (Coilia) borneensis*, 18 fishes, 80-140 mm tot. l., Sumatra, Borneo.

Auction Catalogue: as *Coilia borneensis*, 10|2|2|2|2 (p. 46, no. 64).

RMNH: 8 fishes, 81.2-121.0 mm tot. l., RMNH 7075; 1 fish, 108 mm tot. l., (old bottle but no auction label so perhaps part of B-E series), RMNH 8040.

BMNH: 1 fish, 105 mm S.L. (approx. 120 mm tot. l.), BMNH 1867.11.28.78. Listed as "One of the typical specimens (120 mm long)" by Günther (1868: 404).

Type. — The British Museum specimen matches the largest of Bleeker's four Bandjermassing fishes and may be one of the syntypes, although Bleeker added at least one other specimen of approximately this length (from Pamangat) i.e. the specimen of 121 mm tot. l. now in Leiden. Since 9 fishes have been lost from the auction material, the chances that either the British Museum specimen, or the largest Leiden specimen are syntypes are reduced. The British Museum specimen is best regarded, therefore, as a putative neotype rather than lectotype. It is not the figured specimen in the Atlas (pl. 262 fig. 3) which is 125 mm tot. l.

Description. — Putative neotype, a fish of 105 mm S.L. (118.3 mm tot. l., estimated 120 mm when fresh), head not cut, no pencil marks, in good condition, scales retained, BMNH 1867.11.28.78.

Br. St. 10, D I + iii 10, P 13 fil. + 7, V i 6, A ii 78, gillrakers on lower part of 1st arch 31, scutes 4 + 8.

In percentages of standard length: body depth 22.7, head length 21.7; snout length 4.4, eye diameter 4.4, length of upper jaw 18.9, length of lower jaw 14.7; pectoral fin length 43.4 (filaments undamaged), pelvic fin length 11.8, length of anal base 57.0; pre-dorsal distance 43.2, pre-pelvic distance 32.6, pre-anal distance 46.7.

Head broad, body moderately compressed, its greatest width about $2\frac{1}{3}$ times in its depth, belly rounded in front of pelvic fins, sharply keeled behind; scutes beginning a little before pelvic base, well behind pectoral base. Maxilla reaching a little beyond articulation of lower jaw but not quite to gill opening, projecting somewhat beyond end of 2nd supra-maxilla; finely toothed along lower edge. Posterior supra-maxilla little expanded posteriorly and curving downwards at tip; a small rectangular anterior supra-maxilla present. Lower jaw slender, with distinct knob at symphysis; a series of fine pointed teeth.

Gillrakers fine, slender, $2\frac{1}{2}$ times longest gill filaments, $\frac{3}{4}$ eye diameter; absent on posterior face of 3rd epibranchial. Pseudobranch greatly attenuated, $\frac{3}{4}$ eye diameter, filaments minute. Muscular portion of isthmus reaching to hind border of branchiostegal membrane.

Dorsal preceded by small spine, dorsal origin behind vertical from pelvic base by 1 eye diameter. Pectoral with 13 long filaments, separate throughout most of their length; tip of longest filament reaching to 21st branched anal ray. Pelvic base nearer to pectoral base than to anal base by 1 eye

diameter; pelvic tips failing to reach anal origin by $\frac{3}{4}$ eye diameter. The latter $\frac{1}{2}$ eye diameter behind vertical from last dorsal ray. Posterior part of body not tapering to a point but 4.3 mm deep at caudal base.

Colour. — Body brown, with faint suggestion of silver lateral stripe. Fins hyaline except for faint dusky mark at tip of caudal.

Note. — Differences in meristic counts between this specimen and Bleeker's description are all attributable to faulty counts by the latter. Thus one branchiostegal ray appears to be part of the opercular series (Bleeker invariably discounted this ray), the final pectoral ray and post-pelvic scute are minute, and Bleeker evidently included some caudal rays in his anal count.

Fowler (1941) accepted this species, as also Hardenberg (1936), and the high number of free pectoral rays and presence of a few pre-pelvic scutes make it distinctive.

71. ***Coilia macrognathos*** Bleeker, 1852 (pl. 18 fig. 3)

= *Coilia macrognathos* Bleeker, 1852

Coilia macrognathos Bleeker, 1852, Nat. Tijdschr. Ned. Ind. **3**: 436 (Pamangkat; 2 fishes, 205-215 mm tot. l.; Br. St. 10, D I + iii 11-12, P 5-6 fil. + 11, V i 6, A ii 60-71, scutes 12-13 + 27); Bleeker, 1852, Verh. Bat. Gen. **24**: 50 (description identical).

Atlas: as *Coilia (Chaetomus) macrognathos*, 6 fishes, 205-260 mm tot. l., Borneo.

Auction Catalogue: as *C. macrognathos*, 3/1/1/0 (p. 46, no. 63).

RMNH: 3 fishes, 182, 219 and 220 mm S.L. (205, 253 and ?260 mm tot. l.), RMNH 7074 and 24968.

BMNH: 1 fish, 197 mm S.L. (219 mm tot. l.), head not cut, no pencil marks, metal tag sewn above anal [28.73], BMNH 1867.11.28.73. Listed as "Type of the species" by Günther (1868: 406).

Type. — The British Museum specimen is 4 mm larger than the larger of the two original Bleeker specimens, and may be one of the later additions. However, the smallest of the three Leiden fishes exactly corresponds with Bleeker's lower size limit, and this fish can be designated lectotype. The Atlas figure (pl. 261 fig. 4) may have been based on one of the two larger Leiden specimens.

Description. — Lectotype, a fish of 182.0 mm S.L. (205 mm tot. l.), RMNH 7074.

Br. St. 10, D I + iii 10, P 6 fil. + 11, V i 6, A ii 68, gillrakers on lower part of 1st arch 21, scutes 15 + 38.

In percentages of standard length: body depth 19.6, head length 19.5; snout length 4.4, eye diameter 3.6, length of upper jaw 28.8, length of lower jaw 13.5; pectoral fin length 21.0 (filaments damaged), pelvic fin length 9.9, length of anal base 48.7; pre-dorsal distance 30.6, pre-pelvic distance 33.1, pre-anal distance 58.0.

Head as broad as widest part of body, the latter $2\frac{3}{4}$ times in body depth, belly sharply keeled, especially behind pelvic base; scutes beginning on isthmus. Maxilla failing to reach pelvic base by 1 eye diameter, but tip possibly damaged slightly, projecting 14.3 per cent of S.L. beyond 2nd supra-maxilla; a series of large teeth along lower edge of maxilla, interspersed with smaller teeth. Posterior supra-maxilla with oval expanded portion, not turned downwards at tip; anterior supra-maxilla expanded, $\frac{3}{4}$ depth of posterior supra-maxilla. Lower jaw short, with steeply rising coronoid process, teeth as in upper jaw.

Gillrakers slender, twice length of corresponding gill filaments, equal to eye diameter; rakers with coarse serrae of even length along inner face; gillrakers absent on posterior face of 3rd epibranchial. Pseudobranch attenuated, $\frac{2}{3}$ eye diameter, filaments about $\frac{1}{3}$ pupil diameter. Muscular portion of isthmus just reaching to hind border of branchiostegal membrane.

Dorsal preceded by small spine, dorsal height 17.8 per cent of S.L. Pectoral filaments reaching to just beyond pelvic tip, but filaments now damaged (to just beyond anal origin in British Museum specimen); six long filaments, separate from each other except at base. Pelvic base much nearer to pectoral base than to anal origin. The latter well behind last dorsal ray.

Colour. — Light brown on body. In British Museum specimen, anal and caudal with brown fringe.

Note. — Bleeker described 27 post-pelvic scutes. This must be an error, perhaps for 37. In the two other Leiden specimens the count is 32 and 34, and in the British Museum fish, 37.

Fowler (1941) recognised *C. macrognathos* and separated it from *C. mystus* on its lower scute count (i.e. 12-13 + 27-30; cf. 18-19 + 32-33). The four extant Bleeker specimens have the following complete count, 14-16 + 32-38. He also found lower anal finray and scale counts in *C. macrognathos* (the latter confirmed by the present lectotype). Until a full revision can be undertaken, this species is perhaps best regarded as distinct.

72. *Coilia lindmani* Bleeker, 1858 (pl. 19 fig. 1)

= *Coilia lindmani* Bleeker, 1858

Coilia lindmani Bleeker, 1858, Act. Soc. Sci. Indo-Néerl. 3: 48 (Palembang; 1 fish, 176 mm tot. l.; Br. St. 11, D I + iii 10, P 6 fil. + 11, V i 6, A ii 74, scutes 12 + 19).

Atlas: as *Coilia* (*Chaetomus*) *lindmani*, 1 fish (on previous description), 176 mm tot. l., Sumatra.

Auction Catalogue: not listed.

RMNH: no material labelled *C. lindmani*.

BMNH: 1 fish, 149.3 mm S.L. (165 mm tot. l. but caudal tip broken), metal tag sewn above anal [28.76], BMNH 1867.11.28.76. Listed as "Type of the species" by Günther (1868: 405).

Type. — Bleeker apparently had no further specimens (Atlas: 139), and the British Museum fish is evidently the holotype. The caudal is now damaged, but it can be plausibly sketched in to reach 176 mm. Alternatively, Bleeker's measurement may have been at fault. The Atlas figure (pl. 270 fig. 2) shows a specimen of 152 mm S.L. and only 170 mm tot. l., for which the British Museum specimen may have been the model.

Description. — Holotype, a fish of 149.3 mm S.L. (estimated 176 mm tot. l.), in fair condition but scales mostly shed, left pelvic damaged, belly cut on right side, some faint traces of possible pencil marks (round 2nd supra-maxilla), head not cut, BMNH 1867.11.28.76.

Br. St. 11, D I + iii 10, P 6 fil. + 12 (left) or 11 (right), V i 6, A iii 73, gillrakers on lower part of 1st arch 29, scutes 13 + 23.

Head no broader than body, width $3\frac{1}{2}$ times in body depth, belly compressed and sharply keeled, especially behind pelvic base; scutes beginning on isthmus. Maxilla reaching to beyond pectoral base, projecting well beyond 2nd supra-maxilla; a series of moderately large teeth along lower edge of maxilla, of even length. Posterior supra-maxilla expanded posteriorly, slightly turned downwards; anterior supra-maxilla narrow, about $\frac{1}{4}$ as deep as posterior supra-maxilla. Lower jaw short, with steeply rising coronoid process, teeth as in upper jaw.

Gillrakers slender, twice length of corresponding gill filaments, $\frac{3}{4}$ eye diameter; rakers with coarse serrae of even lengths along inner face; no gillrakers on posterior face of 3rd epibranchial. Pseudobranch attenuated, $\frac{4}{5}$ eye diameter, filaments minute. Muscular portion of isthmus just reaching to hind margin of branchiostegal membrane.

Dorsal preceded by small spine, dorsal origin just behind vertical from pelvic base. Pectoral filaments reaching to 5th branched anal ray. Pelvic base nearer to pectoral base than to anal origin by $\frac{1}{2}$ eye diameter. Anal origin well behind last dorsal ray.

Colour. — Upper $\frac{1}{4}$ of body grey-brown, remainder of flanks silver-grey.

Note. — Recognised by Fowler (1941) as distinct from *C. macrognathos*,

and gillraker and scute counts bear this out. The two species differ also in maxillary dentition and shape of anterior supra-maxilla.

Leptonurus Bleeker, 1849

Leptonurus Bleeker, 1849, Verh. Bat. Gen. **22**: 14 (Type: *Leptonurus chrysostigma* Bleeker = *Coilia dussumieri* Valenciennes).

Bleeker proposed *Leptonurus* before he was aware of the genus *Coilia* (Atlas: 141). He used the name only once after this (Bleeker, 1850) and thereafter placed his type in *Coilia dussumieri* Val.

The name may be of interest, however, because it is founded on a species possessing rows of pearly spots along the flanks which have been identified as light organs (Haneda, 1961). *Coilia quadragesimalis* Valenciennes is a second species with pearly spots according to Fowler (1941) ("*La couleur est argentée et dorée, avec les reflets nacrés*" according to Valenciennes, 1848: 84). Jordan & Seale (1926) named this species type of a new genus *Demicoilia* (distinguished from *Coilia* by its truncate caudal peduncle, but see remarks on caudal regeneration, p. 135). *Demicoilia* appears to be a junior synonym of *Coilia* and not *Leptonurus* since the holotype (MNHN 3734) is *C. ramcarati* (unpublished observation).

73. **Leptonurus chrysostigma** Bleeker, 1849 (pl. 19 fig. 2)

= *Coilia dussumieri* Valenciennes, 1848

Leptonurus chrysostigma Bleeker, 1849, Verh. Bat. Gen. **22**: 14 (Madura, near Kammal and Surabaya; no number, 122 mm tot. l.; Br. St. 9, D I + i 11, P 18, V i 6, A et C 122).

Atlas: as *Coilia* (*Coilia*) *dussumieri*, 19 fishes, 100-160 mm tot. l., Java, Madura, Singapore, Bangka.

Auction Catalogue: as *C. dussumieri*, 11|2|2|2|2 (p. 46, no. 65).

RMNH: 9 fishes, approx. 110-160 mm tot. l. (caudal tips damaged), RMNH 7073 and 24970.

BMNH: 1 fish, 129.4 mm S.L. (154 mm tot. l.), head not cut, scales lost, metal tag sewn above anal fin [28.75], BMNH 1867.11.28.75. Listed as "From Dr. Bleeker's Collection" under *Coilia dussumieri* by Günther (1868: 403).

Type. — The British Museum specimen is too large to be one of the syntypes, and there is only one Leiden fish which is close to the maximum size (122 mm) originally described. Since only two A series specimens seem to have been lost since the auction, there is a fair chance that this fish is the largest type. Bleeker (1852d) recorded 12 specimens of *Coilia dussumieri*, the largest 140 mm, suggesting that more were added to the syntypical series,

at least one specimen exceeding the original size range. The British Museum fish matches the Atlas figure (pl. 270 fig. 3).

Description. — Lectotype, a fish of 121.8 mm S.L. (123.5 mm tot. l.), lower jaw slightly damaged, anal finrays evidently counted in tens (i.e. membrane torn after every tenth ray), RMNH 7073.

Br. St. 8 (?9), D I + iii 12, P 6 fil. + 13, V i 6, A iii 103, C 14 (? + 2), gillrakers on lower part of 1st arch 26, scutes 5 + 8.

In percentages of standard length: body depth 17.2, head length 14.2; snout length 3.4, eye diameter 3.4, length of upper jaw 14.6 (tip broken, estimated 15.6), lower jaw damaged; pectoral fin damaged, pelvic fin length 5.3; pre-dorsal distance 28.0, pre-pelvic distance 25.8, pre-anal distance 37.3.

Body as broad as head, breadth almost 3 times in depth, belly rather rounded before pelvic base, more compressed behind; scutes beginning behind pectoral base. Maxilla just reaching to gill opening, pointed posteriorly, projecting well beyond 2nd supra-maxilla, a series of fine teeth along lower edge. Posterior supra-maxilla small, expanded portion oval; anterior supra-maxilla present, about half as deep as the former. Lower jaw slender, with a series of fine teeth, no steeply rising coronoid process.

Gillrakers slender, about twice length of longest gill filaments and $\frac{3}{4}$ eye diameter; no rakers on posterior face of 3rd gill arch. Pseudobranch minute, $\frac{1}{4}$ eye diameter. Muscular portion of isthmus reaching to margin of branchiostegal membrane.

Dorsal preceded by small spine. Pectoral filaments broken, but reaching to about 10th branched anal ray in other Leiden specimens. Pelvic base below 1st unbranched dorsal ray, nearer to pectoral base than to anal origin by 1 eye diameter. Anal origin well behind dorsal base. Caudal peduncle tapering almost to a point.

Colour. — Body brown, with a series of 17 pearly spots (light organs), along flank on level of jaw; a second series of 16 spots below this, beginning a short distance in front of pelvic base; a third series, of 6 spots, descending from gill opening to pelvic base; 2 spots on either side just below pectoral base; and a series of four small spots on either side of isthmus.

Note. — Jordan & Seale (1926) proposed the name *Demicoilia margaritifera* for a single specimen from Ceylon which also possessed pearly spots on the flank. The description differs from that given here in only two main characters, the length of the anal fin and the truncate caudal peduncle. Jones & Menon (1952) suggest, probably correctly, that both these characters result from damage to the caudal and subsequent regeneration. Like Fowler (1941), they refer *Demicoilia margaritifera* to *Coilia dussumieri*.

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TABLE III

Indo-Pacific species and genera described by Bleeker and list of types in London, Leiden and Paris

Bleeker name	name recognised here	Types
1. <i>Megalops macrophthalmus</i> Blkr., 1851	<i>Megalops cyprinoides</i> (Brouss.)	Holotype BMNH. 1867.II.28.68
2. <i>Megalops macropterus</i> Blkr., 1866	<i>Megalops cyprinoides</i> (Brouss.)	Lectotype BMNH. 1867.II.28.69
3. <i>Megalops oligolepis</i> Blkr., 1866	<i>Megalops cyprinoides</i> (Brouss.)	Holotype BMNH. (lost)
4. <i>Chirocentrus hypselosoma</i> Blkr., 1852	<i>Chirocentrus hypselosoma</i> Blkr.	Holotype RMNH. 7104
5. <i>Dussumieria elopsoides</i> Blkr., 1849	<i>Dussumieria acuta</i> Val.	Lectotype BMNH. 1867.II.28.17
6. <i>Dussumieria hasseltii</i> Blkr., 1851	<i>Dussumieria acuta</i> Val.	Putative neotype BMNH. 1867.II.28.21
7. <i>Elops javanicus</i> Blkr., 1849	<i>Dussumieria acuta</i> Val.	(on unpublished figure)
8. <i>Etrumeus</i> Blkr., 1853	<i>Etrumeus</i> Blkr.	
9. <i>Spratelloides</i> Blkr., 1851	<i>Spratelloides</i> Blkr.	
10. <i>Clupea macassaricensis</i> Blkr., 1849	<i>Spratelloides delicatulus</i> (Bennett)	Putative neotype RMNH. 7126
11. <i>Clupea argyrotaeniata</i> Blkr., 1849	<i>Spratelloides gracilis</i> (Temm. & Schl.)	Putative neotype RMNH. 7127
12. <i>Harengula dispilonotus</i> Blkr., 1852	<i>Herklotsichthys dispilonotus</i> (Blkr.)	Lectotype BMNH. 1867.II.28.28
13. <i>Altausa schrammi</i> Blkr., 1849	<i>Herklotsichthys punctatus</i> (Rüpp.)	Lectotype RMNH. 7083
14. <i>Harengula moluccensis</i> Blkr., 1853	<i>Herklotsichthys punctatus</i> (Rüpp.)	Lectotype RMNH. 7098
15. <i>Harengula kunzei</i> Blkr., 1856	<i>Herklotsichthys punctatus</i> (Rüpp.)	Lectotype RMNH. 7097
16. <i>Clupea (Harengula) dubia</i> Blkr., 1872	<i>Herklotsichthys punctatus</i> (Rüpp.)	Lectotype MNHN. 666
17. <i>Sardinella lemuru</i> Blkr., 1853	<i>Sardinella aurita</i> Val.	Lectotype BMNH. 1867.II.28.41
18. <i>Sardinella brachysoma</i> Blkr., 1852	<i>Sardinella brachysoma</i> Blkr.	Lectotype BMNH. 1867.II.28.38
19. <i>Harengula hypselosoma</i> Blkr., 1855	<i>Sardinella brachysoma</i> Blkr.	Lectotype BMNH. 1867.II.28.29
20. <i>Clupalosa</i> Bleeker, 1849	<i>Sardinella</i> Val.	
21. <i>Clupalosa bulam</i> Blkr., 1849	<i>Sardinella bulam</i> (Blkr.)	Lectotype BMNH. 1867.II.28.37
22. <i>Spratella korwala</i> Blkr., 1851	<i>Sardinella bulam</i> (Blkr.)	Lectotype RMNH. 7091
23. <i>Clupea gibbosa</i> Blkr., 1849	<i>Sardinella jussieu</i> (Lac.)	Putative neotype BMNH. 1867.II.28.46
24. <i>Spratella tembang</i> Blkr., 1851	<i>Sardinella jussieu</i> (Lac.)	(as for <i>Clupea gibbosa</i>)
25. <i>Harengula sumasi</i> Blkr., 1854	<i>Sardinella sumasi</i> (Blkr.)	Holotype BMNH. 1867.II.28.182
26. <i>Clupea (Harengula) sumdaica</i> Blkr., 1872	<i>Sardinella sumasi</i> (Blkr.)	Lectotype RMNH. 7099
27. <i>Harengula melanurus</i> Blkr., 1853	<i>Sardinella melanura</i> (Cuv.)	Lectotype BMNH. 1867.II.28.31
28. <i>Paralosa</i> Blkr., 1868	<i>Sardinella</i> Val.	
29. <i>Harengula (Paralosa) valenciennesi</i> Blkr., 1868	<i>Sardinella melanura</i> (Cuv.)	(type as for <i>Harengula melanurus</i> Blkr.)
30. <i>Amblygaster</i> Blkr., 1849	<i>Sardinella (Amblygaster)</i>	
31. <i>Amblygaster clupeioides</i> Blkr., 1849	<i>Sardinella clupeioides</i> (Blkr.)	Putative neotype RMNH. 7094

TABLE III

Indo-Pacific species and genera described by Bleeker and list of types in London, Leiden and Paris (continued)		Types
Bleeker name	name recognised here	
27. <i>Sardinella leiogastroides</i> Blkr., 1854	<i>Sardinella sirm</i> (Walb.)	Holotype RMNH. 7093
<i>Leptogaster</i> Blkr., 1870	<i>Escualosa</i> Whitley	
28. <i>Rogentia argyrotaenia</i> Blkr., 1852	<i>Escualosa thoracata</i> (Val.)	Lectotype RMNH. 7088
<i>Clupeoides</i> Blkr., 1851	<i>Clupeoides</i> Blkr.	
29. <i>Clupeoides borneensis</i> Blkr., 1851	<i>Clupeoides borneensis</i> Blkr.	Putative neotype RMNH. 7115
30. <i>Clupeoides hypselosoma</i> Blkr., 1866	<i>Clupeoides hypselosoma</i> Blkr.	Holotype BMNH. 1867.11.28.35
31. <i>Clupea</i> (<i>Clupeoides</i>) <i>potamophilus</i> Blkr., 1872	<i>Clupeoides hypselosoma</i> Blkr.	(type as for <i>Clupeoides hypselosoma</i> Blkr.)
32. <i>Spratella pseudopterus</i> Blkr., 1852	<i>Coria soborna</i> Ham. Buch.	Lectotype RMNH. 7116
<i>Clupeichthys</i> Blkr., 1855	<i>Clupeichthys</i> Blkr.	
33. <i>Clupeichthys goniognathus</i> Blkr., 1855	<i>Clupeichthys goniognathus</i> Blkr.	Holotype BMNH. 1867.11.28.36
34. <i>Alosa brevis</i> Blkr., 1848	? <i>Hilsa kelee</i> (Cuv.)	(type(s) lost)
35. <i>Alausa kanagurta</i> Blkr., 1852	<i>Hilsa kelee</i> (Cuv.)	Lectotype BMNH. 1867.11.28.26
36. <i>Alausa brachysoma</i> Blkr., 1853	<i>Hilsa kelee</i> (Cuv.)	Holotype BMNH. 1867.11.28.24
37. [<i>Harengula</i> (<i>Paralosa</i>) <i>zeylanica</i> Hubrecht, 1879]	<i>Hilsa kelee</i> (Cuv.)	[on specimen RMNH. 7495]
38. <i>Alosa malayana</i> Blkr., 1866	<i>Hilsa kelee</i> (Cuv.)	Lectotype RMNH. 7108
39. <i>Alausa ctenolepis</i> Blkr., 1852	<i>Hilsa toli</i> (Val.)	Lectotype BMNH. 1867.11.28.23
40. <i>Alausa macrurus</i> Blkr., 1852	<i>Hilsa macrura</i> (Blkr.)	Neotype RMNH. 7112
<i>Anodontostoma</i> Blkr., 1849	<i>Anodontostoma</i> Blkr.	
41. <i>Anodontostoma hasselii</i> Blkr., 1849	<i>Anodontostoma chacunda</i> (Ham. Buch.)	Putative neotype RMNH. 7082
42. <i>Chatoessus selangkai</i> Blkr., 1852	<i>Anodontostoma chacunda</i> (Ham. Buch.)	(no selection made, see text)
43. <i>Pellona hoevenii</i> Blkr., 1852	<i>Pellona ditcheia</i> Val.	Putative neotype RMNH. 7118
44. <i>Pellona pristigastroides</i> Blkr., 1852	<i>Ilisha pristigastroides</i> (Blkr.)	Holotype BMNH. 1867.11.28.12
45. <i>Pellona amblyropterus</i> Blkr., 1852	<i>Ilisha pristigastroides</i> (Blkr.)	Holotype RMNH. 7120
46. <i>Pellona xanthopterus</i> Blkr., 1851	<i>Ilisha xanthoptera</i> (Blkr.)	Holotype BMNH. 1867.11.28.14
47. <i>Ilisha macrogaster</i> Blkr., 1866	<i>Ilisha macrogaster</i> Blkr.	Holotype BMNH. 1867.11.28.20
48. <i>Pellona schlegelii</i> Blkr., 1854	<i>Ilisha elongata</i> (Bennett)	Holotype BMNH. 1867.11.28.72
49. <i>Pellona brachysoma</i> Blkr., 1852	<i>Ilisha brachysoma</i> (Blkr.)	Holotype BMNH. 1867.11.28.16
50. <i>Pellona russellii</i> Blkr., 1852	<i>Ilisha megaloptera</i> (Swainson)	Lectotype BMNH. 1867.11.28.13
51. <i>Opisthopterus macrogastus</i> Blkr., 1866	<i>Opisthopterus taroore</i> (Cuv.)	Lectotype RMNH. 7125
52. <i>Opisthopterus valenciennesi</i> Blkr., 1872	<i>Opisthopterus valenciennesi</i> Blkr.	Lectotype BMNH. 1965.9.24.1
53. <i>Engraulis zollingeri</i> Blkr., 1849	<i>Engraulis japonicus</i> Temm. & Schl.	Putative neotype BMNH. 1867.11.28.61
54. <i>Engraulis tri</i> Blkr., 1852	<i>Stolephorus tri</i> (Blkr.)	Lectotype RMNH. 2222
55. <i>Engraulis baimensis</i> Blkr., 1849	<i>Stolephorus indicus</i> (Van Hass.)	(no selection made, see text)
56. <i>Engraulis russellii</i> Blkr., 1852	<i>Stolephorus indicus</i> (Van Hass.)	Lectotype RMNH. 7076

TABLE III

Indo-Pacific species and genera described by Bleeker and list of types in London, Leiden and Paris (continued)

Bleeker name	name recognised here	Types
57. <i>Engraulis encrasioloides</i> Blkr., 1852	<i>Thryssina baelama</i> (Forsk.)	Lectotype RMNH. 3536
58. <i>Engraulis kammalensis</i> Blkr., 1849	<i>Thryssa kammalensis</i> (Blkr.)	Lectotype RMNH. 7067
59. <i>Engraulis rhinorhynchus</i> Blkr., 1852	<i>Thryssa kammalensis</i> (Blkr.)	(type as for <i>Engraulis kammalensis</i> Blkr.)
60. <i>Engraulis grayi</i> Blkr., 1851	<i>Thryssa hamiltonii</i> (Gray)	Lectotype RMNH. 7068
61. <i>Engraulis mystacoides</i> Blkr., 1852	<i>Thryssa mystax</i> (Bloch & Schn.)	Lectotype RMNH. 7069
62. <i>Stolephorus</i> (<i>Thryssa</i>) <i>valenciennessi</i> Blkr., 1866	<i>Thryssa mystax</i> (Bloch & Schn.)	Lectotype RMNH. 7071
63. <i>Thryssa macrognathos</i> Blkr., 1849	<i>Thryssa setirostris</i> (Brouss.)	(no selection made, see text)
64. <i>Engraulis telaroides</i> Blkr., 1849	<i>Setipinna taty</i> (Val.)	Putative neotype RMNH. 7080
65. <i>Engraulis melanocheir</i> Blkr., 1849	<i>Setipinna melanocheir</i> (Blkr.)	Putative neotype RMNH. 7079
66. <i>Engraulis pfeifferi</i> Blkr., 1852	<i>Setipinna breviceps</i> (Cantor)	Holotype RMNH. 7077
67. <i>Engraulis crocodilus</i> Blkr., 1850	<i>Lycotryssa crocodilus</i> (Blkr.)	Holotype RMNH. 7015
68. <i>Coilia cantoris</i> Blkr., 1853	<i>Coilia ramcarai</i> (Ham. Buch.)	Holotype BMNH. 1867.II.28.266
69. <i>Coilia rebenitschii</i> Blkr., 1859	<i>Coilia rebenitschii</i> Blkr.	Holotype BMNH. 1867.II.28.74
70. <i>Coilia borneensis</i> Blkr., 1852	<i>Coilia borneensis</i> Blkr.	Putative neotype BMNH. 1867.II.28.78
71. <i>Coilia macrognathos</i> Blkr., 1852	<i>Coilia macrognathos</i> Blkr.	Lectotype RMNH. 7074
72. <i>Coilia lindmani</i> Blkr., 1858	<i>Coilia lindmani</i> Blkr.	Holotype BMNH. 1867.II.28.76
	<i>Coilia</i> Gray	
73. <i>Leptonurus chryso stigma</i> Blkr., 1849	<i>Coilia dussumieri</i> Val.	Lectotype RMNH. 7073



Engraulis pfeifferi, 285 mm tot. l. (BMNH. 1867.11.28.55) showing vertical pencil marks on flank.

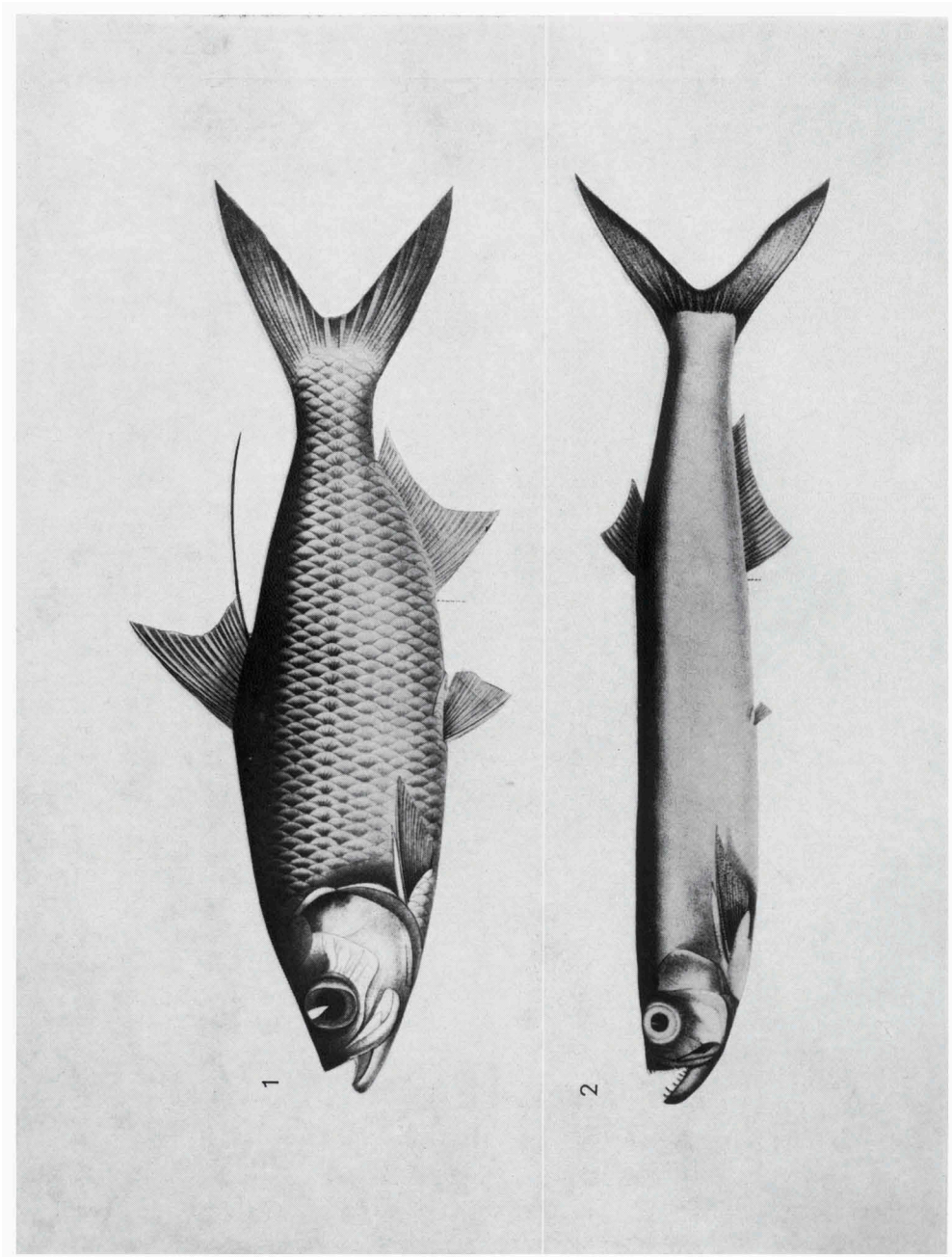


Fig. 1. *Megalops cyprinoides* (Brouss.) [*Megalops macropterus* pl. 273(2) 395 mm.]
Fig. 2. *Chirocentrus hypselosoma* Blkr. [*Chirocentrus hypselosoma* pl. 269(3) 421 mm.]



Fig. 1. *Dussumieria acuta* Val. [*Dussumieria acuta* pl. 271(1) 158 mm.]

Fig. 2. *Dussumieria acuta* Val. [*Dussumieria hasseltii* pl. 271(2) 162 mm.]

Fig. 3. *Spratelloides delicatulus* (Bennett) [*Spratelloides delicatulus* pl. 264 (3) 81 mm.]

Fig. 4. *Spratelloides gracilis* (Temm. & Schl.) [*Spratelloides gracilis* pl. 266(2) 84 mm.]

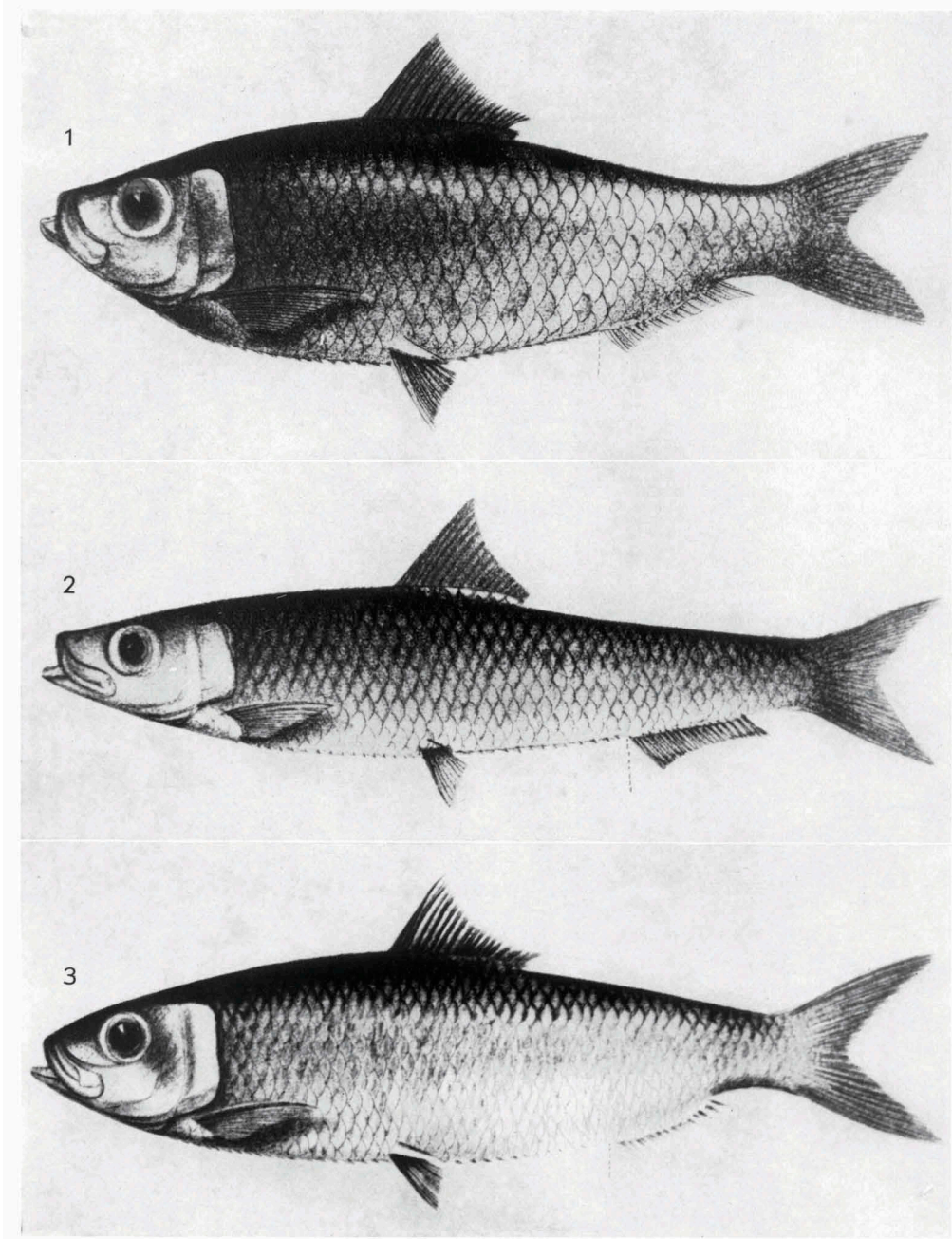


Fig. 1. *Herklotsichthys dispilonotus* (Blkr.) [*Clupea (Harengula) dispilonotus* pl. 261(3)
85 mm.]

Fig. 2. *Herklotsichthys punctatus* (Rüpp.) [*Clupea (Meletta) schrammi* pl. 272(3)
100 mm.]

Fig. 3. *Herklotsichthys punctatus* (Rüpp.) [*Clupea (Harengula) moluccensis* pl. 263(2)
142 mm.]

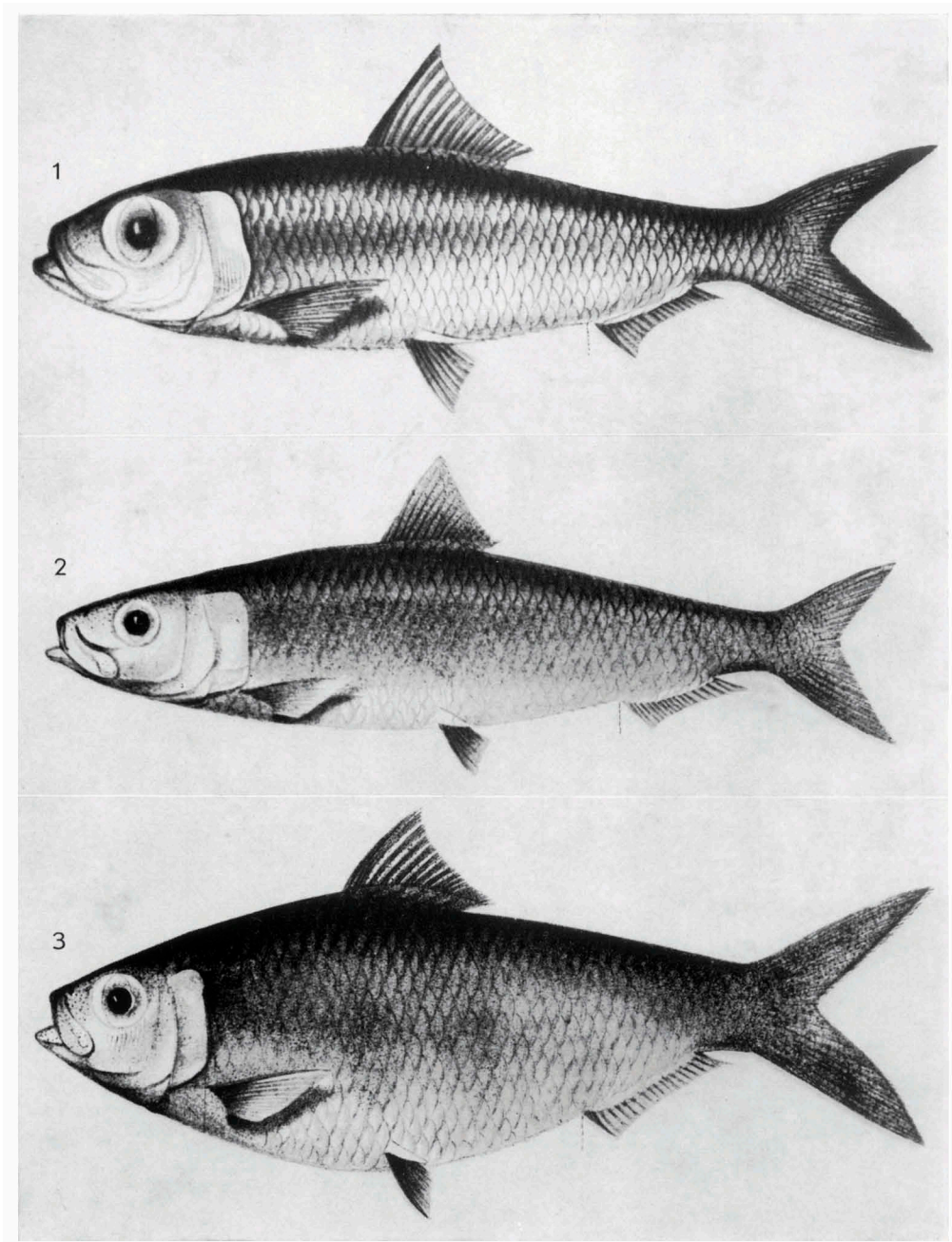


Fig. 1. *Herklotsichthys punctatus* (Rüpp.) [*Clupea (Harengula) kunzei* pl. 263(1)
143 mm.]

Fig. 2. *Sardinella aurita* Val. [*Clupea (Sardinella) lemuru* pl. 267(1) 156 mm.]

Fig. 3. *Sardinella brachysoma* Blkr. [*Clupea (Sardinella) brachysoma* pl. 267(4) 148 mm.]

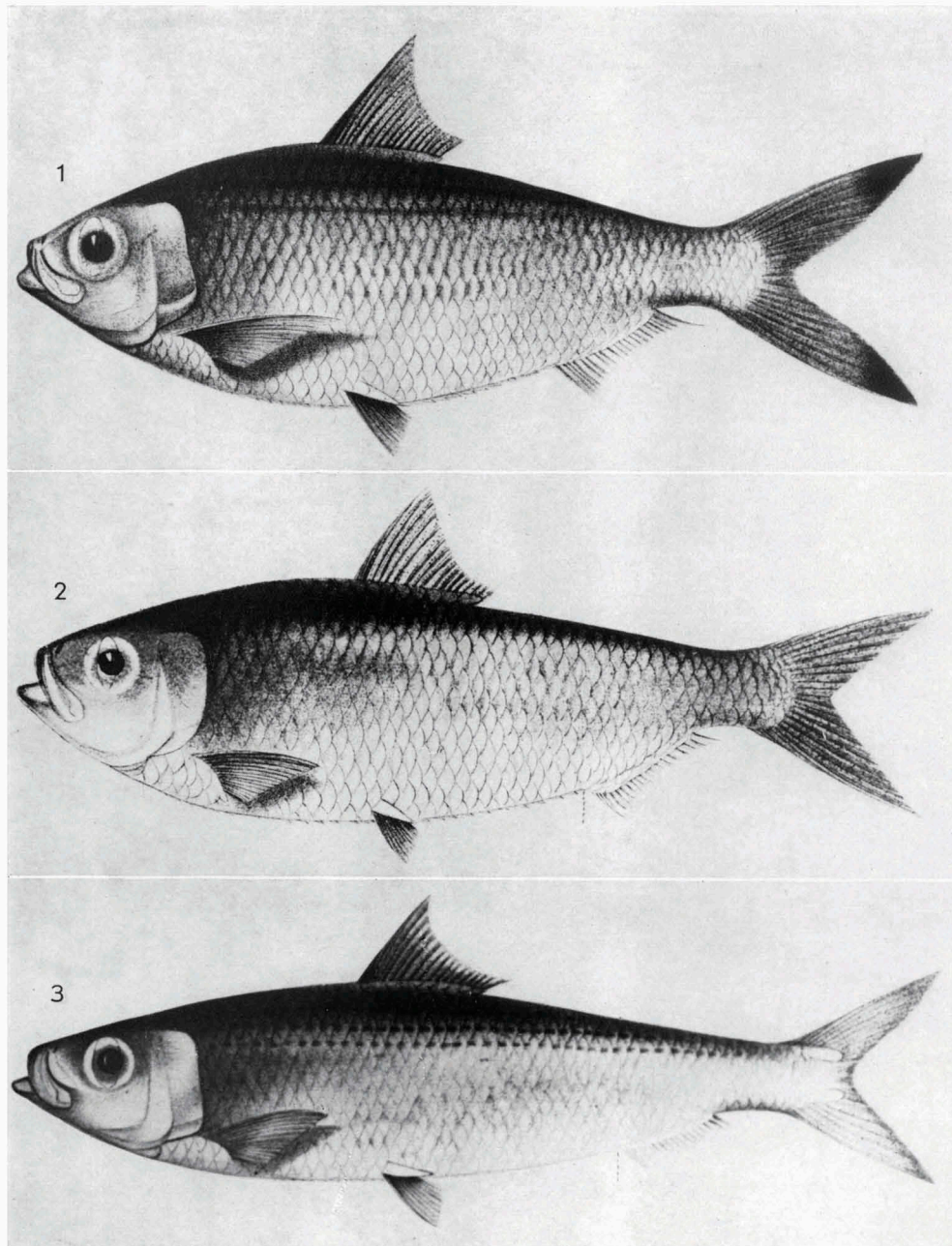


Fig. 1. *Sardinella brachysoma* Blkr. [*Clupea (Harengula) hypselosoma* pl. 267(2) 163 mm.]

Fig. 2. *Sardinella bulan* (Blkr.) [*Clupea (Clupalosa) kowal* pl. 266(5) 140 mm.]

Fig. 3. *Sardinella jussieu* (Lac.) [*Clupea (Spratella) gibbosa* pl. 266(6) 188 mm.]



Fig. 1. *Sardinella zunasi* (Blkr.) [*Clupea* (*Spratella*) *fimbriata* pl. 271(5) 185 mm.]
 Fig. 2. *Sardinella melanura* (Cuv.) [*Clupea* (*Paralosa*) *melanurus* pl. 269(5) 138 mm.]
 Fig. 3. *Sardinella clupeioides* (Blkr.) [*Clupea* (*Sardinella*) *clupeioides* pl. 272(1)
 264 mm.]
 Fig. 4. *Sardinella sirm* (Walb.) [*Clupea* (*Sardinella*) *leiogastroides* pl. 272(2) 143 mm.]

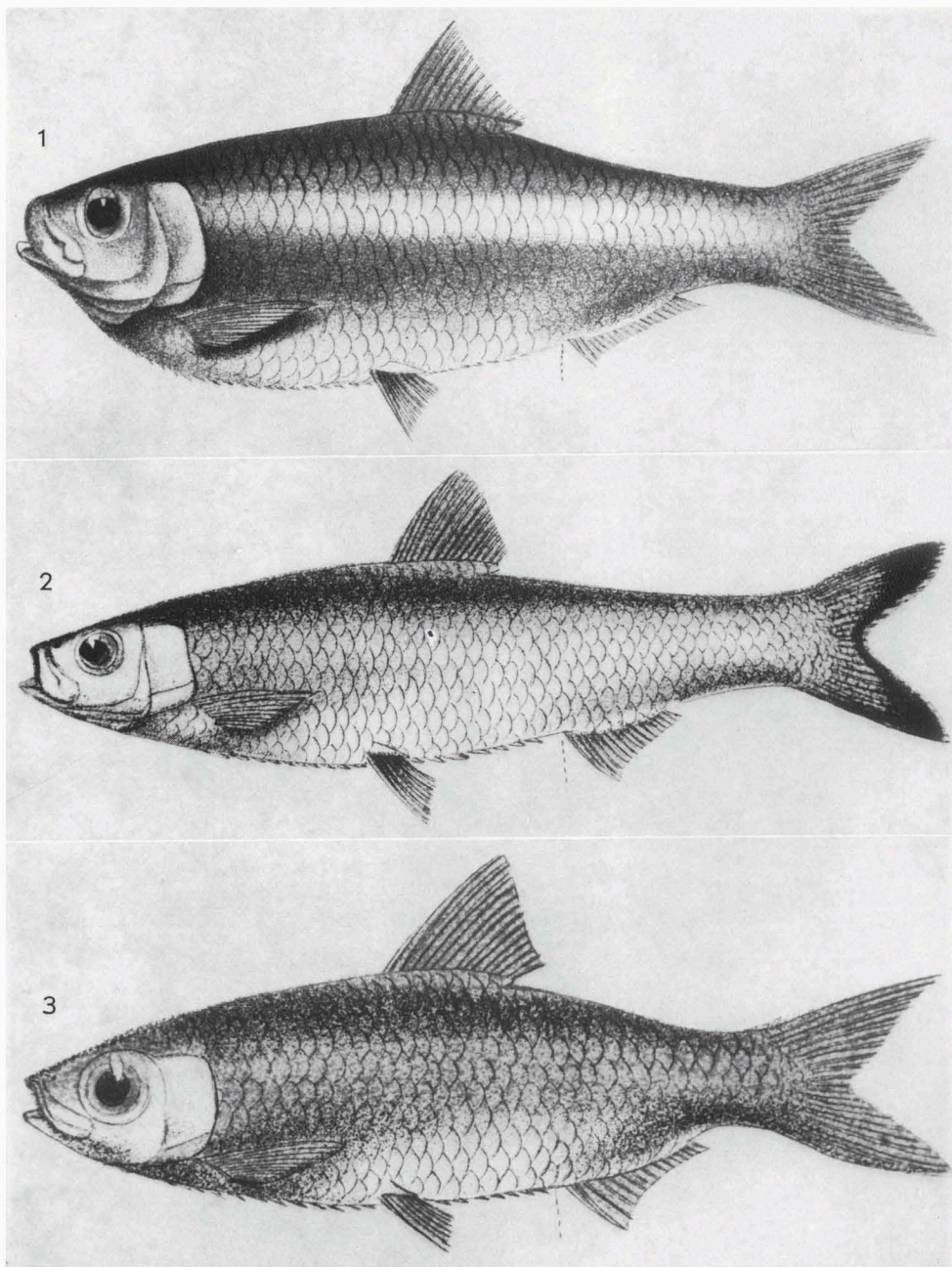


Fig. 1. *Escualosa thoracata* (Val.) [*Clupea* (*Leptogaster*) *argyrotaenia* pl. 264(5) 86 mm.]

Fig. 2. *Clupeoides borneensis* Blkr. [*Clupeoides borneensis* pl. 262(2) 76 mm.]

Fig. 3. *Clupeoides hypselosoma* Blkr. [*Clupeoides hypselosoma* pl. 260(5) 55 mm.]

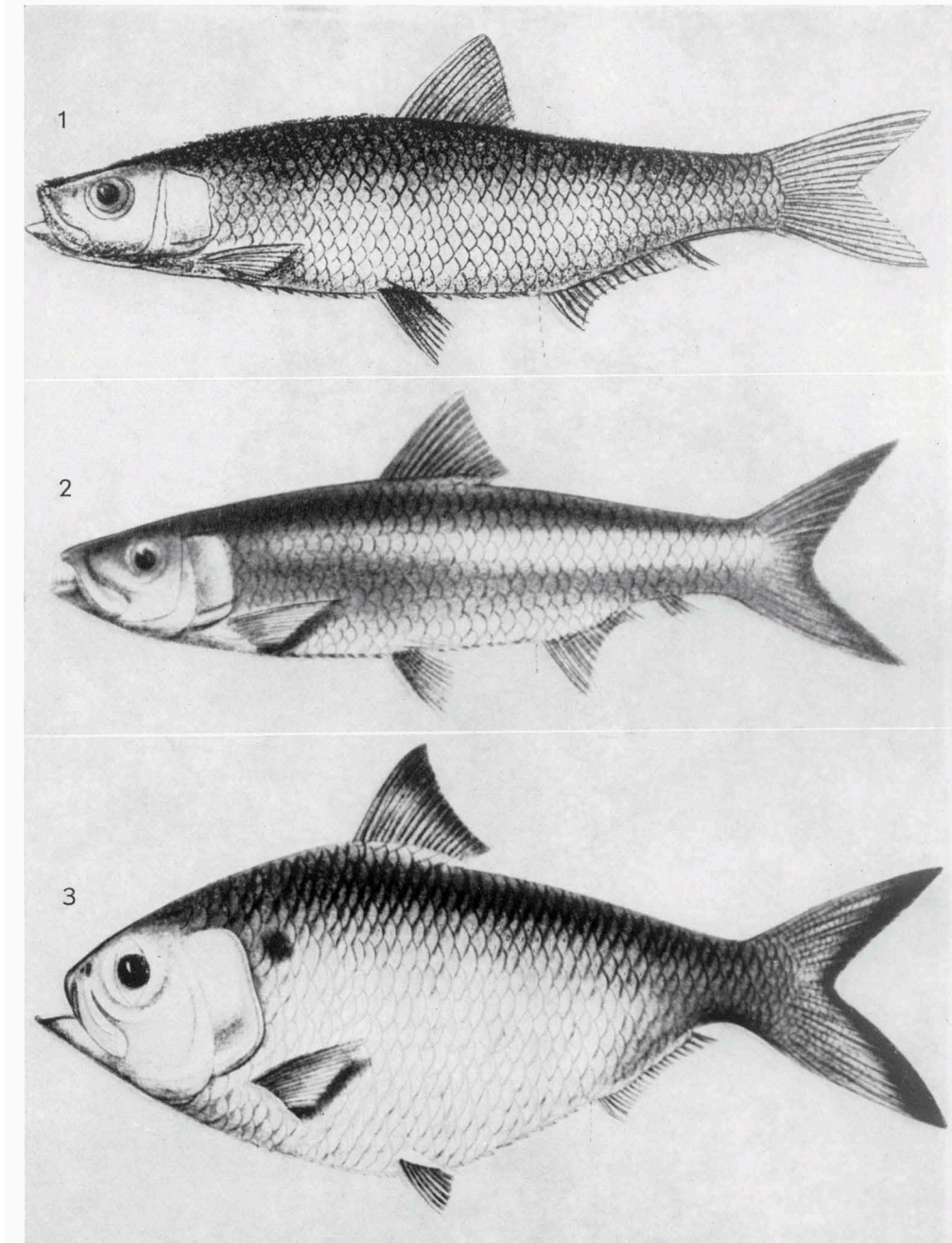


Fig. 1. *Corica soborna* Ham. Buch. [*Corica pseudopterus* pl. 260(3) 49 mm.]
Fig. 2. *Clupeichthys goniognathus* Blkr. [*Clupeichthys goniognathus* pl. 264(1) 84 mm.]
Fig. 3. *Hilsa kelee* (Cuv.) [*Alosa brachysoma* pl. 262(5) 140 mm.]

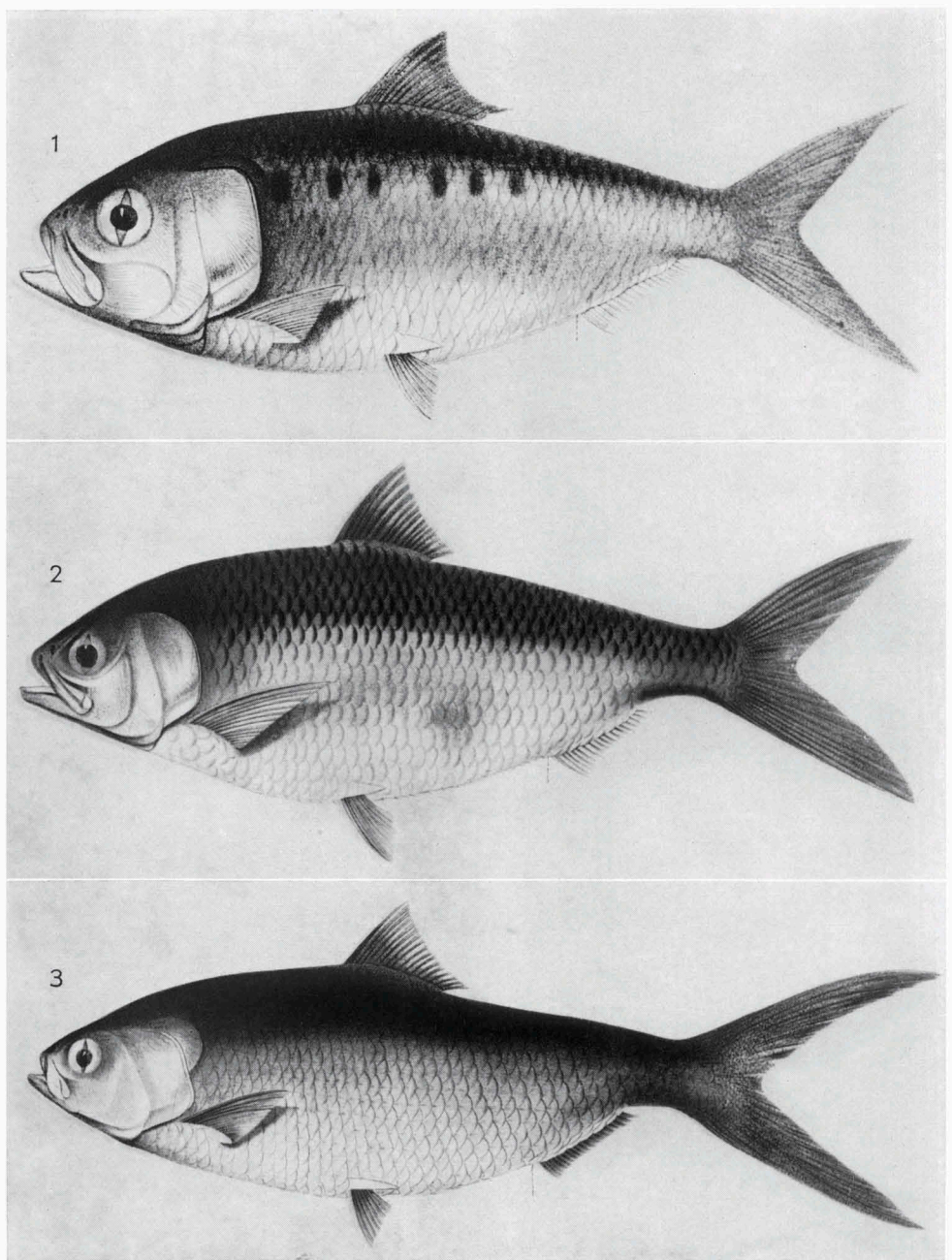


Fig. 1. *Hilsa kelee* (Cuv.) [*Alosa kanagurta* pl. 265(5) 195 mm.]
Fig. 2. *Hilsa toli* (Val.) [*Alosa toli* pl. 266(4) 389 mm.]
Fig. 3. *Hilsa macrura* (Blkr.) [*Alosa macrurus* pl. 264(4) 341 mm.]

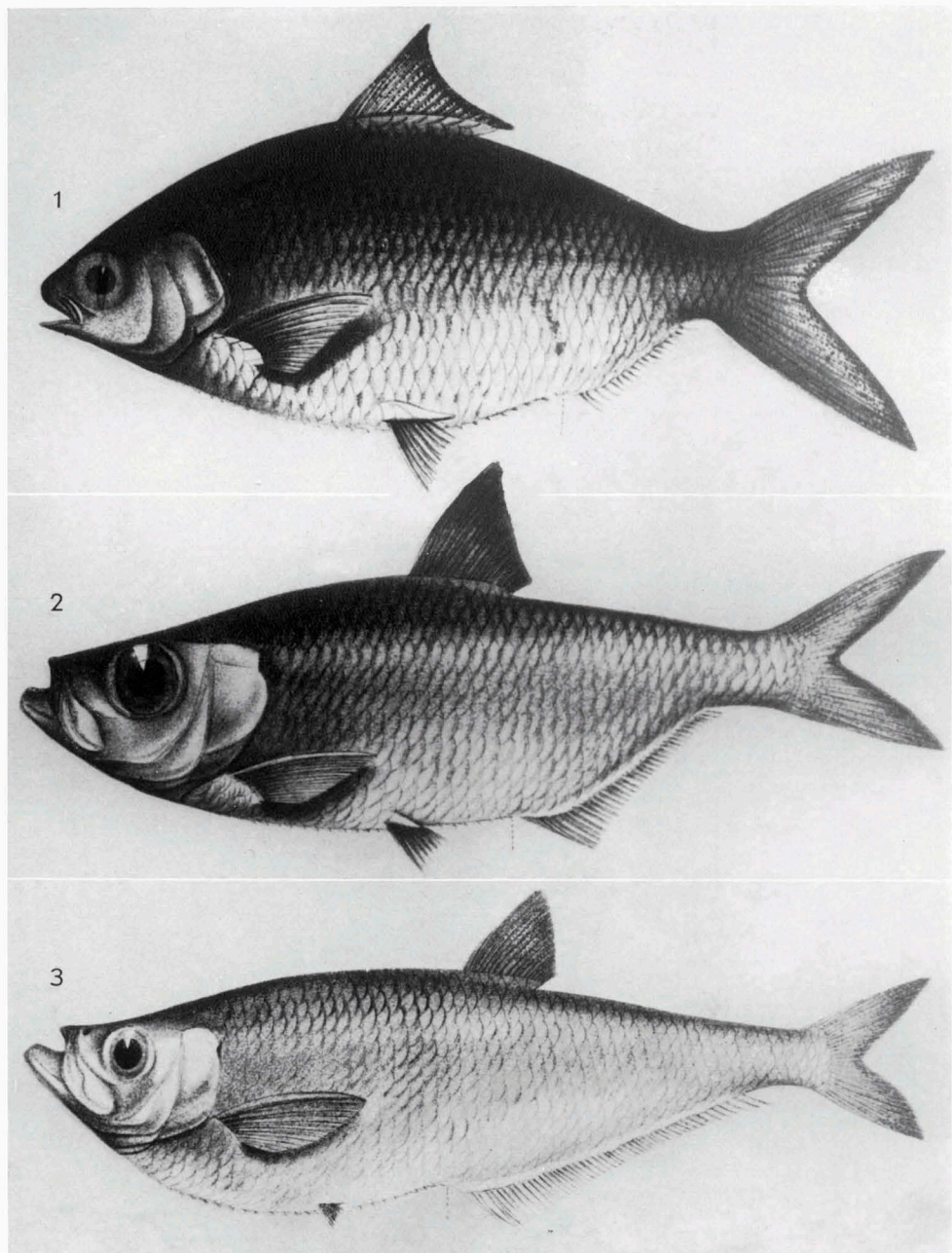


Fig. 1. *Anodontostoma chacunda* (Ham. Buch.) [*Dorosoma chacunda* var. *selangkat* pl. 261(5) 159 mm.]

Fig. 2. *Pellona ditchela* Val. [*Ilisha hocvenii* pl. 269(2) 176 mm.]

Fig. 3. *Ilisha pristigastroides* (Blkr.) [*Ilisha pristigastroides* pl. 269(1) 181 mm.]

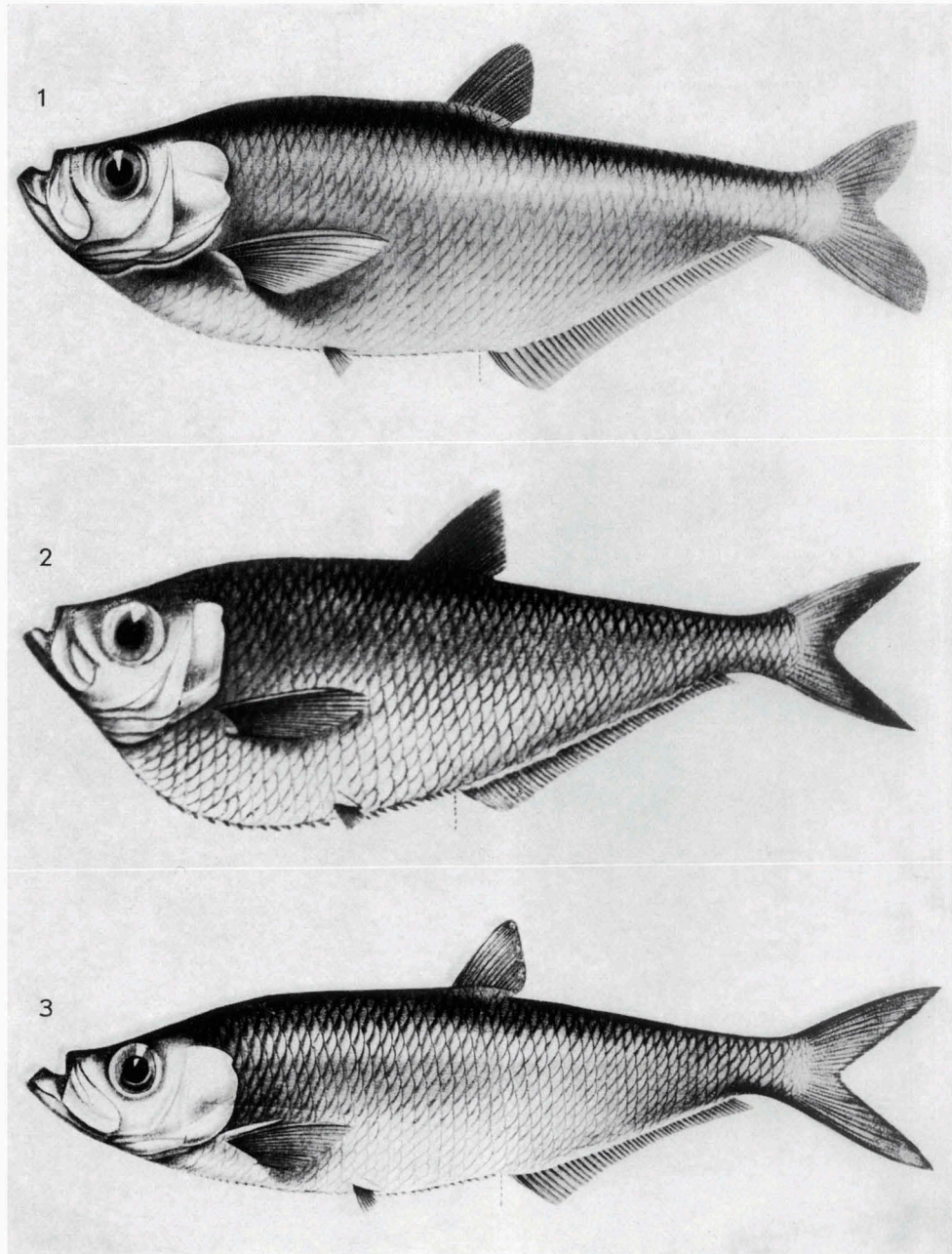


Fig. 1. *Ilisha xanthoptera* (Blkr.) [*Ilisha xanthopterus* pl. 265(3) 352 mm.]

Fig. 2. *Ilisha macrogaster* Blkr. [*Ilisha macrogaster* pl. 271(4) 145 mm.]

Fig. 3. *Ilisha elongata* (Bennett) [*Ilisha elongata* pl. 259(3) 336 mm.]



Fig. 1. *Ilisha brachysoma* (Blkr.) [*Ilisha brachysoma* pl. 267(5) 164 mm.]
Fig. 2. *Ilisha megaloptera* (Swainson) [*Ilisha megalopterus* pl. 264(6) 252 mm.]
Fig. 3. *Opisthopterus tardoore* (Cuv.) [*Opisthopterus macrognathus* pl. 268(4) 206 mm.]

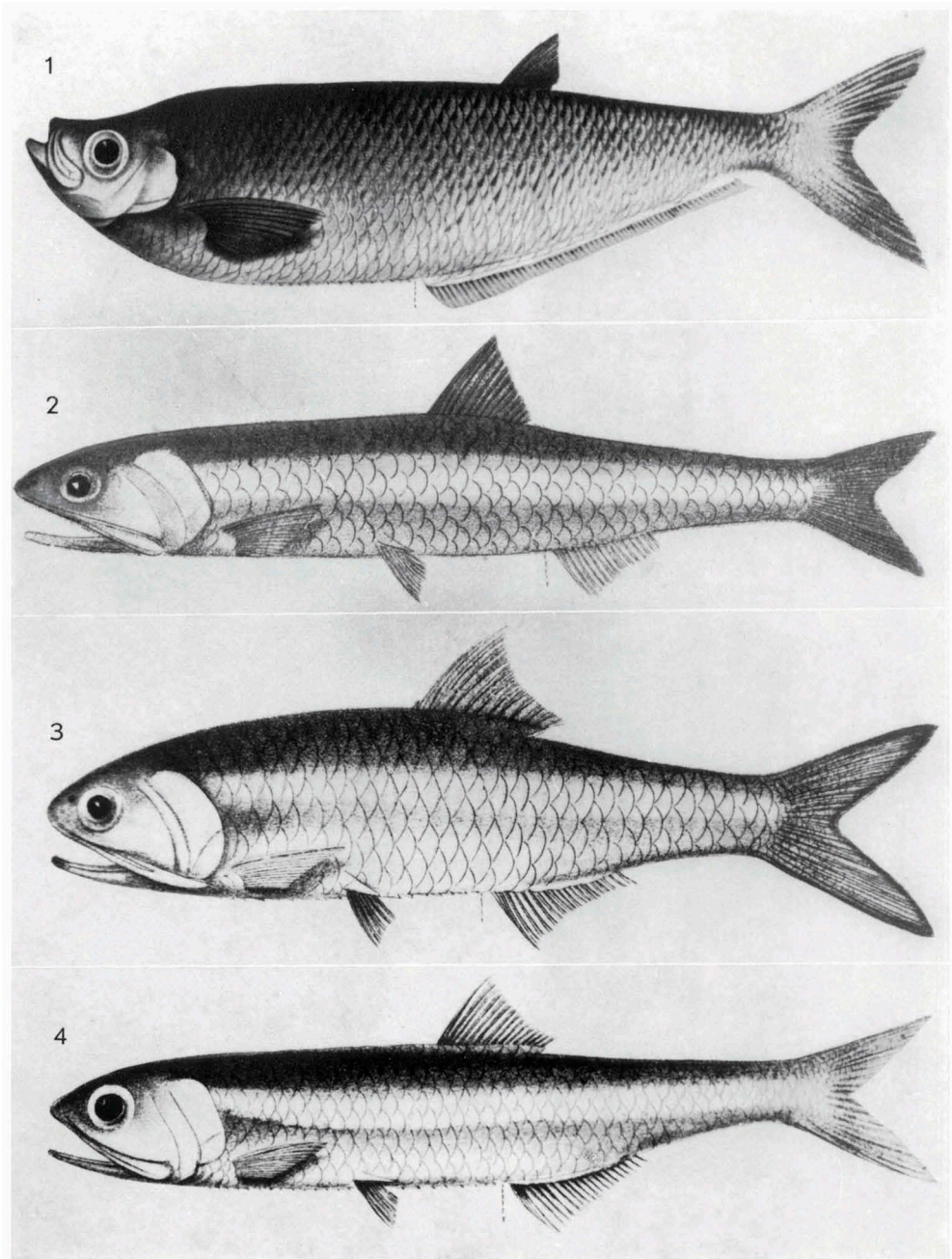


Fig. 1. *Opisthopecterus valenciennesi* Blkr. [*Opisthopecterus tartoor* pl. 263(5) 223 mm.]

Fig. 2. *Engraulis japonicus* Temm. & Schl. [*Stolephorus (Stolephorus) sollingeri* pl. 264(2) 87 mm.]

Fig. 3. *Stolephorus tri* (Blkr.) [*Stolephorus (Thrissa) tri* pl. 262(1) 113 mm.]

Fig. 4. *Stolephorus indicus* (Van Hass.) [*Stolephorus (Stolephorus) indicus* pl. 259(2) 145 mm.]

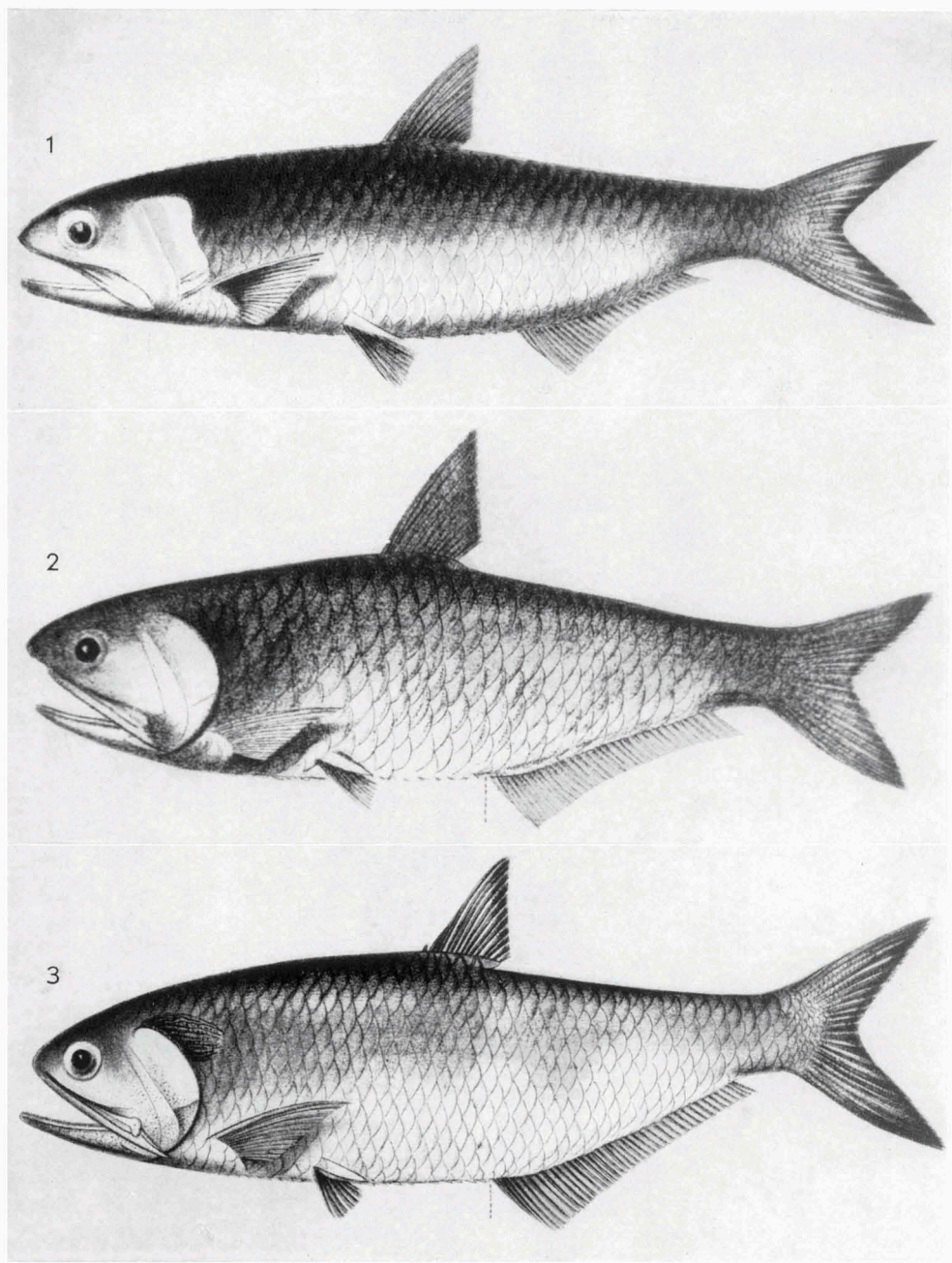


Fig. 1. *Thrissina baclama* (Forsk.) [*Stolephorus (Engraulis) encrasicholoides* pl. 253(4)
132 mm.]

Fig. 2. *Thryssa kammalensis* (Blkr.) [*Stolephorus (Thryssa) kammalensis* pl. 265(2)
99 mm.]

Fig. 3. *Thryssa hamiltonii* (Gray) [*Stolephorus (Thryssa) hamiltoni* pl. 259(5) 193 mm.]

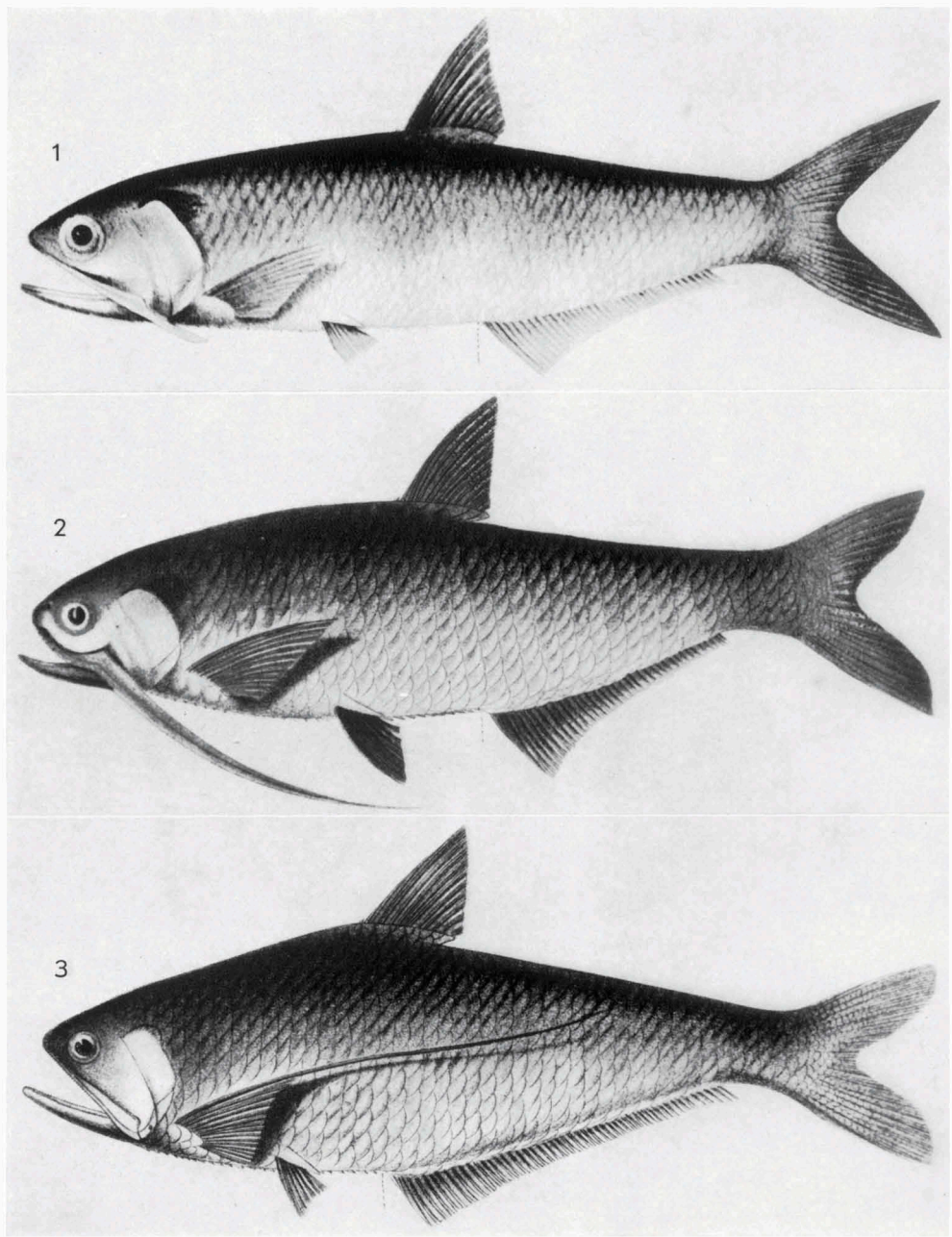


Fig. 1. *Thryssa mystax* (Bloch & Schn.) [*Stolephorus (Thryssa) mystax* pl. 261(2)
175 mm.]

Fig. 2. *Thryssa setirostris* (Brouss.) [*Stolephorus (Thryssa) setirostris* pl. 261(1)
160 mm.]

Fig. 3. *Setipinna taty* (Val.) [*Stolephorus (Setipinna) taty* pl. 260(7) 161 mm.]

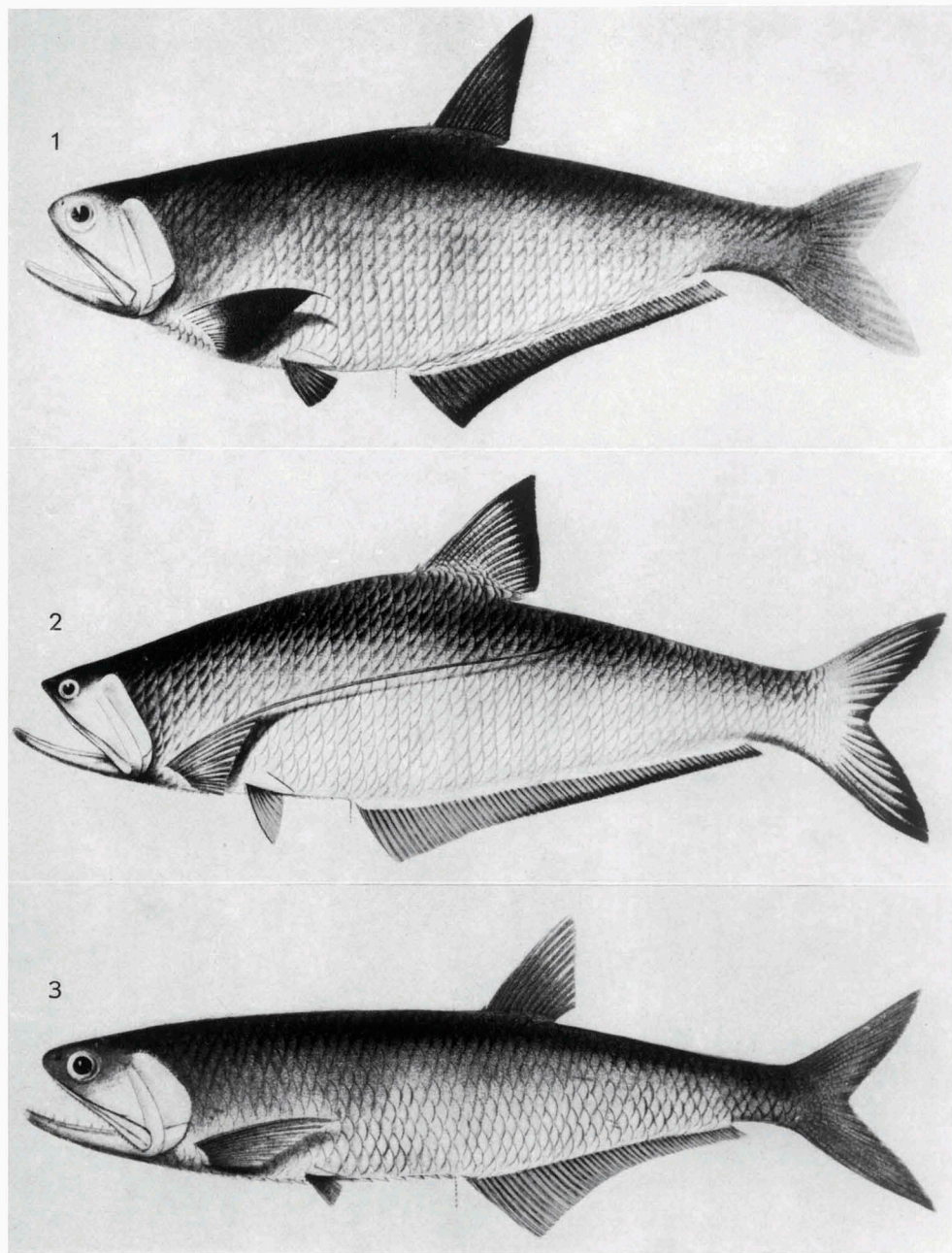


Fig. 1. *Setipinna melanochir* (Blkr.) [*Stolephorus (Setipinna) melanochir* pl. 267(3)
258 mm.]

Fig. 2. *Setipinna breviceps* (Cantor) [*Stolephorus (Setipinna) pfeifferi* pl. 263(3)
288 mm.]

Fig. 3. *Lycothrissa crocodilus* (Blkr.) [*Stolephorus (Lycothrissa) crocodilus* pl. 268(1)
173 mm.]

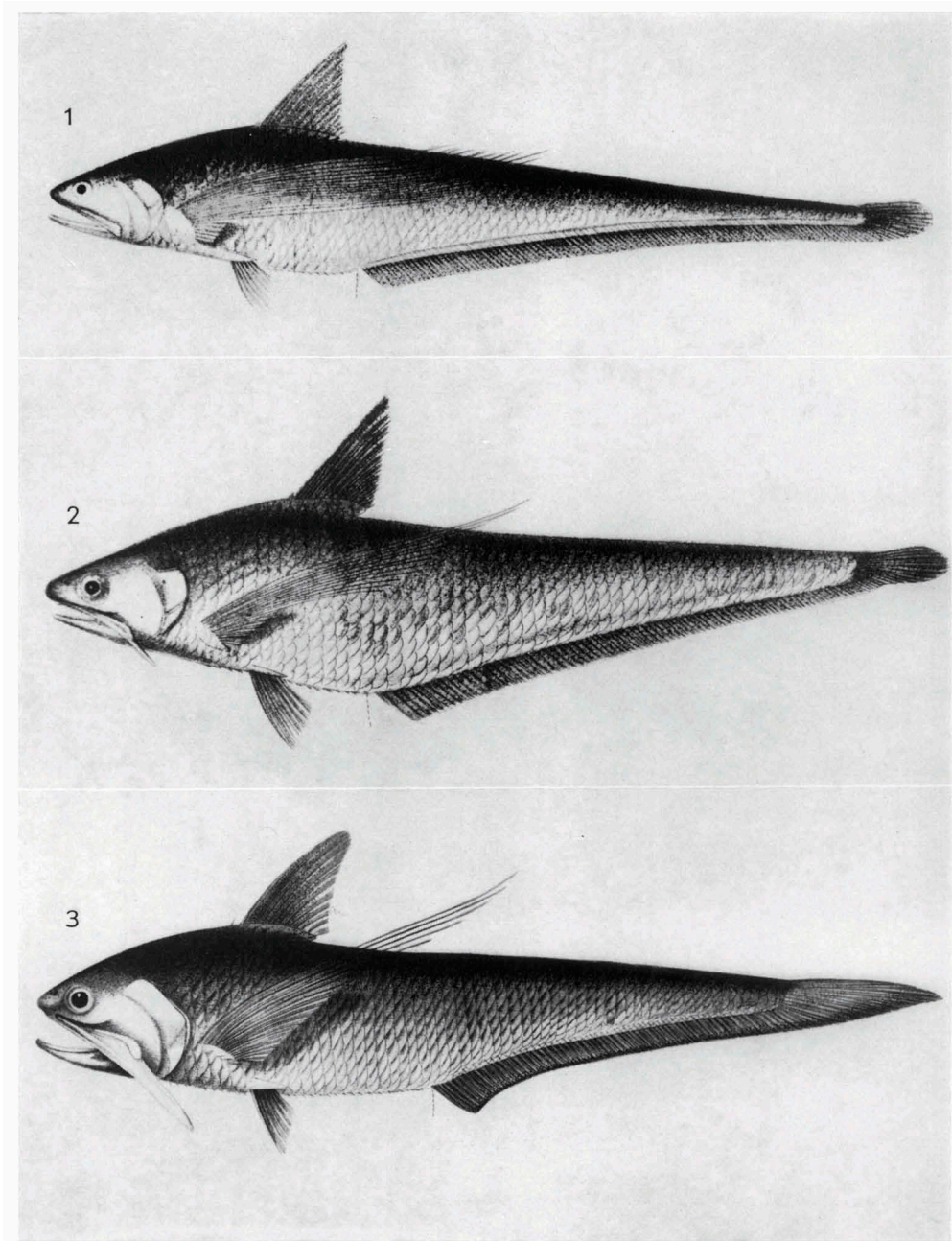


Fig. 1. *Coilia rebentischii* Blkr. [*Coilia (Coilia) rebentischii* pl. 266(3) 158 mm.]

Fig. 2. *Coilia borneensis* Blkr. [*Coilia (Coilia) borneensis* pl. 262(3) 125 mm.]

Fig. 3. *Coilia macrognathos* Blkr. [*Coilia (Chaetomus) macrognathos* pl. 261(4) 255 mm.]

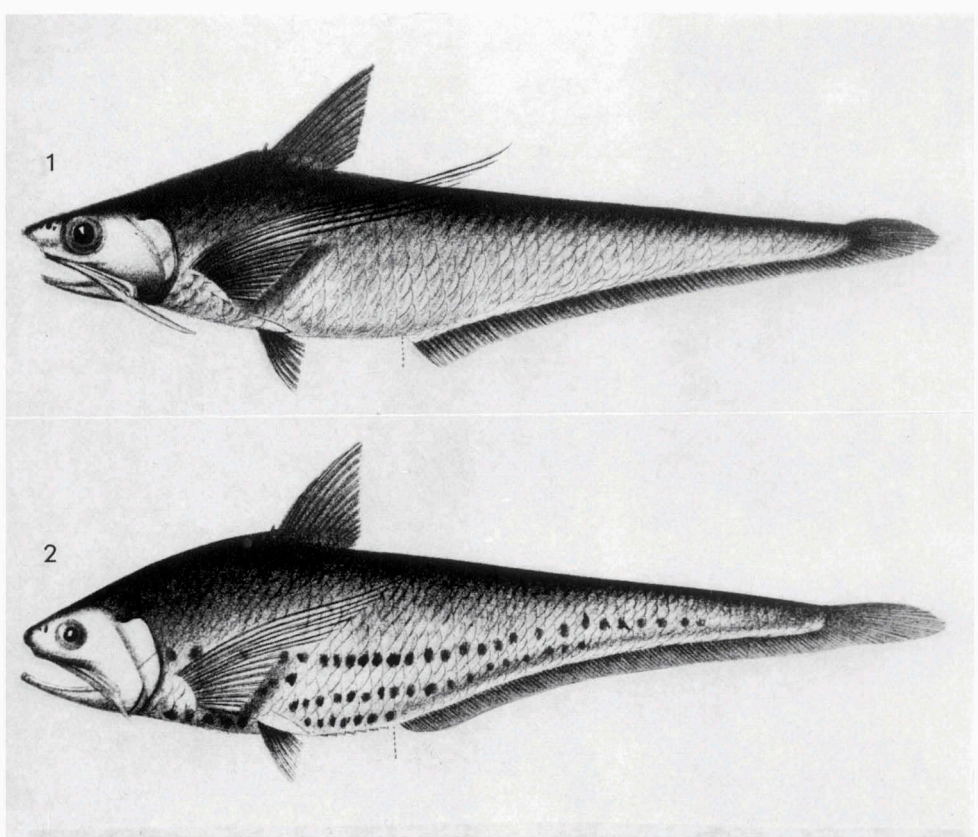


Fig. 1. *Coilia lindmani* Blkr. [*Coilia (Chactomus) lindmani* pl. 270(2) 170 mm.]
Fig. 2. *Coilia dussumieri* Val. [*Coilia (Coilia) dussumieri* pl. 270(3) 155 mm.]