



Title



Acoustic monitoring of Japanese anchovy Engraulis japonicus post larvae “shirasu”

K. Miyashita, A. Watanabe, S. Morioka,
Y. Ikewaki, R. Matsukura, and H. Yasuma



Engraulis japonicus



Shirasu fishery vessels



Recruitment estimation for small pelagic fish

Background

Present methods of the recruitment estimation

Egg-larvae sampling using a net gear

Catch of the adult fish

Characteristics of the fishing ground

In-situ measuring of the quantitative abundance

...efficiently in its early life stage



Acoustic monitoring !!



Goal (our mission) and objective

Long term goal

Development and providing the practical quantitative monitoring system for early life stage of pelagic fish species

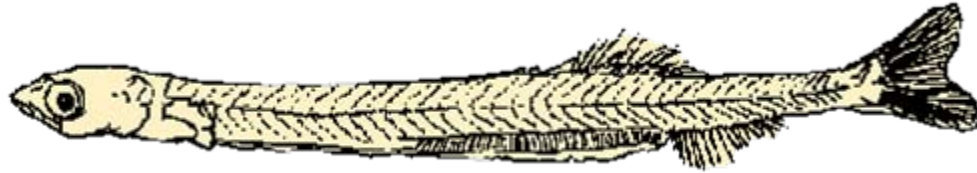


Short term objective

Development of a recruitment monitoring system for Japanese anchovy post larvae, “shirasu”, using acoustics



Approach



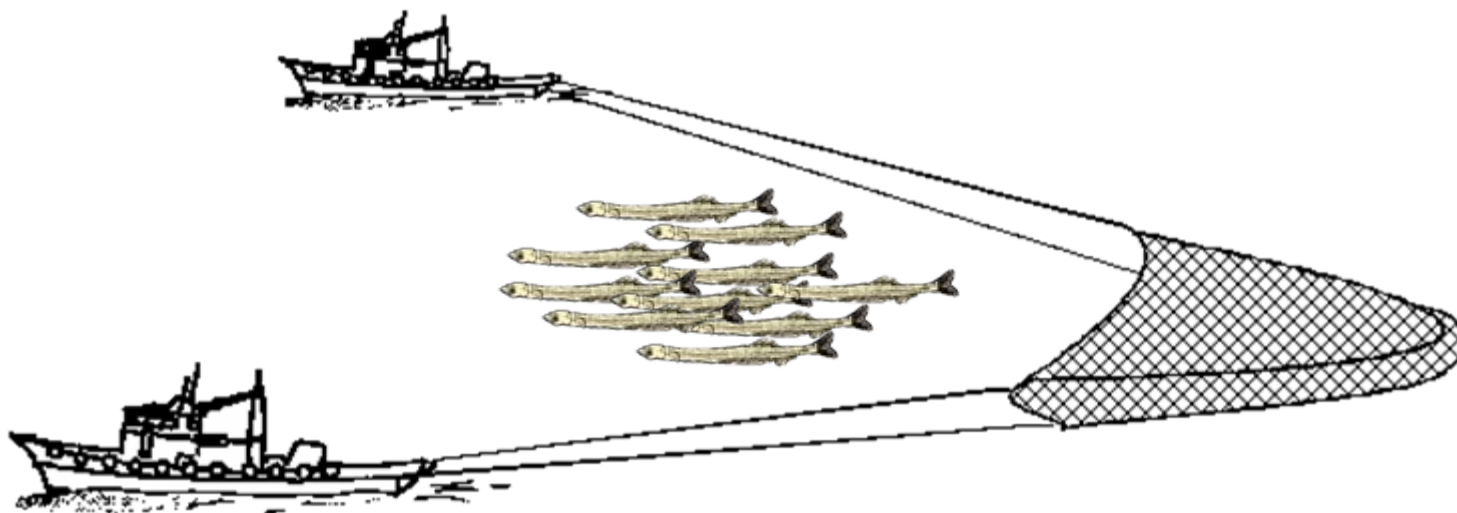
- 1. Refer useful information of shirasu with acoustic technology → our background knowledge**
- 2. Identify shirasu echoes using the obtained knowledge with a commonly used dual quantitative echo sounder**
- 3. Visualize the horizontal distribution of shirasu using GIS**



Background knowledge (Shirasu fishery I)

knowledge

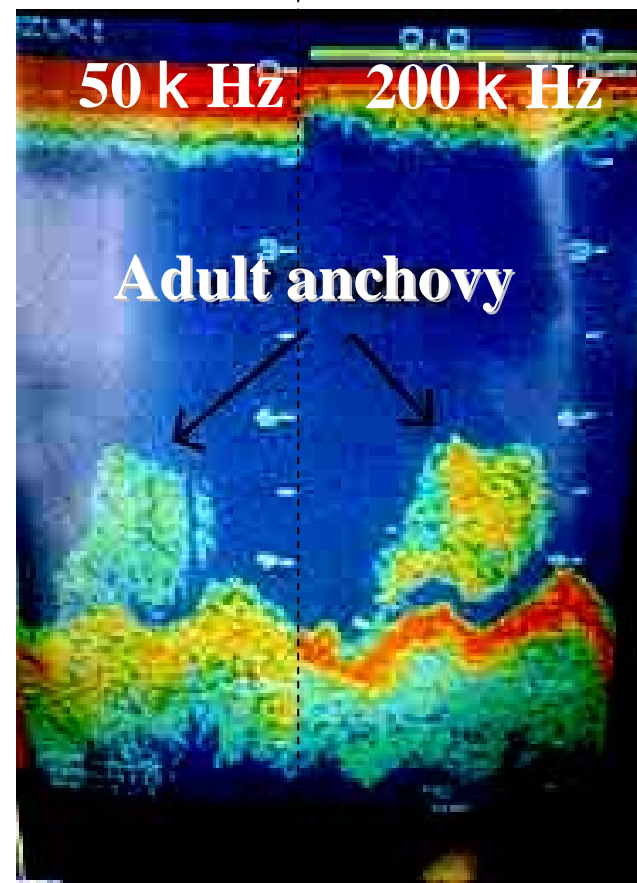
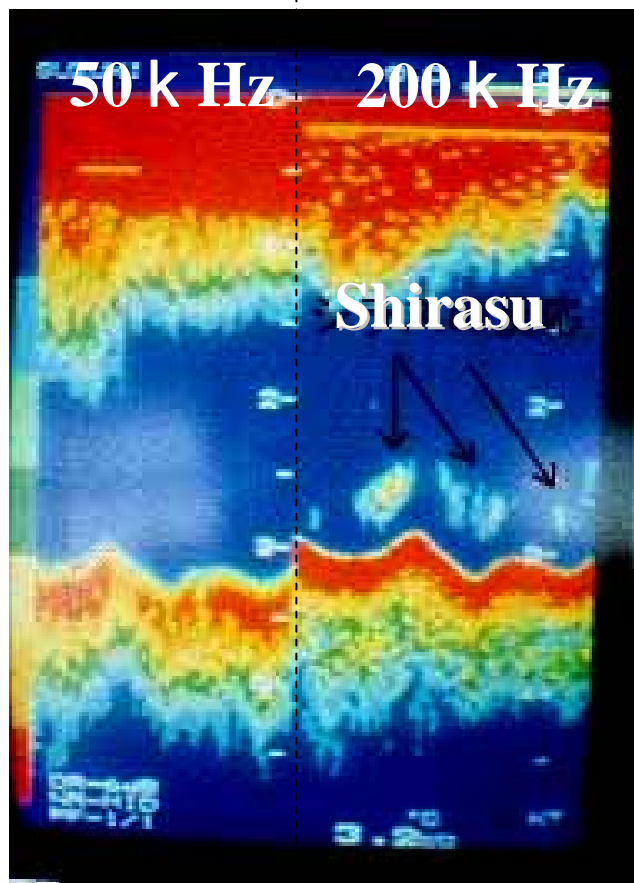
Day time fishery





Background knowledge (Shirasu fishery II)

Use of a dual frequency echo sounder to find a shirasu fishing ground (50kHz and 200kHz)





Background knowledge (Swim bladder condition I)

Day:

No gas in the swim bladder

Night:

Fill gas in the swim bladder

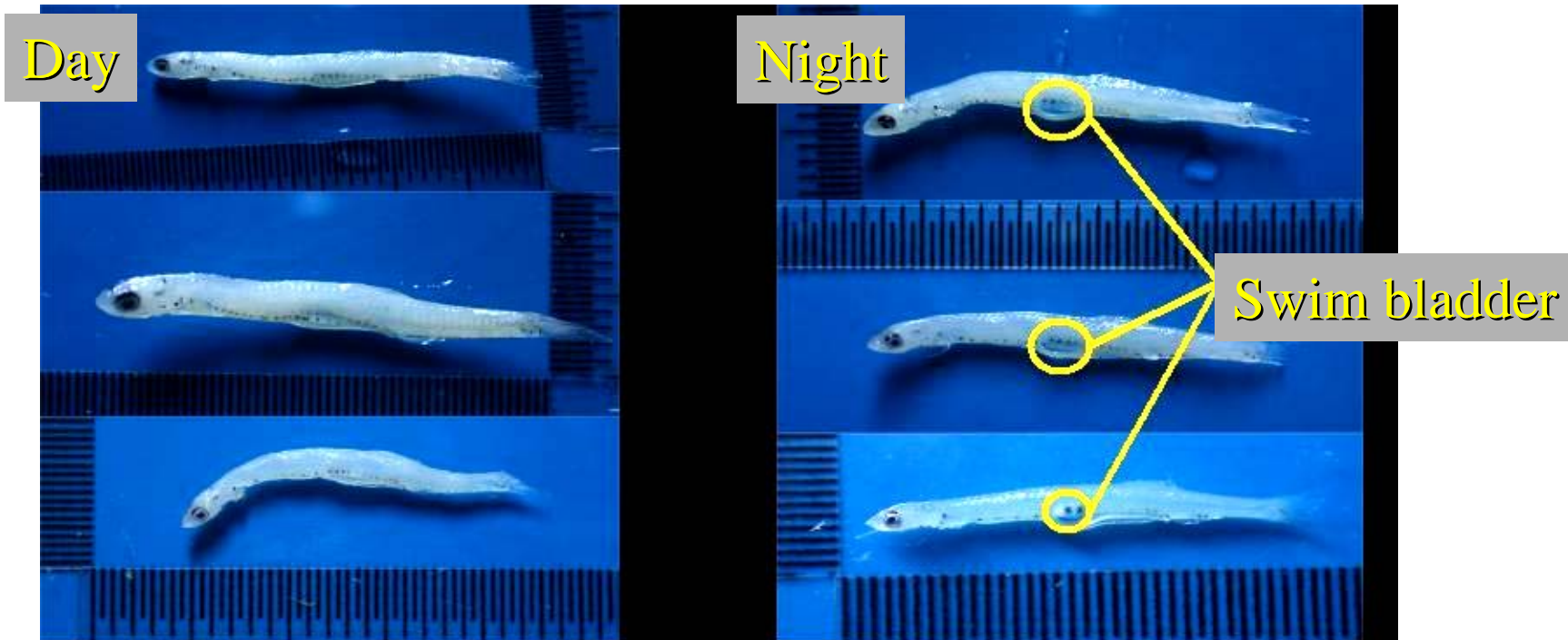
Japanese anchovy (*E. japonicus*), Japanese sardine (*Sardinops melanosticta*), and round herring (*Etrumeus teres*) ;(Uotani, 1973)

Northern anchovy (*E. mordax*) ;(Hunter and Sanchez, 1976)



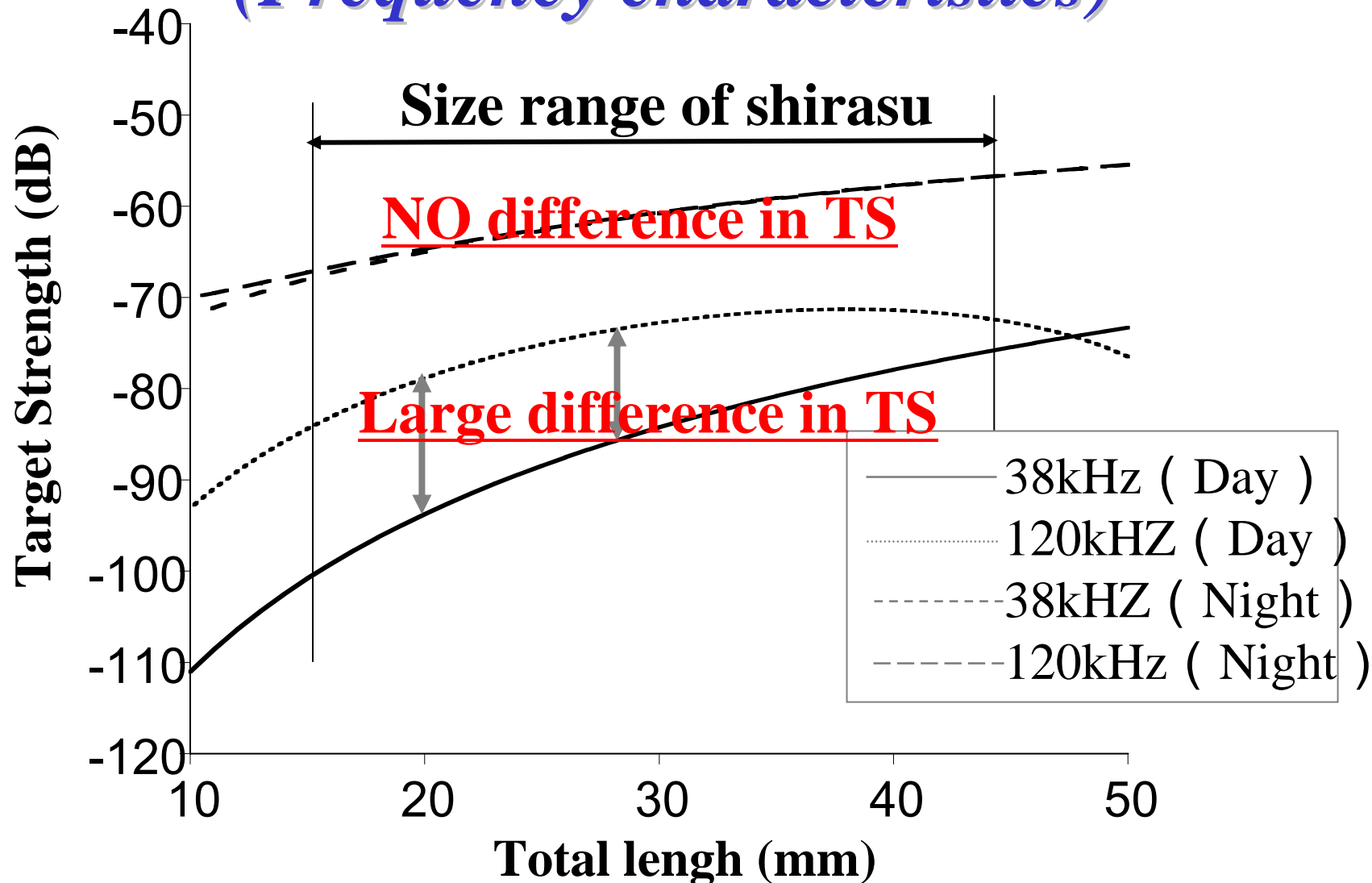
Background knowledge (Swim bladder condition II)

- 1) Day: **All had NO gas in the swim bladder**
- 2) Night: **More than 90% of individuals had gas in the swim bladder**





Background knowledge (Frequency characteristics)



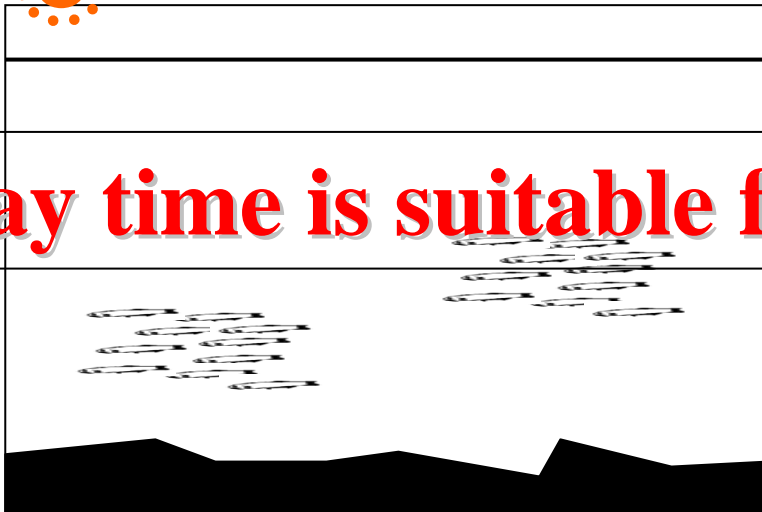
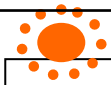


Background knowledge

(Summary)

knowledge

	Day	Night
Swim bladder condition	No gas	Fill gas
School characteristics	Dense	Dispersion
Frequency characteristics	Large difference	No difference

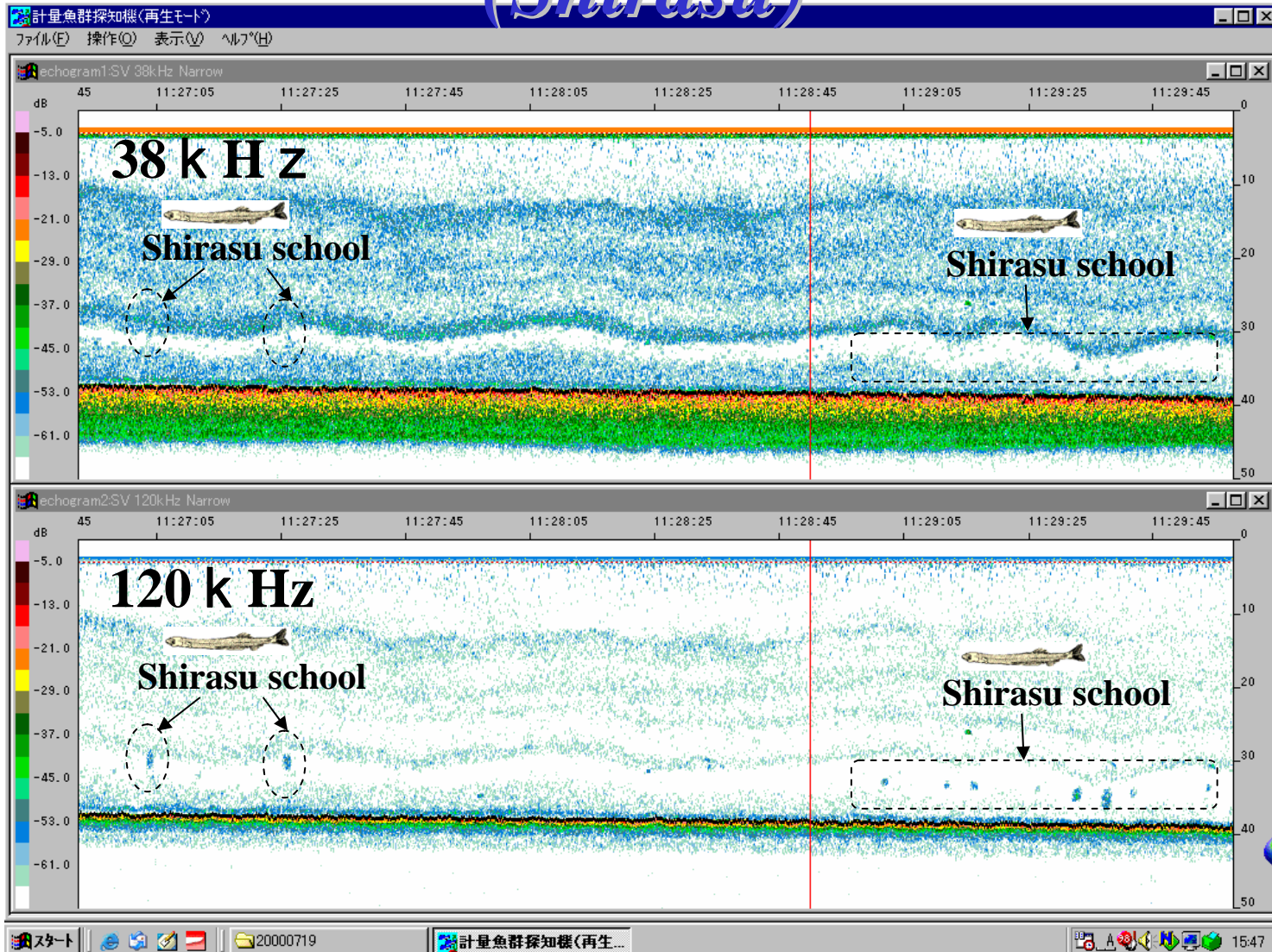


Day time is suitable for the acoustic survey!!



Echograms in a fishing ground (Shirasu)

Example

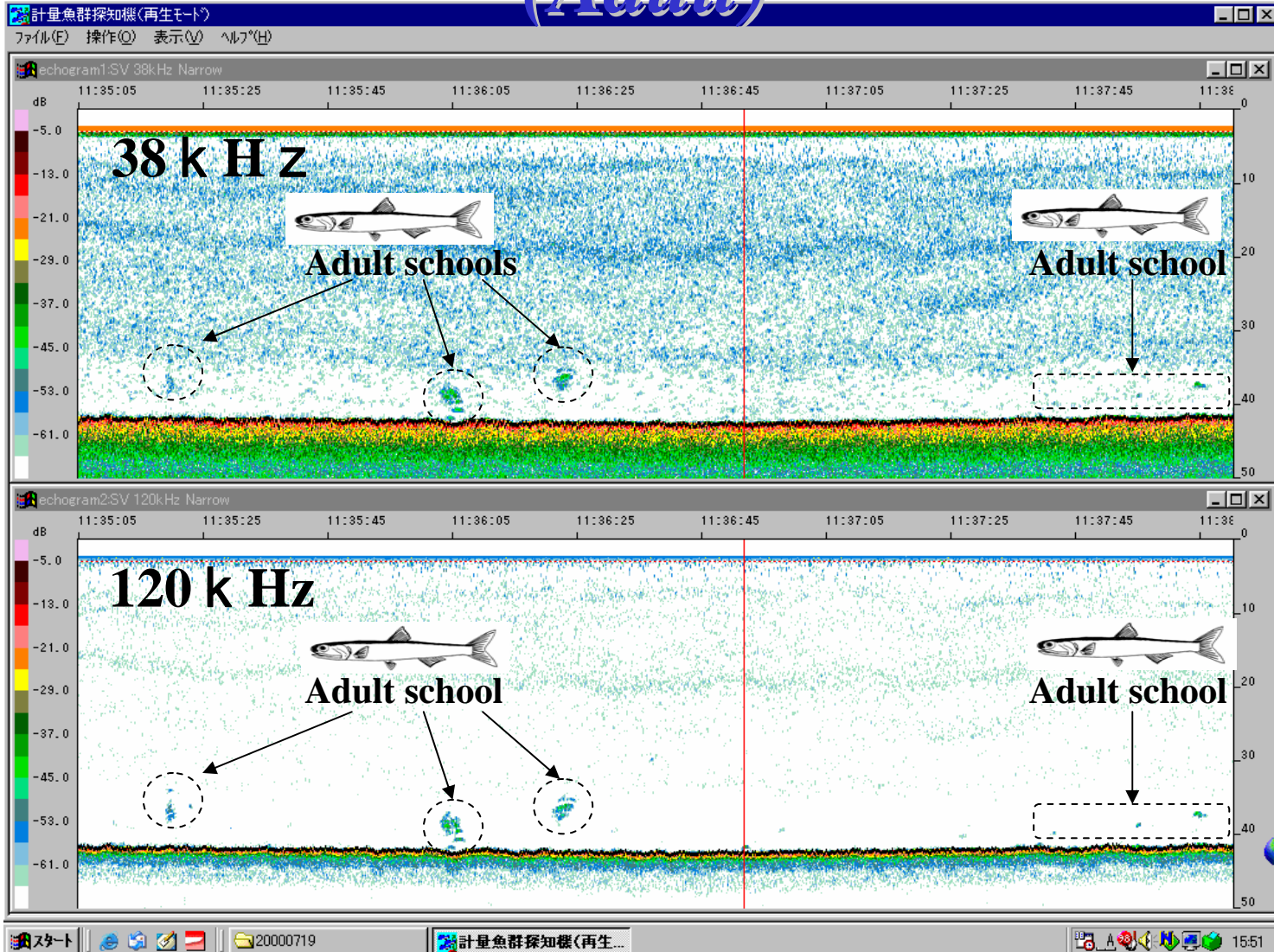


2000/07/19



Echograms in a fishing ground (Adult)

Example

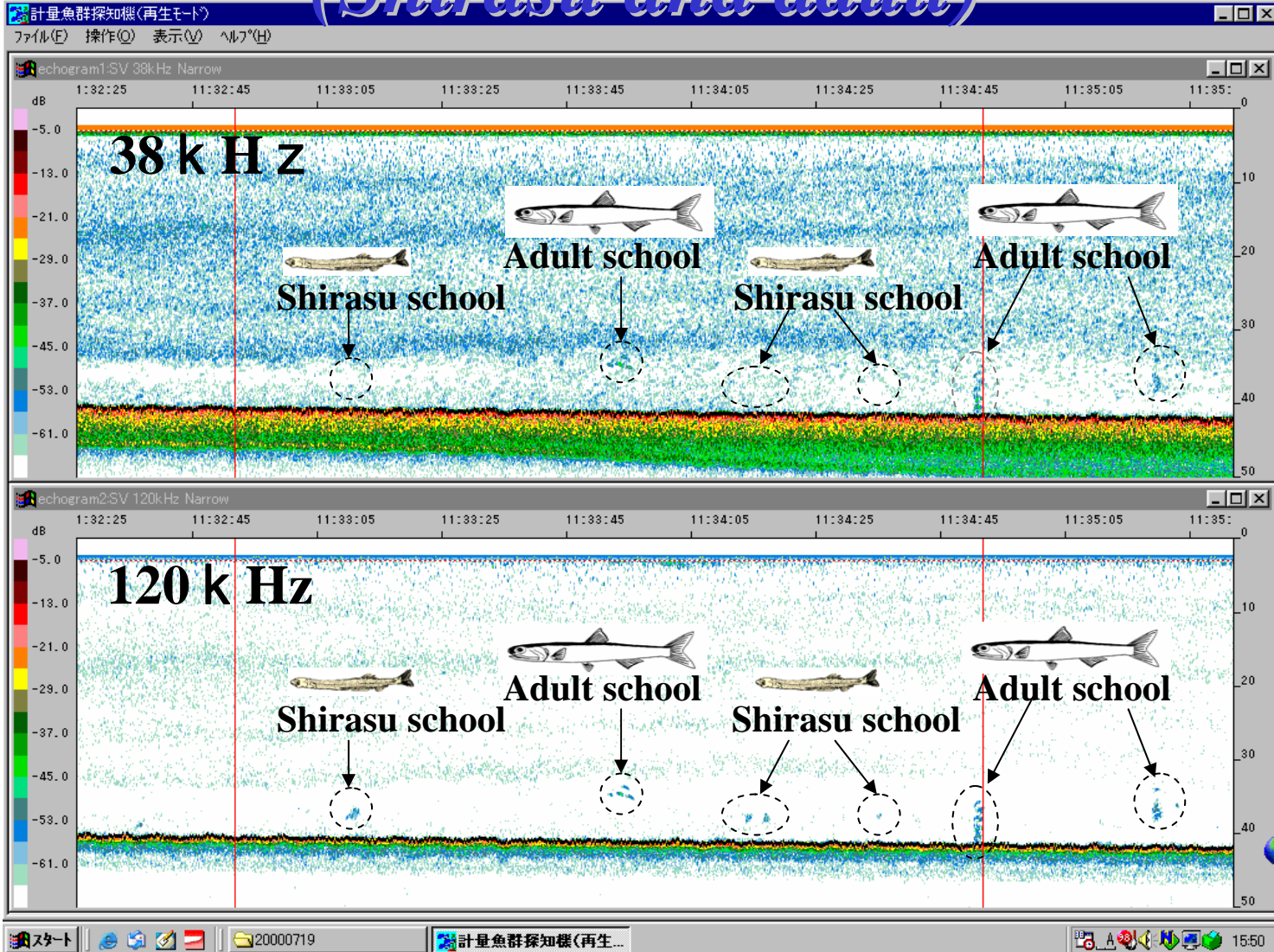


2000/07/19



Echograms in a fishing ground (Shirasu and adult)

Example



2000年7月19日



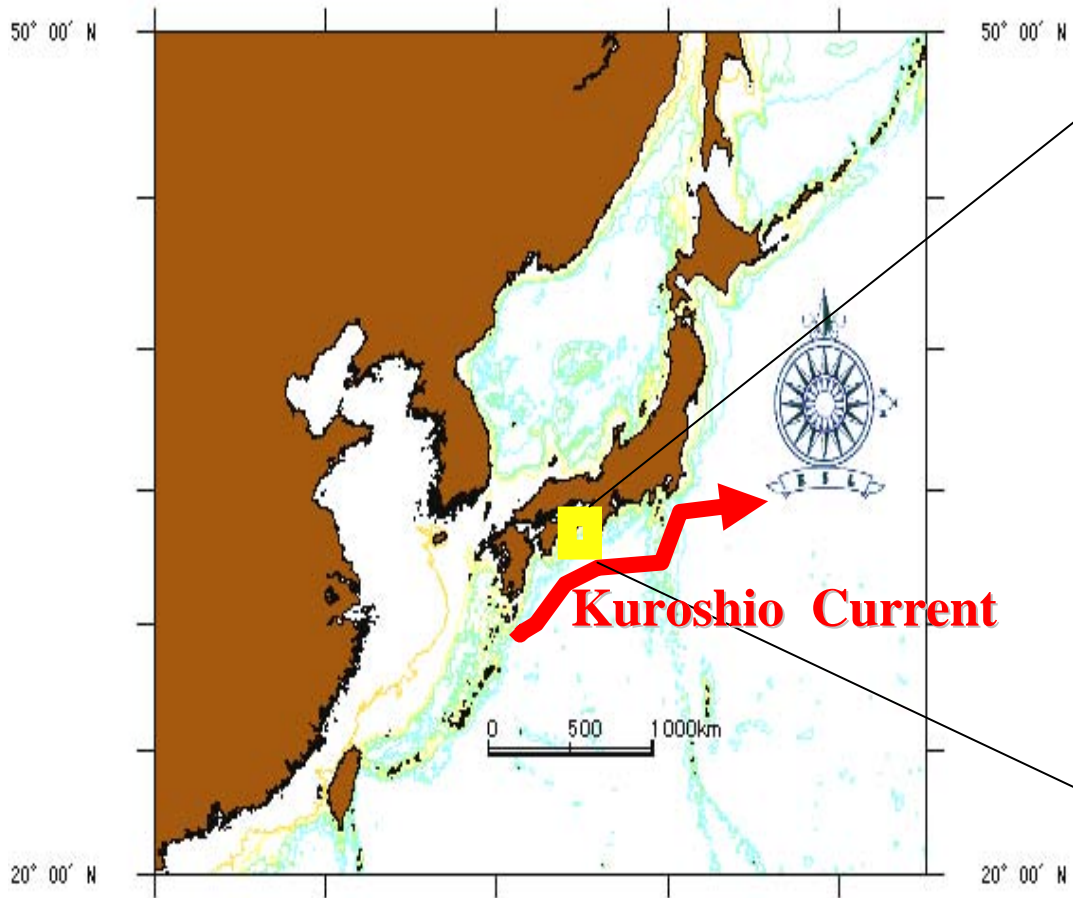
Field survey (Survey area)

110° 00' E

155° 00' E

50° 00' N

50° 00' N



110° 00' E

155° 00' E





Field survey

(Survey contents)

Date and cruise

Oct. 2003 ~ July 2004

Monthly marine environment monitoring survey around Kii-channel (day time)

Echo sounder

KFC3000 (kaijo)

38kHz and 120kHz

Sampling

Plankton net

Surface temp.

Satellite

Vessel

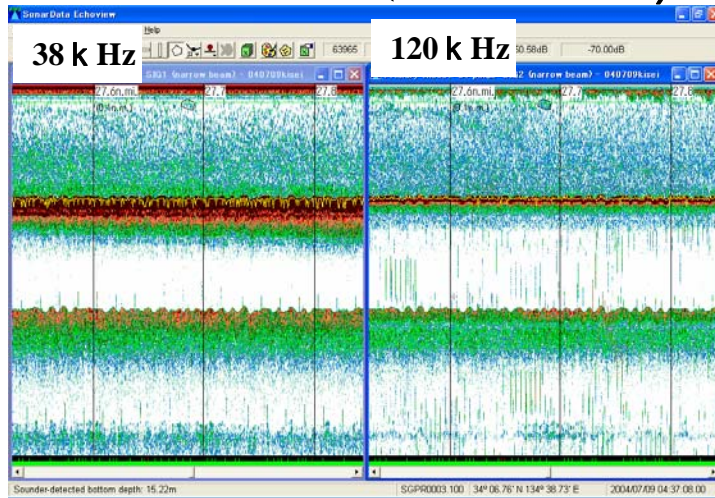


R/V Tokushima

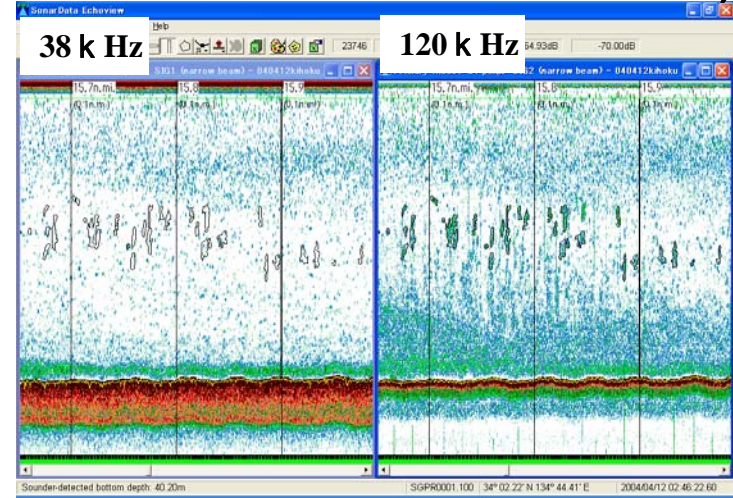


Identification of the shirasu school echoes

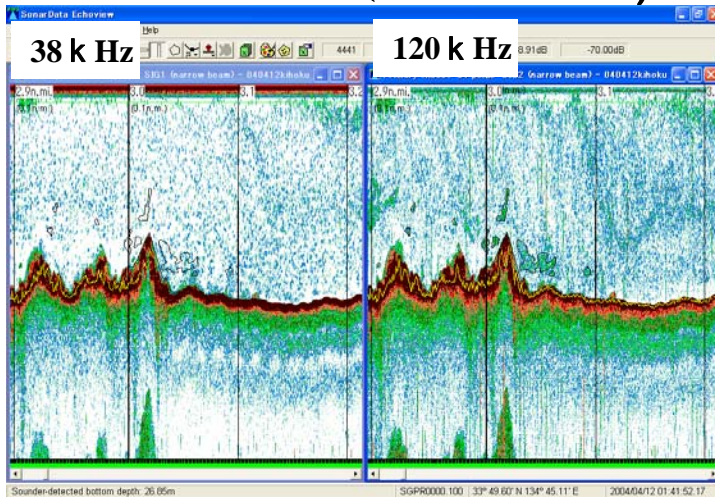
Surface school (near shore)



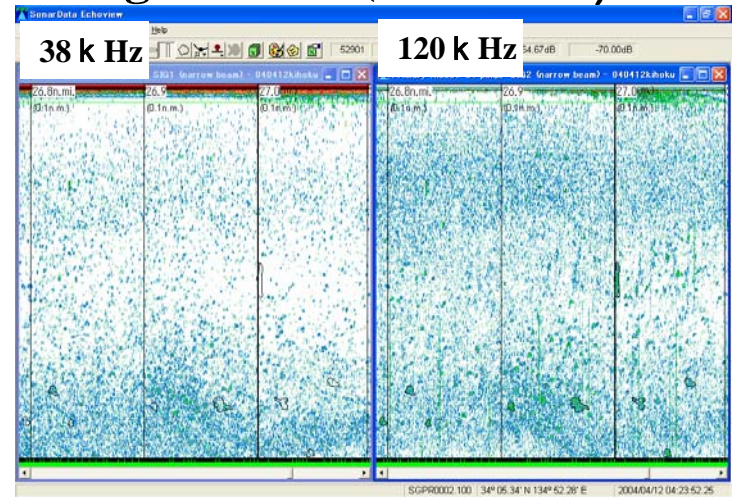
Mid-water school (near shore)



Bottom school (near shore)



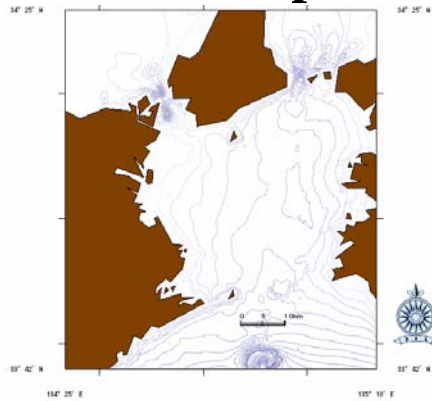
Pelagic school (off shore)



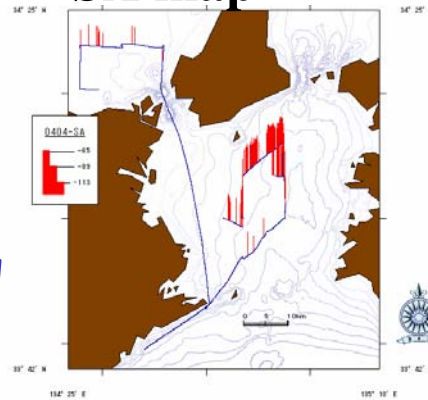


The GIS mapping

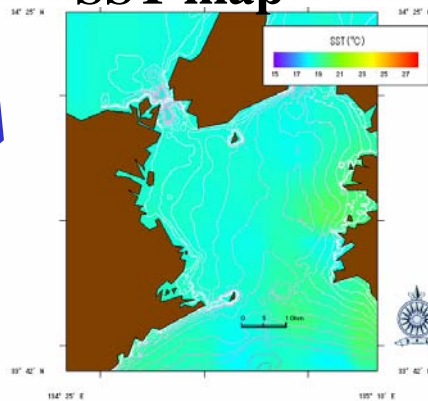
White map



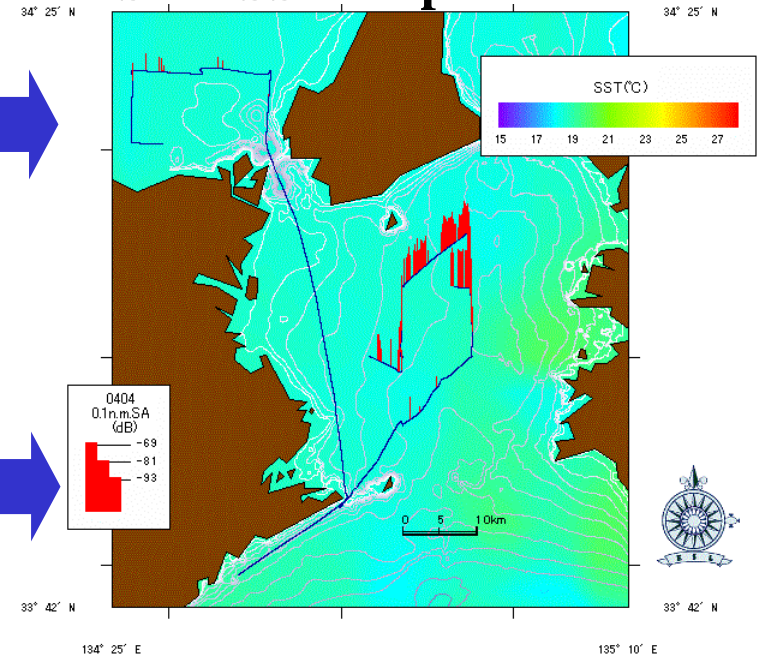
SA map



SST map



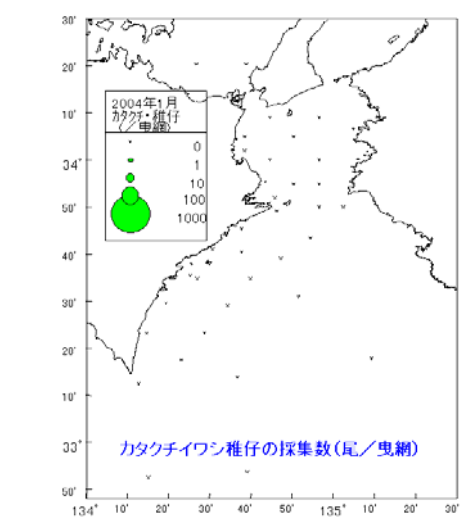
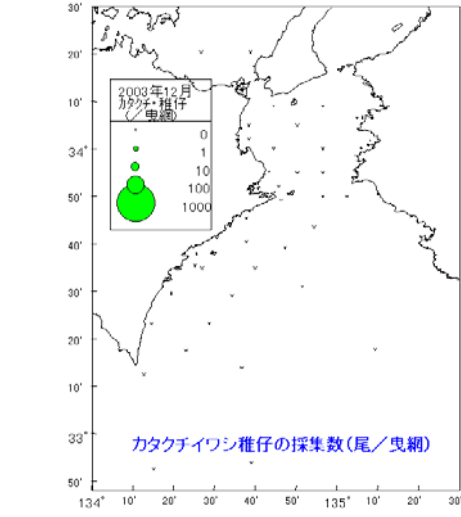
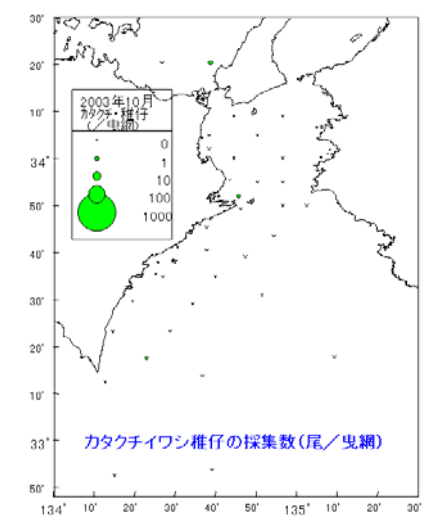
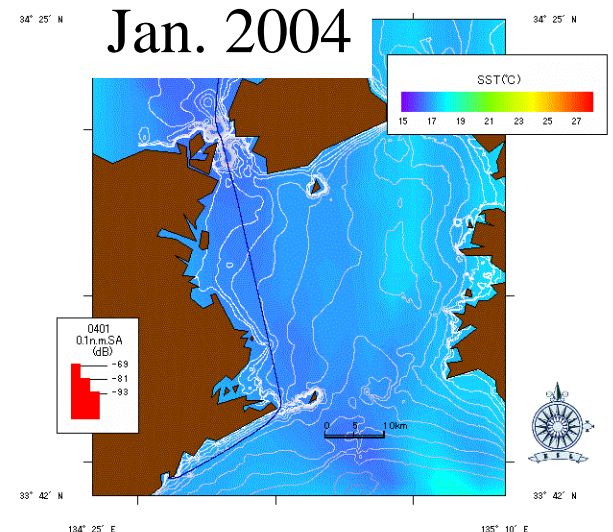
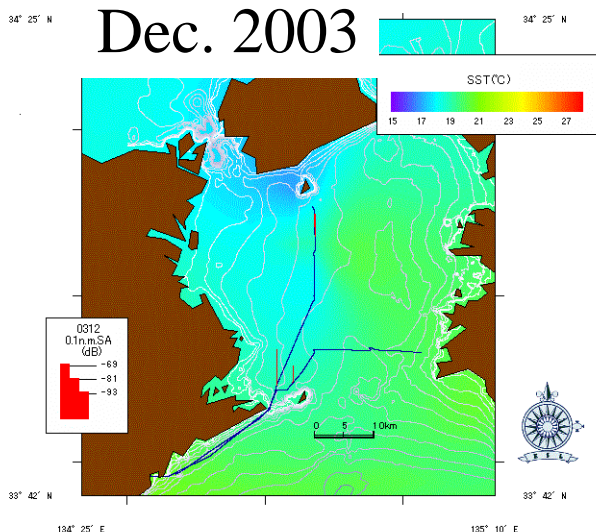
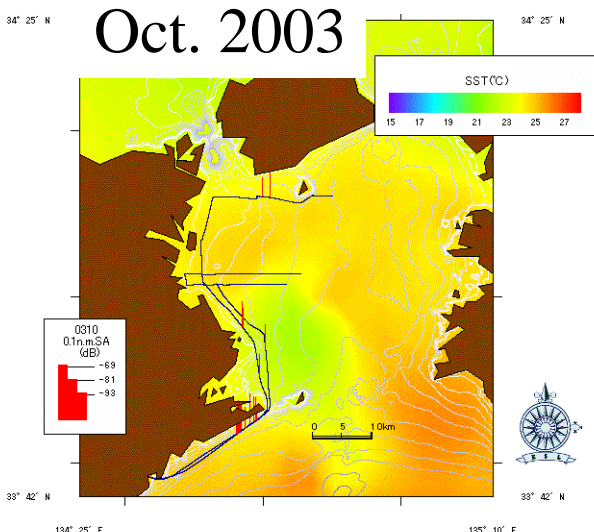
SA + SST map





Horizontal distribution of shirasu (Autumn to winter)

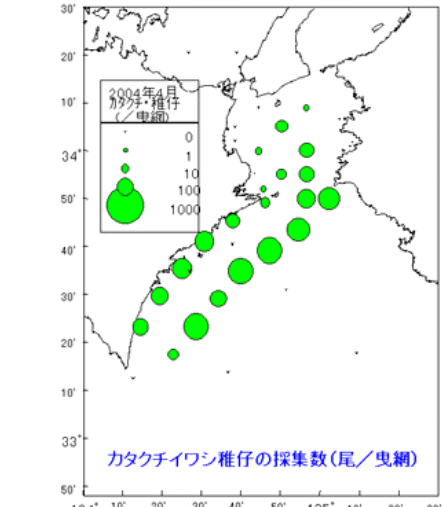
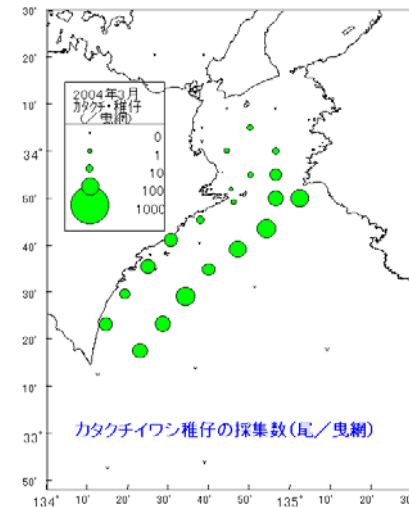
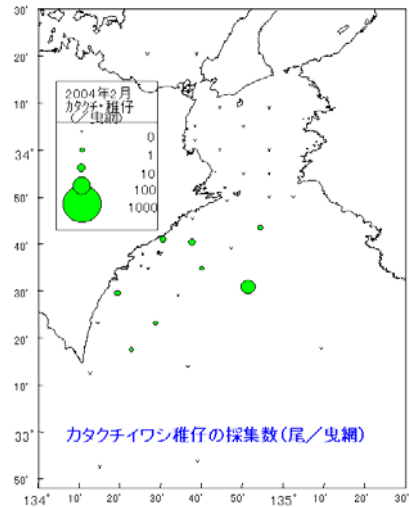
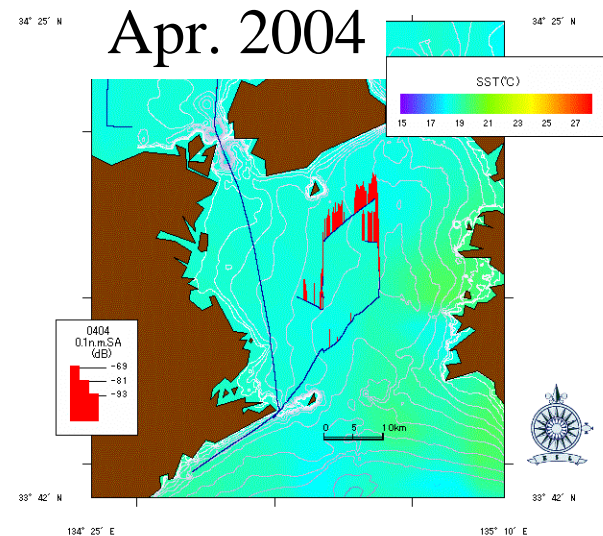
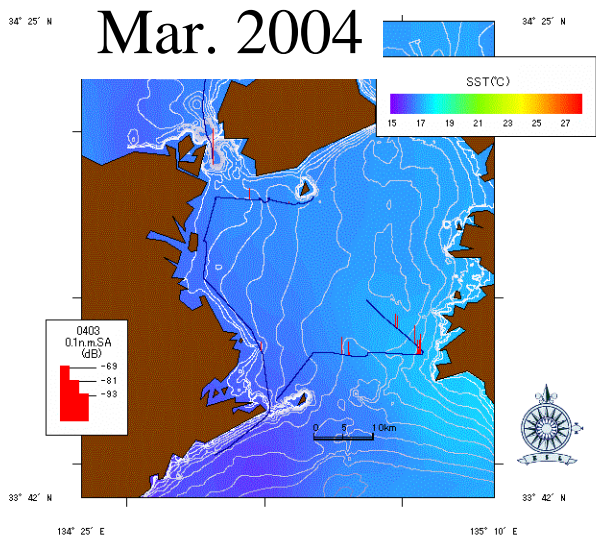
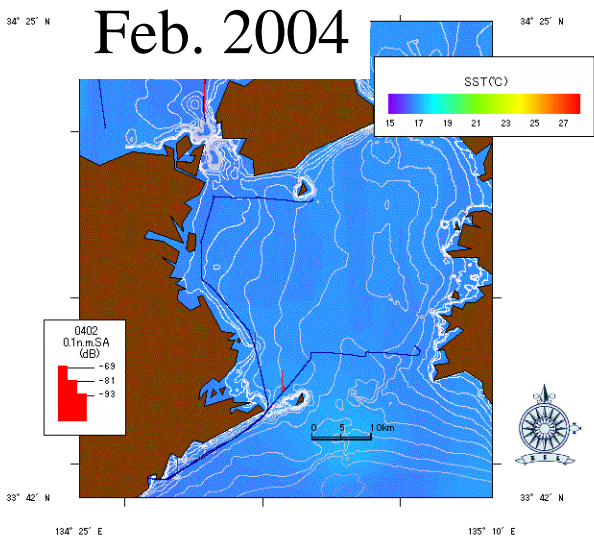
Results





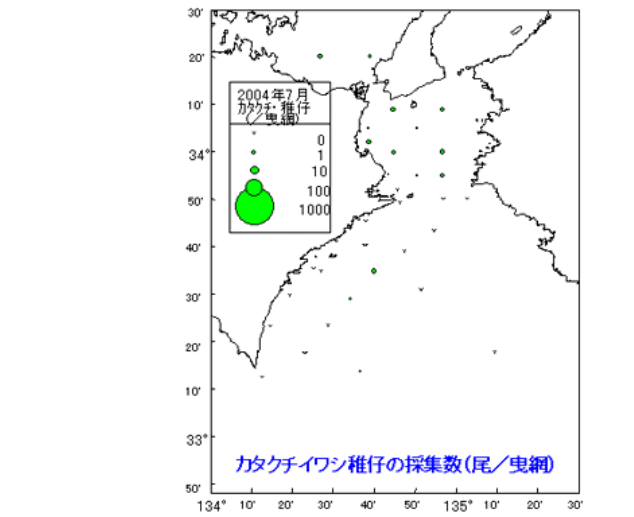
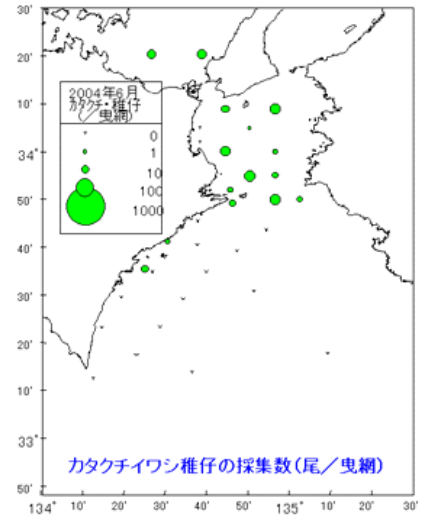
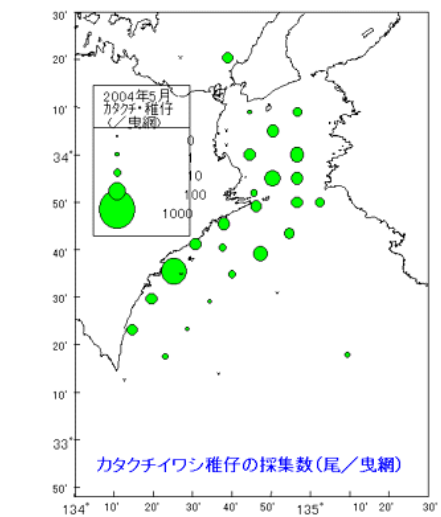
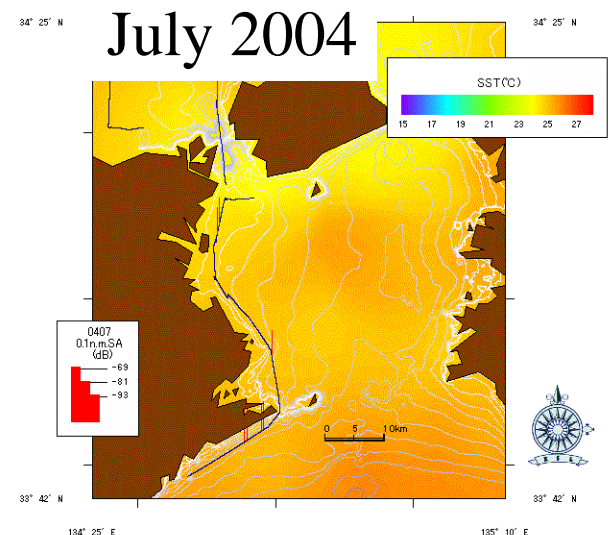
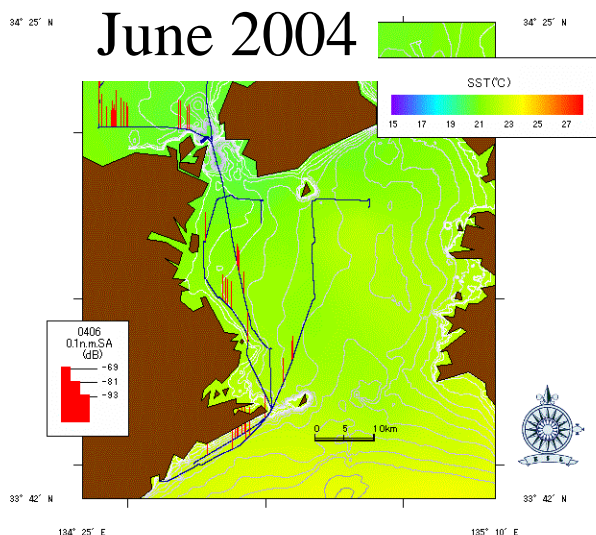
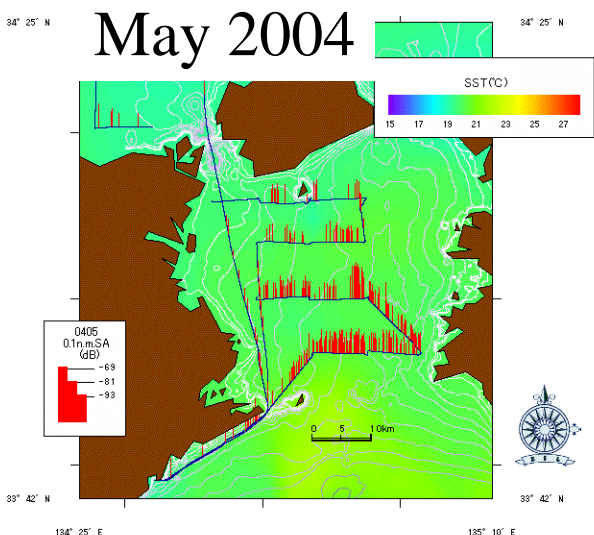
Horizontal distribution of shirasu (Winter to spring)

Results





Horizontal distribution of shirasu (Spring to summer)





Summary

(Shirasu school distribution)

	Winter Dec.- Feb.	Spring Mar. – May <i>Fish. season</i>	Summer June- Aug.	Autumn Sep.-Nor. <i>Fish. season</i>
Acoustics	Near shore ○ Off shore △	Near shore ○ Off shore ○	Near shore ○ Off shore △	Near shore ○ Off shore △
Net	Near shore × Off shore △	Near shore ○ Off shore ○	Near shore × Off shore △	Near shore × Off shore ×



Conclusions

- The distribution of shirasu schools estimated by acoustics is similar to those estimated by net at off-shore areas, but different at near-shore areas.
- With the background knowledge, this result suggests that **acoustics are more robust and reliable method to capture the quantitative distribution of shirasu schools** than net.
- With the net used this study we did not catch shirasu in spite of its fine performance to catch larvae stage of anchovy. In contrast, **acoustics helped to distinguish the wide range of anchovy size** (also researchers **can identify shirasu school**).



Near future?

Future works

- Development of automatic post processing system for shirasu school identification

Software development

- Accuracy improvement

Ground truth using quantitative sampling tools

- Routine the monitoring

Posting to our homepage

→ **Contribution for sustainable shirasu fishery**

- Propagation of shirasu acoustic monitoring

Estimate the standing stock

→ **Contribution for the resources management**