Zooplankton Research in Indonesian waters

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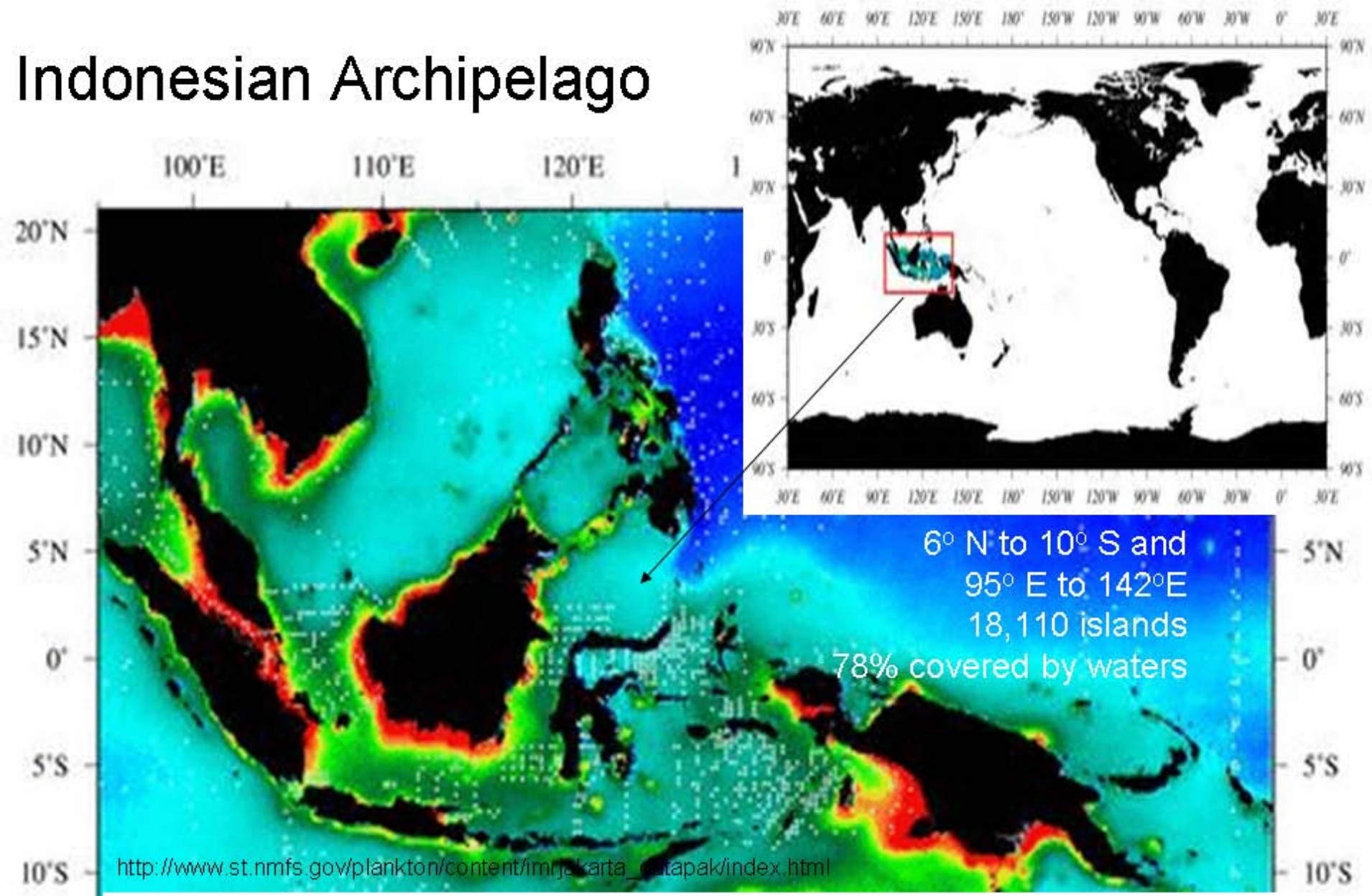
Indonesian Archipelago



The Sunda and Sahul plates - Banda Sea - Sulawesi and Maluku Seas in the north and Bali and Flores Seas in the south. The northern seas: the Pacific Ocean, the southern seas : to the Indian Ocean.

Collections of zooplankton :

- US Exploring in Bangka Region and Malacca Strait Dana (1849, 1853)
- Challenger (1872-1876)
- Valdivia (1898) from the west coast of Sumatra,
- Snellius I (1929)
- Moro (1979) from Buru-Ambon Islands,
- Siboga Expedition (1898-1900) from the eastern Indonesian waters
- Kuroshio (1965-1970 and 1971-1973)
- Snellius II Expedition (1985) in the northern Arafura Sea and the eastern Banda Sea (Baars *et al.*, 1990; Schalk *et al.*, 1990).

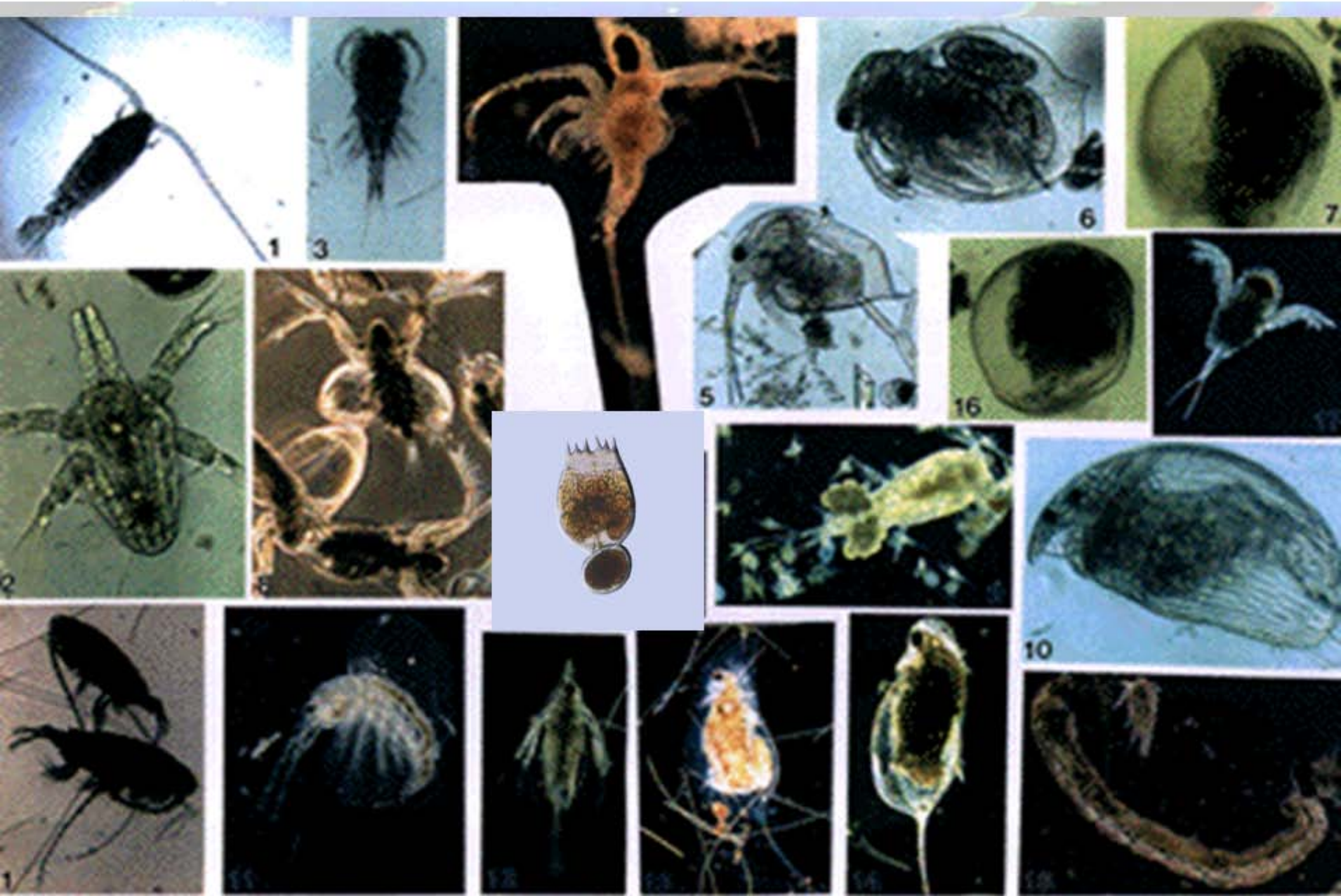
Biosystematic studies

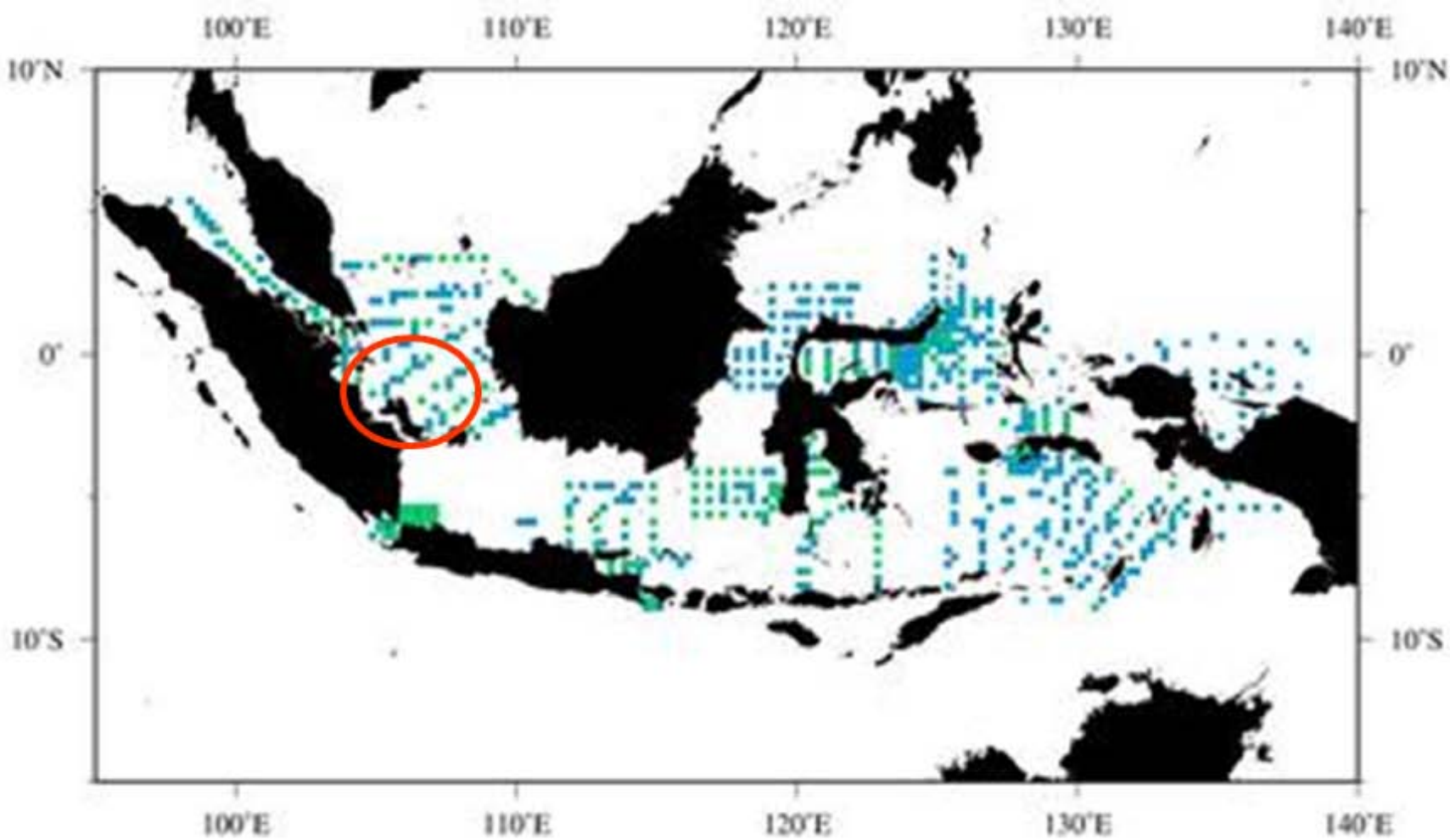
Distributional Studies

Biological Studies

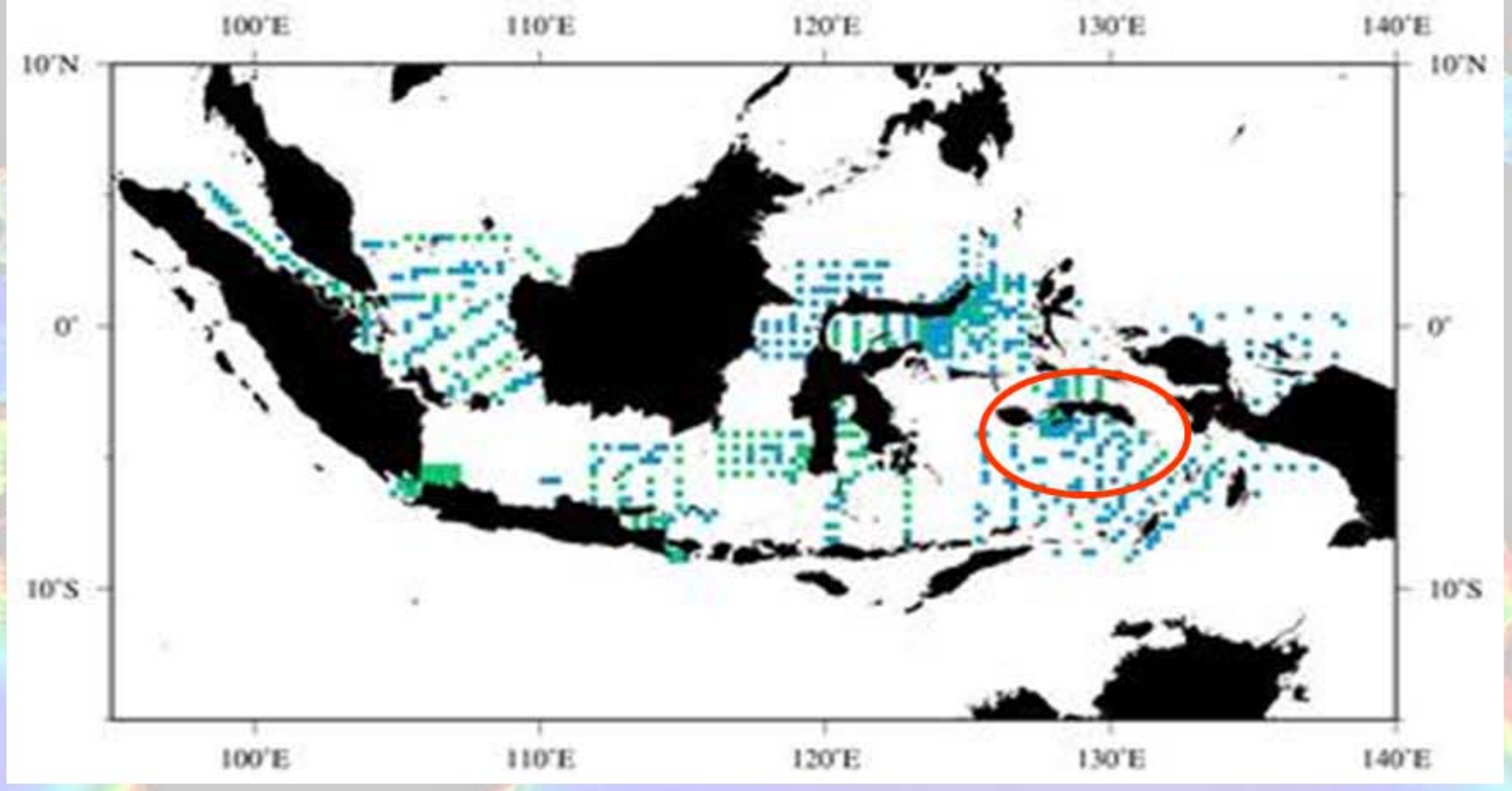
Fisheries related Studies

Biosystematic Studies

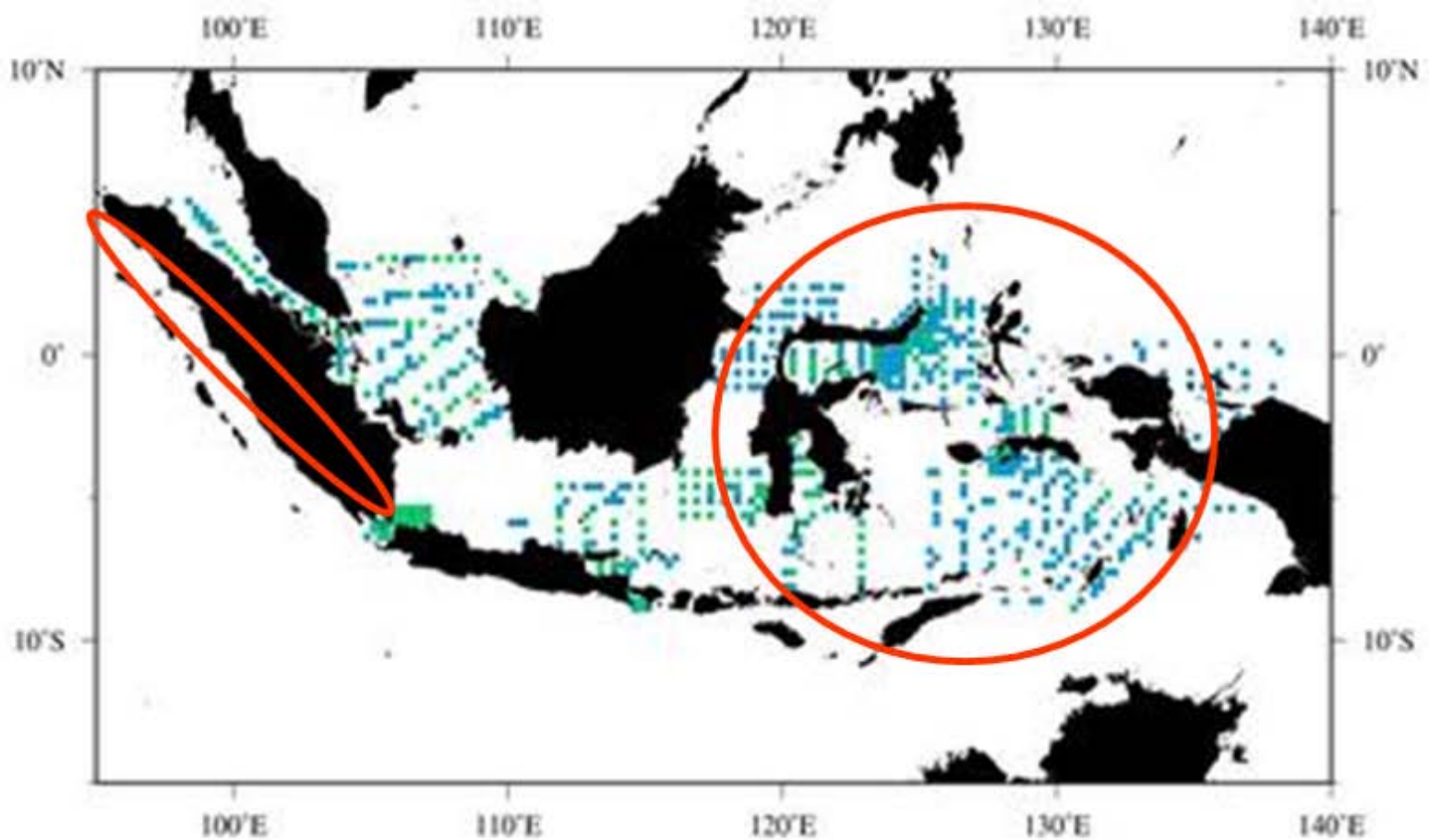




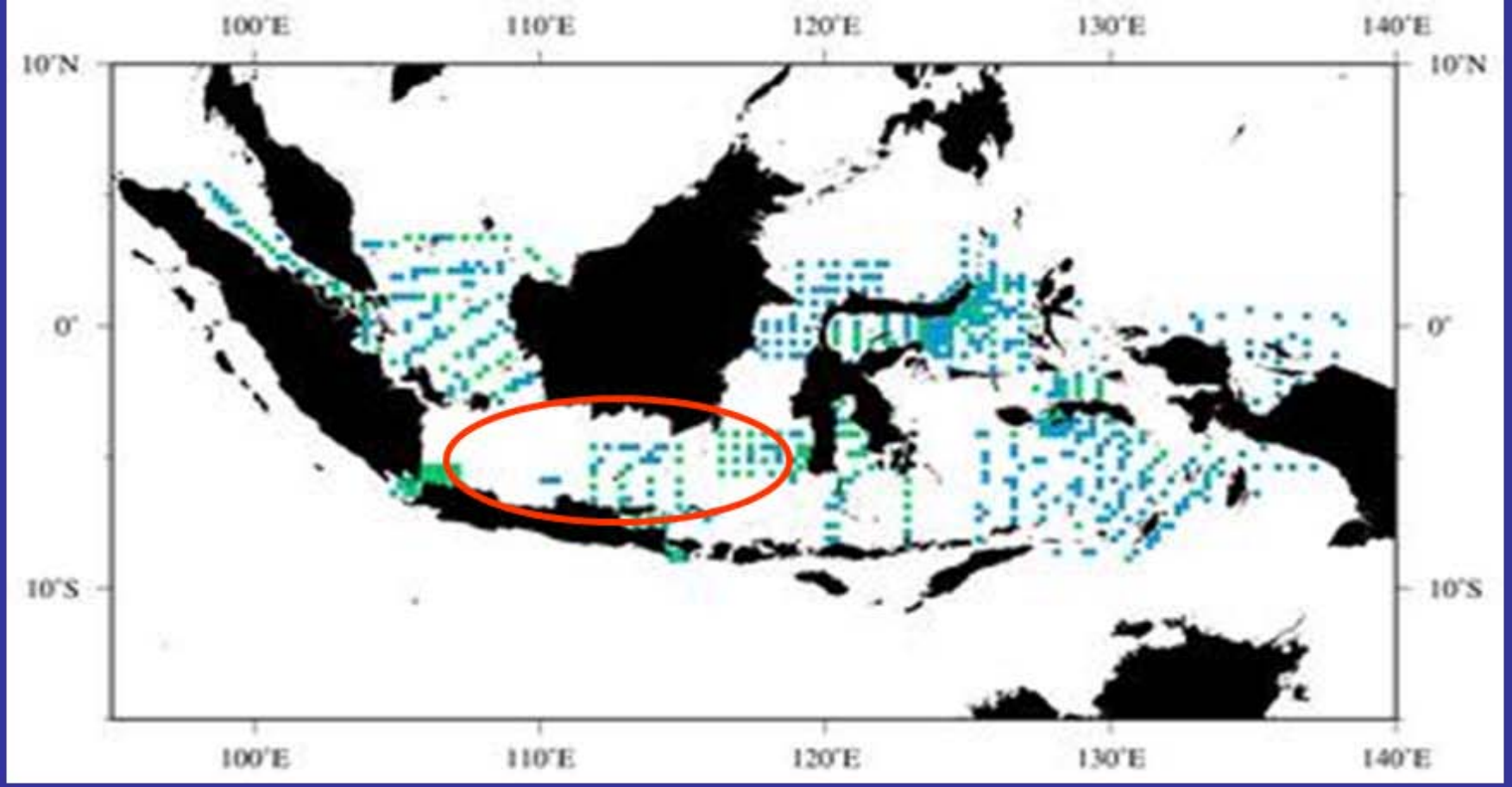
US Exploring Expedition visited Bangka region and Malacca Strait. **Dana (1849)'s monography is the** first studies of zooplankton in Indonesian waters.



In 1874 the Challenger Expedition (1872-1876) visited Arafura, Banda, and Buru Islands. The copepod samples collected during the cruise were studied by Brady (1883).



- The Valdivia Expedition (1899-1899) visited the west coast of Sumatra in 1899. The Copepoda of these expeditions were not treated as a whole, but monographical papers on various groups were published by Schmaus & Lehnhofer (1927) on *Rhincalanus*, and Steuer (1932) on *Pleurommama.*
- Siboga Expedition (1899) is the most important taxonomic studies of crustaceans. The copepod samples were examined by A. Scott (1909)



Meroplankton studies in the Java Sea were conducted for about 17 years by Delsman who found more than 20 taxa of ichtyoplankton. He annually reported it from 1921 to 1939, as shown in the reference list of Praseno (1979).

Some copepod taxa :

Rhincalanus (Schmaus & Lehnhofer, 1927),
Pleurommama (Steuer, 1932),

Some genera of Calanoida (Vervoort, 1946),

Labidocera pectinata (Fleminger *et al.*, 1982)
Pontella alata (Ohtsuka *et al.*, 1987).

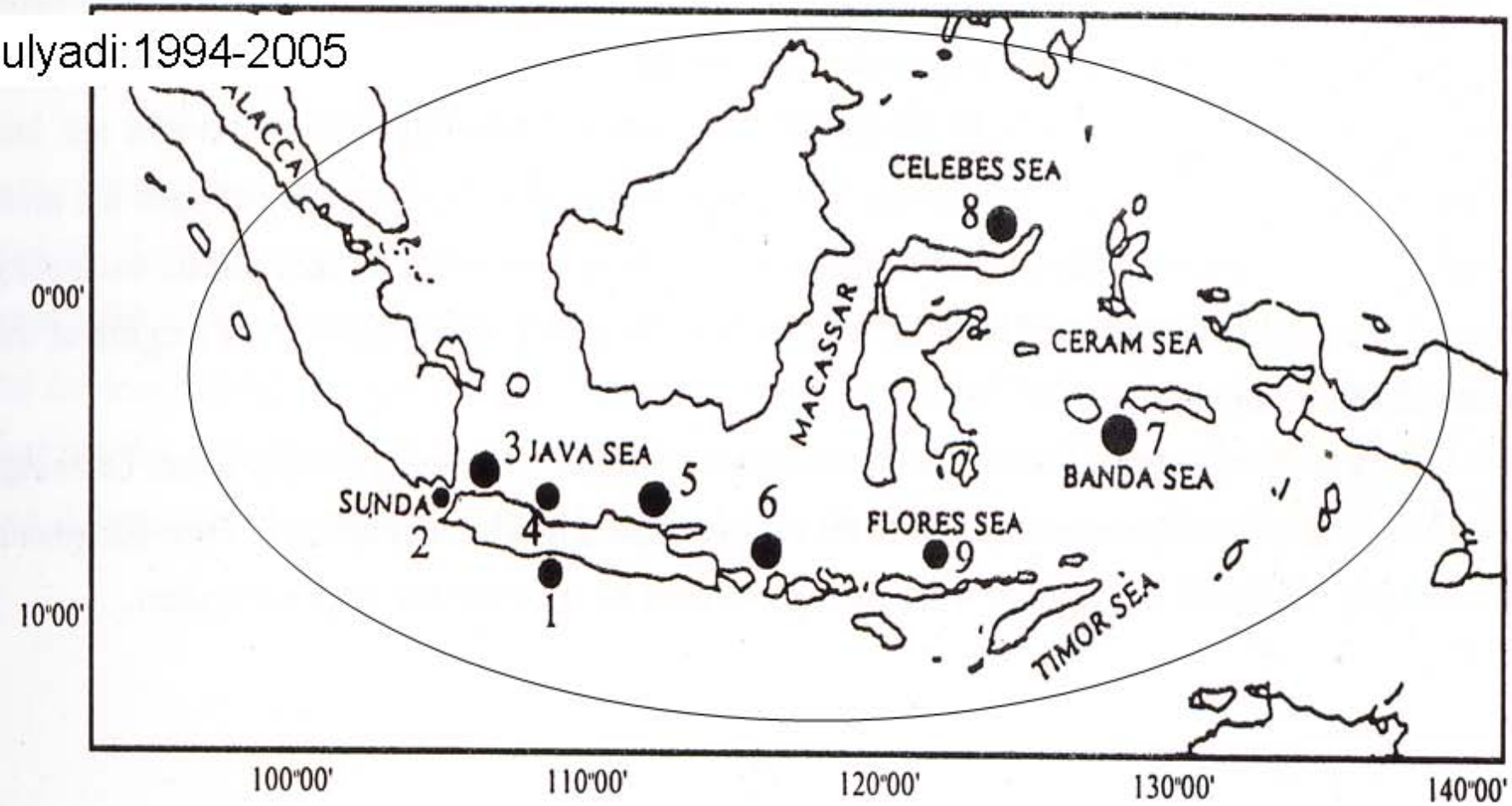


Figure 1. A map of Indonesian waters showing study sites 1-9.

1 = Cilacap Bay (07°40'S 109°00'E); 2 = off Labuan (06°10'S 106°00'E); 3 = Jakarta Bay-Seribu Islands (06°00'S 106°45'E); 4 = off Tegal (06°40'S 109°10'E); 5 = off Surabaya (07°10'S 109°10'E); 6 = Lombok Sea (08°40'S 112°45'E); 7 = Ambon Bay (03°40'S 128°10'E); 8 = Manado Bay (01°30'N 124°00'E); 9 = Flores Sea (07°29'S 121°05'E).

Mulyadi (1994-2005): 300 species, 55 new records and 11 new species of copepods::

Calanopia asymmetrica,
Labidocera javaensis,
L. muranoi,
Pontella labuanensis,
P. vervoorti,
P. kleini,
P. bonei,
Candacia ishimarui,

Hemycyclops javaensis,
H. minutus
Paramacrochiron amboinense

Upwelling species

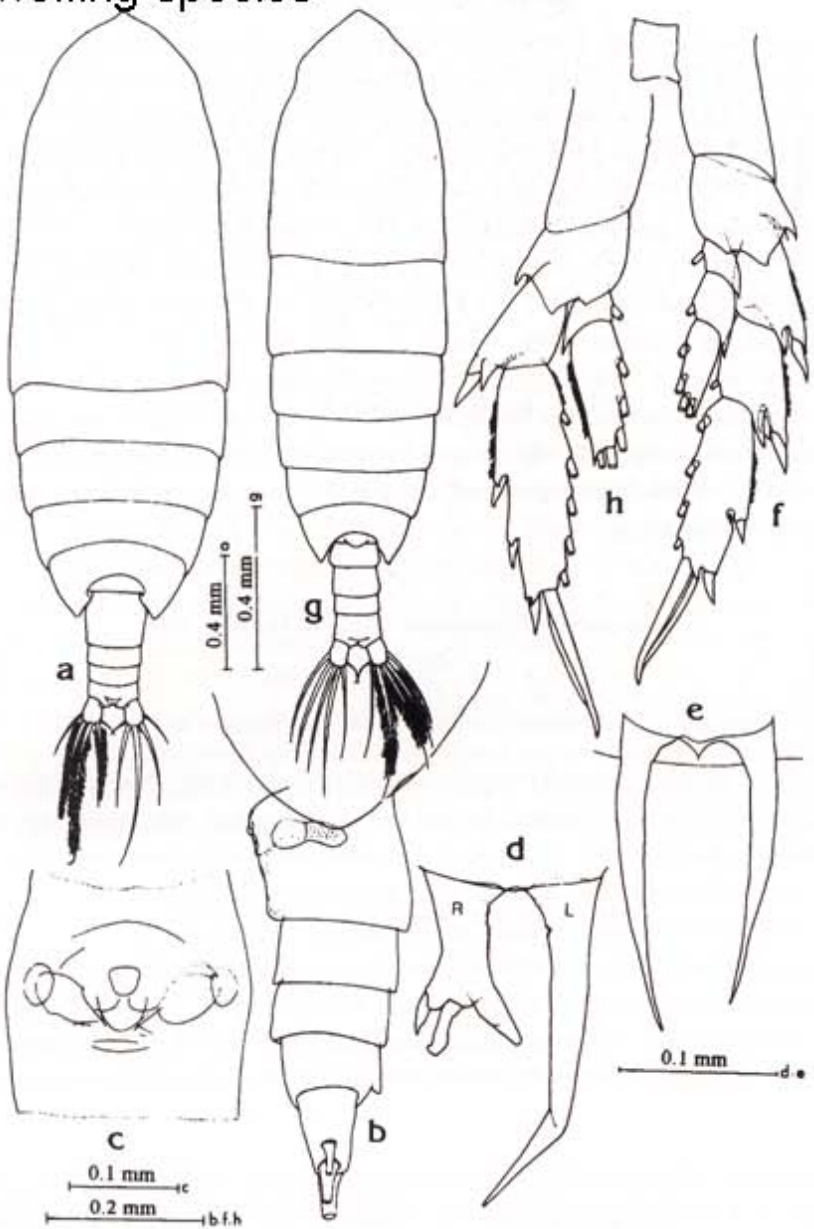
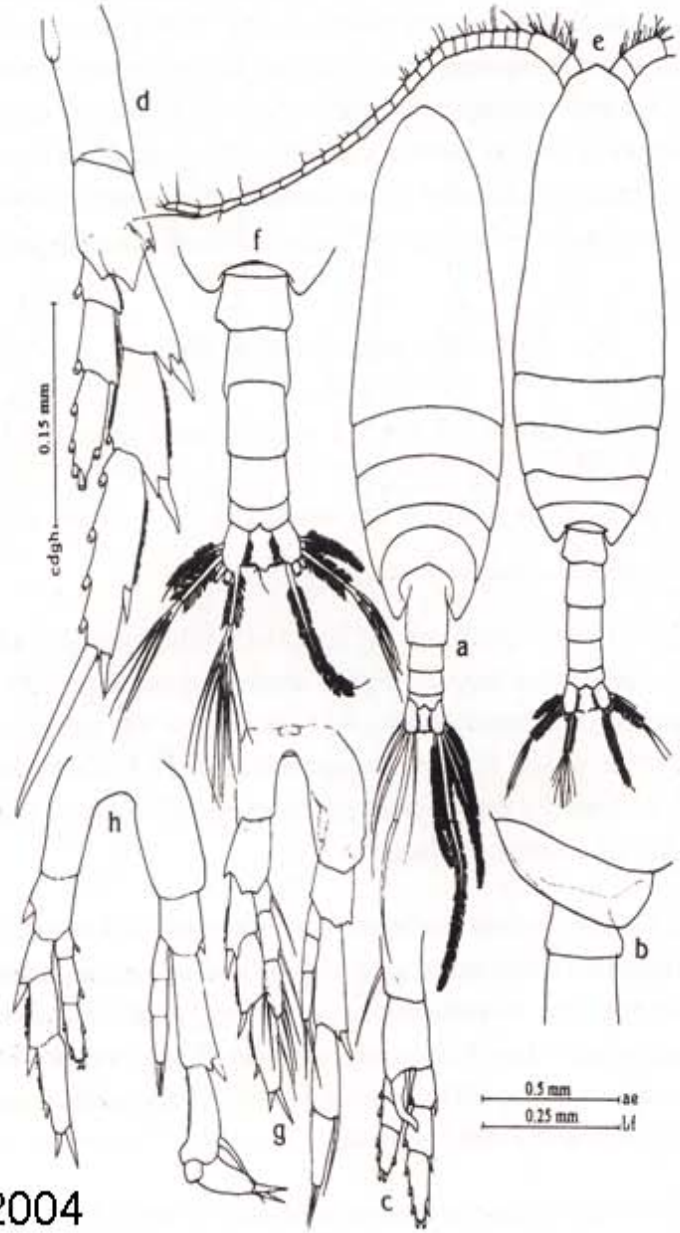


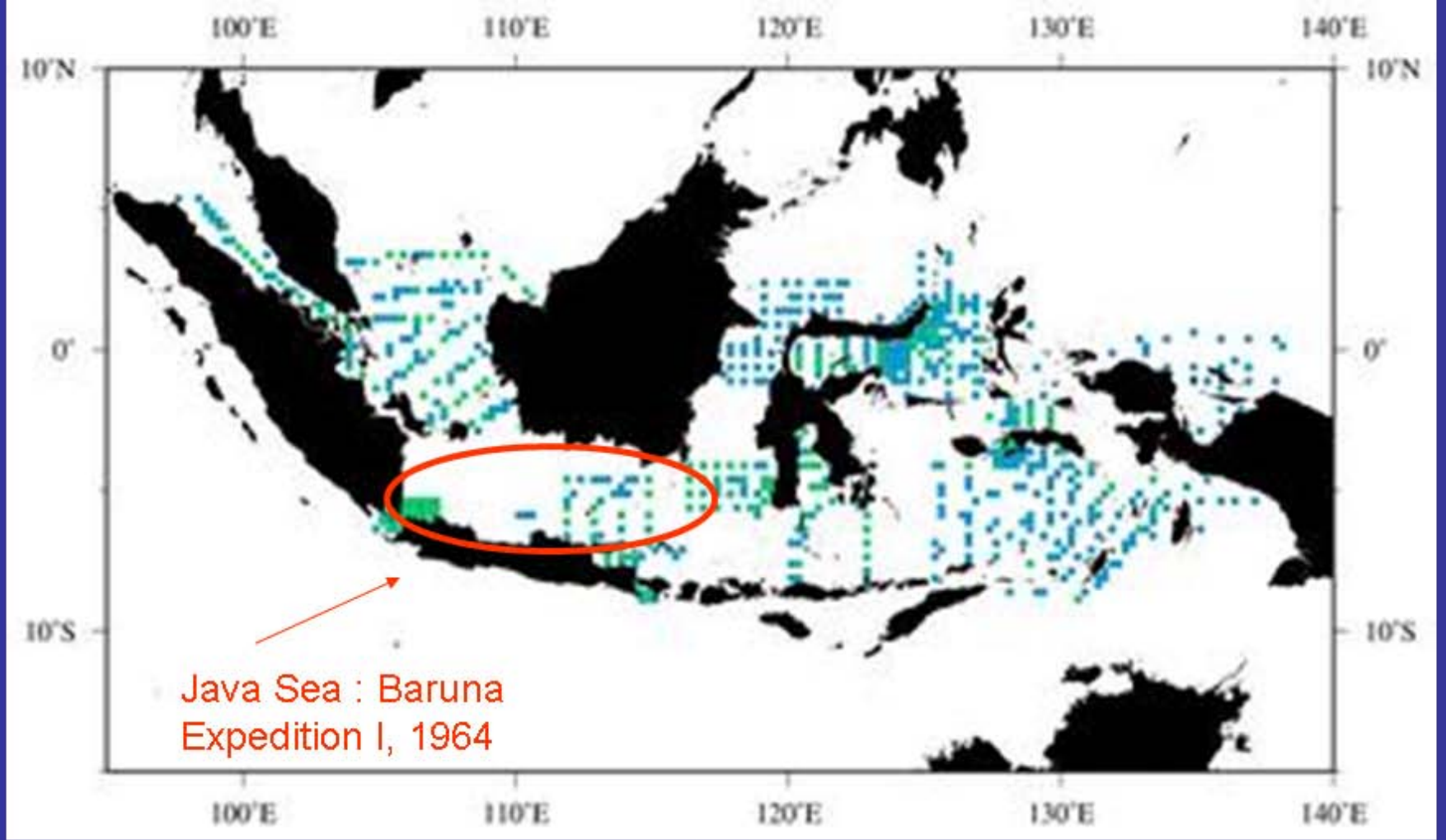
Figure 2. *Calanoides philippinensis* Kitou & Tanaka, 1969. Female. a, whole animal, dorsal view; b, Ms5 and urosome, lateral view; c, genital complex, ventral view; d, abnormal rostrum, anterior view; e, rostrum, anterior view; f, 5th leg. Immature female. g, whole animal, dorsal view; h, 5th leg.



Mulyadi, 2004

Figure 5. *Canthocalanus pauper* (Giesbrecht, 1888). Female. a, whole animal, dorsal v
Ms5 and genital complex, lateral view; c, 1st leg; d, 5th leg. Male. e, whole animal, dorsal
Ms5 and urosome, dorsal view; g, 5th leg other species 1; h, 5th legs, other species

Distributional Studies

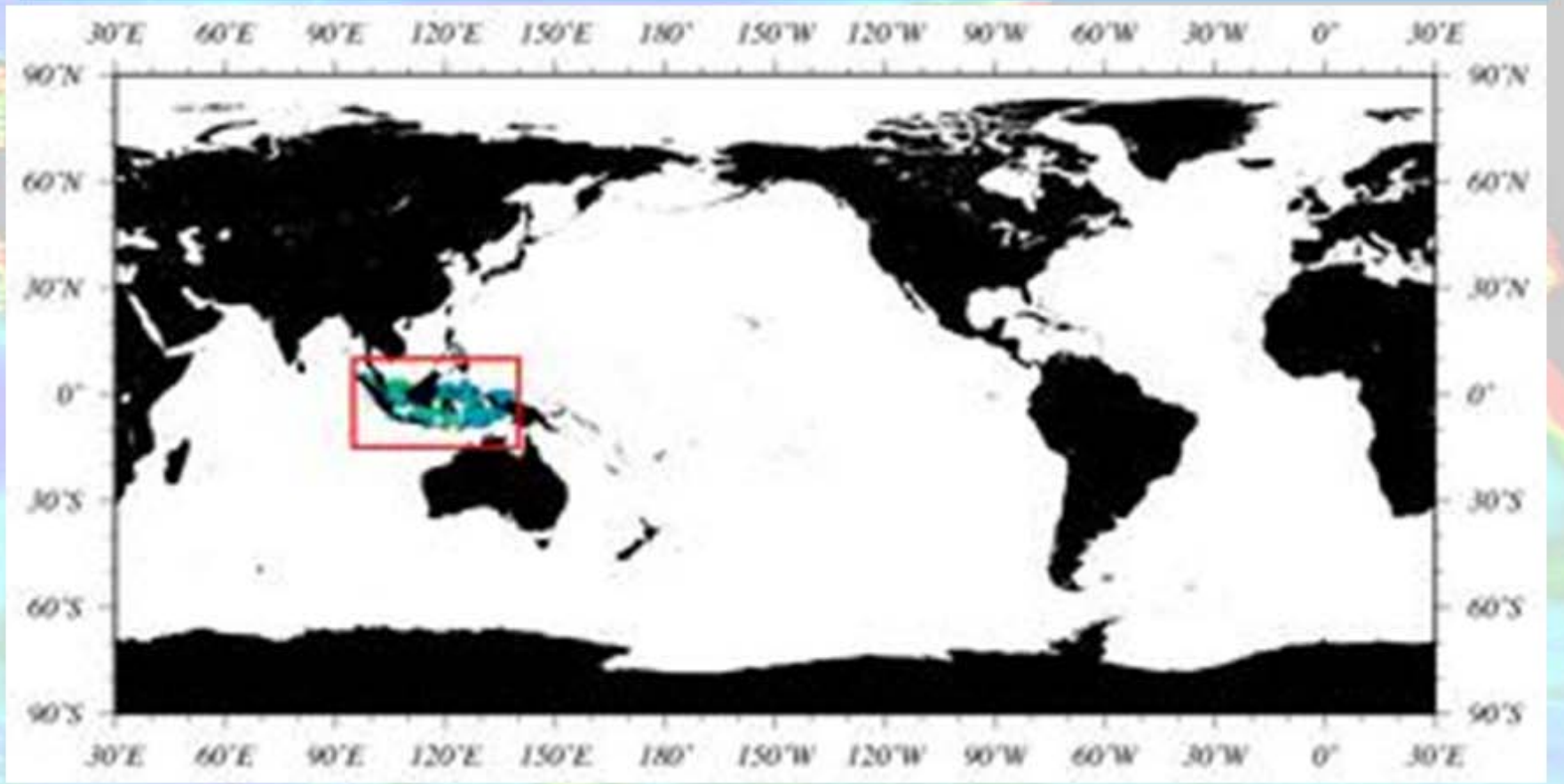


Zooplankton are mostly concentrated near the coasts of Java and Kalimantan. One of the important findings was zooplankton abundance in the Java Sea was higher than in that in the Indian Ocean The zooplankton are mostly concentrated near the coasts of Java and Kalimantan.

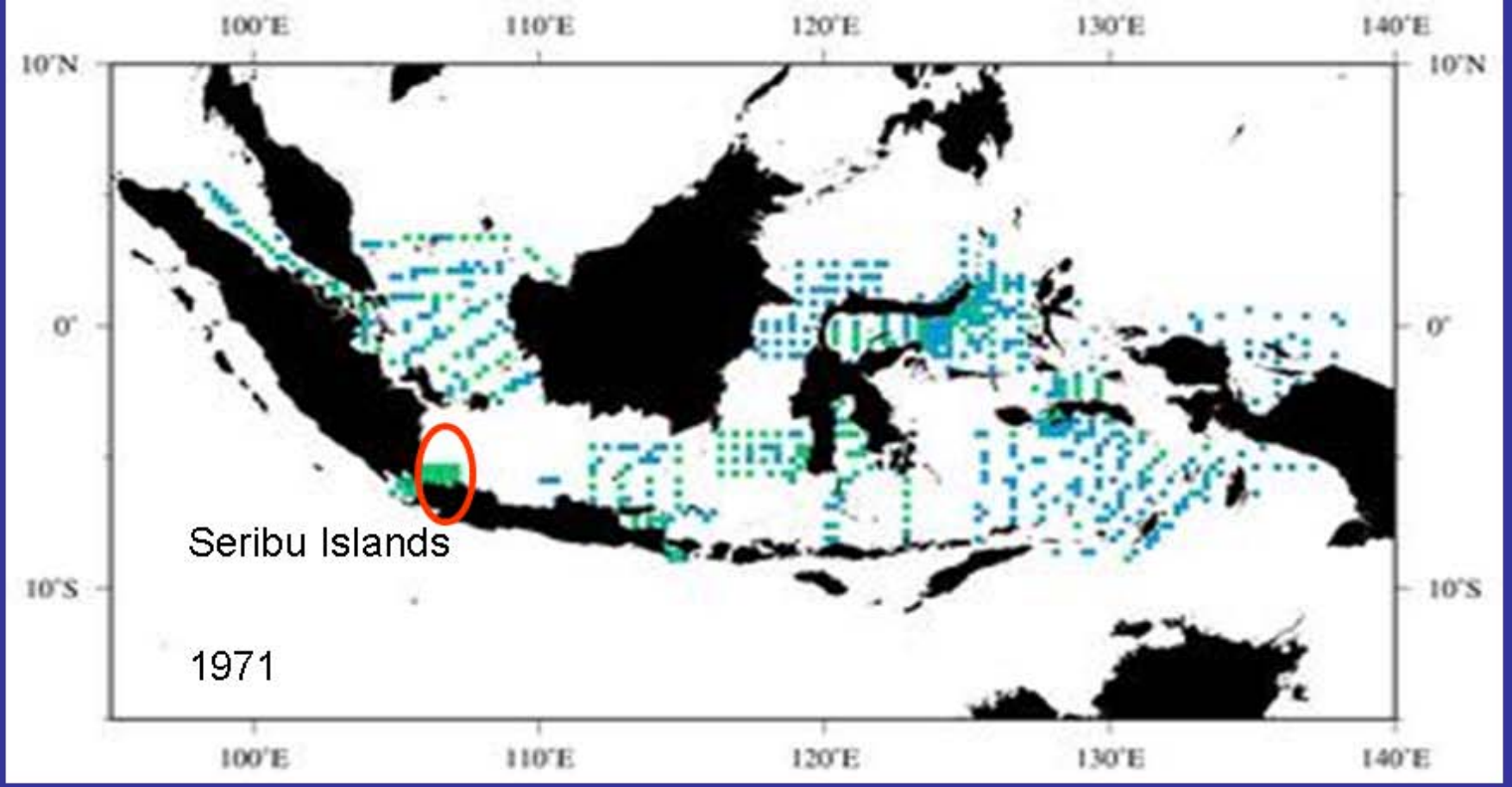
Praseno (1970)

Institue of Marine Research - JAKARTA

Zooplankton biomass data (*displacement volume, settled volume*) and phytoplankton biomass data (*settled volume*) collected by the Insitute of Marine Research - Jakarta.

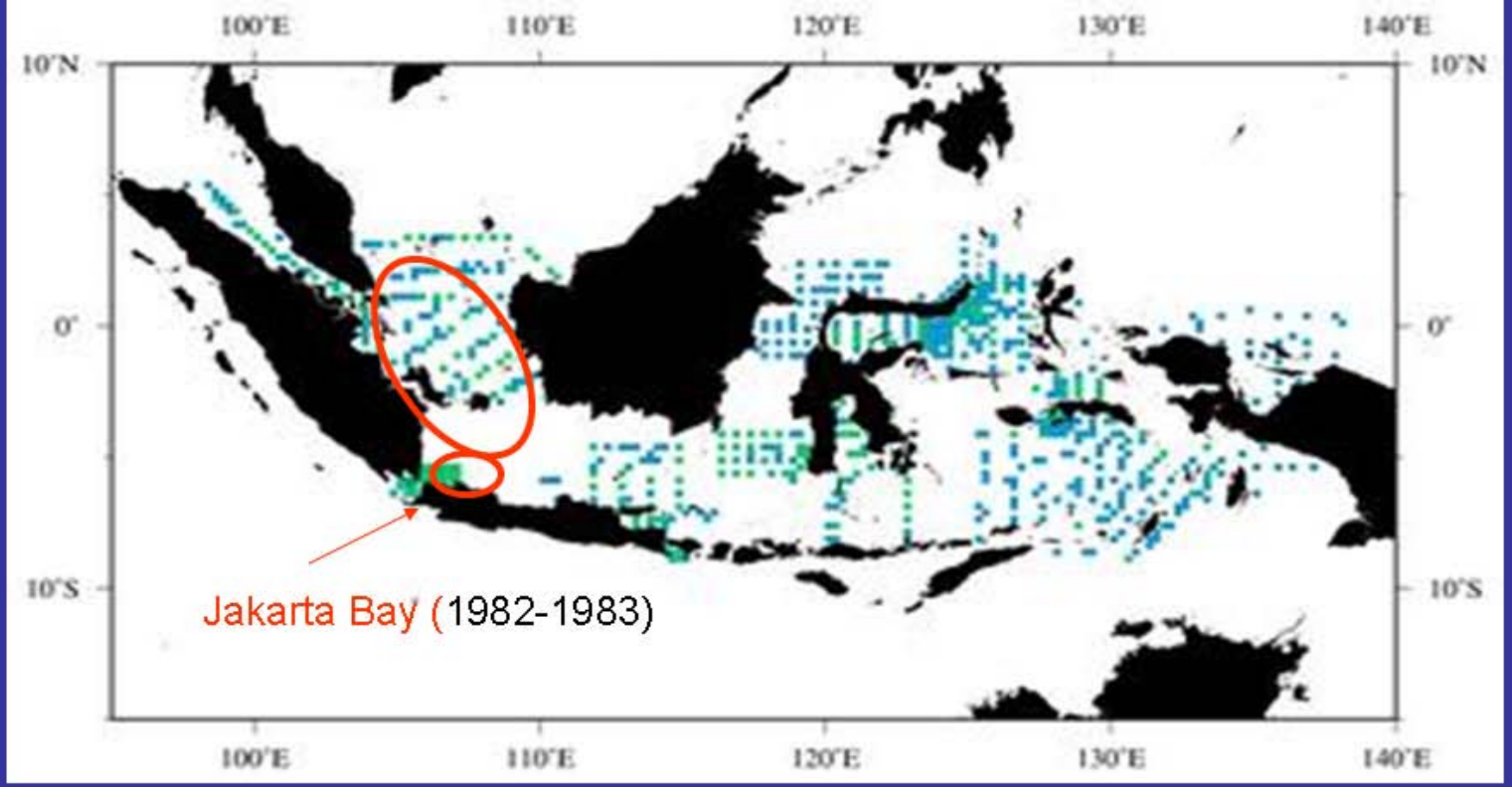


http://www.st.nmfs.gov/plankton/copepod-2005/2005biomass.html



Temporal distribution of zooplankton. The average density of zooplankton was 695 and 689 inds/m^3, during rainy (west monsoon) and dry seasons (east monsoon) in 1971, respectively. During the rainy season the distribution was more or less homogeneous, while during the dry season the plankton were concentrated near the coast.

Arinardi *et al*. 1977



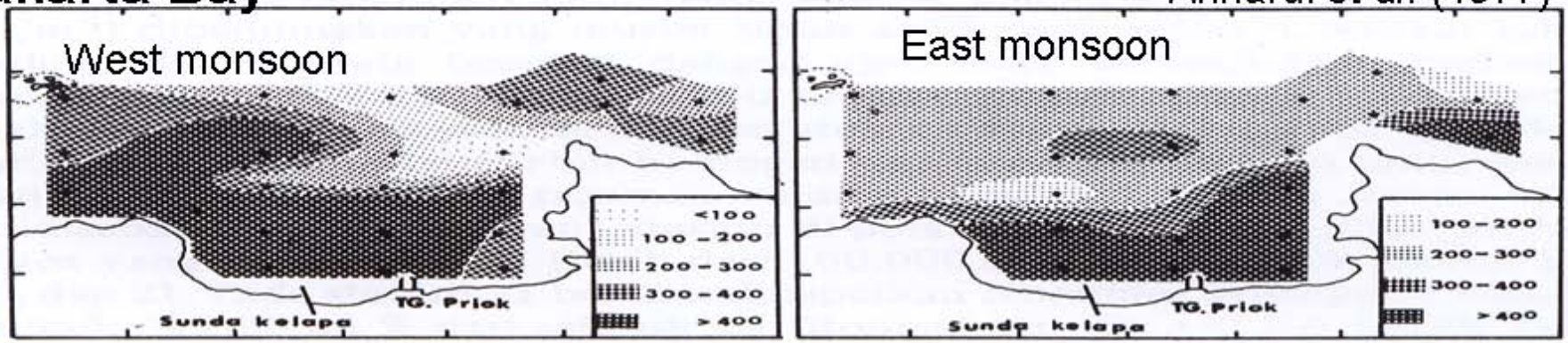
In off eastern Sumatera, western Kalimantan and southern part of the South China Sea the zooplankton displacement volume in the west monsoon is only a half volume than in the east season (0.15 and 0.30 ml/m3, respectively).

The similar condition was found in Jakarta Bay, zooplankton displacement volume in the west season lower than in the east season (0.50 and 0.80 ml/m3, respectively).

Sutomo *et* al. (1977)

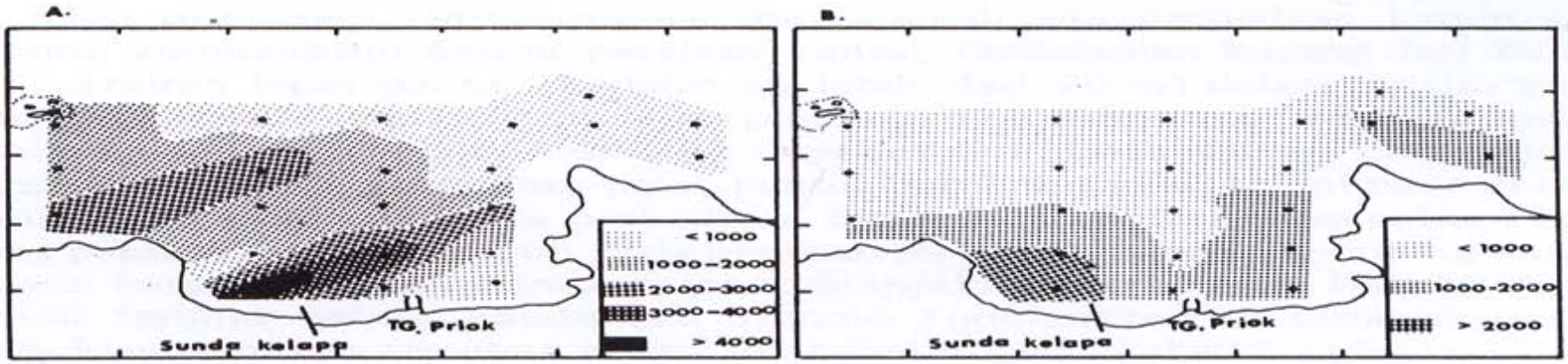
Jakarta Bay

Arinardi *et al.* (1977)



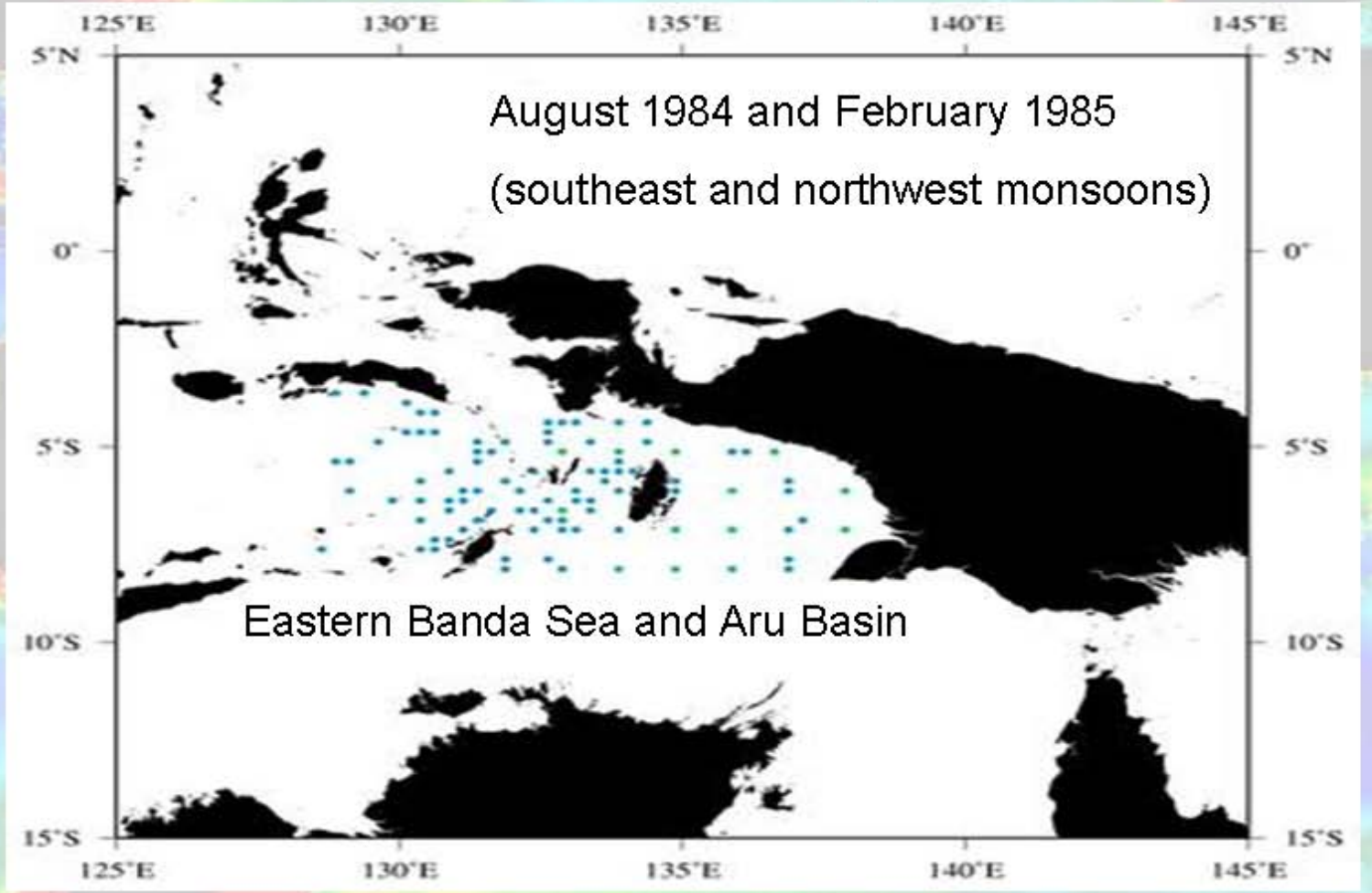
Displacement volume

During the rainy season (west monsoon) the distribution was more or less homogeneous, while during the dry season (east monsoon) the plankton were concentrated near the coast.



The average density of zooplankton was 695 inds/m³ during rainy (west monsoon) and 689 inds/m³ in dry seasons (east monsoon).

Snellius II Expedition



The reaction of pelagic ecosystem to monsoon-induced changes in hydrologi : Zooplankton biomass data– upwelling (southeast monsoon) – downwelling (northwest monsoon)

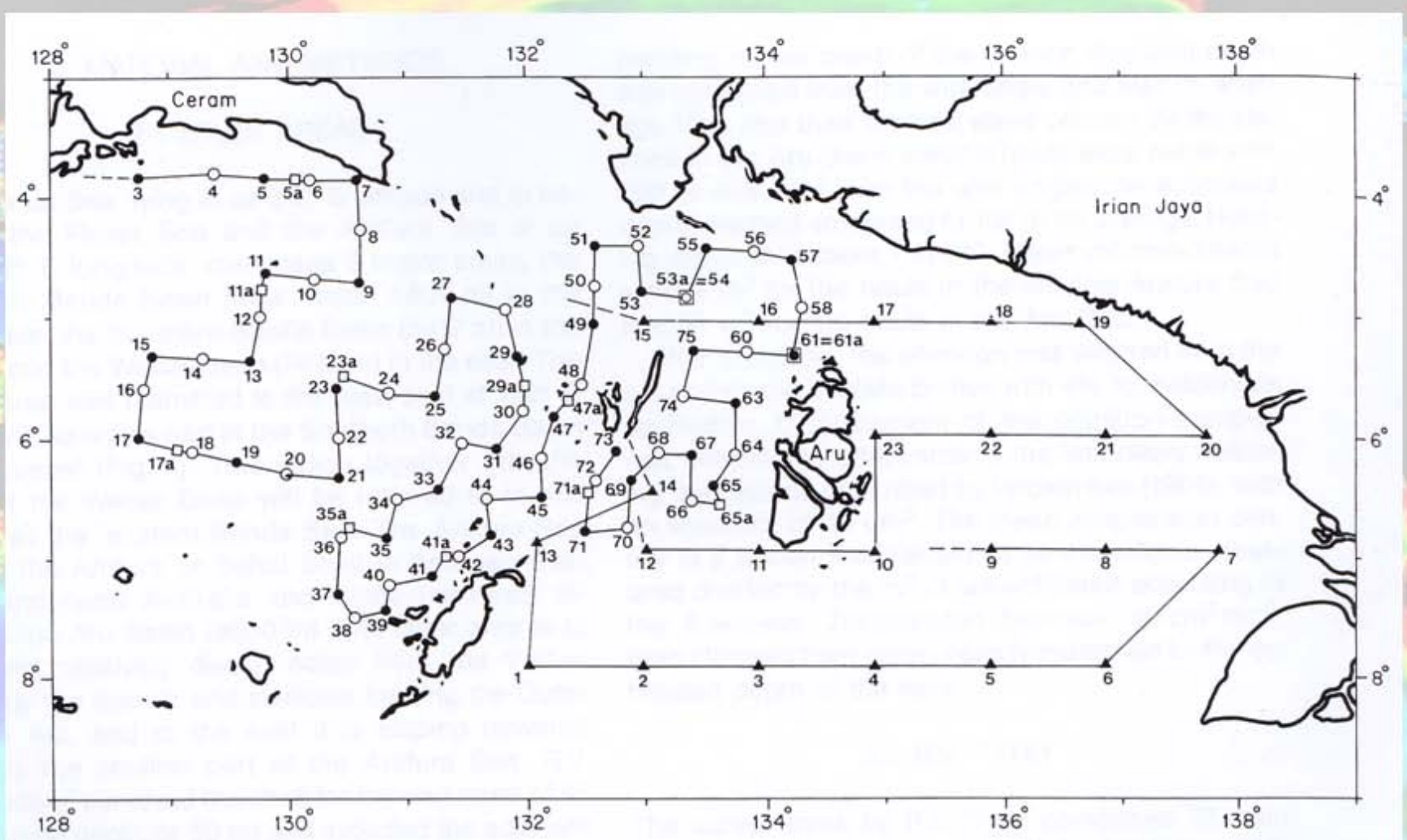


Fig. 1. Survey tracks of R.V. 'Tyro' (left) and R.V. 'Samudera' (right) during February 1985. Zooplankton sampling at all 'Samudera' stations (▲) by vertical net hauls, at even-numbered 'Tyro' stations (o) by double oblique Gulf V hauls and at 12 'Tyro' stations (● , nos. 3, 9, 15, ..., 57,63, 69) by vertical net hauls. Water casts at all 'Samudera' stations and at all odd- numbered 'Tyro' stations (● , □). Tracks during August 1984 were about similar, but R.V. 'Samudera' did not visit stations 11 and 12, and R.V. 'Tyro' did stations 59 (west of 58) and 62 (east of 63) instead of 75 and 74.

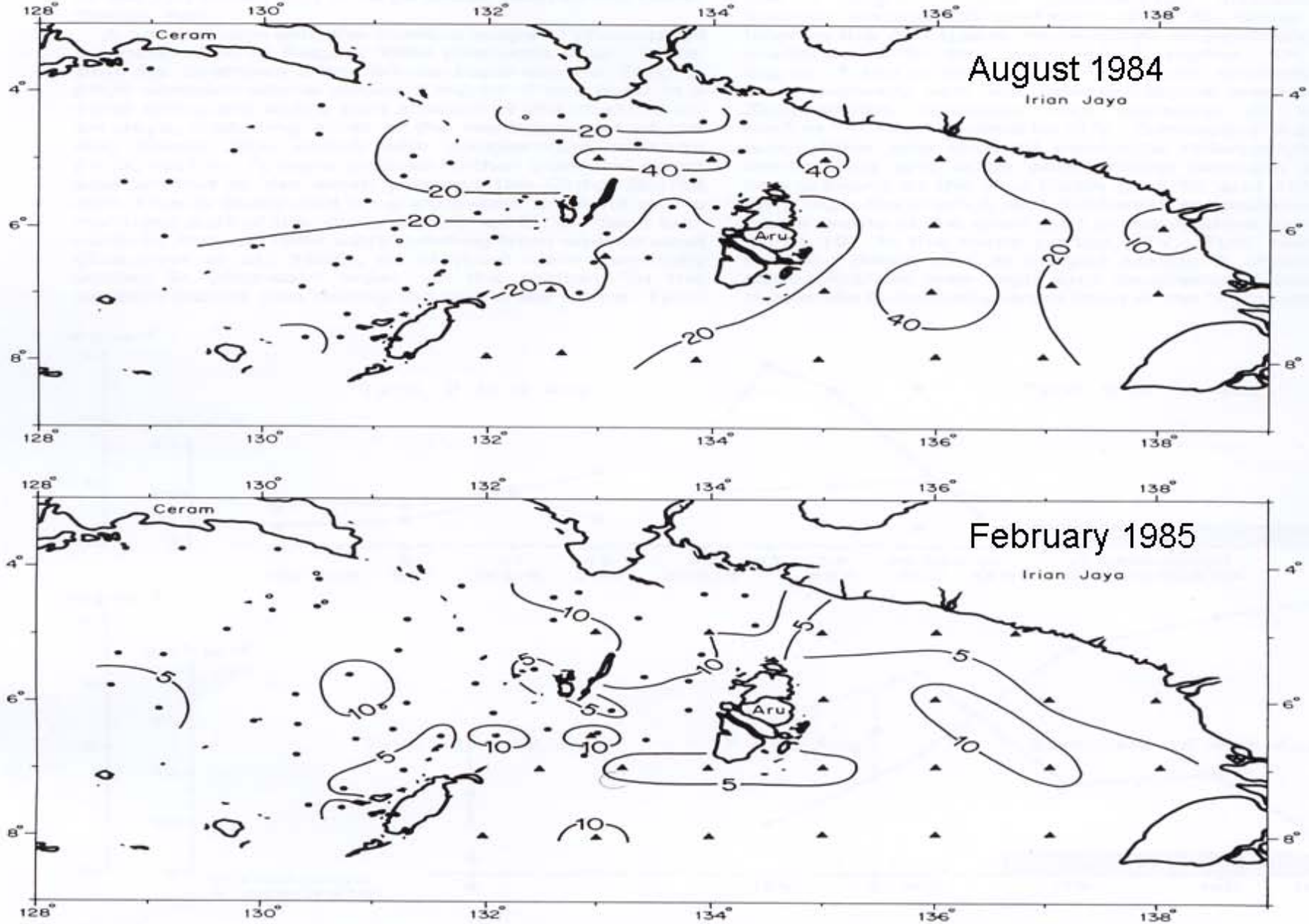


Fig. 7. Distribution of zooplankton displacement volume ($cm^3 \cdot m^{-2}$) during surveys in August 1984 (top) and February 1985 (bottom). Data by R.V. 'Tyro' (●) and R.V. 'Samudera (▲). Hauls by Gulf V and vertical nets to or from a depth of 150 m, or from near-bottom to surface in the shelf area east of Aru.

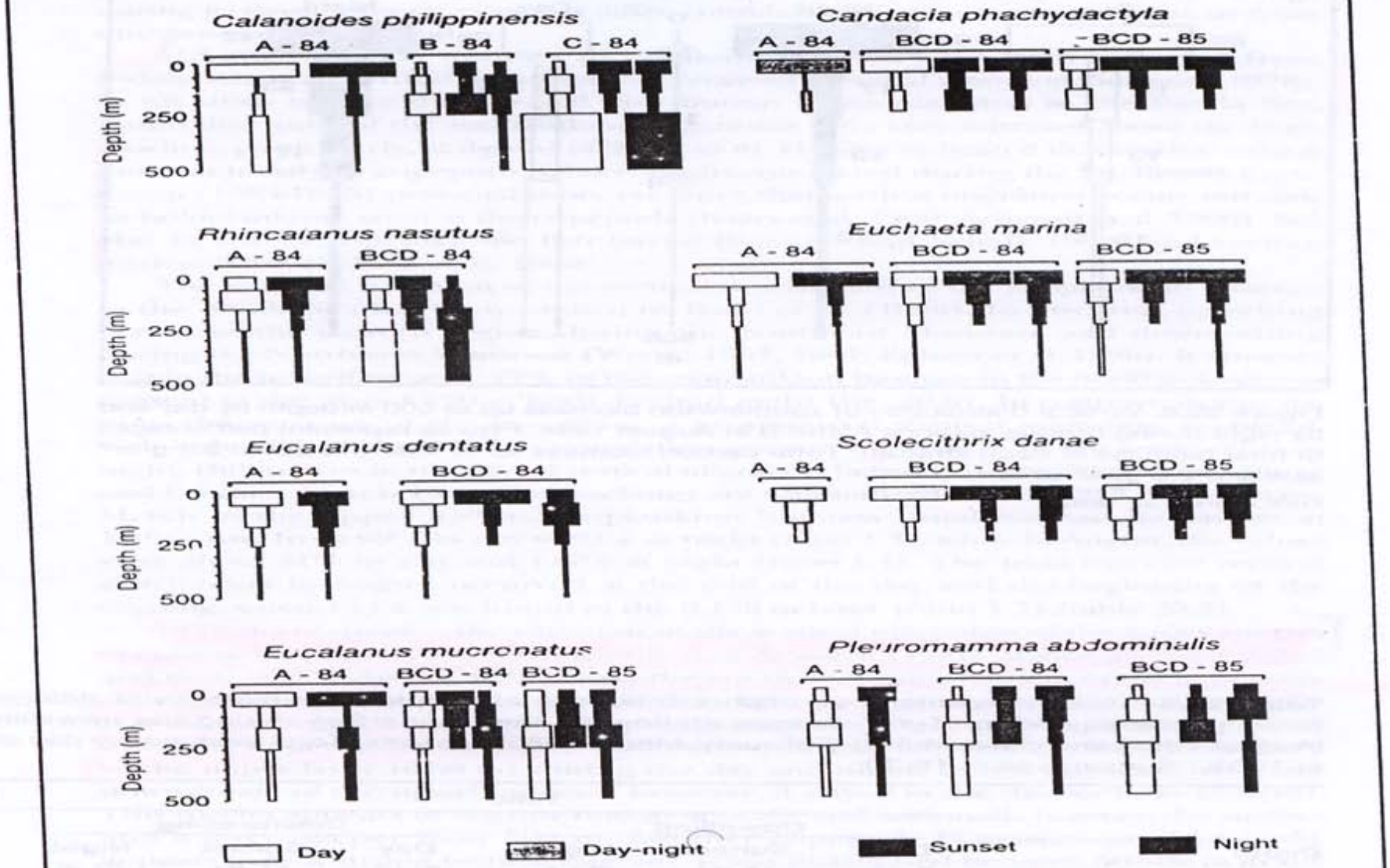
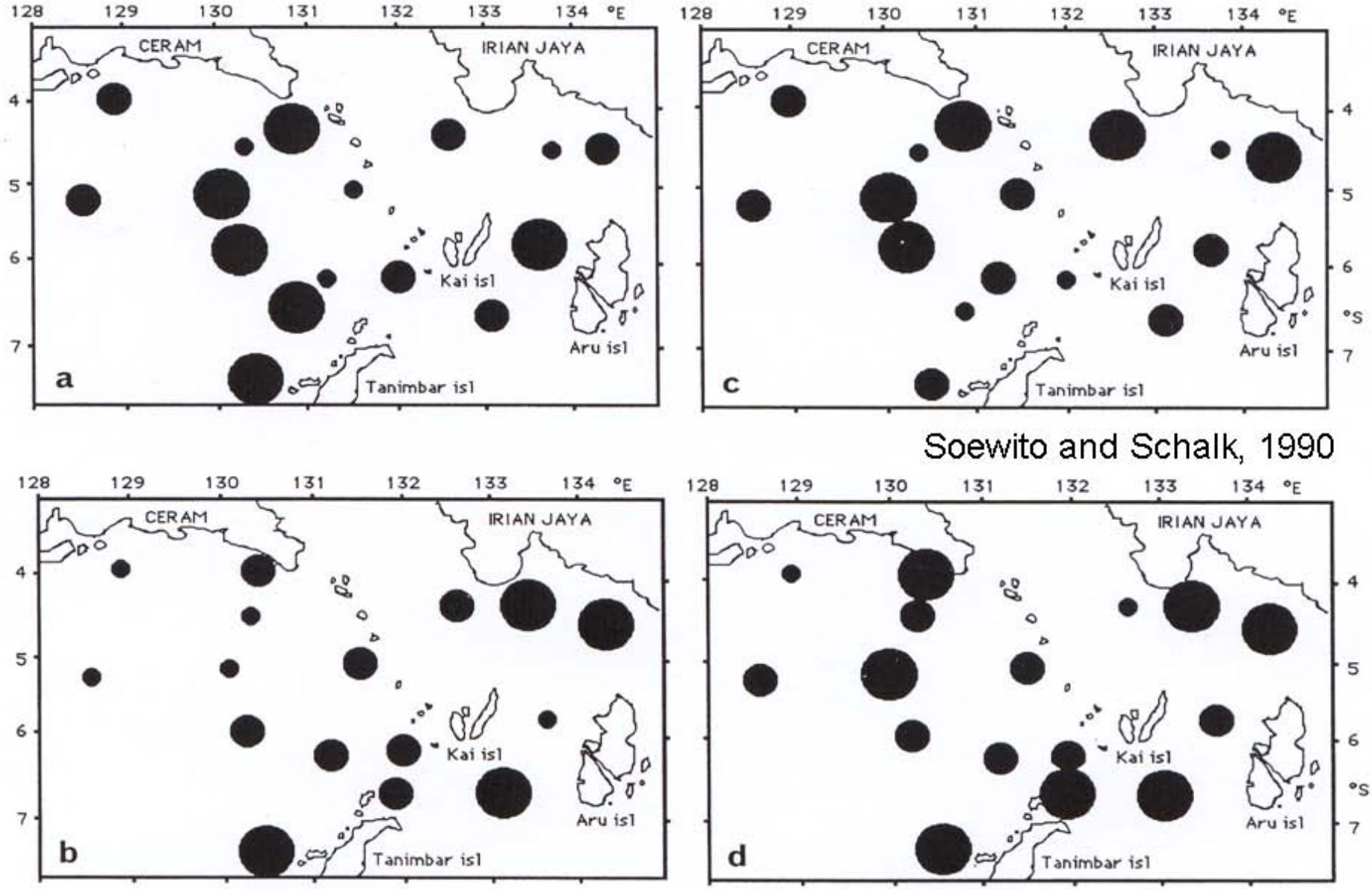


Figure 20.7. Vertical distribution of dominant copepod species in the Banda and Arafura Seas. A-84: August 1984 upwelling site in the northeastern Arafura Sea. B-84, C-84 and BCD-84: Sites downstream of upwelling during August 1984 in the eastern Banda Sea, and March 1985 (BCD-85). Relative abundance of the different layers is shown.

From Arinardi 1991.



Soewito and Schalk, 1990

Fig. 2. Abundance of fish larvae in the 0-100 m stratum at night during August 1984 (top panels) and February/March 1985 (bottom panels). Catches by RMT 1 (A, B) in categories <500, 500 - 1000 and >1000 larvae per 10 000 m^3, catches by RMT 8 (c, d) in categories <40, 40-80 and >80 larvae per 10 000 m^3.

Some findings during Snellius II

The productivity of the Arafura Sea is probably due mainly to upwelling, but terrestrial inputs of the rivers also contribute to the system.

It is possible to distinguish between different water masses using biological indicators

Vertical migration occurs not only by holoplankton, but also meroplankton and various micronekton

Likupang Coast

MANADO

BITUNG

TONDANO

TOMOHON

AMURANG

MINAHASA

SULAWESI SEA

MALUKU SEA

POIGAR

BELANG

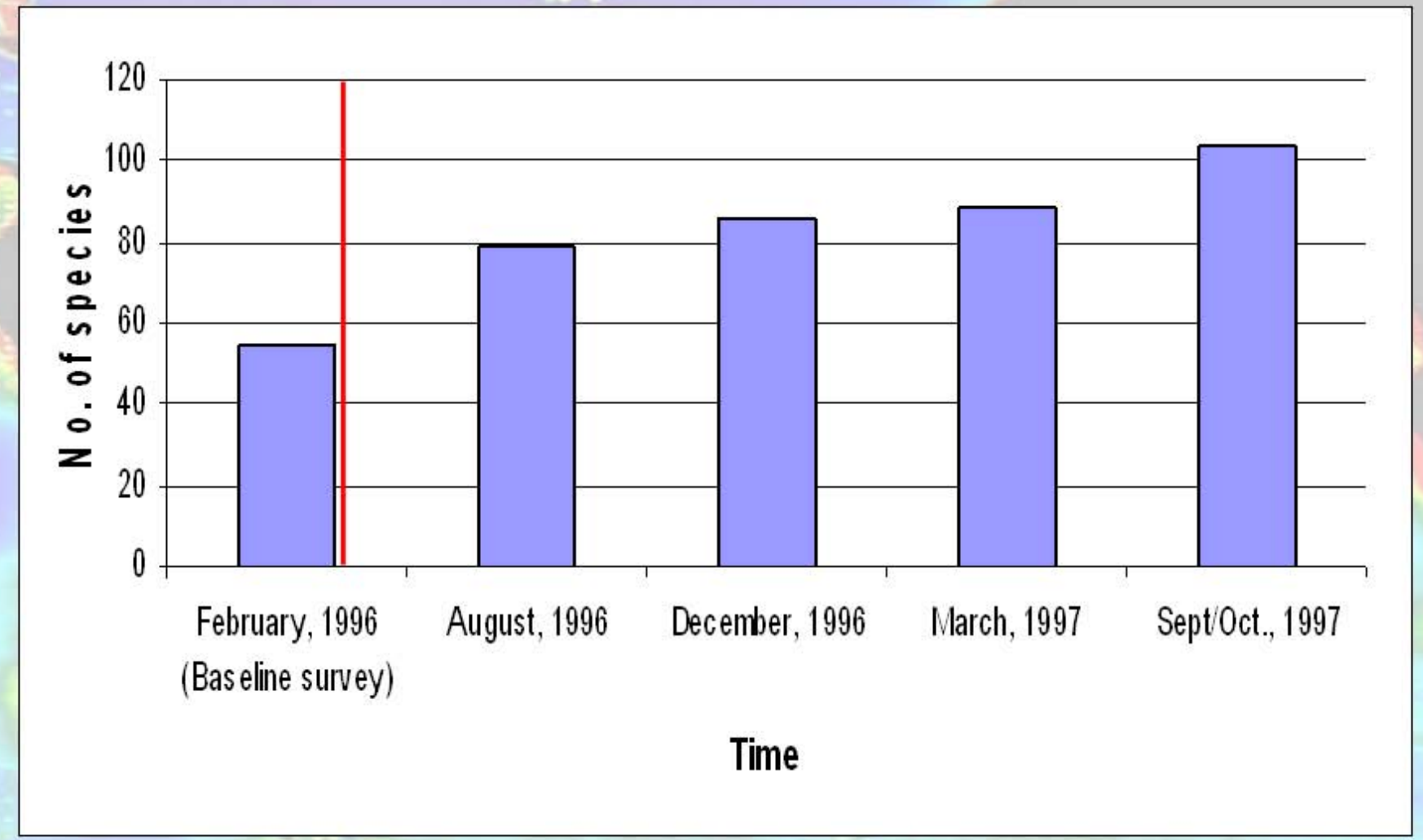
KOTAMOBAGU

BOLAANG MONGONDOW

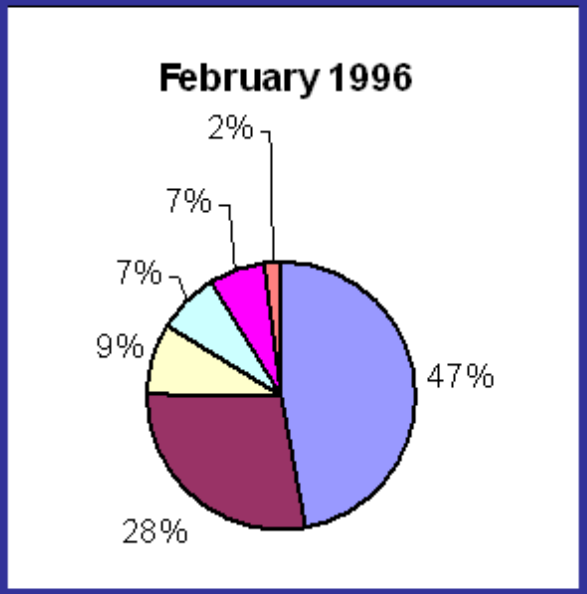
Buyat Bay

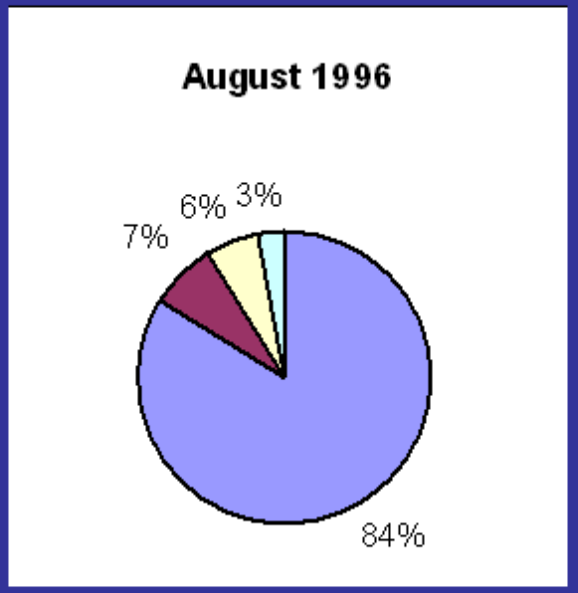
Information on zooplankton in Buyat Bay North Sulawesi facing Moluku Sea has been contributed by RESCAN (1997). Total zooplankton abundance is lowest in areas located in waters shallower than 120 m.

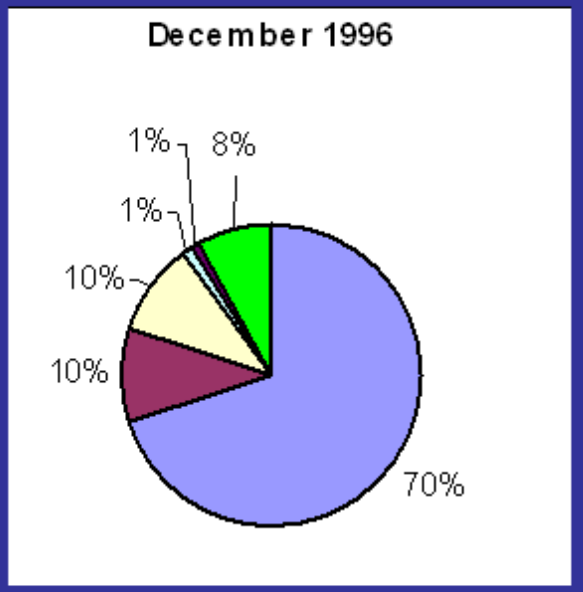
ZOOPLANKTON TAXA IN BUYAT BAY

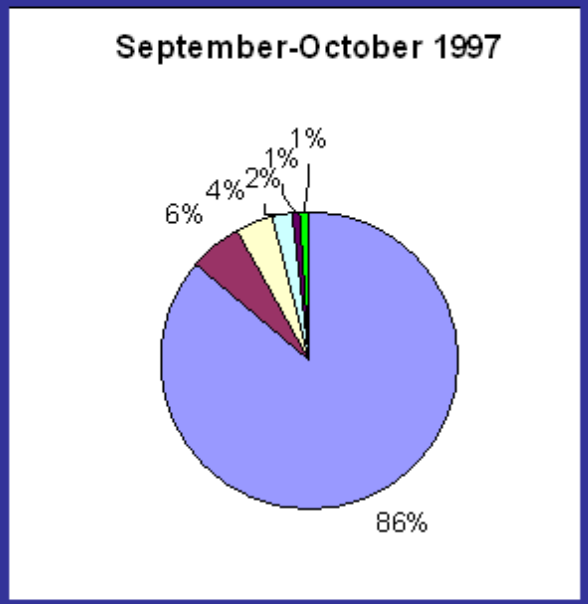


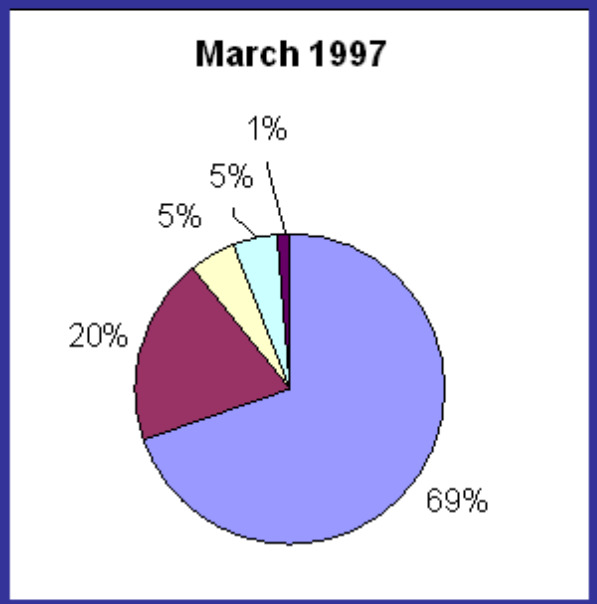
ZOOPLANKTON COMPOSITION IN BUYAT BAY











Arthropoda Chordata Molluscs Chaetognaths Coelenterata Annelida Cnidaria Miscellanous

Biological Studies

•In Ambon Bay:Yusuf (1979) studied on zooplankton biomass and composition affects the live bait fishes such as *Stolephorus* spp., *Rastrelliger* sp. and *Sardinella* spp.

*Fedding habit of several species of copepods have been reported, such as *Paracalanus aculeatus, Temora turbinata, Centropages tenuiremis* , *Acartia pacifica, Euchaeta concinna* and *Tortanus discaudatus …?*

•Ingestion and absorption of food by copepods, with 14ºC (NaH14CO3) or 35S (35S-Methionine) labeling techniques, such as *C. philippinensis* and *R. nasutus (Arinardi & Baars, 1986)*

• Breeding periods, sex ratio, and body size of a common *upweeling* calanoid species, *Calanoides philippinensis* by Arinardi (1986)

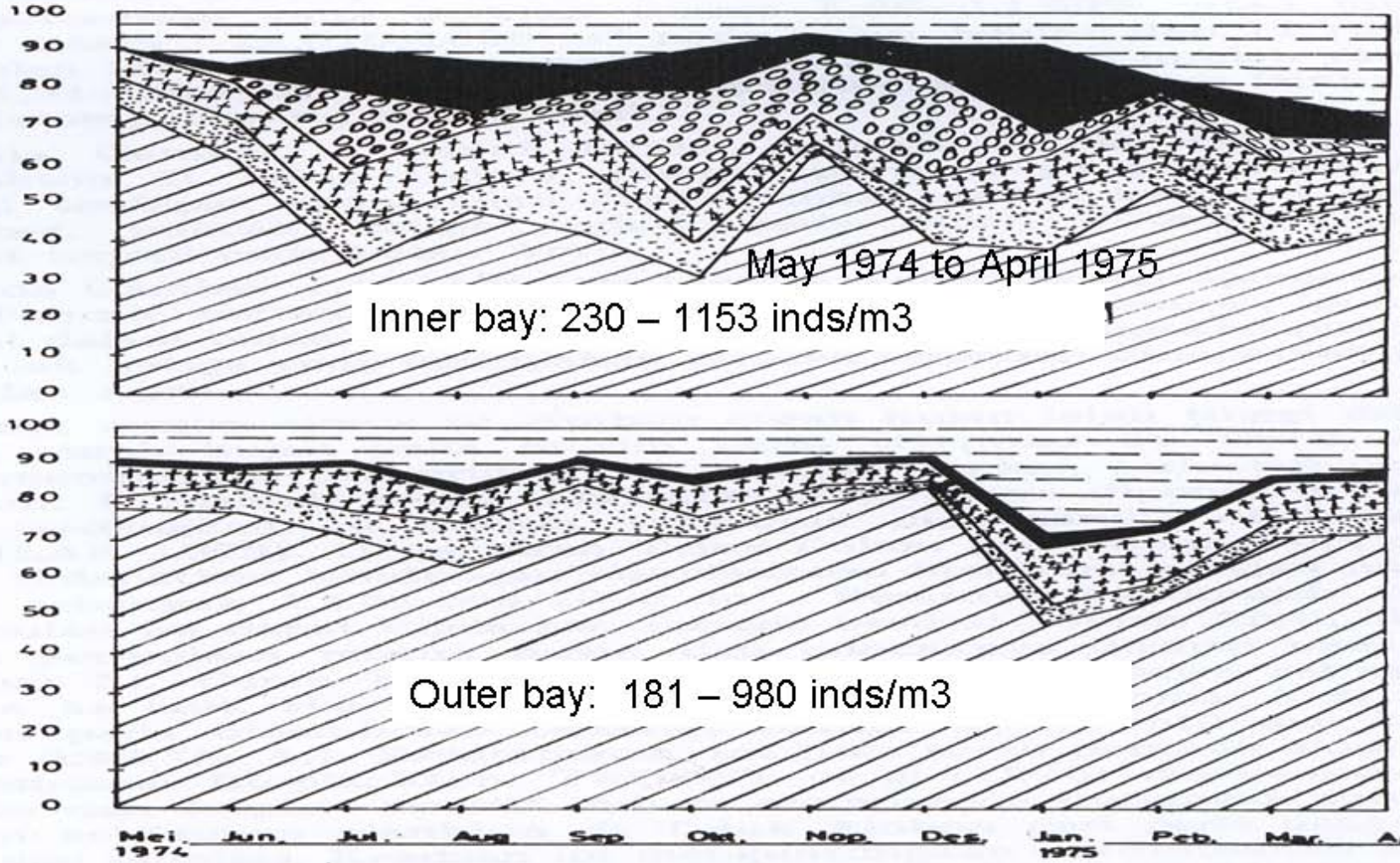
•The effects of temperature on the development of copepods *Euterpina acutifrons* have also been studied by Sutomo (2004)

•The effects of Cu++ and Hg++ on the fecundity of *Acartia pacifica* under controlled laboratory conditions by Romimohtarto & Yuana (1987)

Fisheries studies

Zooplankton in Ambon Bay

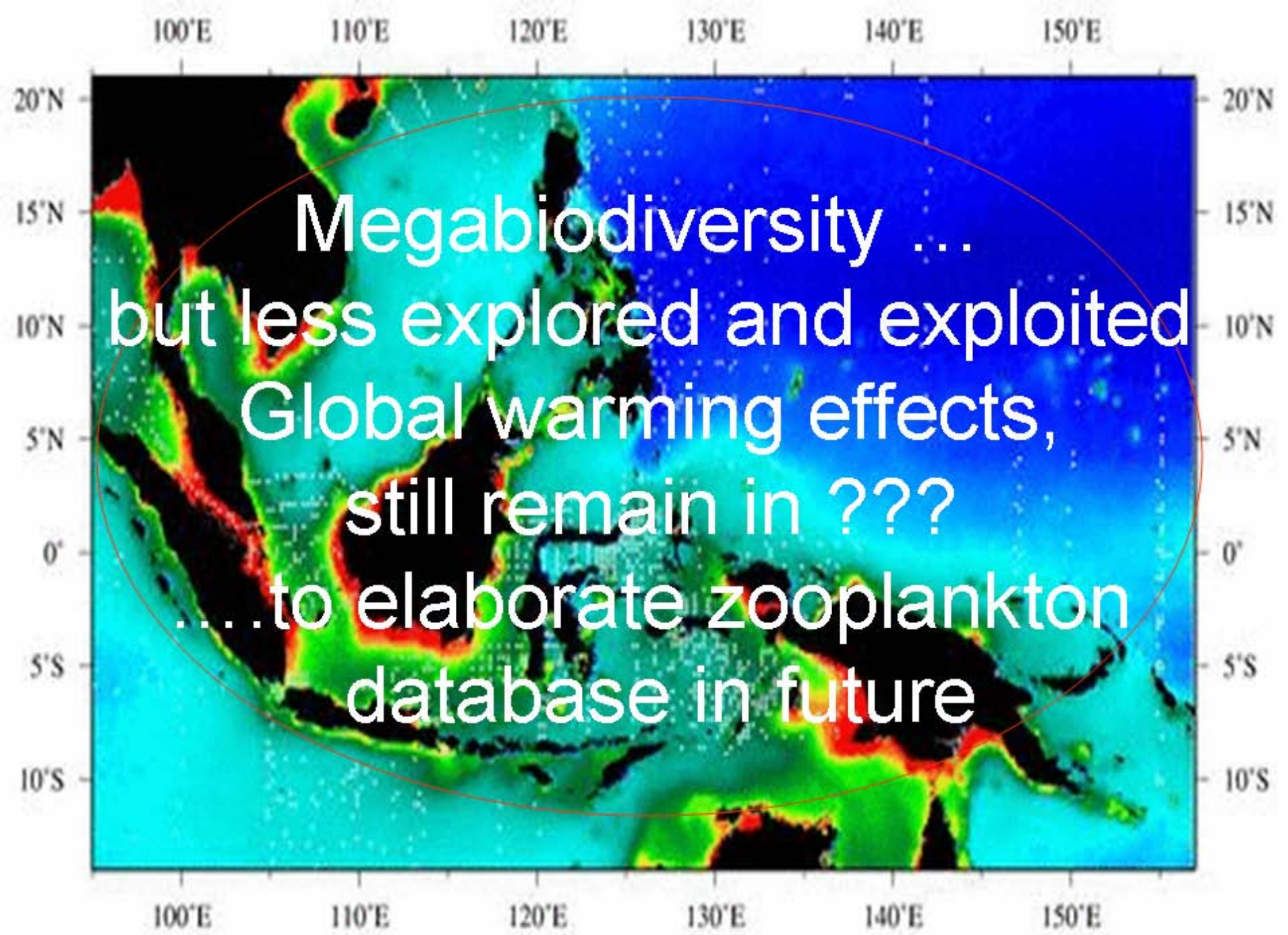
Jusuf (1979)



Gambar 2. Persentase kumulatif kelompok zooplankton di Teluk Dalam dan Teluk Luar.

Important fishing of live bait fishes for tuna and skipjack fishing, such as *Stolephorus* spp., *Rastrelliger* sp. and *Sardinella* spp

Recommendation


100°E
110°E
120°E
130°E
140°E
150°E
20°N
15°N
10°N
5°N
0°
5°S
10°S
Megabiodiversity …
but less explored and exploited
Global warming effects,
still remain in ???
…..to elaborate zooplankton
database in future


THANK
YOU
Manado Bay