Fishery Biology of 40 Trawl-caught Teleosts of Western Indonesia[a]

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Abstract

A review of the biology of 40 fish species abundant in bottom trawl catches in Western Indonesia is presented. This emphasizes geographic and depth distribution, based on surveys conducted from 1974 to 1981 by the research vessels *Jurong, Mutiara 4, Dr. Fridtjof Nansen, Lemuru* and *Bawal Putih 2*, and biological information (growth, length-weight relationships, food and feeding habits) estimated from the survey data and/or extracted from FishBase, the computerized encyclopedia of fish.

Abstrak

Tulisan ini menyajikan suatu tinjauan terhadap biologi dari 40 spesies ikan yang banyak terdapat dalam hasil tangkapan trawl di perairan Indonesia bagian barat. Tulisan ini menekankan penyebaran secara geografis dan kedalaman, berdasarkan survei yang dilaksanakan dari tahun 1974 hingga 1981 oleh kapal-kapal penelitian Jurong, Mutiara 4, Dr. Fridtjof Nansen, Lemuru *dan* Bawal Putih 2, *serta informasi biologi (pertumbuhan, hubungan panjang-berat, makanan dan kebiasaan makan) yang diperoleh dari data survei dan/atau diambil dari FishBase, suatu ensiklopedia ikan dalam bentuk perangkat lunak komputer.*

Introduction

The following review of the biology of 40 trawl-caught species of Western Indonesia was written for a number of interrelated purposes:

1) to serve as repository for selected information on commercially (or potentially) important fish resources, extracted from the trawl surveys documented elsewhere in this book;
2) to make available, in a single source document, key parameters on the biology of these important species for stock assessment and related purposes in Indonesia and other countries with similar ichthyofauna;
3) to refute for audiences elsewhere, the often-stated but increasingly untrue statement that "nothing is known on the biology of tropical fishes" and, last but not least;
4) to illustrate how information extracted from FishBase, the computerized encyclopedia of fishes (see Froese et al., this vol.) can be combined with field data to characterize any species of fish.

Materials and Methods

The catch/effort data obtained during the trawl survey of *Jurong, Mutiara 4, Dr. Fridtjof Nansen, Lemuru* and *Bawal Putih 2*, documented in Lohmeyer (this vol.), Bianchi (this vol.), Martosubroto (this vol.), Pauly et al. (this vol.), Bianchi et al. (this vol.) and Torres et al. (this vol.) were used to identify 40 important teleosts species of Western Indonesia, listed on Table 1 in taxonomic order. For each species, the following is presented, so far available:

i) Valid scientific name (including author and date), and common names, in English and Indonesian when available (see Froese et al., this vol.);
ii) A brief description of the distinctive characteristics of the species including meristic counts, adapted wherever possible from the appropriate FAO species catalogues. The graph illustrating each species was either scanned, or redrawn by Mr. Robbie Cada, of the FishBase project, based on various sources. Maximum lengths are given for each species, and may refer to total length (TL), fork length (FL) or standard length (SL); these codes are omitted when the length type could not be determined from the reference used. These maximum lengths are either:

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a) reported maximum length of any specimen of the species in question, from locations outside Indonesia (here coded L_{max1});
b) maximum length in Indonesia, as observed during the surveys reported upon in this volume or related publications (here coded L_{max2});
c) maximum length (and 95% confidence interval) that may be expected in Indonesia, based on the maxima of a series of length-frequency samples and on extreme value theory (Formacion et al. 1991). Such values are here coded L_{max3}, and are presented along with the graph through which they were estimated, themselves outputs of the FiSAT software (Gayanilo et al. 1996);

iii) Geographic distribution: outside Indonesia through a brief text, and within Indonesia through a map generated by the MAPPER software (Coronado and Froese 1994) and showing the occurrences of each species at stations covered by the surveys documented in this volume;
iv) Graphs illustrating the depth distribution of each species in a survey conducted in Western Indonesia;
v) A brief account of the biology of the species. Emphasis herein is given to habitats, food and feeding habits and, so far available, to estimates of the von Bertalanffy (1951) growth function (VBGF) for the species in question, either in Indonesia or elsewhere. The VBGF has, for length, the form

$$L_t = L_\infty (1-\exp(-K(t-t_0))) \quad ...1)$$

where L_∞ is the mean length the fish of the population would reach if they were to grow indefinitely (here always in cm), K is the rate at which L_∞ is approached, and t_0 is the theoretical age the fish would have had at length zero if they had always grown according to the VBGF. This parameter, difficult to estimate in the absence of *absolute* age data (i.e., when L_∞ and K are estimated from length-frequency data, as is also the case for Indonesian fishes) is not given here. Few stock assessment models require t_0, in any case.

Box 1. Estimating the parameters of length-weight relationships from length-frequency samples and their weights.
[Boks 1. Estimasi parameter hubungan panjang-berat dari contoh frekuensi-panjang dan berat.]

Length-weight relationships, in fisheries biology, usually take the form

$$W = a \cdot L^b \quad ...1)$$

where W is the body weight (live or gutted) of the fish, a is a multiplicative factor, L a linear measure (e.g., total or fork length) of the fish body, and b is an exponent, usually close to 3 but which may range from 2.5 to 3.5 and exceptionally from 2 to 4.

Estimating the parameters of such relationships is usually straightforward, and is usually done by plotting the logarithms of the available individual weights against the logarithms of the corresponding lengths, i.e.,

$$\log(W) = \log(a) + b\log(L) \quad ...2)$$

and using a Type I (or predictive) linear regression to estimate log(a) and b. Variants of this approach exist, but this need not concern us here, as we deal below with cases where the available data do not consist of L-W data pairs.

During the demersal trawl surveys described in this volume, there was often not enough time for fully analyzing the catch of one station before the catch of the next station was hauled in; such cases resulted in aggregated data, i.e., samples of fish that had been *measured* individually, leading to length-frequency samples (L/F), but not *weighted* individually. Thus, only the bulk weights of the L/F are available (accurate shipborn weighting of small fishes was usually not possible anyway).

We present here a new method to estimate a and b in length-weight relationships using such data; this requires the computation of "pseudoweights", i.e., of sample weights obtained using estimates of the parameters a and b of a length-weight relationship.

Estimating the pseudoweight of samples requires an accurate estimator of the mean weight ($\overline{w}_i$) of the fish within a given length class (i), which is not equal to the weight corresponding to the midpoint of that length class, or midlength. For this, we use

$$\overline{w}_i = (1 / L_{i+1} - L_i) \cdot (a / b+1) \cdot (L_{i+1}^{b+1} - L_i^{b+1}) \quad ...3)$$

where a and b are as defined in Equation (1).

The pseudoweight (W'j) of a given sample (j) is then estimated from

$$W'_j = \sum_{i=1}^{n_j} \left(\overline{w}_i \bullet f_{i,j}\right) \quad ...4)$$

where:

$\overline{w}_i$ is the mean weight of class i (Equation 3);
fi,j is the frequency of class i in sample j; and
nj is the number of classes in sample j.

When a number ($\geq$ 3) of length-frequency samples and their bulk weights are available, a and b can be estimated iteratively, using arbitrary seed values of a and b (e.g., a = 0.01 and b = 3), and using a nonlinear least squares procedure (here: Marquardt's compromise algorithm) which minimizes the sum of the squared differences (SSE) between the sample weights (Wj) and the pseudoweights (W'j), both previously log-transformed to stabilize the variance, or

$$SSE = \sum \left[\log(W_j) - \log(W'_j)\right]^2 \quad ...5)$$

The results of the final iteration can be shown by plotting the sample pseudoweights against the observed sample weights; this leads to graphs such as shown in this contribution, which can be used to identify outliers.

These steps are all quickly performed by a new software, ABee, available from ICLARM, and which includes a version of Marquardt's algorithm that provides standard errors for all parameter estimates.

Daniel Pauly and **Felimon Gayanilo, Jr.**

A length-weight relationship of the form

$$W = a \cdot L^b \qquad ...2)$$

is also given for each species. The parameters a and b of equation (2) are usually estimated from the intercept and slope, respectively of a linear regression i.e.,

$$\log(W) = \log(a) + b\log(L) \qquad ...3)$$

A new method was developed, while compiling this review, to estimate the parameters a and b of such relationship from length-frequency samples and their bulk weights (Box 1). This method was applied wherever suitable data were available.

vi) Finally, for each species, we give the (FishBase) numbers of the references documenting the sources of data in (i) to (v) (see Appendix I for full references).

Results

The 40 species considered in this review are listed in Table 1, in the sequence also used for presentation of results on a per-species basis.

Table 1. Classification (from Eschmeyer 1990; see also Froese et al., this vol.) of 40 trawl-caught teleosts of Western Indonesia.
[Tabel 1. Klasifikasi (menurut Eschmeyer 1990; lihat juga Froese et al., dalam buku ini) dari 40 spesies ikan demersal penting di Indonesia bagian barat.]

- Clupeiformes
  - Clupeidae
    - *1 Amblygaster sirm*
    - *2 Dussumieria acuta*
    - *3 Pellona ditchela*
    - *4 Sardinella gibbosa*
    - *5 Sardinella lemuru*
- Siluriformes
  - Ariidae
    - *6 Netuma thalassina*
  - Aulopiformes
  - Synodontidae
    - *7 Saurida micropectoralis*
    - *8 Saurida undosquamis*
- Perciformes
  - Carangidae
    - *9 Carangoides malabaricus*
    - *10 Caranx ignobilis*
    - *11 Caranx tille*
    - *12 Decapterus macrosoma*
    - *13 Decapterus russelli*
    - *14 Parastromateus niger*
    - *15 Selar crumenophthalmus*
  - Gerreidae
    - *16 Pentaprion longimanus*
  - Haemulidae
    - *17 Diagramma pictum*
    - *18 Pomadasys argenteus*
    - *19 Pomadasys maculatus*
  - Lactariidae
    - *20 Lactarius lactarius*
  - Leiognathidae
    - *21 Leiognathus splendens*
    - *22 Leiognathus bindus*
    - *23 Leiognathus equulus*
    - *24 Leiognathus leuciscus*
    - *25 Gazza minuta*
  - Lethrinidae
    - *26 Gymnocranius grandoculis*
  - Lutjanidae
    - *27 Aprion virescens*
    - *28 Pristipomoides typus*
  - Mullidae
    - *29 Upeneus moluccensis*
    - *30 Upeneus sulphureus*
  - Nemipteridae
    - *31 Nemipterus thosaporni*
  - Priacanthidae
    - *32 Priacanthus macracanthus*
  - Scombridae
    - *33 Rastrelliger kanagurta*
    - *34 Scomberomorus commerson*
    - *35 Scomberomorus guttatus*
  - Sphyraenidae
    - *36 Sphyraena obtusata*
  - Stromateidae
    - *37 Pampus argenteus*
  - Terapontidae
    - *38 Terapon jarbua*
  - Trichiuridae
    - *39 Trichiurus lepturus*
- Tetraodontiformes
  - Balistidae
    - *40 Abalistes stellatus*

Amblygaster sirm (Walbaum, 1792)

Spotted sardinella (English); sardin (Indonesian).

Scutes not prominent. Distinguished from *A. leiogaster* and *A. clupeoides* by the presence of a series of 10 to 20 gold (in life) or black (on preservation) spots down the flank (but sometimes missing) and more lower gillrakers, and from *Sardinella* species by its fewer pelvic finrays and lower gillrakers. Dorsal spines: 0-0; soft rays: 13-21; anal spines: 0-0; soft rays: 12-23. L_{max1} = 26 cm (Sudan, Red Sea); L_{max2} = 20 cm; L_{max3} = 22.7 cm TL (Fig. 1A). See Fig. 1B and Table 2 for length-weight relationship.

Indo-West Pacific: coasts of Africa, including Red Sea and Madagascar to Southeast Asia (Fig. 2). Extending northeastward to Taiwan, and Okinawa (Japan), and southeastward to New Guinea, the northern coasts of Australia and Fiji.

A schooling species occurring in coastal waters. Depth range: 10-75 m (Fig. 3). Feeds mainly on small crustaceans and their larvae, larval bivalves and gastropods, as well as phytoplankton (e.g., *Peridinium, Ceratium*). Table 3 presents three sets of growth parameters from Indonesia.

References: 171, 188, 312, 762, 823, 1263, 1314, 1439, 1442, 1443, 1444, 1447, 1488, 1602, 1911, 2178, 2857, 3785, 4615, 5213, 5525, 5542, 5730, 5736, 5756, 5763, 6313

Table 2. Length-weight (g/[TL;cm]) relationship of spotted sardinella, *Amblygaster sirm*, in Indonesia.
[Tabel 2. Hubungan panjang-berat (g/[TL;cm]) dari ikan sardin, Amblygaster sirm, *di Indonesia.]*

Parameter	Estimate
a	0.1177
s.e.(a)	0.1265
b	2.0748
s.e.(b)	0.3688
r^2	0.9933

Table 3. Growth parameters of spotted sardinella, *Amblygaster sirm.*
[Tabel 3. Parameter pertumbuhan ikan sardin, Amblygaster sirm.*]*

Parameter	A	B	C
L_∞ (TL, cm)	25.2	25.8	24.3
K (year^{-1})	1.175	1.150	0.586

A. "Java Sea" (Ref. 1447)
B. Off Pekalongan, North/Central Java (Ref. 1314)
C. Thousand Islands, Java (Ref. 823)

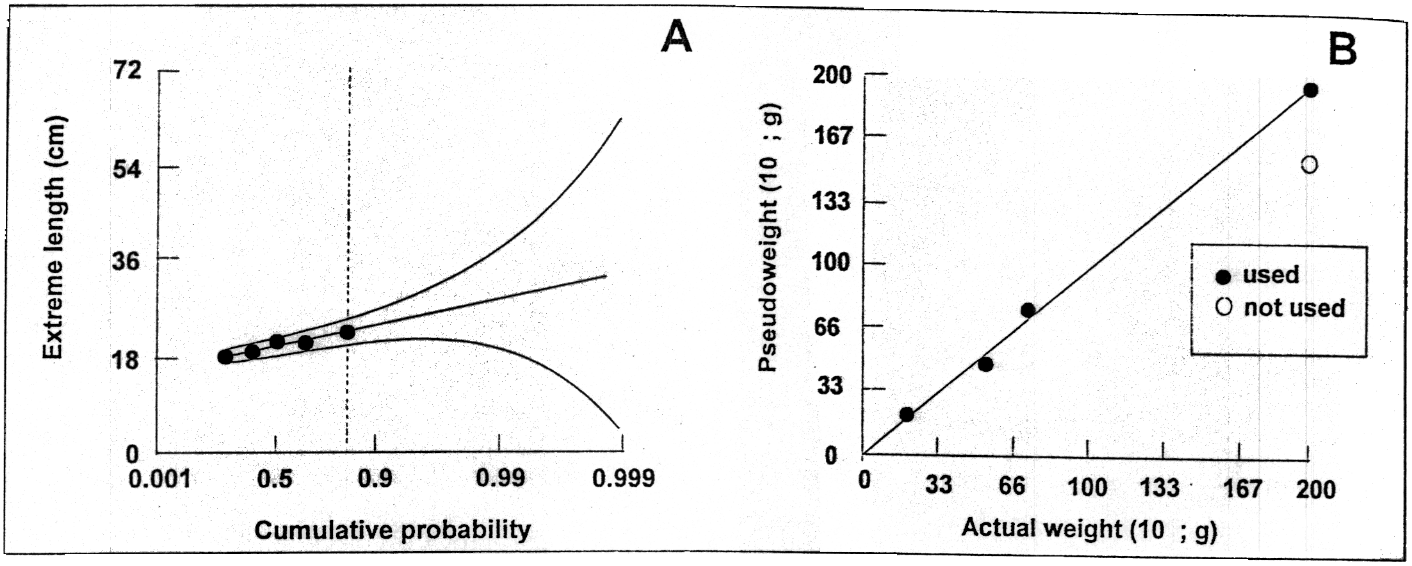


Fig. 1. (A) Extreme value plot for spotted sardinella, *Amblygaster sirm*, in Indonesia based on data from *R/V Dr. Fridtjof Nansen*, showing maxima of 5 length-frequency samples, and estimate of L_{max3} = 22.7 ± 2.2 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 4 length-frequency samples of *Amblygaster sirm* from northern Borneo based on data from *R/V Dr. Fridtjof Nansen* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 2). Open dot represents an outlier not used for analysis.
[Gambar 1. (A) Gambaran nilai ekstrim untuk ikan sardin, Amblygaster sirm, *di Indonesia berdasarkan data dari kapal penelitian* Dr. Fridtjof Nansen, *yang menunjukkan nilai maksimum dari 5 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 22.7 ± 2.2. cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 4 contoh frekuensi panjang ikan sardin,* Amblygaster sirm, *dari Kalimantan berdasarkan data* Dr. Fridtjof Nansen *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 2). Bulatan kosong mewakili suatu pengamatan yang tidak dipakai dalam analisis.]*

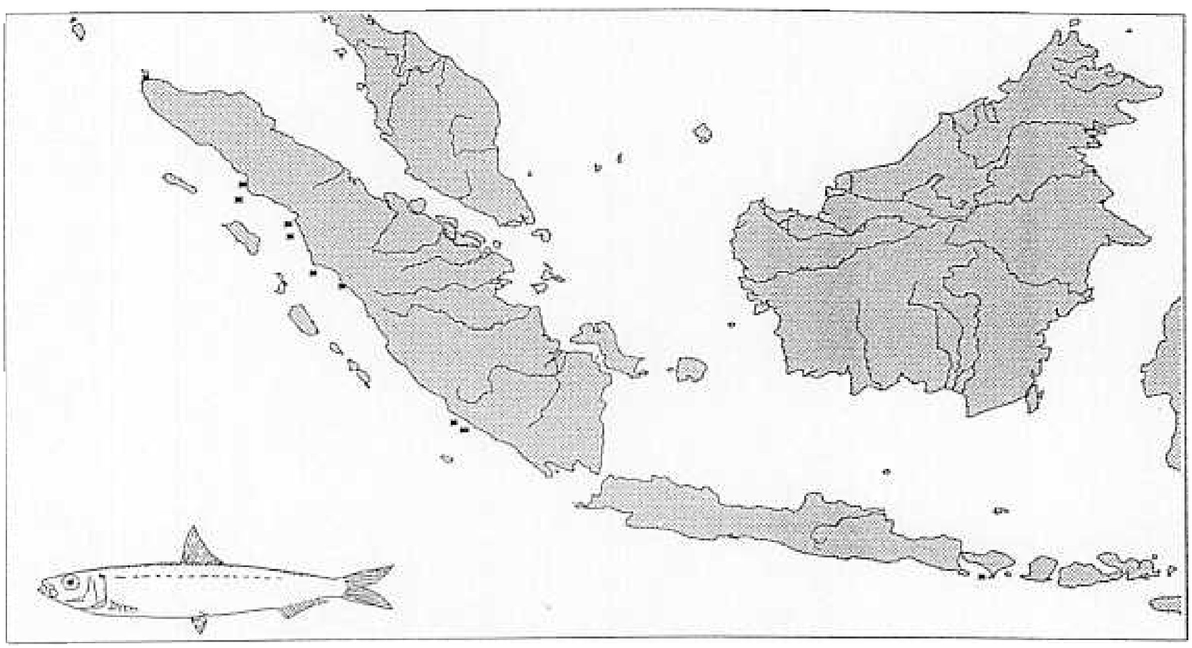


Fig. 2. Distribution of spotted sardinella, *Amblygaster sirm*, in Western Indonesia based on records of the surveys of *R/V Dr. Fridtjof Nansen.*
[Gambar 2. Penyebaran ikan sardin, Amblygaster sirm, *di Indonesia bagian barat berdasarkan laporan survei kapal penelitian* Dr. Fridtjof Nansen.*]*

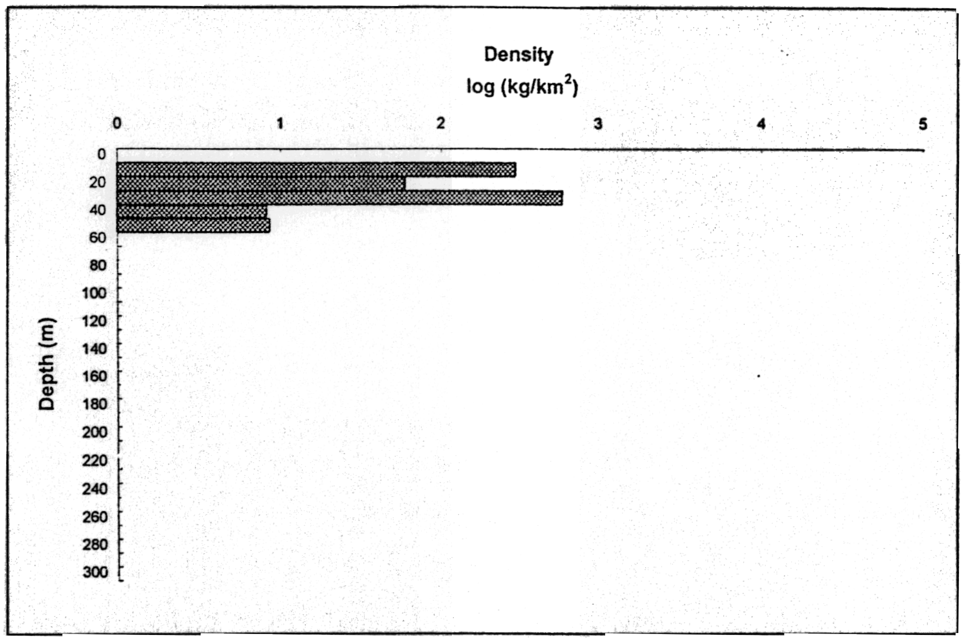


Fig. 3. Depth distribution of spotted sardinella, *Amblygaster sirm*, in Western Indonesia based on surveys of *R/V Dr. Fridtjof Nansen*.
[Gambar 3. Penyebaran kedalaman ikan sardin, Amblygaster sirm*, di Indonesia bagian barat berdasarkan survei kapal penelitian* Dr. Fridtjof Nansen.*]*

Dussumieria acuta (Valenciennes, 1847)

Rainbow sardine (English); Djapuh (Indonesian); Ajapu, Djapuh (West Java, Jakarta); Tjapo (Madura); Tembang djawa (South Sulawesi, Makassar); Tembang rakapeng (South Sulawesi, Bugis); Bete kalo (South Sulawesi, Badjo).

Brachiostegal rays fewer (12 to 15) and posterior part of scales marked with numerous tiny radiating striae. Color is iridescent blue with a shiny gold/brass line below (quickly fading after death). W-shaped pelvic scute; isthmus tapering evenly forward; more anal finrays. Dorsal spines: 0-0; soft rays: -; anal spines: 0-0; soft rays: 14-18. L_{max1} = 20 cm SL; L_{max2} = n.a.; L_{max3} = 20.9 cm TL (Fig. 4A). See Fig. 4B and Table 4 for length-weight relationship.

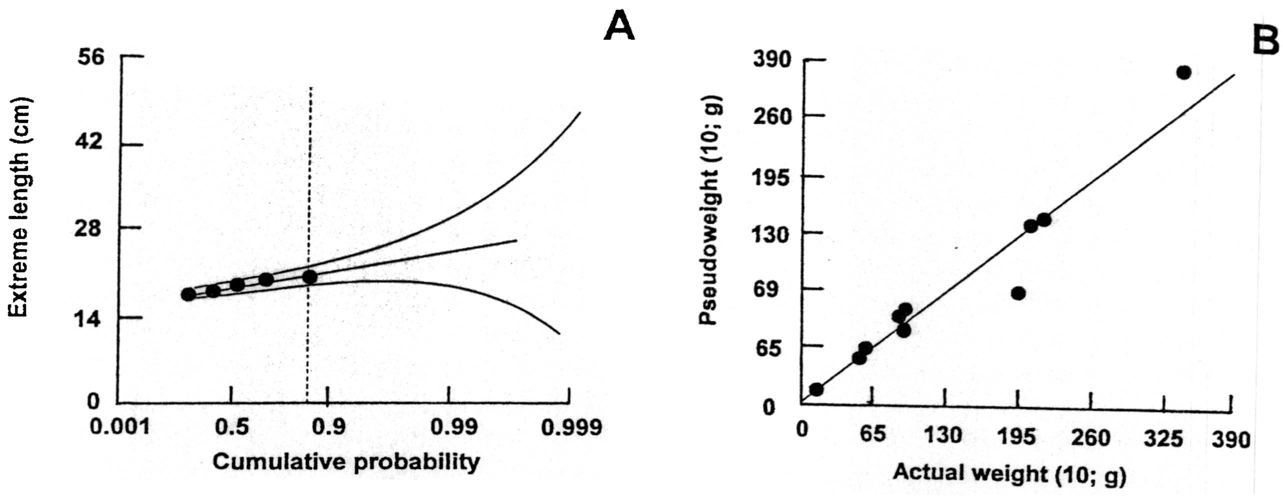
Warmer waters of the Indo-Pacific, from the Persian Gulf (and perhaps south to Somalia), along the coasts of Pakistan, India and Malaysia to Indonesia (Fig. 5) and the Philippines. Earlier records included *D. elopsoides*.

Mainly an inshore species. Depth range: 10-120 m (Fig. 6). Earlier studies on the habitat and biology may have equally referred to *D. elopsoides* which this species closely resembles.

References: 171, 188, 280, 1449, 2178, 2857, 2860, 4789, 5193, 5381, 5525, 5541, 5579, 5730, 5736, 5756, 6313, 6328, 6365

Table 4. Length-weight (g/[TL;cm]) relationship of rainbow sardine, *Dussumieria acuta*, in Indonesia.
[Tabel 4. Hubungan panjang-berat [g/(TL; cm)] ikan japuh, Dussumieria acuta*, di Indonesia.]*

Parameter	Estimate
a	0.0056
s.e.(a)	0.00402
b	3.1462
s.e.(b)	0.25642
r^2	0.9692



Jurong as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 4).

berdasarkan data dari kapal-kapal penelitian Dr. Fridtjof Nansen, Mutiara 4 *dan* Jurong *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 4).]*

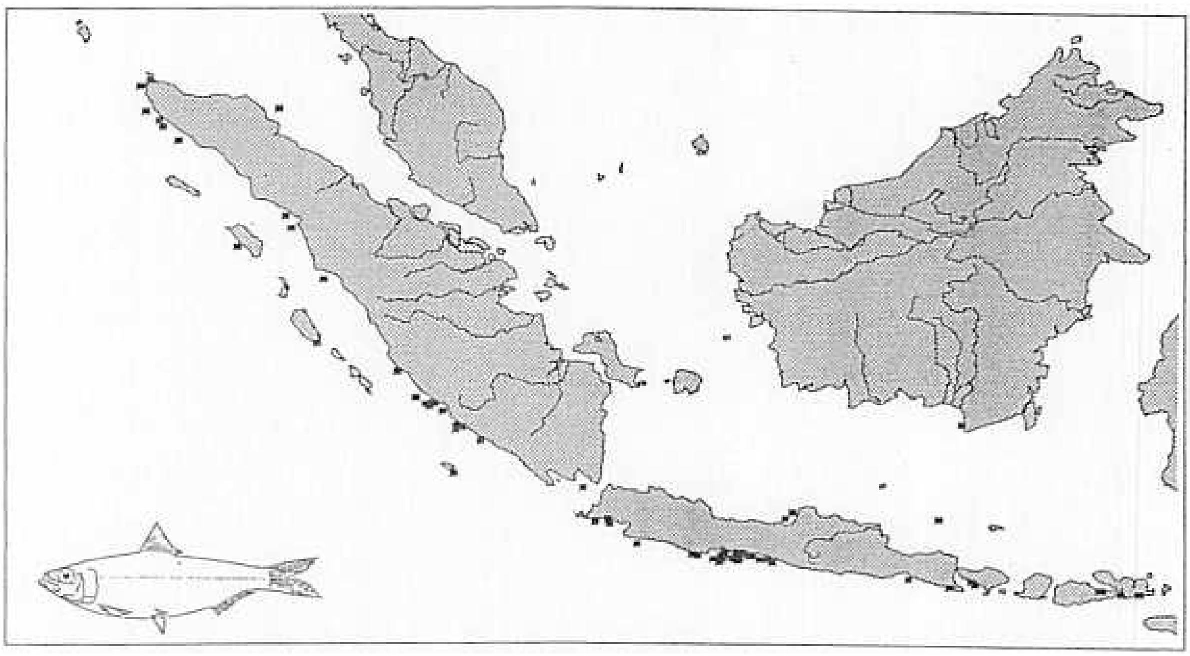


Fig. 5. Distribution of rainbow sardine, *Dussumieria acuta*, in Western Indonesia based on records of the surveys of *R/Vs Dr. Fridtjof Nansen, Mutiara 4, Jurong* and *Bawal Putih 2*.
[Gambar 5. Penyebaran ikan japuh, Dussumieria acuta, *di Indonesia bagian barat berdasarkan laporan survei kapal-kapal penelitian* Dr. Fridtjof Nansen, Mutiara 4, Jurong *dan* Bawal Putih 2.*]*

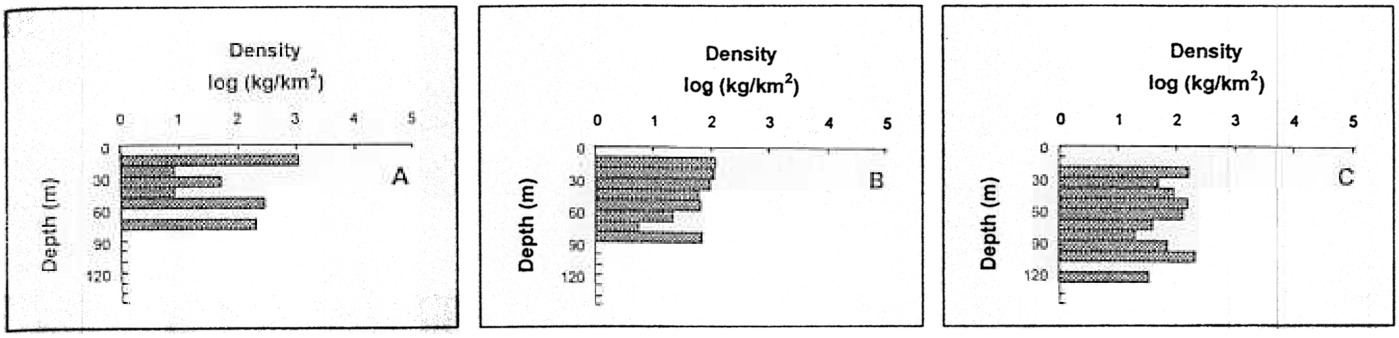


Fig. 6. Depth distribution of rainbow sardine, *Dussumieria acuta*, in Western Indonesia based on records of the surveys of *R/Vs* (A) *Dr. Fridtjof Nansen*, (B) *Mutiara 4* and (C) *Jurong*.
[Gambar 6. Penyebaran kedalaman ikan japuh, Dussumieria acuta, *di Indonesia bagian barat berdasarkan laporan survei kapal-kapal penelitian: (A)* Dr. Fridtjof Nansen, *(B)* Mutiara 4, *dan (C)* Jurong.*]*

Pellona ditchela (Valenciennes, 1847)

Indian pellona (English); Dero (Indonesian); Dero, Longlong mata (Java); Puput (West Java, Jakarta).

Belly with usually 18 or 19 + 8 or 9, total 26 to 28 scutes, strongly keeled. Eye large, lower jaw projecting. Dorsal fin origin near midpoint of body. Scales with upper and lower vertical striae slightly overlapping each other at center of scales. Dorsal spines: 0-0; soft rays: 0-0; anal spines: 0-0; soft rays: 34-42. L_{max1} = 16 cm SL; L_{max2} = n.a.; L_{max3} = 17.7 cm TL (Fig. 7A). See Fig. 7B and Table 5 for length-weight relationship.

Indian Ocean: Madagascar, and from Durban, South Africa to the Gulf of Oman and the coasts of India. From the Andaman Sea to Indonesia (Fig. 8) and the Philippines; southeast to Papua New Guinea and Northern and Western Australia.

Occurs in coastal areas, entering mangrove swamps and penetrating estuaries and freshwater. Depth range: 10-55 m (Fig. 9).

References: 171, 188, 1455, 2857, 3225, 3509, 4749, 4789, 4959, 4967, 5193, 5213, 5284, 5339, 6313, 6365, 6567, 6822

Table 5. Length-weight (g/[TL;cm]) relationship of Indian pellona, *Pellona ditchela*, in Indonesia.
[Tabel 5. Hubungan panjang-berat (g /[(TL; cm]) ikan puput, Pellona ditchela, *di Indonesia.]*

Parameter	Estimate
a	0.0018
s.e.(a)	0.00357
b	3.6209
s.e.(b)	0.62929
r^2	0.9988

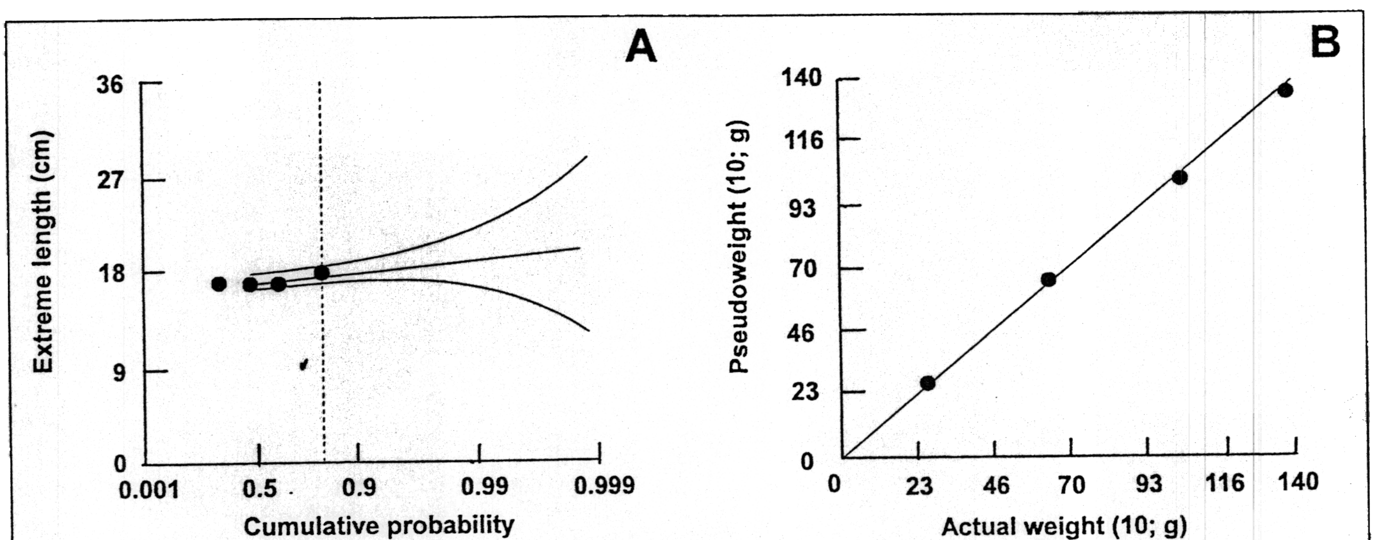


Fig. 7. (A) Extreme value plot for Indian pellona, *Pellona ditchela*, in Indonesia based on data from *R/V Dr. Fridtjof Nansen* showing maxima of 4 length-frequency samples, and estimate of L_{max3} = 17.7 ± 0.6 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 4 length-frequency samples of Indian pellona, *Pellona ditchela*, from northern Borneo based on data from *R/V Dr. Fridtjof Nansen* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 5).
[Gambar 7. (A) Gambaran nilai ekstrim dari ikan puput, Pellona ditchela, *di Indonesia berdasarkan data dari kapal penelitian* Dr. Fridtjof Nansen *yang menunjukkan 4 contoh frekuensi panjang dan angka perkiraan* L_{max3} *= 17.7 ± 0.6 cm TL . (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 4 contoh frekuensi panjang ikan puput,* Pellona ditchela, *dari Kalimantan Utara berdasarkan data dari kapal penelitian* Dr. Fridtjof Nansen *sebagai output dari perangkat lunak ABee (lihat Boks 1), yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 5).]*

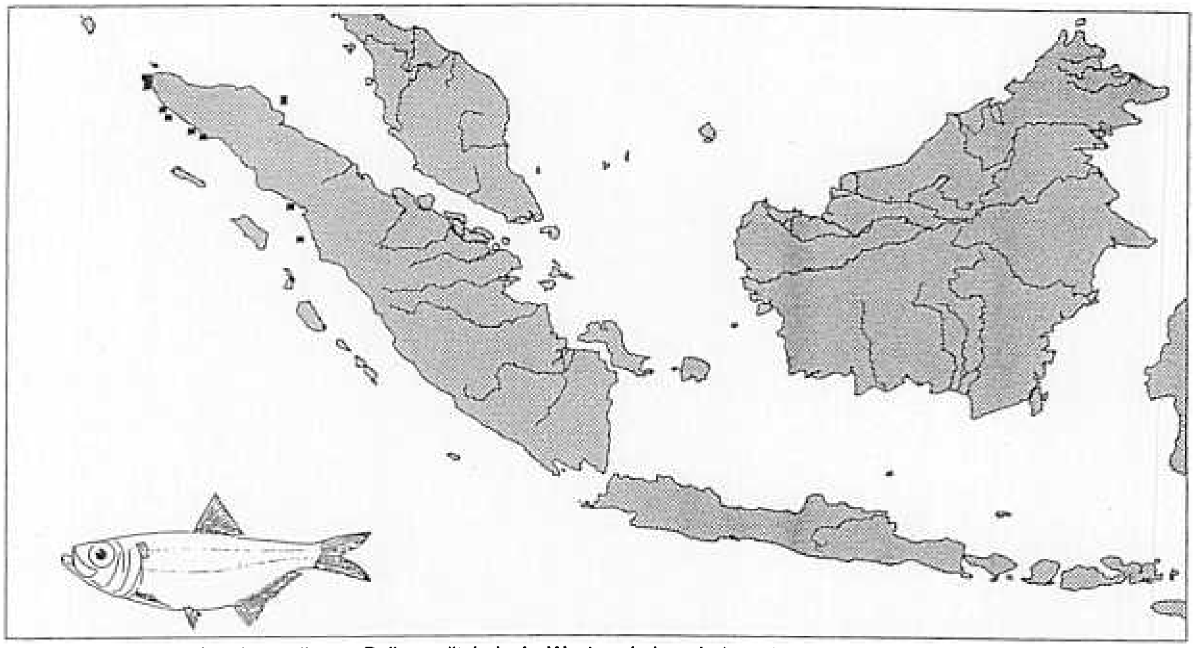


Fig. 8. Distribution of Indian pellona, *Pellona ditchela*, in Western Indonesia based on records of the surveys of *R/V Dr. Fridtjof Nansen*.
[Gambar 8. Penyebaran ikan puput, Pellona ditchela, *di perairan Indonesia bagian barat berdasarkan laporan survei dari kapal penelitian* Dr. Fridtjof Nansen.*]*

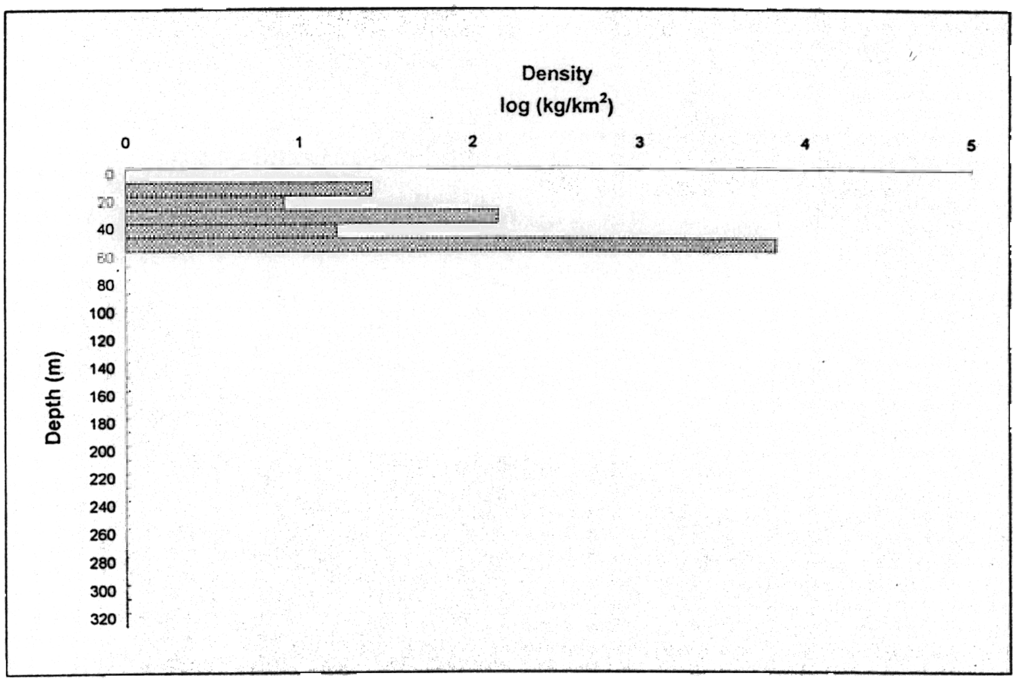


Fig. 9. Depth distribution of Indian pellona, *Pellona ditchela*, in Western Indonesia based on surveys of *R/V Dr. Fridtjof Nansen*.
[Gambar 9. Penyebaran kedalaman ikan puput, Pellona ditchela, *di Indonesia bagian barat berdasarkan survei dengan kapal penelitian* Dr. Fridtjof Nansen.*]*

Sardinella gibbosa (Bleeker, 1849)

Goldstriped sardinella (English); Tembang (Indonesian); Djuwi djuwi, Mursiah, Tjiro (Java); Tamban sisik, Tembang, Tembang djuwi (West Java, Jakarta); Maos, Tandjan (West Java, Bandung); Sintring (Madura); Djurung (East Sumatra); Tamban (South Borneo); Tembang lakara (South Sulawesi, Bugis); Totata (South Sulawesi, Badjo); Mengida (Bali).

Total number of scutes: 32 to 34. A golden mid-lateral line down flank; dorsal and caudal fin margins dusky; a dark spot at dorsal fin origin. Lower gillrakers: 45 to 59 (at 6 to 17 cm SL, not increasing with size of fish after 6 cm SL). Dorsal spines: 0-0; soft rays: 13-21; anal spines: 0-0 soft rays: 12-23. L_{max1} = 17 cm SL. L_{max2} = n.a.; L_{max3} = 20.2 cm TL (Fig. 10A). See Fig. 10B and Table 6 for length-weight relationship.

Indo-West Pacific: from the East African coasts (but not the Red Sea) and Madagascar eastward to the Persian Gulf and Indonesia (Fig. 11), north to Taiwan and Korea; south to Northern Australia. In India, often confused with *S. fimbriata*.

Forms schools in coastal waters. Depth range: 10-70 m (Fig. 12). Feeds on phytoplankton and zooplankton (crustacean and molluscan larvae). Table 7 presents a set of growth parameters from Indonesia.

References: 171, 188, 280, 811, 1314, 1443, 1444, 1488, 1504, 1529, 1751, 2178, 2857, 2948, 3560, 3605, 4330, 4331, 5213, 5284, 5730, 5736, 5756, 6313, 6365

Table 6. Length-weight (g/[TL;cm]) relationship of goldstriped sardinella, *Sardinella gibbosa*, in Indonesia.
[Tabel 6. Hubungan panjang-berat (g/[(TL; cm]) dari ikan tembang, Sardinella gibbosa, *di Indonesia.]*

Parameter	Estimate
a	0.0158
s.e.(a)	0.0136
b	2.7837
s.e.(b)	0.3073
r^2	0.9778

Table 7. Growth parameters of goldstriped sardinella, *Sardinella gibbosa*.
[Tabel 7. Parameter pertumbuhan ikan tembang, Sardinella gibbosa.*]*

Parameter	A
L_∞ (TL, cm)	19.5
K (year^{-1})	1.20

A. Riau waters (Ref. 1314)

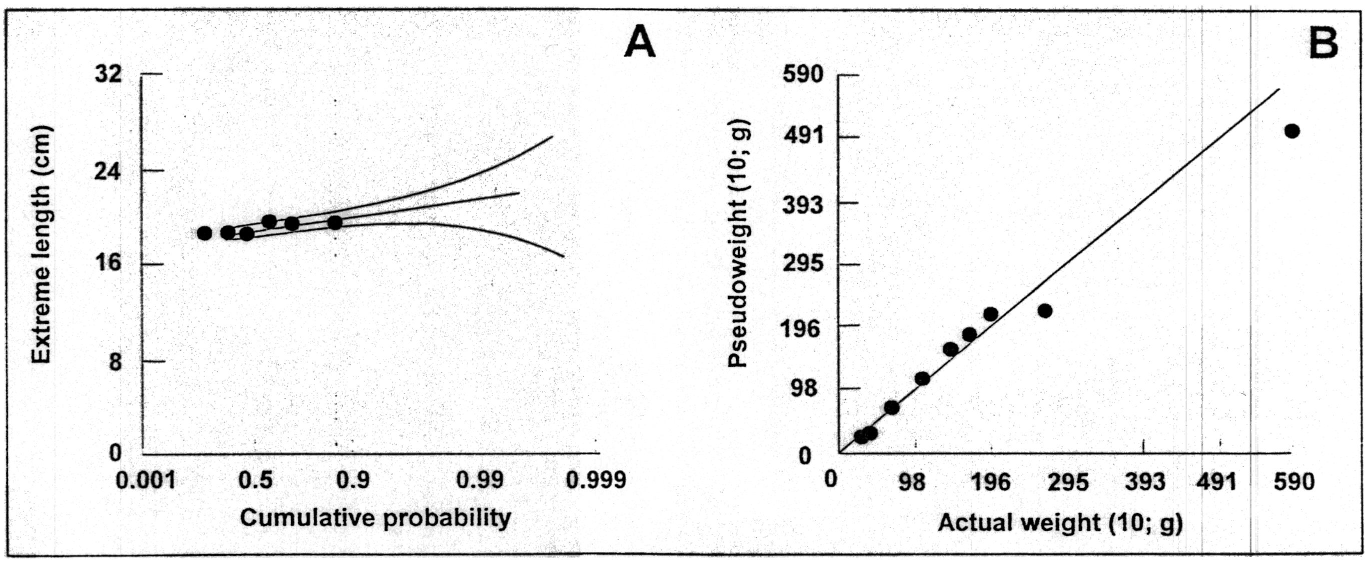


Fig. 10. (A) Extreme value plot for goldstriped sardinella, *Sardinella gibbosa*, in Indonesia based on data from *R/Vs Mutiara 4, Jurong* and *Dr. Fridtjof Nansen*, showing maxima of 6 length-frequency samples, and estimate of L_{max3} = 20.2 ± 0.6 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 9 length-frequency samples of goldstriped sardinella, *Sardinella gibbosa*, from Western Indonesia based on data from *R/Vs Mutiara 4, Jurong* and *Dr. Fridtjof Nansen* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 6).
[Gambar 10. (A) Gambaran nilai ekstrim dari ikan tembang, Sardinella gibbosa, *di Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Jurong *dan* Dr. Fridtjof Nansen, *yang menunjukkan nilai maksimum 6 contoh frekuensi panjang dan nilai perkiraan maksimum L_{max3} = 20.2 ± 0.6 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 9 contoh frekuensi panjang ikan tembang,* Sardinella gibbosa, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Jurong *dan* Dr. Fridtjof Nansen *sebagai output perangkat lunak ABee (lihat Boks 1) dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 6).*

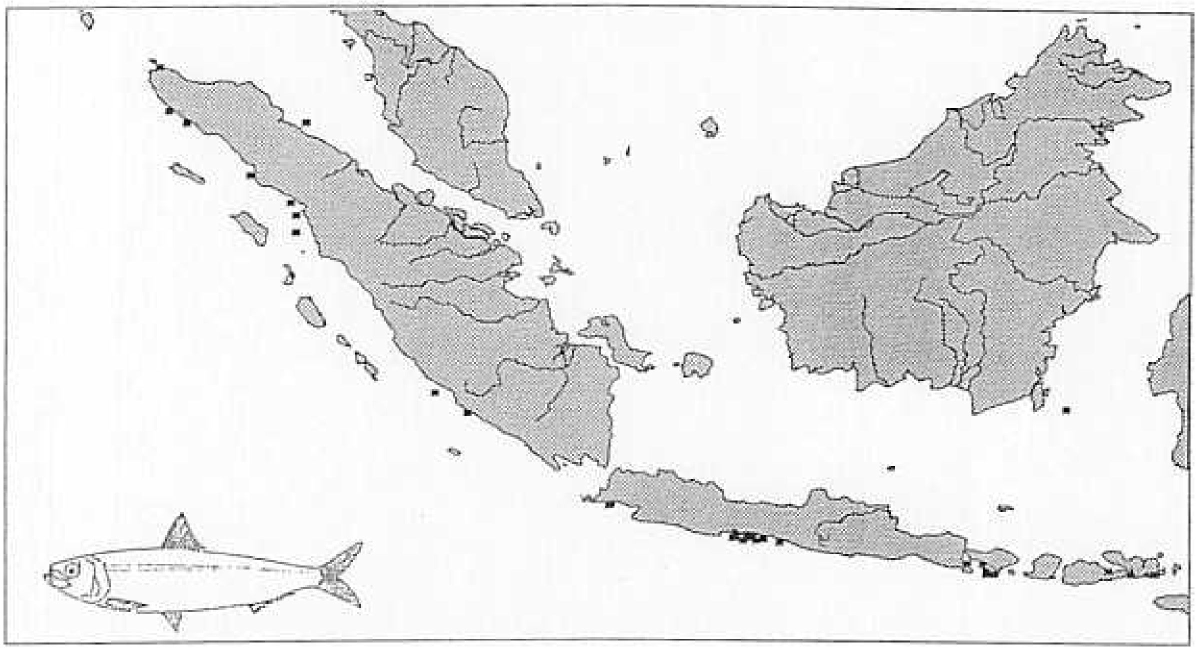


Fig. 11. Distribution of goldstriped sardinella, *Sardinella gibbosa*, in Western Indonesia based on records of the surveys of *R/Vs Mutiara 4*, Bawal *Putih 2, Jurong* and *Dr. Fridtjof Nansen.*
[Gambar 11. Penyebaran ikan tembang, Sardinella gibbosa, *di Indonesia bagian barat berdasarkan laporan survei dari kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

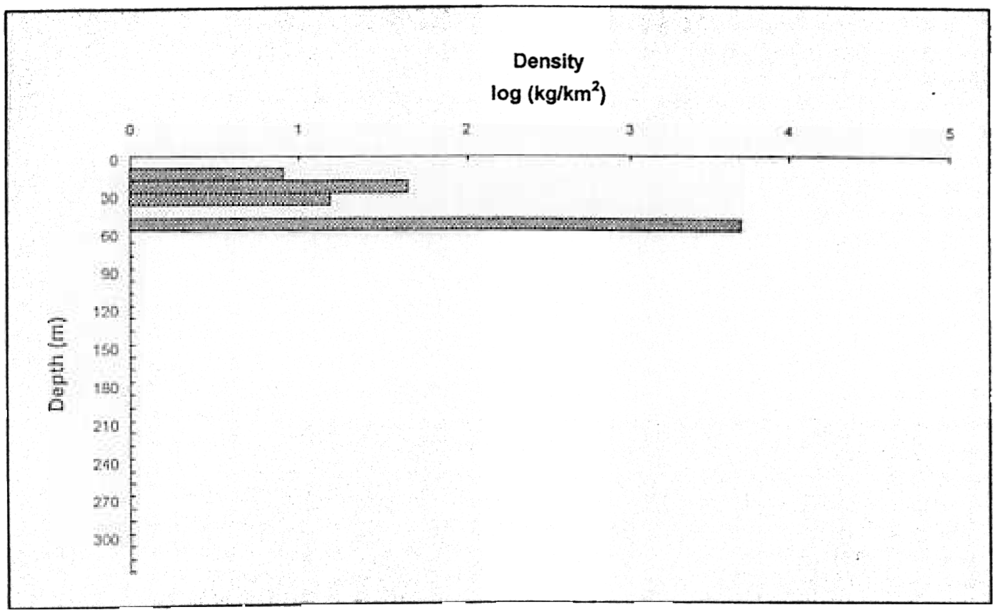


Fig. 12. Depth distribution of goldstriped sardinella, *Sardinella gibbosa*, in Western Indonesia based on surveys of *R/V Dr. Fridtjof Nansen.*
[Gambar 12. Penyebaran kedalaman ikan tembang, Sardinella gibbosa, *di Indonesia bagian barat berdasarkan survei kapal penelitian* Dr. Fridtjof Nansen.*]*

Sardinella lemuru (Bleeker, 1853)

Bali sardinella (English); Tembang montjong (Indonesian); Lemuru (Java); Lemuru, Tembang mata kutjing, Tembang montjong (West Java, Jakarta); Soroi (Madura); Temban montjo (South Sulawesi, Makassar); Bete lalaki (South Sulawesi, Bugis).

A faint golden spot behind gill opening, followed by a faint golden mid-lateral line; a distinct black spot at hind border of gill cover. Body elongate, subcylindrical. Distinguished from all other clupeids in the eastern Indian Ocean and western Pacific by its pelvic finray count of 8; from *S. longiceps* by its shorter head length and fewer lower gillrakers. Dorsal spines: 0-0; soft rays: 13-21; anal spines: 0-0; soft rays: 12-23. L_{max1} = 23 cm SL. L_{max2} = 21 cm TL; L_{max3} = 19.9 cm TL (Fig. 13A). See Fig. 13B and Table 8 for length-weight relationship.

Eastern Indian Ocean: Phuket, Thailand and southern coasts of East Java and Bali (Fig. 14); also in Western Australia, Western Pacific: Java Sea north to the Philippines, Hong Kong, Taiwan Island to southern Japan.

Forms large schools in coastal waters. Depth range: 15-100 m (Fig. 15). Feeds on phytoplankton and zooplankton (chiefly copepods). Ghofar and Mathews (Box 2) discuss the fluctuations of the Bali Straits lemuru fishery from 1976 to 1993. Table 9 presents six sets of growth parameters from Indonesia.

References: 171, 188, 280, 818, 819, 1263, 1314, 1392, 1449, 1511, 1830, 2178, 2858, 3268, 3557, 3605, 3784, 5381.

Table 8. Length-weight (g/[TL;cm]) relationship of Bali sardinella, *Sardinella lemuru*, in Indonesia.
[Tabel 8. Hubungan panjang-berat (g/[TL;cm]) dari ikan lemuru, Sardinella lemuru, *di Indonesia.]*

Parameter	A	B
a	0.0012	0.0299
s.e.(a)	0.0012	n.a.
b	3.7515	2.671
s.e.(b)	0.3087	n.a.
r^2	0.9641	n.a.

A. This study
B. Bali Strait (Ref. 3268), L in SL.

Table 9. Growth parameters of Bali sardinella, *Sardinella lemuru*.
[Tabel 9. Parameter pertumbuhan dari ikan lemuru, Sardinella lemuru.*]*

Parameter	A	B	C	D	E	F
L_∞ (TL, cm)	21.6	21.1	22.3	22.5	23.2	23.8
K ($year^{-1}$)	0.95	0.8	0.85	1.0	1.28	0.505

A. Bali Strait (Ref. 3268), L originally in SL.
B. Bali Strait, 1981 (Ref. 1314)
C. Bali Strait, 1977 (Ref. 1314)
D. Bali Strait, 1980 (Ref. 1314)
E. Bali Strait, 1979 (Ref. 1314)
F. Muntjar, Bali Strait (Ref. 819)

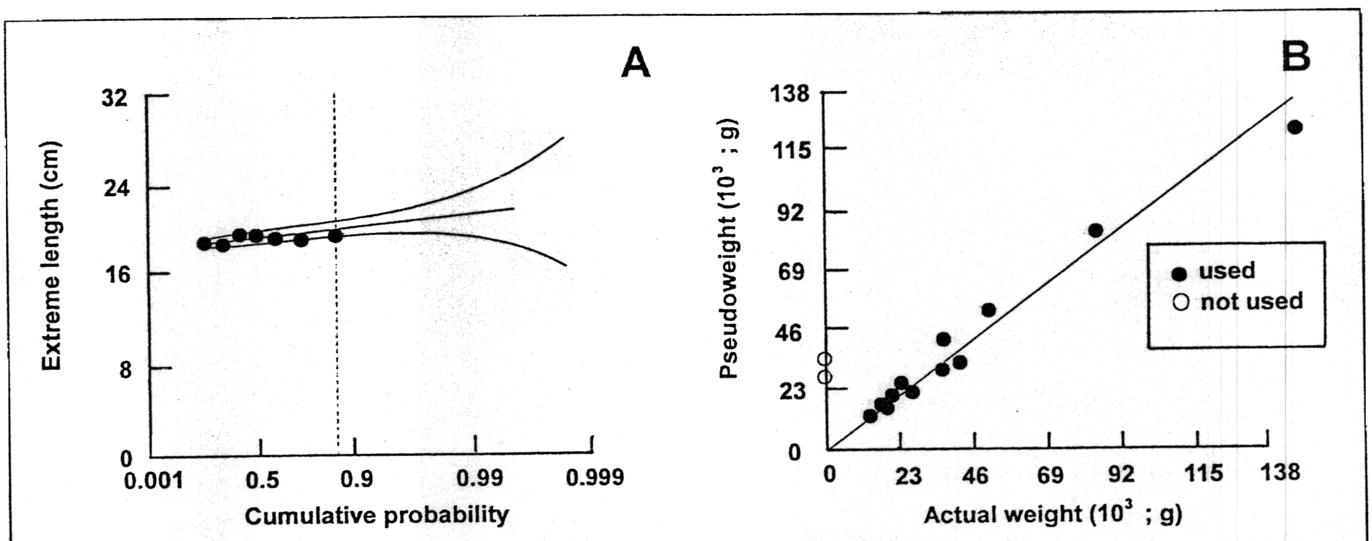


Fig. 13. (A) Extreme value plot for Bali sardinella, *Sardinella lemuru*, in Indonesia based on data from *R/V Jurong*, showing maxima of 7 length-frequency samples, and estimate of L_{max3} = 19.9 ± 0.5 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 12 length-frequency samples of Bali sardinella, *Sardinella lemuru*, from Western Indonesia based on data from *R/V Jurong* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 8). Open dots represent outliers, not used for analysis.
[Gambar 13. (A) Gambaran nilai ekstrim untuk ikan lemuru, Sardinella lemuru, *di Indonesia berdasarkan data dari kapal penelitian* Jurong, *yang menunjukkan nilai maksimum dari 7 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 19.9 ± 0.5 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 12 contoh frekuensi-panjang ikan lemuru,* Sardinella lemuru, *dari Indonesia bagian barat berdasarkan data dari kapal penelitian* Jurong *sebagai output perangkat lunak ABee (lihat Boks 1) dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 8). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

Box 2. The Bali Straits lemuru fishery.
[Boks 2. Perikanan lemuru Selat Bali]

The Bali Straits lemuru (*Sardinella lemuru*) fishery relied until 1975 mainly on small (<5 GT) sail powered boats with a range of up to about 20 nm offshore. In the early fishery four kinds of hand operated gear were used: *payang* (a non-closing surface seine net); *jala buang* (throw net); *serok* (dip net); and *bagan cancap* (lift net), which attract lemuru with lights at night to a bamboo platform: the fish are caught by lifting a large suspended net. Starting aroung the early 1970s, the ca. 9 m boats were motorized, and by the mid-1970s, the older gear was being replaced by (often larger) mechanized purse seiners (*pukat cincin*) which are now the dominant type, with over 85% of the catch; this is taken mainly from October to April, with a strong peak in December and January.

Two data sets on catch and effort are available: 1950-1973 and 1976-1993 (Fig. 1). Both series cover the same stock and area, with catches overwhelmingly (<90%) of lemuru, but have been gathered using different methodologies. Still, increasing mechanization, and natural variations similar to those observed in earlier and later years could account for the jump in landings from ca. 5,000 in 1973 to about 28,000 $t \cdot year^{-1}$ in 1976 recorded at the end of the first, and the beginning of the second, respectively, of the data sets.

Catches show an overall increase, but with marked fluctuations (Fig. 1). Data for 1994 are not yet available but the decline that started in 1993 appears to have continued. Effort was low prior to 1976, but quantitative data are not available. Observed effort changes (Fig. 1) cannot account for the low landings in 1977-1980 and 1985-1987.

To test if lemuru landings may be related to the El Niño/Southern Oscillation (ENSO) events, the catch series were converted into a single series of standardized anomalies (A) by fitting a five-year running mean to the data from 1950 to 1993. We defined $A = (C_o/C_m)-1$, where C_o is the observed catch in a given year, and C_m is the running mean for the same year.

As might be seen from Fig. 1 (insert), high positive anomalies values are clearly related to ENSO events. Therefore, the increased effort directed towards the Bali Straits lemuru stock from 1950 to 1993, which produced an increase in landings for <5,000 $t \cdot year^{-1}$ to >50,000 $t \cdot year^{-1}$ is not the primary cause for the strong catch fluctuations which are probably due to large-scale oceanographic events (see also Sharp, this vol.).

Nevertheless, there is a suggestion that higher effort in the last decades had some effect on the stock: the amplitude of the positive anomalies declines from >1.5 to <0.5 over the time series (Fig. 1, insert), while the amplitude of the negative anomalies remains roughly constant over the whole time series. Perhaps the higher catches in recent years were taken from a stock that has become less resilient, with the fishery removing most of the surplus production. This would prevent the spawning stock from recovering during favorable periods ("E"), making it more vulnerable to fishing during less favorable periods ("N"). This suggests that further effort increases, while not increasing catches, will increase the risk of a collapse. Also, the quick recovery observed from 1986 to 1988 may not recur at higher effort levels. This issue needs further work; to support this, we have contributed our time series of catch and effort data to the database (Diskette 2) described by Torres et al. (this vol.).

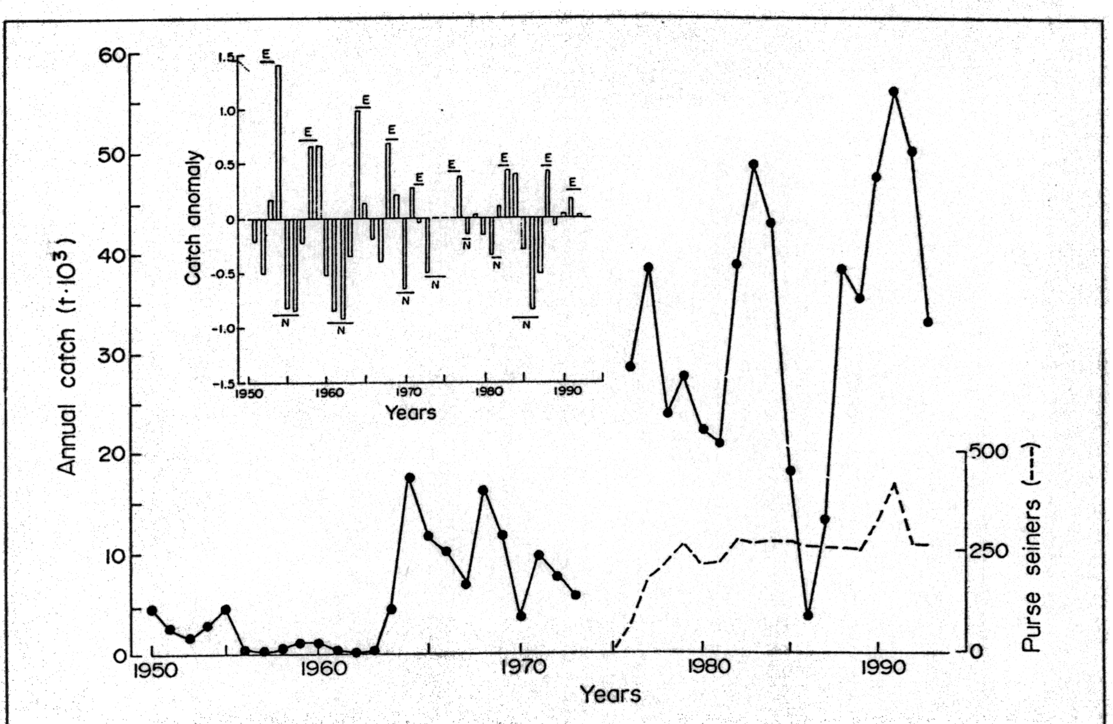


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Fig. 1. Major features of the Bali Straits lemuru fishery.
[Gambar 1. Sifat-sifat utama perikanan lemuru Selat Bali.]
Main panel: catches of 1950 to 1973 (from Ref. 3268); catch and effort for 1976-1993: original data.
Insert: catch anomalies (1950 to 1993) and ENSO events ("E") and their opposite ("N") from Refs. 9577, 9578 and 9580.

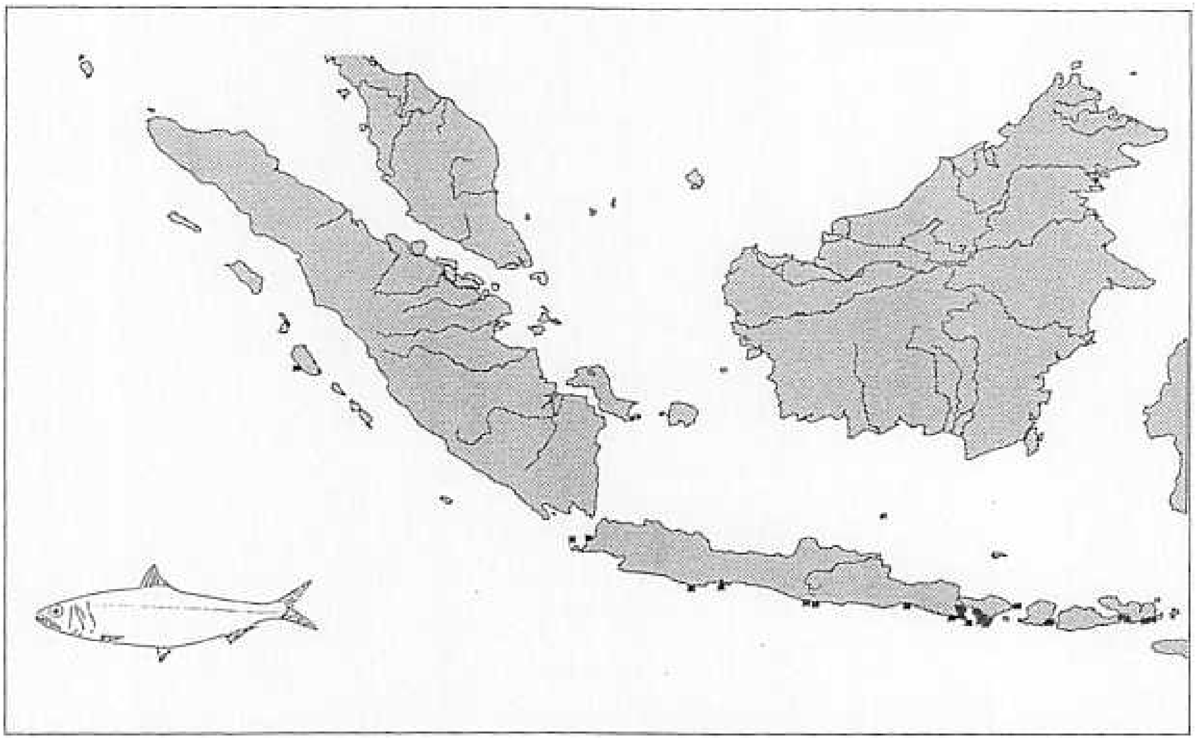


Fig. 14. Distribution of Bali sardinella, *Sardinella lemuru*, in Western Indonesia based on records of the surveys of *R/Vs Jurong* and *Bawal Putih 2.*
[Gambar 14. Penyebaran ikan lemuru, Sardinella lemuru, *di Indonesia bagian barat berdasarkan laporan survei dari kapal-kapal penelitian* Jurong *dan* Bawal Putih 2.*]*

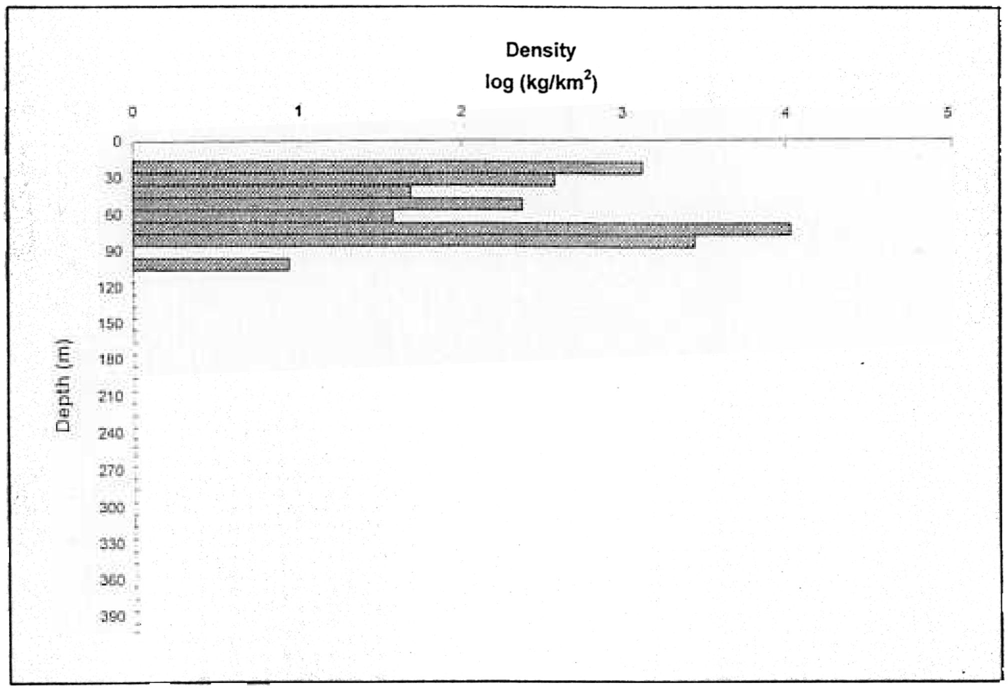


Fig. 15. Depth distribution of Bali sardinella, *Sardinella lemuru*, in Western Indonesia based on surveys of *R/V Jurong.*
[Gambar 15. Penyebaran kedalaman ikan lemuru, Sardinella lemuru, *di Indonesia bagian barat berdasarkan survei kapal penelitian* Jurong.*]*

Netuma thalassina (Rüppell, 1837)

Giant catfish (English); Manjung (Indonesian); Mangmung, Manjong (Java); Manjung kerbo (West Java); Duri padi, Manjung (West Java, Jakarta); Duri utek, Utik (West Java, Jakarta); Gaguk, Putih (South Sumatra); Duri padi, Duri utek (Riouw); Gugup, Gungut (West Borneo); Barukang (South Sulawesi, Makassar); Lampa (South Sulawesi, Badjo).

Head shield weakly striated and granulated, its surface nearly smooth. Three pairs of barbels around mouth. Supraoccipital process about 1.5 times as long as broad. Dorsal spines: 1-1; soft rays: 7-7; anal spines: - ; soft rays: 16-30. L_{max1} = 100 cm TL; L_{max2} = n.a.; L_{max3} = 83 cm TL (Fig. 16A). See Fig. 16B and Table 10 for length-weight relationship.

Indian Ocean: known with certainty only from the Red Sea and northwest Indian Ocean. Malaysia, Indonesia (Fig. 17) and southeast to north Australia.

A marine species often found in estuaries, but rarely enters freshwater; depth range 10-195 m (Fig. 18). Feeds mainly on crabs, prawns, mantis shrimps (*Squilla* spp.) but also on fishes and molluscs. Table 11 presents two sets of growth parameters from Indonesia.

References: 1263, 1314, 2045, 2857, 2872, 3279, 3290, 3627, 3641, 4515, 4557, 4600, 4735, 4789, 4883, 4959, 5213, 5450, 5736, 5756, 6313, 6365, 6567

Table 10. Length-weight (g/[TL;cm]) relationship of giant catfish, *Netuma thalassina*, in Indonesia.
[Tabel 10. Hubungan panjang-berat (g/[TL;cm]) ikan manyung, Netuma thalassina, *di Indonesia.]*

Parameter	Estimate

Table 11. Growth parameters of giant catfish, *Netuma thalassina*.
[Tabel 11. Parameter pertumbuhan ikan manyung, Netuma thalassina.*]*

Parameter	A	B
L_∞ (TL, cm)	52.7	60.0
K ($year^{-1}$)	0.27	0.65

A. Sampit Bay, Central Kalimantan (Ref. 4557)
B. Java Sea (South Kalimantan) (Ref. 1314)

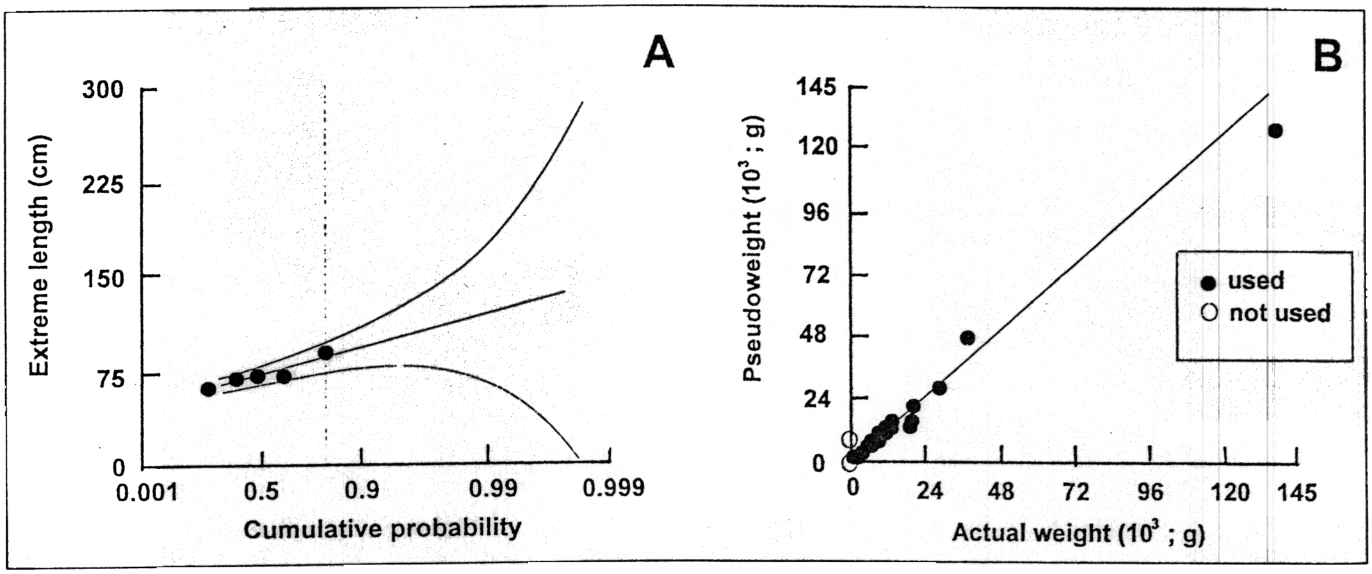


Fig. 16. (A) Extreme value plot for giant catfish, *Netuma thalassina*, in Indonesia based on data from *R/Vs Mutiara 4* and *Jurong*, showing maxima of 5 length-frequency samples, and estimate of L_{max3} = 83.0 ± 11.0 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 26 length-frequency samples of giant catfish, *Netuma thalassina*, from Western Indonesia based on data from *R/Vs Mutiara 4* and *Jurong* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 10). Open dots represent outliers, not used for analysis.
[Gambar 16. (A) Gambaran nilai ekstrim ikan manyung, Netuma thalassina, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Jurong *menunjukkan nilai maksimum dari 5 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 83.0 ± 11.0 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 26 contoh frekuensi-panjang ikan manyung,* Netuma thalassina, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Jurong *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 10). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

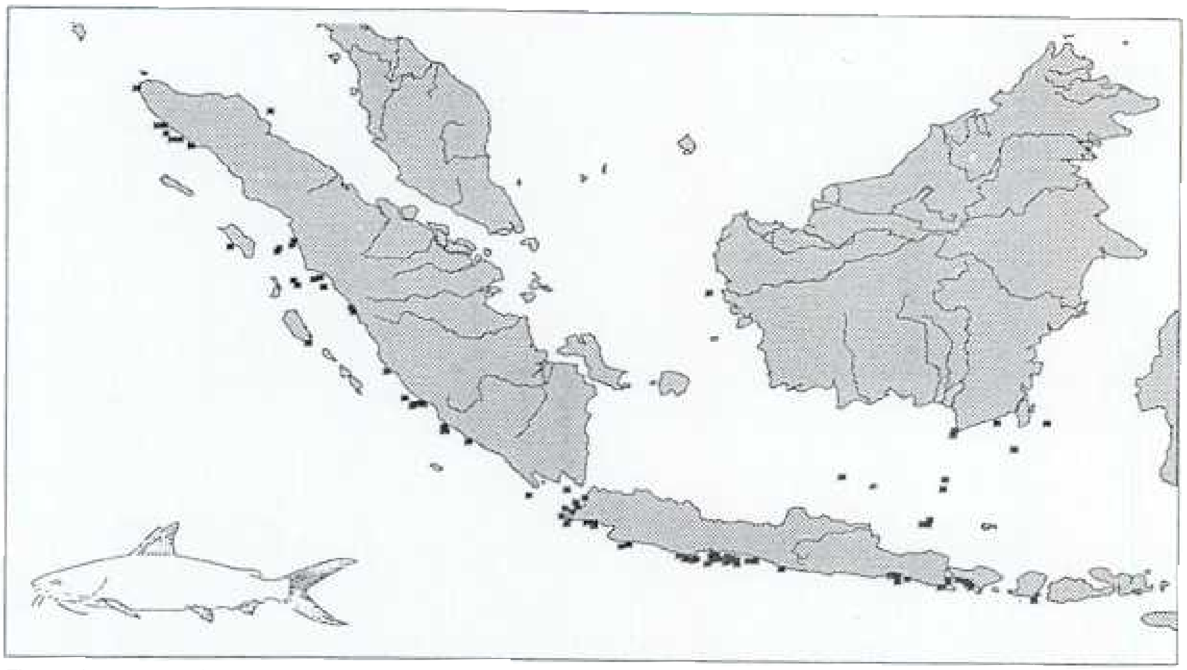


Fig. 17. Distribution of giant catfish, *Netuma thalassina*, in Western Indonesia based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Dr. Fridtjof Nansen*, and *Jurong*.
[Gambar 17. Penyebaran ikan manyung, Netuma thalassina, *di Indonesia bagian barat berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Dr. Fridtjof Nansen *dan* Jurong.*]*

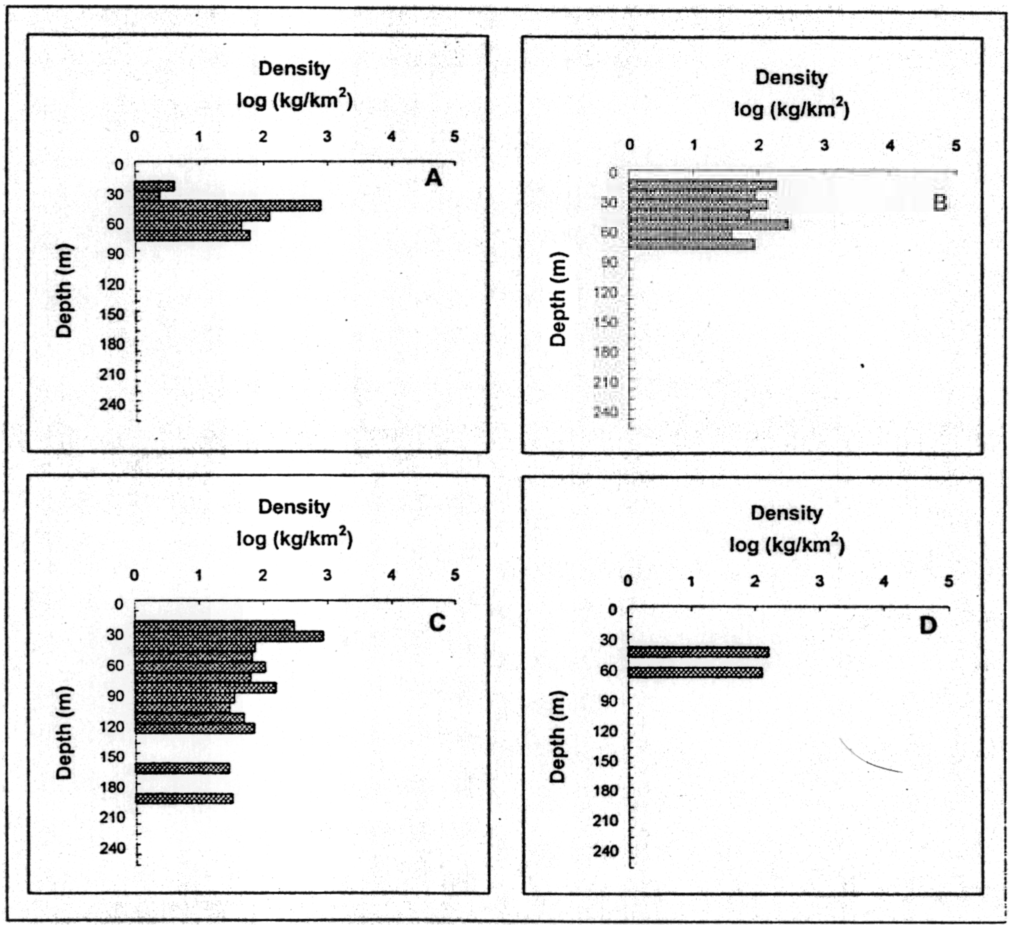


Fig. 18. Depth distribution of giant catfish, *Netuma thalassina*, in Western Indonesia based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen*, (B) *Mutiara 4*, (C) *Jurong* and (D) *Bawal Putih 2*.
[Gambar 18. Penyebaran kedalaman ikan manyung, Netuma thalassina, *di Indonesia bagian barat berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen, *(B)* Mutiara 4, *(C)* Jurong *dan (D)* Bawal Putih 2.*]*

Saurida micropectoralis (Shindo & Yamada, 1972)

Shortfin lizardfish (English); Beloso sirip pendek (Indonesian).

Body elongate, cylindrical. Back and upper sides brown, lower sides and belly white. Nine to ten faint blotches along the lateral line, sometimes with traces of very indistinct cross-bars on the back. Dorsal spines: -; soft rays: -; anal spines: -; soft rays: -. L_{max1} = 38 cm; L_{max2}= n.a.; L_{max3} = 49.7 cm FL (Fig. 19A). See Fig. 19B and Table 12 for length-weight relationship.

Indo-West Pacific: Andaman and South China Sea, Indonesia (Fig. 20); south to northern Australia.

Occurs over muddy bottoms from 20 to 260 m (Fig. 21). Feeds on small bottom-dwelling invertebrates and fishes. Table 13 presents a set of growth parameters from Indonesia.

References: 393, 1314, 2117, 2857, 4749, 4789, 5756

Table 12. Length-weight (g/[FL;cm]) relationship of shortfin lizardfish, *Saurida micropectoralis*, in Indonesia.
[Tabel 12. Hubungan panjang-berat [g/(FL;cm)] ikan beloso sirip pendek, Saurida micropectoralis, *di Indonesia.]*

Parameter	Estimate
a	0.0050
s.e.(a)	0.0008
b	3.1959
s.e.(b)	0.0530
r^2	0.9988

Table 13. Growth parameters of shortfin lizardfish, *Saurida micropectoralis*.
[Tabel 13. Parameter pertumbuhan dari ikan beloso sirip pendek, Saurida micropectoralis.*]*

Parameter	A
L_∞ (TL, cm)	42.0
K (year^{-1})	0.88

A. Java Sea (Central Java) (Ref. 1314)

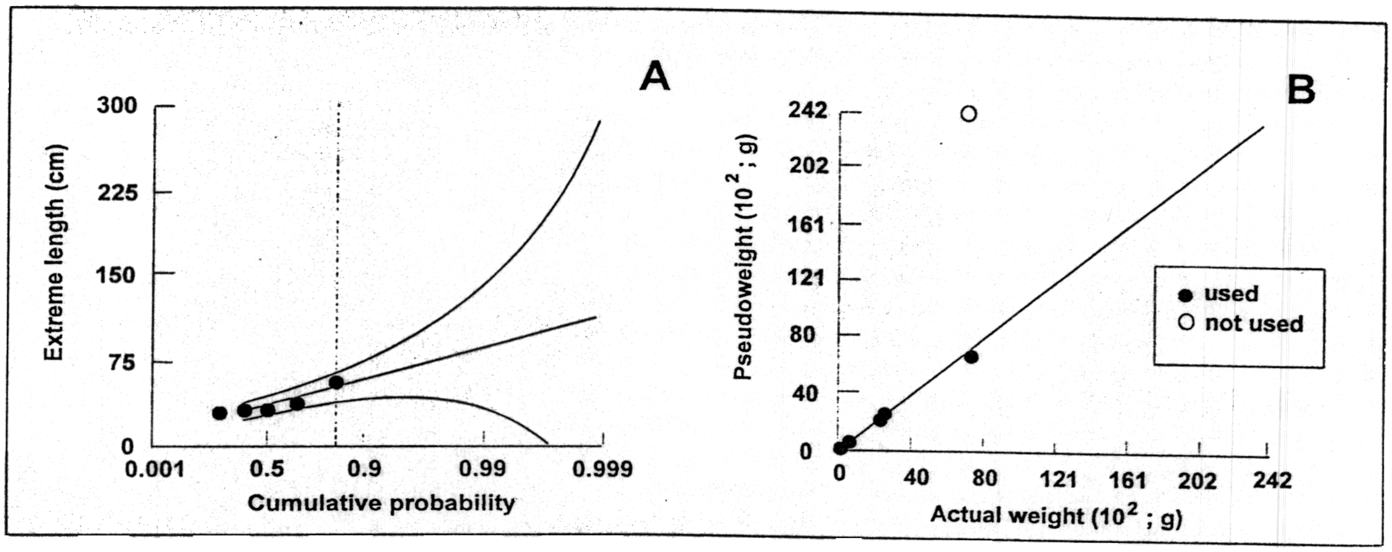


Fig. 19. (A) Extreme value plot for shortfin lizardfish, *Saurida micropectoralis*, in Indonesia based on data from *R/Vs Mutiara 4* and *Jurong*, showing maxima of 5 length-frequency samples, and estimate of L_{max3} = 49.7 ± 12.8 cm FL. (B) Predicted *vs.* observed weights (in g wet weight) of 7 length-frequency samples of shortfin lizardfish, *Saurida micropectoralis*, from Western Indonesia based on data from *R/Vs Mutiara 4* and *Jurong* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 12). Open dot represents outlier, not used for analysis.
[Gambar 19. (A) Gambaran nilai ekstrim untuk ikan beloso sirip pendek, Saurida micropectoralis, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Jurong, *menunjukkan nilai maksimum dari 5 contoh frekuensi-panjang, dan nilai perkiraan L_{max3} = 49.7 ± 12.8 cm FL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 7 contoh frekuensi-panjang ikan beloso sirip pendek,* Saurida micropectoralis, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan Jurong sebagai output perangkat lunak ABee (lihat Boks 1), dan memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 12). Bulatan kosong mewakili suatu pengamatan yang tidak dipakai dalam analisis.]*

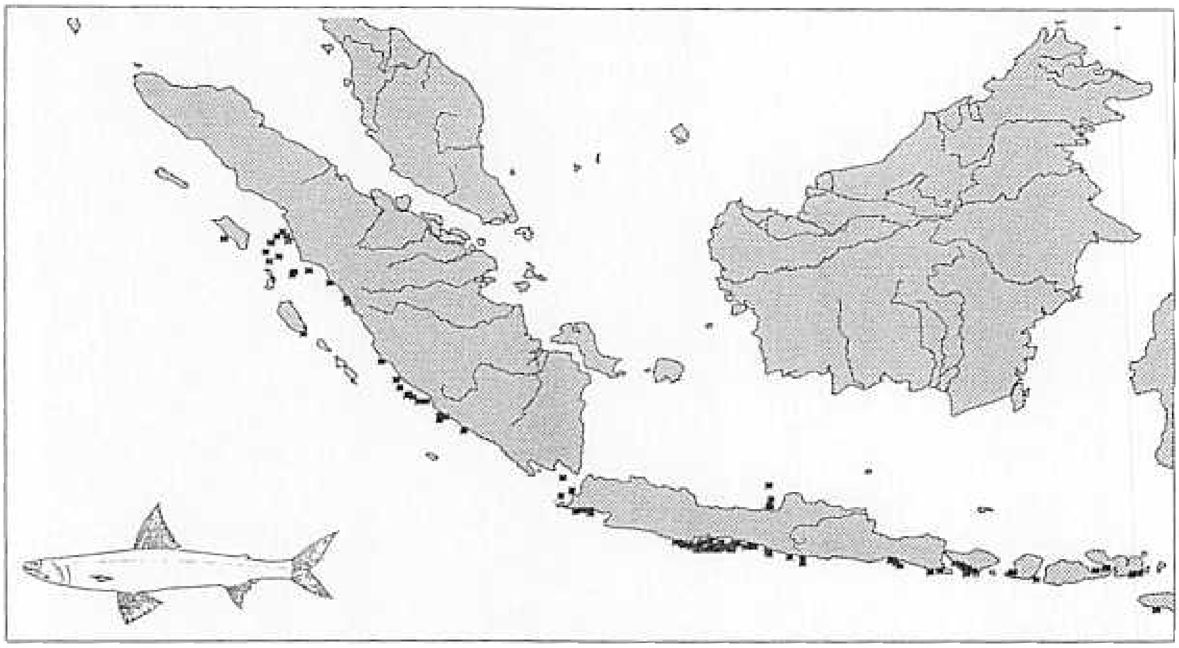


Fig. 20. Distribution of shortfin lizardfish, *Saurida micropectoralis*, in Western Indonesia based on records of the surveys of *R/Vs* *Mutiara 4, Bawal Putih 2* and *Jurong.*

[Gambar 20. Penyebaran ikan beloso sirip pendek, Saurida micropectoralis, *di Indonesia bagian barat berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2 *dan* Jurong.*]*

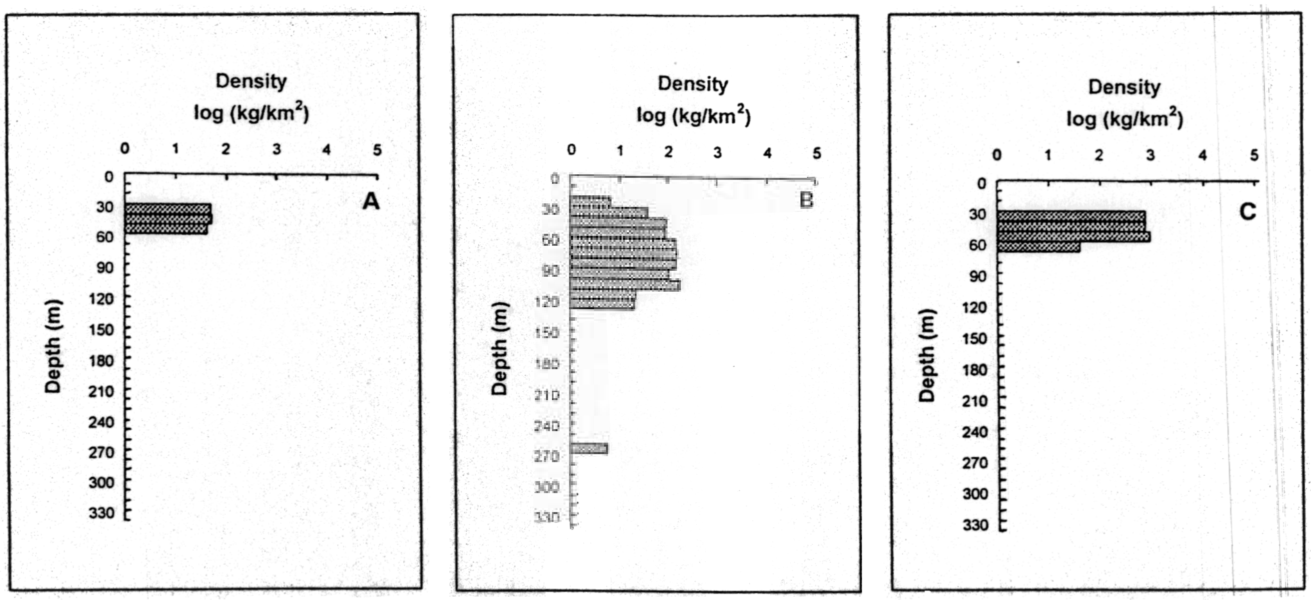


Fig. 21. Depth distribution of shortfin lizardfish, *Saurida micropectoralis*, in Western Indonesia based on surveys of *R/Vs* (A) *Mutiara 4,* (B) *Jurong* and (C) *Bawal Putih 2.*

[Gambar 21. Penyebaran kedalaman dari ikan beloso sirip pendek, Saurida micropectoralis, *di Indonesia bagian barat berdasarkan survei kapal-kapal penelitian (A)* Mutiara 4, *(B)* Jurong *dan (C)* Bawal Putih 2.*]*

Saurida undosquamis (Richardson, 1848)

Brushtooth lizardfish (English); Beloso (Indonesian).

Cigar-shaped, rounded or slightly compressed; the head pointed and depressed; the snout rounded. Color is brown-gray above and creamy below, with 8-10 indistinct darker spots alongthe middle of the sides. Dorsal spines: 0-0; soft rays: 11-12; anal spines: 0-0; soft rays: 11-12. L_{max1}= 50 cm. SL; L_{max2}= n.a.; L_{max3}= 41.45 cm TL (Fig. 22A). See Fig. 22B and Table 14 for length-weight relationship.

Indo-West Pacific from South Africa, through Indonesia (Fig. 23) to Japan and Western Australia (Great Barrier Reef). Migrated from the Red Sea through the Suez Canal to the eastern Mediterranean.

Found over muddy substrates of coastal waters, from about 20-290 m (Fig. 24). Feeds on fishes, crustaceans, and other invertebrates. Table 15 presents a set of growth parameters from Indonesia.

References: 231, 312, 1139, 1263, 1288, 1289, 1314, 1449, 1474, 1486, 1488, 1498, 1524, 1532, 2178, 2857, 2877, 3397, 3557, 3626, 3670, 3674, 3675, 3676, 3678, 4055, 4595, 4789, 4964, 5193 5213, 5284, 5337, 5381, 5385, 5450, 5525, 5736, 5756, 5760, 5829, 6313, 6328, 6365, 6567

Table 14. Length-weight (g/[TL;cm]) relationship of brushtooth lizardfish, *Saurida undosquamis*, in Indonesia.
[Tabel 14. Hubungan panjang-berat (g/[TL;cm]) ikan beloso, Saurida undosquamis, *di Indonesia.]*

Parameter	Estimate
a	0.0027
s.e.(a)	0.0017
b	3.3200
s.e.(b)	0.1918
r^2	0.9601

Table 15. Growth parameters of brushtooth lizardfish, *Saurida undosquamis*.
[Tabel 15. Parameter pertumbuhan ikan beloso, Saurida undosquamis.*]*

Parameter	A
L_∞ (TL, cm)	33.5
K ($year^{-1}$)	0.95

A. Java Sea (Central Java) (Ref. 1314)

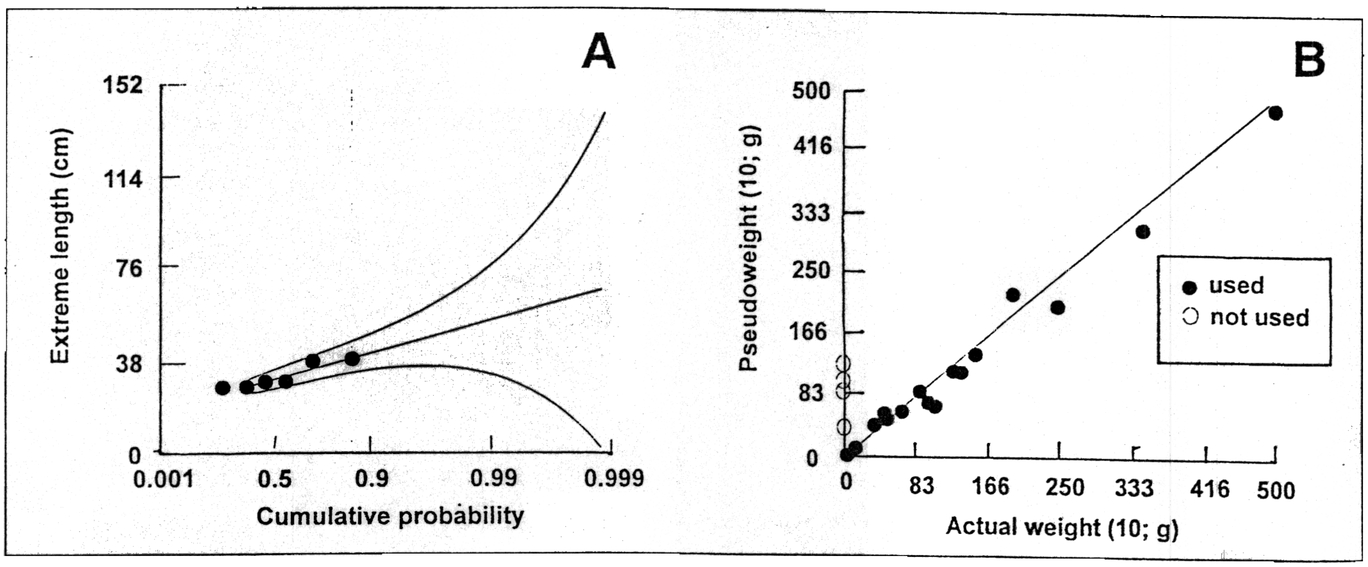


Fig. 22. (A) Extreme value plot for brushtooth lizardfish, *Saurida undosquamis*, in Indonesia based on data from *R/Vs Mutiara 4* and *Jurong*, showing maxima of 6 length-frequency samples, and estimate of L_{max3} = 41.45 ± 5.92 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 18 length-frequency samples of brushtooth lizardfish, *Saurida undosquamis*, from Western Indonesia based on data from *R/Vs Mutiara 4* and *Jurong* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 14). Open dots represent outliers, not used for analysis. *[Gambar 22. (A) Gambaran nilai ekstrim untuk ikan beloso,* Saurida undosquamis, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Jurong *menunjukkan nilai maksimum 6 contoh frekuensi-panjang, dan nilai perkiraan L_{max3} = 41.45 ± 5.92 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 18 contoh frekuensi-panjang ikan beloso,* Saurida undosquamis, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Jurong *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 14). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

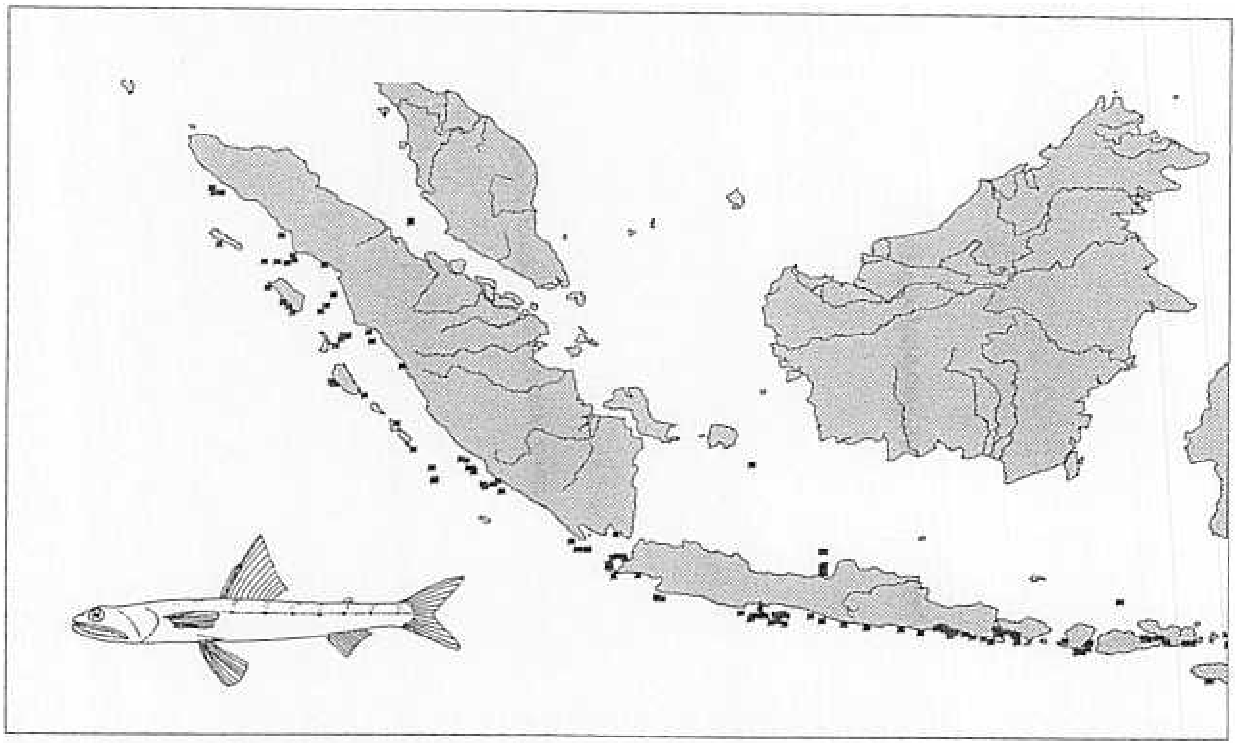


Fig. 23. Distribution of brushtooth lizardfish, *Saurida undosquamis*, in Western Indonesia based on records of the surveys of *R/Vs Dr. Fridtjof Nansen, Mutiara 4, Jurong* and *Bawal Putih 2*.
[Gambar 23. Penyebaran ikan beloso, Saurida undosquamis, *di Indonesia bagian barat berdasarkan laporan survei kapal-kapal penelitian* Dr. Fridtjof Nansen, Mutiara 4, Jurong *dan* Bawal Putih 2.*]*

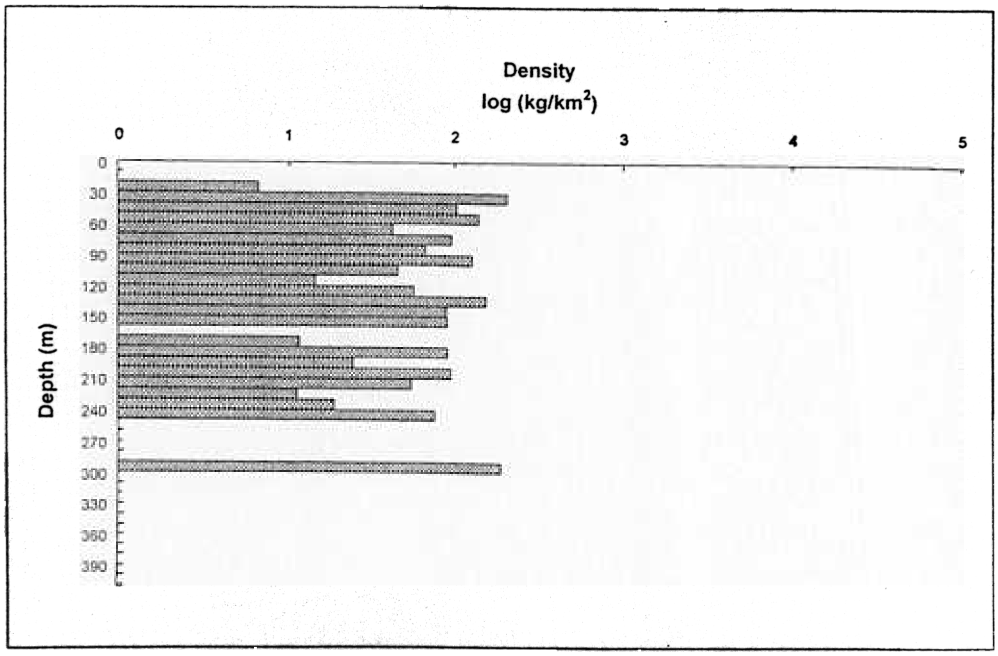


Fig. 24. Depth distribution of brushtooth lizardfish, *Saurida undosquamis*, in Western Indonesia based on surveys of *R/V Jurong*.
[Gambar 24. Penyebaran kedalaman ikan beloso, Saurida undosquamis, *di Indonesia bagian barat berdasarkan survei kapal penelitian* Jurong.*]*

Carangoides malabaricus (Bloch & Schneider, 1801)

Malabar trevally (English); Karang trevali, Kuwe (Indonesian).

Silvery, bluish gray dorsally. Opercle with a small, black spot. Lateral line with 19-36 weak scutes. Pectoral fins falcate; first dorsal lobe slightly falcate. No scales on breast to behind pelvic origin and laterally to pectoral base, including the small area anteriorly just above fin. Dorsal spines: 9 - 9; soft rays: 20-23; anal spines: 3-3; soft rays: 17-19. L_{max1}= 60 cm; L_{max2}= n.a.; L_{max3}= 29.18 cm TL (Fig. 25A). See Fig. 25B and Table 16 for length-weight relationship.

Ranges from the east coast of Africa (without verified records from the Red Sea) to Sri Lanka and farther eastward to the Gulf of Thailand and Indonesia (Fig. 26), north to Okinawa (Japan) and south to Australia.

Found near rocks and coral reefs. Depth range: 20-110 m (Fig. 27). Juveniles inhabit sandy bays. Feeds on crustaceans, small squids and fish.

References: 280, 1449, 2334, 2857, 3280, 3287, 3605, 5213, 5450, 5736, 5756, 6313, 6365, 6567

Table 16. Length-weight [g/(TL;cm)] relationship of Malabar trevally, *Carangoides malabaricus*, in Indonesia.
[Tabel 16. Hubungan panjang-berat [g/(TL;cm)] ikan karang trevali, Carangoides malabaricus, *di Indonesia.]*

Parameter	Estimate
a	0.0205
s.e.(a)	0.0120
b	2.8476
s.e.(b)	0.1953
r^2	0.9796

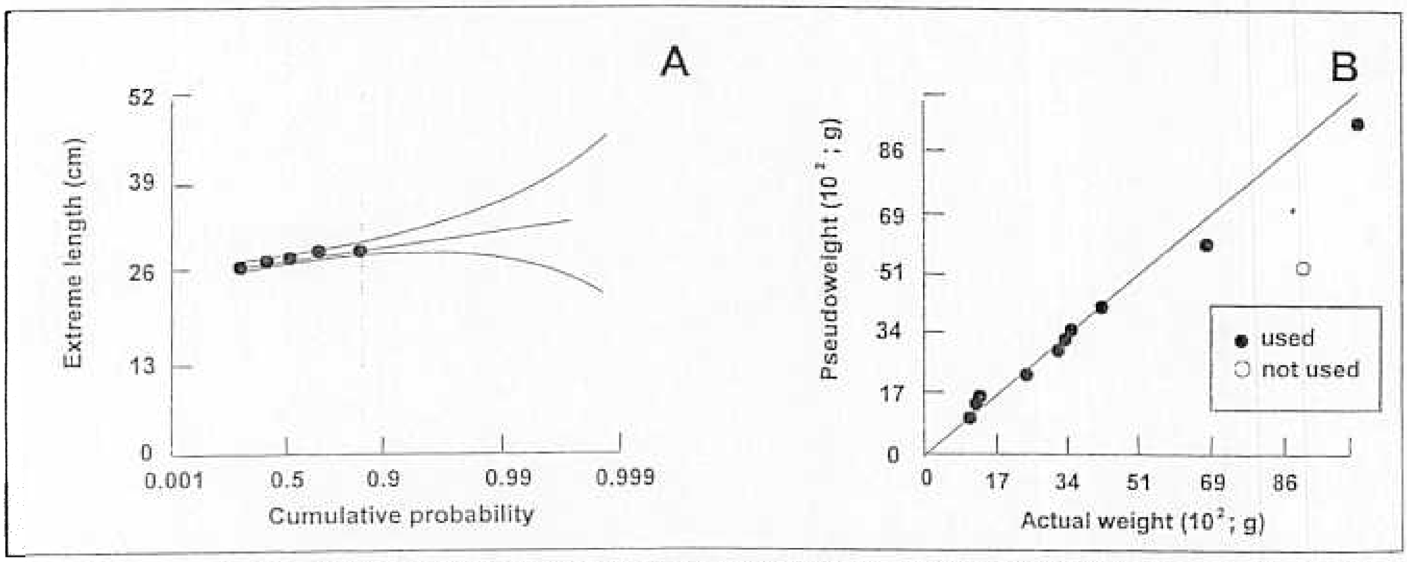


Fig. 25. (A) Extreme value plot for Malabar trevally, *Carangoides malabaricus*, in Indonesia based on data from *R/Vs Dr. Fridtjof Nansen* and *Jurong*, showing maxima of 5 length-frequency samples, and estimate of L_{max3} = 29.18 ± 0.945 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 10 length-frequency samples of Malabar trevally, *Carangoides malabaricus*, from Western Indonesia based on data from *R/Vs Mutiara 4, Dr. Fridtjof Nansen* and *Jurong* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 16). Open dot represents outlier, not used for analysis.

[Gambar 25. (A) Gambaran nilai ekstrim dari ikan karang trevali, Carangoides malabaricus, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Dr. Fridtjof Nansen *dan* Jurong, *yang menunjukkan angka maksimum dari 5 contoh frekuensi-panjang, dan nilai perkiraan L_{max3} = 29.18 ± 0.945 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 10 contoh frekuensi-panjang ikan karang trevali,* Carangoides malabaricus, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Dr. Fridtjof Nansen *dan* Jurong *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 16). Bulatan kosong mewakili suatu pengamatan yang tidak dipakai dalam analisis.]*

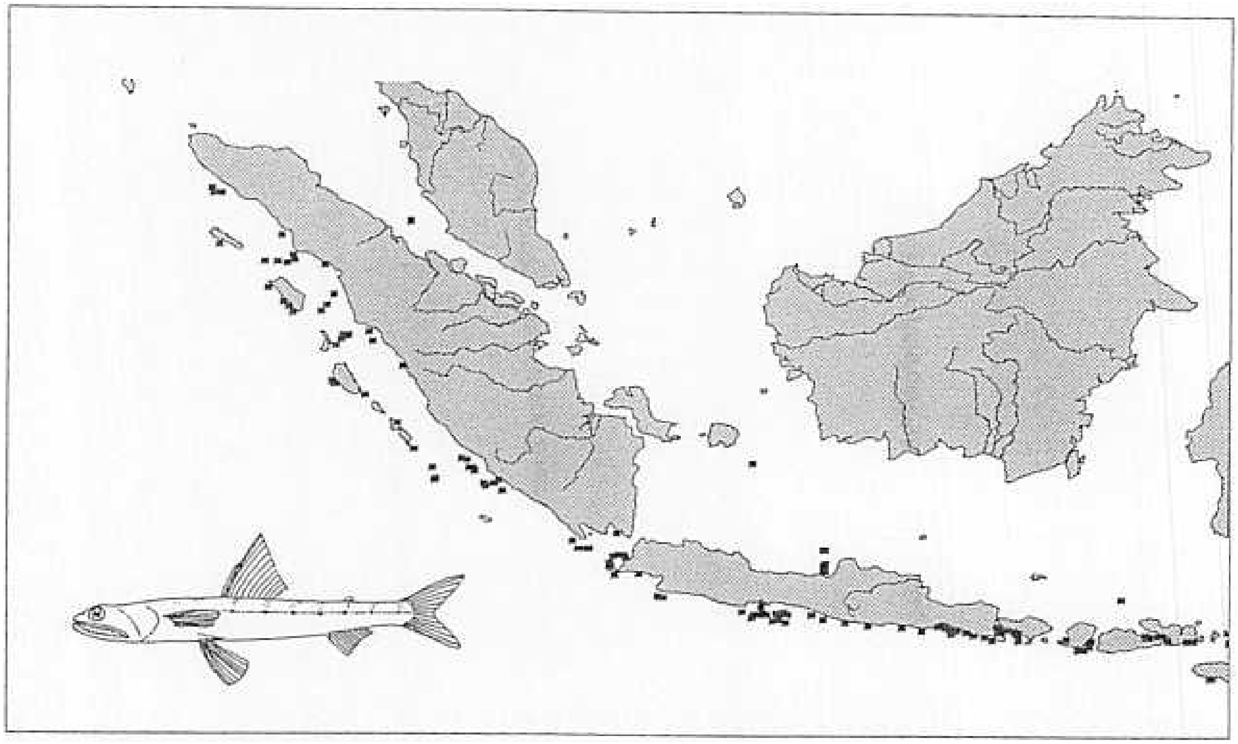


Fig. 23. Distribution of brushtooth lizardfish, *Saurida undosquamis*, in Western Indonesia based on records of the surveys of *R/Vs Dr. Fridtjof Nansen, Mutiara 4, Jurong* and *Bawal Putih 2.*

[Gambar 23. Penyebaran ikan beloso, Saurida undosquamis, *di Indonesia bagian barat berdasarkan laporan survei kapal-kapal penelitian* Dr. Fridtjof Nansen, Mutiara 4, Jurong *dan* Bawal Putih 2.*]*

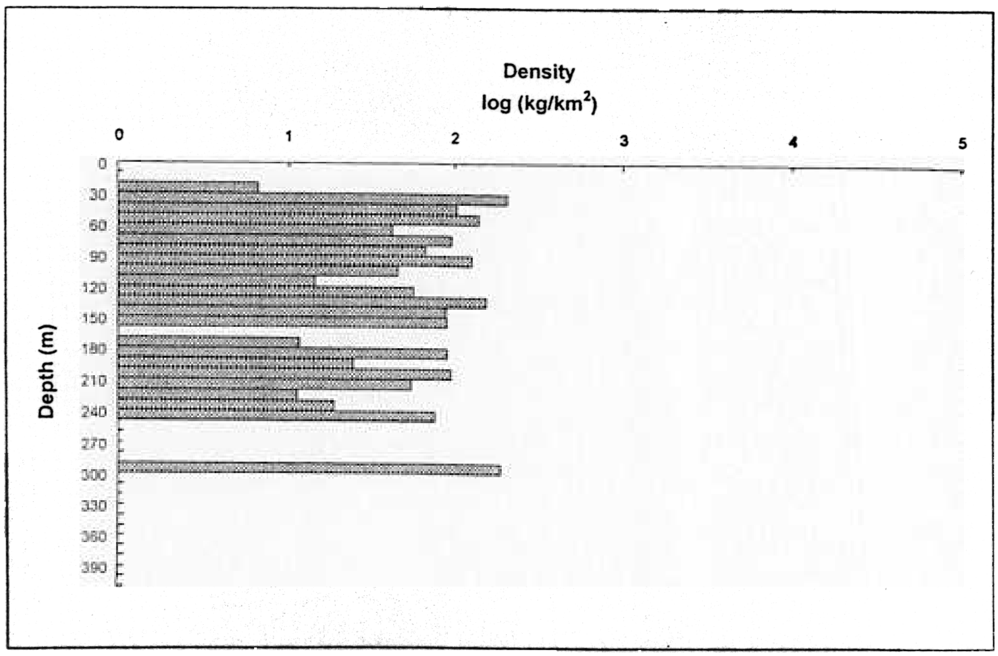


Fig. 24. Depth distribution of brushtooth lizardfish, *Saurida undosquamis*, in Western Indonesia based on surveys of *R/V Jurong.*

[Gambar 24. Penyebaran kedalaman ikan beloso, Saurida undosquamis, *di Indonesia bagian barat berdasarkan survei kapal penelitian* Jurong.*]*

Caranx ignobilis (Forsskål, 1775)

Giant trevally (English); Karang besar (Indonesian).

Head and body dusky golden dorsally, silver ventrally; fins usually pigmented gray to black. Opercular spot absent. Twenty-six to 38 strong scutes. Breast scaleless ventrally; a small patch of prepelvic scales. Pectoral fins falcate; anal fin with 2 detached spines. Dorsal spines: 9-9; soft rays: 17-22; anal spines: 3-3; soft rays: 15-17. L_{max1} = 165 cm FL; L_{max2} = n.a.; L_{max3} = 57.2 cm FL (Fig. 28A). See Fig. 28B and Table 17 for length-weight relationship.

Widely distributed throughout most of the Indian Ocean, the Indonesian Archipelago (Fig. 29) and the Central Pacific, eastward to the Hawaiian and Marquesas Islands.

Juveniles are found in small schools over sandy inshore bottoms, adults usually solitary, over the reef. Depth range 20-100 m (Fig. 30). Usually feeds at night on fishes and crustaceans such as crabs and spiny lobsters. Large individuals may be ciguatoxic.

References: 171, 583, 1602, 2334, 2857, 2872, 3280, 3287, 3605, 3626, 3678, 3804, 3807, 4332, 4362, 4390, 4560, 4699, 4735, 4795, 4821, 4887, 4917, 4959, 5213, 5450, 5525, 5736, 5756, 5970, 6026, 6057, 6273, 6306, 6313, 6365

Table 17. Length-weight (g/[FL;cm]) relationship of giant trevally, *Caranx ignobilis*, in Indonesia.
[Tabel 17. Hubungan panjang-berat (g/[FL;cm]) ikan karang besar, Caranx ignobilis, *di Indonesia.]*

Parameter	Estimate
a	0.0202
s.e.(a)	n.a.
b	3.0000
s.e.(b)	n.a.
r^2	0.0000

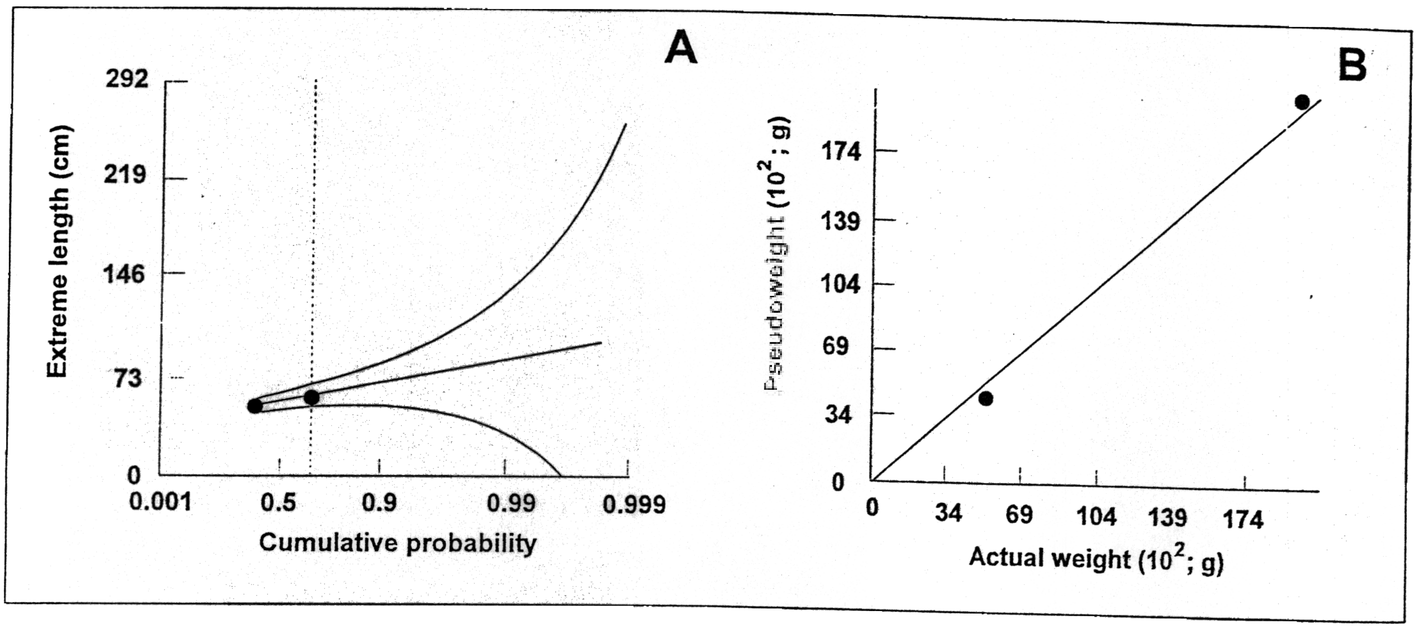


Fig. 28. (A) Extreme value plot for giant trevally, *Caranx ignobilis*, in Indonesia based on data from *R/V Jurong*, showing maxima of 2 length-frequency samples, and estimate of L_{max3} = 57.2 ± 8.2 cm FL. (B) Predicted *vs.* observed weights (in g wet weight) of 2 length-frequency samples of giant trevally, *Caranx ignobilis*, from Western Indonesia based on data from *R/V Jurong* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 17).

[Gambar 28. (A) Penggambaran nilai ekstrim ikan karang besar, Caranx ignobilis, *di Indonesia berdasarkan data dari kapal penelitian* Jurong, *yang menunjukkan nilai maksimum dari 2 contoh frekuensi-panjang, dan nilai perkiraan L_{max3} = 57.2 ± 8.2 cm FL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 2 contoh frekuensi-panjang ikan karang besar,* Caranx ignobilis, *dari Indonesia bagian barat berdasarkan data kapal penelitian* Jurong *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 17).]*

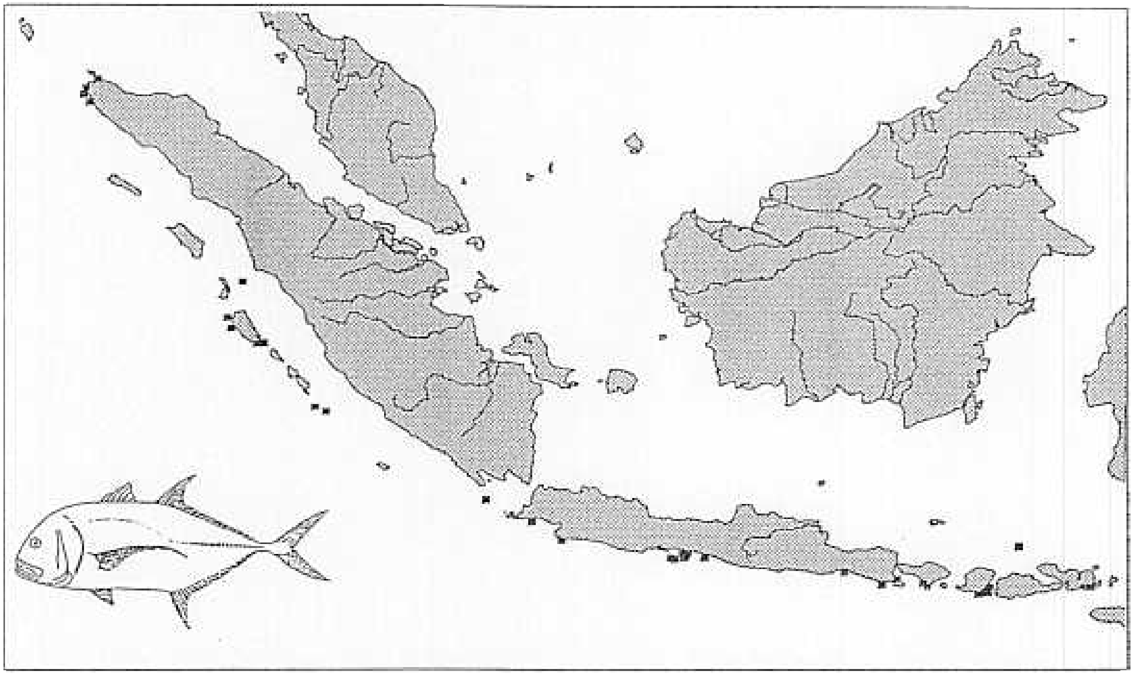


Fig. 29. Distribution of giant trevally, *Caranx ignobilis*, in Western Indonesia based on records of the surveys of *R/Vs Dr. Fridtjof Nansen, Jurong* and *Bawal Putih 2.*
[Gambar 29. Penyebaran ikan karang besar, Caranx ignobilis, *di Indonesia bagian barat berdasarkan laporan dari survei kapal-kapal penelitian* Dr. Fridtjof Nansen, Jurong *dan* Bawal Putih 2.*]*

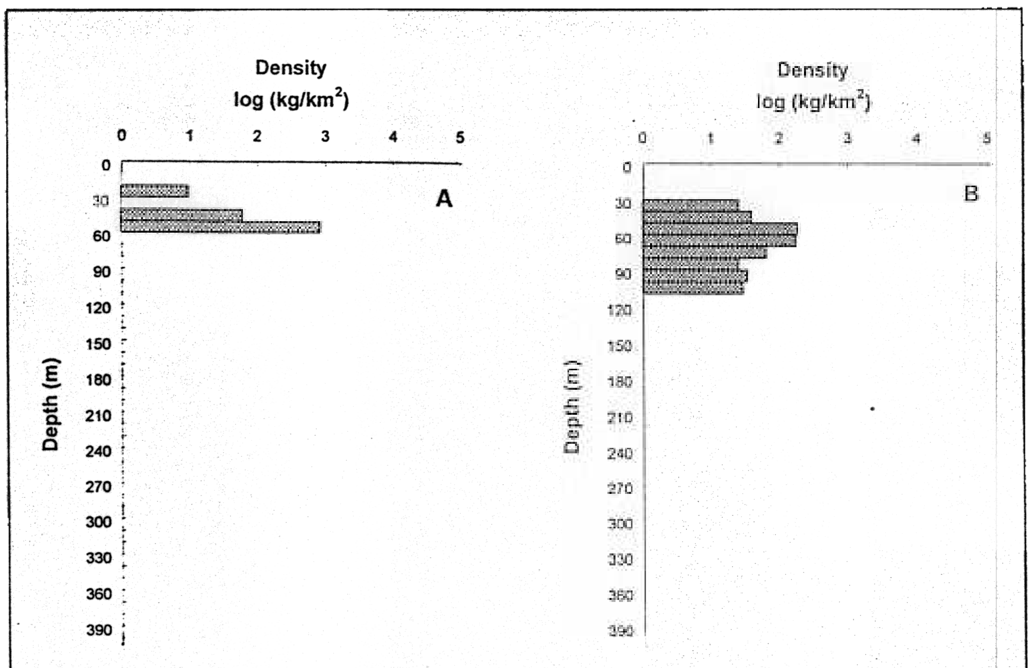


Fig. 30. Depth distribution of giant trevally, *Caranx ignobilis*, in Western Indonesia based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen* and (B) *Jurong.*
[Gambar 30. Penyebaran kedalaman ikan karang besar, Caranx ignobilis, *di Indonesia bagian barat berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen *dan (B)* Jurong.*]*

Caranx tille (Cuvier, 1833)

Tille trevally (English); Karang tile (Indonesian).

Body dark olive green to bluish gray dorsally, silvery white below; soft dorsal lobe olive gray to blackish. Upper part of opercle with a small blackish spot. Thirty-three to 42 strong scutes. Pectoral fins falcate. Two anal fin spines detached. Breast fully scaled. Dorsal spines: 9-9; soft rays: 20-22; anal spines: 3-3; soft rays: 16-18. L_{max1} = 80 cm; L_{max2} = n.a.; L_{max3} = 54.5 cm FL (Fig. 31A). See Fig. 31B and Table 18 for length-weight relationship.

Distribution in the Indian Ocean not well established; reported from Durban to Zanzibar; also recorded in Madagascar and Sri Lanka. Ranges from Indonesia (Fig. 32) to southern Japan (Okinawa), Australia and Fiji.

Inhabits coastal waters, near coral reefs and rocks. Depth range: 30 to 120 m (Fig. 33). Feeds on fish and crustaceans.

References: 171, 2334, 2857, 3197, 3280, 3807, 5193, 5213

Table 18. Length-weight (g/[FL;cm]) relationship of tille trevally, *Caranx tille*, in Indonesia.
Tabel 18. Hubungan panjang-berat (g/[FL;cm]) dari ikan karang tile, Caranx tille, *di Indonesia.*

Parameter	Estimate
a	0.0088
s.e.(a)	0.0092
b	3.1630
s.e.(b)	0.2859
r^2	0.9928

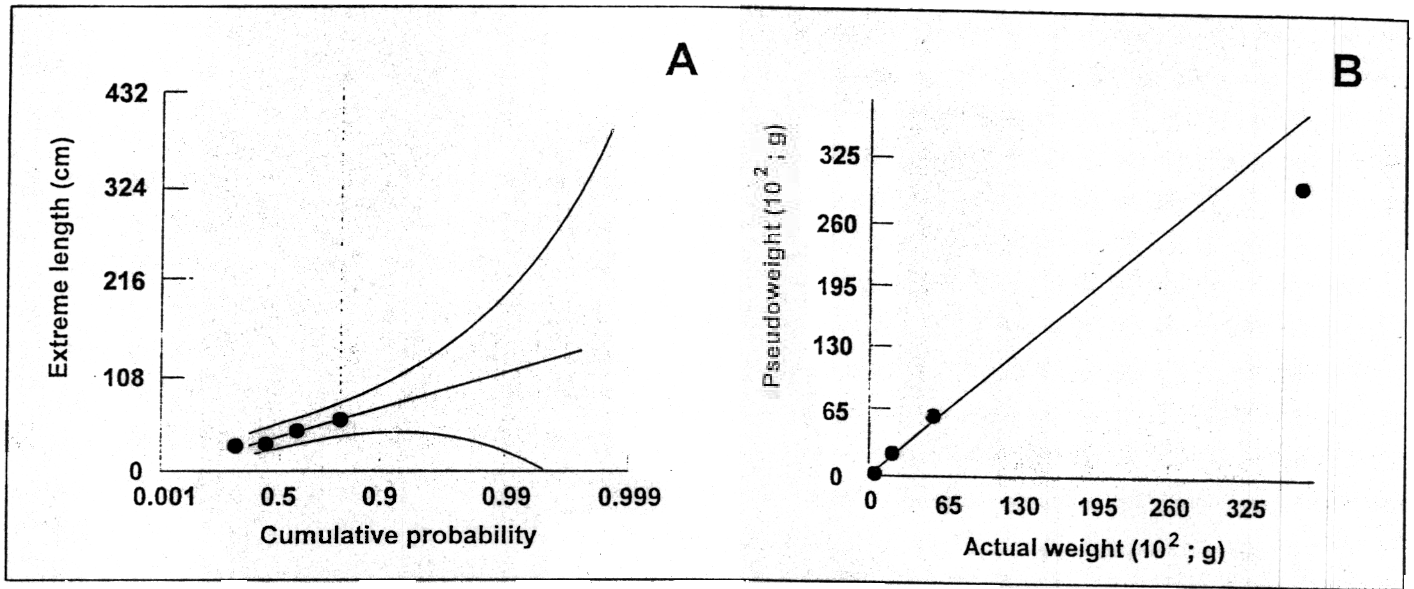


Fig. 31. (A) Extreme value plot for tille trevally, *Caranx tille*, in Indonesia based on data from *R/V Jurong*, showing maxima of 4 length-frequency samples, and estimate of L_{max3} = 54.5 ± 17.6 cm FL. (B) Predicted *vs.* observed weights (in g wet weight) of 4 length-frequency samples of tille trevally, *Caranx tille*, from Western Indonesia based on data from *R/V Jurong* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 18).

[Gambar 31. (A) Penggambaran nilai ekstrim ikan karang tile, Caranx tille, *di Indonesia berdasarkan data dari kapal penelitian* Jurong, *menunjukkan nilai maksimum dari 4 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 54.5 ± 17.6 cm FL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 4 contoh frekuensi-panjang ikan karang tile,* Caranx tille, *dari Indonesia bagian barat berdasarkan data kapal penelitian* Jurong *sebagai output perangkat lunak ABee (lihat Boks 1), yang memungkinkan estimasi hubungan panjang-berat (lihat Tabel 18).*

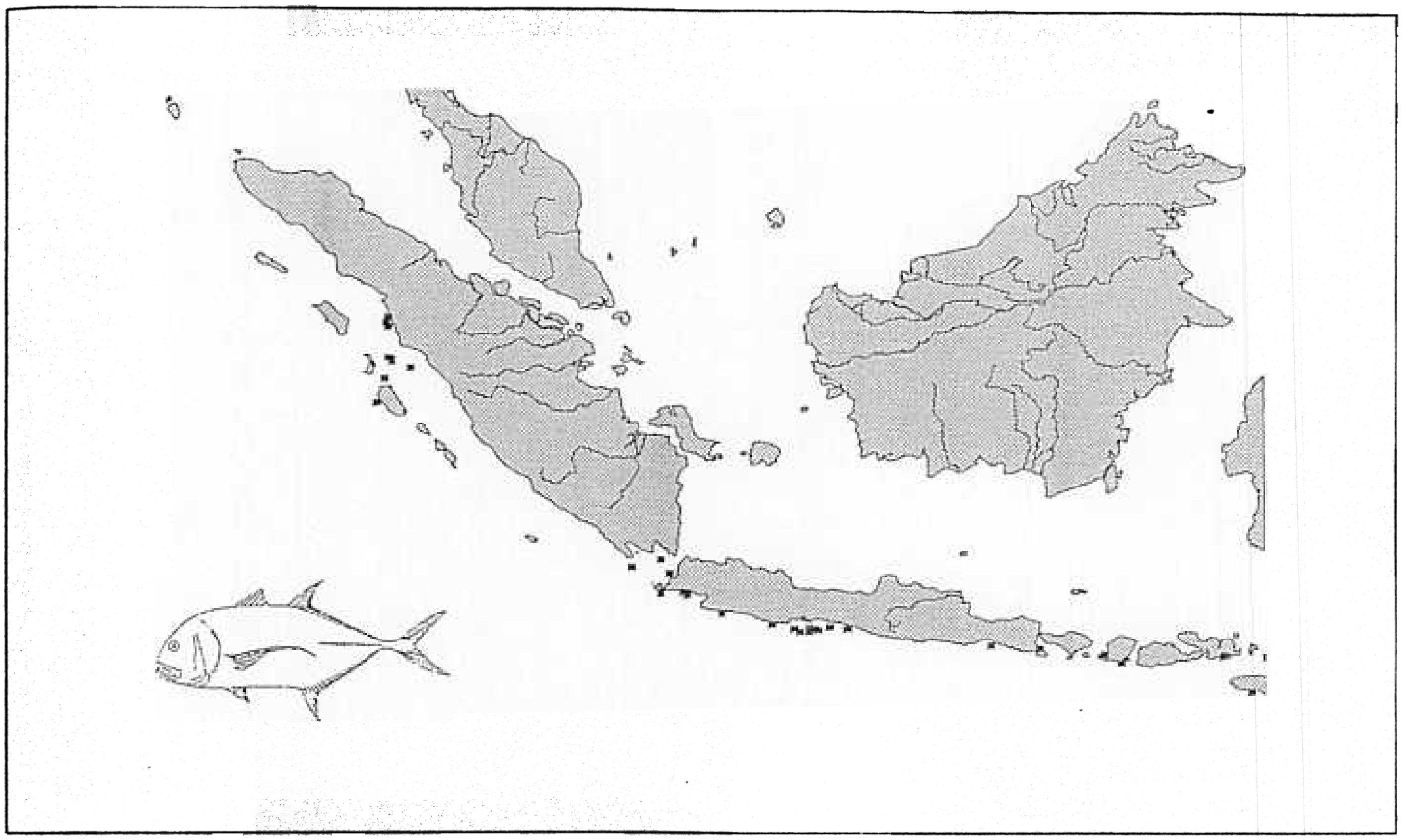


Fig. 32. Distribution of tille trevally, *Caranx tille*, in Western Indonesia based on records of the surveys of *R/Vs Jurong* and *Bawal Putih 2*.
[Gambar 32. Penyebaran ikan karang tile, Caranx tille, *di Indonesia bagian barat berdasarkan laporan survei kapal-kapal penelitian* Jurong *dan* Bawal Putih 2.*]*

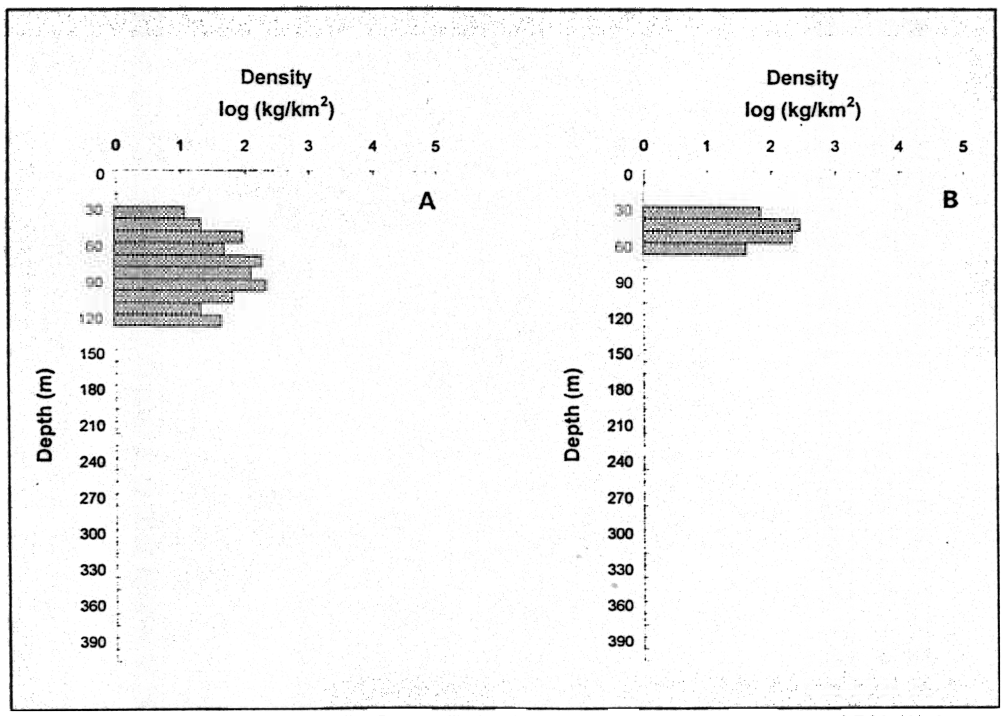


Fig. 33. Depth distribution of tille trevally, *Caranx tille*, in Western Indonesia based on surveys of *R/Vs* (A) *Jurong*, and (B) *Bawal Putih 2*.
[Gambar 33. Penyebaran kedalaman ikan karang tile, Caranx tille, *di Indonesia bagian barat berdasarkan survei kapal-kapal penelitian (A)* Jurong *dan (B)* Bawal Putih 2.*]*

Decapterus macrosoma (Bleeker, 1851)

Shortfin scad (English); Lajang deles (Indonesian); Bengol deles, Deles, Lajang, Lajang deles, Lajang lidi, Luntju (Java); Lajang (West Java, Jakarta); Bulus blangseng, Kaban bulus, Kaban laes, Kaban padara, Kaban patek, Ladjeng lakek, Rentjek bulus, Rentjek kaban (Madura); Bulus (Bawean).

Metallic blue dorsally, silvery ventrally; fins hyaline. Opercle with a small black spot. Anal fin with 2 detached spines. Twenty-four to 40 scutes. Upper jaw reaching below front margin of eye. Dorsal spines: 9-9; soft rays: 33-38; anal spines: 3-3; soft rays: 27-30. L_{max1} = 35 cm; L_{max2} = 20 cm ; L_{max3} = 28.95 cm TL (Fig. 34A). See Fig. 34B and Table 19 for length-weight relationship.

Pacific Ocean: from southern Japan to warm waters of the Western Pacific, including the Indonesian Archipelago (Fig. 35). Eastern Pacific: from the Gulf of California, Mexico to Peru, including the Galapagos Islands.

Forms schools. Depth range: 20-140 m (Fig. 36). Feeds on small invertebrate plankton. Table 20 presents six sets of growth parameters from Indonesia.

References: 171, 312, 559, 761, 1263, 1314, 1386, 1392, 1447, 1449, 1462, 1467, 1602, 2021, 2023, 2334, 2857, 3280, 3287, 3555, 3556, 3786, 3804, 3807, 4536, 4789, 4838, 5213, 5337, 5340, 5530, 5730, 5756, 6313, 6365

Table 19. Length-weight (g/[TL;cm]) relationship of shortfin scad, *Decapterus macrosoma*, in Indonesia.
[Tabel 19. Hubungan panjang-berat (g/[TL;cm]) ikan layang deles, Decapterus macrosoma, *di Indonesia.]*

Parameter	A	B
a	0.0076	0.009
s.e.(a)	0.0125	n.a.
b	3.0051	3.01
s.e.(b)	0.5630	n.a.
r^2	0.8669	n.a.

A. This study.
B. Java Sea (Ref. 1386).

Table 20. Growth parameters of shortfin scad, *Decapterus macrosoma*.
[Tabel 20. Parameter pertumbuhan ikan layang deles, Decapterus macrosoma.*]*

Parameter	A	B	C	D	E	F
L_∞ (cm)	24.0	24.0	25.4	25.6	25.7	27.7
K ($year^{-1}$)	1.15	1.00	0.98	1.05	0.90	1.20

A. Java Sea (Ref. 1386), L in FL.
B. Asahan, Sumatra (Ref. 1467).
C. Java Sea (Pekalongan) (Ref. 1314), L in TL.
D. Java Sea (Ref. 1447), L in TL.
E. Langsa, Sumatra (Ref. 1467).
F. Banda Aceh, Sumatra (Ref. 1467).

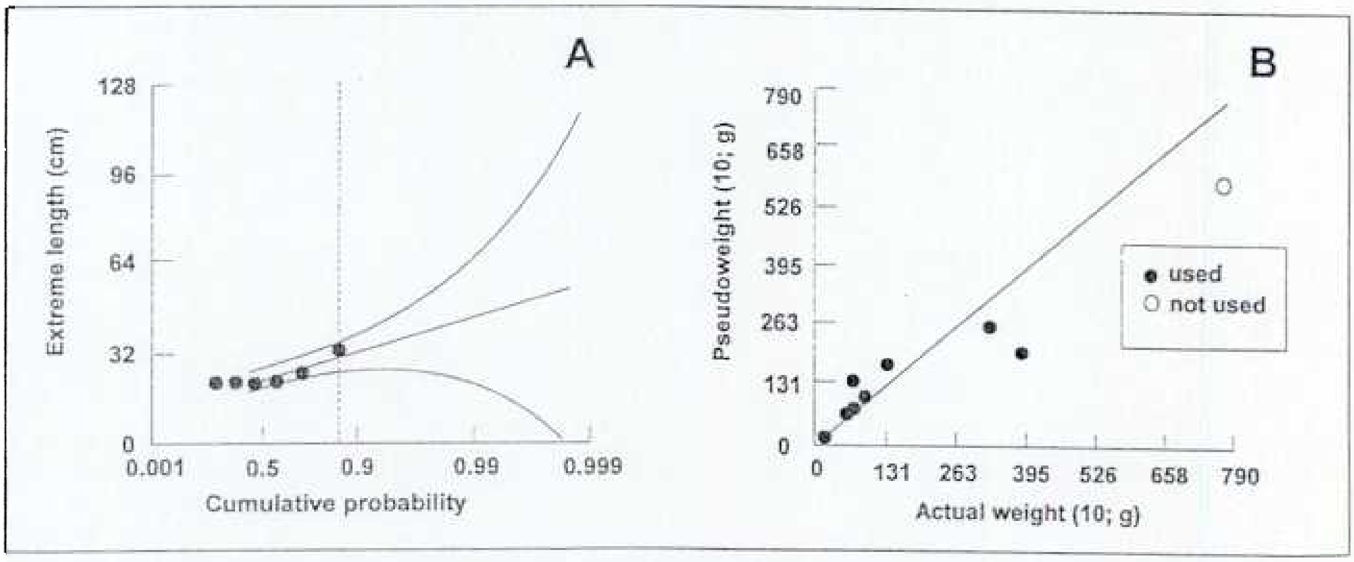


Fig. 34. (A) Extreme value plot for shortfin scad, *Decapterus macrosoma*, in Indonesia based on data from *R/Vs Dr. Fridtjof Nansen, Jurong* and *Bawal Putih 2*, showing maxima of 6 length-frequency samples, and estimate of L_{max3} = 28.95 ± 5.24 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 8 length-frequency samples of shortfin scad, *Decapterus macrosoma*, from Western Indonesia based on data from *R/Vs Dr. Fridtjof Nansen, Jurong* and *Bawal Putih 2* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 19). Open dot represents outlier, not used for analysis.
[Gambar 34. (A) Gambaran nilai ekstrim ikan layang deles, Decapterus macrosoma, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Dr. Fridtjof Nansen, Jurong *dan* Bawal Putih 2, *menunjukkan nilai maksimum dari 6 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 28.95 ± 5.24 cm TL. (B) Berat prediksi terhadap berat berat observasi (dalam g berat basah) dari 8 contoh frekwensi-panjang ikan layang deles,* Decapterus macrosoma, *dari Indonesia bagian barat berdasarkan data kapal-kapal penelitian* Dr. Fridtjof Nansen, Jurong *dan* Bawal Putih 2 *sebagai output perangkat lunak ABee (lihat Box 1), dan yang memungkinkan suatu hubungan panjang-berat (lihat Tabel 19). Bulatan kosong mewakili suatu pengamatan yang tidak dipakai dalam analisis.]*

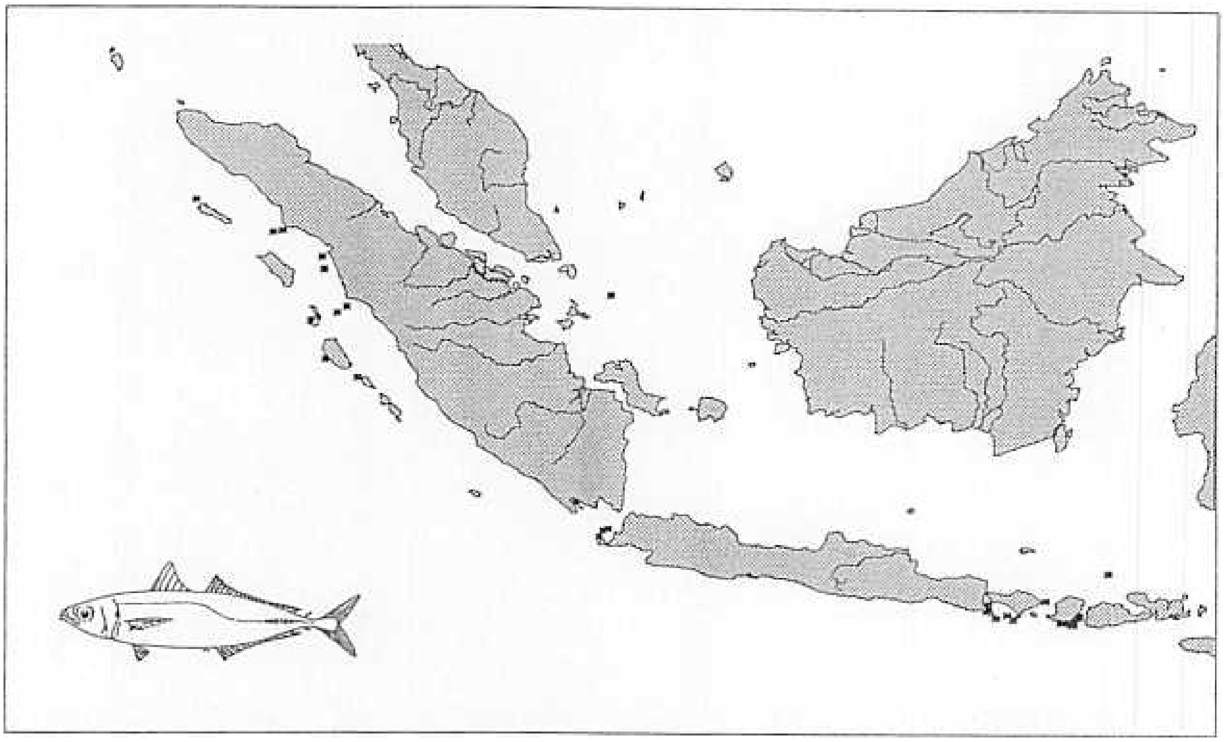


Fig. 35. Distribution of shortfin scad, *Decapterus macrosoma*, in Western Indonesia based on records of the surveys of *R/Vs Dr. Fridtjof Nansen, Jurong* and *Bawal Putih 2.*

[Gambar 35. Penyebaran ikan layang deles, Decapterus macrosoma, *di Indonesia bagian barat berdasarkan laporan survei kapal-kapal penelitian* Dr. Fridtjof Nansen, Jurong *dan* Bawal Putih 2.*]*

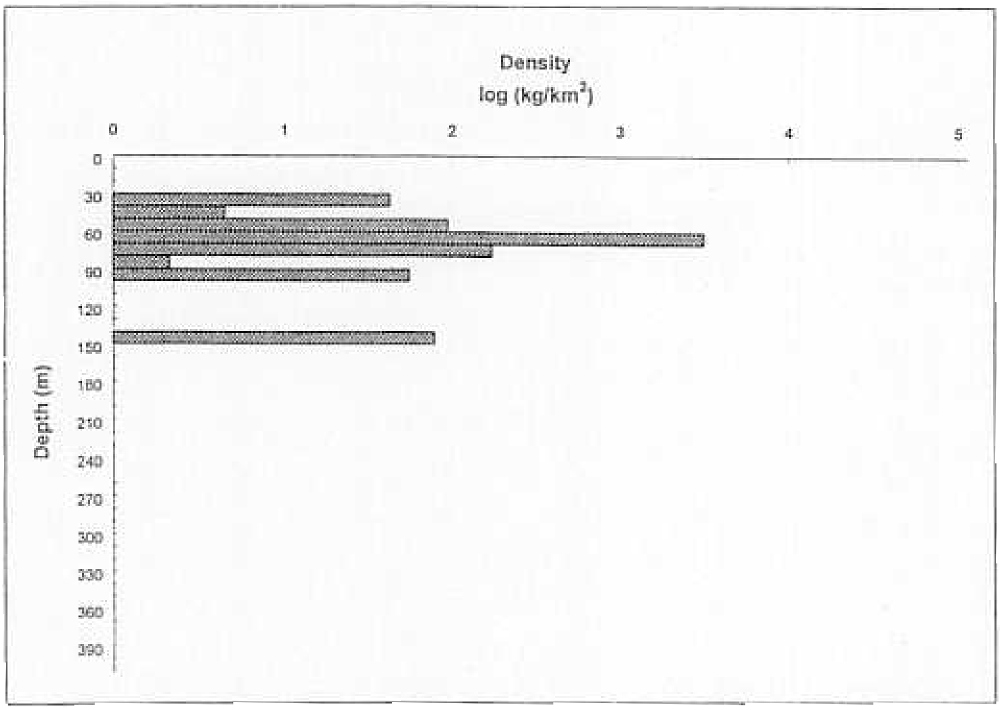


Fig. 36. Depth distribution of shortfin scad, *Decapterus macrosoma,* in Western Indonesia based on surveys of *R/V Jurong.*

[Gambar 36. Penyebaran kedalaman ikan layang deles, Decapterus macrosoma, *di Indonesia bagian barat berdasarkan survei kapal penelitian* Jurong.*]*

Decapterus russelli (Rüppell, 1830)

Indian scad (English); Lajang (Indonesian); Bengol, Korok, Ladjeng, Lajang (Java); Lajang (West Java, Jakarta); Kaban padara, Kaban patek, Ladjang (Madura); Rentjek bulus, Rentjek kaban, Rentjek padara, Rentjek patek (Madura).

Lateral line curved below soft dorsal and with 30-44 strong scutes; bluish green above, silvery below; caudal fin hyaline to yellowish; dorsal fins hyaline basally, light dusky distally. Opercle with small, black spot; opercular membrane with smooth margin. Snout longer than eye diameter; squarish lower posterior edge of maxilla; upper jaw with small teeth anteriorly; soft dorsal and anal fins relatively low, not falcate; pectoral fin subfalcate. Dorsal spines: 9-9; soft rays: 28-31; anal spines: 3-3; soft rays: 25-28. L_{max1} = 35 cm FL; L_{max2} = n.a.; L_{max3} = n.a. See Table 21 for length-weight relationship.

From East Africa via Southeast Asia and the Indonesian Archipelago (Fig. 37) to Japan and Australia (and possibly to New Caledonia).

Schooling in coastal waters and on open banks. Depth range: 40-275 m (Fig. 38). Feeds mainly on smaller planktonic invertebrates. Table 22 presents five sets of growth parameters from Indonesia.

References: 171, 312, 559, 761, 1263, 1314, 1384, 1385, 1454, 1455, 1632, 2021, 2334, 3131, 3197, 3287, 3555, 3556, 3807, 4537, 4546, 4591, 4838, 4883, 4931, 5213, 5284, 5337, 5339, 5406, 5417, 5418, 5432, 5433, 5434, 5440, 5441, 5443, 5444, 5446, 5525, 5730, 5736, 5756, 5885, 5970, 6026, 6365

Table 21. Length-weight (g/[TL; cm]) relationship of Indian scad, *Decapterus russelli*, in Indonesia.
[Tabel 21. Hubungan panjang-berat (g/[TL;cm]) ikan layang, Decapterus russelli, *di Indonesia.]*

Parameter	Estimates A	Estimates B
a	0.0112	0.0104
b	2.970	3.000
r^2	n.a.	0.980

A. Tegal (Ref. 5441), Length type unspecified.
B. Java Sea (Ref. 1385).

Table 22. Growth parameters of Indian scad, *Decapterus russelli.*
[Tabel 22. Parameter pertumbuhan ikan layang, Decapterus russelli.*]*

Parameter	A	B	C	D	E
L_∞ (cm)	26.0	26.6	27.0	27.0	28.4
K ($year^{-1}$)	0.90	0.95	1.15	1.18	0.90

A. Idi, Malacca Strait (Ref. 5432), L in FL.
B. Java Sea (Seribu Island) (Ref. 1314), L in TL.
C. Jakarta Bay (Seribu Island), L in TL, 1973 (Ref. 1314).
D. Jakarta Bay (Seribu Island), L in TL, 1975 (Ref. 1314).
E. Java Sea (Ref. 1385), L in FL.

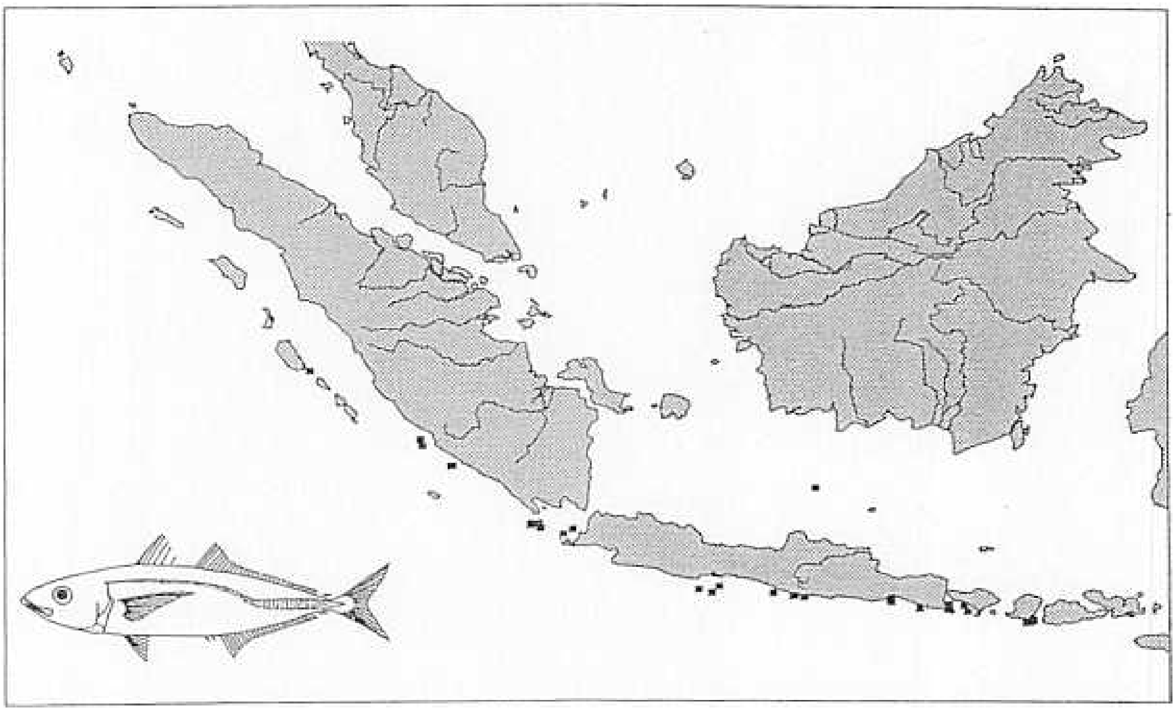


Fig. 37. Distribution of Indian scad, *Decapterus russelli*, in Western Indonesia based on records of the surveys of *R/Vs Jurong* and *Bawal Putih 2*.
[Gambar 37. Penyebaran ikan layang, Decapterus russelli, *di Indonesia bagian barat berdasarkan laporan survei kapal-kapal penelitian* Jurong *dan* Bawal Putih 2.*]*

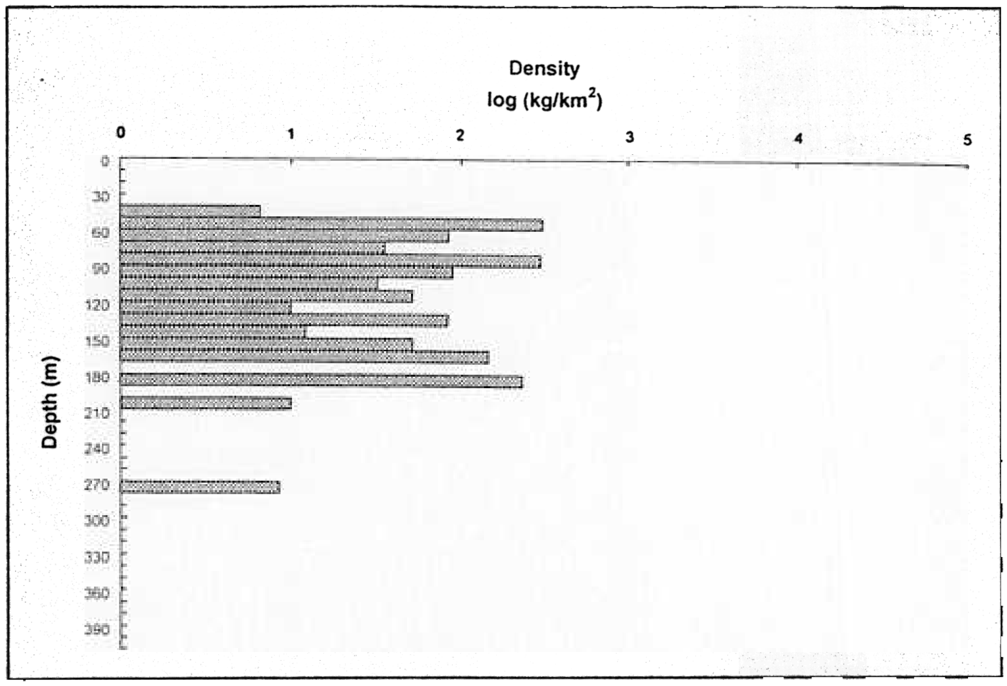


Fig. 38. Depth distribution of Indian scad, *Decapterus russelli,* in Western Indonesia, based on surveys of *R/V Jurong.*
[Gambar 38. Penyebaran kedalaman ikan layang, Decapterus russelli, *di Indonesia bagian barat berdasarkan survei kapal penelitian* Jurong.*]*

Parastromateus niger (Bloch, 1795)

Black pomfret (English); Bawal hitam (Indonesian); Gebel (Java); Bawal, Bawal hitam, Dorang, Dorang hitam (West Java, Jakarta); Dibas, Kandibas, Kapet, Kibas, Tjeplek (Madura); Bawal hitam (East Sumatra); Manriwasa leleng (South Sulawesi, Makasar); Peda-peda lotong (South Sulawesi, Bugis).

Deep-bodied and strongly compressed. Lateral line ends in weakly-developed scutes on the caudal peduncle. Pelvic fins lost in individuals over 9 cm. Color is brown above, silvery-white below. The anterior parts of the dorsal and anal fins bluish-gray, other fins yellowish. Dorsal spines: 2-6; soft rays: 41-46; anal spines: 2-2; soft rays: 35-40. L_{max1} = 75 cm; L_{max2} = n.a.; L_{max3} = 38.4 cm TL (Fig. 39A). See Fig. 39B and Table 23 for length-weight relationship.

From East Africa through the Indonesian Archipelago (Fig. 40) to southern Japan and Australia.

Forms large schools in coastal areas with muddy substrate. Depth range: 20-105 m (Fig. 41); near the bottom during daytime and near the water surface at night. Table 24 presents a set of growth parameters from Indonesia.

References: 171, 1314, 2334, 3287, 4789, 5213, 5284, 5736, 5756, 6365, 6567

Table 23. Length-weight (g/[TL;cm]) relationship of black pomfret, *Parastromateus niger,* in Indonesia.
[Tabel 23. Hubungan panjang-berat [g/(TL;cm)] ikan bawal hitam, Parastromateus niger, *di Indonesia.]*

Parameter	Estimate
a	0.0073
s.e.(a)	0.0063
b	3.3189
s.e.(b)	0.2676
r^2	0.8901

Table 24. Growth parameters of black pomfret, *Parastromateus niger.*
[Tabel 24. Parameter pertumbuhan ikan bawal hitam, Parastromateus niger.*]*

Parameter	A
L_∞ (TL, cm)	29.5
K (year^{-1})	0.68

A. Java Sea (Central Java) (Ref. 1314)

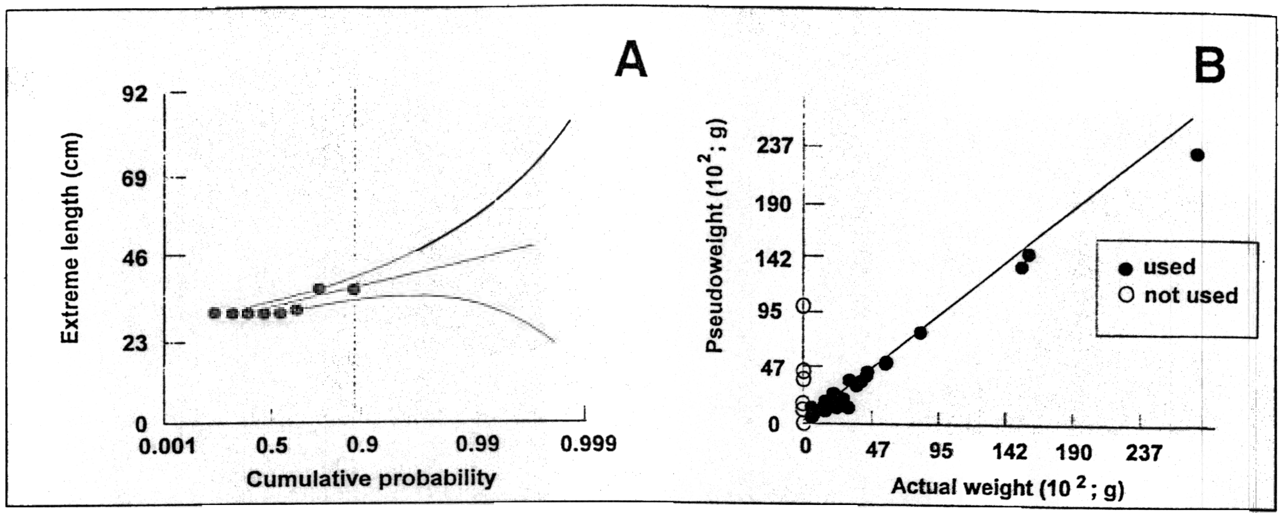


Fig. 39. (A) Extreme value plot for black pomfret, *Parastromateus niger*, in Indonesia based on data from *R/Vs Mutiara 4, Dr. Fridtjof Nansen, Bawal Putih 2* and *Jurong*, showing maxima of 8 length-frequency samples, and estimate of L_{max3} = 38.4 ± 3.3 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 26 length-frequency samples of black pomfret, *Parastromateus niger*, from Western Indonesia based on data from *R/Vs Mutiara 4, Dr. Fridtjof Nansen, Bawal Putih 2* and *Jurong* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 23). Open dots represent outliers, not used for analysis.
[Gambar 39. (A) Gambaran nilai ekstrim untuk ikan bawal hitam, Parastromateus niger, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Dr. Fridtjof Nansen, Bawal Putih 2 *dan* Jurong, *menunjukkan nilai maksimum untuk 8 contoh frekuensi-panjang, dan angka perkiraan* L_{max3} *= 38.4 ± 3.3 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 26 contoh frekuensi-panjang ikan bawal hitam,* Parastromateus niger, *dari Indonesia bagian barat berdasarkan data kapal-kapal penelitian* Mutiara 4, Dr. Fridtjof Nansen, Bawal Putih 2 *dan* Jurong *sebagai output perangkat lunak ABee (lihat Boks 1) yang memungkinkan estimasi hubungan panjang-berat (lihat Tabel 23). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

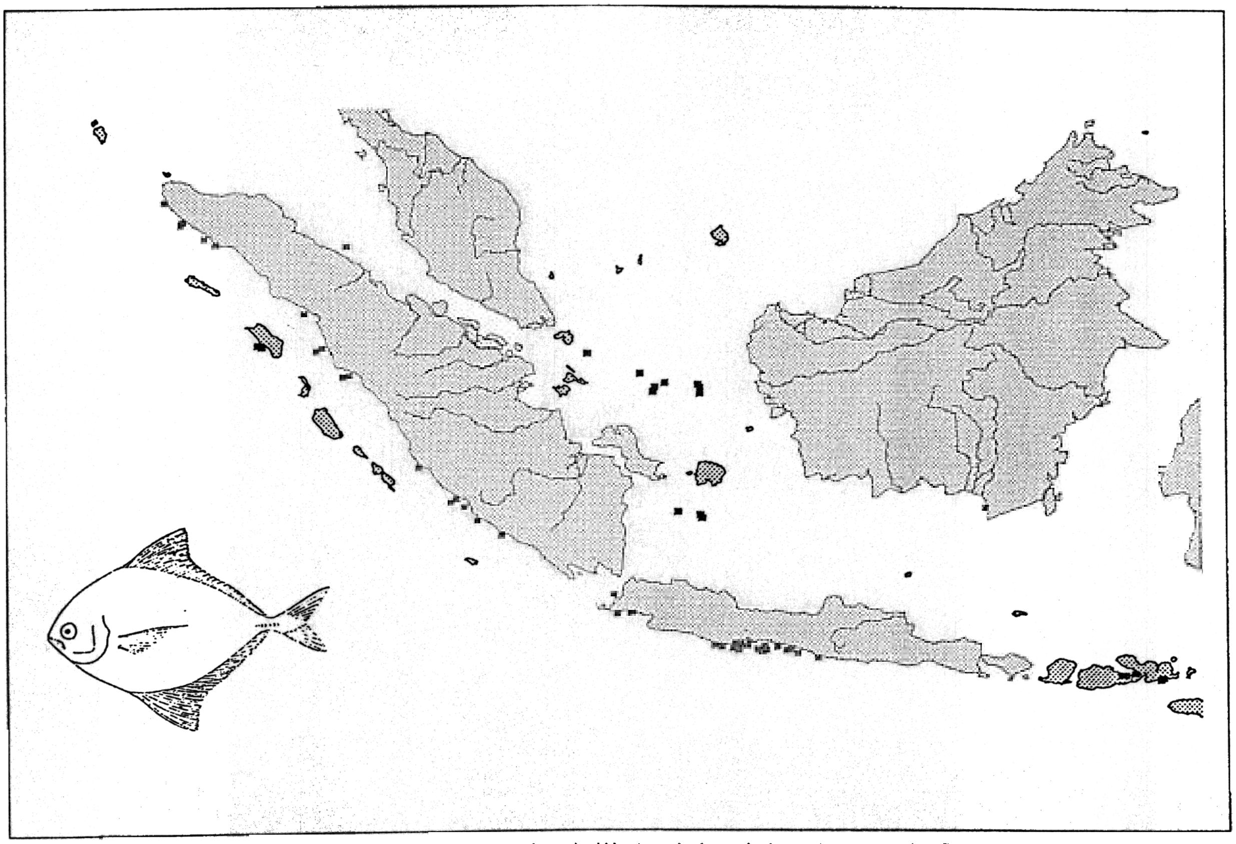


Fig. 40. Distribution of black pomfret, *Parastromateus niger*, in Western Indonesia based on records of the surveys of *R/Vs Dr. Fridtjof Nansen, Mutiara 4, Jurong* and Bawal *Putih 2.*
[Gambar 40. Penyebaran ikan bawal hitam, Parastromateus niger, *di Indonesia bagian barat berdasarkan laporan survei kapal-kapal penelitian* Dr. Fridtjof Nansen, Mutiara 4, Jurong *dan* Bawal Putih 2.*]*

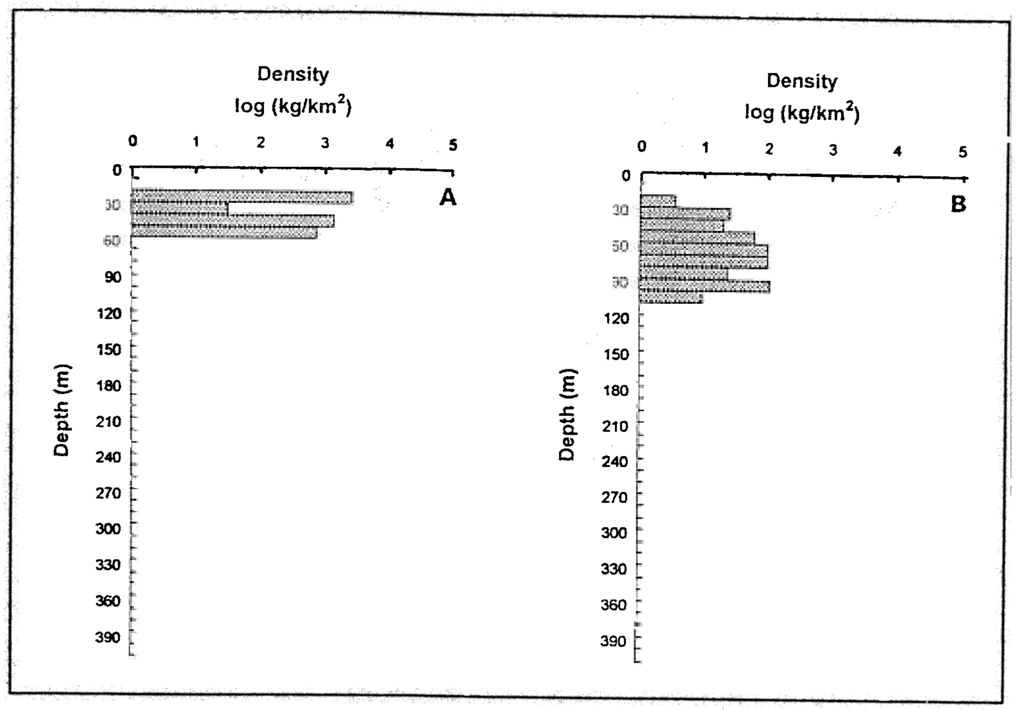


Fig. 41. Depth distribution of black pomfret, *Parastromateus niger*, in Western Indonesia based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen* and (B) *Jurong*.
[Gambar 41. Penyebaran kedalaman ikan bawal hitam, Parastromateus niger, *di Indonesia bagian barat berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen *dan (B)* Jurong.*]*

Selar crumenophthalmus (Bloch, 1793)

Bigeye scad (English); Bentong (Indonesian); Penteng, Pentong, Selar bentong (West Java, Jakarta); Bun bun, Tong gentong (Madura); Gintong (Central Sumatra).

Metallic blue to bluish green dorsally, shading to white ventrally; the lateral yellow stripe sometimes present. Lower margin of gill opening with a deep furrow, a large papilla immediately above it and a smaller one near upper edge. Operculum with black spot. Straight part of lateral line with 0-11 scales and 29-42 scutes. First two anal spines detached; pectoral fins falcate. Dorsal spines: 9-9; soft rays: 24-27; anal spines: 3-3; soft rays: 21-23. L_{max1} = 60 cm SL; L_{max2} = n.a.; L_{max3} = 26.7 cm FL (Fig. 42A). See Fig. 42B and Table 25 for length-weight relationship.

Circumtropical; Indo-Pacific: from southern Africa to Indonesia (Fig. 43); northeast to southern Japan and the Hawaiian Islands; south to New Caledonia and Rapa; east to Mexico to Peru and the Galapagos Islands, Western Atlantic: through the West Indies.

Forms small to large compact schools in inshore water and shallow reefs; mainly nocturnal; younger stages feed inshore on small shrimp and benthic invertebrates (including foraminiferans). The adults feed further offshore on zooplankton and fish larva, and range in depth from 10 to 170 m (Fig. 44). Table 26 presents two sets of growth parameters from Indonesia.

References: 171, 276, 1263, 1314, 1447, 1602, 2178, 2300, 2325, 2334, 2857, 3084, 3277, 3605, 3786, 3804, 3807, 4390, 4789, 4795, 4821, 4838, 4839, 4887, 4905, 5213, 5217, 5284, 5288, 5337, 5450, 5525, 5530, 5730, 5736, 5756, 5970, 6026, 6273, 6306, 6313, 6315, 6365, 6567, 6810

Table 25. Length-weight (g/[FL;cm]) relationship of bigeye scad, *Selar crumenophthalmus*, in Indonesia.
[Tabel 25. Hubungan panjang-berat (g/[FL;cm]) ikan selar bentong, Selar crumenophthalmus, *di Indonesia.]*

Parameter	Estimate
a	0.0176
s.e.(a)	0.0109
b	3.0039
s.e.(b)	0.2102
r^2	0.9737

Table 26. Growth parameters of bigeye scad, *Selar crumenophthalmus*.
[Tabel 26. Parameter pertumbuhan ikan selar bentong, Selar crumenophthalmus.*]*

Parameter	A	B
L_∞ (TL; cm)	25.9	26.9
K ($year^{-1}$)	1.25	1.35

A. Java Sea (Pekalongan) (Ref. 1386)
B. Java Sea (Ref. 1447)

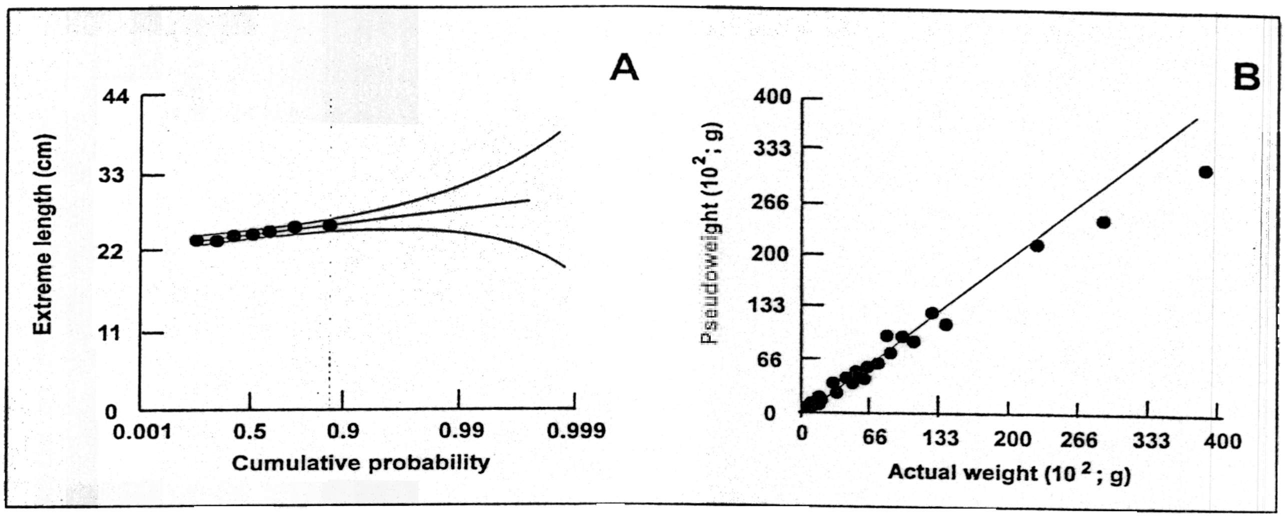


Fig. 42. (A) Extreme value plot for bigeye scad, *Selar crumenophthalmus*, in Indonesia based on data from *R/Vs Dr. Fridtjof Nansen, Jurong* and *Bawal Putih 2*, showing maxima of 7 length-frequency samples, and estimate of L_{max3} = 26.7 ± 0.86 cm FL. (B) Predicted *vs.* observed weights (in g wet weight) of 28 length-frequency samples of bigeye scad, *Selar crumenophthalmus*, from Western Indonesia based on data from *R/Vs Dr. Fridtjof Nansen, Jurong* and *Bawal Putih 2* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 25).

[Gambar 42. (A) Gambaran nilai ekstrim dari ikan selar bentong, Selar crumenophthalmus, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Dr. Fridtjof Nansen, Jurong *dan* Bawal Putih 2 *menunjukkan nilai maksimum dari 7 contoh frekuensi-panjang, dan angka perkiraan* L_{max3} *= 26.7 ± 0.86 cm FL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 28 contoh frekuensi-panjang dari ikan selar bentong,* Selar crumenophthalmus, *dari Indonesia bagian barat berdasarkan data kapal-kapal penelitian* Dr. Fridtjof Nansen, Jurong *dan* Bawal Putih 2 *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 25).*

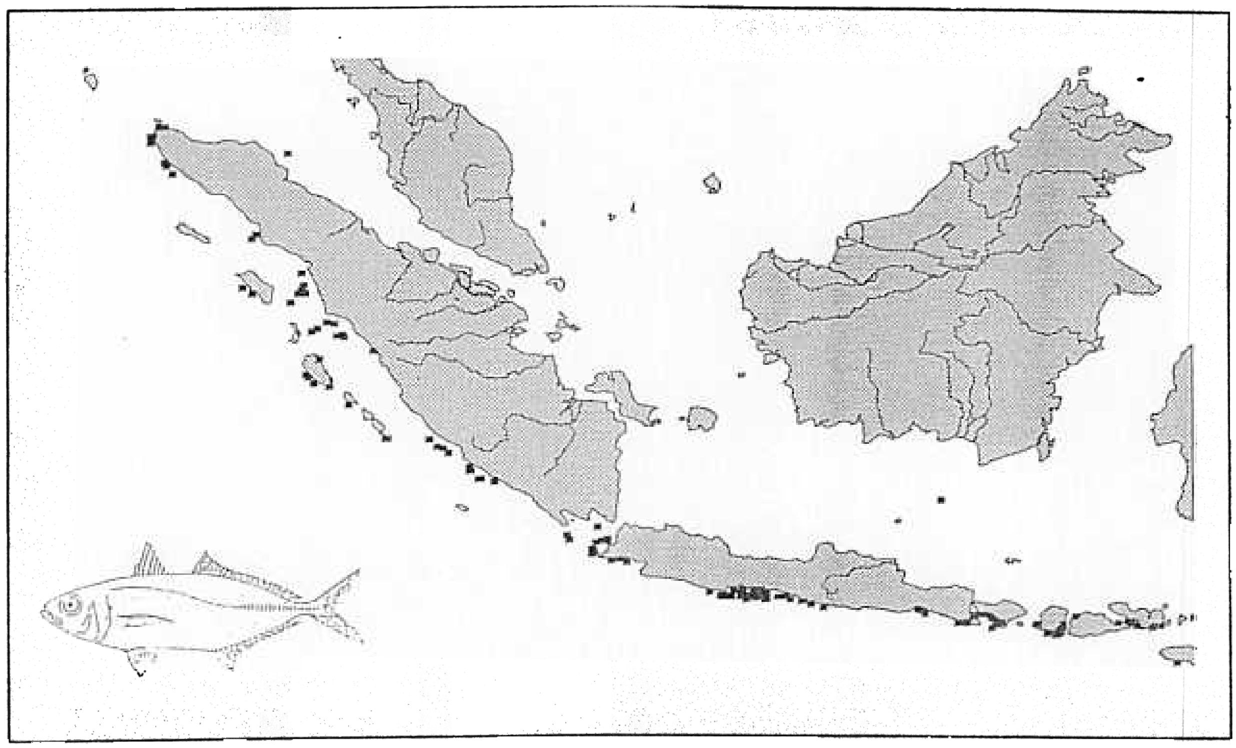


Fig. 43. Distribution of bigeye scad, *Selar crumenophthalmus*, in Western Indonesia based on records of the surveys of *R/Vs Dr. Fridtjof Nansen, Jurong* and *Bawal Putih 2*.

[Gambar 43. Penyebaran ikan selar bentong, Selar crumenophthalmus, *di Indonesia bagian barat berdasarkan laporan survei kapal-kapal penelitian* Dr. Fridtjof Nansen, Jurong *dan* Bawal Putih 2.*]*

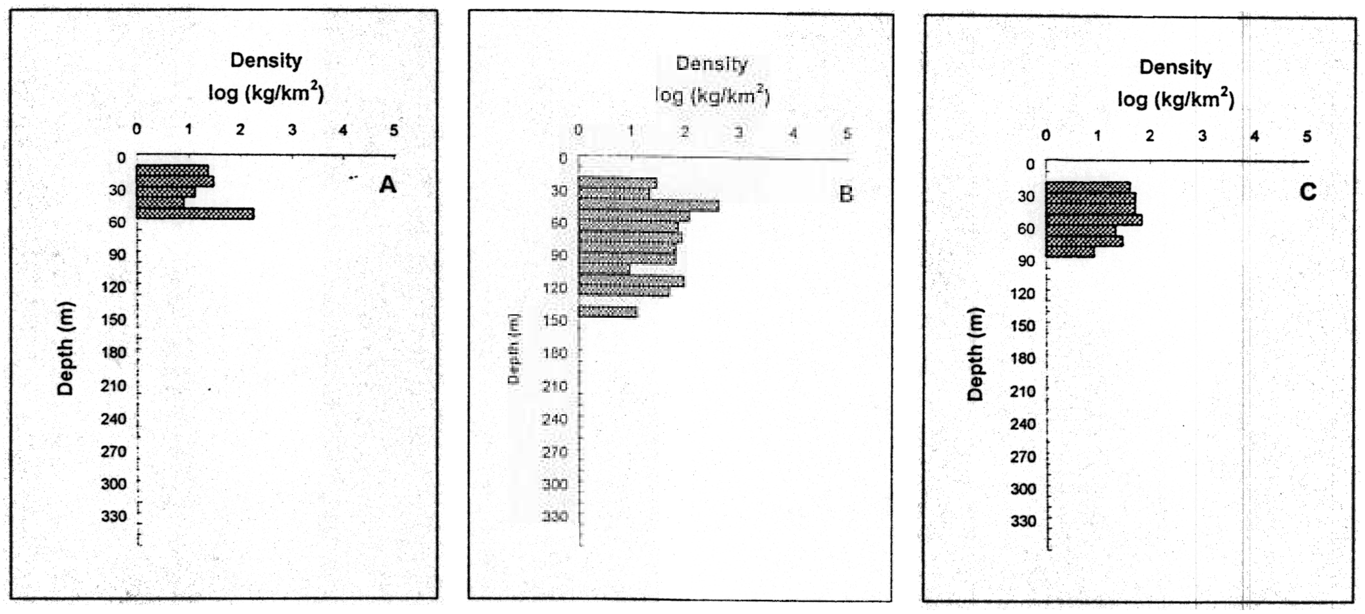


Fig. 44. Depth distribution of bigeye scad, *Selar crumenophthalmus*, in Western Indonesia based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen,* (B) *Jurong* and (C) *Bawal Putih 2.*

[Gambar 44. Penyebaran kedalaman ikan selar bentong, Selar crumenophthalmus, *di Indonesia bagian barat berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen, *(B)* Jurong *dan (C)* Bawal Putih 2.*]*

Pentaprion longimanus (Cantor, 1850)

Longfin mojarra (English); Lontong (Indonesian); Lontjong (Java); Hajam (West Java, Jakarta).

Body is slender, with weakly attached silvery scales. The spines of the dorsal and anal fins longer than the rays; the pectoral fins long and pointed, reaching beyond the anal fin spines; the anal fin is long; the caudal fin lobes rounded. Dorsal spines: 9-10; soft rays: 14-15; anal spines: 5-6; soft rays: 12-13. L_{max1} = 15 cm; L_{max2} = n.a.; L_{max3} = 15.5 cm TL (Fig. 45A). See Fig. 45B and Table 27 for length-weight relationship.

Indian Ocean: from the western and southern coasts of India and off Sri Lanka to Indonesia. Western Pacific: Indonesia (Fig. 46) to the Philippines and the Ryukyu Islands, and south to the northern part of Australia.

Forms large schools in coastal waters. Depth range: 20-220 m (Fig. 47). Feeds on small benthic animals. Table 28 presents six sets of growth parameters from Indonesia.

References: 393, 559, 1263, 1314, 1381, 1392, 1435, 1449, 1452, 1486, 1966, 2029, 2178, 2857, 2872, 2926, 3131, 3399, 3409, 3807, 4672, 4749, 5381, 5756, 6365, 6567

Table 27. Length-weight (g/[TL;cm]) relationship of longfin mojarra, *Pentaprion longimanus*, in Indonesia. *[Tabel 27. Hubungan panjang-berat (g/[TL;cm]) ikan loncong,* Pentaprion longimanus, *di Indonesia.]*

Parameter	Estimate
a	0.0169
s.e.(a)	0.0080
b	2.9173
s.e.(b)	0.1949
r^2	0.9725

Table 28. Growth parameters of longfin mojarra, *Pentaprion longimanus*. *[Tabel 28. Parameter pertumbuhan ikan loncong,* Pentaprion longimanus.*]*

Parameter	A	B	C	D	E	F
L_∞ (cm)	13.4	13.5	13.7	14.2	15.6	15.6
K ($year^{-1}$)	1.77	1.10	1.12	1.80	0.80	0.94

A. Java Sea (Ref. 1452)
B. Java Sea (Semarang) (Ref. 1314), L in TL
C. Java Sea (Ref. 1452)
D. Java Sea (Ref. 1452)
E. Java Sea (Ref. 1452)
F. Java Sea (southern) (Ref. 1381), L in TL

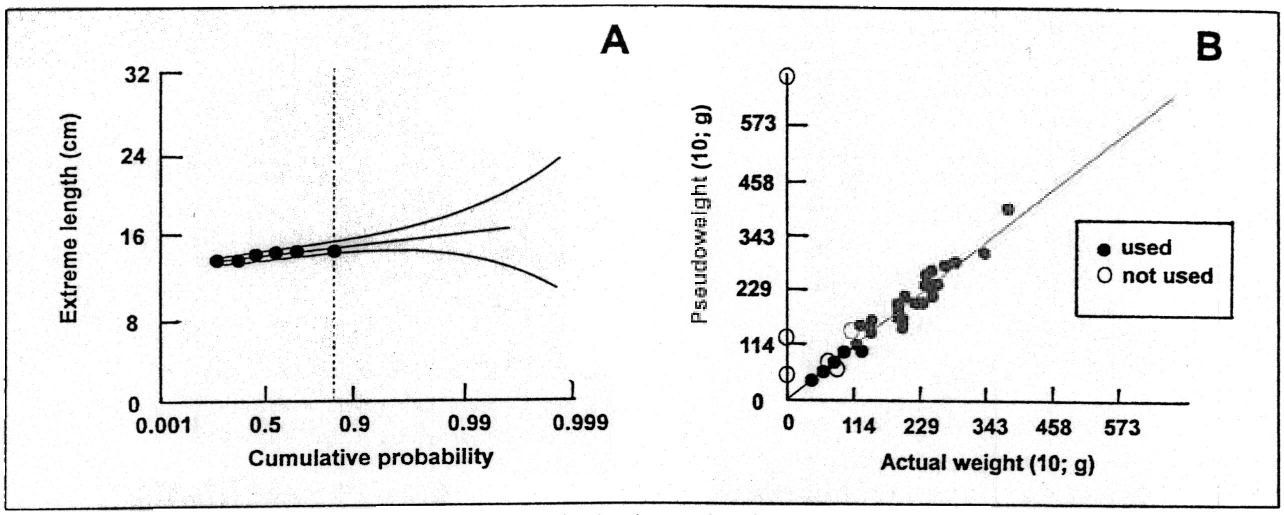


Fig. 45. (A) Extreme value plot for longfin mojarra, *Pentaprion longimanus*, in Indonesia based on data from *R/Vs Mutiara 4* and *Dr. Fridtjof Nansen* showing maxima of 6 length-frequency samples, and estimate of L_{max3} = 15.5 ± 0.54 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 39 length-frequency samples of longfin mojarra, *Pentaprion longimanus*, from Western Indonesia based on data from *R/Vs Mutiara 4, Jurong* and *Dr. Fridtjof Nansen* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 27). Open dots represent outliers, not used for analysis.

[Gambar 45. (A) Gambaran nilai ekstrim dari ikan loncong, Pentaprion longimanus, *di Indonesia berdasarkan data kapal-kapal penelitian* Mutiara 4 *dan* Dr. Fridtjof Nansen *menunjukkan nilai maksimum dari 6 contoh frekuensi-panjang, dan angka perkiraan* L_{max3} = *15.5 ± 0.54 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 39 contoh frekuensi-panjang dari ikan loncong,* Pentaprion longimanus, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Jurong *dan* Dr. Fridtjof Nansen *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 27). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

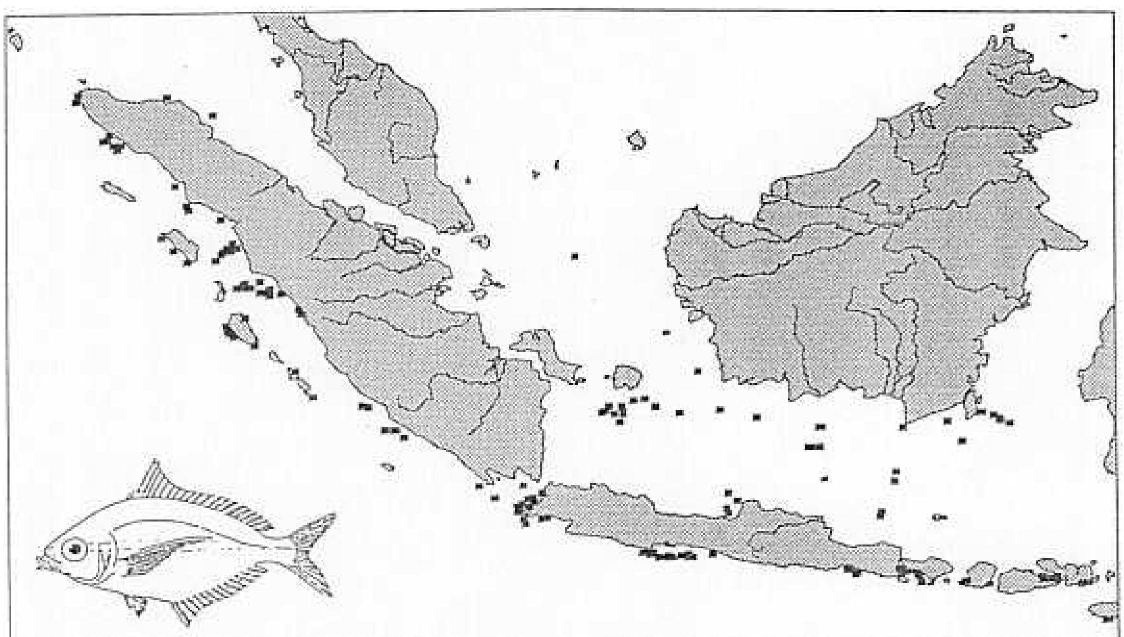


Fig. 46. Distribution of longfin mojarra, *Pentaprion longimanus*, in Western Indonesia based on records of the surveys of *R/Vs Dr. Fridtjof Nansen, Mutiara 4, Jurong* and *Bawal Putih 2*.

[Gambar 46. Penyebaran ikan loncong, Pentaprion longimanus, *di Indonesia bagian barat berdasarkan laporan survei kapal-kapal penelitian* Dr. Fridtjof Nansen, Mutiara 4, Jurong *dan* Bawal Putih 2.*]*

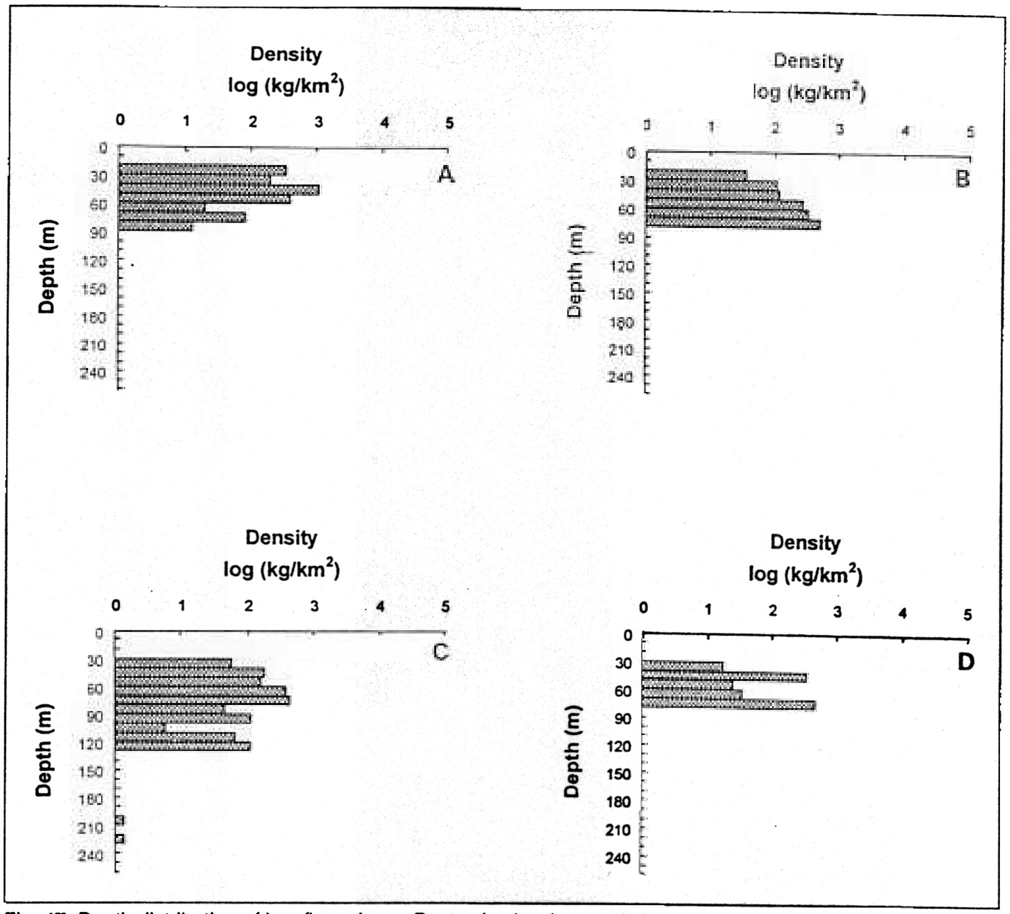


Fig. 47. Depth distribution of longfin mojarra, *Pentaprion longimanus,* in Western Indonesia based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen,* (B) *Mutiara 4,* (C) *Jurong* and (D) *Bawal Putih 2.*
[Gambar 47. Penyebaran kedalaman ikan loncong, Pentaprion longimanus, *di Indonesia bagian barat berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen, *(B)* Mutiara 4, *(C)* Jurong *dan (D)* Bawal Putih 2.*]*

Diagramma pictum (Thunberg, 1792)

Painted sweetlips (English); Gadjih (Indonesian); Katji (Java); Katji-katji (Java); Domul (West Java, Jakarta); Gadji Java, Jakarta); Gadji-gadji (Java, Jakarta); Ikan kadji (West Java, Jakarta); Kadji (West Java, Jakarta); Besiko (Riouw); Domul (Riouw); Radja bau (Ceram, Wahai, Ambon, Luhu, Saparua, Haria, Geser).

Body typically perciform. Flesh in maxilla thick. Usually cardiform jaw teeth. Vomer generally toothless. Usually with enlarged chin pore. Branchiostegal rays: 7. Dorsal spines: 9-10; soft rays: 21-26; anal spines: 3-3; soft rays: 7-8. L_{max1} = 100 cm FL; L_{max2} = n.a.; L_{max3} = 84.2 cm TL (Fig. 48A). See Fig. 48B and Table 29 for length-weight relationship.

Indo-West Pacific: East Africa and Red Sea, Indonesia to New Caledonia, north to Japan.

Occurs in shallow coastal areas and coral reefs. Depth range: 20-170 m. (Fig. 50). Juveniles usually occur in seaweed beds, and large adults in small schools or solitary around coral. Carnivore; feeds on benthic invertebrates and fishes.

References: 280, 559, 1498, 1602, 1830, 2112, 2290, 2334, 2682, 2799, 2871, 2872, 3111, 3131, 3412, 3626, 3670, 3678, 4517, 5213, 5450, 5525, 5736, 5970, 5978, 6026, 6065, 6066, 6067, 6068, 6365, 6567, 6956, 9070, 9137

Table 29. Length-weight (g/[TL;cm]) relationship of painted sweetlips, *Diagramma pictum,* in Indonesia.
[Tabel 29. Hubungan panjang-berat (g/[TL;cm]) ikan kaji, Diagramma pictum, *di Indonesia.]*

Parameter	Estimate
a	0.0077
s.e.(a)	0.0058
b	3.1314
s.e.(b)	0.1783
r^2	0.9867

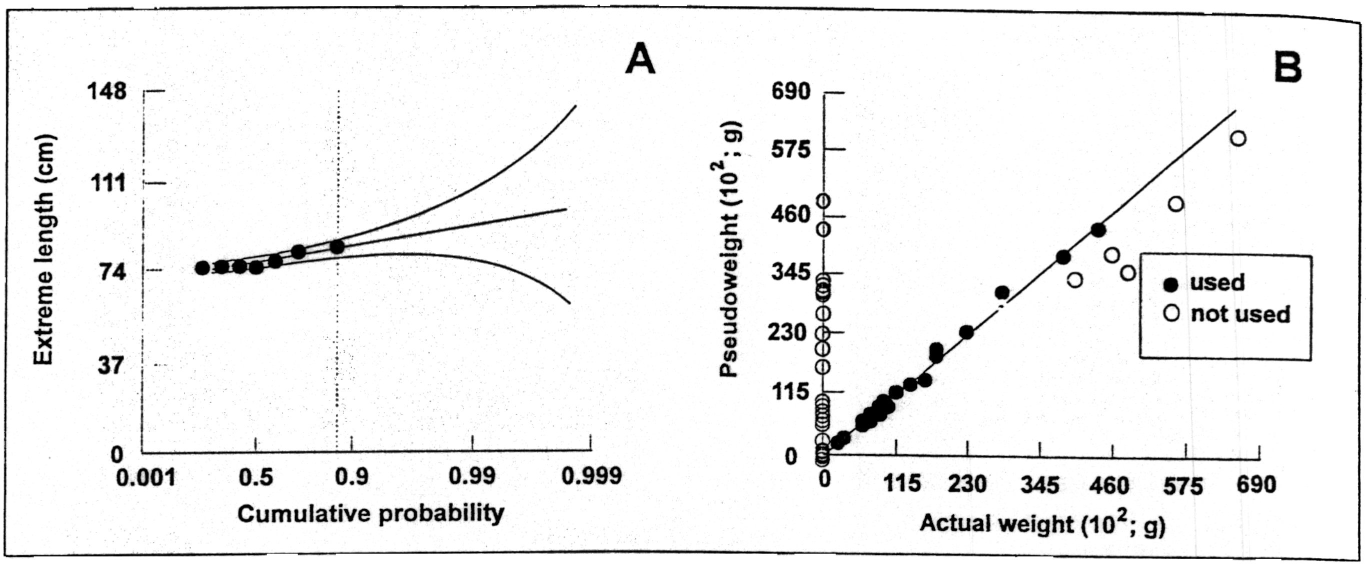


Fig. 48. (A) Extreme value plot for painted sweetlips, *Diagramma pictum*, in Indonesia based on data from *R/Vs Mutiara 4* and *Jurong* showing maxima of 7 length-frequency samples, and estimate of L_{max3} = 84.2 ± 3.6 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 21 length-frequency samples of painted sweetlips, *Diagramma pictum*, from Western Indonesia based on data from *R/Vs Mutiara 4, Jurong* and *Bawal Putih 2* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 29). Open dots represent outliers, not used for analysis.
[Gambar 48. (A) Penggambaran nilai ekstrim untuk ikan kaji, Diagramma pictum, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Jurong *menunjukkan nilai maksimum dari 7 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 84.2 ± 3.6 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 21 contoh frekuensi panjang ikan kaji,* Diagramma pictum, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Jurong *dan* Bawal Putih 2 *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 29). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

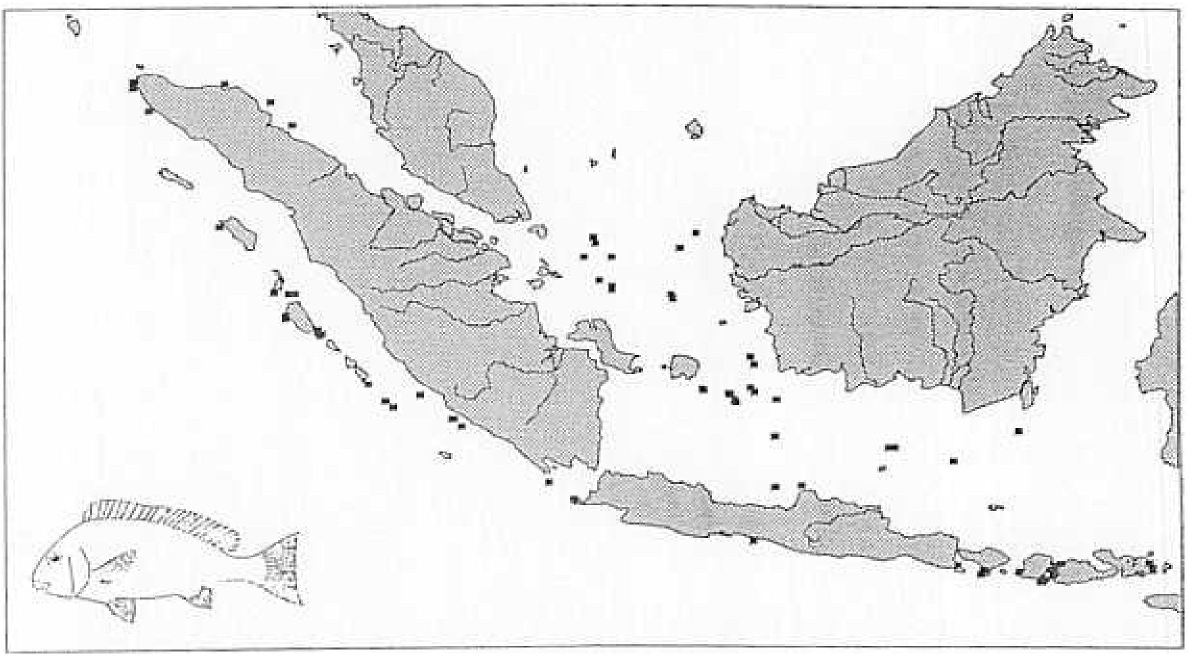


Fig. 49. Distribution of painted sweetlips, *Diagramma pictum*, based on records of the surveys of *R/Vs Dr. Fridtjof Nansen, Mutiara 4, Jurong* and *Bawal Putih 2*.
[Gambar 49. Penyebaran ikan kaji, Diagramma pictum, *berdasarkan laporan survei kapal-kapal penelitian* Dr. Fridtjof Nansen, Mutiara 4, Jurong *dan* Bawal Putih 2.*]*

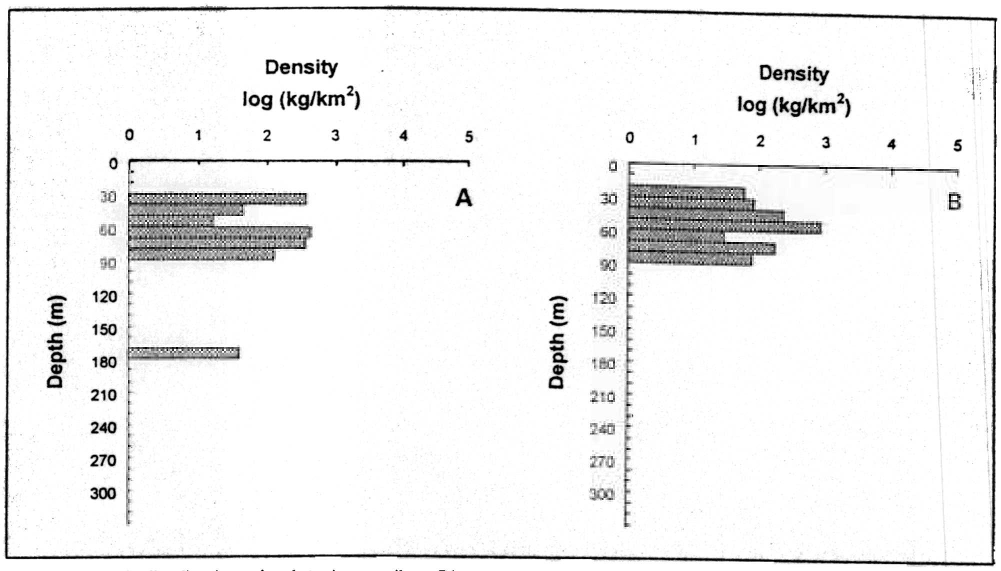


Fig. 50. Depth distribution of painted sweetlips, *Diagramma pictum*, based on surveys of *R/Vs* (A) *Jurong* and (B) *Bawal Putih 2.*
[Gambar 50. Penyebaran kedalaman ikan kaji, Diagramma pictum, *berdasarkan survei kapal-kapal penelitian (A)* Jurong *dan (B)* Bawal Putih 2.*]*

Pomadasys argenteus (Forsskål, 1775)

Silver grunt (English); Da-tanda (Indonesian); Krokot (Java); Gerot-gerot, Kerot-kerot, Krot, Krot-krot (West Java, Jakarta); Da-tanda, Mengantih, Towoito (Madura); Ronga (South Sulawesi, Makassar); Garut (West Borneo).

Body ovate; head profile almost straight. Mouth small; lips not thickened; two pores and a central groove under the chin. No antrorse spine before the dorsal fin origin; notch between the spinous and soft rayed portion of the dorsal fin shallow. Color is generally silver-mauve to fawn above, white below. Small specimens with numerous spots aligned horizontally or fused into horizontal lines; large specimens plain or with scattered charcoal scale spots on back and upper sides; the snout is dark brown; the upper operculum charcoal or purplish. Dorsal spines: 12-12; soft rays: 13-14; anal spines: 3-3; soft rays: 7-7. L_{max1} = 66 cm TL; L_{max2} = n.a.; L_{max3} = 60.4 cm TL (Fig. 51A). See Fig. 51B and Table 30 for length-weight relationship.

From the Red Sea to Indonesia (Fig. 52) and the Philippines (but without record from the Persian Gulf) and southern to northern Australia. Also reported from New Caledonia.

Found in coastal waters. Depth range: 15-115 m (Fig. 53). Mainly carnivore, feeds on benthic animals. Table 31 presents a set of growth parameters from Indonesia.

References: 312, 1115, 1116, 1139, 1314, 3412, 3624, 3627, 3642, 3670, 3678, 4606, 4959, 5284, 5450, 5525, 5736, 5756, 6026, 6365

Table 30. Length-weight (g/[TL;cm]) relationship of silver grunt, *Pomadasys argenteus*, in Indonesia.
[Table 30. Hubungan panjang-berat (g/[TL;cm]) ikan da-tanda, Pomadasys argenteus, *di Indonesia.]*

Parameter	Estimate
a	0.0267
s.e.(a)	0.0157
b	2.8551
s.e.(b)	0.1545
r^2	0.9758

Table 31. Growth parameter of silver grunt, *Pomadasys argenteus.*
[Tabel 31. Parameter pertumbuhan ikan da-tanda, Pomadasys argenteus.*]*

Parameter	A
L_∞ (TL; cm)	54
K ($year^{-1}$)	0.5

A. Java Sea (Tanjung Selatan, South Kalimantan) (Ref. 1314)

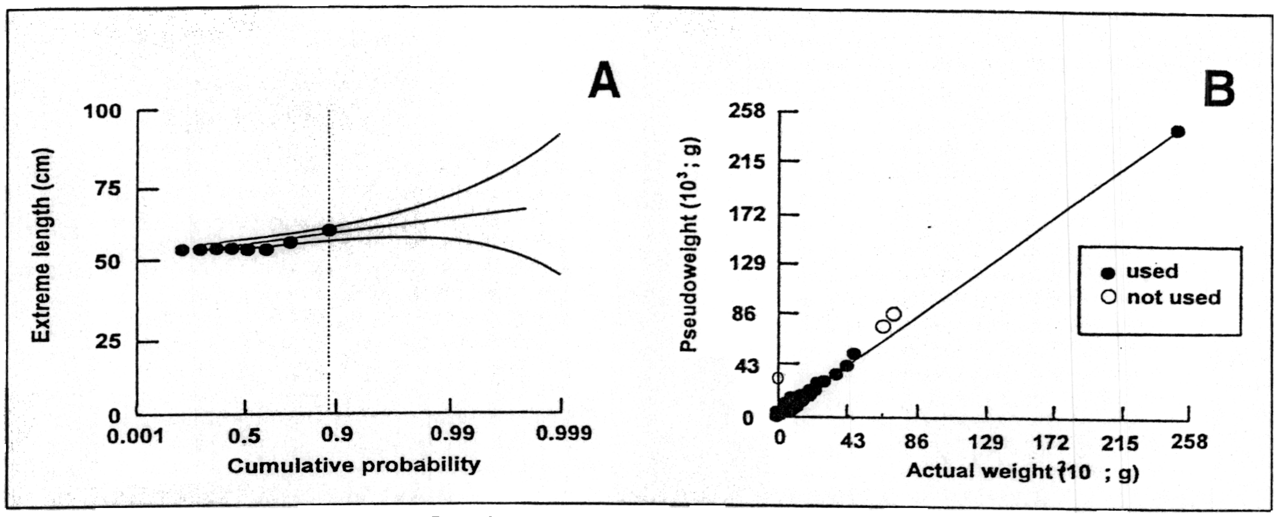


Fig. 51. (A) Extreme value plot for silver grunt, *Pomadasys argenteus*, in Indonesia based on data from *R/V Jurong* showing maxima of 8 length-frequency samples, and estimate of L_{max3} = 60.4 ± 2.2 cm TL. (B) Predicted vs. observed weights (in g wet weight) of 42 length-frequency samples of silver grunt, *Pomadasys argenteus*, from Western Indonesia based on data from *R/Vs Mutiara 4*, *Jurong* and *Bawal Putih 2* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 30). Open dots represent outliers, not used for analysis.

[Gambar 51. (A) Gambaran nilai ekstrim ikan da-tanda, Pomadasys argenteus, *di Indonesia berdasarkan data dari kapal penelitian Jurong menunjukkan nilai maksimum dari 8 contoh frekuensi-panjang, dan nilai perkiraan* L_{max3} *= 60.4 ± 2.2 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 42 contoh frekuensi-panjang ikan da tanda,* Pomadasys argenteus, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Jurong *dan* Bawal Putih 2 *sebagai output perangkat lunak ABee (lihat Boks 1), yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 30). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

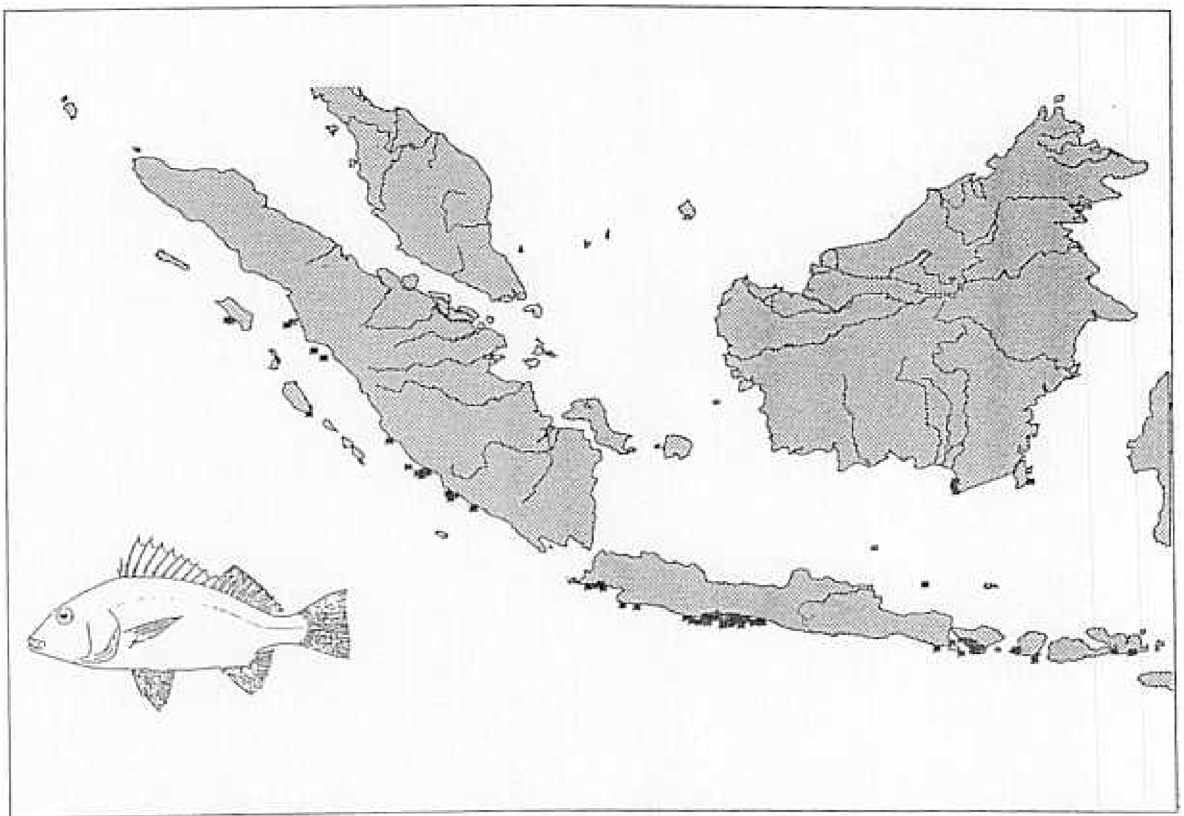


Fig. 52. Distribution of silver grunt, *Pomadasys argenteus*, in Western Indonesia based on records of the surveys of *R/Vs Mutiara 4*, *Jurong* and *Bawal Putih 2*.

[Gambar 52. Penyebaran ikan da-tanda, Pomadasys argenteus, *di Indonesia bagian barat berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Jurong *dan* Bawal Putih 2.*]*

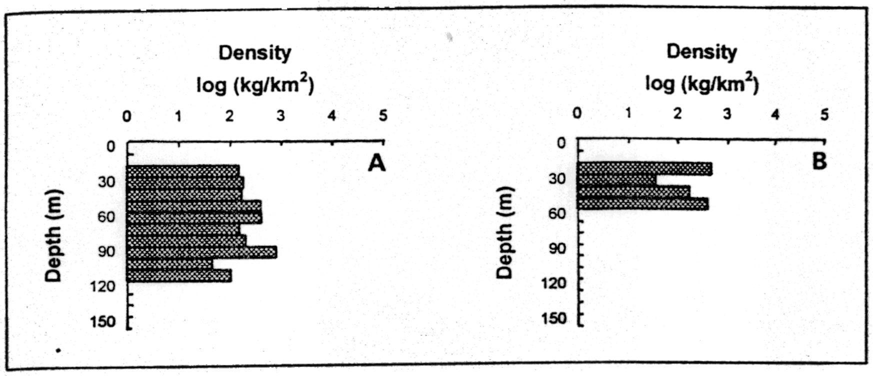


Fig. 53. Depth distribution of silver grunt, *Pomadasys argenteus*, in Western Indonesia based on surveys of *R/Vs* (A) *Jurong* and (B) *Bawal Putih 2.*
[Gambar 53. Penyebaran kedalaman ikan da-tanda, Pomadasys argenteus, *di Indonesia bagian barat berdasarkan survei kapal-kapal penelitian (A)* Jurong *dan (B)* Bawal Putih 2.*]*

Pomadasys maculatus (Bloch, 1797)

Saddle grunt (English); Gerot-gerot (Indonesian); Gerot-gerot, Ikan krot, Kerot-kerot, Krot-krot (West Java, Jakarta).

Small-sized fish of moderately deep body. Isthmus narrow, forming a groove. Chin with two pairs of small pores. This species is characterized by several dark large elongate blotches on the upper back, one forming a saddle on the nape. Dorsal spines: 12-12; soft rays: 13-14; anal spines: 3-3; soft rays: 7-7. L_{max1} = 59.3 cm FL; L_{max2} = n.a.; L_{max3} = 57.5 cm FL (Fig. 54A). See Fig. 54B and Table 32 for length-weight relationship.

Indo-West Pacific: from the east coast of Africa and Madagascar, to Southeast Asia, via the Indonesian Archipelago (Fig. 55) and, thence northeast to China and southeast to Australia.

Found in coastal waters over sand near reefs; depth range: 20-110 m (Fig. 56). Feeds on crustaceans and fish.

References: 280, 393, 1498, 2112, 2135, 2857, 2871, 2872, 3225, 3626, 4749, 5213, 5450, 5736, 5756, 6567

Table 32. Length-weight (g/[FL;cm]) relationship of saddle grunt, *Pomadasys maculatus*, in Indonesia.
[Tabel 32. Hubungan panjang-berat (g/[FL;cm]) dari ikan gerot-gerot, Pomadasys maculatus, *di Indonesia.]*

Parameter	Estimate

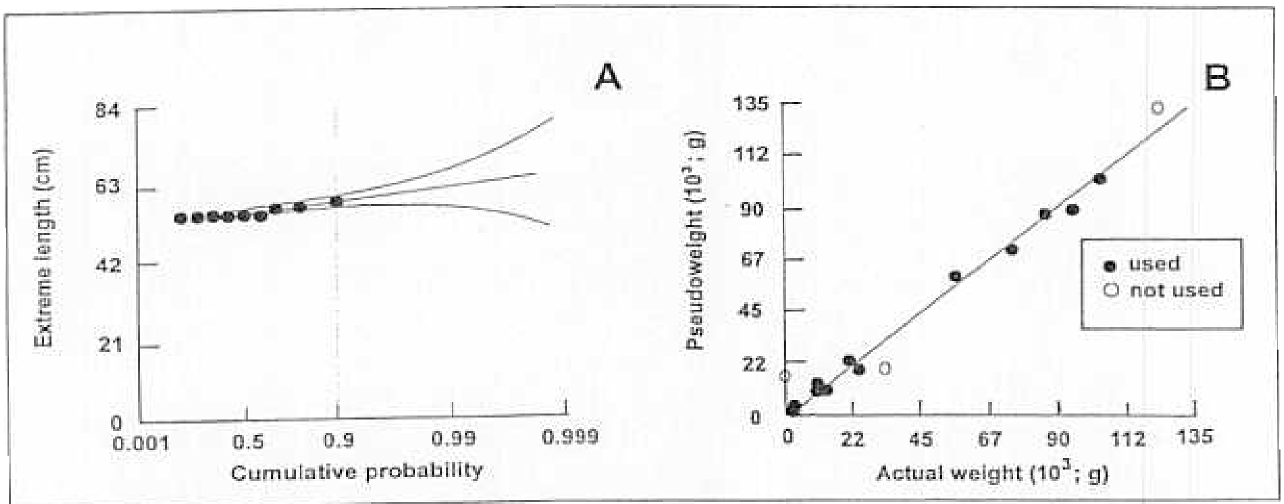


Fig. 54. (A) Extreme value plot for saddle grunt, *Pomadasys maculatus*, in Indonesia based on data from *R/Vs Jurong* and *Bawal Putih 2* showing maxima of 9 length-frequency samples, and estimate of L_{max3} = 57.5 ± 1.5 cm FL. (B) Predicted *vs.* observed weights (in g wet weight) of 13 length-frequency samples of silver grunt, *Pomadasys maculatus*, from Western Indonesia based on data from *R/Vs Mutiara 4, Dr. Fridtjof Nansen, Jurong* and *Bawal Putih 2* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 32). Open dots represent outliers, not used for analysis.
[Gambar 54. (A) Gambaran nilai ekstrim ikan gerot-gerot, Pomadasys maculatus, *di Indonesia berdasarkan data kapal-kapal penelitian* Jurong *dan* Bawal Putih 2 *menunjukkan nilai maksimum dari 9 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 57.5 ± 1.5 cm FL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 13 contoh frekuensi-panjang ikan gerot-gerot,* Pomadasys maculatus, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Dr. Fridtjof Nansen, Jurong *dan* Bawal Putih 2 *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 32). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

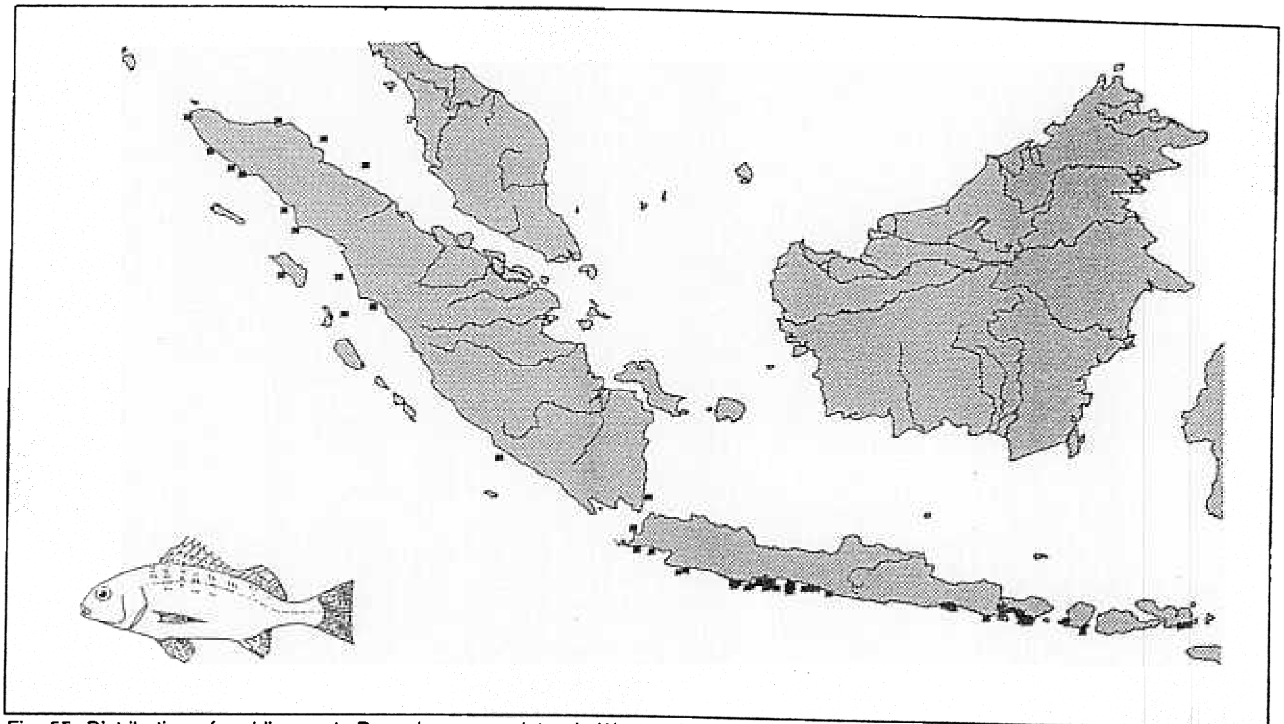


Fig. 55. Distribution of saddle grunt, *Pomadasys maculatus*, in Western Indonesia based on records of the surveys of *R/Vs Mutiara 4, Dr. Fridtjof Nansen, Jurong* and *Bawal Putih 2.*
[Gambar 55. Penyebaran ikan gerot-gerot, Pomadasys maculatus, *di Indonesia bagian barat berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Dr. Fridtjof Nansen, Jurong *dan* Bawal Putih 2.*]*

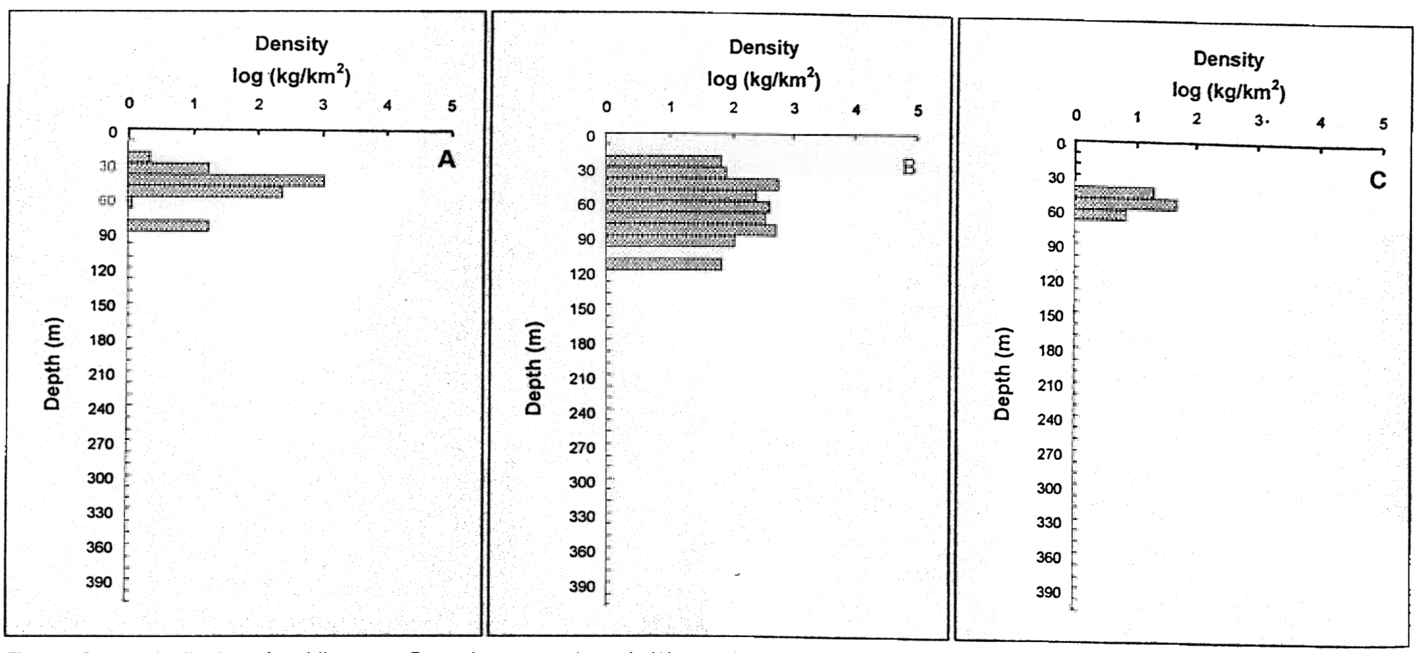


Fig. 56. Depth distribution of saddle grunt, *Pomadasys maculatus*, in Western Indonesia based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen*, (B) *Jurong* and (C) *Bawal Putih 2.*
[Gambar 56. Penyebaran kedalaman ikan gerot-gerot, Pomadasys maculatus, *di Indonesia bagian barat berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen, *(B)* Jurong *dan (C)* Bawal Putih 2.*]*

Lactarius lactarius (Bloch & Schneider, 1801)

False trevally (English); Ikan susu (Indonesian); Lemahan, Limat, Tana (Java); Ikan lemah, Lelemah, Lemah, Susu (West Java, Jakarta); Klemes (Madura); Tambi-tambi (South Borneo); Bebete lubangang (South Sulawesi, Badjo).

Silvery gray with blue iridescence dorsally, silvery white ventrally; upper part of gill cover with a dusky black spot; fins pale yellow. Mouth large and oblique. Dorsal spines: 8-9; soft rays: 20-22; anal spines: 3-3; soft rays: 25-28. L_{max1} = 40 cm; L_{max2} = n.a.; L_{max3} = 29.1 cm TL (Fig. 57A). See Fig. 57B and Table 33 for length-weight relationship.

From the eastern Indian Ocean to Southeast Asia, extending northward to Japan, and southeastward through the Indonesian Archipelago (Fig. 58) to Queensland, Australia.

Occurs in coastal waters; depth range: 15-90 m (Fig. 59). Feeds on sand-dwelling and other benthic and zooplanktonic animals.

References: 312, 1012, 2857, 2872, 3404, 3423, 4789, 4931, 5193, 5213, 5736, 5756, 5978, 6313, 6567, 7300

Table 33. Length-weight (g/[TL;cm]) relationship of false trevally, *Lactarius lactarius*, in Indonesia.
Tabel 33. Hubungan panjang-berat (g/[TL;cm]) ikan susu, Lactarius lactarius, *di Indonesia.*

Parameter	Estimate
a	0.0098
s.e.(a)	0.0034
b	3.0469
s.e.(b)	0.1237
r^2	0.9942

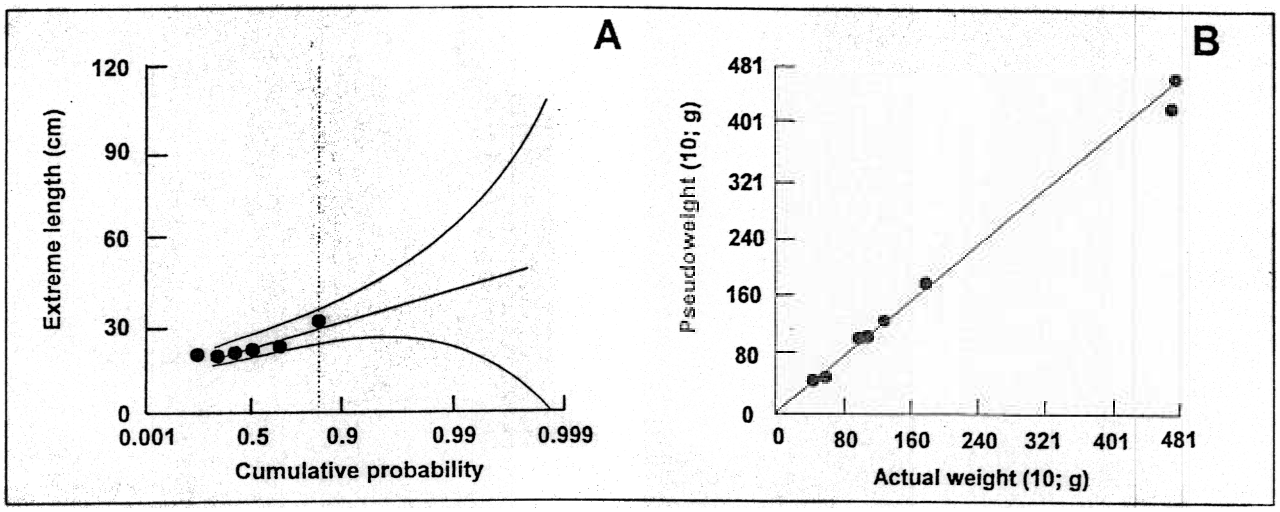


Fig. 57. (A) Extreme value plot for false trevally, *Lactarius lactarius*, in Indonesia based on data from *R/Vs Mutiara 4, Jurong* and *Dr. Fridtjof Nansen* showing maxima of 6 length-frequency samples, and estimate of L_{max3} = 29.1 ± 4.97 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 8 length-frequency samples of false trevally, *Lactarius lactarius*, from Western Indonesia based on data from *R/Vs Mutiara 4, Jurong* and *Dr. Fridtjof Nansen* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 33).
[Gambar 57. (A) Gambaran nilai ekstrim untuk ikan susu, Lactarius lactarius, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Jurong *dan* Dr. Fridtjof Nansen *menunjukkan nilai maksimum untuk 6 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 29.1 ± 4.97 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 8 contoh frekuensi-panjang dari ikan susu,* Lactarius lactarius, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Jurong *dan* Dr. Fridtjof Nansen *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 33).*

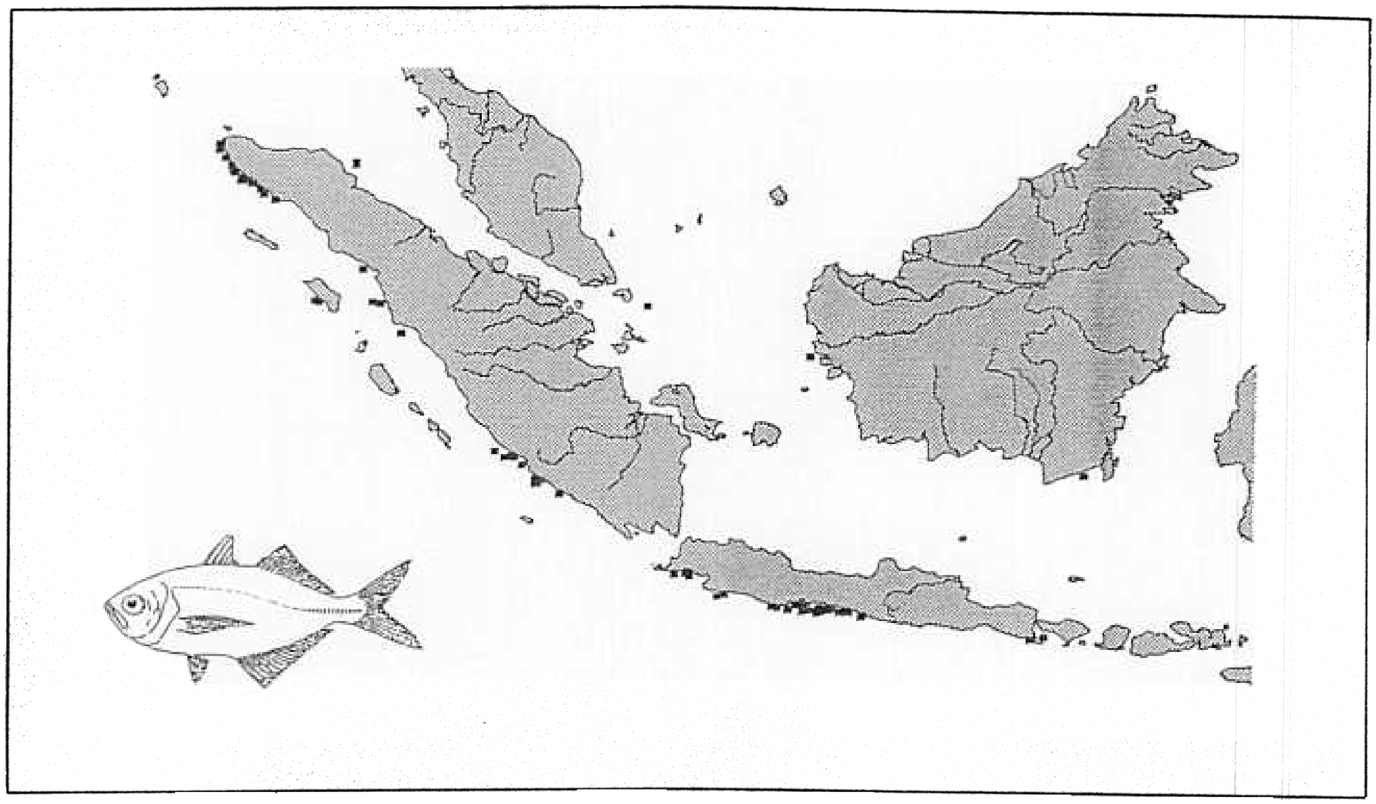


Fig. 58. Distribution of false trevally, *Lactarius lactarius*, based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen.*
[Gambar 58. Penyebaran ikan susu, Lactarius lactarius, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

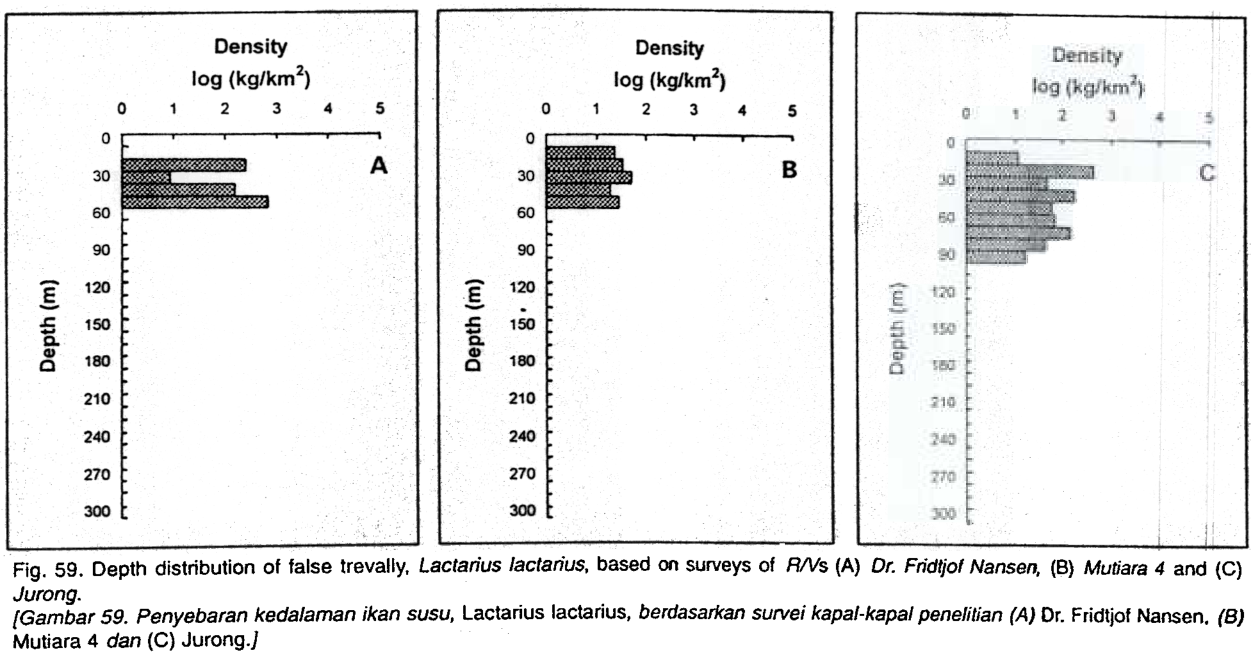


Fig. 59. Depth distribution of false trevally, *Lactarius lactarius*, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen,* (B) *Mutiara 4* and (C) *Jurong.*
[Gambar 59. Penyebaran kedalaman ikan susu, Lactarius lactarius, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen, *(B)* Mutiara 4 *dan* (C) Jurong.*]*

Box 3. Reasons for studying the Leiognathidae.
[Boks 3. Alasan-alasan mempelajari Leiognathidae.]

It was in 1974 that I was hired by the German Agency for Technical Cooperation (GTZ), and prepared for a project that was to develop the coastal fisheries in Tanzania. Among my preparations for this project was - besides learning Swahili - a two-month stage at the Senkenberg Museum, in Frankfurt, under the guidance of Dr. W. Klausewitz, a taxonomist, to acquire a basic knowledge of the Indo-Pacific fish fauna.

From the literature, I had identified the family Leiognathidae as the most important group along the Tanzania coast (at least in terms of biomass) and hence learnt to identify them. Also, I gathered all publications I could about their biology (this obviously formed the base for my bibliography on this group (Ref. 4961)).

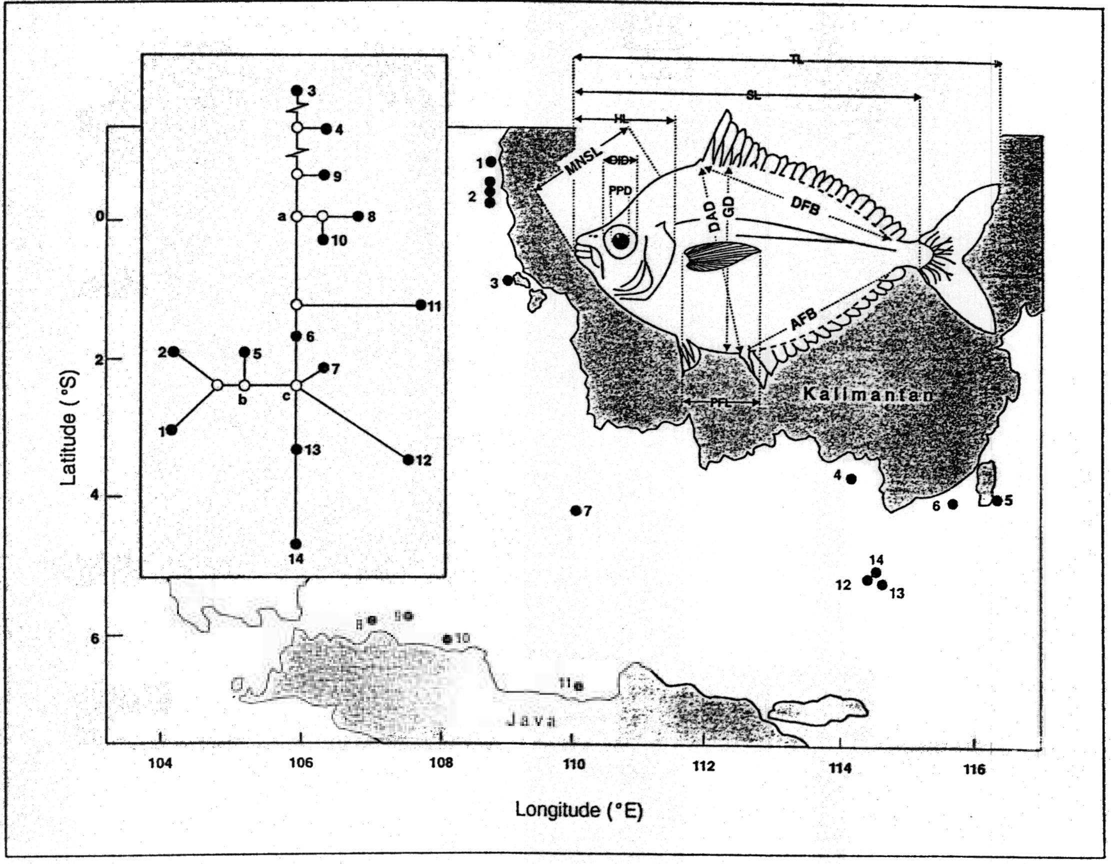
In May 1975, I re-emerged in a fisheries development project in Indonesia, where Swahili did not help, but where Leiognathidae, and particularly *Leiognathus splendens* were not only as important, in terms of biomass, as in Tanzania, but, moreover, were appreciated because of their small sizes.

The combination of abundant catch samples and access to the literature enabled me to publish several papers only on Leiognathidae (Ref. 2089, 4962, 4544), or incorporating various aspects of their biology and population dynamics (9569, 1263). Also, I was able to draw a map (Fig. 1 in Ref. 6967) showing that *L. splendens* is so much of an inshore species that its occurrence in trawl catches can be used to distinguish inshore from offshore communities, and to gather samples later used for a morphometric study of this species (Ref. 6992; see figure below).

All leiognathids are bioluminescent, an aspect of their biology that allows for both practical jokes (try rubbing your face with extract from their bioluminescent organ, located around the esophagus: you will glow in the dark!) and science as well (Ref. 4962; 9567). Also, leiognathids are extremely slimy, and this can be linked - though tentatively - with their bioluminescence (Ref. 9568, 4962). Thus, leiognathids are important, fun, and allow for testing of all kinds of scientific hypotheses.

I will be pleased to supply anyone who wants to try this with copies of those hard-to-get leiognathid papers I happen to have.

Daniel Pauly
ICLARM
and
Fisheries Centre, UBC



Distribution of samples of *Leiognathus splendens* taken by the author and later used in Ref. 6992 to study the different morphs. Left insert: Affinities of different morphs. Right insert: Measurement of *L. splendens* used for morphological study (redrawn from Ref. 6992).

[Penyebaran contoh Leiognathus splendens *yang diambil oleh penulis, dan kemudian digunakan didalam Ref. 6992 untuk mempelajari perbedaan berbagai kelompok ikan Leiognathidae. Sisipan kiri: Keterkaitan antar berbagai kelompok ikan Leiognathidae. Sisipan kanan: Pengukuran dari* L. splendens *yang digunakan untuk studi morfologi (digambar kembali dari Ref. 6992.]*

Leiognathus splendens (Cuvier, 1829)

Splendid ponyfish (English); Bondol (Indonesian); Dodok, Gempar, Gemper (Java); Peperek Tjina (West Java, Jakarta); Bondol (West Java, Bandung).

Belly silvery; back grayish silvery with faint, gray wavy vertical lines above lateral lines in adults; lateral line scales and pectoral fin base yellow; pectoral axis black. Scales small and deciduous. Nuchal spine with a distinct median keel. Chest fully scaled. Mouth horizontal, pointing slightly downward when protracted; line of closed mouth passing below eye; a narrow brown band around end of snout. Lower edge of operculum and margin of supraorbital serrated. Third and fourth dorsal and third anal spines anteriorly serrated. Dorsal spines: 7-8; soft rays: 15-17; anal spines: 3-3; soft rays: 13-14. L_{max1} = 17 cm TL; L_{max2} = n.a.; L_{max3} = 21.1 cm TL (Fig. 60A). See Fig. 60B and Table 34 for length-weight relationship.

Indian Ocean: Madagascar and Mauritius to the Red Sea, along the coasts of India and Sri Lanka; Indonesian Archipelago (Fig. 61) and throughout Western Central Pacific, reaching westward to Australia and Fiji.

This schooling species inhabits coastal waters. Depth range: 10-100 m (Fig. 62). Feeds on small fish, crustaceans, foraminiferans, and bivalves. Table 35 presents four sets of growth parameters from Indonesia.

References: 312, 393, 559, 560, 573, 1139, 1263, 1314, 1449, 1486, 1539, 1617, 1633, 1724, 1830, 1918, 2045, 2089, 2108, 2178, 2462, 2504, 2505, 2682, 3131, 3151, 3424, 3430, 3436, 3437, 3438, 3439, 3440, 3441, 3442, 3443, 3444, 3605, 3607, 3614, 3649, 3653, 3655, 3667, 4544, 4880, 4961, 4962, 4963, 5213, 5346, 5381, 5450, 5525, 5736, 5756, 5978, 6192, 6313, 6567, 6992, 7050, 7100

Table 34. Length-weight (g/[TL;cm]) relationship of splendid ponyfish, *Leiognathus splendens*, in Indonesia.
[Tabel 34. Hubungan panjang-berat (g/[TL;cm]) ikan bondol, Leiognathus splendens, *di Indonesia.]*

Parameter	Estimates A	Estimates B
a	0.0112	0.0168
s.e.(a)	n.a.	0.0104
b	3.2170	3.0392
s.e.(b)	n.a.	0.2612
r^2	n.a.	0.9707

A. Northwestern coast of Java (Ref. 2089)
B. This study

Table 35. Growth parameters of splendid ponyfish, *Leiognathus splendens*.
[Tabel 35. Parameter pertumbuhan ikan bondol, Leiognathus splendens.*]*

Parameter	Indonesia A	B	C	D
L_∞ (TL, cm)	14	14.5	16.7	16.9
K (year^{-1})	1.04	1.25	0.90	1.10

A. Southern Kalimantan (Ref. 1139)
B. Riau (Bintan) (Ref. 1314)
C. Java Sea (Central Java) (Ref. 1314)
D. Java Sea (South Kalimantan) (Ref. 1314)

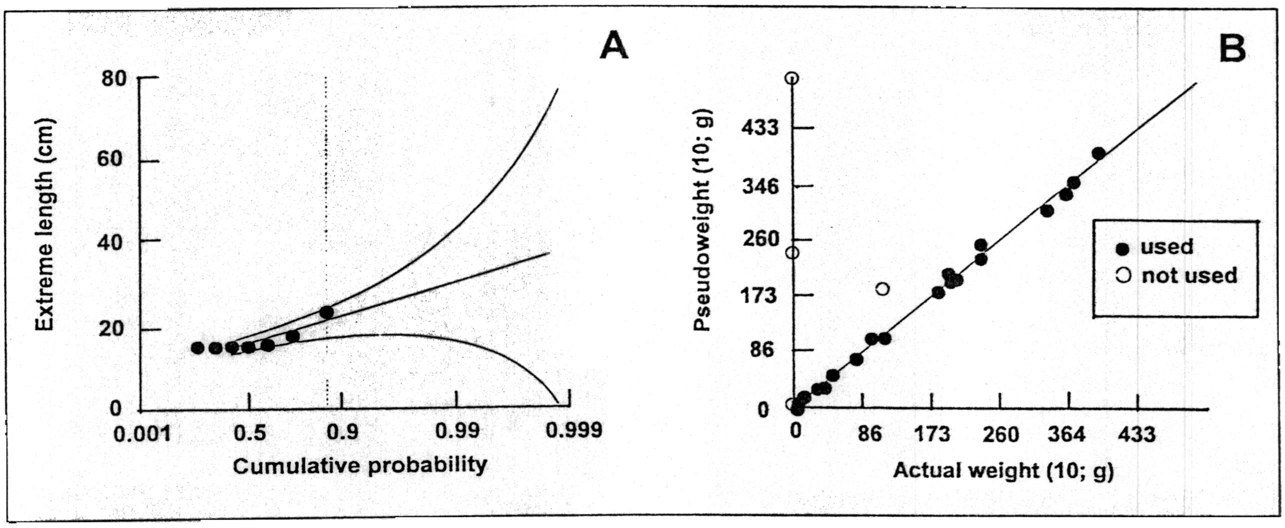


Fig. 60. (A) Extreme value plot for splendid ponyfish, *Leiognathus splendens*, in Indonesia based on data from *R/Vs Mutiara 4, Dr. Fridtjof Nansen* and *Jurong* showing maxima of 7 length-frequency samples, and estimate of L_{max3} = 21.1 ± 3.35 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 19 length-frequency samples of splendid ponyfish, *Leiognathus splendens*, from Western Indonesia based on data from *R/Vs Mutiara 4*, Jurong and *Dr. Fridtjof Nansen* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 34). Open dots represent outliers, not used for analysis.
[Gambar 60. (A) Gambaran nilai ekstrim ikan bondol, Leiognathus splendens, *di Indonesia berdasarkan data survei kapal-kapal penelitian* Mutiara 4, Dr. Fridtjof Nansen *dan* Jurong *yang menunjukkan 7 contoh frekuensi-panjang dan angka perkiraan L_{max3} = 21.1 ± 3.35 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 19 contoh frekuensi-panjang ikan bondol,* Leiognathus splendens, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Jurong *dan* Dr. Fridtjof Nansen *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 34). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

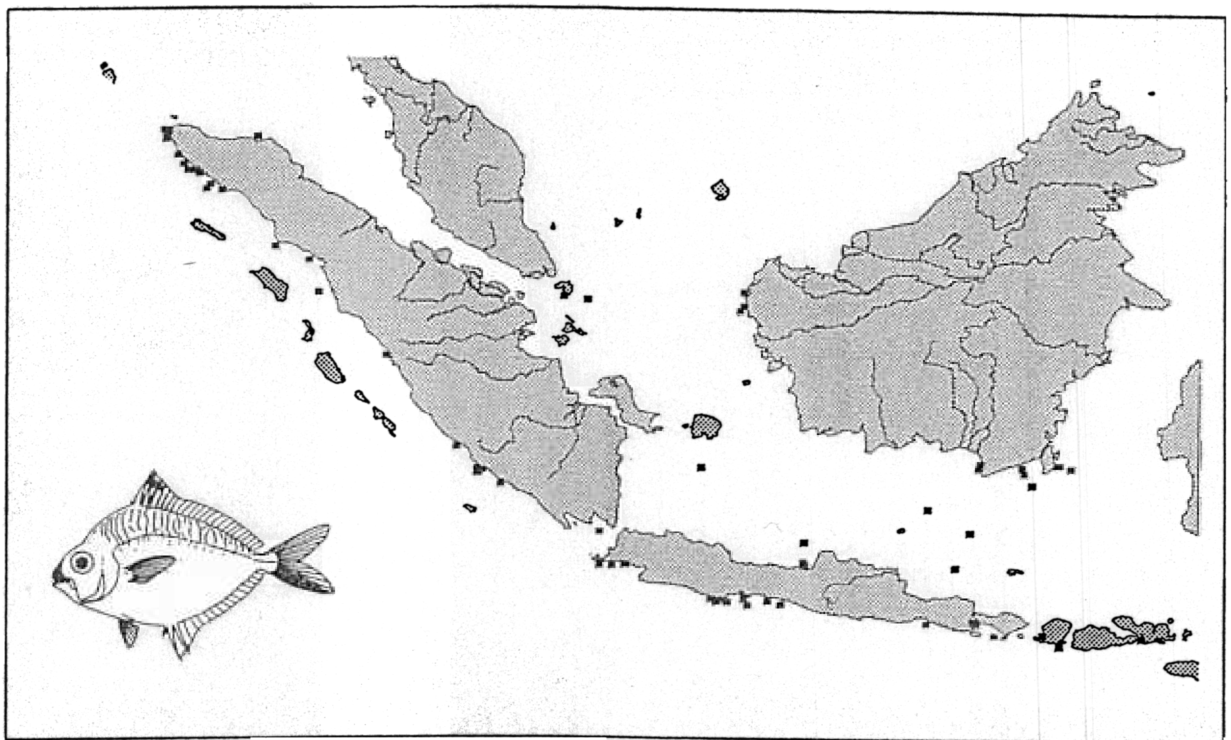


Fig. 61. Distribution of splendid ponyfish, *Leiognathus splendens*, based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen.*

[Gambar 61. Penyebaran ikan bondol, Leiognathus splendens, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

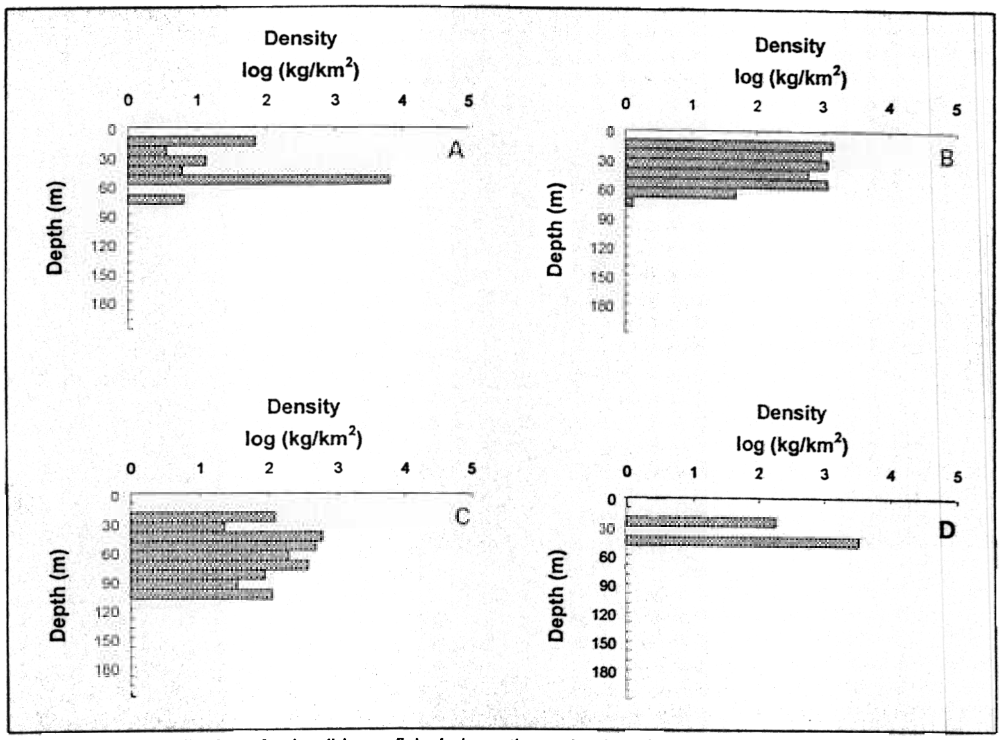


Fig. 62. Depth distribution of splendid ponyfish, *Leiognathus splendens*, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen*, (B) *Mutiara 4*, (C) *Jurong* and (D) *Bawal Putih 2.*

[Gambar 62. Penyebaran kedalaman ikan bondol, Leiognathus splendens, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen, *(B)* Mutiara 4, *(C)* Jurong *dan (D)* Bawal Putih 2.*]*

Leiognathus bindus (Valenciennes, 1835)

Orangefin ponyfish (English); Tjaria (Indonesian); Petah (Java); Peperek (West Java, Jakarta); Tjaria (South Sulawesi, Bugis).

Silvery body; snout with a dark band; dorsal and anal fins with orange tips. Head naked; with nuchal spine. Mouth pointing forward when protracted. Breast with small scales. Dorsal spines: 8-8; soft rays: 16-16; anal spines: 3-3; soft rays: 14-14. L_{max1} = 14 cm; L_{max2} = n.a.; L_{max3} = 14.8 cm TL (Fig. 63A). See Fig. 63B and Table 36 for length-weight relationship.

Indian Ocean: Red Sea (Port Sudan), Persian Gulf, India, Sri Lanka, Bangladesh. Western Central Pacific, including Indonesia (Fig. 64) and Australia; also reported from New Caledonia.

Found in shallow waters. Depth range: 10-100 m (Fig. 65). Forms schools. Table 37 presents a set of growth parameters from Indonesia.

References: 312, 393, 1015, 1016, 1263, 1314, 1372, 1403, 1449, 1486, 2044, 2088, 2108, 2857, 3424, 3605, 4789, 5346, 5381, 5525, 5756, 6365, 6567

Table 36. Length-weight (g/[TL;cm]) relationship of orangefin ponyfish, *Leiognathus bindus*, in Indonesia.
[Tabel 36. Hubungan panjang-berat (g/[TL;cm]) ikan caria, Leiognathus bindus, *di Indonesia.]*

Parameter	Estimate
a	0.0182
s.e.(a)	0.0044
b	2.9191
s.e.(b)	0.1210
r^2	0.9902

Table 37. Growth parameters of orangefin ponyfish, *Leiognathus bindus.*
[Tabel 37. Parameter pertumbuhan ikan caria, Leiognathus bindus.*]*

Parameter	A
L_∞ (TL, cm)	12.5
K (year^{-1})	1.38

A. Java Sea (Central Java) (Ref. 1314)

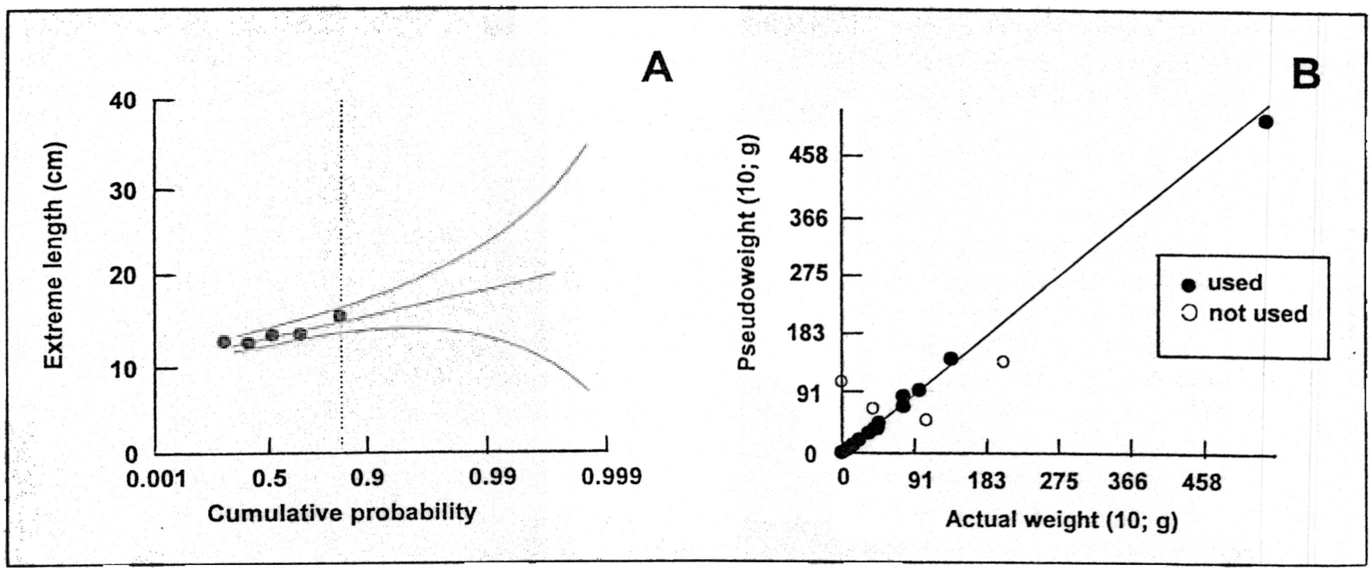


Fig. 63. (A) Extreme value plot for orangefin ponyfish, *Leiognathus bindus*, in Indonesia based on data from *R/V Jurong* showing maxima of 5 length-frequency samples, and estimate of L_{max3} = 14.8 ± 1.15 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 17 length-frequency samples of orangefin ponyfish, *Leiognathus bindus*, from Western Indonesia based on data from *R/Vs Mutiara 4, Jurong* and *Dr. Fridtjof Nansen* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 35). Open dots represent outliers, not used for analysis.
[Gambar 63. (A) Gambaran nilai ekstrim untuk ikan caria, Leiognathus bindus, *di Indonesia berdasarkan data dari kapal penelitian* Jurong *menunjukkan 5 contoh frekuensi-panjang dan angka perkiraan L_{max3} = 14.8 ± 1.15 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 17 contoh frekuensi-panjang ikan caria,* Leiognathus bindus, *dari Indonesia bagian barat berdasarkan data kapal-kapal penelitian* Mutiara 4, Jurong *dan* Dr. Fridtjof Nansen *sebagai output perangkat lunak ABee (lihat Boks 1), yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 35). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

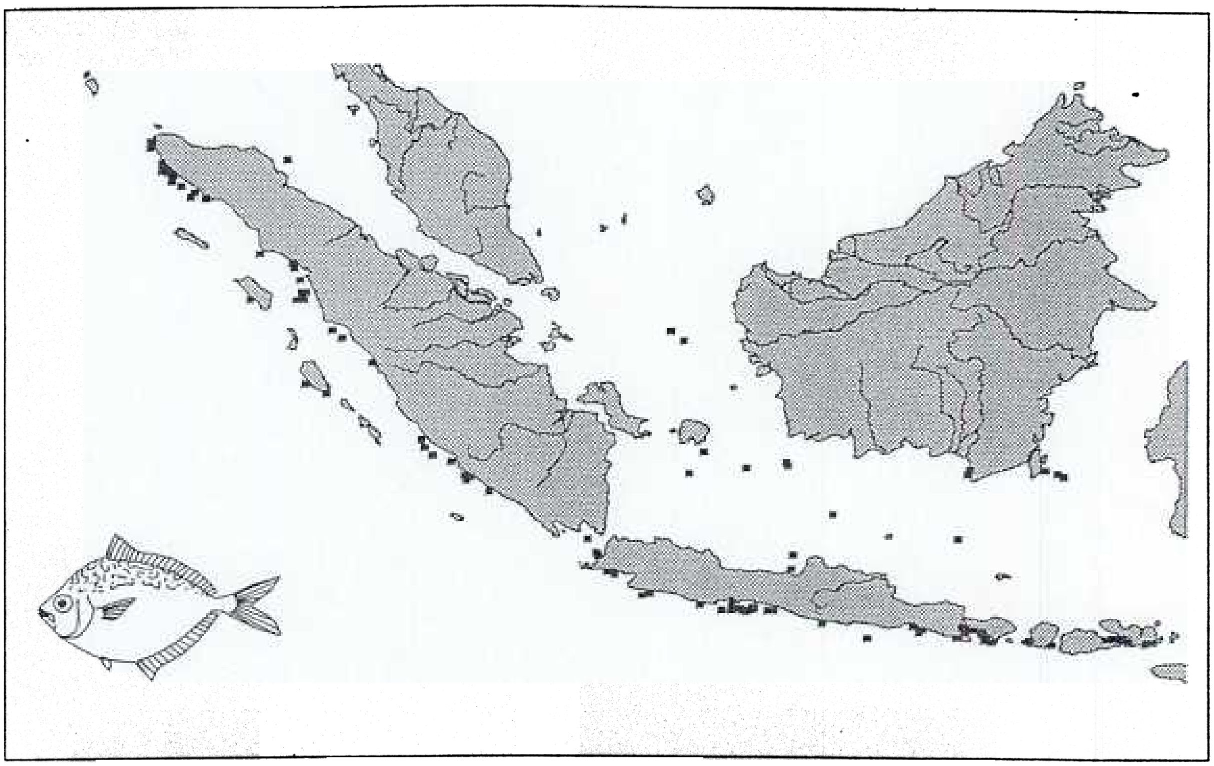


Fig. 64. Distribution of orangefin ponyfish, *Leiognathus bindus,* based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen.*
[Gambar 64. Penyebaran ikan caria, Leiognathus bindus, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

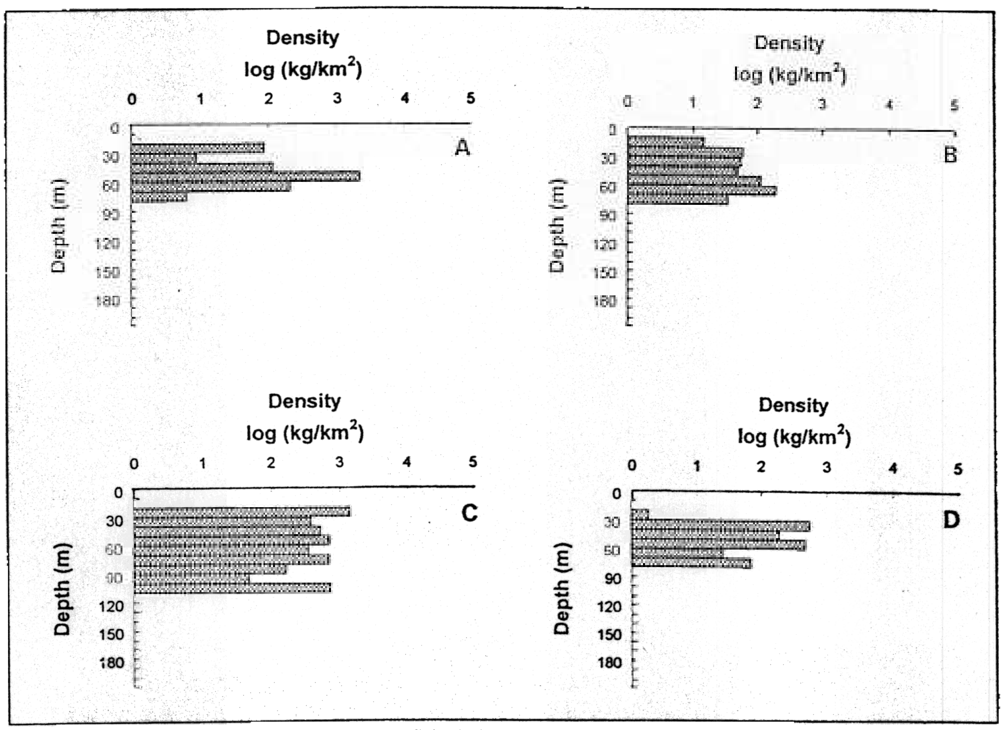


Fig. 65. Depth distribution of orangefin ponyfish, *Leiognathus bindus,* based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen,* (B) *Mutiara 4,* (C) *Jurong* and (D) *Bawal Putih 2.*
[Gambar 65. Penyebaran kedalaman ikan caria, Leiognathus bindus, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen, *(B)* Mutiara 4, *(C)* Jurong *dan (D)* Bawal Putih 2.*]*

Leiognathus equulus (Forsskål, 1775)

Common ponyfish (English); Peperek topang (Indonesian); Dodok (Java); Perek topang, Peperek topang, Peperek Tjina (West Java, Jakarta); Lokmolok (Madura); Molok-molok (Madura); Petek kuning (South Borneo); Bebete (South Sulawesi, Badjo).

Body silvery; caudal peduncle with a small brown saddle; anal fins yellowish; dorsal fin transparent. Strongly arched back. Naked head, with nuchal spine. Protracted mouth pointing downward. Dorsal spines: 8-8; soft rays: 16-16; anal spines: 3-3; soft rays: 14-14. L_{max1} = 25 cm TL; L_{max2} = n.a.; L_{max3} = 28.4 cm TL (Fig. 66A). See Fig. 66B and Table 38 for length-weight relationship.

Indo-West Pacific: from East London, South Africa including Réunion, Comores, Seychelles, Madagascar and Mauritius, Zanzibar, the Red Sea, Persian Gulf, India and Sri Lanka and thence to Southeast Asia and the islands of Indonesia (Fig. 67). Northeast to Okinawa, Ryukyu Islands; south to Australia and Fiji.

Occurs in river mouths and muddy inshore areas. Depth range: 10-110 m (Fig. 68). Feeds on polychaetes, small crustaceans, and small fish. Table 39 presents a set of growth parameters from Indonesia.

References: 186, 312, 393, 986, 1263, 1314, 1449, 1486, 1602, 2029, 2108, 2857, 3424, 3605, 3670, 3678, 4789, 4867, 4959, 5213, 5301, 5339, 5346, 5381, 5525, 5736, 5756, 6026, 6313, 6567

Length-weight (g/[TL;cm]) relationship of common ponyfish, *Leiognathus equulus*, in Indonesia.
[Tabel 38. Hubungan panjang-berat (g/[TL;cm]) ikan peperek topang, Leiognathus equulus, *di Indonesia.]*

Parameter	Estimate
a	0.0023
s.e.(a)	0.0031
b	3.6738
s.e.(b)	0.4120
r^2	0.9398

Table 39. Growth parameters of common ponyfish, *Leiognathus equulus*.
[Table 39. Parameter pertumbuhan ikan peperek topang, Leiognathus equulus.*]*

Parameter	A
L_∞ (TL, cm)	21.5
K ($year^{-1}$)	1.50

A. Java Sea (Central Java) (Ref. 1314)

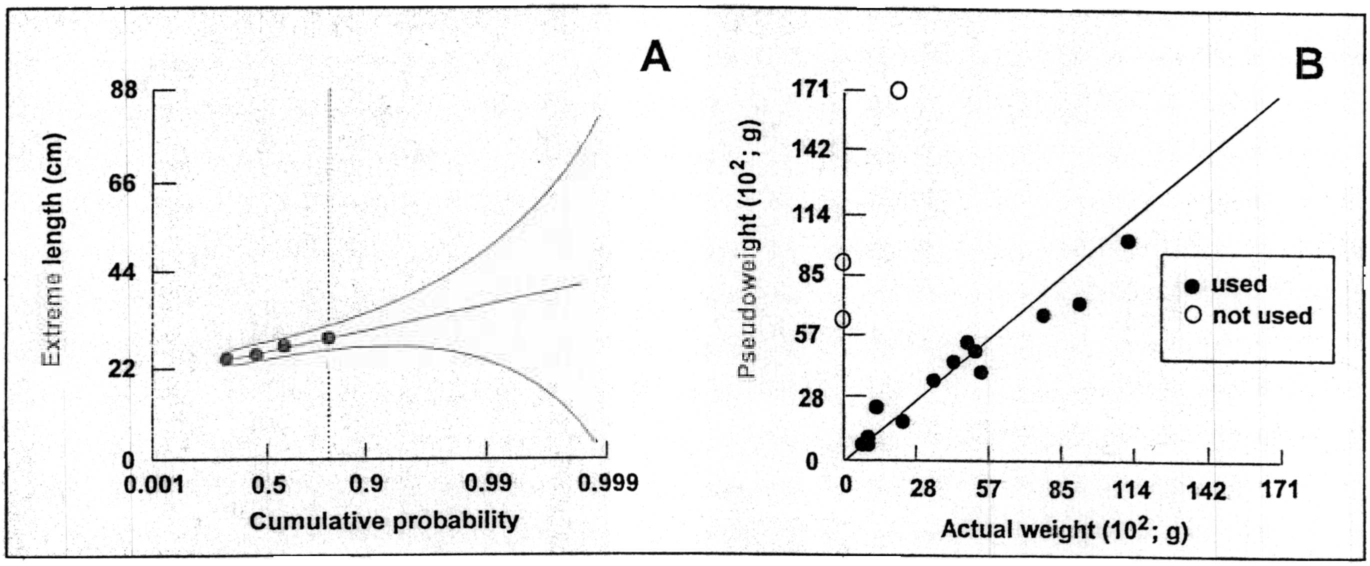


Fig. 66. (A) Extreme value plot for common ponyfish, *Leiognathus equulus*, in Indonesia based on data from *R/Vs Mutiara 4* and *Jurong* showing maxima of 4 length-frequency samples, and estimate of L_{max3} = 28.4 ± 2.65 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 14 length-frequency samples of common ponyfish, *Leiognathus equulus*, from Western Indonesia based on data from *R/Vs Mutiara 4, Jurong* and *Dr. Fridtjof Nansen* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 37). Open dot(s) represent outliers, not used for analysis.

[Gambar 66. (A) Gambaran nilai ekstrim ikan peperek topang, Leiognathus equulus, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Jurong *yang menunjukkan nilai maksimum untuk 4 contoh frekuensi-panjang dan angka perkiraan* L_{max3} *= 28.4 ± 2.65 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 14 contoh frekuensi-panjang ikan peperek topang,* Leiognathus equulus, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Jurong *dan* Dr. Fridtjof Nansen *sebagai output perangkat lunak ABee (lihat Boks 1), dan memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 37). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

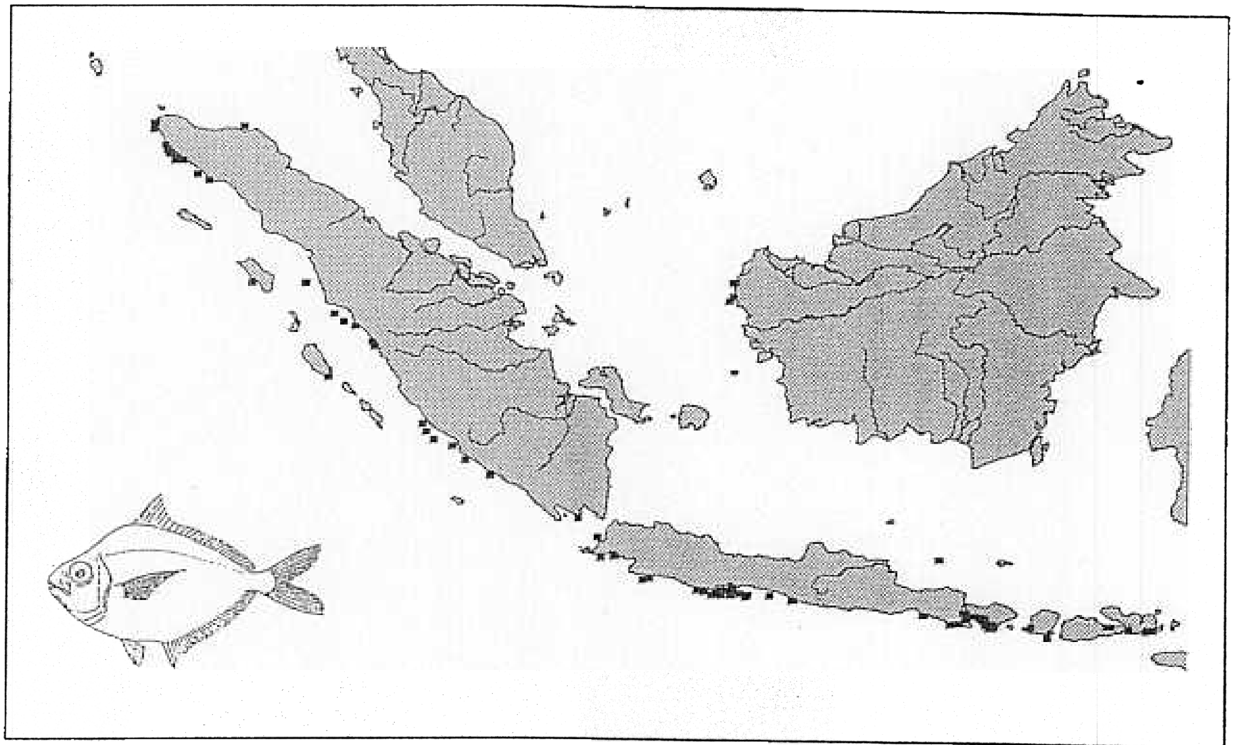


Fig. 67. Distribution of common ponyfish, *Leiognathus equulus,* based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen.*
[Gambar 67. Penyebaran ikan peperek topang, Leiognathus equulus, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

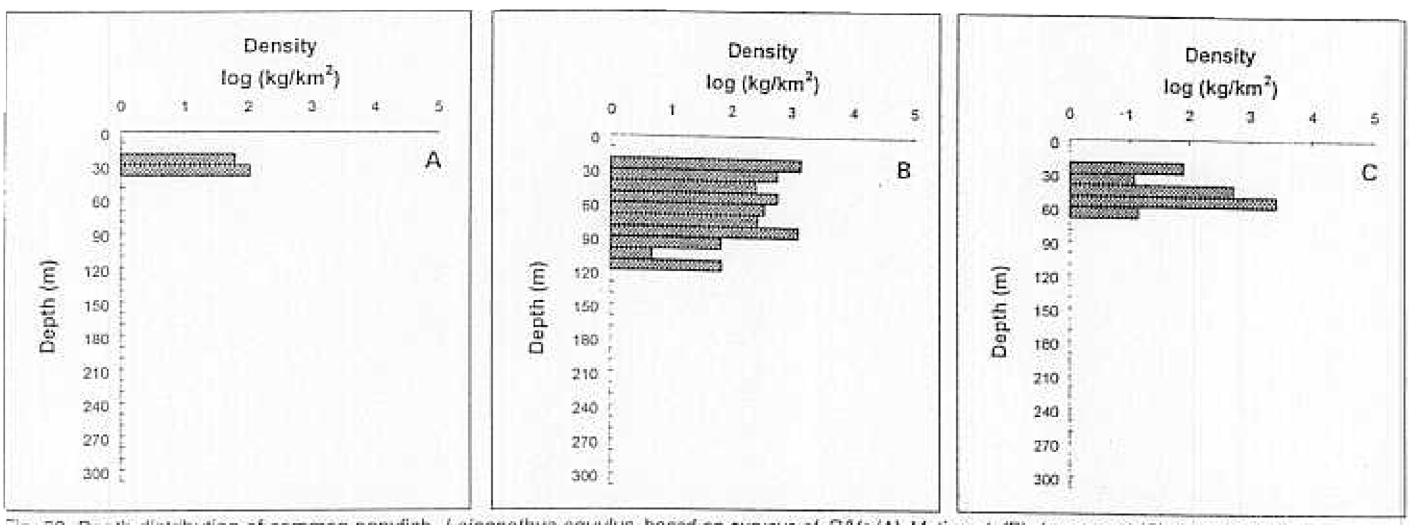


Fig. 68. Depth distribution of common ponyfish, *Leiognathus equulus,* based on surveys of *R/Vs* (A) *Mutiara 4,* (B) *Jurong* and (C) *Bawal Putih 2.*
[Gambar 68. Penyebaran kedalaman ikan peperek topang, Leiognathus equulus, *berdasarkan survei kapal-kapal penelitian (A)* Mutiara 4, *(B)* Jurong *dan (C)* Bawal Putih 2.*]*

Leiognathus leuciscus (Günther, 1860)

Whipfin ponyfish (English); Peperek (Indonesian); Peperek (Sundanese).

Body silvery; males usually with triangular bluish patch on side of belly; eyes greenish. Head naked; with nuchal spine. Protracted mouth pointing downward. Second dorsal and anal spines elongated. Dorsal spines: 8-8; soft rays: 16-16; anal spines: 3-3; soft rays: 14-14. L_{max1} = 12 cm; L_{max2} = n.a.; L_{max3} = 17.8 cm TL (Fig. 69A). See Fig. 69B and Table 40 for length-weight relationship.

Indo-West Pacific: from Madagascar and Seychelles eastward to India and Sri Lanka to SoutheastAsia via Indonesia (Fig. 70); southeast to northern Australia and New Caledonia.

Found in coastal waters and stays near the substrate. Depth range: 20-70 m (Fig. 71). Feeds on small shrimps, other crustaceans, and polychaetes. Table 41 presents a set of growth parameters from from Indonesia.

References: 393, 1263, 1314, 1449, 1486, 2108, 2857, 3424, 3607, 4789, 4959, 5213, 5346, 5381, 5450, 5525, 5756, 6567

Table 40. Length-weight (g/[TL;cm]) relationship of whipfin ponyfish, *Leiognathus leuciscus*, in Indonesia.
[Tabel 40. Hubungan panjang-berat (g/[TL;cm]) ikan peperek, Leiognathus leuciscus, *di Indonesia.]*

Parameter	Estimate
a	0.0230
s.e.(a)	0.0108
b	2.7913
s.e.(b)	0.2028
r^2	0.9873

Table 41. Growth parameters of whipfin ponyfish, *Leiognathus leuciscus*.
[Tabel 41. Parameter pertumbuhan ikan peperek, Leiognathus leuciscus.*]*

Parameter	A
L_∞ (TL, cm)	13.5
K ($year^{-1}$)	1.80

A. Java Sea (Central Java) (Ref. 1314)

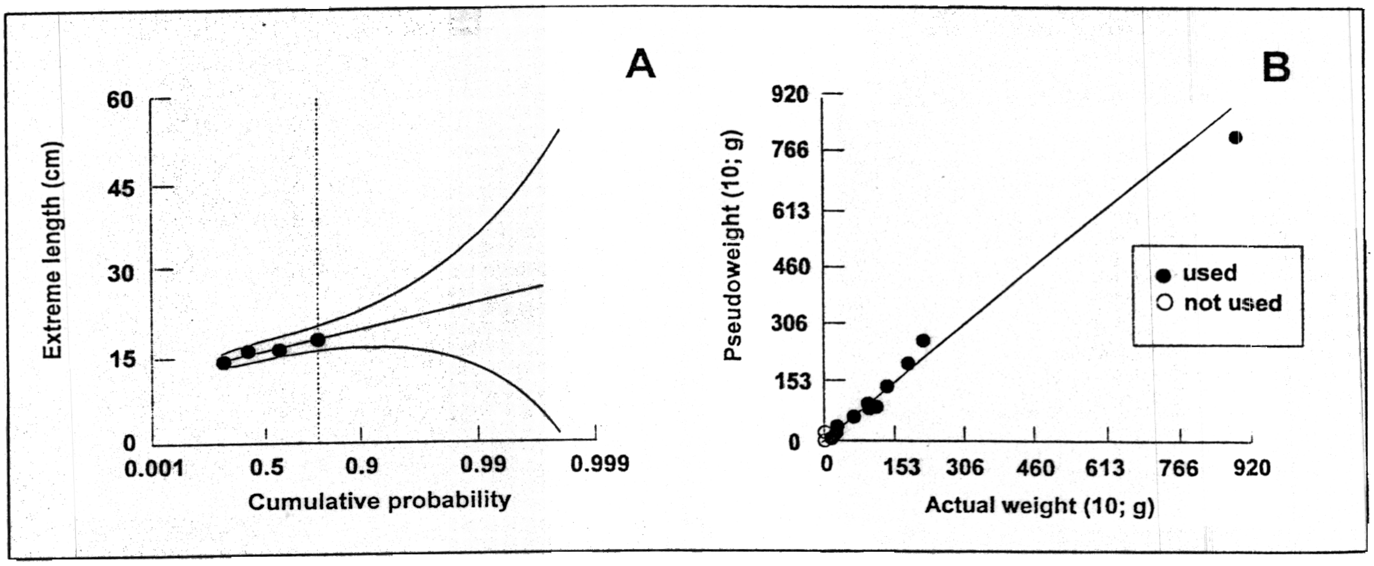


Fig. 69. (A) Extreme value plot for whipfin ponyfish, *Leiognathus leuciscus* in Indonesia based on data from *R/Vs Mutiara 4, Bawal Putih 2* and *Jurong* showing maxima of 4 length-frequency samples, and estimate of L_{max3} = 17.8 ± 1.94 cm TL. (B) Predicted vs. observed weights (in g wet weight) of 14 length-frequency samples of whipfin ponyfish, *Leiognathus leuciscus*, from Western Indonesia based on data from *R/Vs Mutiara 4, Jurong, Bawal Putih 2* and *Dr. Fridtjof Nansen* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 40). Open dots represent outliers, not used for analysis.
[Gambar 69. (A) Gambaran nilai ekstrim ikan peperek, Leiognathus leuciscus, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Bawal Putih 2 *dan* Jurong *menunjukkan nilai maksimum untuk 4 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 17.8 ± 1.94 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 14 contoh frekuensi-panjang ikan peperek,* Leiognathus leuciscus, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Jurong, Bawal Putih 2 *dan* Dr. Fridtjof Nansen *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 40). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

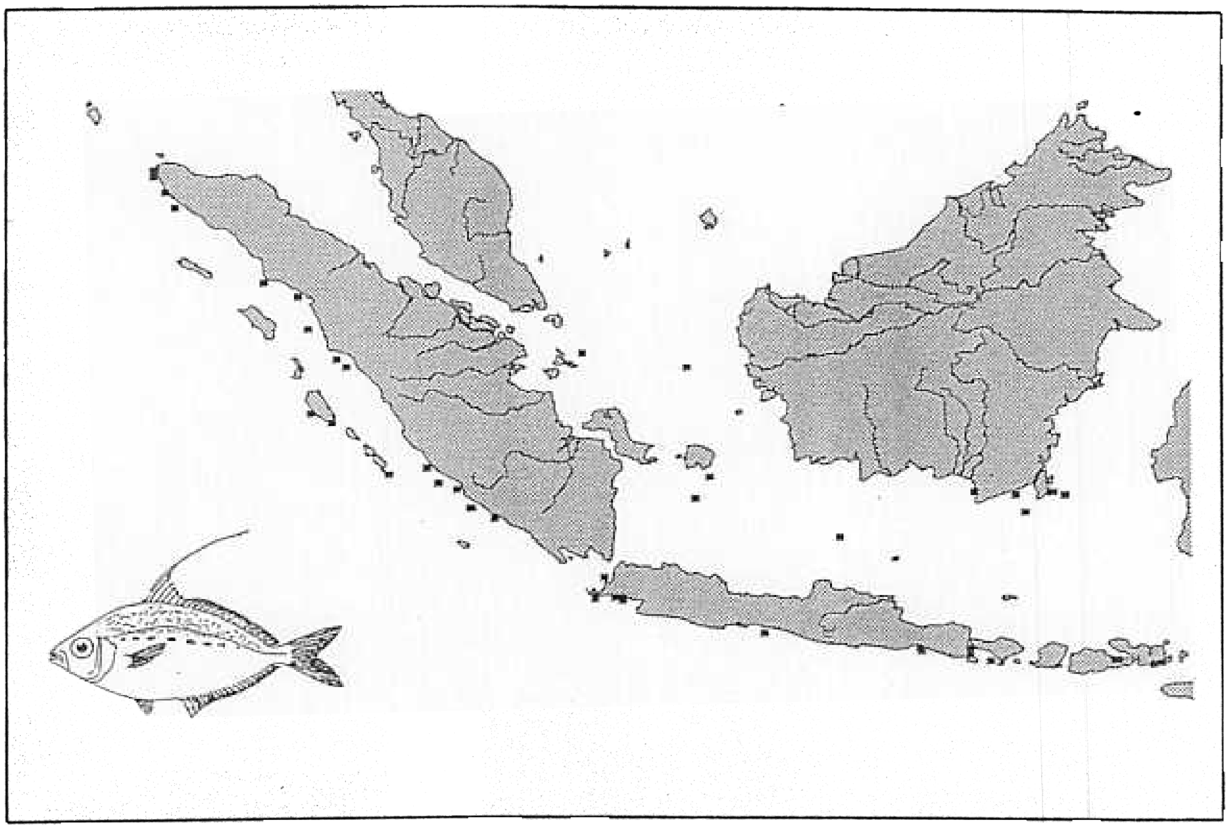


Fig. 70. Distribution of whipfin ponyfish, *Leiognathus leuciscus*, based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen.*
[Gambar 70. Penyebaran ikan peperek, Leiognathus leuciscus, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

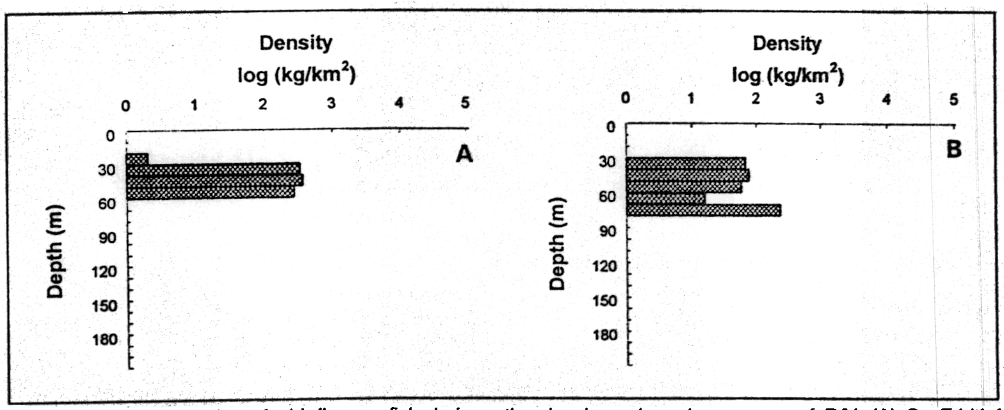


Fig. 71. Depth distribution of whipfin ponyfish, *Leiognathus leuciscus*, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen* and (B) *Bawal Putih 2.*
[Gambar 71. Penyebaran kedalaman ikan peperek, Leiognathus leuciscus, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen *dan (B)* Bawal Putih 2.*]*

Gazza minuta (Bloch, 1797)

Toothpony (English); Peperek bondolan (Indonesian); Kempar, Petah (Java); Peperek, Peperek bondolan (West Java, Jakarta); Kempor labu (Madura); Bete-bete sulamang (South Sulawesi, Makassar); Bebete lumuh (South Sulawesi, Bugis).

Body silvery; anterior part of anal fin yellow; dorsal, pectoral and pelvic fins colorless. Scales minute. Head and breast scaleless. Nuchal spine on nape. Mouth pointing forward when protracted. Dorsal spines: 8-8; soft rays: 16-16; anal spines: 3-3; soft rays: 14-14. L_{max1} = 18 cm; L_{max2} = n.a.; L_{max3} = 16.8 cm TL (Fig. 72A). See Fig. 72B and Table 42 for length-weight relationship.

Indo-West Pacific: East African coast, Madagascar, Seychelles, Réunion Islands and Mauritius; north to the Red Sea and Gulf of Aden, India, Sri Lanka; eastwards to Southeast Asia, including Indonesia (Fig. 73), reaching northeastward to Okinawa, Japan, south to Australia and Tahiti.

Found in coastal waters; predominantly close to the substrate. Depth range: 10-110 m (Fig. 74). Feeds on small fish, shrimps, other crustaceans and polychaetes.

References: 393, 559, 1263, 1449, 2108, 2857, 3424, 3605, 4376, 4462, 4789, 4959, 5213, 5346, 5381, 5450, 5525, 5736, 5756, 6026, 6313, 6567

Table 42. Length-weight [g/(TL;cm)] relationship of toothpony, *Gazza minuta* in Indonesia.
[Tabel 42. Hubungan panjang-berat (g/[TL;cm]) ikan peperek bondolan, Gazza minuta, *di Indonesia.]*

Parameter	Estimate
a	0.0161
s.e.(a)	0.0045
b	3.0006
s.e.(b)	0.1145
r^2	0.9950

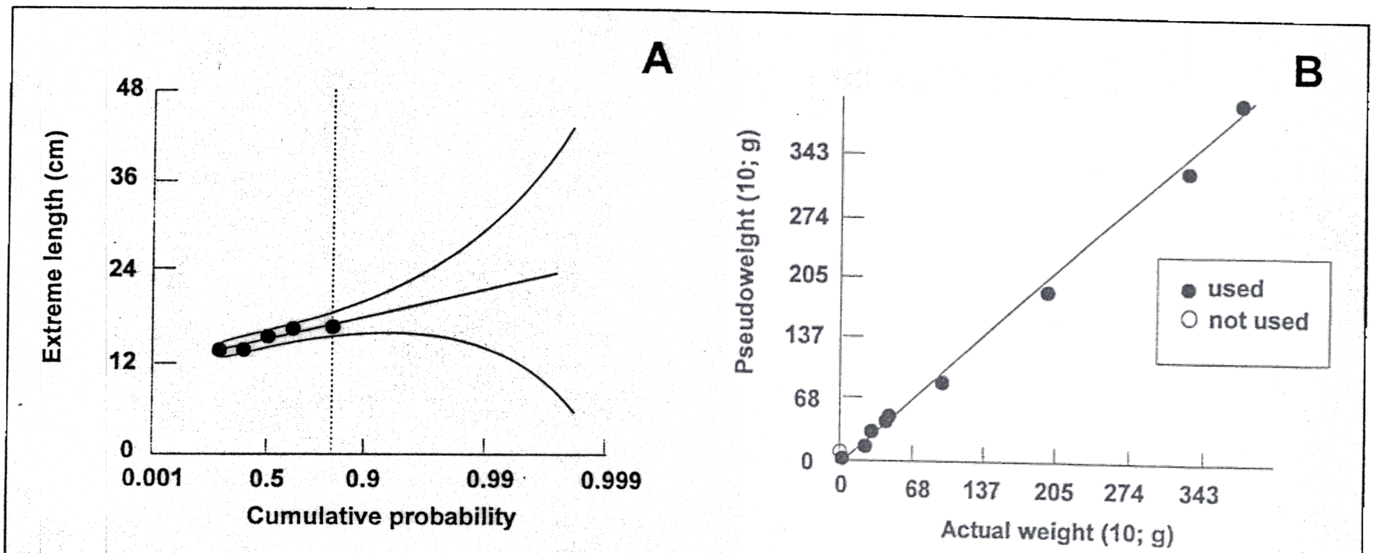


Fig. 72. (A) Extreme value plot for toothpony, *Gazza minuta*, in Indonesia based on data from *R/Vs Mutiara 4* and *Dr. Fridtjof Nansen* showing maxima of 5 length-frequency samples, and estimate of L_{max3} = 16.8 ± 1.6 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 9 length-frequency samples of toothpony, *Gazza minuta*, from Western Indonesia based on data from *R/Vs Mutiara 4* and *Dr. Fridtjof Nansen* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 42). Open dot represents outlier, not used for analysis.
[Gambar 72. (A) Gambaran nilai ekstrim ikan peperek bondolan, Gazza minuta, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Dr. Fridtjof Nansen *menunjukkan nilai maksimum untuk 5 contoh frekuensi-panjang, dan angka perkiraan* L_{max3} *= 16.8 ± 1.6 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 9 contoh frekuensi-panjang ikan peperek bondolan,* Gazza minuta, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Dr. Fridtjof Nansen *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 42). Bulatan kosong mewakili suatu pengamatan yang tidak dipakai dalam analisis.]*

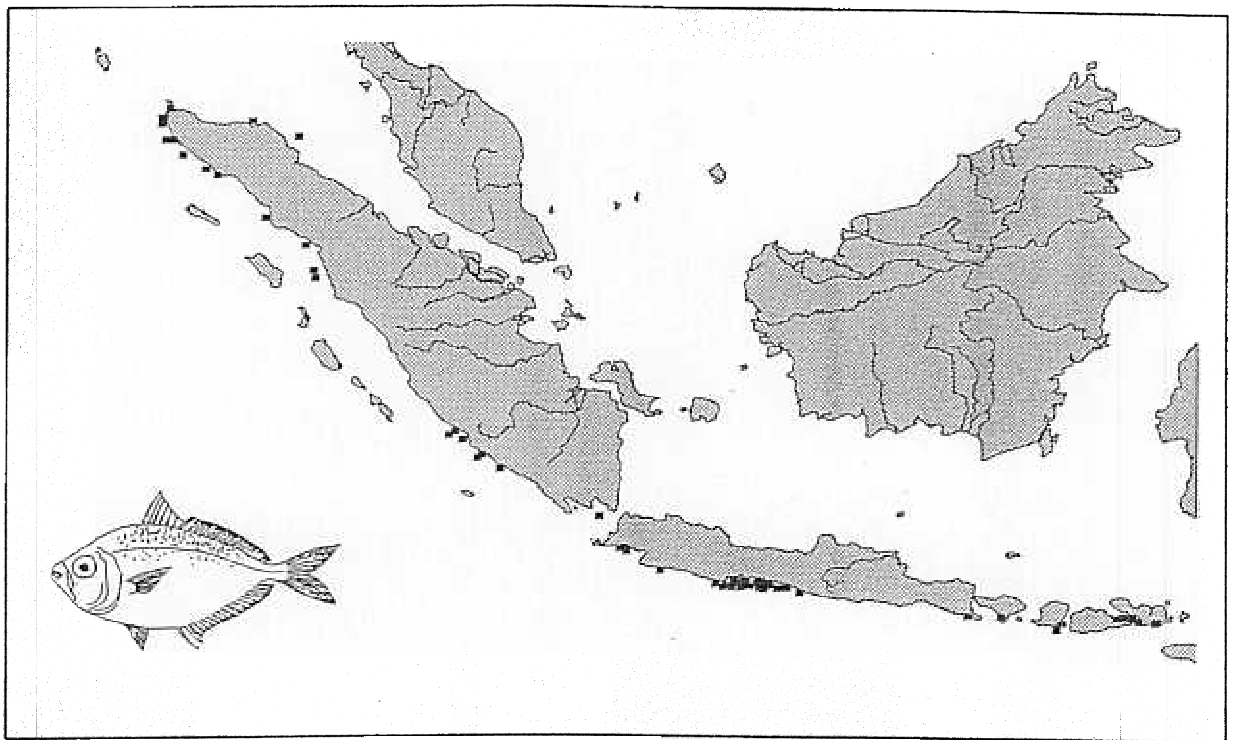


Fig. 73. Distribution of toothpony, *Gazza minuta*, based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen.*
[Gambar 73. Penyebaran ikan peperek bondolan, Gazza minuta, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

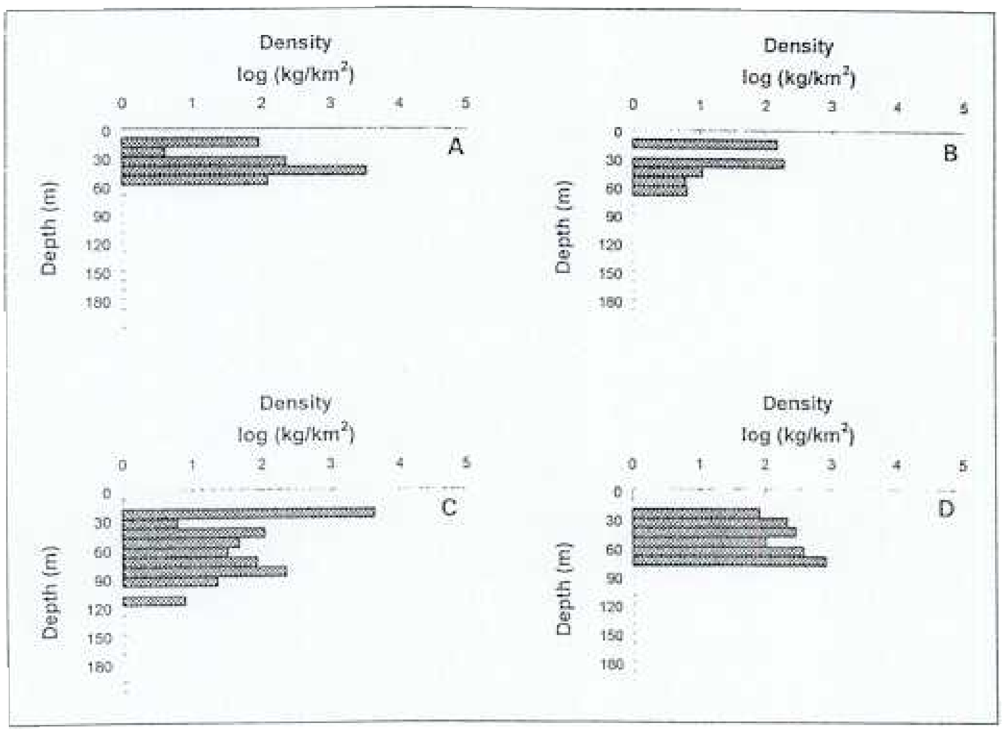


Fig. 74. Depth distribution of toothpony, *Gazza minuta*, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen*, (B) *Mutiara 4*, (C) *Jurong* and (D) *Bawal Putih 2.*
[Gambar 74. Penyebaran kedalaman ikan peperek bondolan, Gazza minuta, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen, *(B)* Mutiara 4, *(C)* Jurong *dan (D)* Bawal Putih 2.*]*

Gymnocranius grandoculis (Valenciennes, 1830)

Rippled barenose.

Forehead profile moderately steep; large adults develop a bony ridge on the nape and a bony shelf over the front part of the eye. The inner surface of the pectoral fin axil is scaleless. Overall color is silvery with thin brown scale margins. The anterior half of the head is often brown with a series of narrow undulating, longitudinal lines on the cheek and side of the snout. Fins are yellow or orange; caudal fin is frequently dusky brown; a narrow brown bar across the base of pectoral fins. Juveniles under about 25 cm SL often with 5 or 6 dark bars on the side and a dark bar below the eye. Dorsal spines: 10-10; soft rays: 10-10; anal spines: 3-3; soft rays: 10-10. L_{max1} = 80 cm TL; L_{max2} = n.a.; L_{max3} = 74.3 cm FL (Fig. 75A). See Fig. 75B and Table 43 for length-weight relationship.

Widely distributed from East Africa in the Indian Ocean via Southeast Asia to Japan in the north, and Indonesia (Fig. 76), Australia and Oceania.

Inhabits trawling grounds of the continental shelves and offshore rocky bottoms. Depth range: 20-170 m (Fig. 77). Feeds mostly on benthic invertebrates and small fishes.

References: 171, 1830, 2030, 2290, 2295, 4537, 4830, 5213, 5450, 5525, 5756, 6567

Table 43. Length-weight (g/[FL;cm]) relationship of rippled barenose, *Gymnocranius grandoculis*, in Indonesia.
[Tabel 43. Hubungan panjang-berat (g/[FL;cm]) ikan Gymnocranius grandoculis, *di Indonesia.]*

Parameter	Estimate
a	0.2492
s.e.(a)	0.1445
b	2.3647
s.e.(b)	0.1538
r^2	0.8875

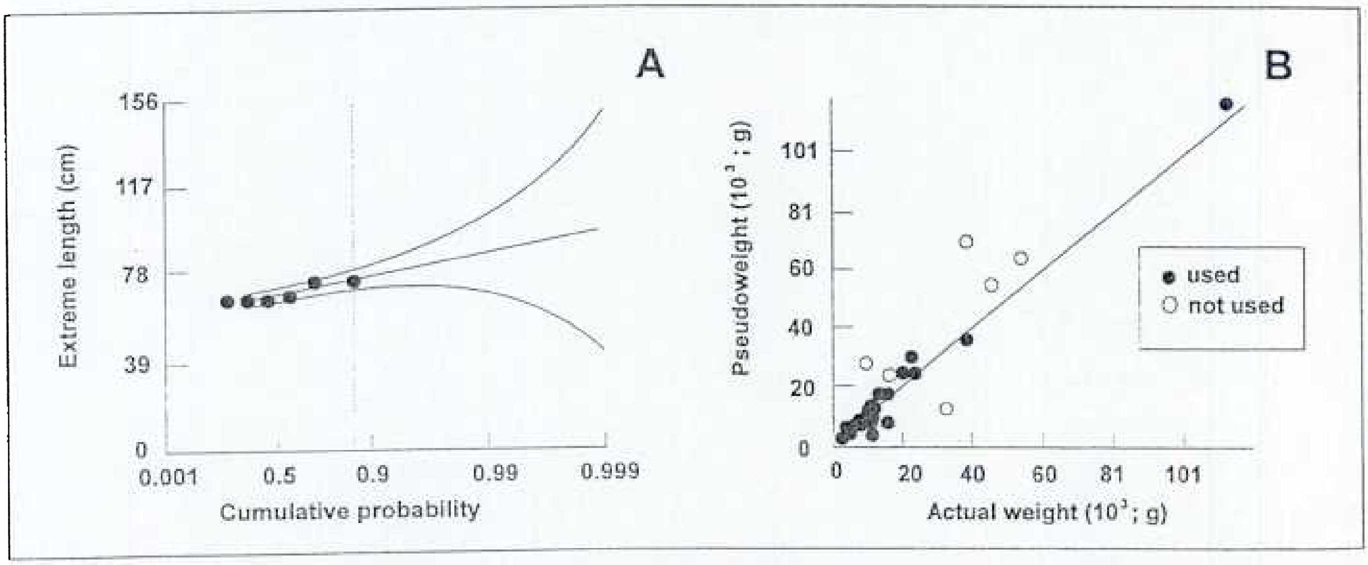


Fig. 75. (A) Extreme value plot for rippled barenose, *Gymnocranius grandoculis*, in Indonesia based on data from *R/V Jurong* showing maxima of 6 length-frequency samples, and estimate of L_{max3} = 74.3 ± 4.3 cm FL. (B) Predicted *vs.* observed weights (in g wet weight) of 31 length-frequency samples of rippled barenose, *Gymnocranius grandoculis*, from Western Indonesia based on data from *R/Vs Mutiara 4, Jurong* and *Bawal Putih 2* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 43). Open dots represent outliers, not used for analysis.
[Gambar 75. (A) Gambaran nilai ekstrim ikan Gymnocranius grandoculis *di Indonesia berdasarkan data dari kapal penelitian* Jurong *menunjukkan nilai maksimum untuk 6 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 74.3 ± 4.3 cm FL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 31 contoh frekuensi-panjang ikan* Gymnocranius grandoculis *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Jurong *dan Bawal Putih 2 sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 43). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

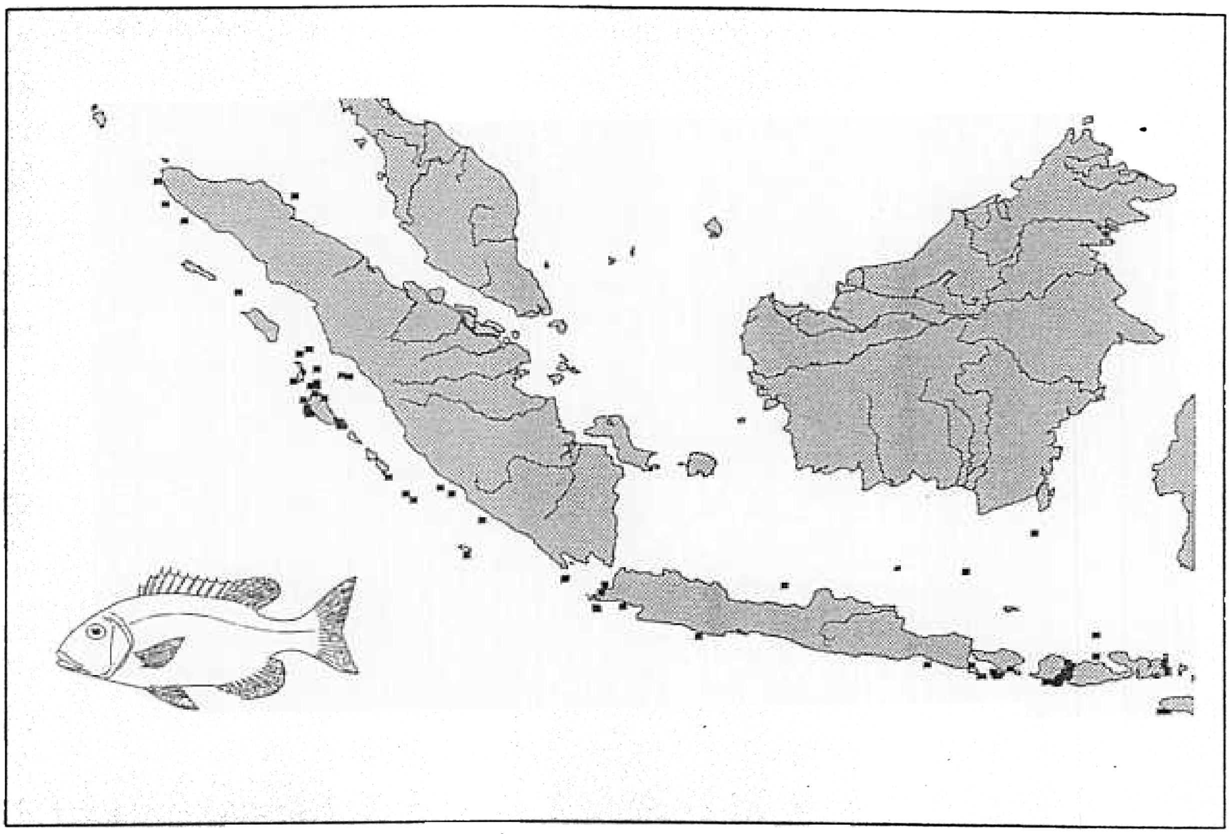


Fig. 76. Distribution of rippled barenose, *Gymnocranius grandoculis*, based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen.*
[Gambar 76. Penyebaran ikan Gymnocranius grandoculis *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan Dr. Fridtjof Nansen.]*

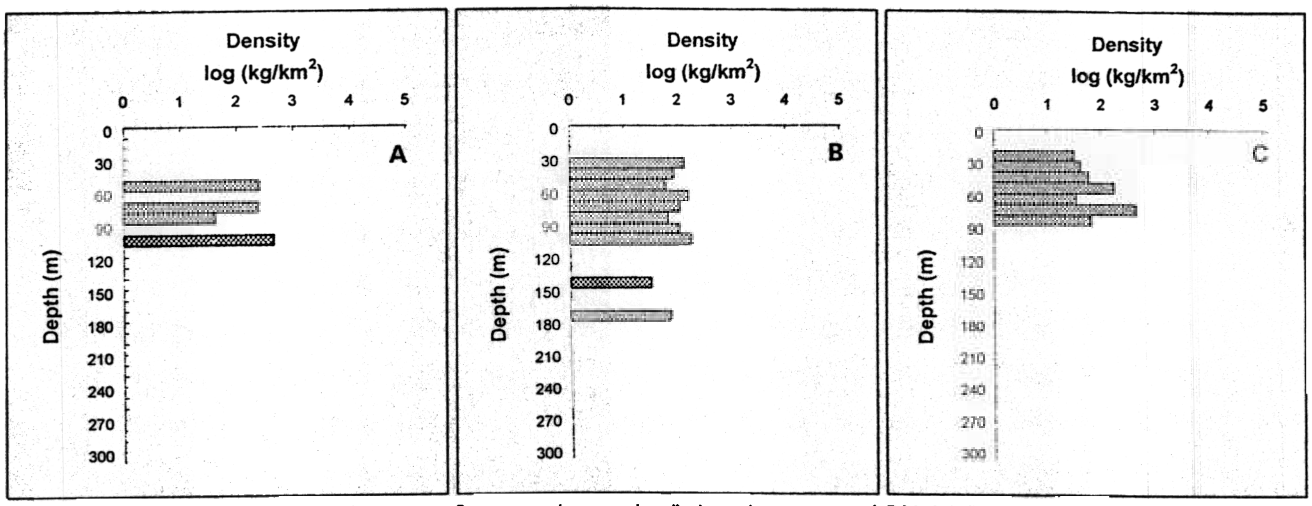


Fig. 77. Depth distribution of rippled barenose, *Gymnocranius grandoculis*, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen,* (B) *Jurong* and (C) *Bawal Putih 2.*
[Gambar 77. Penyebaran kedalaman ikan Gymnocranius grandoculis *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen, *(B)* Jurong *dan (C)* Bawal Putih 2.*]*

Aprion virescens (Valenciennes, 1830)

Green jobfish.

Preopercle edge smooth or sometimes denticulate in juveniles. There is a distinct horizontal groove in front of eye. Dorsal and anal fins scaleless. Scale rows on back parallel with lateral line. Color dark green to bluish or blue-gray. Dorsal spines: 10-10; soft rays: 11-11; anal spines: 3-3; soft rays: 8-8. L_{max1} = 112 cm TL; L_{max2} = n.a.; L_{max3} = 86.9 cm FL (Fig. 78A). See Fig. 78B and Table 44 for length-weight relationship.

Widely distributed in the tropical Indo-Pacific Ocean from East Africa via Southeast Asia to southern Japan and Hawaii, and southward via Indonesia (Fig. 79) to Australia.

Inhabits inshore reef areas, usually solitary. Depth range: 20-100 m (Fig. 80). Feeds mainly on fishes, but also shrimps, crabs, cephalopods and planktonic organisms.

References: 55, 171, 245, 280, 583, 1602, 1830, 2290, 3084, 3090, 3111, 3670, 3678, 3804, 3807, 4517, 4690, 4699, 4795, 4821, 4868, 4887, 5213, 5358, 5450, 5525, 5579, 5736, 5756, 6089, 6273, 6306, 6365

Table 44. Length-weight (g/[FL;cm]) relationship of green jobfish, *Aprion virescens*, in Indonesia.
Tabel 44. Hubungan panjang-berat (g/[FL;cm]) ikan Aprion virescens *di Indonesia.*

Parameter	Estimate
a	0.0077
s.e.(a)	0.0039
b	3.1368
s.e.(b)	0.1181
r^2	0.9922

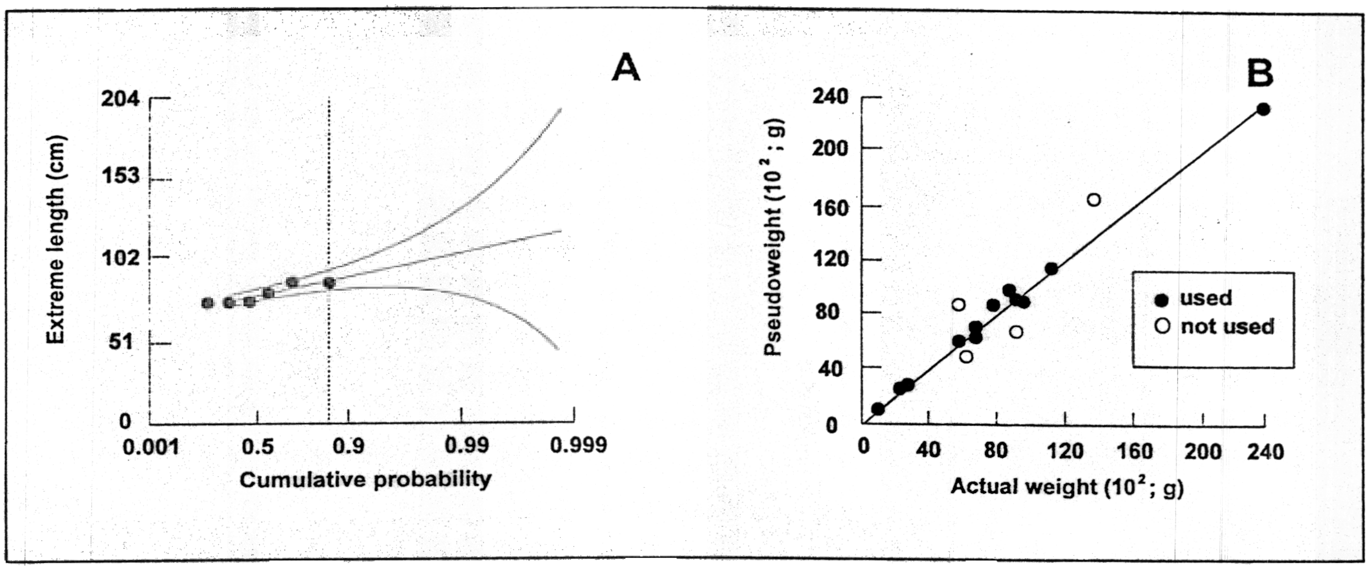


Fig. 78 (A) Extreme value plot for green jobfish, *Aprion virescens*, in Indonesia based on data from *R/V Jurong* showing maxima of 6 length-frequency samples, and estimate of L_{max3} = 86.9 ± 6.5 cm FL. (B) Predicted *vs.* observed weights (in g wet weight) of 12 length-frequency samples of green jobfish, *Aprion virescens*, from Western Indonesia based on data from *R/V Jurong* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 44). Open dots represent outliers, not used for analysis.

[Gambar 78. (A) Gambaran nilai ekstrim ikan Aprion virescens *di Indonesia berdasarkan data dari kapal penelitian* Jurong *yang menunjukkan nilai maksimum untuk 6 contoh frekuensi-panjang, dan angka perkiraan* L_{max3} *= 86.9 ± 6.5 cm FL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 12 contoh frekuensi-panjang ikan* Aprion virescens *dari Indonesia bagian barat berdasarkan data dari kapal penelitian* Jurong *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 44). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

)84,
'95,
'56,

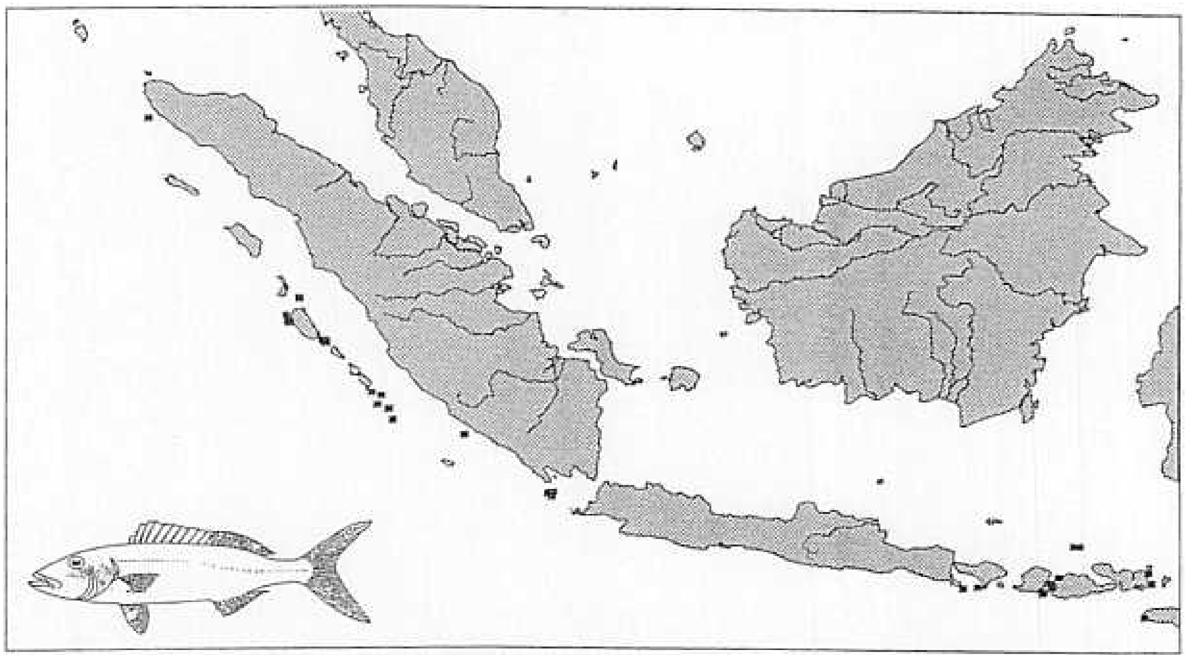


Fig. 79. Distribution of green jobfish, *Aprion virescens*, based on records of the surveys of *R/Vs Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen*.
[Gambar 79. Penyebaran ikan Aprion virescens *berdasarkan laporan survei kapal-kapal penelitian* Bawal Putih 2, Jurong dan Dr. Fridtjof Nansen.*]*

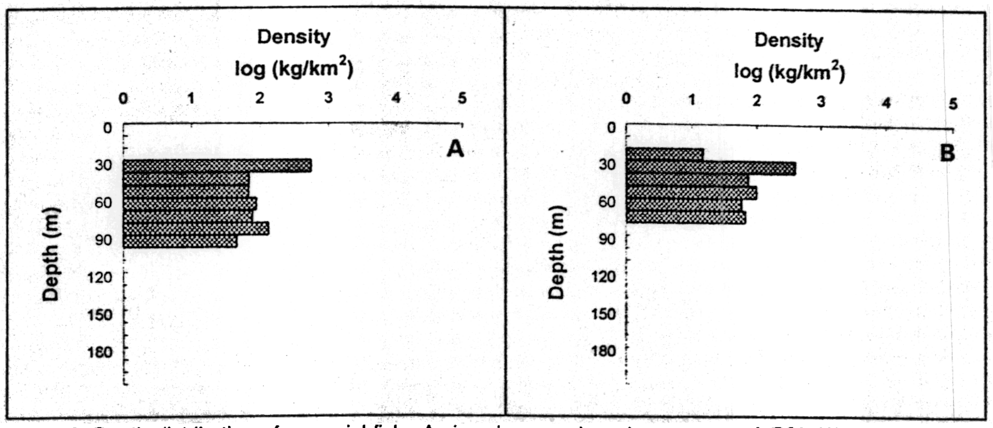


Fig. 80. Depth distribution of green jobfish, *Aprion virescens*, based on surveys of *R/Vs* (A) *Jurong* and (B) *Bawal Putih* 2.
[Gambar 80. Penyebaran kedalaman ikan Aprion virescens *berdasarkan survei kapal-kapal penelitian (A)* Jurong *dan (B)* Bawal Putih 2.*]*

Pristipomoides typus (Bleeker, 1852)

Sharptooth jobfish.

Interorbital space flat. Bases of dorsal and anal fins scaleless, their last soft rays extended into short filaments. Pectoral fins long, reaching level of anus. Scale rows on back parallel to lateral line. Overall color rosy red; the top of the head with longitudinal vermiculated lines and spots of brownish yellow; the dorsal fin with wavy yellow lines. Dorsal spines: 10-10; soft rays: 11-12; anal spines: 3-3; soft rays: 8-8. L_{max1} = 70 cm TL; L_{max2} = n.a.; L_{max3} = 68.3 cm TL (Fig. 81A). See Fig. 81B and Table 45 for length-weight relationship.

Tropical western Pacific ranging in Indonesia from Sumatra to Irian Jaya (Fig 82) and northward to the Ryukyu Islands. Records from the western Indian Ocean need to be confirmed.

Occurs over rocky bottoms. Depth range: 40-120 m (Fig. 83). Feeds on benthic invertebrates and fishes.

References: 55, 171, 438, 1451, 2857, 3090, 4517, 4789, 5213, 5450, 5515, 5725, 5756, 6365, 6425, 6567

Table 45. Length-weight (g/[TL;cm]) relationship of sharptooth jobfish, *Pristipomoides typus*, in Indonesia.
[Tabel 45. Hubungan panjang-berat [g/(TL;cm)] ikan Pristipomoides typus *di Indonesia.]*

Parameter	Estimate
a	0.0143
s.e.(a)	0.0175
b	2.9158
s.e.(b)	0.3156
r^2	0.9208

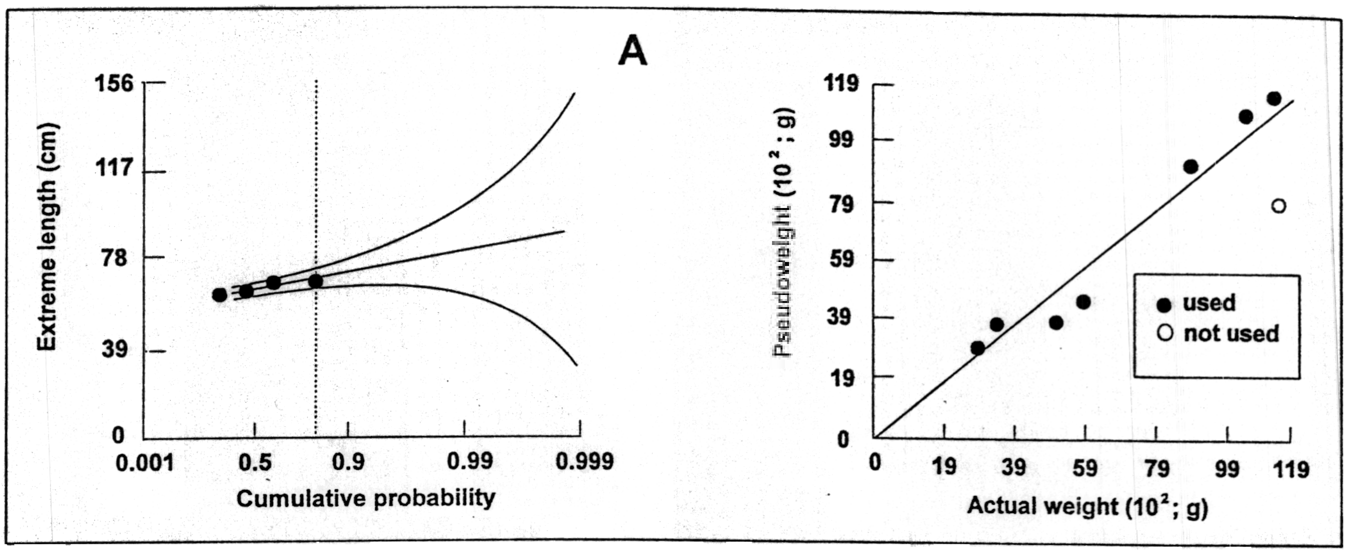


Fig. 81. (A) Extreme value plot for sharptooth jobfish, *Pristipomoides typus*, in Indonesia based on data from *R/Vs Mutiara 4* and *Dr. Fridtjof Nansen* showing maxima of 4 length-frequency samples, and estimate of L_{max3} = 68.3 ± 4.1 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 7 length-frequency samples of sharptooth jobfish, *Pristipomoides typus*, from Western Indonesia based on data from *R/Vs Mutiara 4*, *Bawal Putih 2* and *Dr. Fridtjof Nansen* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 45). Open dot represents outlier, not used for analysis.
[Gambar 81. (A) Gambaran nilai ekstrim ikan Pristipomoides typus *di Indonesia berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Dr. Fridtjof Nansen *yang menunjukkan nilai maksimum untuk 4 contoh frekuensi-panjang, dan angka perkiraan* L_{max3} *= 68.3 ± 4.1 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 7 contoh frekuensi-panjang* Pristipomoides typus *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Bawal Putih 2 *dan* Dr. Fridtjof Nansen *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 45). Bulatan kosong mewakili suatu pengamatan yang tidak dipakai dalam analisis.]*

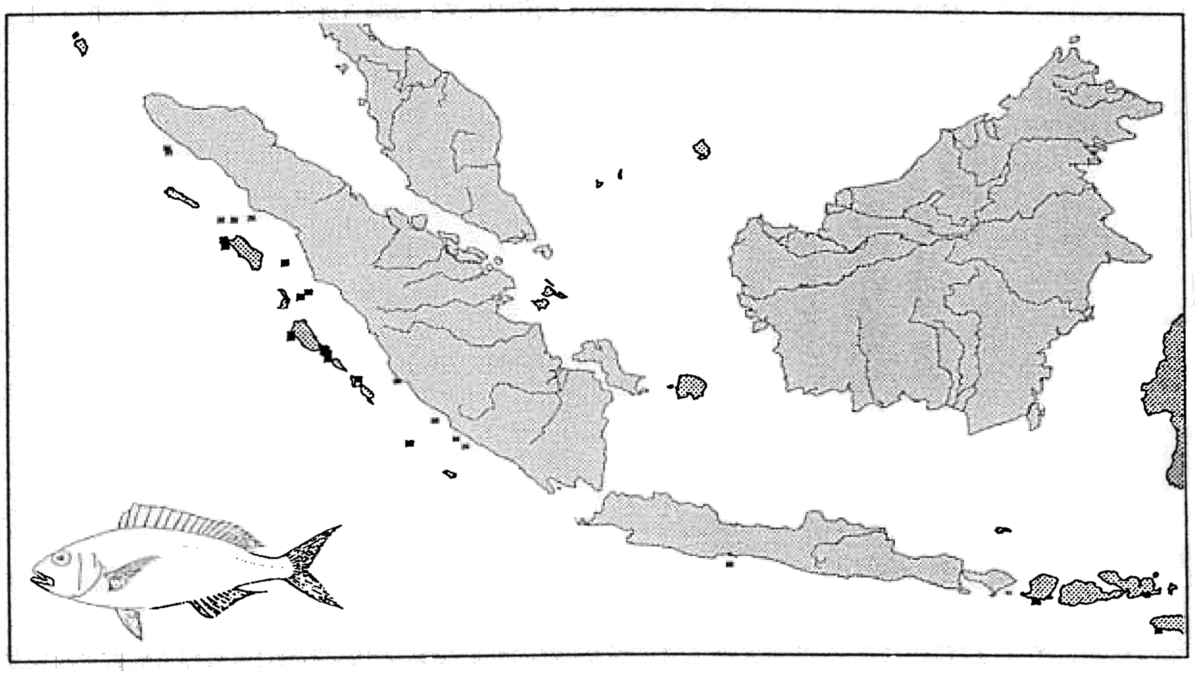


Fig. 82. Distribution of sharptooth jobfish, *Pristipomoides typus*, based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen*.
[Gambar 82. Penyebaran ikan Pristipomoides typus *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

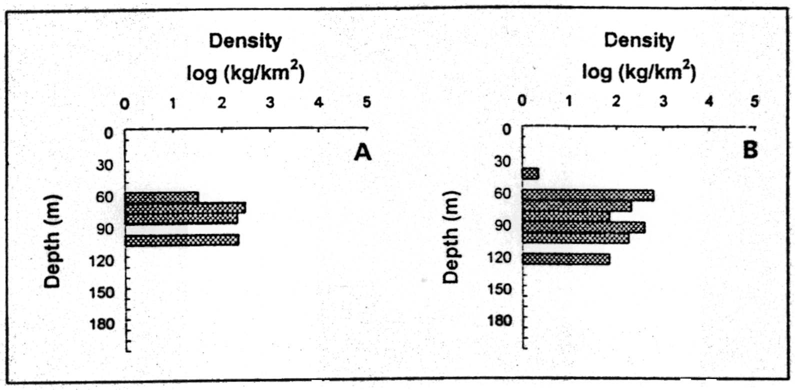


Fig. 83. Depth distribution of sharptooth jobfish, *Pristipomoides typus*, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen* and (B) *Jurong*. *[Gambar 83. Penyebaran kedalaman ikan* Pristipomoides typus *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen *dan (B)* Jurong.*]*

Upeneus moluccensis (Bleeker, 1855)

Goldband goatfish (English); Bijinangka (Indonesian).

Body elongate, with relatively large ctenoid scales. Color is silvery white, with a bright yellow horizontal band running through the eye to the caudal fin. Dorsal fins with 3-4 orange or red bars; anal and pelvic fin pale. Upper lobe of the caudal fin with 5-6 orange-black bars, lower lobe plain yellow with dark margin. Dorsal spines: 13-13; soft rays: 9-9; anal spines: 0-0; soft rays: 7-7; L_{max1} = 20 cm TL; L_{max2} = n.a.; L_{max3} = 20.0 cm FL (Fig. 84A). See Fig. 84B and Table 46 for length-weight relationship.

Occurs in the Indo-West Pacific from the east coast of Africa to Southeast Asia, the Indonesian Archipelago (Fig. 85) and the northern coasts of Australia; also reported from New Caledonia. Recently invaded the eastern Mediterranean from the Red Sea through the Suez Canal.

Found in coastal waters with a muddy substrate at depths ranging from 30 to 120 m (Fig. 86).

References: 393, 1263, 1449, 1486, 1975, 2029, 2178, 2795, 2857, 3397, 4789, 5213, 5381, 5385, 5450, 5525, 5756, 6306, 6328, 6567

Table 46. Length-weight (g/[FL;cm]) relationship of goldband goatfish, *Upeneus moluccensis*, in Indonesia.
[Tabel 46. Hubungan panjang-berat (g/[FL;cm]) ikan bijinangka, Upeneus moluccensis, *di Indonesia.]*

Parameter	Estimate
a	0.0451
s.e.(a)	0.0275
b	2.6364
s.e.(b)	0.2400
r^2	0.9631

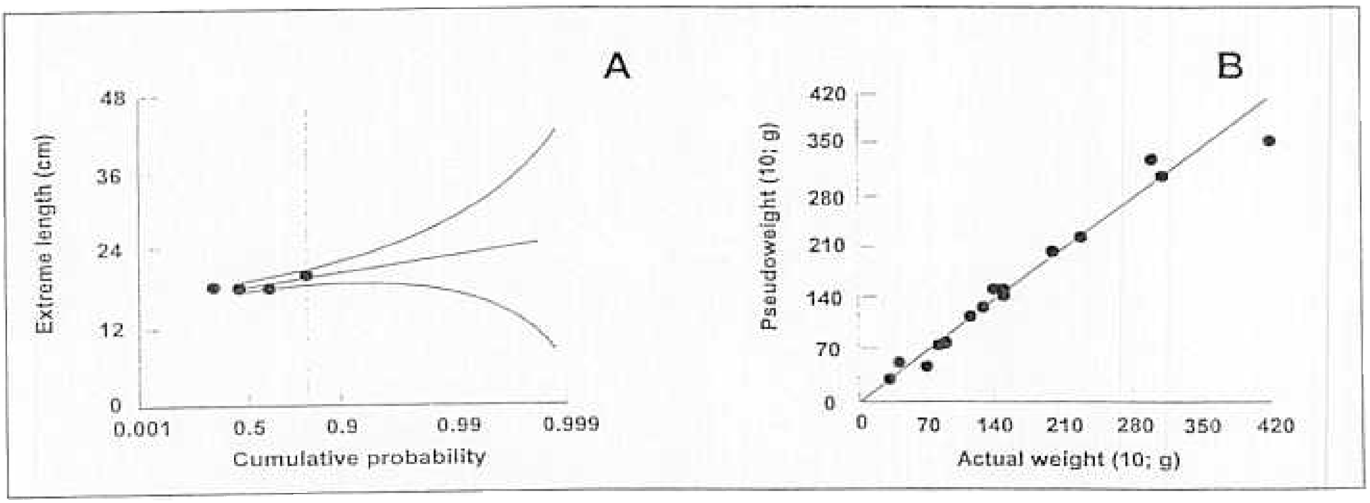


Fig. 84. (A) Extreme value plot for goldband goatfish, *Upeneus moluccensis*, in Indonesia based on data from *R/Vs Jurong* and *Dr. Fridtjof Nansen* showing maxima of 4 length-frequency samples, and estimate of $L_{max3} = 20.0 \pm 1.1$ cm FL. (B) Predicted *vs.* observed weights (in g wet weight) of 15 length-frequency samples of goldband goatfish, *Upeneus moluccensis*, from Western Indonesia based on data from *R/Vs Jurong, Dr. Fridtjof Nansen* and *Bawal Putih 2* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 46).
[Gambar 84. (A) Gambaran nilai ekstrim ikan bijinangka, Upeneus moluccensis, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Jurong *dan* Dr. Fridtjof Nansen *yang menunjukkan nilai maksimum untuk 4 contoh frekuensi-panjang, dan angka perkiraan $L_{max3} = 20. \pm 1.1$ cm FL. (B). Berat prediksi terhadap berat observasi (dalam g berat basah) dari 15 contoh frekuensi-panjang ikan bijinangka,* Upeneus moluccensis, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Jurong, Dr. Fridtjof Nansen *dan* Bawal Putih 2 *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 46).*

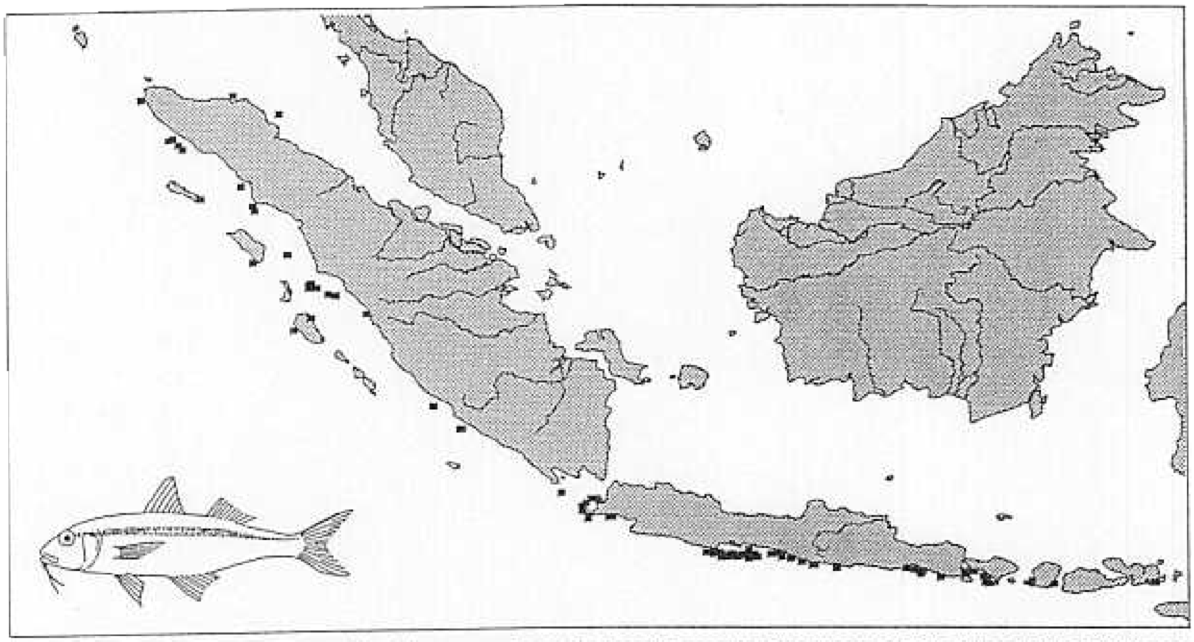


Fig. 85. Distribution of goldband goatfish, *Upeneus moluccensis*, based on records of the surveys of *R/Vs Jurong, Dr. Fridtjof Nansen* and *Bawal Putih 2.*
Gambar 85. Penyebaran ikan bijinangka, Upeneus moluccensis, *berdasarkan laporan survei kapal-kapal penelitian* Jurong, Dr. Fridtjof Nansen *dan* Bawal Putih 2.

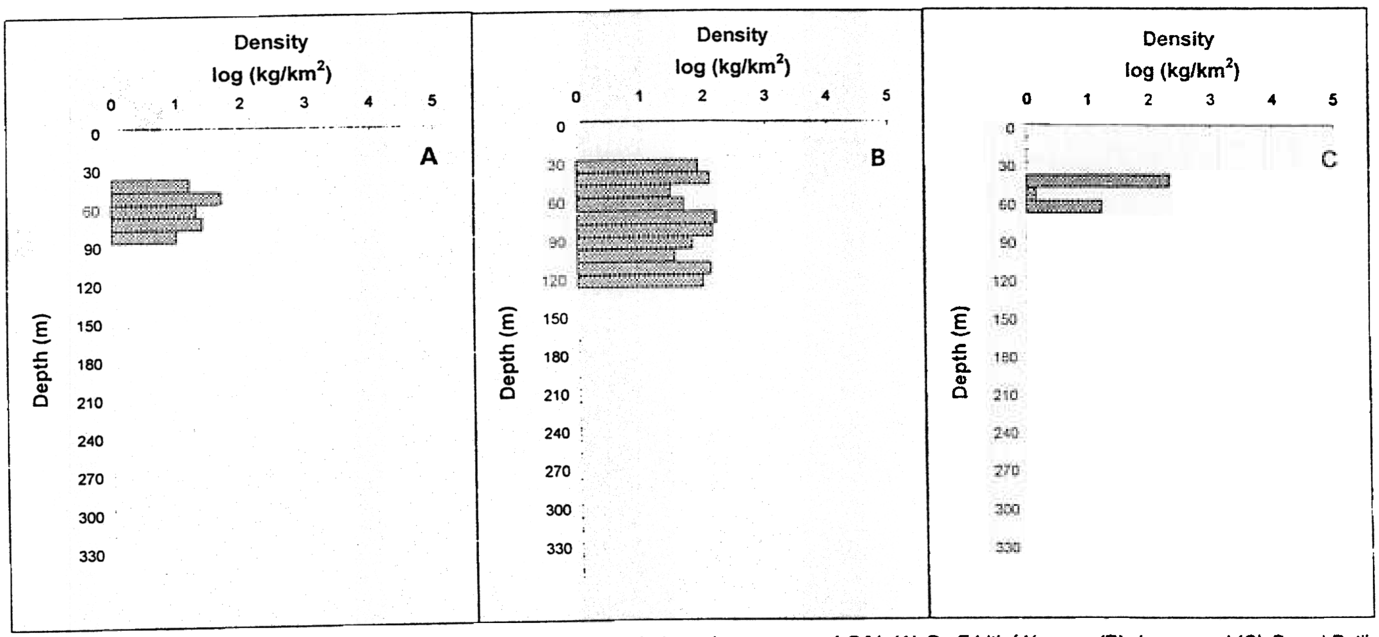


Fig. 86. Depth distribution of goldband goatfish, *Upeneus moluccensis*, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen*, (B) *Jurong* and (C) *Bawal Putih 2.*
[Gambar 86. Penyebaran kedalaman ikan bijinangka, Upeneus moluccensis, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen, *(B)* Jurong *dan (C)* Bawal Putih 2.*]*

Sulphur goatfish (English); Kunir (Indonesian); Kakunir, Kunir, Kuniran (Java); Bidji nangka (West Java, Jakarta).

Medium-sized fish of moderately elongate bodies. Head small; mouth small and slightly oblique; a pair of barbels under the chin. Dorsal fins with 2 to 3 olive bars, and black or dark brown tips; anal, pelvic and pectoral fins pale; caudal fin plain dull yellow, its hind margin dusky, its lower lobe tipped white. Two orange-yellow bands extend from the head to the caudal peduncle. Dorsal spines: 8-8; soft rays: 8-8; anal spines: 1-1; soft rays: 7-7. L_{max1} = 23 cm; L_{max2} = n.a.; L_{max3} = 23 cm TL (Fig. 87A). See Fig. 87B and Table 47 for length-weight relationship.

From East Africa to Southeast Asia; through Indonesia (Fig. 88); northward to the coast of China and southward to the northern coasts of Australia; also reported from New Caledonia.

Forms schools in coastal waters. Depth range: 10-90 m (Fig. 89). Table 48 presents four sets of growth parameters from Indonesia.

References: 393, 1263, 1314, 1379, 1392, 1435, 1449, 1474, 1486, 1966, 2029, 2110, 2178, 2857, 2871, 2926, 3470, 4749,

Table 47. Length-weight (g/[TL;cm]) relationship of sulphur goatfish, *Upeneus sulphureus*, in Indonesia.
[Tabel 47. Hubungan panjang-berat (g/[TL;cm]) ikan kunir, Upeneus sulphureus, *di Indonesia.]*

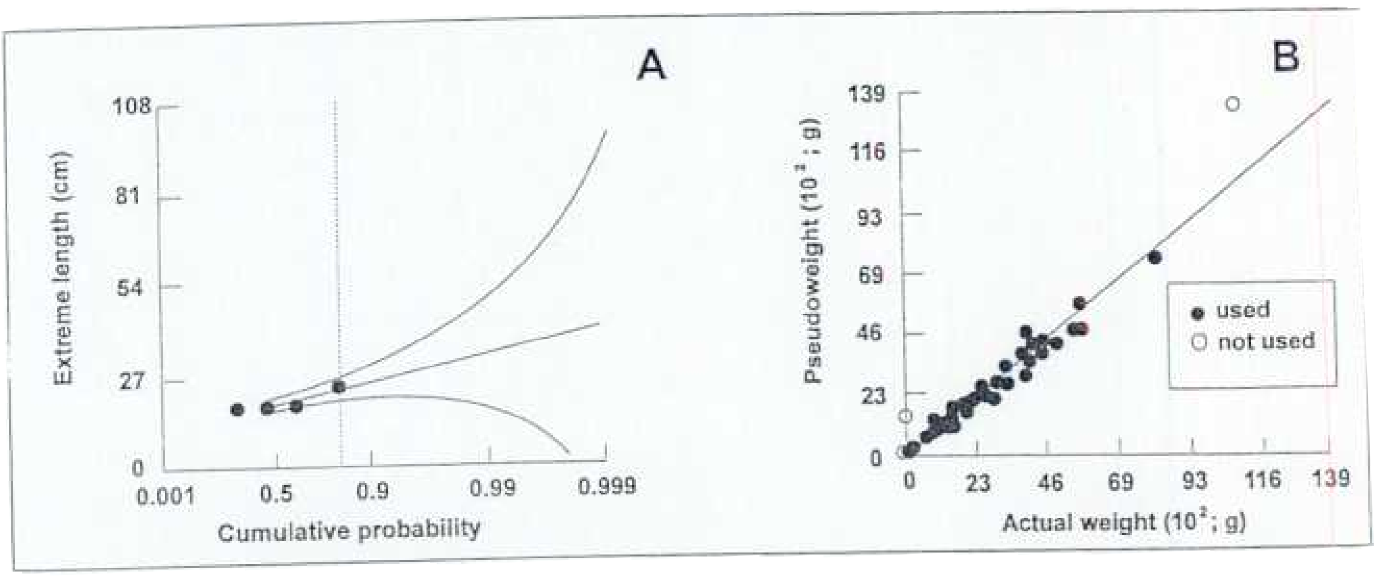
Parameter	Estimate A	Estimate B
a	0.009	0.0081
s.e.(a)	n.a.	0.0027
b	3.193	3.2134
s.e.(b)	n.a.	0.1272
r^2	n.a.	0.9782

A. Java (north coast) (Ref. 1379)
B. This study

Table 48. Growth parameters of sulphur goatfish, *Upeneus sulphureus*.
[Tabel 48. Parameter pertumbuhan ikan kunir, Upeneus sulphureus.*]*

Parameter	A	B	C	D
L_∞ (TL, cm)	15.8	16.5	17.5	19.9
K (year^{-1})	1.74	0.78	0.90	0.875

A. North Java Coast (Ref. 1435)
B. Java Sea (Central Java, 1978-79) (Ref. 1314)
C. Java Sea (Central Java, 1977-78) (Ref. 1314)
D. Java Sea (Ref. 1379)



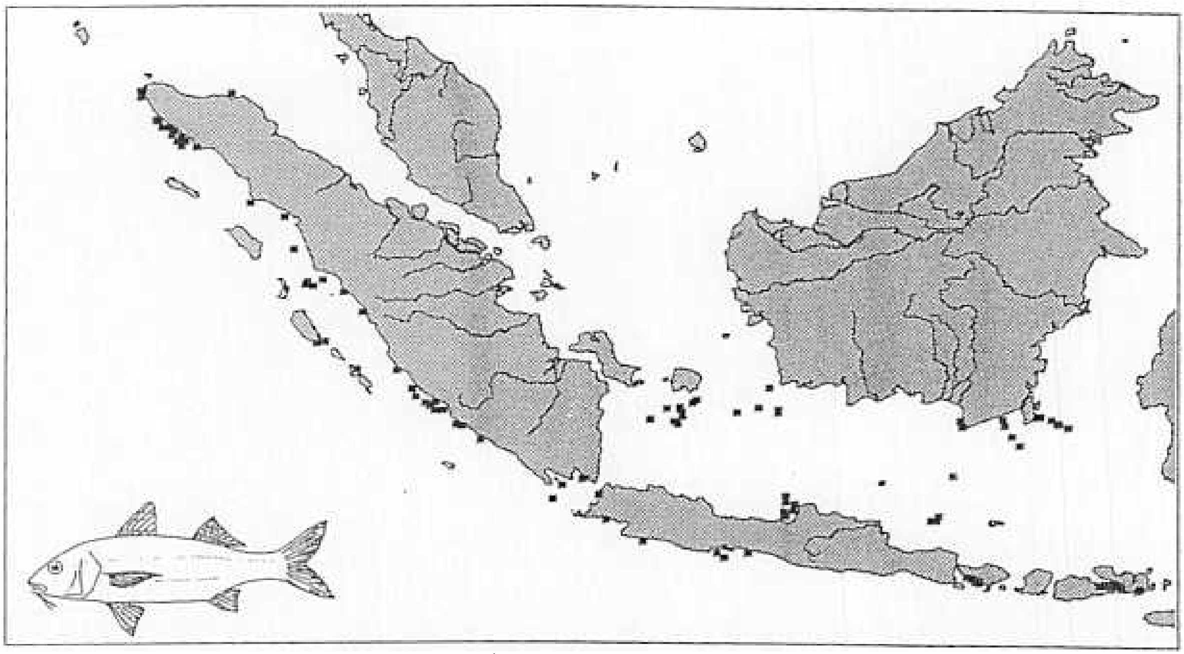


Fig. 88. Distribution of sulphur goatfish, *Upeneus sulphureus*, based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen.*
[Gambar 88. Penyebaran ikan kunir, Upeneus sulphureus, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

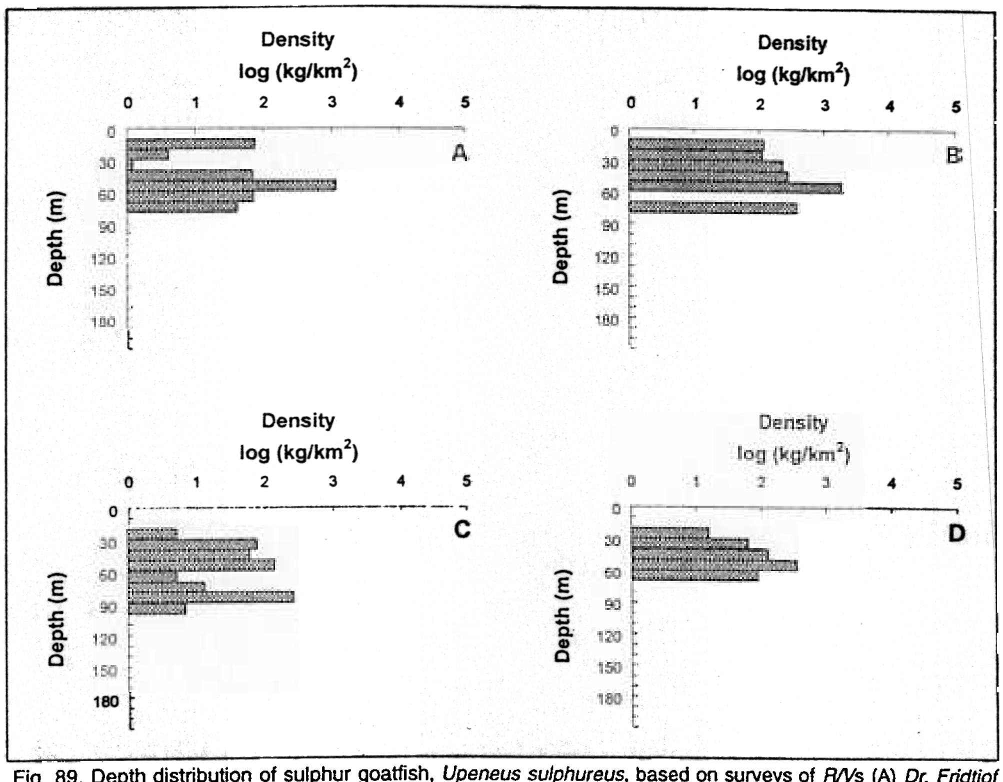


Fig. 89. Depth distribution of sulphur goatfish, *Upeneus sulphureus*, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen,* (B) *Mutiara 4,* (C) *Jurong* and (D) *Bawal Putih 2.*
[Gambar 89. Penyebaran kedalaman ikan kunir, Upeneus sulphureus, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen, *(B)* Mutiara 4, *(C)* Jurong *dan (D)* Bawal Putih 2.*]*

Nemipterus thosaporni (Russell, 1991)

Palefin threadfin bream (English); Kurisi (Indonesian).

Lower edge of eye touching or just above a line from tip of snout to upper pectoral-fin base; lower edge of suborbital slightly emarginate. Dorsal fin origin about 3-7 scale rows from imaginary line projected upward from posterior edge of suborbital to dorsal profile. Pectoral and pelvic fins long, reaching to or just short of level of anal-fin origin. Closely resembles *N. bathybius*, but has no yellow stripe on either side of the ventral midline and the upper tip of the caudal fin not drawn into a distinct filament. Axillary scale present. Color: Upper part pinkish, silvery below. Dorsal spines: 10-10; soft rays: 9-9; anal spines: 3-3; soft rays: 7-7. L_{max1} = 21.5 cm SL; L_{max2} = 23 cm TL; L_{max3} = n.a. See Table 49 for length-weight relationship.

Widely distributed throughout the Western Pacific, notably in the Strait of Malacca, the Gulf of Thailand, the Sunda Islands, Indonesia (Fig. 90), and to southern Japan. This species has been previously misidentified as *N. marginatus* by most authors. Fig. 90 shows its distribution based on records of the *R/Vs Mutiara 4, Jurong* and *Dr. Fridtjof Nansen* surveys; Fig. 91 provides details on the distribution of *N. thosaporni* in the southern part of the South China Sea.

Found on sand or mud bottoms. Depth range: 10-80 m (Fig. 92). During that part of the *R/V Mutiara 4* survey which covered Area 5 in Pauly et al. (this vol.), i.e., the southern part of the South China Sea, D. Pauly and P. Martosubroto (Ref. 1158) measured a large number of nemipterids belonging to this species, which they thought was *Nemipterus marginatus.* This does not invalidate the results obtained by these two authors, and their main findings which are recalled here (see Box 4). Table 50 presents a set of growth parameters from Indonesia.

References: 171, 1066, 1139, 1158, 3207, 3810

Table 49. Length-weight (g/[TL;cm]) relationship of palefin threadfin bream, *Nemipterus thosaporni*, in Indonesia.
[Tabel 49. Hubungan panjang-berat (g/[TL;cm]) ikan kurisi, Nemipterus thosaporni, *di Indonesia.]*

Parameter	Estimate*
a	0.0135
b	3.02
r	0.999

*West Kalimantan (Ref. 1158)

Table 50. Growth parameters of palefin threadfin bream, *Nemipterus thosaporni.*
[Tabel 50. Parameter pertumbuhan ikan kurisi, Nemipterus thosaporni.*]*

Parameter	A	B
L_∞ (TL, cm)	24.5	28.4
K ($year^{-1}$)	0.420	0.363

A. Western Kalimantan (Ref. 1158)
B. Sarawak and Sabah (Northern Kalimantan) (Ref. 1139)

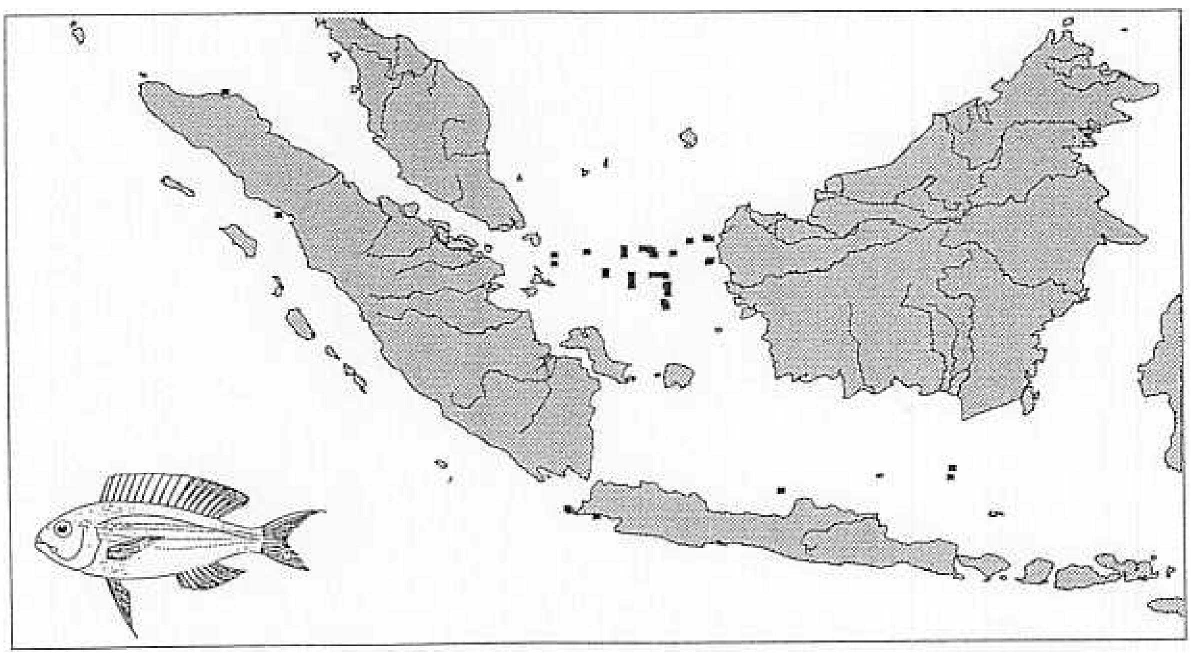


Fig. 90. Distribution of palefin threadfin bream, *Nemipterus thosaporni*, based on records of the surveys of *R/Vs Mutiara 4, Jurong* and *Dr. Fridtjof Nansen.*
[Gambar 90. Penyebaran ikan kurisi, Nemipterus thosaporni, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Jurong *dan* Dr. Fridtjof Nansen.*]*

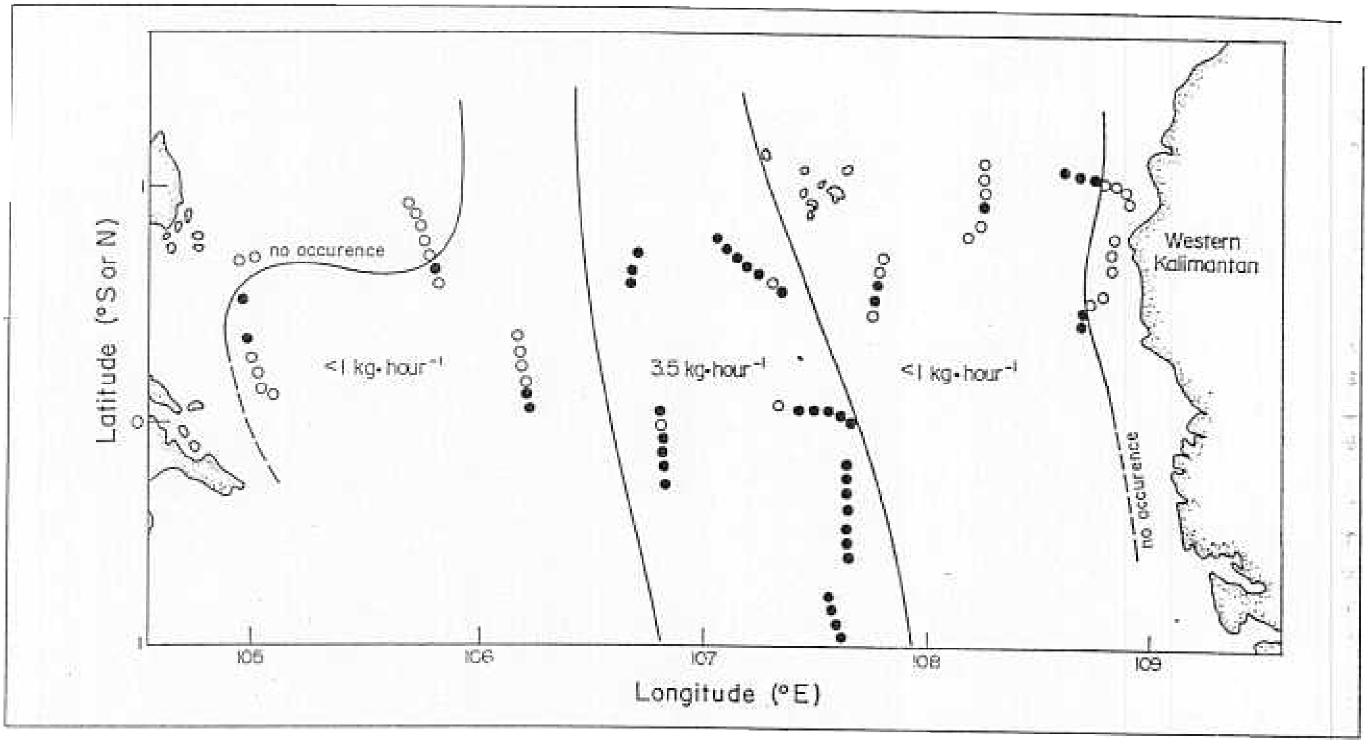


Fig. 91. Distribution and relative abundance of palefin threadfin bream, *Nemipterus thosapomi*, in the southern part of the South China Sea from 9 August to 29 September 1975. See Pauly et al. (this vol.) for details on this survey.
[Gambar 91. Penyebaran dan kelimpahan relatif ikan kurisi, Nemipterus thosapomi, *di bagian selatan Laut Cina Selatan dari 9 Agustus hingga 29 September 1975. Lihat Pauly et al. (dalam buku ini) untuk rincian survei ini.]*

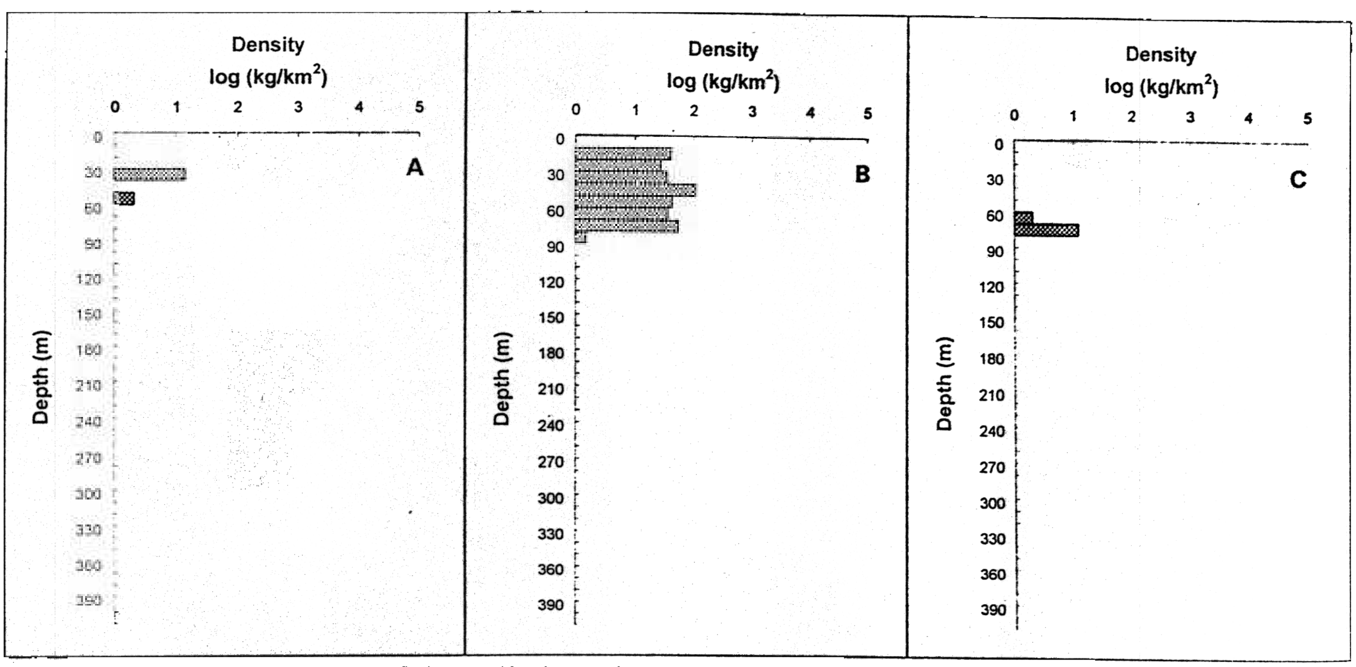


Fig. 92. Depth distribution of palefin threadfin bream, *Nemipterus thosaporni*, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen*, (B) *Mutiara 4* and (C) *Jurong*.
[Gambar 92. Penyebaran kedalaman ikan kurisi, Nemipterus thosaporni, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen, *(B)* Mutiara 4 *dan (C)* Jurong.*]*

Box. 4. A case study of *Nemipterus thosaporni* a.k.a *N. marginatus*.
[Boks 4. Suatu studi kasus dari Nemipterus thosaporni, *yang dikenal juga dengan nama* N. marginatus.*]*

Purwito Martosubroto and I measured, from 6 August to 29 September 1975 (Ref. 1158) the 3,283 specimens of *N. thosaporni* (which we called *N. marginatus*) in the table below during a survey off Western Kalimantan (see Fig. 91).

Summary of length-frequency data on *Nemipterus thosaporni* from Western Kalimantan (= 3,283).

Lower limit of class (TL; cm)	N*	Lower limit of class (TL; cm)	N*
7.5	1	15.5	172
8.0	3	16.0	140
8.5	9	16.5	133
9.0	16	17.0	102
9.5	40	17.5	79
10.0	55	18.0	82
10.5	100	18.5	78
11.0	122	19.0	59
11.5	157	19.5	39
12.0	200	20.0	24
12.5	218	20.5	12
13.0	211	21.5	13
13.5	287	21.5	8
14.0	356	22.0	2
14.5	334	22.5	3
15.0	226	23.0	2

* Sum of 44 samples: Stations 59-147: see Fig. 4 in Pauly et al. (this vol.).

In the absence of computers, we used the then popular, graphical "Cassie method" (Ref. 9564) to split our cumulative samples into three normally distributed components, to which we assigned relative ages, which were then used to estimate von Bertalanffy growth parameters that compared well with previous estimate from Northern Kalimantan (Table 50). These growth parameters, complemented with a length-weight relationship (Table 49), and an estimate of M - estimated from the size distribution in the then unexploited stock - allowed computation of yield-per-recruit curves.

This entire procedure - although involving no development of new methodology - was exemplary in that it illustrated how a wide range of analytic techniques could be applied to data obtained during a fairly standard trawl survey, and a more or less complete "assessment" thus being performed using data then generally not perceived as being sufficient for such purpose.

Although it has been cited perhaps 20 times to date, this work is now rather well known among fisheries scientists in the tropics because it formed the base of a "case study", taught in the 1980s by Dr. Erik Ursin, of the roving FAO/DANIDA Training Course in Tropical Fish Stock Assessment, and consisting of the following elements:

i) evaluation of the work's methodology, based on copies of all paper cited in its "Methods" section;

ii) evaluation of the "Results" section, based on recomputation of all estimates, and re-evaluation of all assumptions (explicit and implicit); and

iii) evaluation of the "Discussion" section, through comparison with similar results in contemporary contributions (e.g., Ref. 1066), and later advances.

The paper survived this rather stringent test of its replicability, and the fish was thus allowed to migrate, via my textbook of 1984 (Ref. 4715) into the text that emerged from the above-mentioned training course (Ref. 9566).

I wish we had written more such papers.

Daniel Pauly
ICLARM
and
Fisheries Centre, UBC

Priacanthus macracanthus (Cuvier 1829)

Red bigeye (English); Swanggi (Indonesian); Swanggi (Javanese).

Medium-sized fish of moderately deep body. The eyes large; the mouth oblique, with the lower jaw projecting upwards. The body tapers very slightly to beneath the middle of the soft portion of the dorsal fin, then abruptly to the peduncle. This species is distinguished from *Priacanthus fitchi* by the presence of numerous rusty brown to yellowish spots in the membranes of the dorsal and anal fins, and its less tapered body. Dorsal spines: 10-10; soft rays: 12-14; anal spines: 3-3; soft rays: 13-14. L_{max1} = 29 cm SL; L_{max2} = n.a.; L_{max3} = 25.2 cm TL (Fig. 93A). See Fig. 93B and Table 51 for length-weight relationship.

East Indo-West Pacific: from southern Japan in the north to Western Indonesia (Fig. 94) and Australia in the south.

Occurs in inshore and offshore reefs, apparently forms aggregations in open bottom areas. Depth range: 20-350 m (Fig. 95). Table 52 presents 2 sets of growth parameters from Indonesia.

References: 559, 1263, 1314, 1449, 2857, 3132, 3414, 4539, 4885, 5381, 5736, 5756

Table 51. Length-weight (g/[TL;cm]) relationship of red bigeye, *Priacanthus macracanthus,* in Indonesia.
Tabel 51. Hubungan panjang-berat (g/[TL;cm]) ikan swanggi, Priacanthus macracanthus, *di Indonesia.*

Parameter	Estimate
a	0.0163
s.e.(a)	0.0072
b	2.9914
s.e.(b)	0.1648
r^2	0.9543

Table 52. Growth parameters of red bigeye, *Priacanthus macracanthus.*
Tabel 52. Parameter pertumbuhan ikan swanggi, Priacanthus macracanthus.

Parameter	A	B
L_∞ (TL, cm)	23	23.8
K (year^{-1})	1.15	1.30

A. Java Sea (Central Java, 1978-79) (Ref. 1314)
B. Java Sea (Central Java, 1977-78) (Ref. 1314)

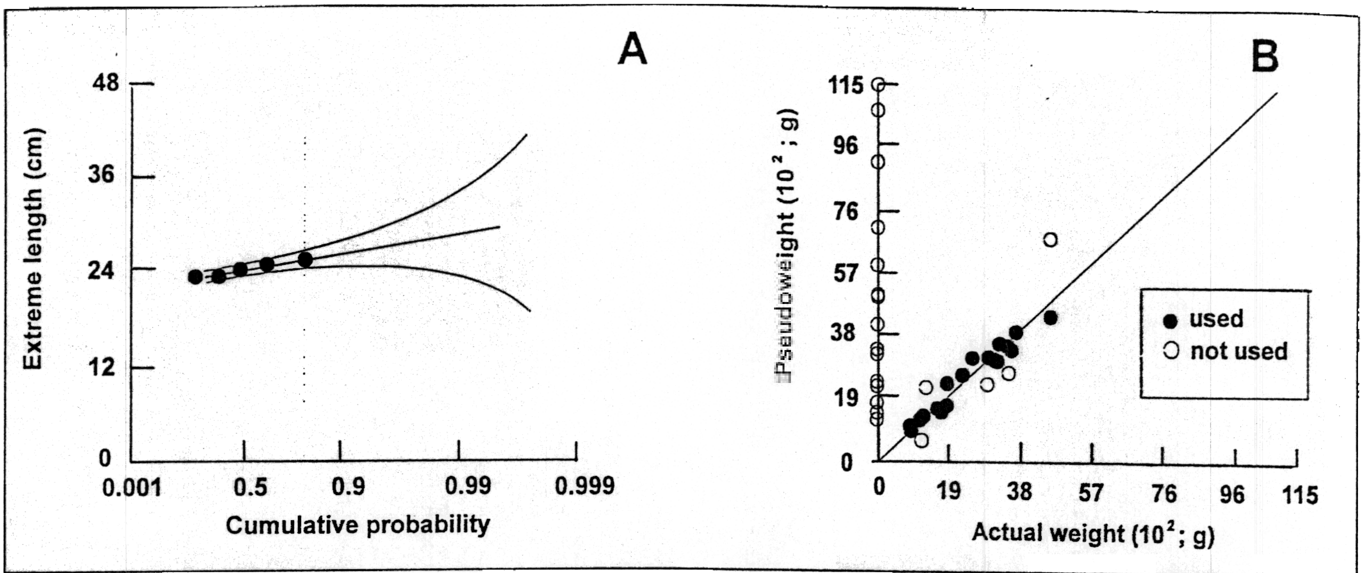


Fig. 93. (A) Extreme value plot for red bigeye, *Priacanthus macracanthus*, in Indonesia based on data from *R/Vs Mutiara 4* and *Dr. Fridtjof Nansen* showing maxima of 5 length-frequency samples, and estimate of L_{max3} = 25.2 ± 1.0 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 19 length-frequency samples of red bigeye, *Priacanthus macracanthus*, from Western Indonesia based on data from *R/Vs Mutiara 4* and *Dr. Fridtjof Nansen* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 51). Open dots represent outliers, not used for analysis.

[Gambar 93. (A) Gambaran nilai ekstrim ikan swanggi, Priacanthus macracanthus, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Dr. Fridtjof Nansen *yang menunjukkan nilai maksimum untuk 5 contoh frekuensi-panjang, dan angka perkiraan* L_{max3} *= 25.2 ± 1.0 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 19 contoh frekuensi-panjang ikan swanggi,* Priacanthus macracanthus, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Dr. Fridtjof Nansen *sebagai luaran perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 51). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

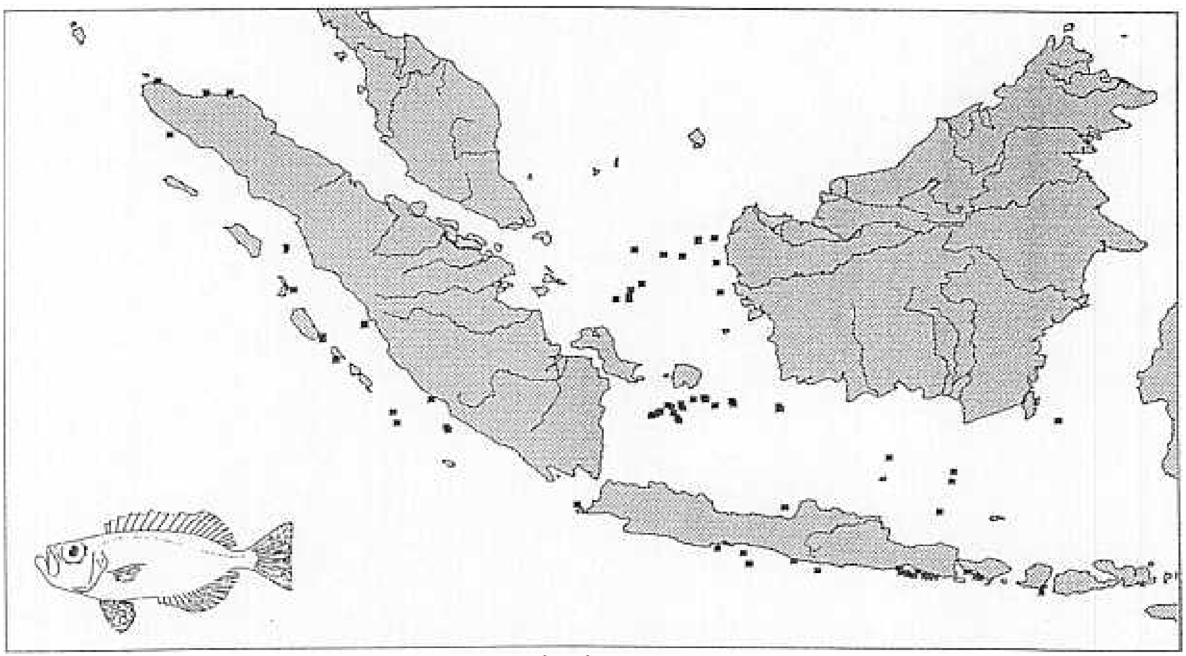


Fig. 94. Distribution of red bigeye, *Priacanthus macracanthus*, based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen*.

[Gambar 94. Penyebaran ikan swanggi, Priacanthus macracanthus, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

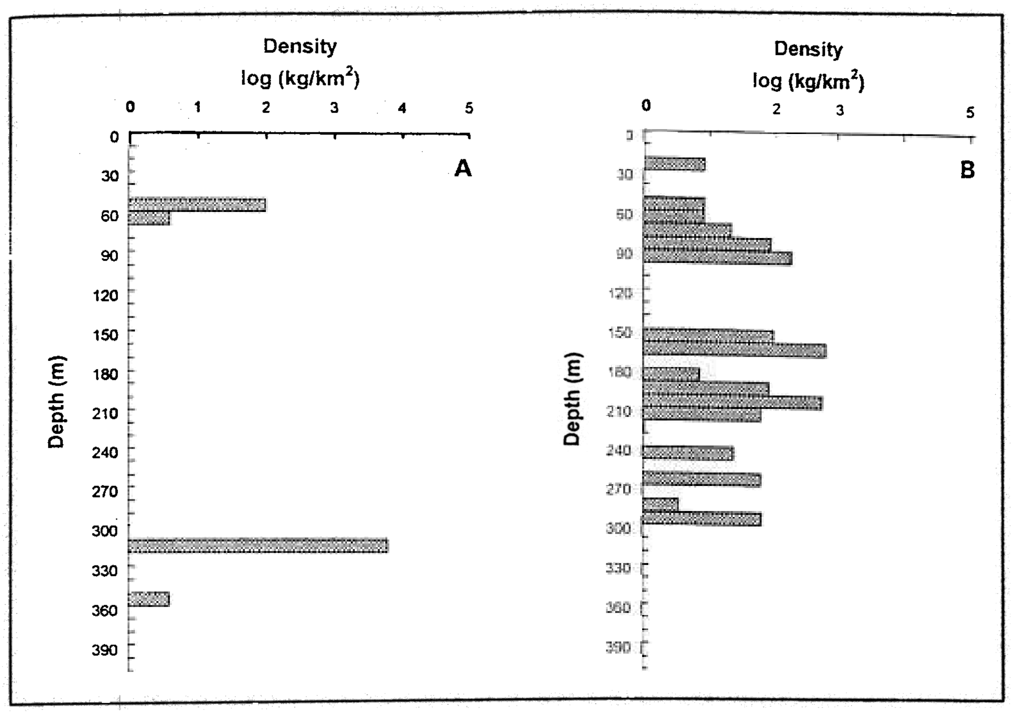


Fig. 95. Depth distribution of red bigeye, *Priacanthus macracanthus*, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen* and (B) *Jurong*.
[Gambar 95. Penyebaran kedalaman ikan swanggi, Priacanthus macracanthus, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen *dan (B)* Jurong.*]*

Rastrelliger kanagurta (Cuvier, 1816)

Indian mackerel (English); Kembung lelaki (Indonesian); Banjar, Kembung lelaki (West Java, Jakarta); Gombong (Central Java); Bulus lake, Saängsa (Madura); Banjara (South Sulawesi, Makassar); Botto-botto (South Sulawesi, Bugis); Banjar (South Sulawesi, Badjo).

Head longer than body depth. Maxilla partly concealed, covered by lacrimal bone but extending to about hind margin of eye. Bristles on longest gillraker 105 on one side in specimens of 12.7 cm, 140 in 16 cm, and 160 in 19 cm fork length specimens. A black spot on body near lower margin of pectoral fin. Interpelvic process small and single. Swimbladder present. Anal spine rudimentary. Dorsal spines: 8-11; soft rays: 12-12; anal spines: 0-0; soft rays: 12-12. L_{max1} = 36 cm TL; L_{max2} = 26 cm; L_{max3} = 26.8 cm TL (Fig. 96A). See Fig. 96B and Table 53 for length-weight relationship.

Indo-West Pacific: from South Africa and the Seychelles in the east to the Red Sea, and Southeast Asia; Indonesia (Fig. 97); north to the Ryukyu Islands, China. Southeast to Northern Australia, Melanesia, Micronesia, Samoa. Entered the eastern Mediterranean Sea through the Suez Canal.

Form schools in coastal waters, bays and deep lagoons, usually in plankton-rich waters. Depth range: 20-90 m (Fig. 98). Feeds on phytoplankton (diatoms) and small zooplankton (cladocerans, ostracods, larval polychaetes, etc.). Adult individuals feed on macroplankton (larval shrimps and fish). Table 54 presents six sets of growth parameters from Indonesia.

References: 168, 171, 312, 762, 786, 821, 1139, 1195, 1196, 1197, 1198, 1263, 1314, 1389, 1392, 1447, 1449, 1462, 1463, 1464, 1465, 1466, 1467, 1485, 1488, 1531, 1602, 1687, 1751, 1836, 2178, 3557, 3626, 3621, 3579, 3669, 3670, 3678, 4546, 4547, 4593, 4749, 4789, 4838, 5213, 5284, 5385, 5450, 5756

Table 53. Length-weight (g/[TL;cm]) relationship of Indian mackerel, *Rastrelliger kanagurta*, in Indonesia.
[Tabel 53. Hubungan panjang-berat (g/[TL;cm]) ikan kembung lelaki, Rastrelliger kanagurta, *di Indonesia.]*

Parameter	Estimates A	B	C	D	E
a	0.0039	0.0061	0.0022	0.0014	0.0061
s.e. (a)	n.a.	n.a.	n.a.	n.a.	0.0027
b	3.1900	3.1910	3.3300	3.3770	3.1743
s.e. (b)	n.a.	n.a.	n.a.	n.a.	0.1437
r^2	n.a.	n.a.	n.a.	n.a.	0.9909

A. Indonesia, Java Sea (Ref. 1463)
B. Indonesia, Java Sea (Ref. 1196)
C. Indonesia, Andaman Islands (Ref. 1463)
D. Indonesia, Malacca Strait (Ref. 1389)
E. This study

Table 54. Growth parameters of Indian mackerel, *Rastrelliger kanagurta*.
Tabel 54. Parameter pertumbuhan ikan kembung lelaki, Rastrelliger kanagurta.

Parameter	A	B	C	D	E	F
L_∞ (TL, cm)	23.9	25.7	25.8	26.5	28.5	28.7
K (year^{-1})	2.76	1.625	1.63	0.80	0.90	0.78

A. Indonesia, Java Sea (Ref. 1196)
B. Indonesia, Java Sea (Ref. 1447)
C. Indonesia, Java Sea (Pekalongan, 1982-83) (Ref. 1314)
D. Indonesia, Asahan, Sumatra (Ref. 1467)
E. Indonesia, Banda Aceh (Ref. 4547)
F. Indonesia, Strait of Malacca (1984-86) (Ref. 1389)

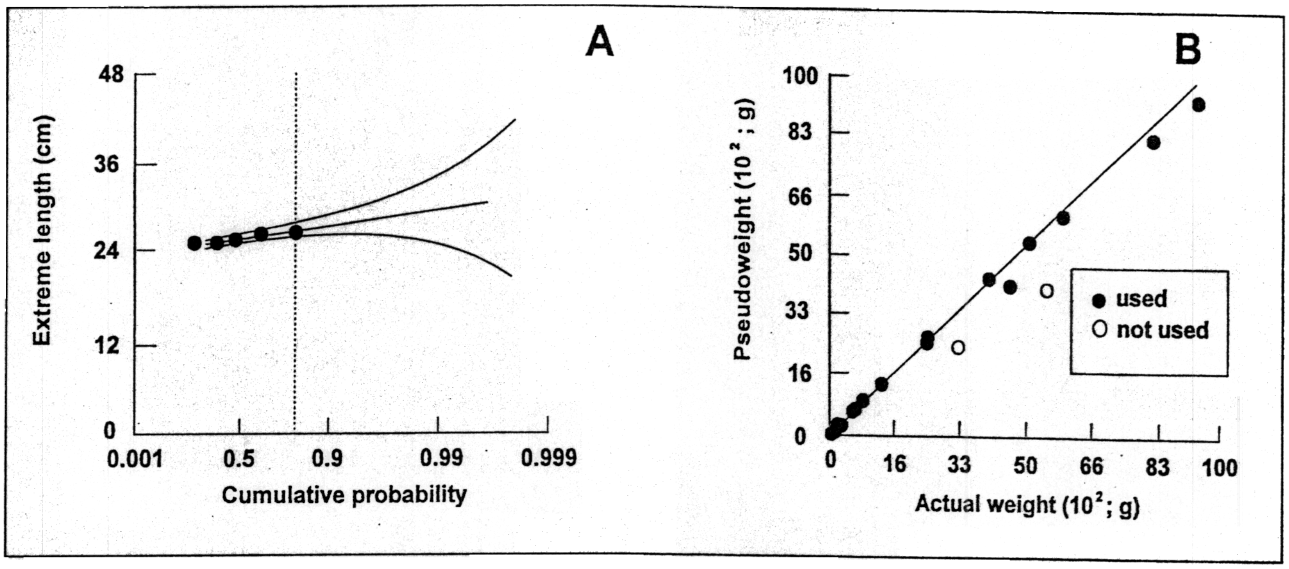


Fig. 96. (A) Extreme value plot for Indian mackerel, *Rastrelliger kanagurta*, in Indonesia based on data from *R/Vs Mutiara 4* and *Jurong* showing maxima of 5 length-frequency samples, and estimate of L_{max3} = 26.8 ± 0.85 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 16 length-frequency samples of Indian mackerel, *Rastrelliger kanagurta*, from Western Indonesia based on data from *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 53). Open dots represent outliers, not used for analysis.
[Gambar 96. (A) Gambaran nilai ekstrim ikan kembung lelaki, Rastrelliger kanagurta, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Jurong *yang menunjukkan nilai maksimum 5 contoh frekuensi-panjang, dan angka perkiraan* L_{max3} *= 26.8 ± 0.85 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 16 contoh frekuensi-panjang ikan kembung lelaki,* Rastrelliger kanagurta, *dari Indonesia bagian barat berdasarkan data kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen *sebagai luaran perangkat lunak ABee (lihat Box 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 53). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

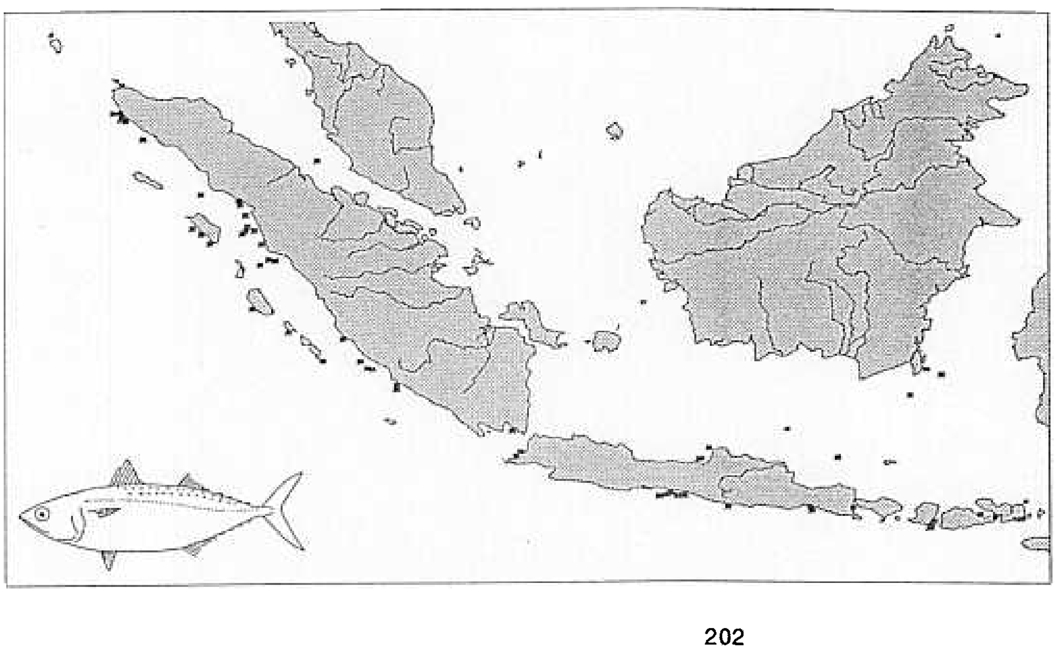


Fig. 97. Distribution of Indian mackerel, *Rastrelliger kanagurta*, based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen*.
[Gambar 97. Penyebaran ikan kembung lelaki, Rastrelliger kanagurta, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

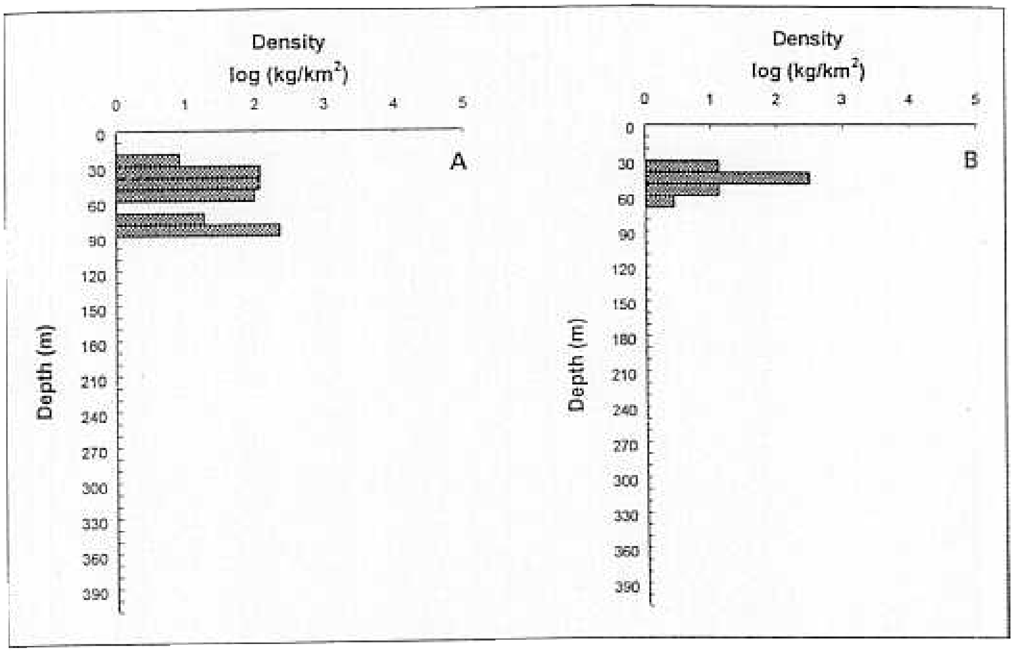


Fig. 98. Depth distribution of Indian mackerel, Rastrelliger kanagurta, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen* and (B) *Bawal Putih 2.*
[Gambar 98. Penyebaran kedalaman ikan kembung lelaki, Rastrelliger kanagurta, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen *dan (B)* Bawal Putih 2.*]*

Scomberomorus commerson (Lacepède, 1800)

Narrow-barred Spanish mackerel (English); Tjalong (Indonesian); Tengiri (West Java, Jakarta); Langung, Tengere, Tjalong, Tjangetjang (Madura).

Interpelvic process small and bifid. Swimbladder absent. Lateral line abruptly bent downward below end of second dorsal fin. Intestine with 2 folds and 3 limbs. Vertical bars on trunk sometimes break up into spots ventrally which number 40-50 in adults, and less than 20 in juveniles (which have jet black anterior first dorsal fin). Dorsal spines: 15-18; soft rays: 15-20; anal spines: 0-0; soft rays: 16-21. L_{max1} = 220 cm FL; L_{max2} = n.a.; L_{max3} = 96.9 cm FL (Fig. 99A). See Fig. 99B and Table 55 for length-weight relationship.

Indo-West Pacific: from South Africa and the Red Sea

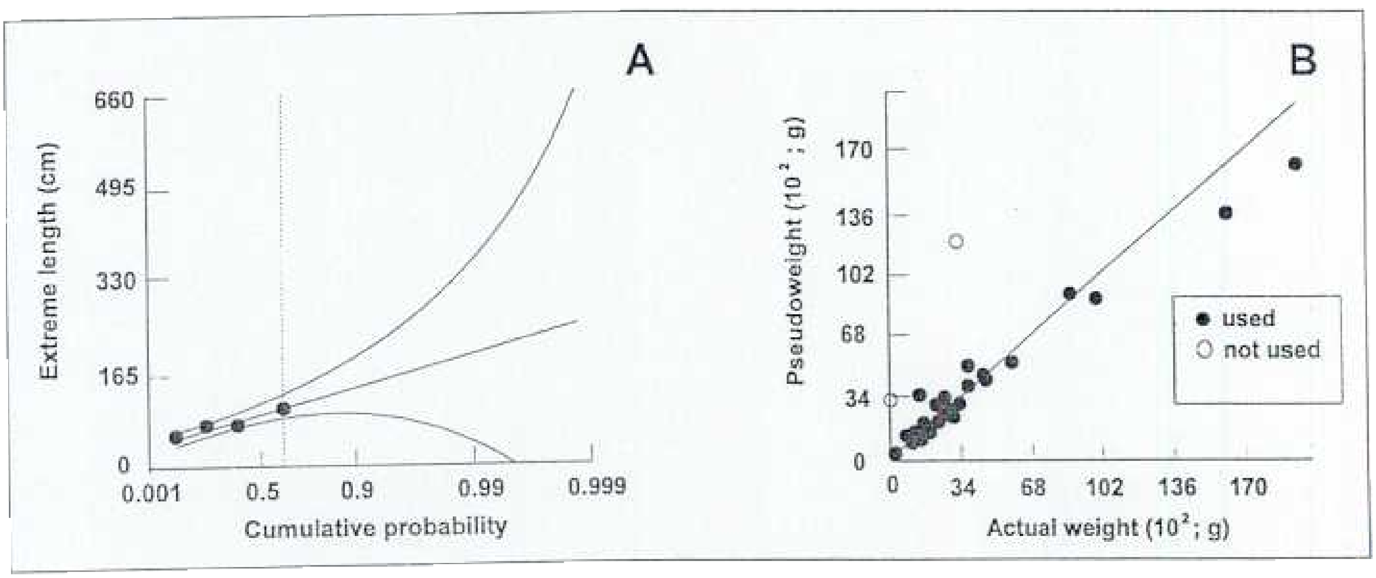


Fig. 99. (A) Extreme value plot for narrow-barred Spanish mackerel, *Scomberomorus commerson*, in Indonesia based on data from *R/V Jurong* showing maxima of 4 length-frequency samples, and estimate of L_{max3} = 96.9 ± 26.2 cm FL. (B) Predicted *vs.* observed weights (in g wet weight) of 32 length-frequency samples of narrow-barred Spanish mackerel, *Scomberomorus commerson*, from Western Indonesia based on data from *R/Vs Mutiara 4* and *Jurong* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 55). Open dots represent outliers, not used for analysis.
[Gambar 99. (A) Gambaran nilai ekstrim ikan tenggiri papan, Scomberomorus commerson, *di Indonesia berdasarkan data dari kapal penelitian* Jurong *menunjukkan nilai maksimum dari 4 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 96.9 ± 26.2 cm FL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 32 contoh frekuensi panjang ikan tenggiri papan,* Scomberomorus commerson, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Jurong *sebagai luaran perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 55). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

through Southeast Asia, north to China and Japan and southward to Indonesia (Fig. 100) and Southeast Australia. A recent immigrant to the eastern Mediterranean Sea by way of the Suez Canal. Atlantic Ocean: reported only from St. Helena.

Found in small schools and known to undertake lengthy longshore migrations, but permanently resident populations also seem to exist. Depth range: 10-70 m (Fig. 101). Feeds primarily on small fish such as anchovies, clupeids, carangids, squids and penaeid shrimps.

References: 168, 171, 1139, 1263, 1375, 1391, 1415, 1416, 1470, 1498, 1602, 2325, 2682, 2857, 3383, 3557, 3626, 3678, 4332, 4588, 4699, 4883, 4905, 5213, 5284, 5288, 5385, 5450, 5515, 5736, 5756, 5765, 5766, 5970, 6026, 6323, 6365, 6783

Table 55. Length-weight (g/[FL;cm]) relationship of narrow-barred Spanish mackerel, *Scomberomorus commerson*, in Indonesia.
[Tabel 55. Hubungan panjang-berat (g/[FL;cm]) ikan tenggiri papan, Scomberomorus commerson, *di Indonesia.]*

Parameter	Estimate
a	0.0057
s.e. (a)	0.0046
b	3.1247
s.e. (b)	0.2094
r^2	0.9271

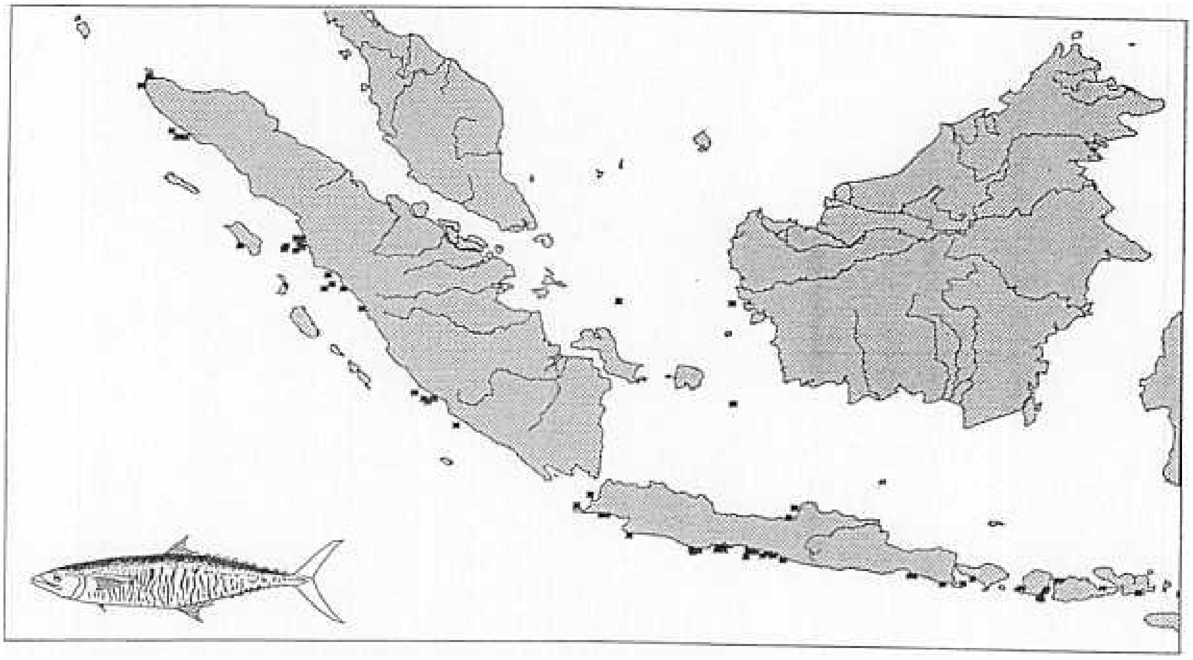


Fig. 100. Distribution of narrow-barred Spanish mackerel, *Scomberomorus commerson*, based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen.*
[Gambar 100. Penyebaran ikan tenggiri papan, Scomberomorus commerson, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

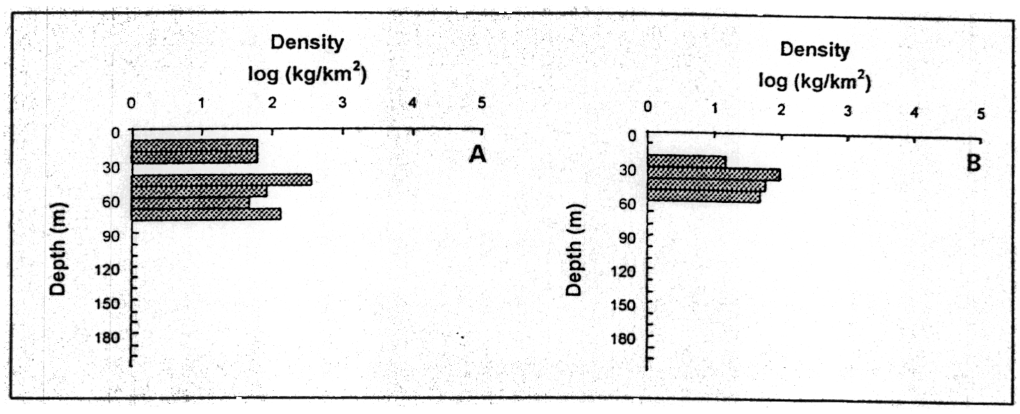


Fig. 101. Depth distribution of narrow-barred Spanish mackerel, *Scomberomorus commerson*, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen* and (B) *Bawal Putih 2.*
[Gambar 101. Penyebaran kedalaman ikan tenggiri papan, Scomberomorus commerson, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen *dan (B)* Bawal Putih 2.*]*

Scomberomorus guttatus (Bloch & Schneider, 1801)

Indo-Pacific king mackerel (English); Tenggiri (Indonesian); Ajong-ajong, Usek-usek (Java); Tengiri (West Java, Jakarta); Langung, Tengere, Tjalong, Tjangetjang (Madura); Tengiri (South Borneo).

Interpelvic process small and bifid. Swimbladder absent. Body entirely covered with small scales. Lateral line with many auxiliary branches extending dorsally and ventrally in anterior third, curving down toward caudal peduncle. Intestine with 2 folds and 3 limbs. Sides silvery white with several rows of round dark brownish spots scattered in about three irregular rows along the lateral line. First dorsal fin membrane black. Dorsal spines: 15-18; soft rays: 18-24; anal spines: 0-0; soft rays: 19-23. L_{max1} = 76 cm FL; L_{max2} = n.a.; L_{max3} = 64.4 cm FL (Fig. 102A). See Fig. 102B and Table 56 for length-weight relationship.

Indo-West Pacific from the Persian Gulf, India and Sri Lanka to Southeast Asia, Indonesia (Fig. 103); north to Hong Kong and Wakasa Bay, Sea of Japan.

Depth range: 20-90 m (Fig. 104). A pelagic migratoryy fish inhabiting coastal waters; sometimes entering turbid estuarine waters, usually found in small schools. Feeds mainly on small schooling fishes (especially sardines and anchovies), squids and crustaceans.

References: 168, 171, 280, 298, 2682, 3383, 4515, 4588, 4883, 5515, 5285, 5736, 5756, 6313, 6365, 6567

Table 56. Length-weight (g/[FL;cm]) relationship of Indo-Pacific king mackerel, *Scomberomorus guttatus*, in Indonesia.
[Tabel 56. Hubungan panjang-berat (g/[FL;cm]) ikan tenggiri, Scomberomorus guttatus, *di Indonesia.]*

Parameter	Estimate
a	0.0096
s.e.	0.0053
b	3.0020
s.e.	0.1515
r^2	0.9777

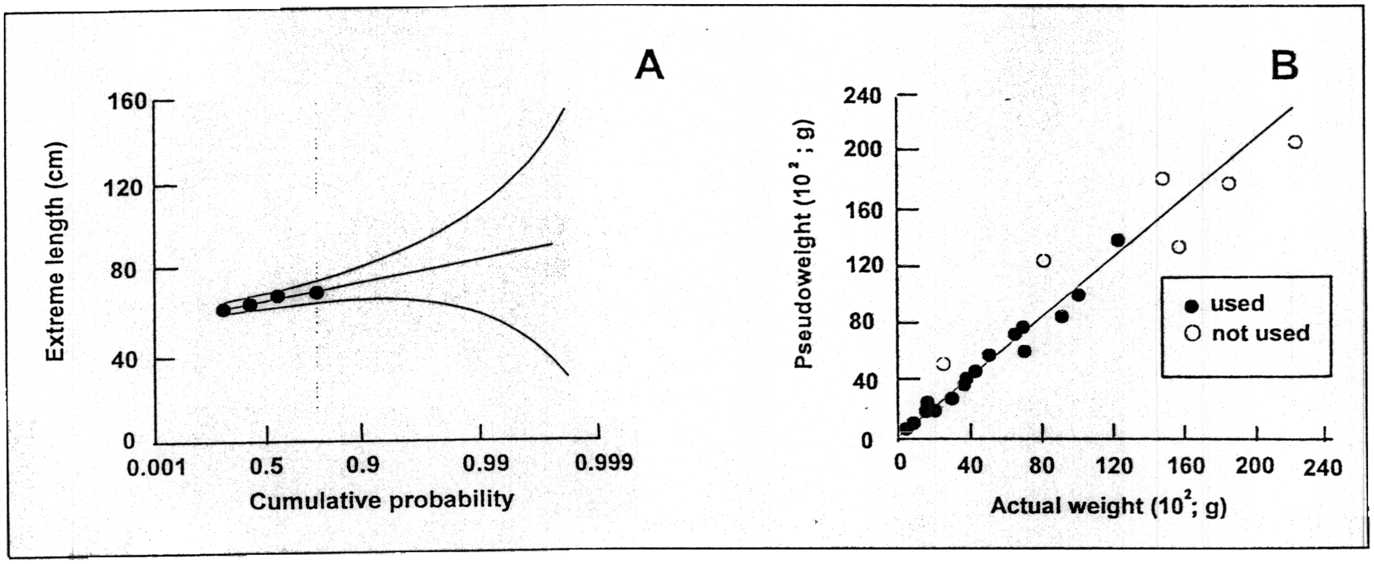


Fig. 102. (A) Extreme value plot for Indo-Pacific king mackerel, *Scomberomorus guttatus*, in Indonesia based on data from *R/Vs Mutiara 4, Bawal Putih 2* and *Dr. Fridtjof Nansen* showing maxima of 4 length-frequency samples, and estimate of L_{max3} = 64.4 ± 4.35 cm FL. (B) Predicted *vs.* observed weights (in g wet weight) of 16 length-frequency samples of Indo-Pacific king mackerel, *Scomberomorus guttatus*, from Western Indonesia based on data from *R/Vs Mutiara 4, Bawal Putih 2, Dr. Fridtjof Nansen* and *Jurong* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 56). Open dots represent outliers, not used for analysis.
[Gambar 102. (A) Gambaran nilai ekstrim ikan tenggiri, Scomberomorus guttatus, *di Indonesia berdasarkan data kapal-kapal penelitian* Mutiara 4, Bawal Putih 2 *dan* Dr. Fridtjof Nansen *menunjukkan nilai maksimum dari 4 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 64.4 ± 4.35 cm FL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 16 contoh frekuensi-panjang ikan tenggiri,* Scomberomorus guttatus, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Dr. Fridtjof Nansen *dan* Jurong *sebagai luaran perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 56). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

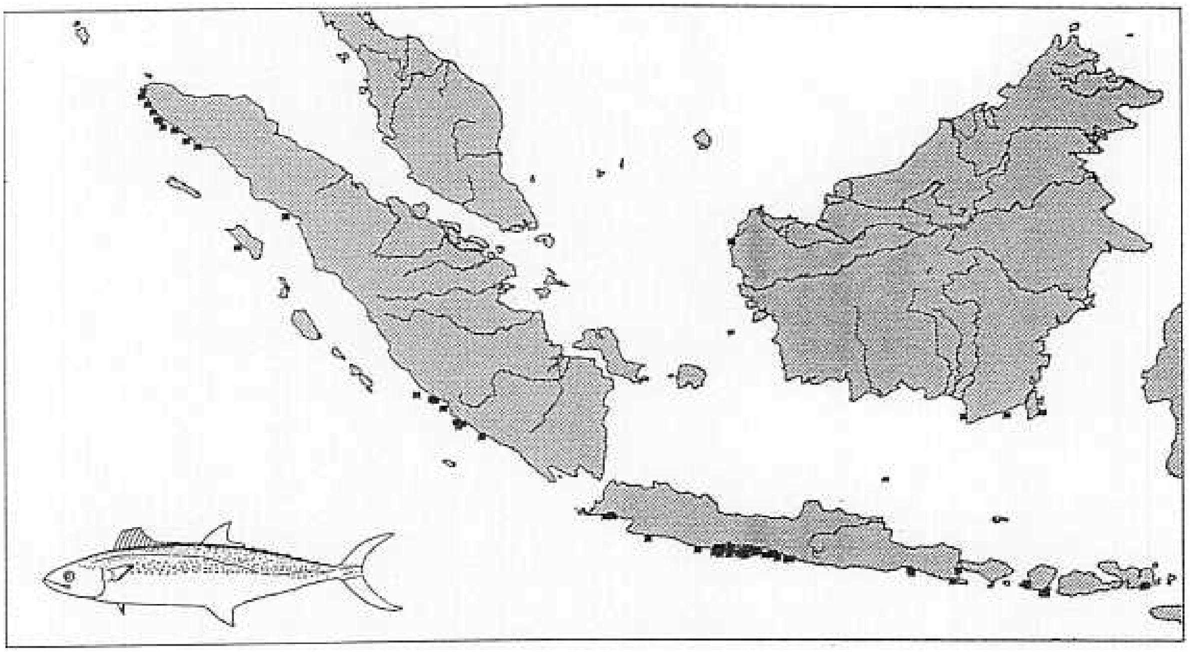


Fig. 103. Distribution of Indo-Pacific king mackerel, *Scomberomorus guttatus*, based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen.*
[Gambar 103. Penyebaran ikan tenggiri, Scomberomorus guttatus, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

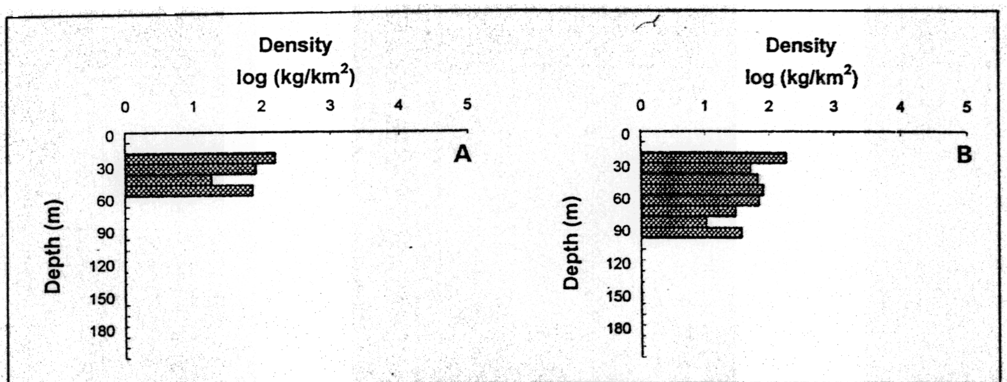


Fig. 104. Depth distribution of Indo-Pacific king mackerel, *Scomberomorus guttatus*, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen* and (B) *Jurong.*
[Gambar 104. Penyebaran kedalaman ikan tenggiri, Scomberomorus guttatus, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen *dan (B)* Jurong.*]*

Sphyraena obtusata (Cuvier, 1829)

Obtuse barracuda (English); Tantjak (Indonesia); Alu-alu, Kutjul, Langsar (Java);Alu-alu (West Java, Jakarta); Kotjol, Tantjak (Madura).

Body elongate and subcylindrical with small cycloid scales; head long and pointed. Mouth large and horizontal, the tip of the lower jaw protruding; intermaxilla non-protractile. Preoperculum rectangular, with wide naked skin flap. First dorsal fin origin slightly before the pectoral fin tip, the first spine equal to the second. Pelvic fins well before the tip of the pectoral, closer to the anal than the tip of the lower jaw. Color is generally green above and silvery below. Dorsal spines: 6-6; soft rays: 9-9; anal spines: 2-2; soft rays: 9-9. L_{max1} = 55 cm; L_{max2} = n.a.; L_{max3} = 47.3 cm FL (Fig. 105A). See Fig. 105B and Table 57 for length-weight relationship.

Indo-Pacific Ocean: East Africa and Red Sea to Philippines and Indonesia (Fig. 106); from Samoa north to Ryukyus, south to Lord Howe Islands; Kapingamarangi and Marianas in Micronesia. Migrated to eastern Mediterranean from the Red Sea via the Suez Canal.

Inhabits bays and estuaries. Found in schools in seagrass beds and rocky reefs. Depth range: 20-120 (Fig. 107). Feeds mainly on fishes.

References: 560, 1365, 1602, 2857, 4752, 5213, 5381, 5385, 5450, 5525, 5579, 5736, 5756, 6328, 6365, 6567

Table 57. Length-weight (g/[FL;cm]) relationship of obtuse barracuda, *Sphyraena obtusata*, in Indonesia.
[Tabel 55. Hubungan panjang-berat (g/[FL;cm]) ikan alu-alu, Sphyraena obtusata, *di Indonesia.]*

Parameter	Estimate
a	0.0095
s.e.(a)	0.0031
b	2.8678
s.e.(b)	0.0977
r^2	0.9961

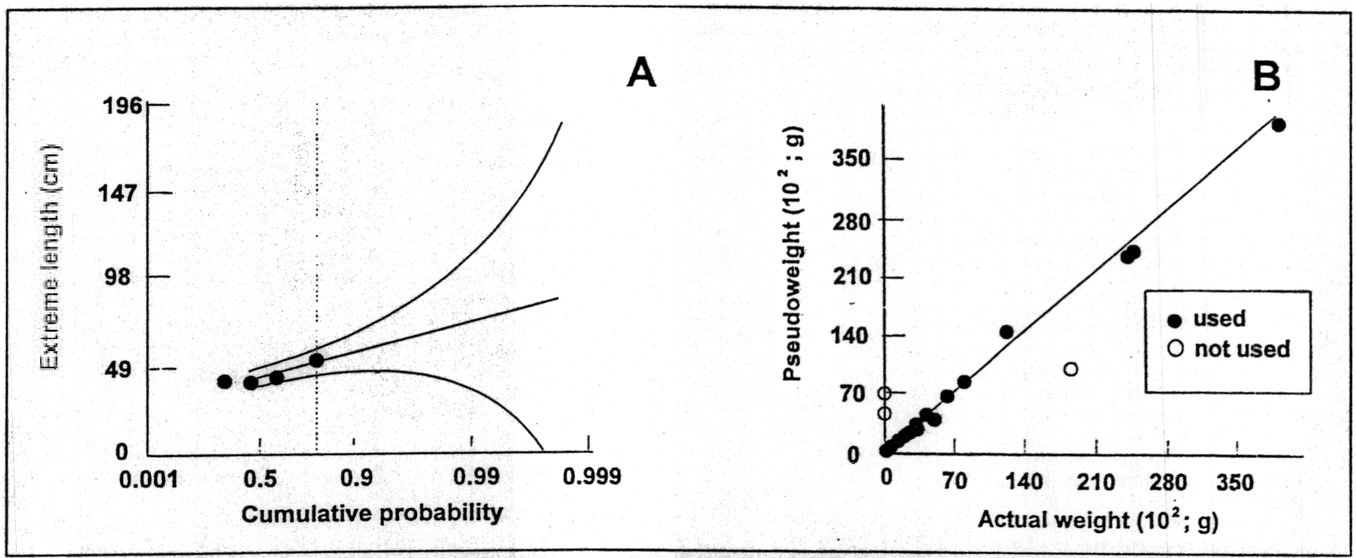


Fig. 105. (A) Extreme value plot for obtuse barracuda, *Sphyraena obtusata*, in Indonesia based on data from *R/V Jurong* showing maxima of 4 length-frequency samples, and estimate of L_{max3} = 47.3 ± 7.0 cm FL. (B) Predicted *vs.* observed weights (in g wet weight) of 19 length-frequency samples of obtuse barracuda, *Sphyraena obtusata*, from Western Indonesia based on data from *R/Vs Mutiara 4, Jurong* and *Dr. Fridtjof Nansen* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 57). Open dots represent outliers, not used for analysis. *[Gambar 105. (A) Gambaran nilai ekstrim ikan alu-alu,* Sphyraena obtusata; *di Indonesia berdasarkan data kapal penelitian* Jurong *menunjukkan nilai maksimum dari 4 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 47.3 ± 7.0 cm FL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 19 contoh frekuensi-panjang ikan alu-alu,* Sphyraena obtusata, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Jurong *dan* Dr. Fridtjof Nansen, *sebagai luaran perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 57). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

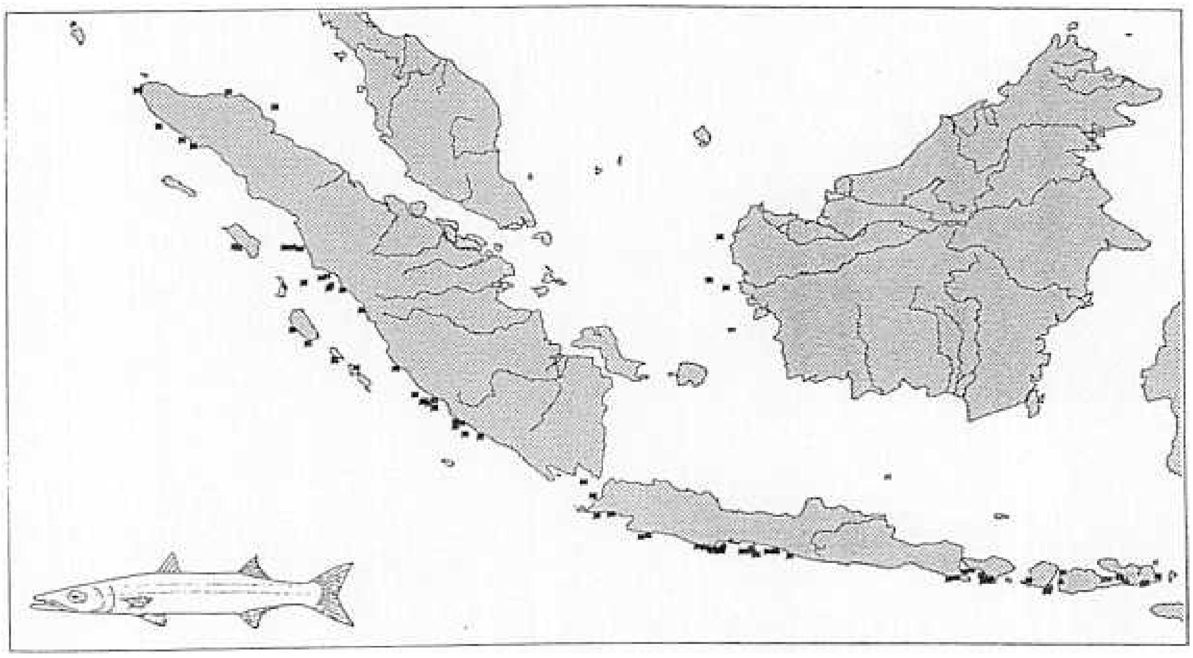


Fig. 106. Distribution of obtuse barracuda, *Sphyraena obtusata* based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen.* *[Gambar 106. Penyebaran ikan alu-alu,* Sphyraena obtusata, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

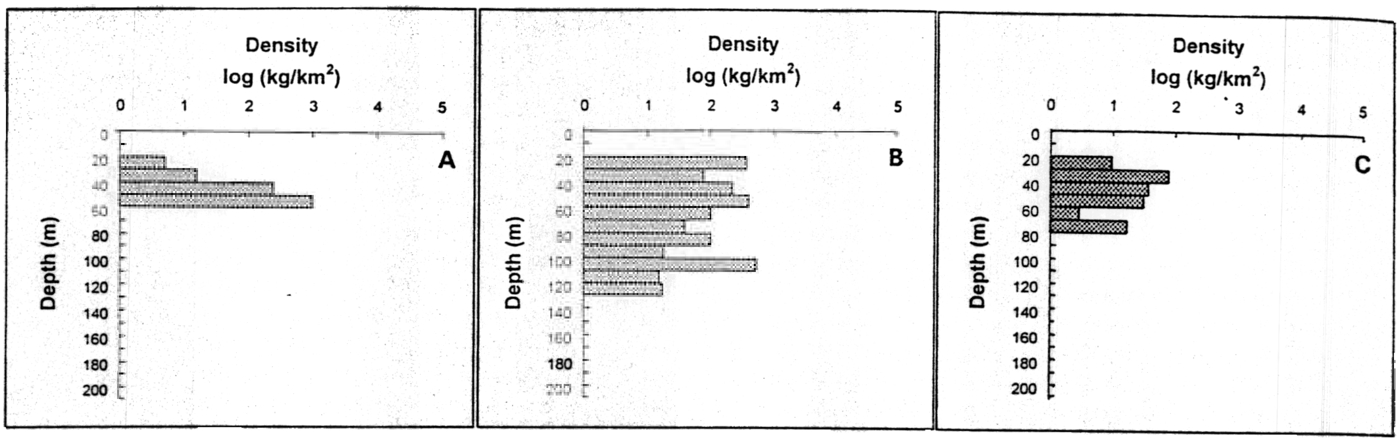


Fig. 107. Depth distribution of obtuse barracuda, *Sphyraena obtusata* based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen*, (B) *Jurong* and (C) *Bawal Putih 2*. *[Gambar 107. Penyebaran kedalaman ikan alu-alu,* Sphyraena obtusata, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen, *(B)* Jurong *dan (C)* Bawal Putih 2.*]*

Pampus argenteus (Euphrasen, 1788)

Silver pomfret (English); Bawal putih (Indonesian); Dawah, Dawahan, Lawang, Lowang (Java); Bawal, Bawal putih (West Java, Jakarta); Njiuran, Njor njoran, Potean, Potian, Tangkolok, Tjeplak (Madura); Manriwasakebo (South Sulawesi, Makassar); Peda-peda puti (South Sulawesi, Bugis).

Body very deep, and compressed. Operculum absent; gill opening reduced to a vertical slit on the side of the body; gill membrane broadly united to isthmus. Dorsal and anal fins preceded by a series of 5 to 10 blade-like spines with anterior and posterior points. Pelvic fins absent. Caudal fin deeply forked, the lower lobe longer than the upper. Color is gray above grading to silvery white towards the belly, with small black dots all over the body. Fins are faintly yellow; vertical fins with dark edges. L_{max1} = 60 cm; L_{max2} = n.a.; L_{max3} = 30.7 cm FL (Fig. 108A). See Fig. 108B and Table 58 for length-weight relationship.

Indo-West Pacific: from the Persian Gulf east to Southeast Asia, Indonesia (Fig. 109) and north to southern Japan.

Found in coastal waters over muddy bottoms, associated with prawns and *Nemipterus* and *Leiognathus* species. Forms schools which can be large and abundant. Depth range: 10-110 m (Fig. 110). Feeds on ctenophores, salps, medusae and other zooplankton groups. Table 59 presents a set of growth parameters from Indonesia.

References: 559, 1314, 2047, 3517, 4606, 4789, 5204, 5736, 5756, 6365

Table 58. Length-weight (g/[FL;cm]) relationship of silver pomfret, *Pampus argenteus*, in Indonesia.
[Tabel 58. Hubungan panjang-berat (g/[FL; cm]) ikan bawal putih, Pampus argenteus, *di Indonesia.]*

Parameter	Estimate
a	0.1660
s.e.(a)	0.0496
b	2.5033
s.e.(b)	0.1043
r^2	0.9715

Table 59. Growth parameters of silver pomfret, *Pampus argenteus*.
[Tabel 59. Parameter pertumbuhan ikan bawal putih, Pampus argenteus.*]*

Parameter	A
L_∞ (TL, cm)	31.5
K ($year^{-1}$)	0.95

A. Java Sea (Central Java) (Ref. 1314)

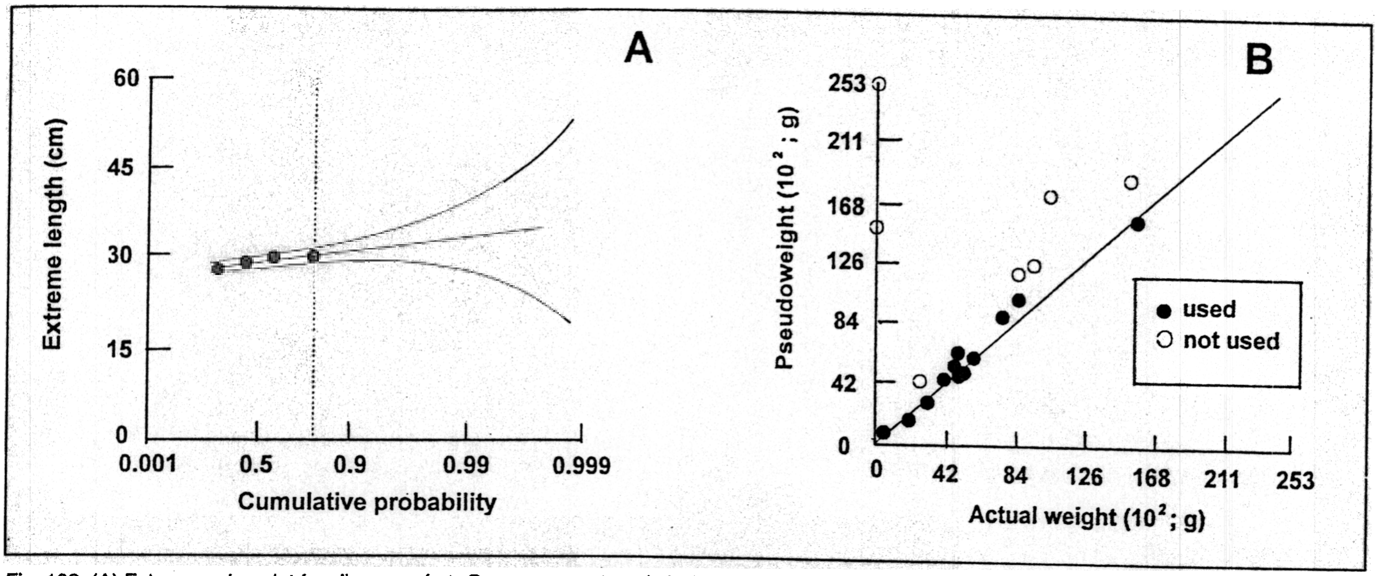


Fig. 108. (A) Extreme value plot for silver pomfret, *Pampus argenteus*, in Indonesia based on data from *R/Vs Mutiara 4* and *Jurong* showing maxima of 4 length-frequency samples, and estimate of L_{max3} = 30.7 ± 1.15 cm FL. (B) Predicted *vs.* observed weights (in g wet weight) of 13 length-frequency samples of silver pomfret, *Pampus argenteus*, from Western Indonesia based on data from *R/Vs Mutiara 4* and *Jurong* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 58). Open dots represent outliers, not used for analysis.

[Gambar 108. (A) Gambaran nilai ekstrim ikan bawal putih, Pampus argenteus, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Jurong *menunjukkan nilai maksimum 4 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 30.7 ± 1.15 cm FL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 13 contoh frekuensi-panjang ikan bawal putih,* Pampus argenteus, *dari Indonesia bagian barat berdasarkan data kapal-kapal penelitian* Mutiara 4 *dan* Jurong *sebagai luaran perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 58). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

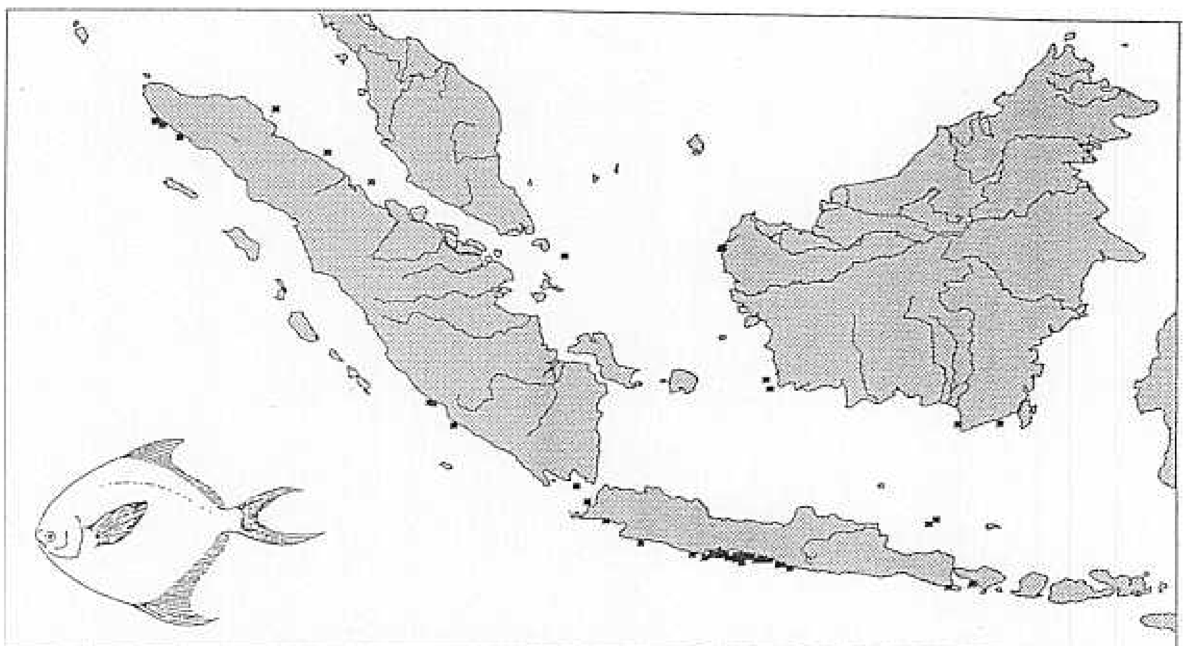


Fig. 109. Distribution of silver pomfret, *Pampus argenteus* based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong, Lemuru* and *Dr. Fridtjof Nansen.*

[Gambar 109. Penyebaran ikan bawal putih, Pampus argenteus, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong, Lemuru *dan* Dr. Fridtjof Nansen.*]*

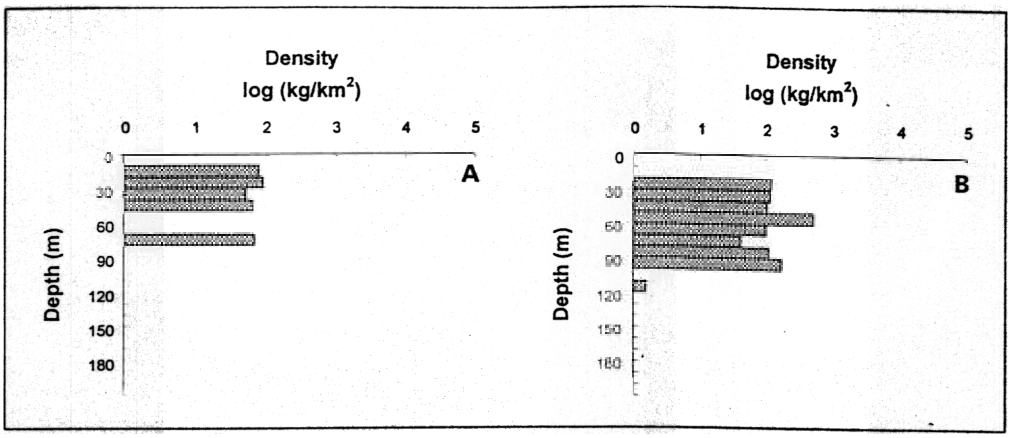


Fig. 110. Depth distribution of silver pomfret, *Pampus argenteus*, based on surveys of *R/Vs* (A) *Mutiara 4* and (B) *Jurong*.
[Gambar 110. Penyebaran kedalaman ikan bawal putih, Pampus argenteus, *berdasarkan survei kapal-kapal penelitian (A)* Mutiara 4 *dan (B)* Jurong.*]*

Terapon jarbua (Forsskål, 1775)

Jarbua terapon (English); Kerong-kerong tambi (Indonesian); Djambrung, Djandjan, Djangdjan, Kerong-kerong (Java); Djambron, Erong-erong, Kerong-kerong tambi (West Java, Jakarta); Kerongan (Central Java); Djambon, Longkerong (Madura); Keretang (East Sumatra); Kerung-kerung, Mangahua (South Sulawesi, Makassar); Karong-karong (South Sulawesi, Bugis).

Lower opercular spine extending well beyond the opercular flap. Post temporal bone exposed posteriorly and serrate. Body color is fawn above, cream below, nape dark; head, body and fins with an iridescent sheen. Three or four curved dark brown bands run from the nape to the hind part of the body, the lowermost continuing across the middle of the caudal fin. Dorsal spines: 12-12; soft rays: 10-10; anal spines: 3-3; soft rays: 8-8. L_{max1} = 33 cm TL; L_{max2} = n.a.; L_{max3} = 19.7 cm FL (Fig. 111A). See Fig. 111B and Table 60 for length-weight relationship.

From the Red Sea in the Indian Ocean to Southeast Asia, Indonesia (Fig. 112): north to southern Japan, south to Samoa, Belau in Micronesia and Lord Howe Islands.

Occurs over shallow sandy bottoms, in the vicinity of river mouths. Depth range: 20-290 m (Fig. 113). Feeds on sand-dwelling invertebrates.

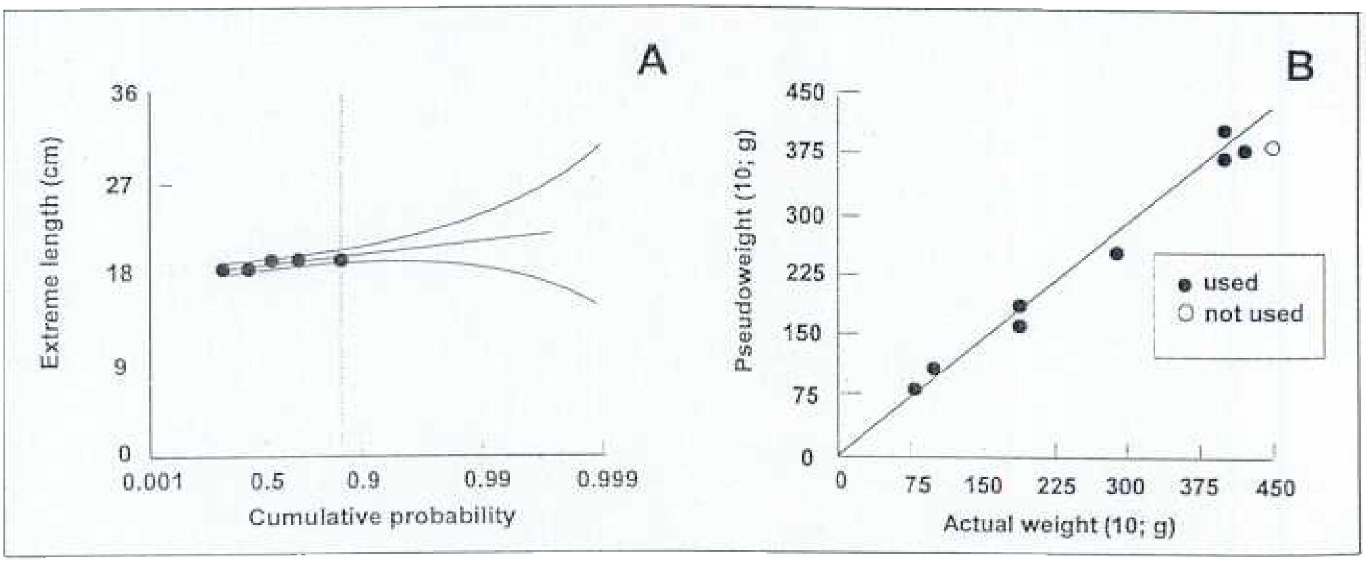


Fig. 111. (A) Extreme value plot for Jarbua terapon, *Terapon jarbua*, in Indonesia based on data from *R/V Jurong* showing maxima of 5 length-frequency samples, and estimate of L_{max3} = 19.7 ± 0.65 cm FL. (B) Predicted *vs.* observed weights (in g wet weight) of 8 length-frequency samples of Jarbua terapon, *Terapon jarbua*, from Western Indonesia based on data from *R/V Jurong* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 60). Open dot represents outlier, not used for analysis.
[Gambar 111. (A) Gambaran nilai ekstrim ikan kerong-kerong tambi, Terapon jarbua, *di Indonesia berdasarkan data dari kapal penelitian* Jurong *menunjukkan nilai maksimum 5 contoh frekuensi-panjang, dan angka perkiraan L_{max3} = 19.7 ± 0.65 cm FL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 8 contoh ikan kerong-kerong tambi,* Terapon jarbua, *dari Indonesia bagian barat berdasarkan data dari kapal penelitian* Jurong *sebagai output perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 60). Bulatan kosong mewakili suatu pengamatan yang tidak dipakai dalam analisis.]*

References: 1602, 2857, 3539, 4327, 4515, 4959, 4967, 5213, 5255, 5450, 5525, 5736, 5756, 5970, 6026, 6365

Table 60. Length-weight (g/[FL;cm]) relationship of Jarbua terapon, *Terapon jarbua*, in Indonesia.
[Tabel 60. Hubungan panjang-berat (g/[FL; cm]) ikan kerong-kerong tambi, Terapon jarbua, *di Indonesia.]*

Parameter	Estimate
a	0.0748
s.e. (a)	0.0896
b	2.5241
s.e. (b)	0.4443
r^2	0.9824

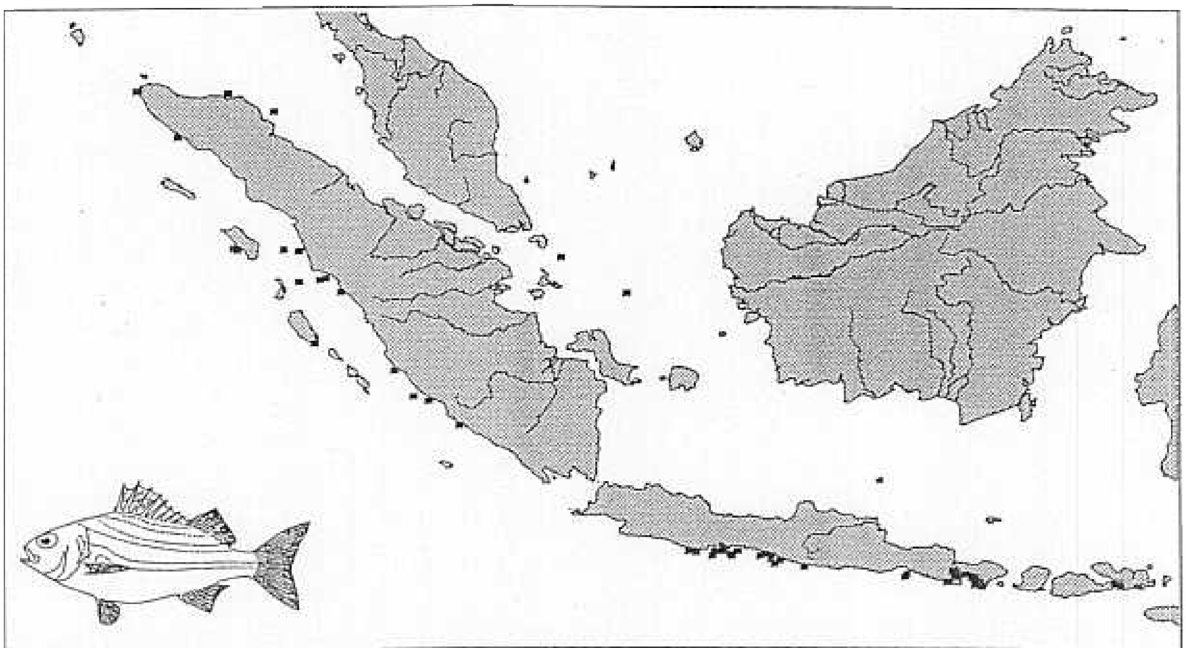


Fig. 112. Distribution of Jarbua terapon, *Terapon jarbua*, based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen*.
[Gambar 112. Penyebaran ikan kerong-kerong tambi, Terapon jarbua, *berdasarkan laporan survei dari kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

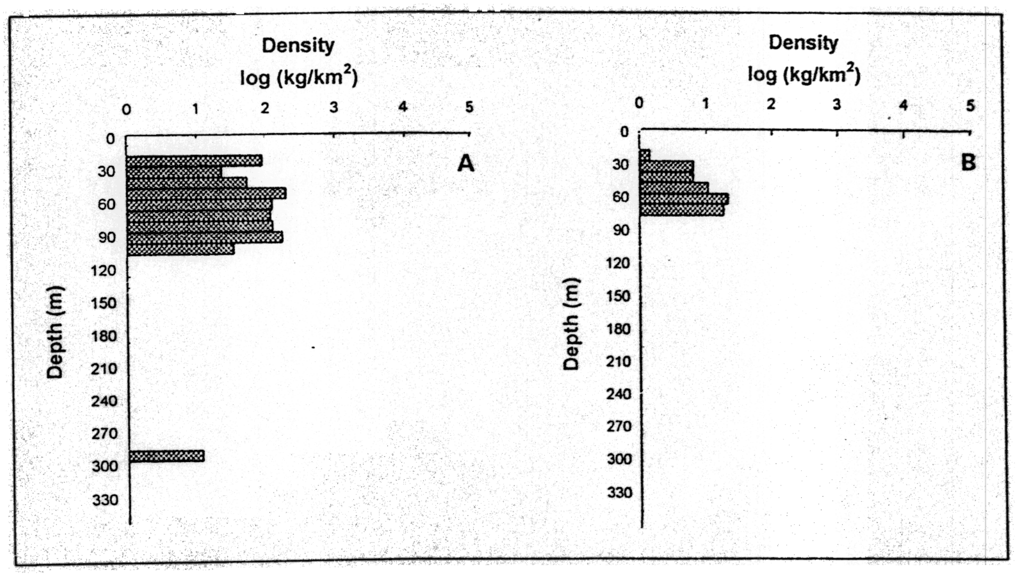


Fig. 113. Depth distribution of Jarbua terapon, *Terapon jarbua*, based on surveys of *R/Vs* (A) *Jurong* and (B) *Bawal Putih 2*.
[Gambar 113. Penyebaran kedalaman ikan kerong-kerong tambi, Terapon jarbua, *berdasarkan survei kapal-kapal penelitian (A)* Jurong *dan (B)* Bawal Putih 2.*]*

Trichiurus lepturus (Linnaeus, 1758)

Largehead hairtail (English); Lajur (Indonesian); Djogor (Java); Lajur (West Java, Jakarta); Ladjur (Madura); Ladjuru (South Sulawesi, Makassar).

Body extremely elongate, compressed and tapering to a point. Mouth large with a dermal process at the tip of each jaw. Dorsal fin relatively high; anal fin reduced to minute spinules usually embedded in the skin or slightly breaking through; anterior margin of pectoral fin spine not serrated. Pelvic and caudal fins absent. Lateral line beginning at the upper margin of the gill cover, running oblique to behind the tip of the pectoral fins, then straight close to the ventral contour. Fresh specimens steely blue with silvery reflections, becoming uniformly silvery gray sometime after death. Dorsal spines: 3-3; soft rays: 130-135; anal spines: -; soft rays: 100-105. L_{max1} = 213 cm TL; L_{max2} = n.a.; L_{max3} = 125.8 cm TL (Fig. 114A). See Fig. 114B and Table 61 for length-weight relationship.

Throughout tropical waters such as Indonesia (Fig. 115) and temperate waters of the world.

Occurs on continental shelf, occasionally in shallow waters and at surface at night. Depth range: 55-385 m (Fig. 116). Immature fish feed mostly on euphausiids, small pelagic planktonic crustaceans and small fishes while adults feed on anchovies, sardines, myctophiids etc. and occasionally on squid and crustaceans. Adults and juveniles have opposing complementary vertical diurnal feeding migrations.

References: 171, 181, 245, 276, 312, 559, 591, 637, 1263, 1348, 1349, 1350, 1351, 1652, 1751, 1809, 2221, 2302, 2308, 2311, 2682, 2857, 3136, 3383, 3397, 3669, 3670, 3678, 4604, 4733, 4743, 4789, 4830, 4868, 4883, 4931, 5204, 5213, 5217, 5219, 5252, 5287, 5516, 5525, 5541, 5756, 6181, 6365, 6490

Table 61. Length-weight (g/[TL;cm]) relationship of largehead hairtail, *Trichiurus lepturus*, in Indonesia. *[Tabel 61. Hubungan panjang-berat (g/[TL;cm]) ikan layur,* Trichiurus lepturus, *di Indonesia.]*

Parameter	Estimate
a	0.0009
s.e. (a)	0.0014
b	2.9686
s.e. (b)	0.2967
r^2	0.9019

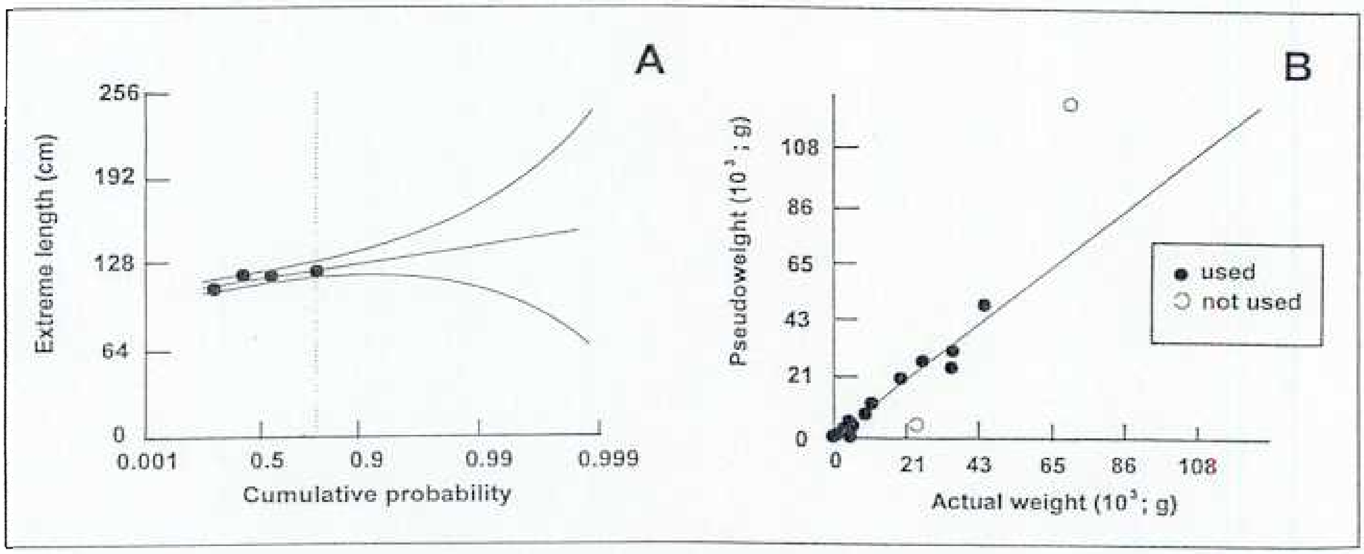


Fig. 114. (A) Extreme value plot for largehead hairtail, *Trichiurus lepturus*, in Indonesia based on data from *R/Vs Mutiara 4* and *Jurong* showing maxima of 4 length-frequency samples, and estimate of L_{max3} = 125.8 ± 6.0 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 17 length-frequency samples of largehead hairtail, *Trichiurus lepturus*, from Western Indonesia based on data from *R/Vs Mutiara 4* and *Jurong* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 61). Open dots represent outliers, not used for analysis.
[Gambar 114. (A) Gambaran nilai ekstrim ikan layur, Trichiurus lepturus, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Jurong *menunjukkan nilai maksimum 4 contoh frekuensi-panjang, dan angka perkiraan* L_{max3} *= 125.8 ± 6.0 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) 17 contoh frekuensi-panjang ikan layur,* Trichiurus lepturus, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4 *dan* Jurong *sebagai luaran perangkat lunak ABee (lihat Boks 1), dan yang memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 61). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

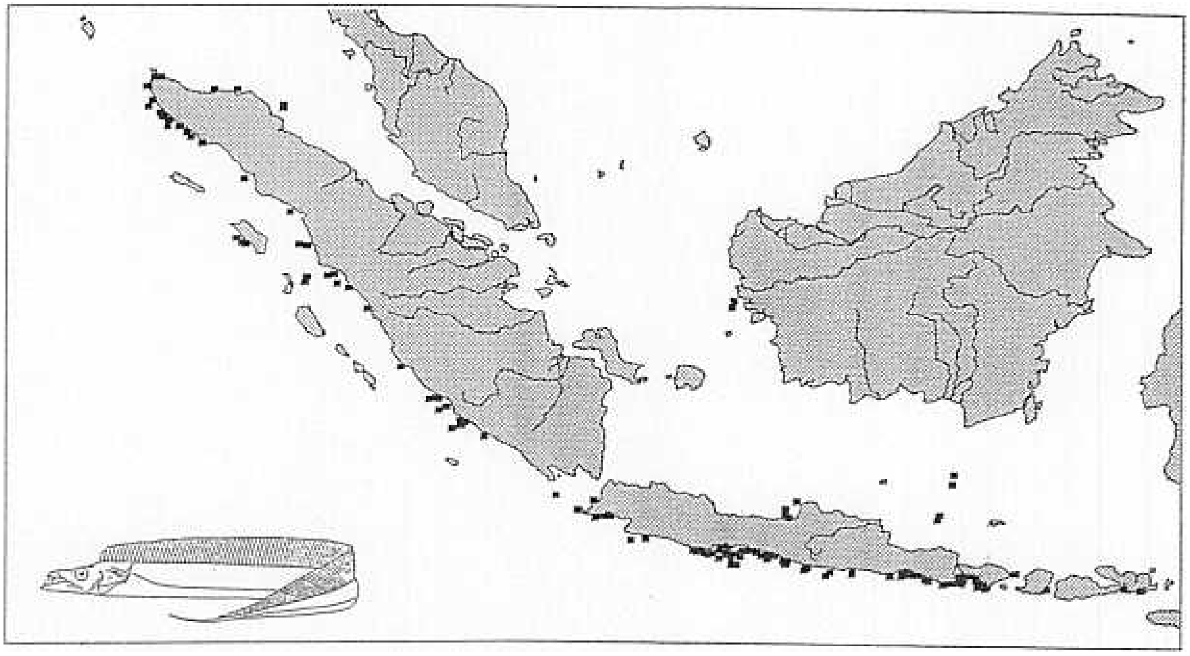


Fig. 115. Distribution of largehead hairtail, *Trichiurus lepturus*, based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen*.
[Gambar 115. Penyebaran ikan layur, Trichiurus lepturus, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

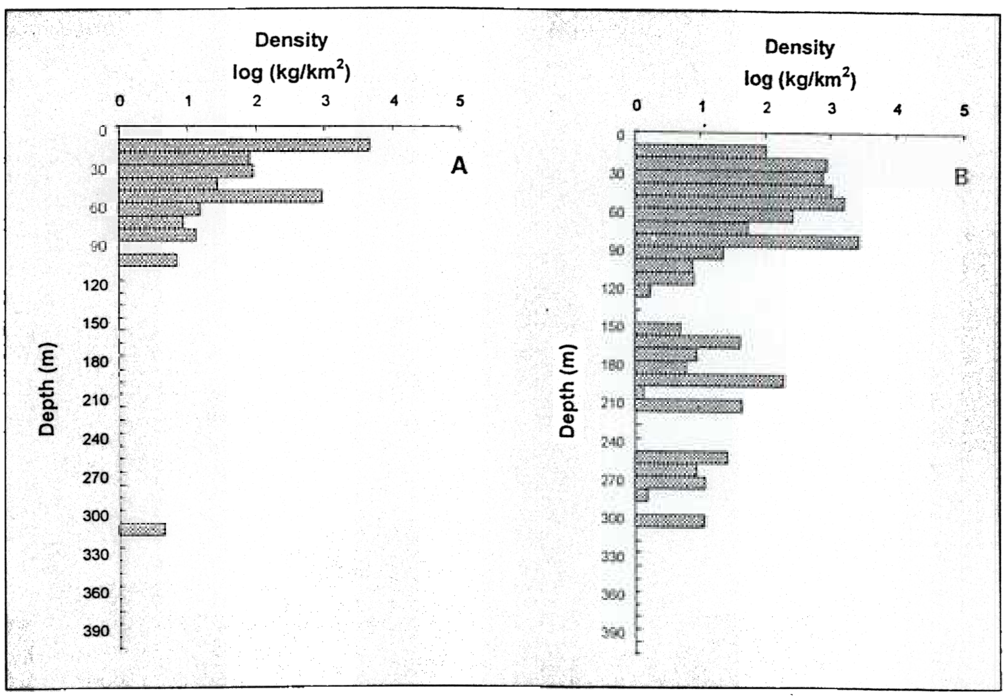


Fig. 116. Depth distribution of largehead hairtail, *Trichiurus lepturus*, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen* and (B) *Jurong*.
[Gambar 116. Penyebaran kedalaman ikan layur, Trichiurus lepturus, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen *dan (B)* Jurong.*]*

Abalistes stellatus (Lacepède, 1798)

Starry triggerfish (English); Kambing-kambing (Indonesian).

Scales enlarged above the pectoral fin base and just behind the gill slit to form a flexible tympanum; scales of posterior body with prominent keels, forming longitudinal ridges. A prominent groove in the skin extending anteriorly from front of eye for a distance of about 1 eye diameter. Caudal peduncle depressed. Caudal fin rays of adults prolonged above and below. Dorsal spines: 3-3; soft rays: 25-27; anal spines: 0-0; soft rays: 24-26. L_{max1} = 60 cm; L_{max2} = n.a.; L_{max3} = 51.5 cm TL (Fig. 117A). See Fig. 117B and Table 62 for length-weight relationship.

Indo-West Pacific, from East Africa and the Red Sea, Southeast Asia, Indonesia (Fig.118) and thence to Northern Australia and Japan; also reported from the eastern tropical Atlantic.

Inhabits coastal areas, usually found over muddy and sandy bottoms, also around reefs, together with the sponges and algae. Depth range: 20-170 m (Fig. 119). Feeds on benthic animals.

References: 28, 182, 2683, 2857, **3109**, **3128**, 3804, 3807, 4789, 5193, 5213, 5255, 5450, 5736, 5756, 6026, 6365, 6567.

Table 62. Length-weight (g/[TL;cm]) relationship of starry triggerfish, *Abalistes stellatus*, in Indonesia.
Tabel 62. Hubungan panjang-berat (g/[TL;cm]) ikan kambing-kambing, Abalistes stellatus, *di Indonesia.*

Parameter	Estimate
a	0.0281
s.e. (a)	0.0085
b	2.8746
s.e. (b)	0.0845
r^2	0.9877

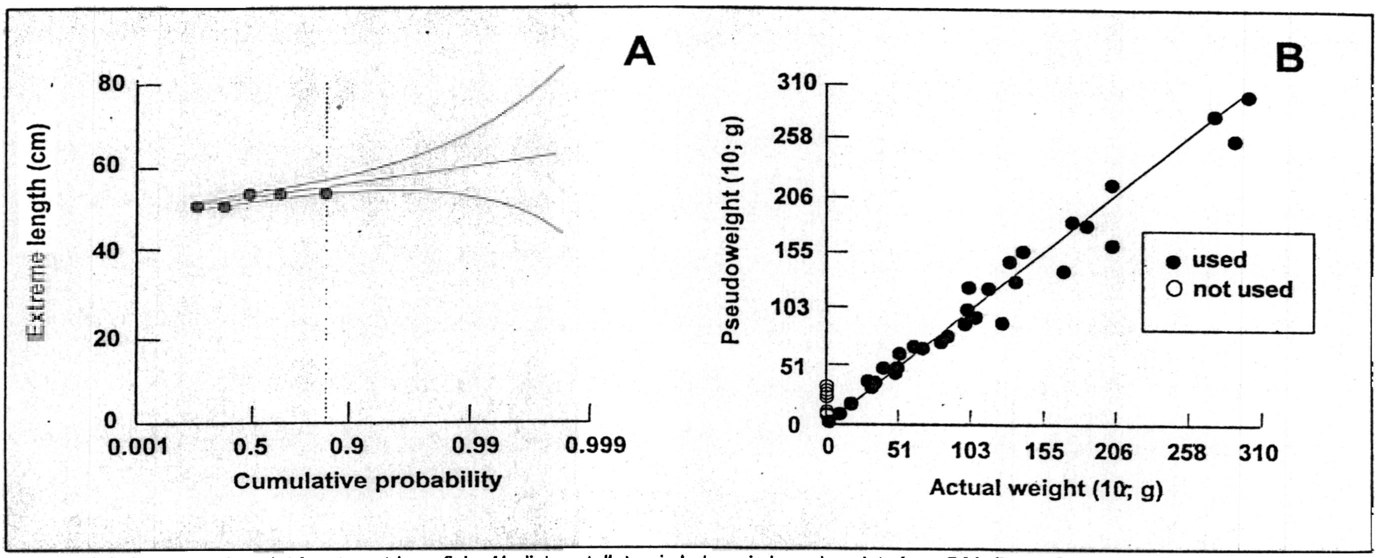


Fig. 117. (A) Extreme value plot for starry triggerfish, *Abalistes stellatus*, in Indonesia based on data from *R/Vs Bawal Putih 2* and *Jurong* showing maxima of 5 length-frequency samples, and estimate of L_{max3} = 51.5 ± 1.25 cm TL. (B) Predicted *vs.* observed weights (in g wet weight) of 31 length-frequency samples of starry triggerfish, *Abalistes stellatus*, from Western Indonesia based on data from *R/Vs Mutiara 4, Jurong* and *Bawal Putih 2* as output by the ABee software (see Box 1), and allowing estimation of a length-weight relationship (see Table 62). Open dot(s) represent outliers, not used for analysis. *[Gambar 117. (A) Gambaran nilai ekstrim ikan kambing-kambing,* Abalistes stellatus, *di Indonesia berdasarkan data dari kapal-kapal penelitian* Bawal Putih 2 *dan* Jurong *menunjukkan nilai maksimum 5 contoh frekuensi-panjang, dan angka perkiraan* L_{max3} *= 51.5 ± 1.25 cm TL. (B) Berat prediksi terhadap berat observasi (dalam g berat basah) dari 31 contoh frekuensi-panjang ikan kambing-kambing,* Abalistes stellatus, *dari Indonesia bagian barat berdasarkan data dari kapal-kapal penelitian* Mutiara 4, Jurong *dan* Bawal Putih 2 *sebagai luaran perangkat lunak ABee (lihat Box 1)), dan memungkinkan estimasi suatu hubungan panjang-berat (lihat Tabel 62). Bulatan-bulatan kosong mewakili pengamatan-pengamatan yang tidak dipakai dalam analisis.]*

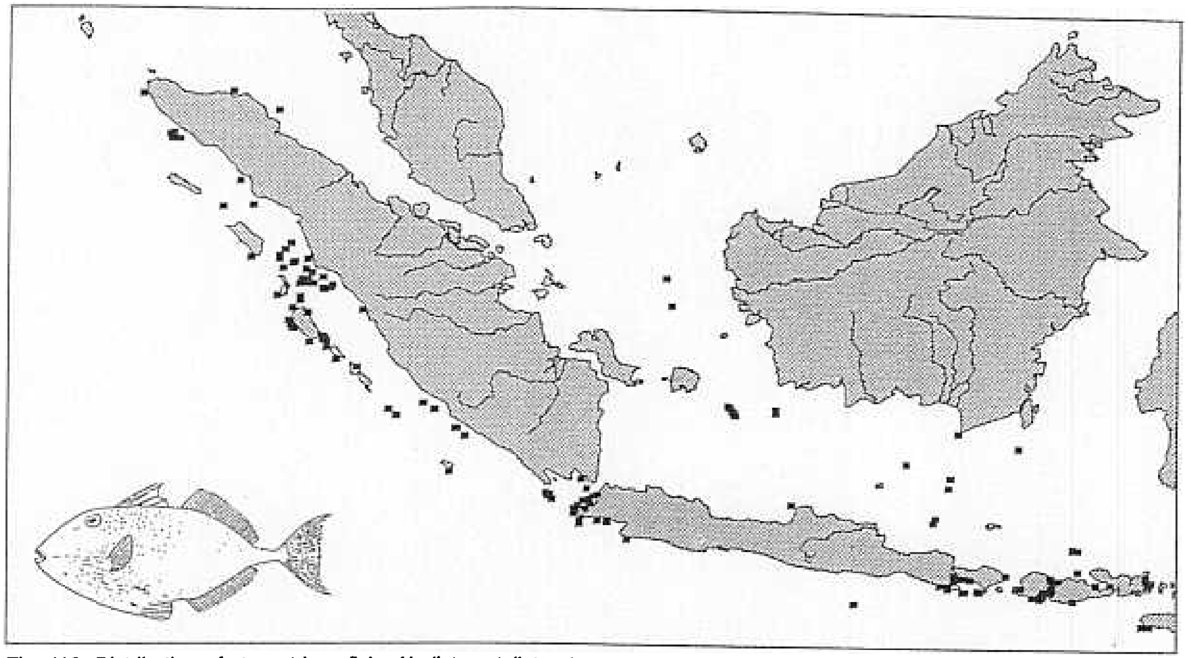


Fig. 118. Distribution of starry triggerfish, *Abalistes stellatus*, based on records of the surveys of *R/Vs Mutiara 4, Bawal Putih 2, Jurong* and *Dr. Fridtjof Nansen.*
[Gambar 118. Penyebaran ikan kambing-kambing, Abalistes stellatus, *berdasarkan laporan survei kapal-kapal penelitian* Mutiara 4, Bawal Putih 2, Jurong *dan* Dr. Fridtjof Nansen.*]*

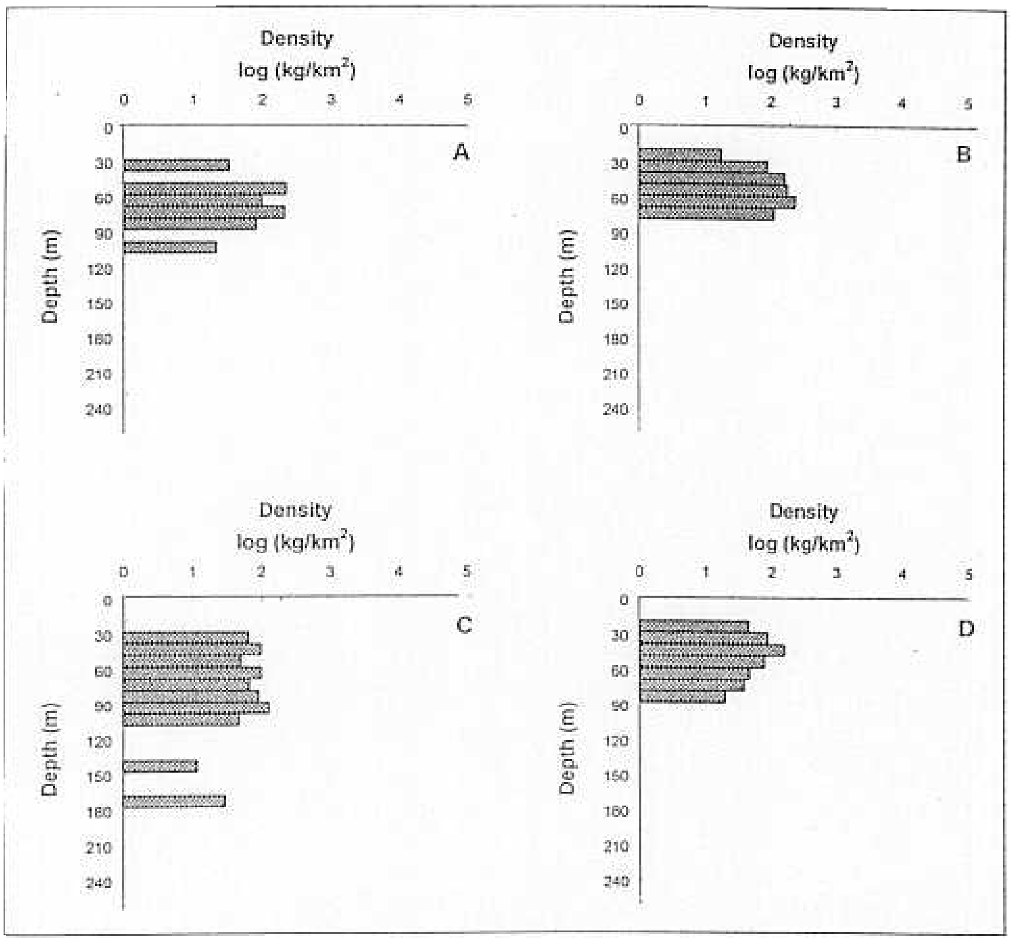


Fig. 119. Depth distribution of starry triggerfish, *Abalistes stellatus*, based on surveys of *R/Vs* (A) *Dr. Fridtjof Nansen*, (B) *Mutiara 4*, (C) *Jurong* and (D) *Bawal Putih 2.*
[Gambar 119. Penyebaran kedalaman ikan kambing-kambing, Abalistes stellatus, *berdasarkan survei kapal-kapal penelitian (A)* Dr. Fridtjof Nansen, *(B)* Mutiara 4, *(C)* Jurong *dan (D)* Bawal Putih 2.*]*

Discussion

Given the wealth of data collected during the various surveys documented in this volume, the above coverage of the biology of 40 Western Indonesian fish species could easily have been expanded to cover more species, or to cover the 40 species in more detail. Particularly, we could have presented length-frequency data from which new growth parameters, mortality and related information could have been extracted, using approaches and software documented in Pauly and Morgan (1987) and Gayanilo et al. (1996).

Also, we could have used the available knowledge on the food and feeding habits of these species, and of their predators (much of which is available in FishBase) to define the trophic web within which these species are embedded, a first step toward their incorporation into formal ecosystem models (see contributions in Christensen and Pauly 1993 and Christen and Pauly 1996).

We did not do these things because of space and time constraints to the completion of this volume, but we encourage colleagues to follow up on this, using the data documented in Torres et al. (this vol.) and FishBase. The approach documented here can also be applied to the retroactive analysis of data from surveys conducted outside of Indonesia, an activity presently being pursued at ICLARM.

Finally, we wish to point to our colleagues organizing new trawl surveys the possibility of computerizing, i.e., automatizing the entire approach documented in this paper and the additional analyses suggested above. This would cover the detailed analysis of length-frequency data, to estimate growth, mortality and related parameters by linking pertinent software packages (FiSAT, ABee, NAN-SIS, etc.) such that the data from a survey can be analyzed in real time, and connected with biological information in FishBase, and would enable the survey report to be completed at the same time as they survey itself. We would be pleased to discuss the implementation of this idea with anyone interested.

References[d]

Bertalanffy, L. von. 1951. Theoretische Biologie-Zweiter Band: Stoffwechsel, Wachstum. A. Francke AG Verlag, Bern. 418 p.

Christensen, V. and D. Pauly, Editors. 1993. Trophic models of aquatic ecosystems. ICLARM Conf. Proc. 26, 390 p.

Christensen, V. and D. Pauly. 1996. Ecological modelling for all. Naga, ICLARM Q. 19(2):25-26.

Coronado, G. and R. Froese. 1994. MAPPER, a low-level geographic information system. Naga, ICLARM Q. 16(4):43-45.

Eschmeyer, W.N. 1990. Catalog of the genera of recent fishes. California Academy of Sciences, San Francisco, USA. 697 p.

Formacion, S.P., J.M.Rongo and V.C. Sambilay, Jr. 1991. Extreme value theory applied to the statistical distribution of the largest lengths of fish. Asian Fish. Sci. 4(1992):123-135.

Gayanilo, F.C., Jr., P. Sparre and D. Pauly. 1996. The FAO-ICLARM Stock Assessment Tools (FiSAT) user's manual. FAO Comput. Info. Ser. (Fish.) 8. FAO, Rome. 126 p.

Marquardt, D.W. 1963. An algorithm for least squares estimation of non-linear parameters. J. Soc. Appl. Math. 11:431-441.

Pauly, D. and G.R. Morgan, Editors. 1987. Length-based methods in fisheries researh. ICLARM Conf. Proc. 13, 468 p.

[d]See Appendix I for numbered (FishBase) references.