Feeding biology of *Nemopilema nomurai* (Scyphozoa: Rhizostomeae) and its ecological implication

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Introduction

- Changing climate & ocean conditions, overfishing …

→ Dramatic increase in jellyfish biomass

- *Nemopilema nomurai* bloomed in Korean waters.

- The huge biomass and venom caused severe damages to the fishermen, swimmers, and ecosystems.

- Few studies on *Nemopilema nomurai*.

The huge size of *N. nomurai*

Jellyfishes in the set net

Jellyfishes in the inlet of power plant

The victim's foot and leg caused by sting of *N. nomurai*

Jellyfishes collected in the trawl net (South Sea, 2007)

Biology of *Nemopilema nomurai*

- **Distribution**
  - Northwestern Pacific
  - Mainly August ~ October
- **Size**
  - 200 cm in bell diameter
  - 200 kg in wet weight
- **Life span**: *ca.*12 month
- **Life cycle**: Sexual & Asexual reproduction

- **Jellyfish is a voracious predator on a broad range of prey, ranging from phytoplankton to fish larvae** (Purcell, 1985; Båmstdt, 1990; Arai, 1997).

- **Jellyfishes compete with other predators for food and comprise a potential mortality factor for other predators** (Alldrege, 1984).

- **The abundance of medusae can have an significant influence on the structure of coastal plankton communities** (Lindahl and Henroth, 1983).

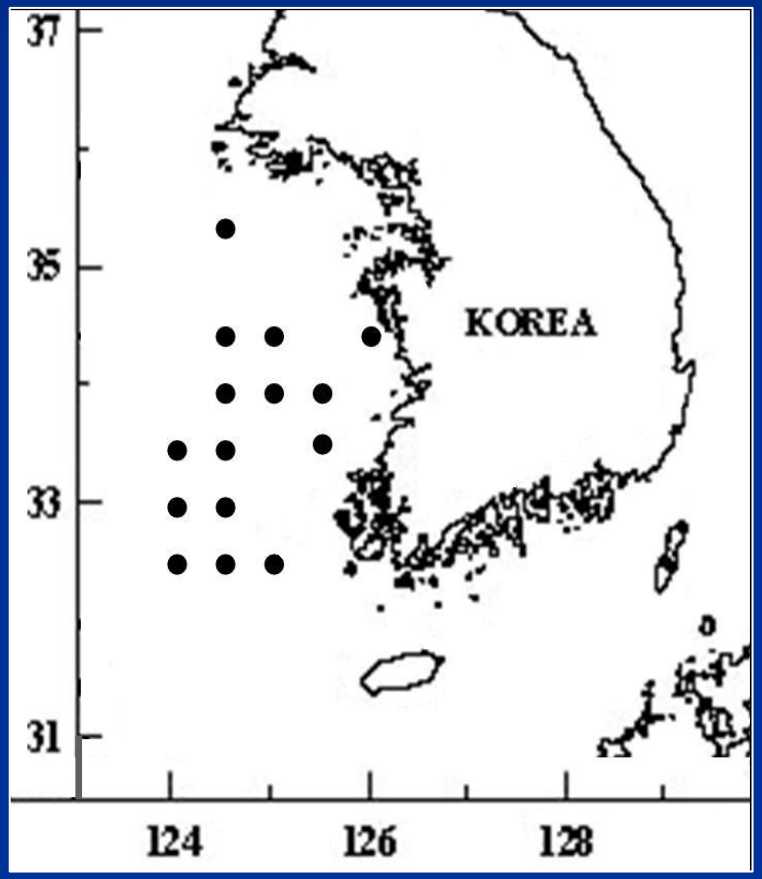
Objective

Ecological importance

of *Nemopilema nomurai* in ecosystem

- **Morphological characters of feeding apparatus**
- **Food items of *Nemopilema nomurai* in the field**

Materials and Methods



- Sampling site: Yellow Sea
- Sampling date: Aug. 2006
- Sampling gear: bottom trawl
- Number of station: 15
- Total specimen: 45 inds.

  (fixed 10% formalin)
- Zooplankton: NORPAC net

  (vertical tow, ø45cm, 330㎛)

Observation of feeding apparatus

- Dissected and described under the microscope

Investigation of prey organisms

- Analyzed contents of oral arms

1. Rinse the oral arms

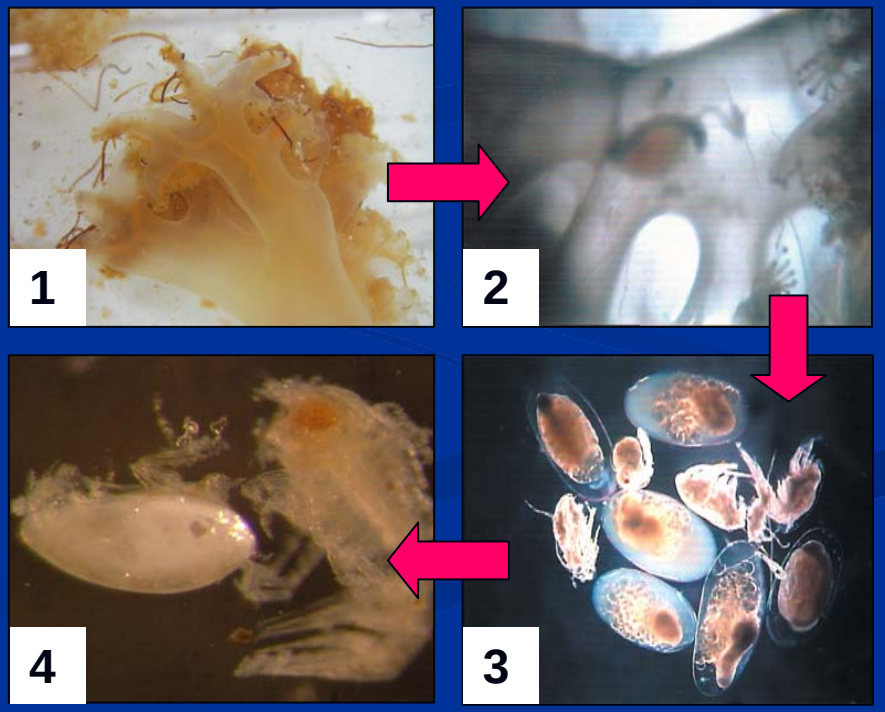
   (20㎛ sieve / one oral arm per medusa / for getting preys around cirri)

2. Dissection of canals in oral arm

3. Counting the prey organisms

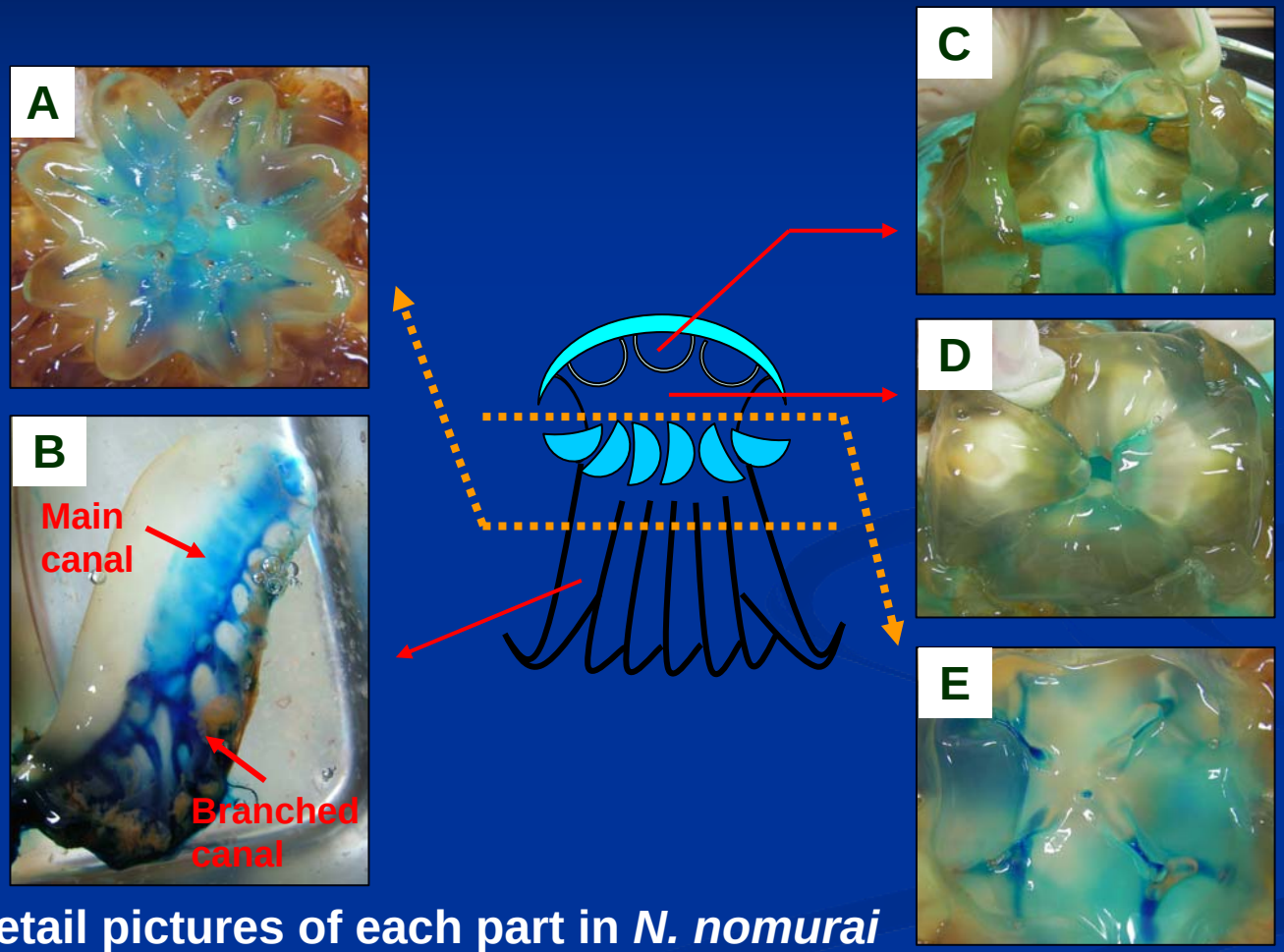
4. Identification and measurement size of preys

5. Conversion to the total number of prey



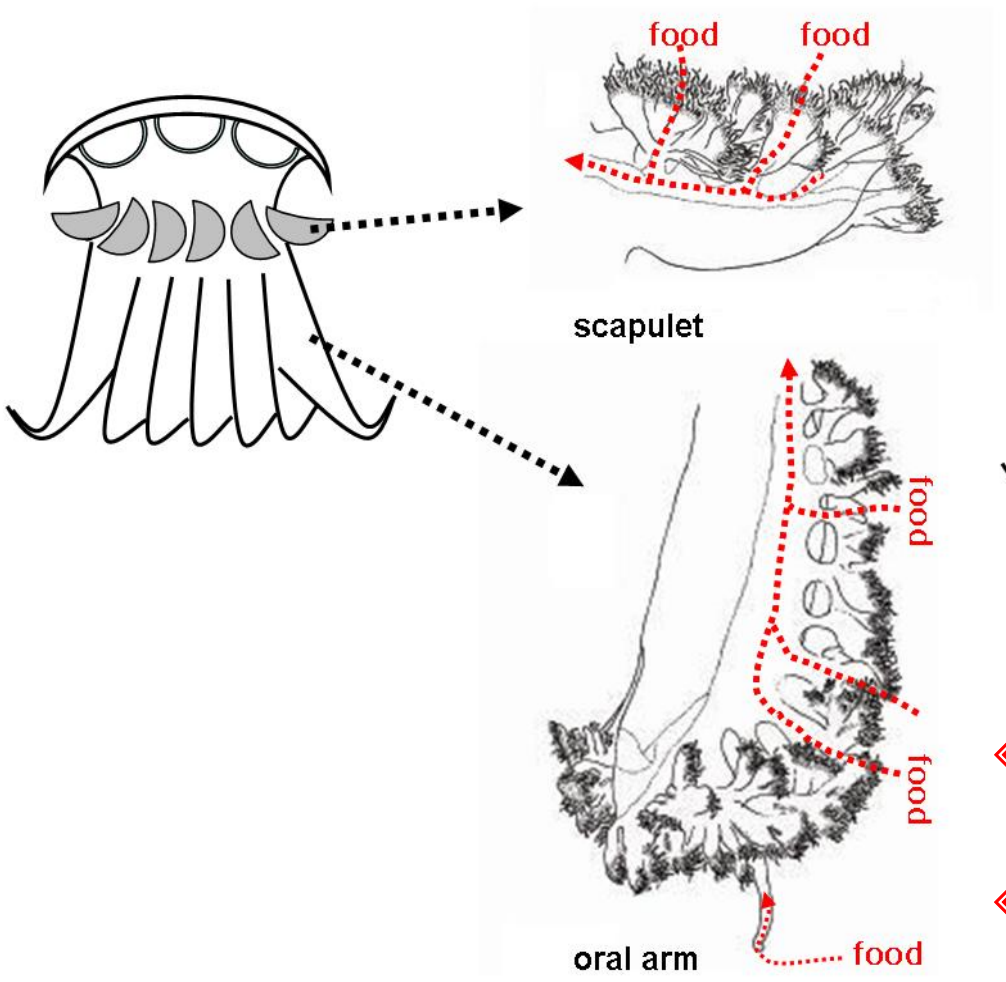
Results

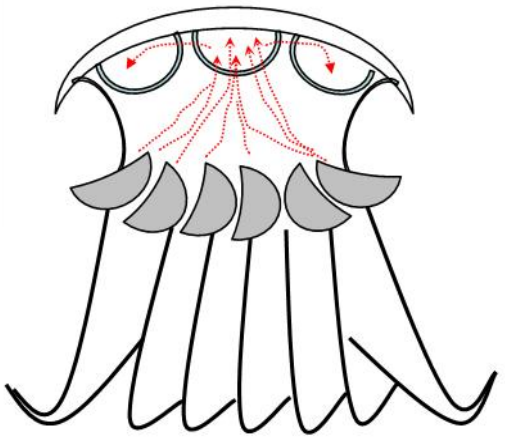
1. Morphological characters of feeding apparatus



The detail pictures of each part in *N. nomurai*

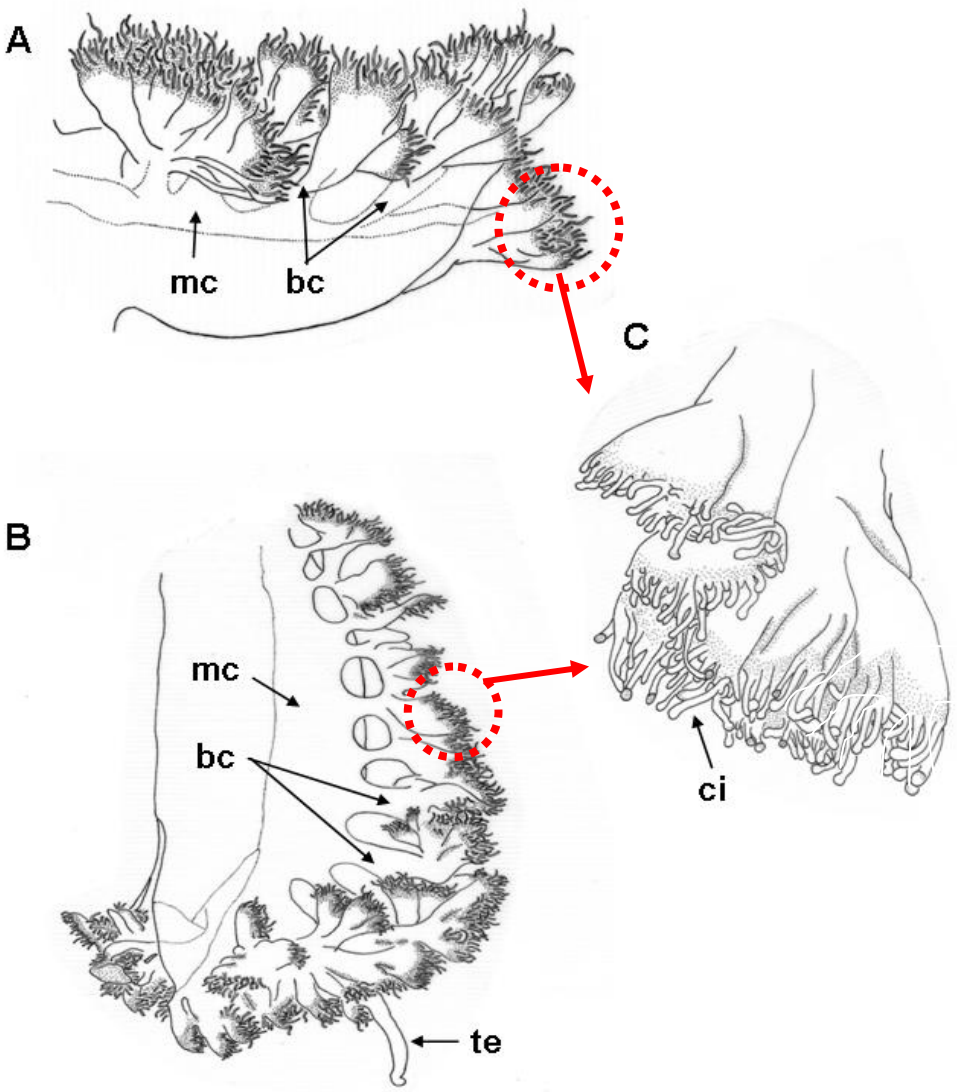
A, The cross section of whole oral arm. **B**, The oral arm. **C**, The gut cavity. **D**, The upper part of manubrium. **E**, The lower part of manubrium.





- ***Nemopilema nomurai***
  → **central mouth (x)**
- **Role of mouth**
  → **8 oral arms and 16 scapulets**

A diagram of the prey passage in *Nemopilema nomurai*



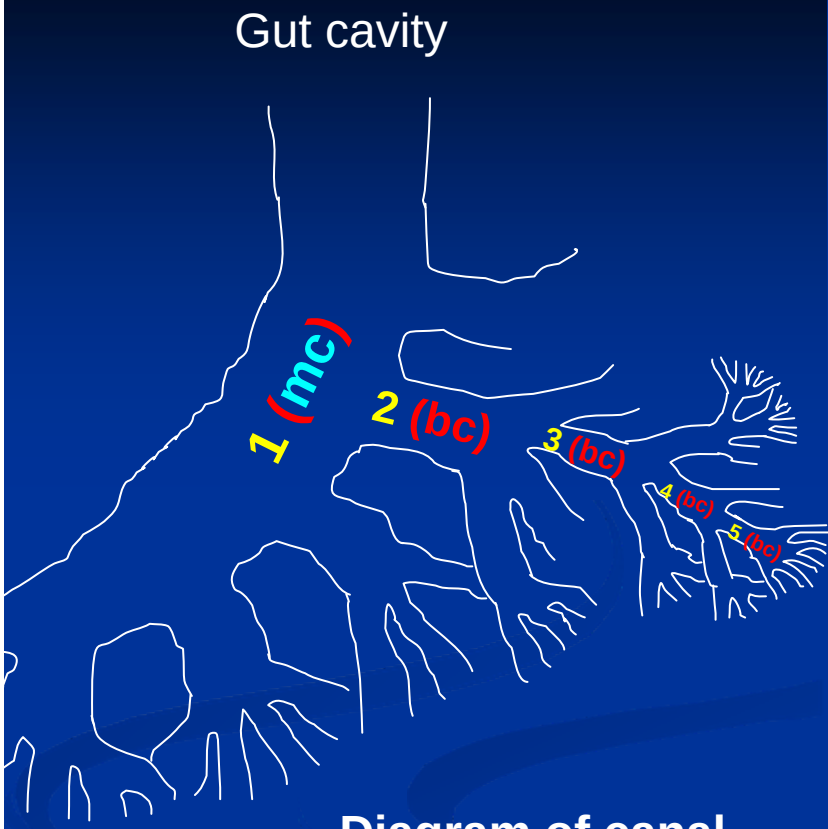
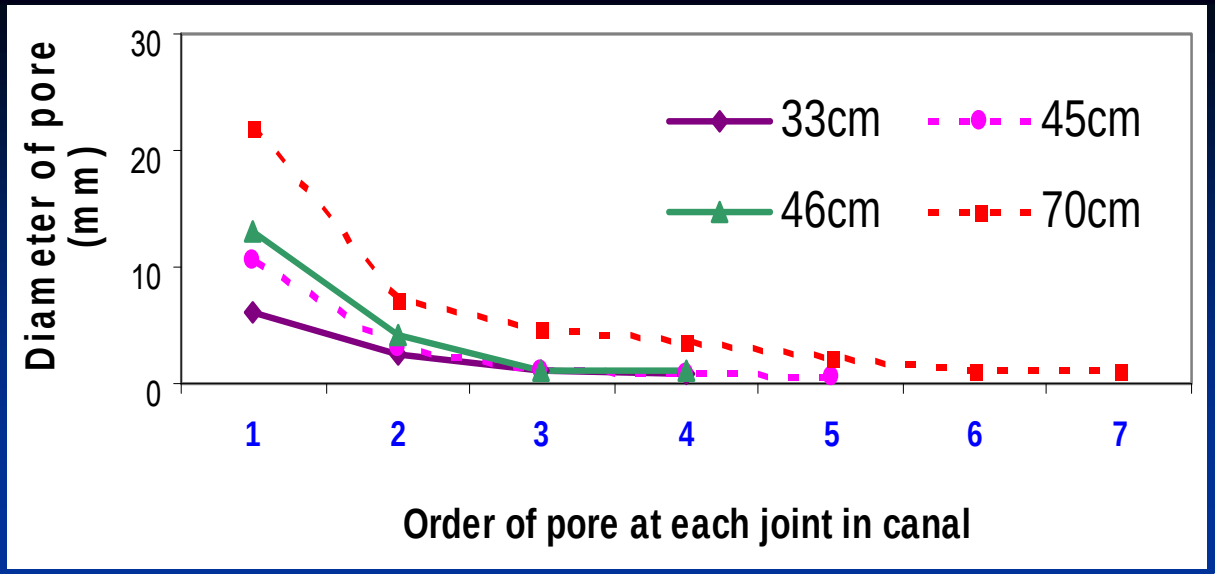


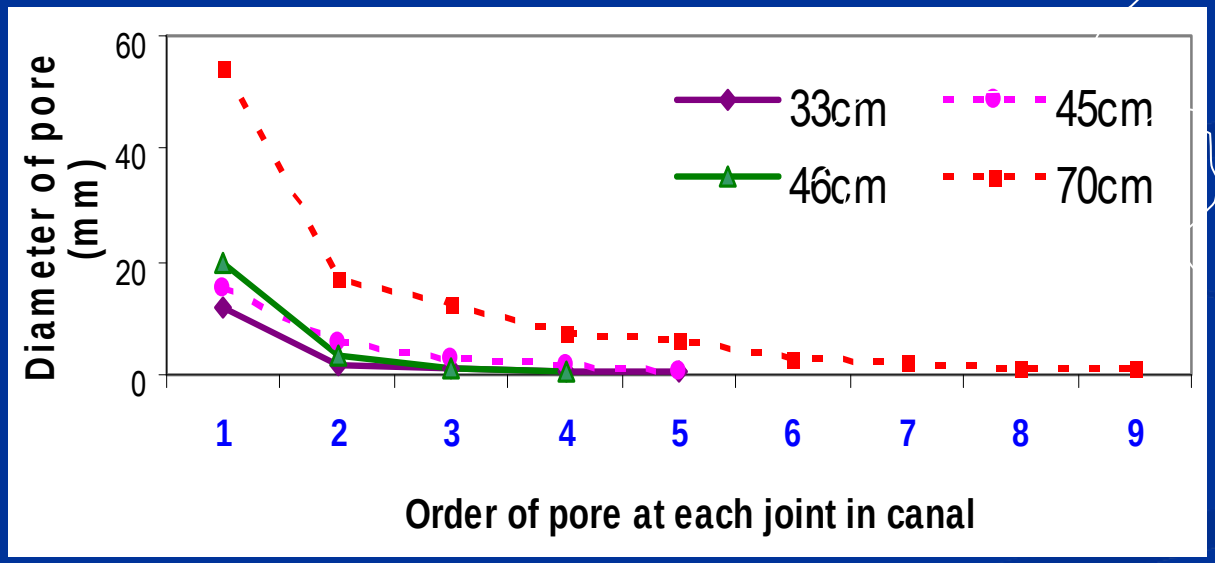
Diagram of canal in oral arm & scapulet

Feeding apparatus in *Nemopilema nomurai*.

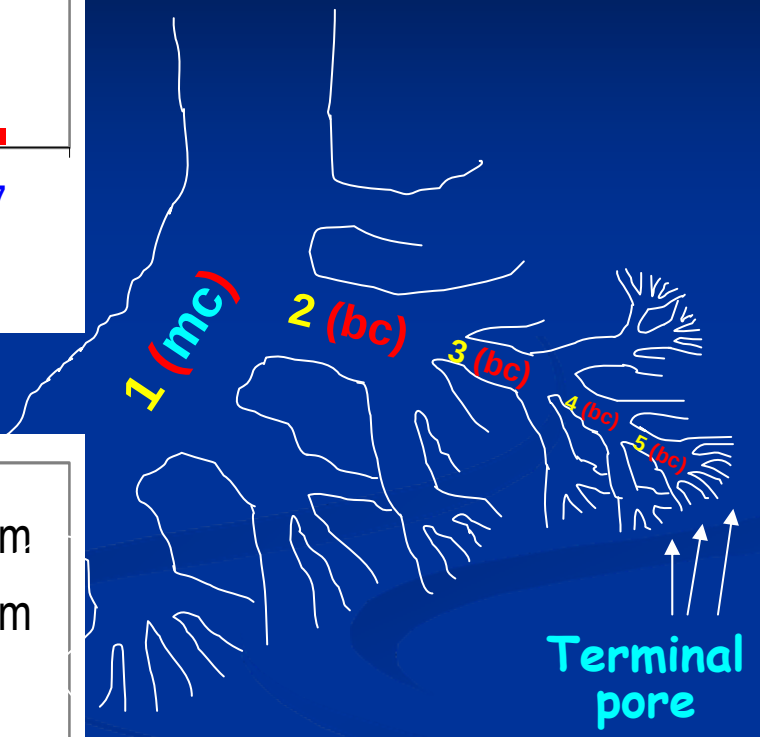
scapulet (A), oral arm (B), and enlarged marginal part of scapulet and oral arm (C). Abbreviations:***mc*** main canal, ***bc*** branched canal, ***ci*** cirri, ***te*** tentacle.



The diameter of canals on scapulet



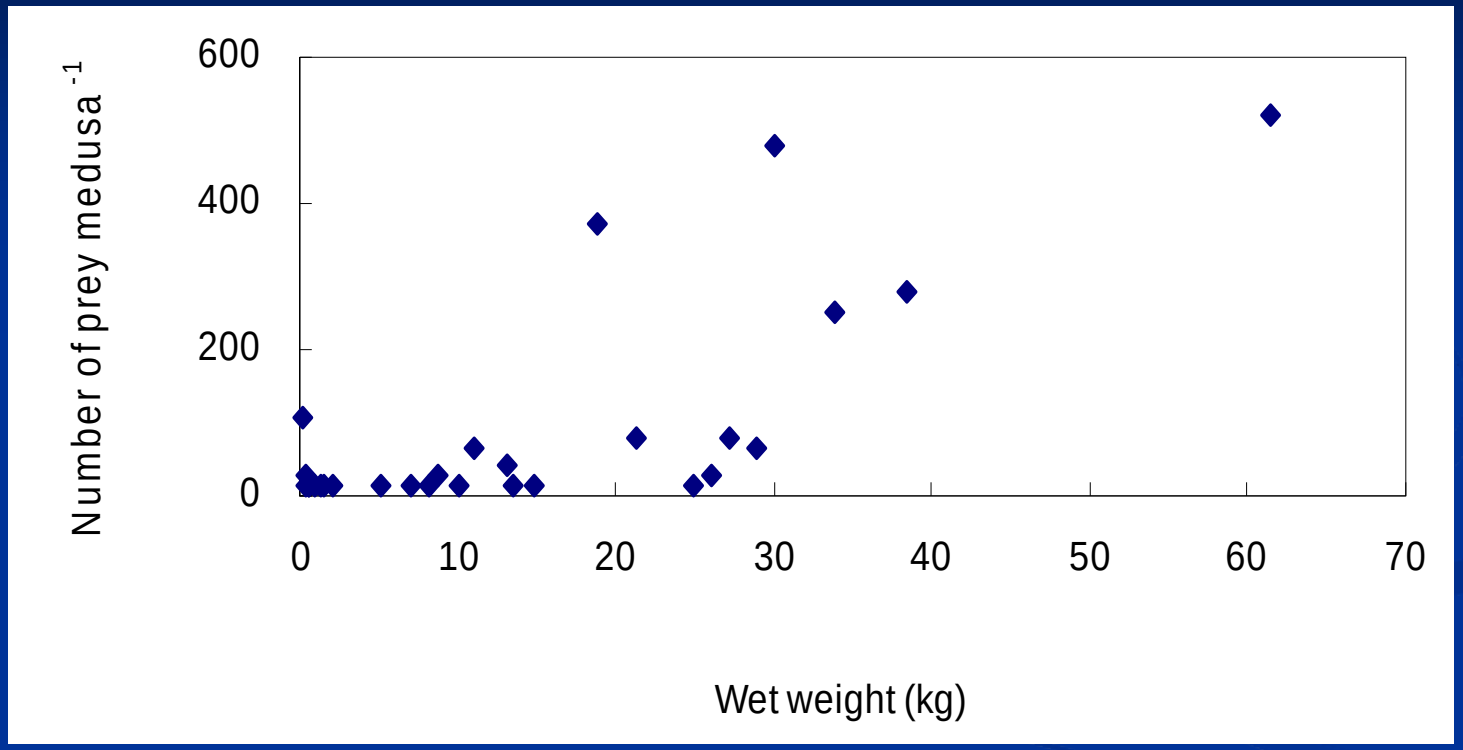
The diameter of canals on oral arm



Size of terminal pore : *ca.* 1mm

⇒ The type of prey is limited by the size of terminal pore.

2. Prey organisms of *N. nomurai* in the field



Number of prey contained in the oral arms and scapulets of different wet weight of *Nemopilema nomurai* (n=28).

- Prey composition of *N. nomurai* (n=28)

Prey taxa	Number	Percent of total
► **Calanoid copepods**	1320	**50.51**
Larvaceans (*Oikopleura* sp.)	360	13.78
Amphipod (Hyperid)	240	9.18
► **Poecilostomatoid copepods**	160	6.12
Fish eggs	160	6.12
Euphausiid larvae	107	4.08
► **Copepod (others)**	93	3.57
Decapod larvae	67	2.55
Chaetognaths (*Sagitta* spp.)	40	1.53
Bivalve larvae	27	1.02
► **Harpacticoid copepods**	13	0.51
Foraminifera	13	0.51
Cypris larvae of barnacle	13	0.51
Total	2613	100

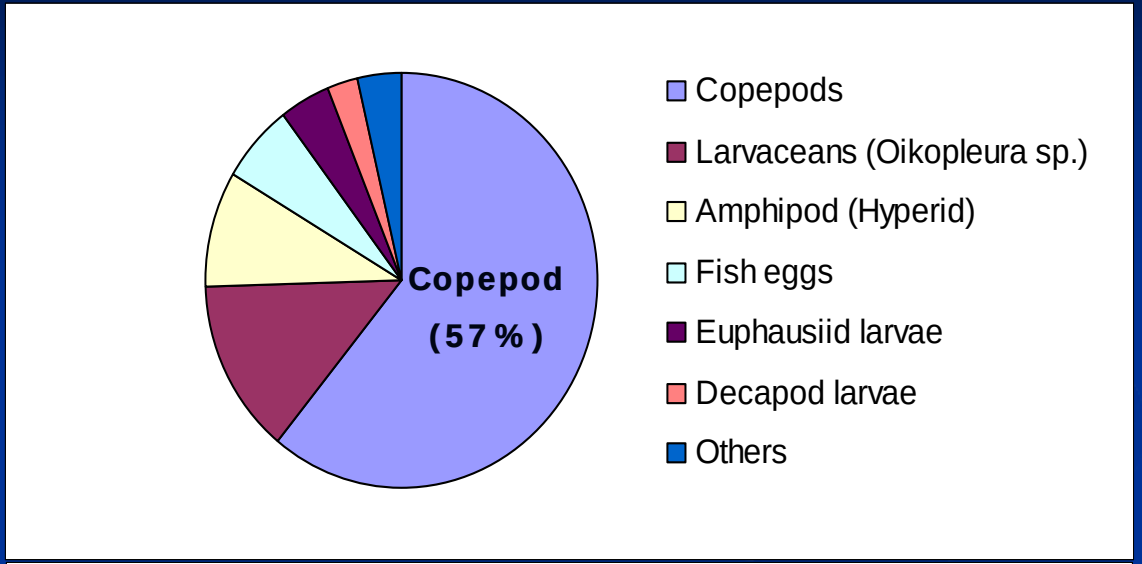
- Size of prey in *N. nomurai* (n=196)

Prey taxa	Length (mm)		Width (mm)	
	Mean	Range	Mean	Range
Calanoid copepods	1.27	0.56 - 2.53	0.50	0.20 - 0.93
Larvaceans (*Oikopleura* sp.)	0.68	0.45 - 0.80*	0.49	0.23 - 0.62
Amphipod (Hyperid)	0.82	0.50 - 1.90	0.27	0.19 - 0.63
Poecilostomatoid copepods	0.74	0.50 - 0.85	0.47	0.16 - 0.57
Fish eggs	0.63	0.34 - 1.21	0.49	0.30 - 0.98
Euphausiid larvae	13.53	8.00-17.60	2.00	1.36 - 2.72
Copepod (others)	0.68	0.45 - 0.80	0.40	0.12 - 0.72
Decapod larvae	3.77	0.32-17.00	0.67	0.17 - 2.20
Chaetognaths (*Sagitta* spp.)	12.79	8.75-17.75	1.00	0.75 - 1.38
Bivalve larvae	0.37	0.36 - 0.37	0.28	0.25 - 0.30
Harpacticoid copepods	13.5		0.55	
Foraminifera	0.4		0.27	
Cypris larvae of barnacle	0.4		0.32	

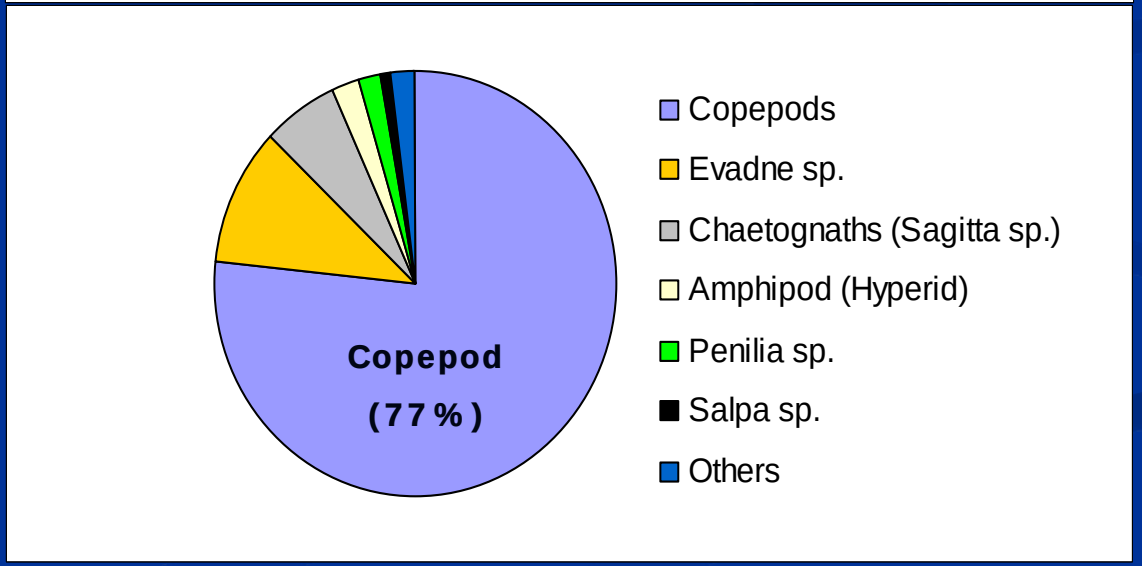
*: trunk length (except tail)

- Composition of zooplankton in oral arm and field

Oral arm contents (%)



Field zooplankton (%)



Conclusions

- They possess huge number of tiny pores which are properly sized for feeding on micro- and mesozooplankton.

(can eat a plenty of zooplankton at once)

- They eat mainly small size of prey less than 1 mm. (does not have a central mouth)

◈ **The most frequently observed prey item was copepod.**

(Copepod was abundant & size is in accordance with diameter of terminal pore)

☞ ***Nemopilema nomurai*** **can influence greatly the species composition and abundances of zooplankton in the pelagic system.**


THANK YOU