Vertical distribution of common squid (*Todarodes pacificus*) paralarvae in the northern East China Sea

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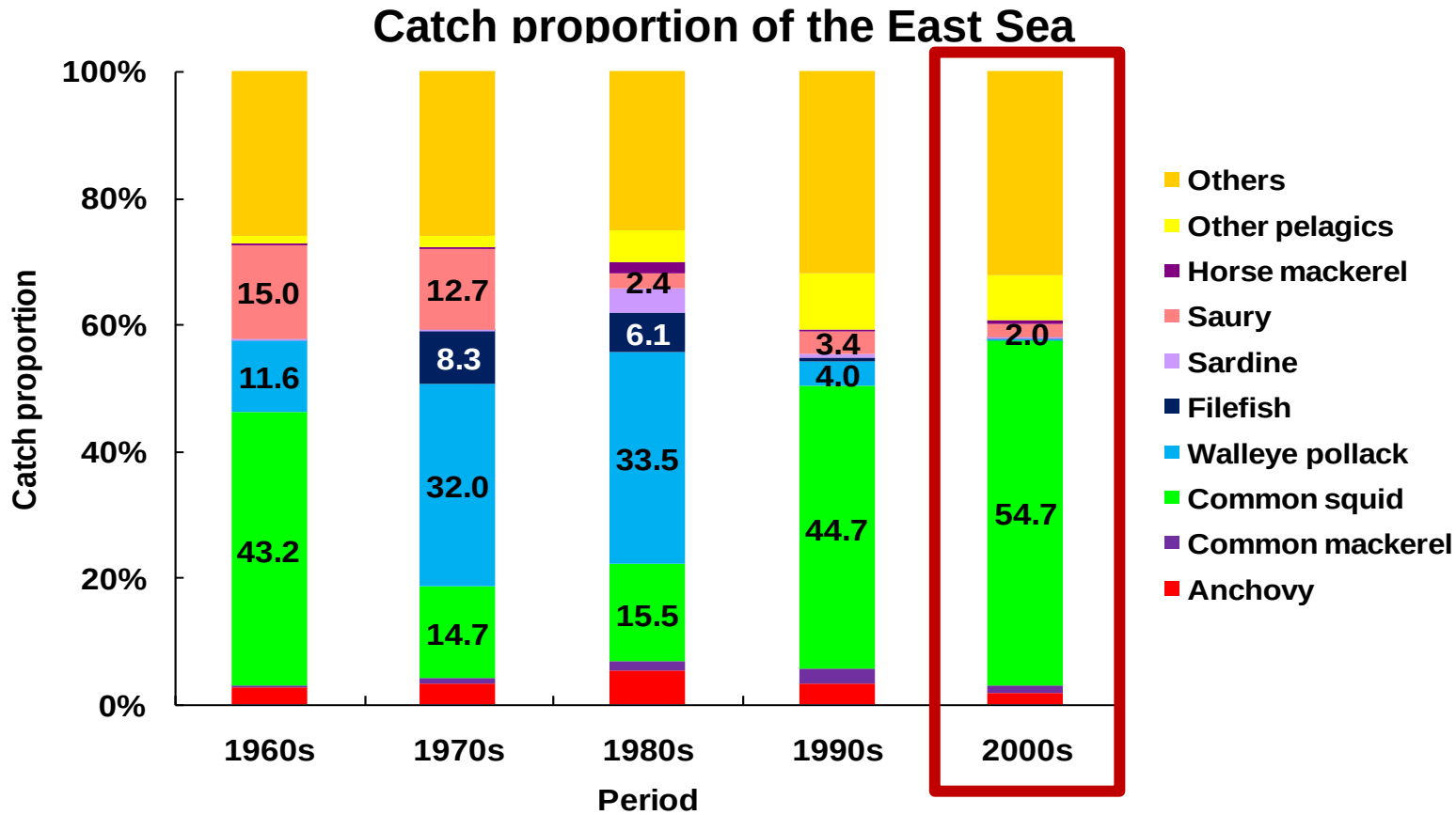
WHY CEPHALOPOD LARVAE?

Cephalopods, especially common squid, is very important commercial species in Korea



WHY CEPHALOPOD LARVAE?

Cephalopods, especially common squid, is very important commercial species in Korea

Nobody interested in larval stage cephalopods

WHY DO WE STUDY VERTICAL DISTRIBUTION?

Key factor for dispersion of squid larvae from spawning place to feeding area

To track the movement by the Current

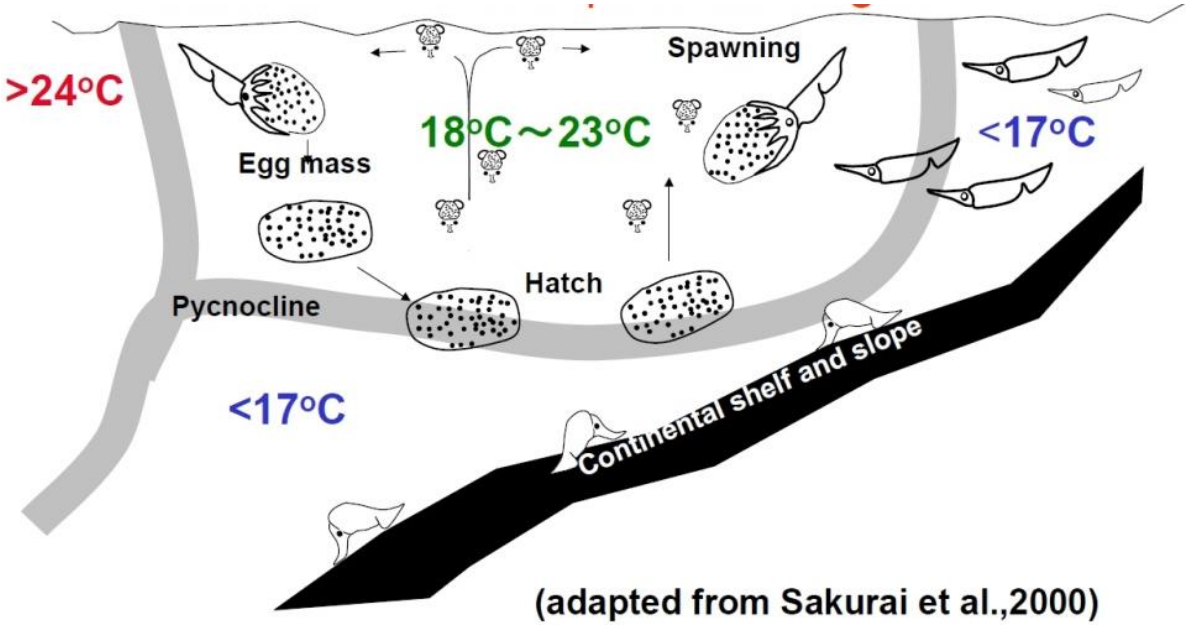
➡ Influence recruitment ➡ Recruitment variability

QUESTIONS AND PAST STUDIES

Changes in inferred spawning areas of *Todarodes pacificus* (Cephalopoda: Ommastrephidae) due to changing environmental conditions (Sakurai et al., 2000)

In common squid egg mass and larvae

- Egg mass stays above pycnocline, and hatching larvae swim up to surface.



PURPOSES

This Research aims to

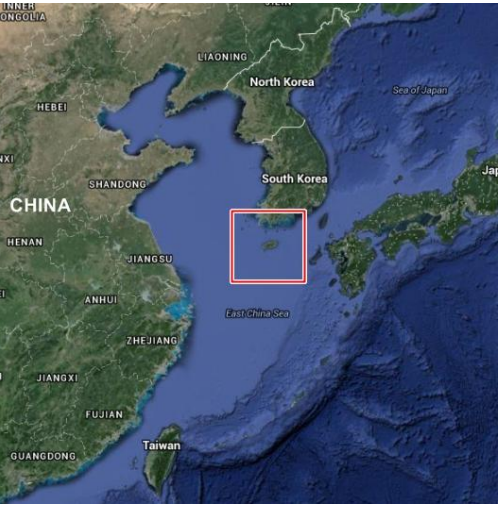
1. **Identify the distribution of cephalopod larvae near Jeju Island.**

2. **Figure out the relationship between water properties and larval occurrence of common squid.**

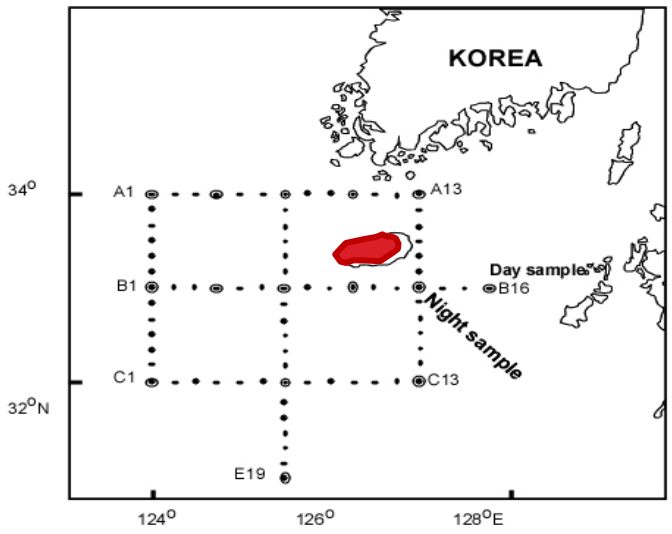
MATERIALS AND METHODS

Sampling location

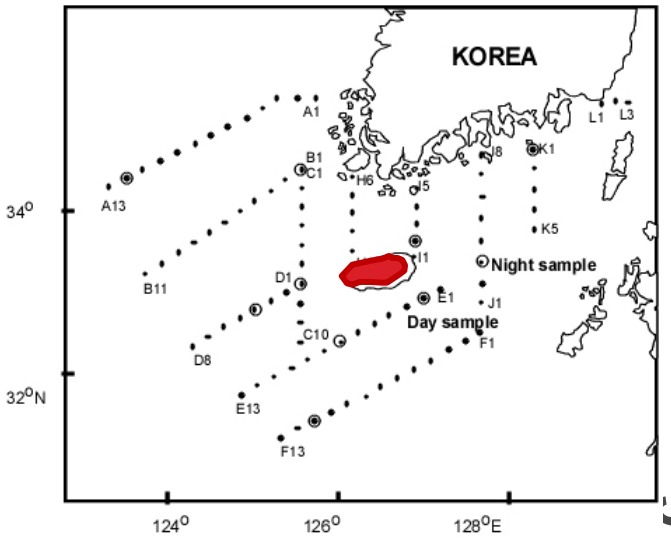
- Zooplankton sample using MOCNESS net
  - surface to bottom, with 20m depth interval
  - 333 mm mesh, 1x1.4m ($1m^2$), 2-3 knot oblique tow



Aug. 1997



Jan., Apr. 1999
Oct. 2000



MATERIALS AND METHODS

Sampling cruise

Cruise date	Number of Sample station (Larvae occurred St.)	Number of Sample bottle (1bottle/20m depth)	Total number of larvae Occurred
Aug. 1997	15 (8)	133	66
Jan. 1999	21 (18)	136	172
Apr. 1999	18 (15)	112	235
Oct. 2000	11 (8)	52	193

MATERIALS AND METHODS

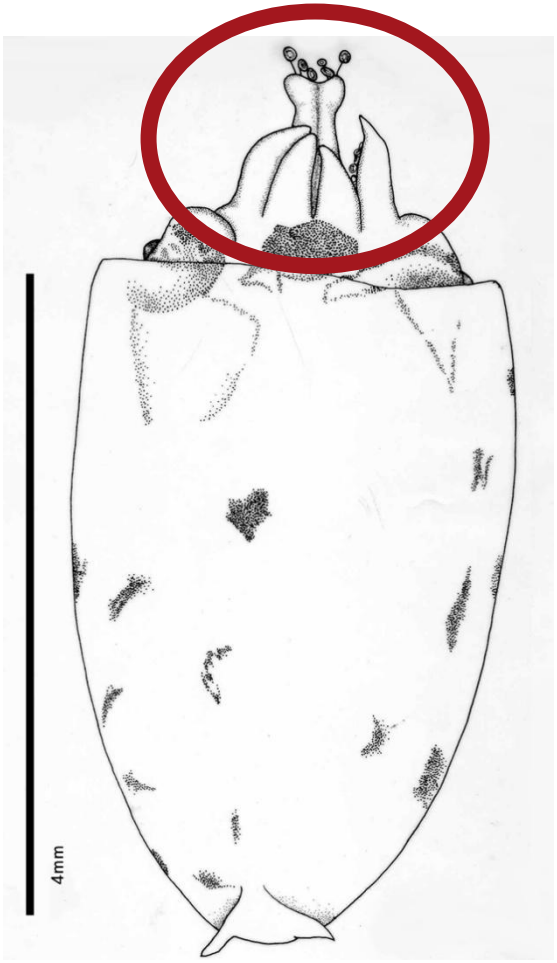
Lab. work

- Specimens :
  - **Sort and Identification** - cephalopod larvae
    - Morphological identification - under light microscope
    - Dorsal Mantle Length (ML, mm) measurement
  - **Larval density at each depth interval**
    - based on the number caught and the amount of water filtered
- Water density
  - based on temperature and salinity at depth
  - Vertical profile of water density was overlap on larval density in water column.

MATERIALS AND METHODS

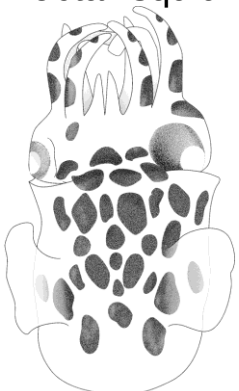
Ommastrephidae

Common squid, flying squid, *T. pacificus*

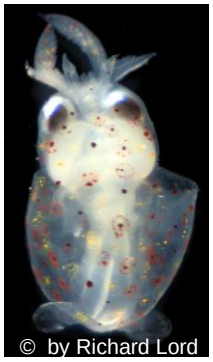


- **Small fins, relatively short arms**
- **Fused tentacle (proboscis)**
  - Rhynchoteuthion larvae, Paralarvae
  - 8 suckers on tentacle tip

Bobtail squid

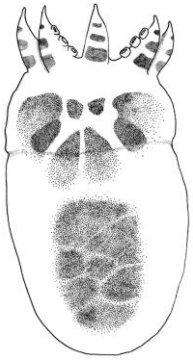


Pencil squid



Enop. Squid

Octopod



RESULTS
VERTICAL DISTRIBUTION

Larval abundance and proportion

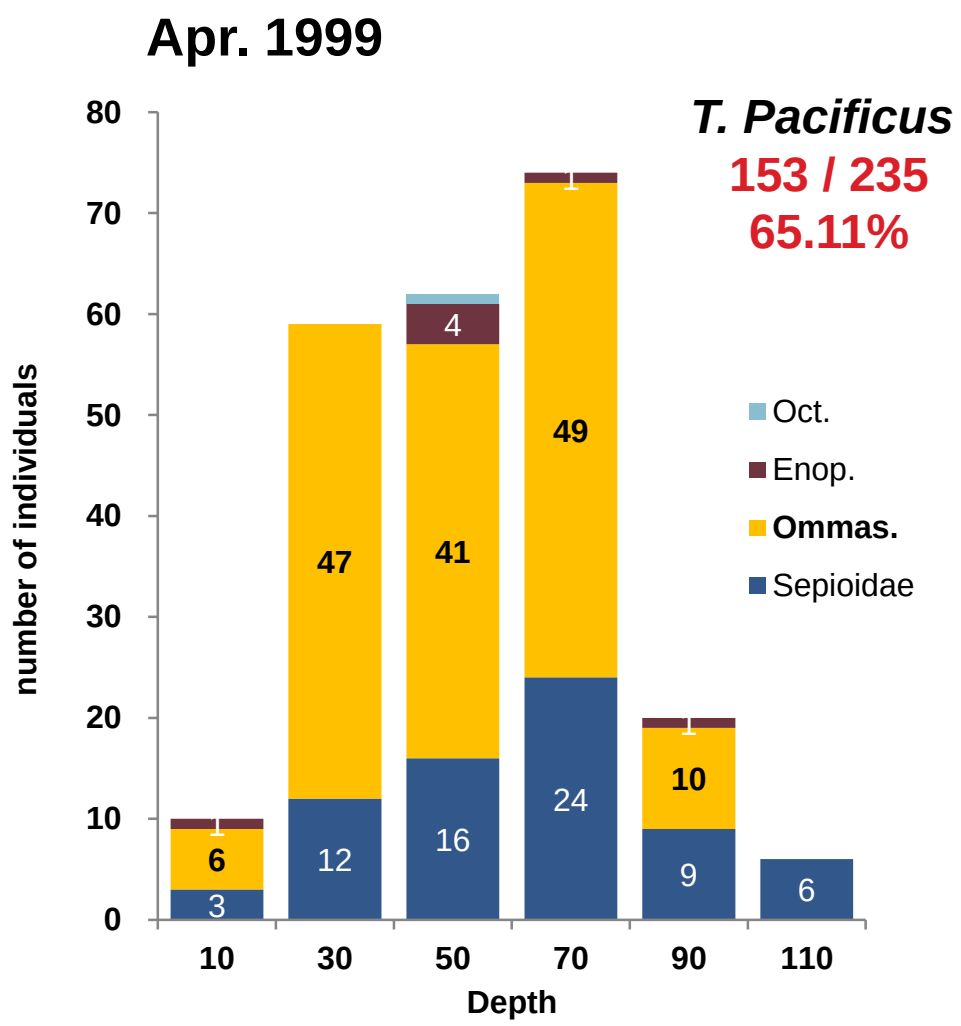
Cruise / Depth	1997 Aug.	1999 Jan.	1999 Apr.	2000 Oct.	Total	%
0-20	10	30	10	63	**113**	16.9
20-40	29	54	64	65	**212**	31.7
40-60	20	44	63	51	**178**	26.6
60-80	5	25	74	13	**117**	17.5
80-100	2	19	20	1	**42**	6.3
100-120			6		**6**	0.9
Total	**66**	**172**	**237**	**193**	**668**	

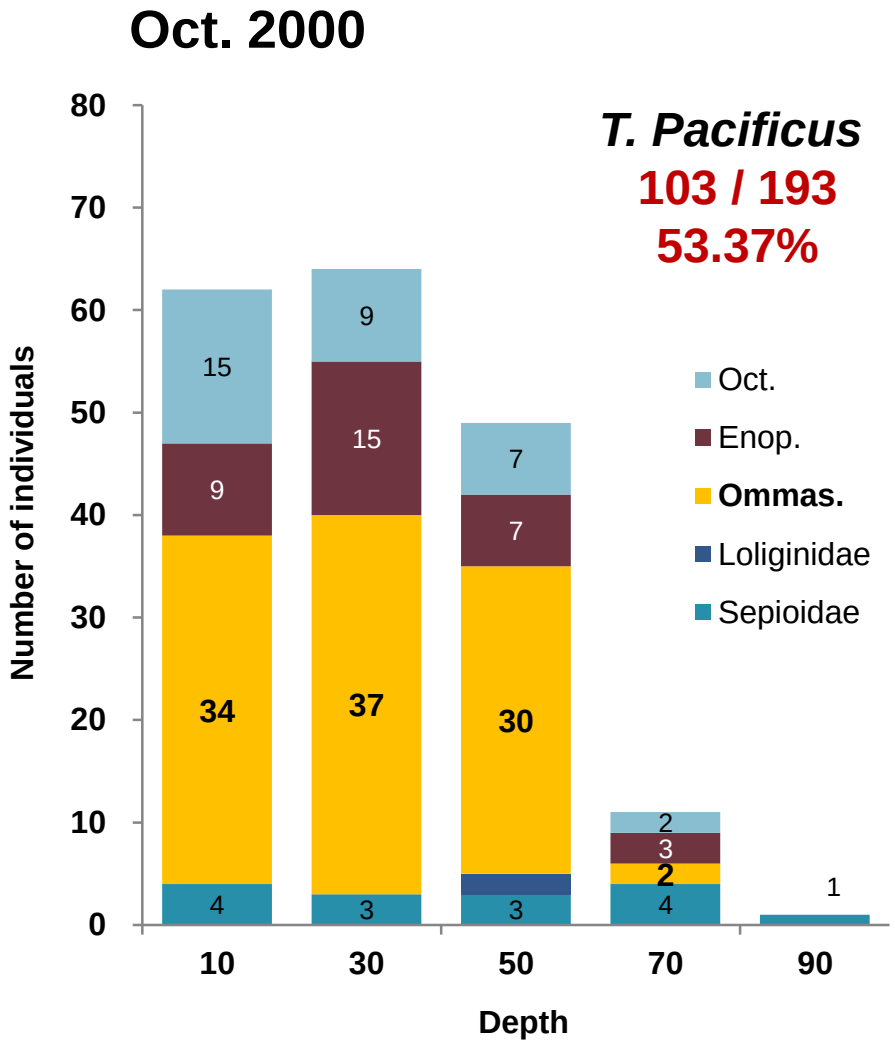
92.7%

75.8%

RESULTS

VERTICAL DISTRIBUTION

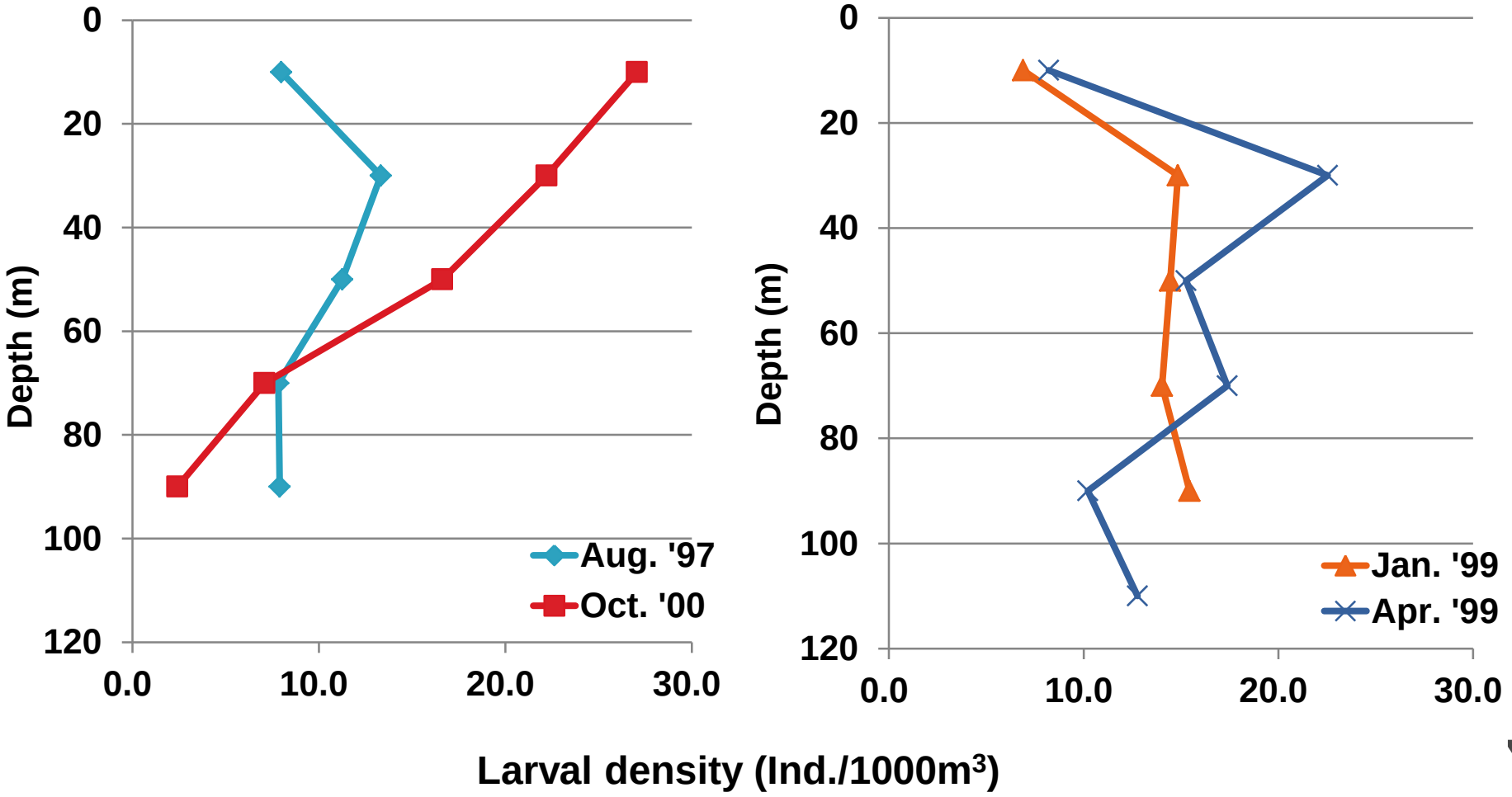




RESULT

VERTICAL DISTRIBUTION

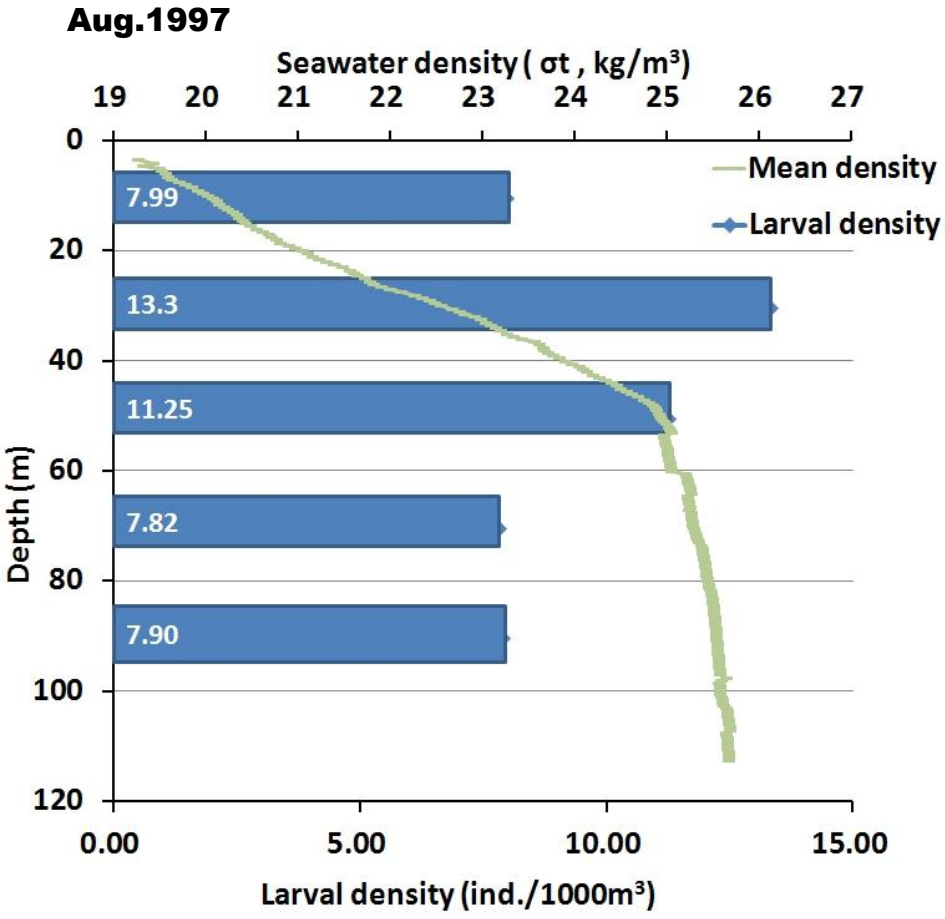
Vertical pattern of larval density

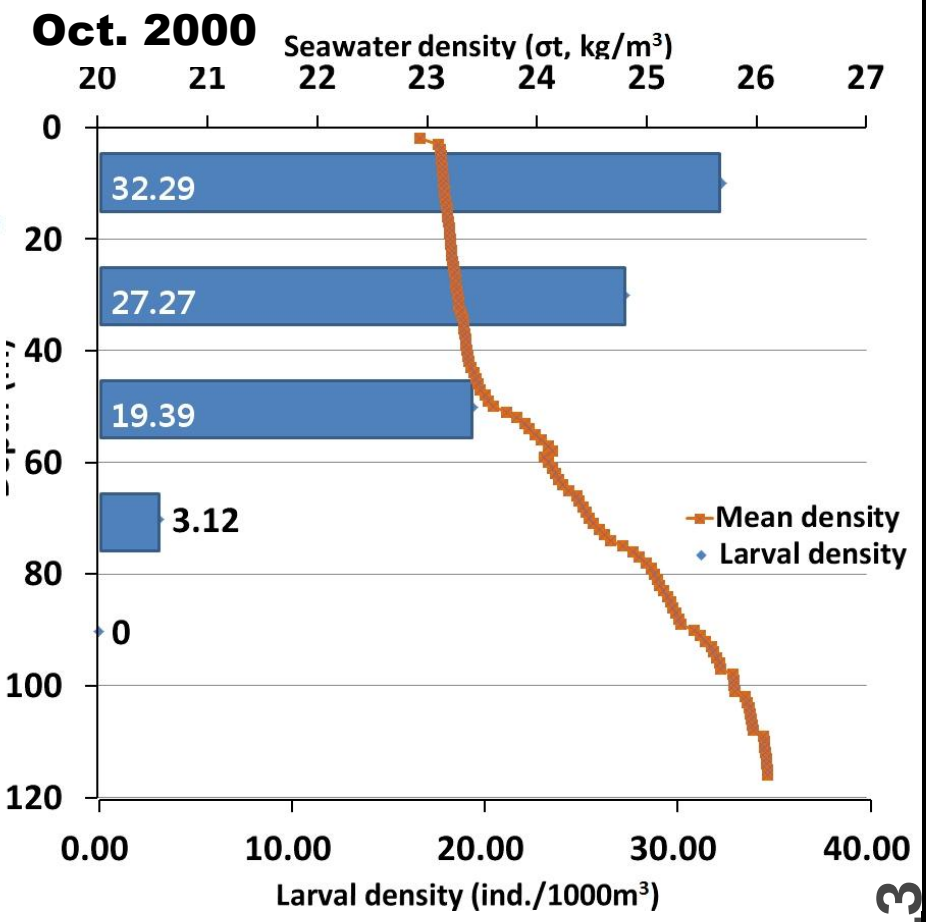


RESULT

HIGH DENSITY IN UPPER 50 m

With stratified condition

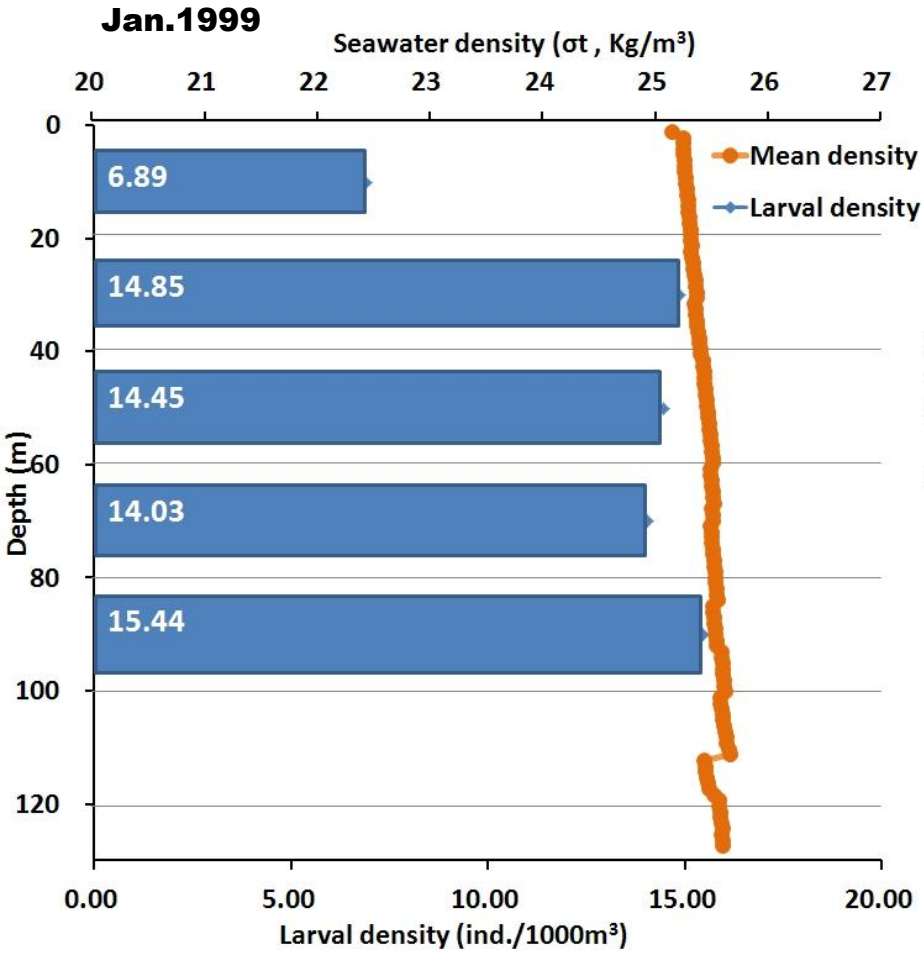


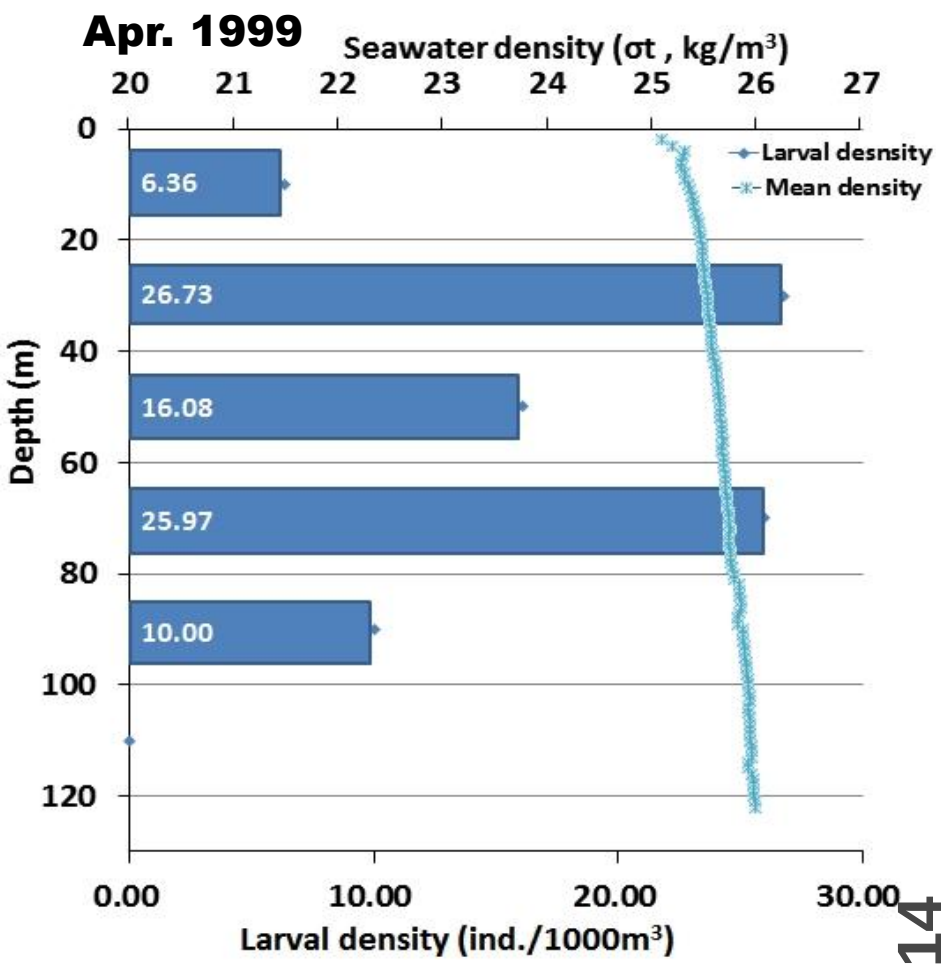


RESULT

HIGH DENSITY IN MID LAYER

With well-mixed condition

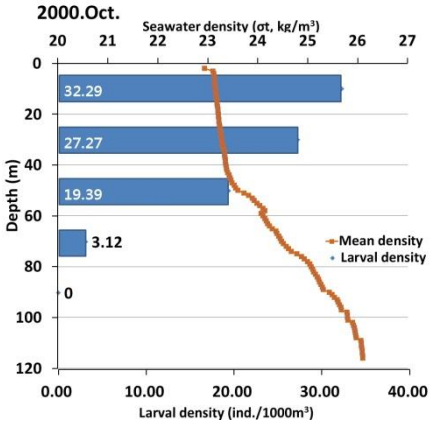


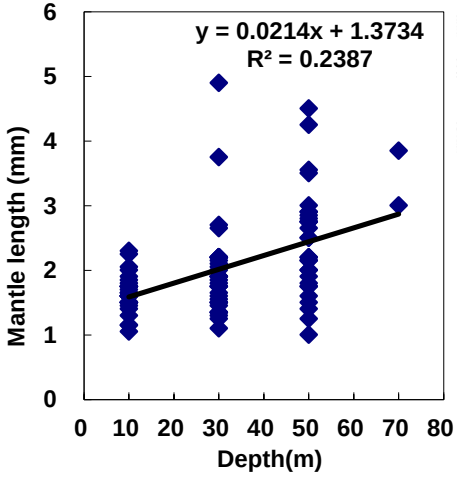


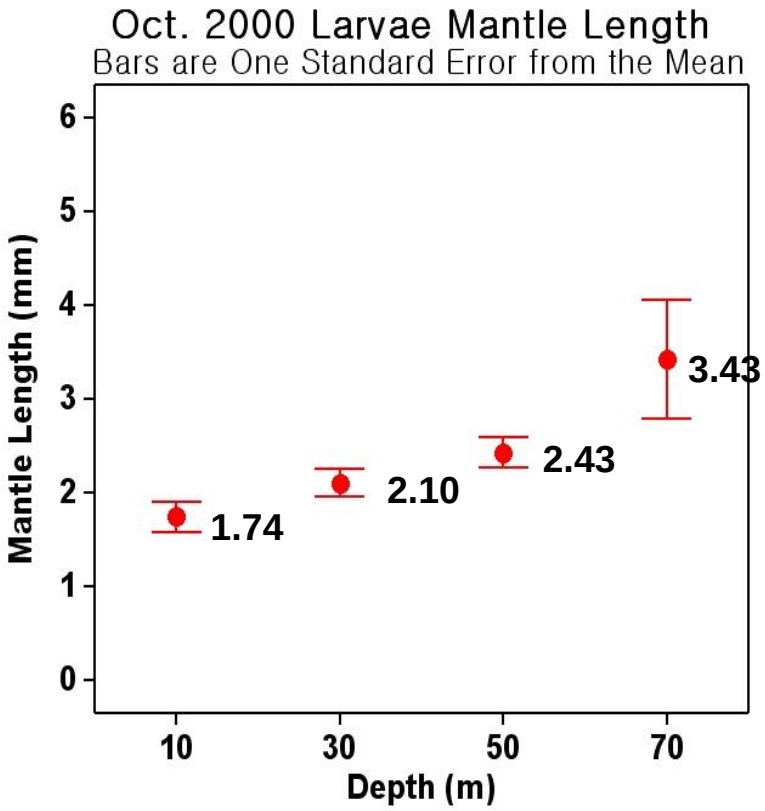
RESULT.
LARVAL SIZE AND DEPTH

October 2000

Depth	Total	*T. pacificus*	Mean ML SE
0-20	63	34	1.74 0.109
20-40	65	37	2.10 0.192
40-60	51	30	2.43 0.151
60-80	13	2	3.43 0.425
80-100	1	0	0.00
	193	103 53.37%	



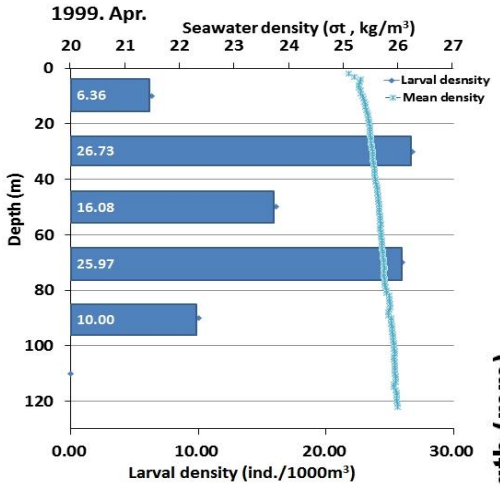


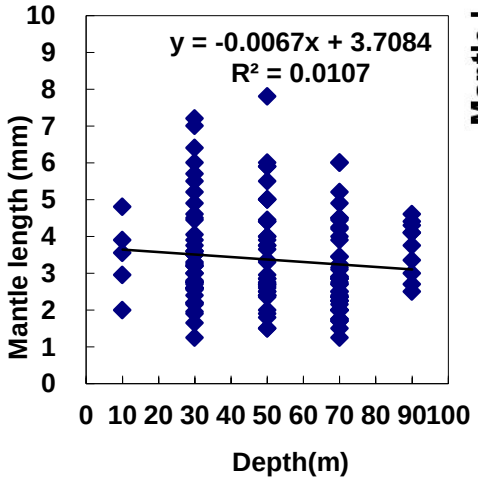


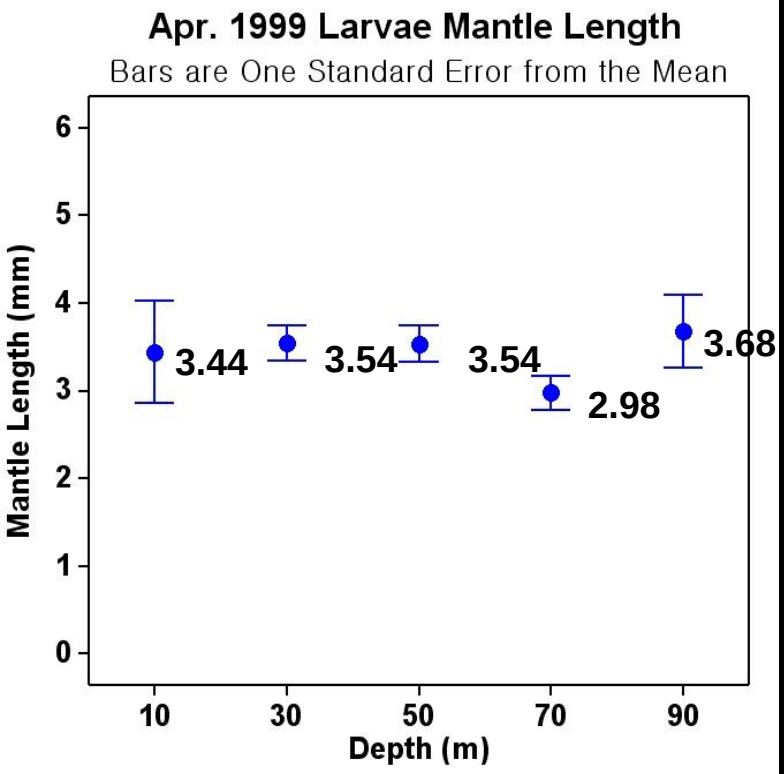
RESULT 3.
LARVAL SIZE AND DEPTH

April 1999

Depth	Total	*T. pacificus*	Mean ML SE
0-20	10	6	3.44 0.468
20-40	62	47	3.54 0.218
40-60	63	41	3.54 0.235
60-80	74	49	2.98 0.174
80-100	20	10	3.68 0.236
100-120	6	0	0.00
	235	153 65.11%	





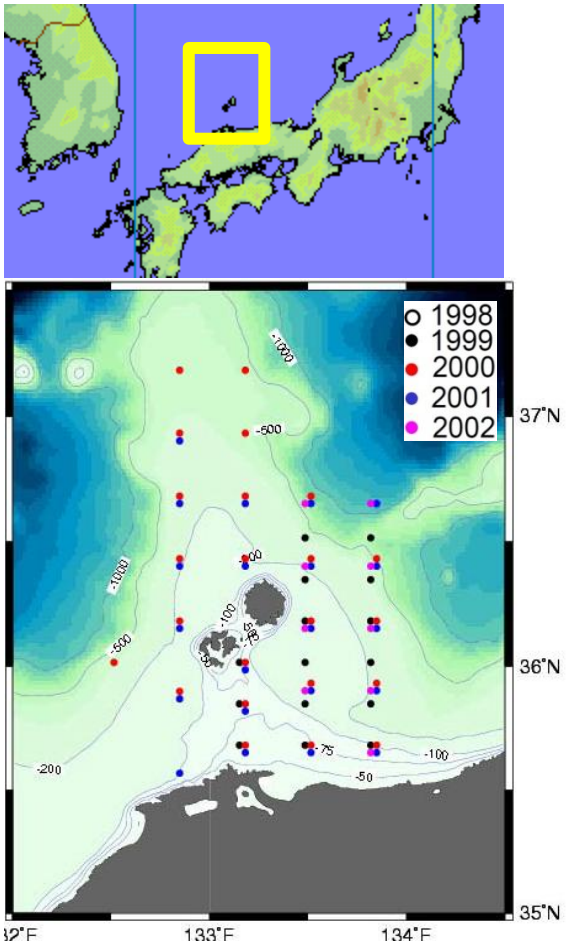


DISCUSSION

Vertical distribution of common squid (*Todarodes pacificus*) larvae near Japan

(Yamamoto et al., 2007)

- Oki Island, Japan
  - primary spawning ground of Autumn spawning population
- Period : Nov. 1998-2002
- **MOCNESS**, 0.333mm, 25m depth
- 1,511 paralarvae
  - ML range : 0.7-7.3mm
- 84% paralarvae collected above 75m water depth and mixed layer
- Do not exhibit large vertical migration pattern
- Larvae increase in size with water depth

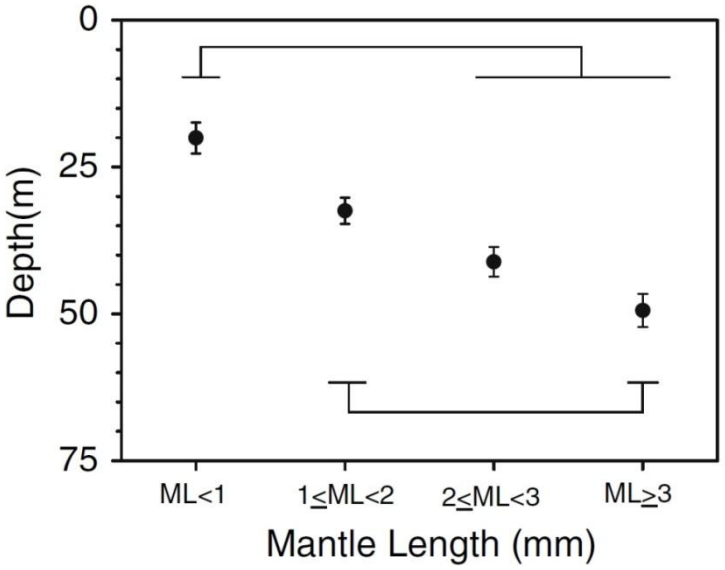


DISCUSSION

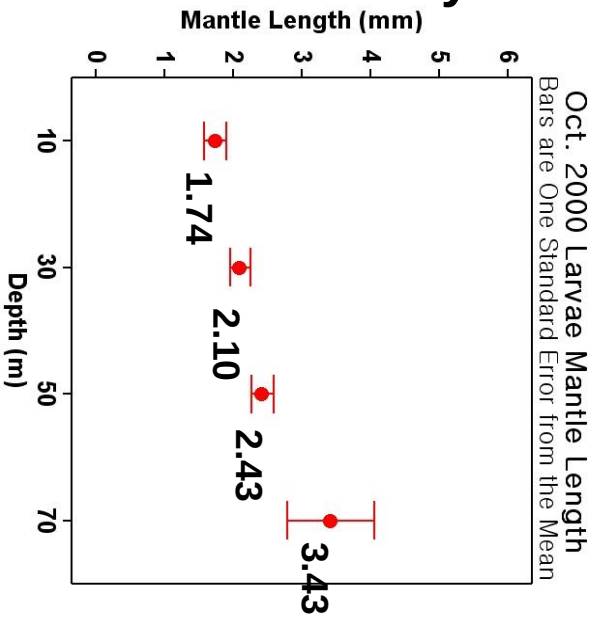
Larvae size and depth - *Todarodes pacificus*

- Individual size and depth relationship(Yamamoto et al., 2007)
  - Gradually increase in size each depth interval
  - Similar environmental condition
    - thermocline exist around 75m water depth

After Yamamoto et al. (2007)



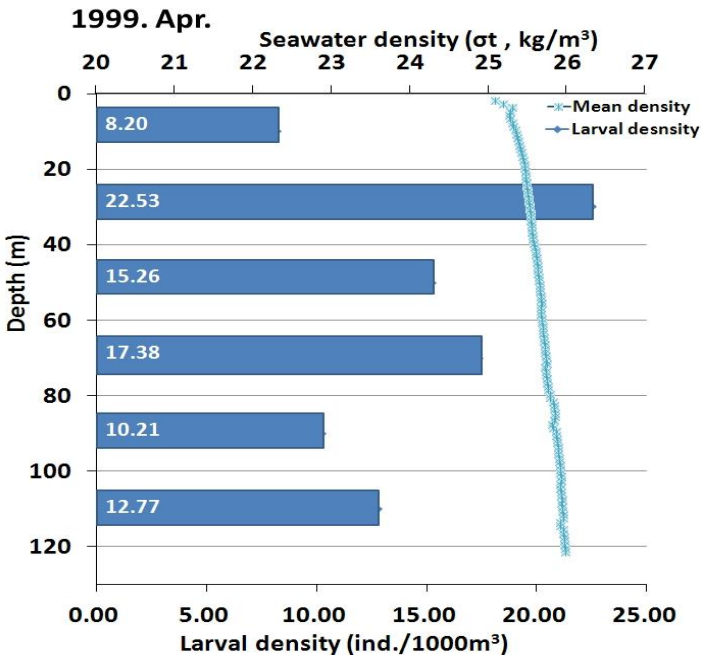
In this study

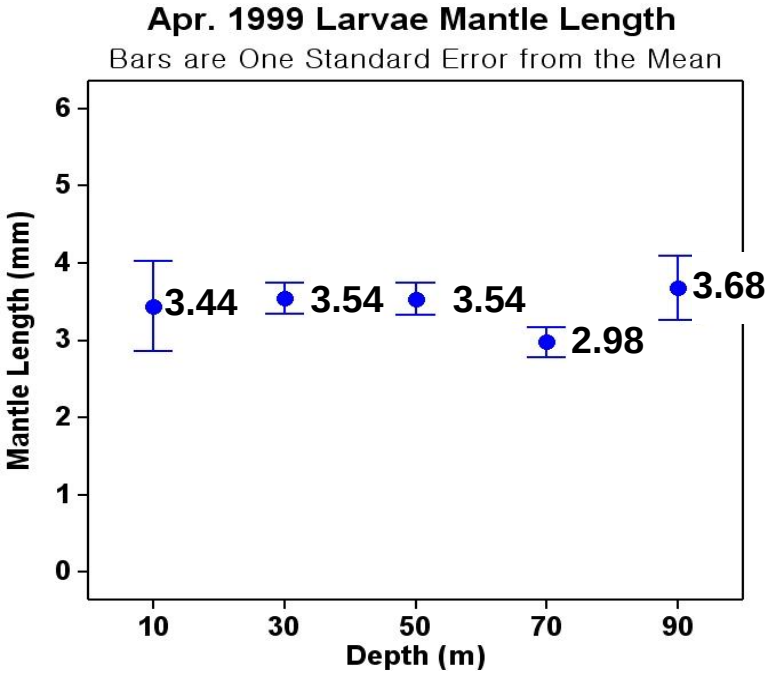


DISCUSSION

Larvae size and depth - *Todarodes pacificus*

- But in this research





CONCLUSION

Stratified condition

- Higher larval density upper picnocline (or thermocline)

Well mixed condition

- Higher densities shown in mid layer

Sampling strategy

- Consider the seasonal variation of picnocline

Marine physics model

- Concern the current depth and high density larval depth

Thank you
for your attention