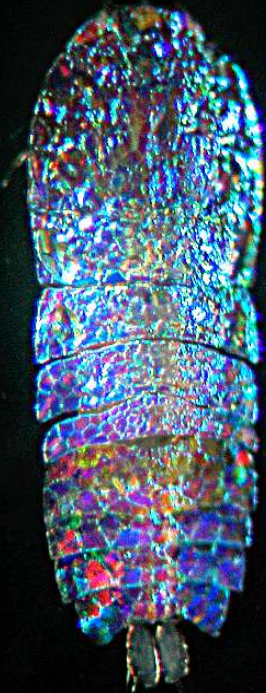


Zooplankton biodiversity in Southeast Asia: An overview

Shuheï Nishida

*Atmosphere and Ocean Research Institute
University of Tokyo*



Center of marine biodiversity

Tethyan origin (200 MYA)

Complex geologic history

- eustatic sea-level change
- continental fusion/fission

Island chains, marginal basins

Java Sea

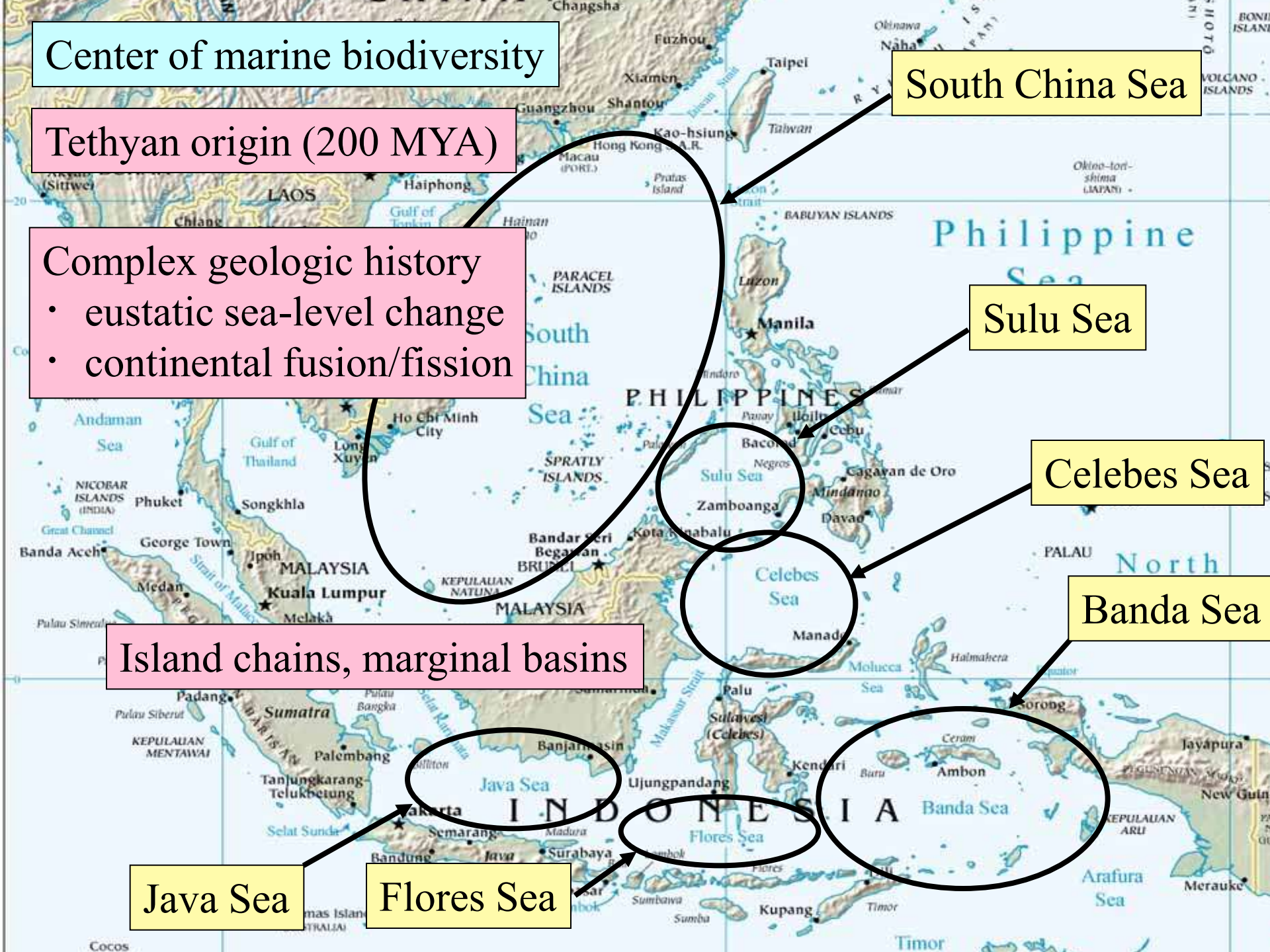
Flores Sea

South China Sea

Sulu Sea

Celebes Sea

Banda Sea





MUSORSTOM Expedition (1976, 80, 84)

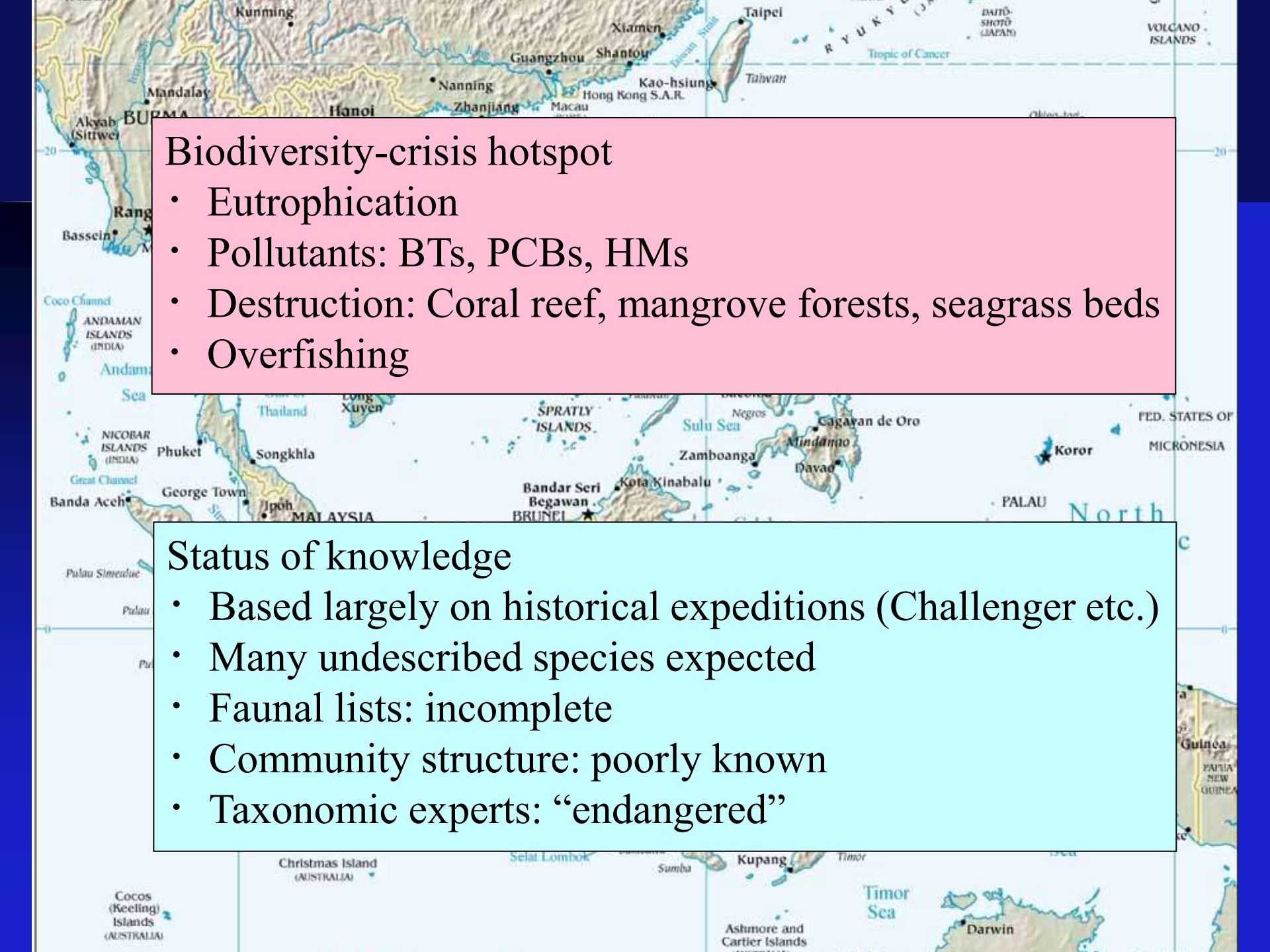
- Living fossil: *Neoglyphea* “Jurassic shrimp”
- Benthos and demersal fish 600 spp., > 80 new species

Living fossil: Coelacanth (1998)

Indo-Malay Archipelago
Pelagic copepods: ca. 550 spp.
(1/4 of world total)

Sulu Sea



A map of Southeast Asia and surrounding regions, including parts of China, Burma, Thailand, Malaysia, Brunei, Indonesia, and the Philippines. Major cities like Kunming, Hanoi, Nanning, Guangzhou, Shantou, Xiamen, Taipei, and Macau are labeled. The Tropic of Cancer is shown as a dashed line. A pink text box is overlaid on the map.

Biodiversity-crisis hotspot

- Eutrophication
- Pollutants: BTs, PCBs, HMs
- Destruction: Coral reef, mangrove forests, seagrass beds
- Overfishing

A map of Southeast Asia and surrounding regions, including parts of China, Burma, Thailand, Malaysia, Brunei, Indonesia, and the Philippines. Major cities like Kunming, Hanoi, Nanning, Guangzhou, Shantou, Xiamen, Taipei, and Macau are labeled. The Tropic of Cancer is shown as a dashed line. A cyan text box is overlaid on the map.

Status of knowledge

- Based largely on historical expeditions (Challenger etc.)
- Many undescribed species expected
- Faunal lists: incomplete
- Community structure: poorly known
- Taxonomic experts: “endangered”

Biodiversity of Zooplankton in Southeast Asia

Census of Marine Zooplankton (CMarZ/CoML): 2004-2010

JSPS Program- Coastal Marine Science: 2001-2010

Thailand
Malaysia
Indonesia
Philippines
Vietnam
Japan

Sites for

- ★ General Sampling
- ★ Community-structure Study
- Taxonomic Survey

**Hakuho-Maru
Cruises**

- Sulu Sea
- Celebes Sea
- South China Sea



Aims of research

Goals

- Past- and present status of zooplankton communities
- Mechanisms of generation/maintenance of biodiversity
- Functional role of biodiversity
- Future of the marine ecosystem

Approaches

- Fulfill basic knowledge of biodiversity at species/community levels
- Utilize genetic tools for biodiversity analysis
- Establish databases
- Have training courses on methods of ecology and identification

Major accomplishments



1. Discovery of new species
2. Community structure
3. Genetic diversity (incl. East Asian Region)
4. Education and outreach
5. Database (CMarZ-Asia Database)

1. Discovery of new species from Asian Region (2001–2010)

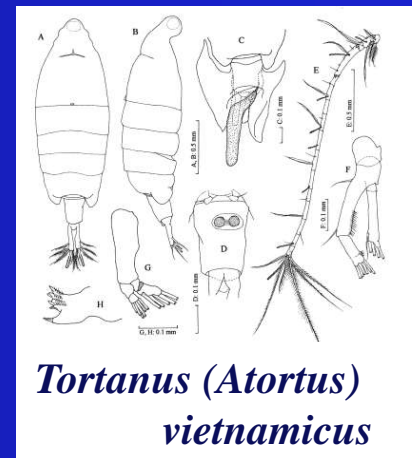
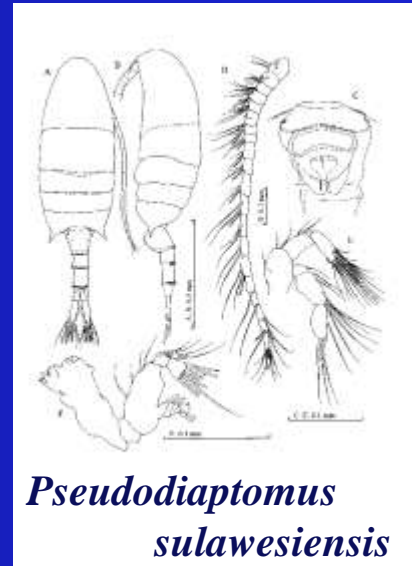
43 scientific papers describing
1 new family, 6 new genera
And 82 new species

- Mysids: 2 new gen. & 37 n. spp.
- Copepods: 4 new gen. & 38 n. spp.
- Other Crustacea: 5 n. spp.

Still >> 50 species are waiting for description

Specific habitats

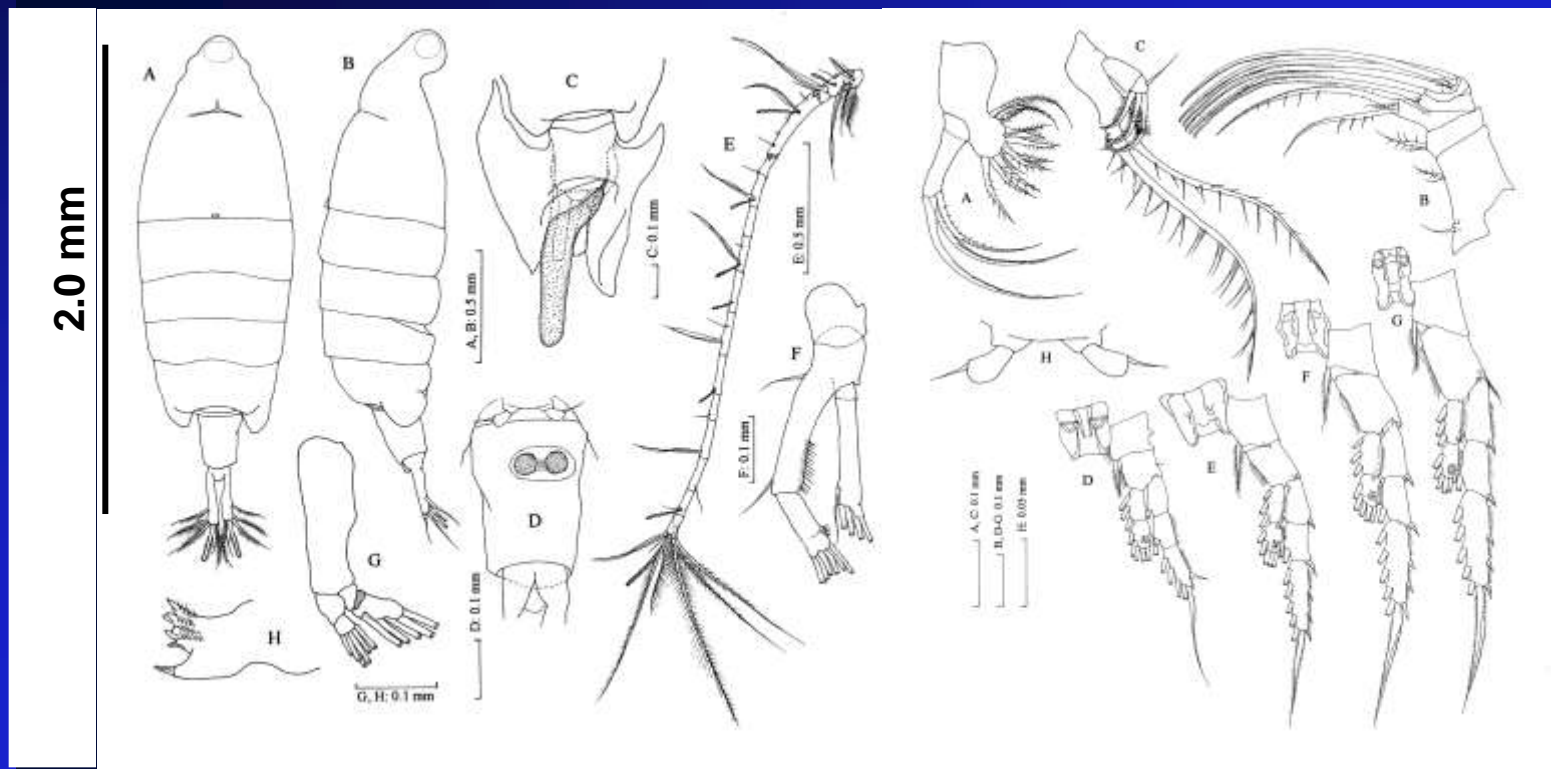
- estuaries
- benthic-pelagic zone
- coral reefs
- marginal basins



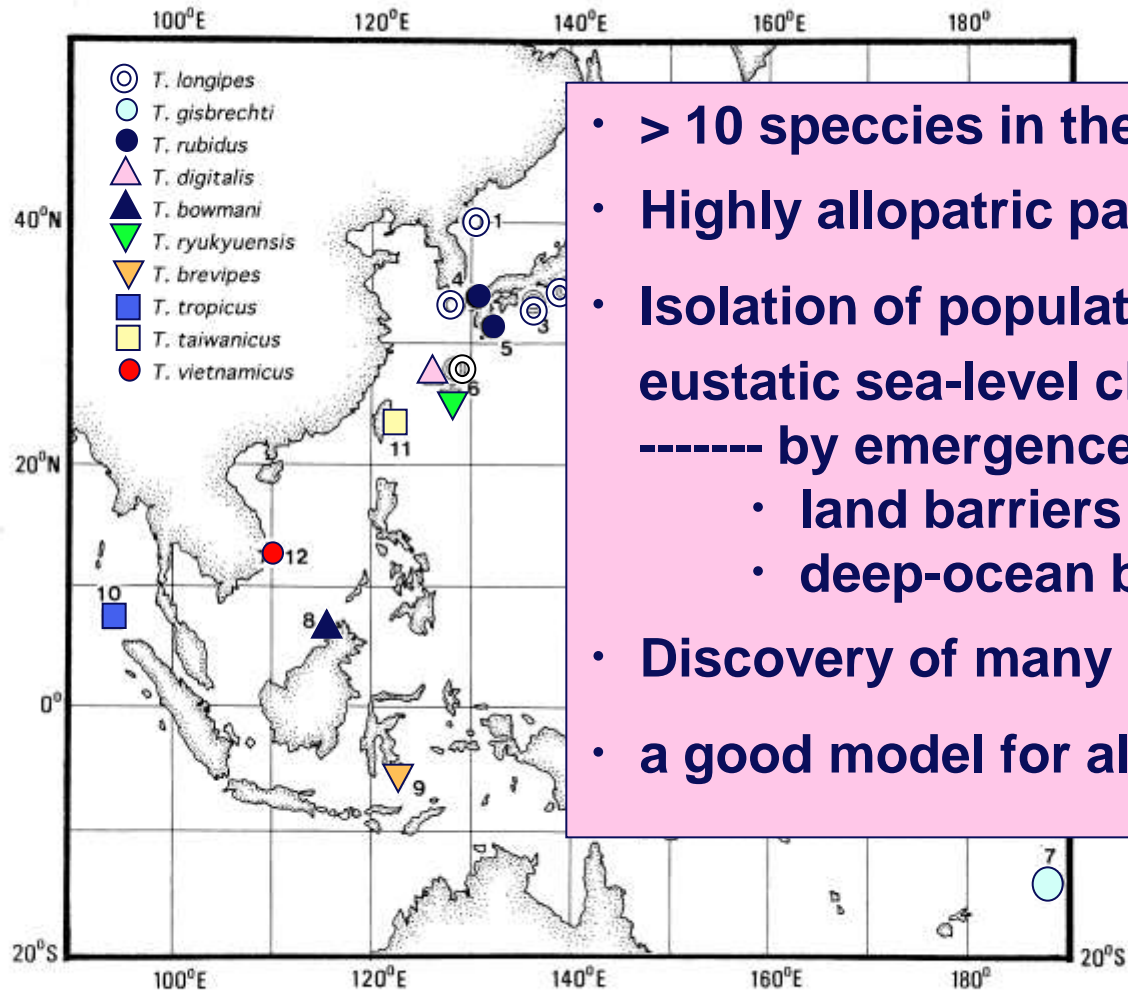
Tortanus (Atortus) vietnamicus

Nishida & Cho, 2005

- Simple collection from a pier with a small plankton net
- Night-time sampling
- Representing pristine habitat: coral-reef area of Nha Trang



Zoogeography of *Tortanus* (*Atortus*) : *Tropicus*-subgroup



- > 10 species in the Indo-pacific
- Highly allopatric pattern of distribution
- Isolation of populations through eustatic sea-level changes
 - by emergence of
 - land barriers
 - deep-ocean barriers
- Discovery of many more species expected
- a good model for allopatric speciation

2. Community structure in characteristic habitats

- Mesopelagic communities in marginal basins (Sulu, Celebes, and South China Seas) by Jun Nishikawa

Nishikawa

- (• Monitoring in the Straits of Malacca Othman B.H. Ross)

- Comparison between coral and sea-grass habitats by Ephrime B. Metillo

- Collaborative Jellyfish research in Vietnam and Indonesia
J. Nishikawa & coworkers

Jellyfish fisheries in the north of Vietnam

To know...

- Target species
- Fishing gear
- Processing method
- Economic and Ecological aspects
(Nishikawa et al. 2008)

- PI: Nguyen Thi Thu (IMER)
- Funded by: Vietnam Academy of Science and Technology (VAST)
- Years: 2006-2007
- JSPS collaborator: Jun Nishikawa



An on-going bilateral research project

**“Biodiversity and Ecological Roles of Medusae and
Ctenophores in Indonesian Waters”**

2008-2010

LIPI-JSPS

S. Ohtsuka and Mulyadi (Co-PIs)

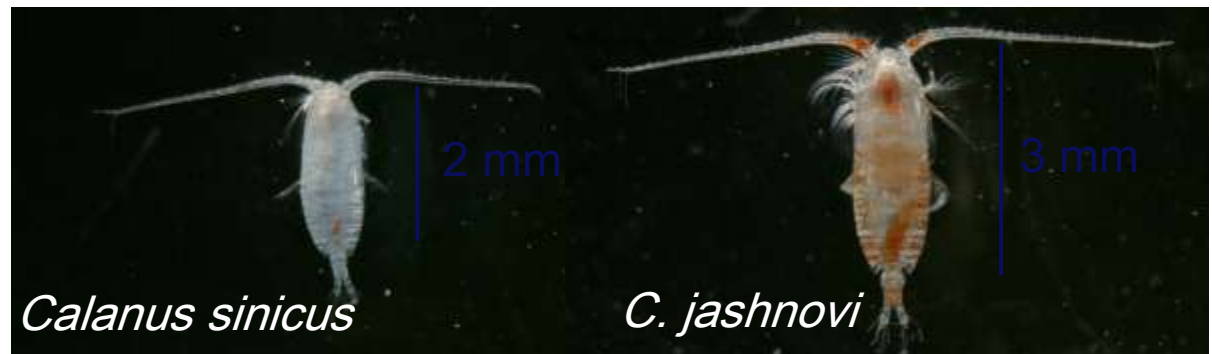
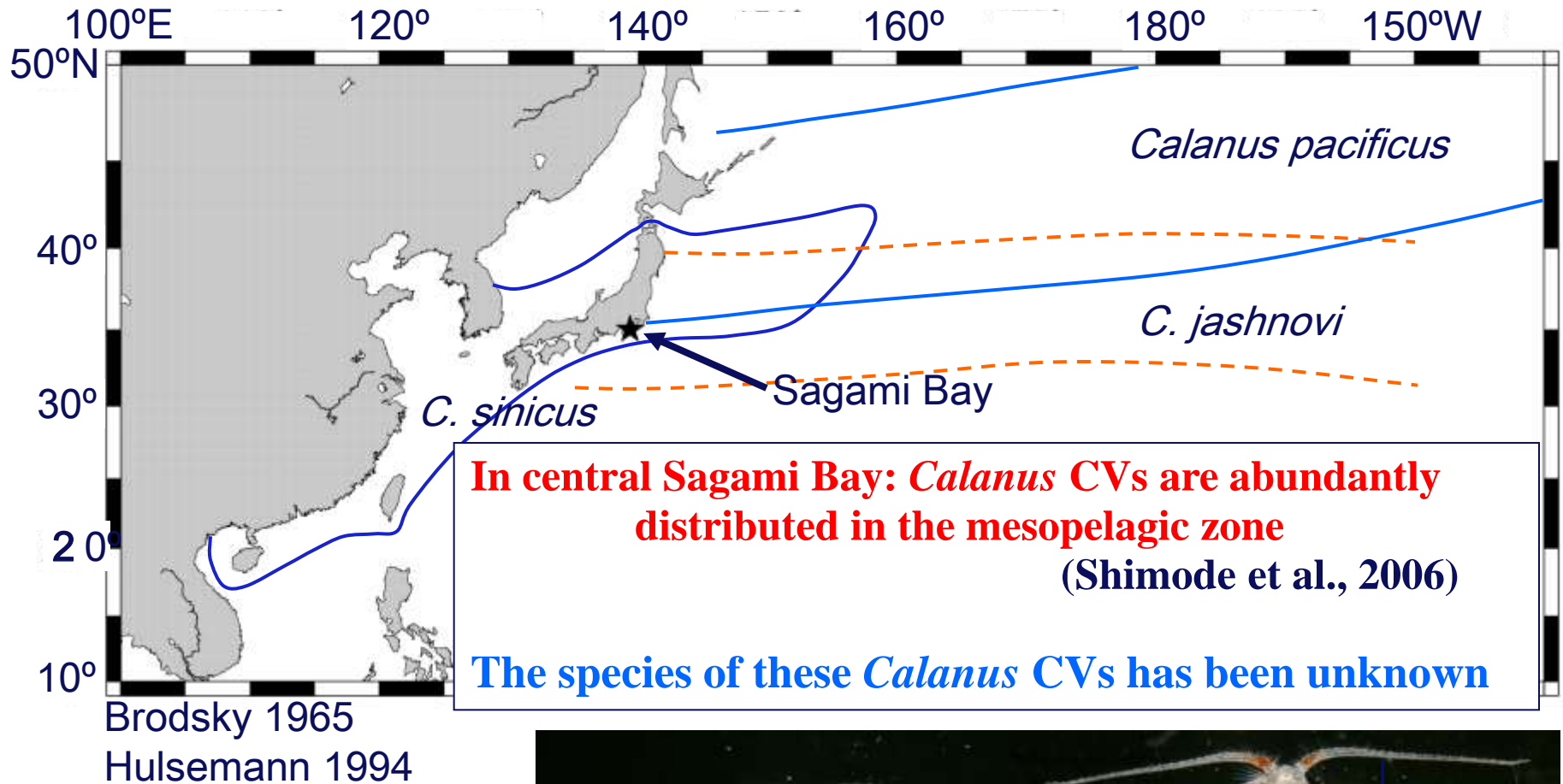
R. Machida, J. Nishikawa, S. Nishida, J. Hiromi, D.J. Lindsay,
Y. Miyake and 3 Indonesian Scientists

- Taxonomy, ecology, life history, behavior
- Edible giant jellyfishes

3. Genetic biodiversity (including other regions)

- Barcoding of copepods and chaetognaths (ca. 120 species)
- Zooplankton community genomics by Ryuji Machida
- Re-evaluation of chaetognath taxonomy by molecular tools by Hiroomi Miyamoto
- Identification by molecular tools discovered large mid-water populations of *Clalanus sinicus* (Nonomura et al. 2008)

Geographical distribution of *Calanus* in the western North Pacific



Genetic variation of *C. sinicus*, *C. jashnovi*, *C. pacificus*

	srRNA	ITS1	ITS2
<i>C. sinicus</i>	<0.002	<0.001	<0.001
Between spp.	0.119-0.149	0.010-0.014	0.005-0.010

Genetic distance within *C. sinicus*, and between *C. sinicus*

C. jashnovi and *C. pacificus*

Regions: srRNA (456-458bp) , ITS1 (366bp) , ITS2 (185-186bp)

Three species of *Calanus* can be identified at three regions

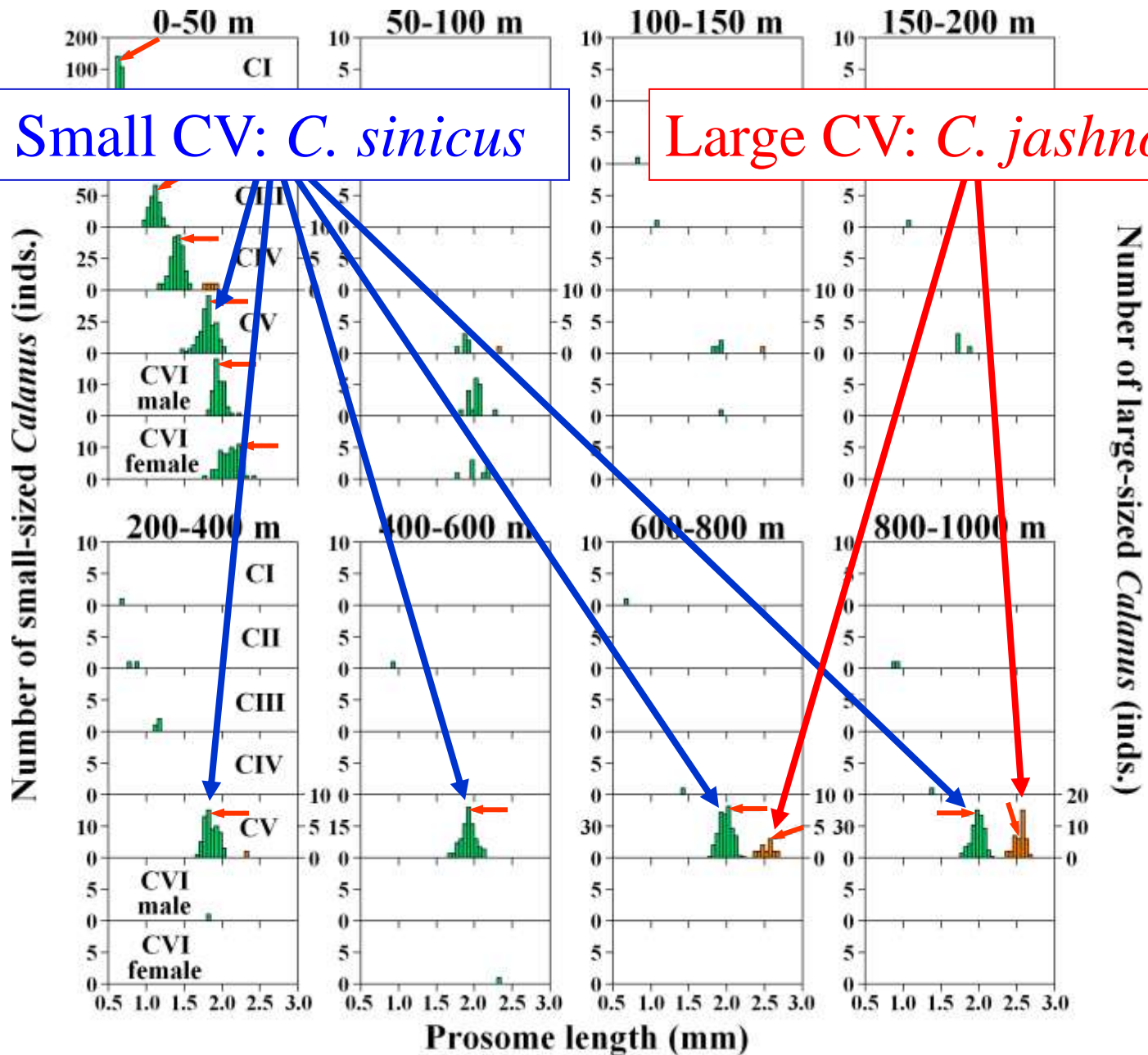
Calanus spp.: Vertical distribution and genetic identification

0-200m
4 layers

Small CV: *C. sinicus*

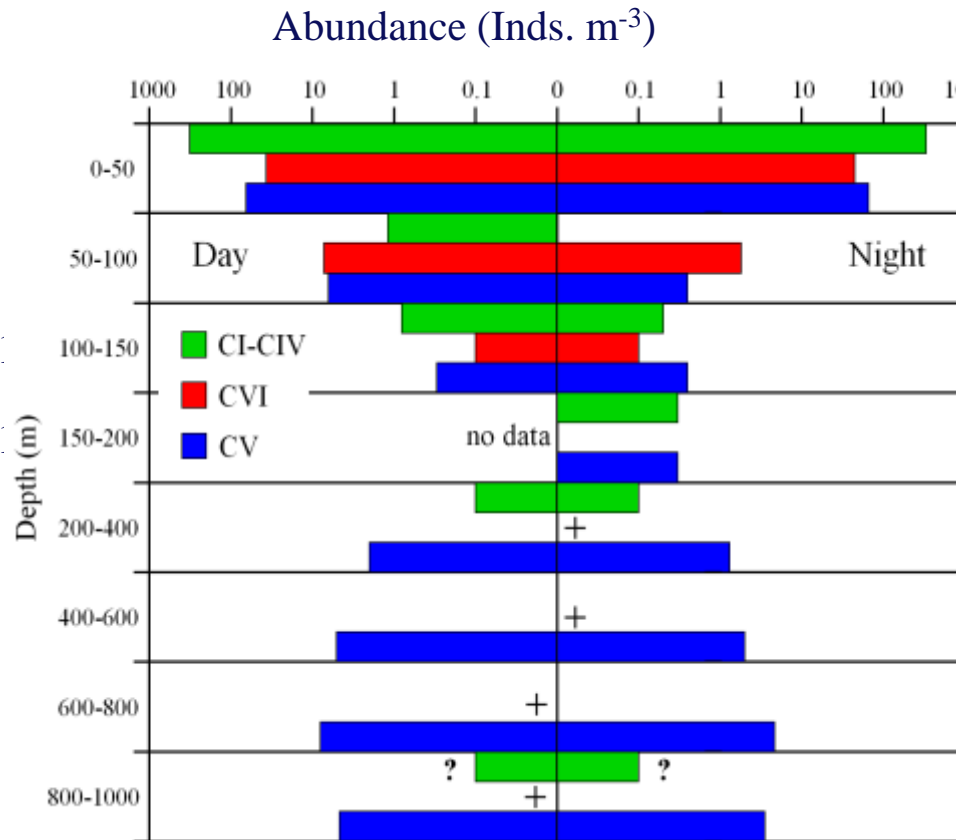
Large CV: *C. jashnovi*

200-1000m
4 layers



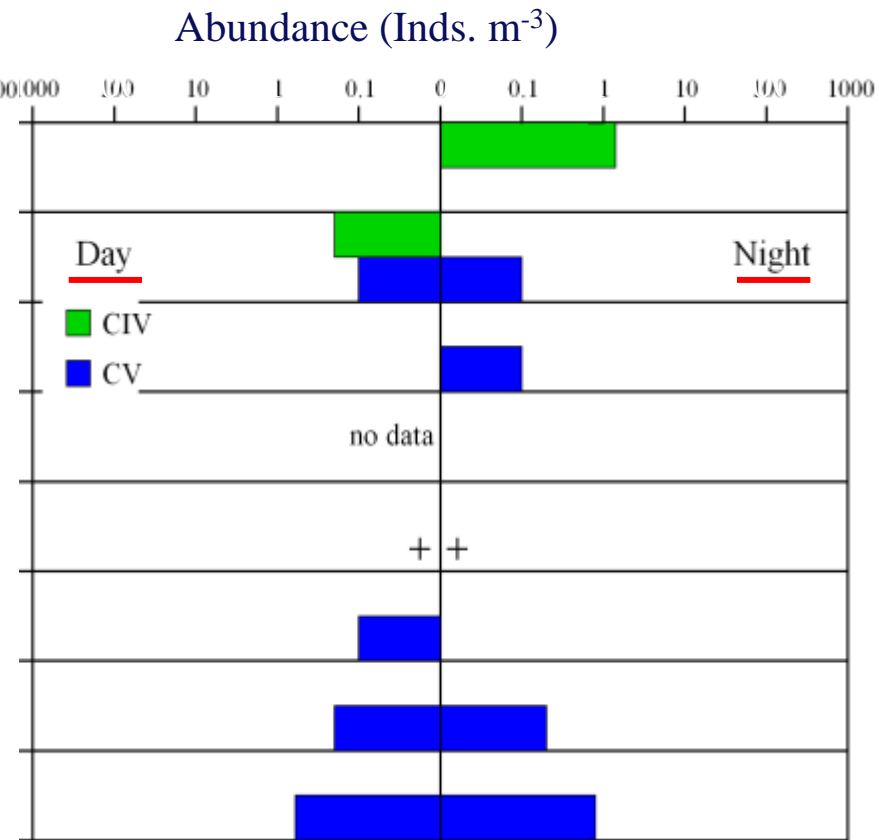
Vertical distribution of *C. sinicus* and *C. jashnovi*

C. sinicus



A large population of CV *C. sinicus* was present in the mesopelagic zone

C. jashnovi



C. jashnovi was much less abundant, with only shallow CIV and mesopelagic population of CV.

4. Education and outreach

- Training courses in SE Asian countries, 2003-09
- Cruises for high-school students: “Let’s study the ocean on a research vessel!”, 2006-09
- Sorting Zooplankton from the *Shirasu* assemblage: civic education for school children, 2007-2009

Training Courses on Methods of Zooplankton Ecology and Identification

Lectures (2 days)

- **What is plankton?—A general introduction**
- **Methodology of zooplankton ecology**
- **Introductions to**
Crustacea, gelatinous plankton, other animal groups

Practices (4 days, including field sampling)

- **Sample processing and primary sorting**
- **Identification of major taxonomic groups:**
Copepoda, Chaetognatha, Mysidacea, Cnidaria, Tunicata,
Demersal plankton

2003: Chulalongkorn University, Thailand

2004: University of the Philippines, Philippine

2005: Institute of Marine Environment and Resources, Vietnam

2006: Univresiti Putra Malaysia

2007: Research Center for Biology, Indonesia

2008: “Advanced course”, Universiti Kebangsaan Malaysia

2009: “Advanced course”, Burapha Univ., Thailand

Dr. Sawamoto's lecture
on sampling methods

Training Course in Indonesia, 2007



Plankton sampling off
Port Dickson



Training Course in Malaysia, 2006

Training Course in Indonesia, 2007



Dr. Ohtsuka demonstrating copepod dissection

5. CMarZ-Asia Database: www.cmarz-asia.org/db

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- [Community Genes and Genomes Search](#)
- [BLAST Search \(Species\)](#)
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About This Database

CMarZ (Census of Marine Zooplankton)-Asia Database

Introduction
CMarZ-Asia Database is an integrated search system of zooplankton information provided by the Asian Regional Office of CMarZ. It consists of 4 search systems of zooplankton data: Sample Collections, Species Names, Community Genes and Genomes, and BLAST Search. While its title contains the regional name "Asia", the data provided encompass those from all over the world.

Contents

Sample Collection Search

This system provides information on repositories of zooplankton samples that belong to universities, institutions, museums, and other research organizations from all over the world. Sample collections can be searched by various meta-data criteria, e.g., geographic areas and positions, dates of sampling, types of collections (nets, ROV, etc.) and/or locations.

Species Information Search

This system provides taxonomic and ecological information of zooplankton searched by taxonomic categories at the species and higher levels, including photographic images, representative taxonomic illustrations, geographic distributions, and DNA sequences. The system is also linked to database for ecological information, including those on the abundance, biomass, and the attached meta-data such as depths and time, that have been provided by CMarZ Network members, institutions, individual scientists, and other database projects from all over the world.

Community Genes and Genomes Search

This system provides geographical position of sequence datasets derived from the Zooplankton Community Genomic Analysis, a special enterprise of CMarZ-Asia which aims at exhaustively sequencing as many species as possible contained in the bulk zooplankton samples, thus providing estimates of total genetic diversity of zooplankton from representative areas of the world, including those of pelagic larvae of benthos and netton on which morphological information is still limited. The contained data can be screened out by, e.g., geographic ranges, sampling dates, type of collections.

BLAST Search (Species) (Community)

This system is available to examine the similarity of your DNA sequence with the CMarZ-Asia Database both in the species- and community genomic analyses. You can search for the occurrence of similar sequence in the community genomic database with "your" species' sequence. You can also search for similar sequence in the species DNA database with the DNA sequences that are determined from unknown origin (such as fish-gut content).

Data Acknowledgment Policy

The data available here are intended for scholarly use by the academic, management, industrial, and scientific communities, with the express understanding that any such use will properly acknowledge the originating investigator. Use or reproduction of any material herein for any commercial purpose is prohibited without prior written permission from the [Data Management Office](#). Please read [the complete data acknowledgment](#)

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Total Records; 4174

Sample: 3040
Species: 1110
DNA Sequence: 24
Species Sequence: 11
Community Sequence: 13

System Specification

Version 1.0
Update Jul, 2007

Sample Collection Search

Sample Area (Latitude, Longitude) ; Please magnify into your interested area.



Sampling Year, Month and Hour

Year -
 Month -
 Hour -

Advanced Search

Submit Reset

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- Sample Collection Search
- Species Name Search
- Community Genomes and Genomes
- BLAST Search

Sample Collection Search

Results 1 - 15 of 26

Search Result



03 00 33.9H
180 00 00.0W Map Range 180 00 00.0E
04 29 22.1S

Download Result

No.	Latitude Longitude	Date/Time	Mesh Size	Month Opening	Contact Person	Detail
1	25 01 14 N 147 14 0E	2000-01-17 03:25:00	1	7:30	MACHIDA R.J.	Detail
2	21 46 31 N 149 21 8E	2000-01-18 02:00:00	1	7:30	NOYAMA J.	Detail
3	09 59 33 9N 156 23 78 E	2000-01-21 13:00:00	033	016	HAGUMOTO H.	Detail
4	09 59 33 9N 156 23 78 E	2000-01-21 13:00:00	011	016	HAGUMOTO H.	Detail
5	09 59 33 9N 156 23 78 E	2000-01-21 00:00:00	033	016	HAGUMOTO H.	Detail
					HAGUMOTO H.	Detail
					MACHIDA R.J.	Detail
8	2 29 59 7N 122 23 93 0E	1995-09-31 03:50:00	011	1	MACHIDA R.J.	Detail
9	2 29 59 7N 122 23 93 0E	1995-09-31 09:17:00	011	1	MACHIDA R.J.	Detail
10	2 29 59 7N 122 23 93 0E	1995-09-31 09:31:00	011	1	MACHIDA R.J.	Detail
11	2 29 59 7N 122 23 93 0E	1995-09-31 09:05:00	011	1	MACHIDA R.J.	Detail
12	2 29 59 7N 122 23 93 0E	1995-09-31 09:16:00	011	1	MACHIDA R.J.	Detail
13	2 29 59 7N 122 23 93 0E	1995-09-31 09:36:00	011	1	MACHIDA R.J.	Detail
14	2 29 59 7N 122 23 93 0E	1995-09-31 10:01:00	011	1	MACHIDA R.J.	Detail
15	2 29 59 7N 122 23 93 0E	1995-09-31 10:23:00	011	1	MACHIDA R.J.	Detail

List of selected samples

Next >>

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- Sample Collection Search
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Sample Collection Search

Detail

sample ID 1

Latitude:25 01 14 N
Longitude:147 14 5E



Latitude, Longitude

75 11 06.0N
13 21 33.8E Map Range 79 27 11.3W
56 33 34.1S

Sampling metadata

Date	2000-01-17 03:25:00
Ship Name	HAKUHOU-MARU
Cruise Name	KH02-4
Station	1
Fixation	FORMALIN
Net Type	IKMT
Mouse Opening	7.32 m ²
Mesh Size	1 mm
Tow	OBLIQUE
Filtered Water	34072
Min. Depth	0
Max. Depth	1130
CTD	Download
Oxygen	Download
Chlorophyll	Download
Contact	MACHIDA R.J.
Remarks	

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A Newly Funded Plankton Research (JSPS: 2010-2013)

Title: Census of Marine Zooplankton
in Southeast Asia

Goal:

Establishing present status of marine biodiversity in SE Asia, through quantitative analysis of communities based on the taxonomic background established through the CMarZ project (-2010), as a basis for monitoring of effects of human impacts, such as fisheries and pollutants, and environmental changes.

CMarZ-JSPS (2001-2010)

Collaborating countries

Indonesia
Malaysia
Philippine
Thailand
Vietnam

Additional sampling

(All members+
collaborators)

Sample-collection database

(Foreign collaborators)

Sample analysis

Taxonomy (All members)

Community structure
(Nishida, collaborators)

Genetic analysis
(Nishida)

Pollution
(Nishida, collaborators)

- New species
- Species' list
- ID Manual

CMarZ-OBIS

Zooplankton database
for SE Asia (Nishida)

**This
Research
(2010-2013)**

謝謝大家！

Thank you very much!

Acknowledgements

- Census of Marine Zooplankton (CMarZ)
A. Bucklin (Univ. Connecticut, USA)
S. Schiel (AWI, Germany)
- JSPS Multilateral Program: Coastal Marine Science
Indonesia: Mulyadi, Inneke FM Rumengan
Malaysia: Fatimah MD Yusoff, Othman BH Ross
Philippine: Lourdes V. Castillo, Wilfredo L. Campos
Thailand: Ajcharaporn Piumsomboon
Vietnam: Nguyen Thi Thu, Nguyen Cho
Japan: J. Nishikawa, S. Sawamoto, H. Sekiguchi,
S. Ohtsuka, T. Kikuchi, N. Iwasaki, T. Toda