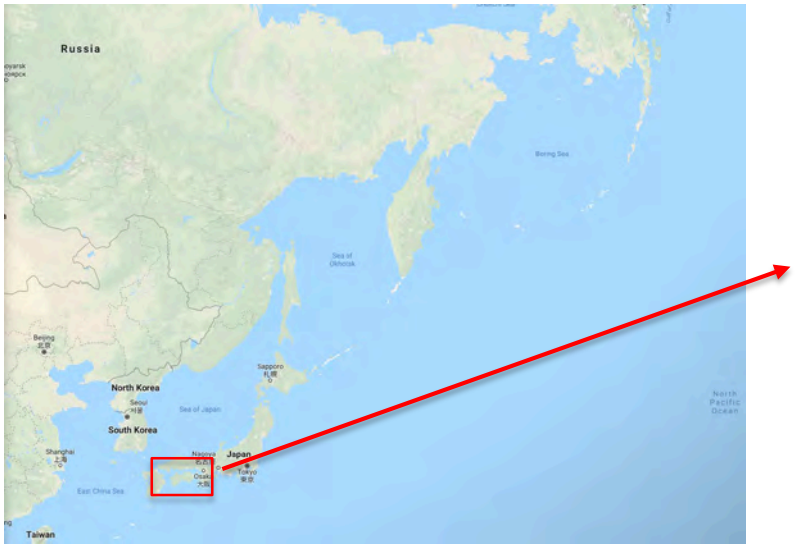
# Spatial and temporal variation of mesozooplankotn productivity in the Seto Inland Sea, Japan

Kazuaki Tadokoro, Akihide Kasai, Katsuyuki Abo, Kazutaka Miyahara, Keigo Yamamoto, and Kazuhiko Koike

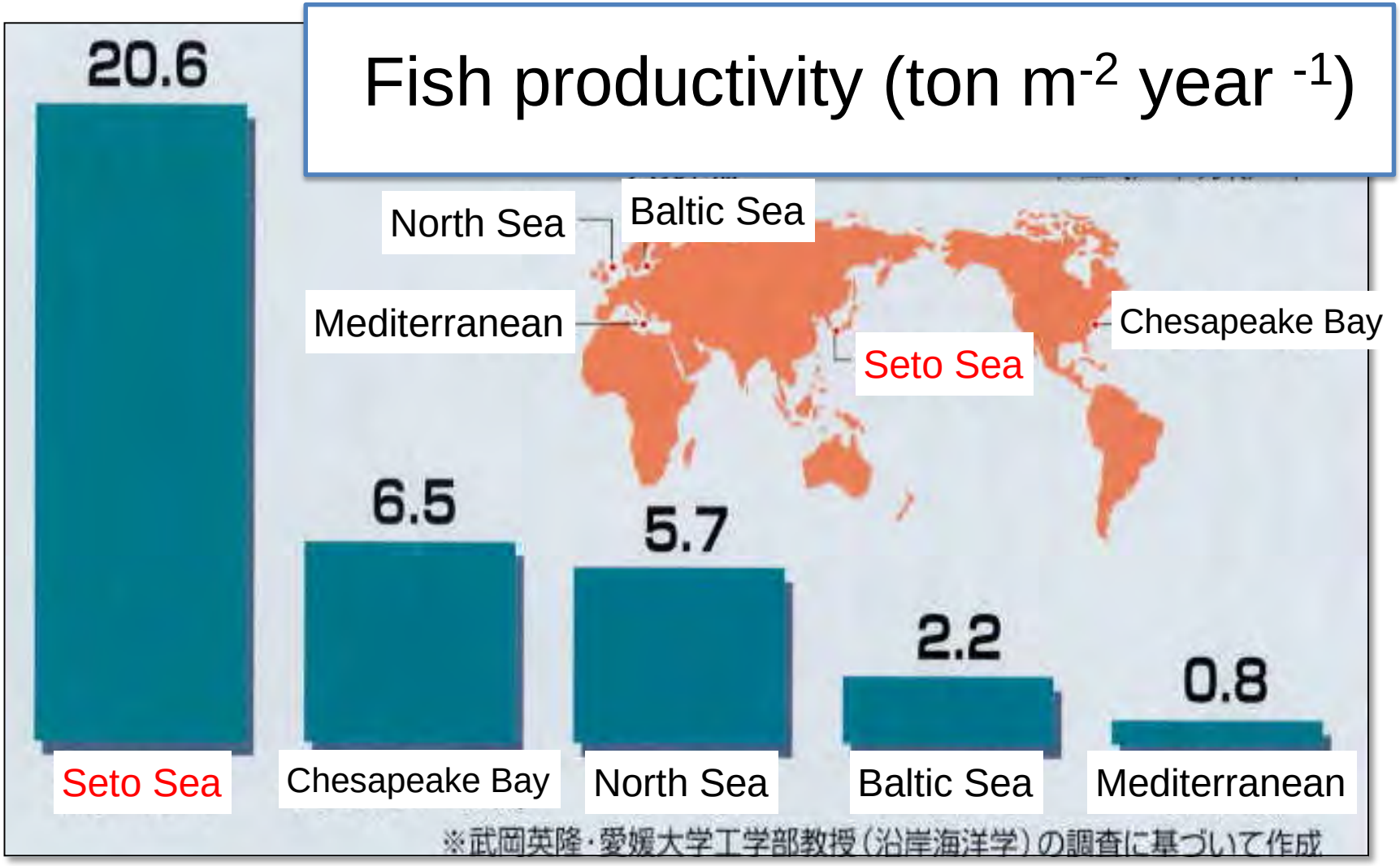
Tohoku National Fisheries Research Institute, Shiogama, Miyagi, Japan.
E-mail: den@affrc.go.jp





Average depth: 38m
Max depth: 105m

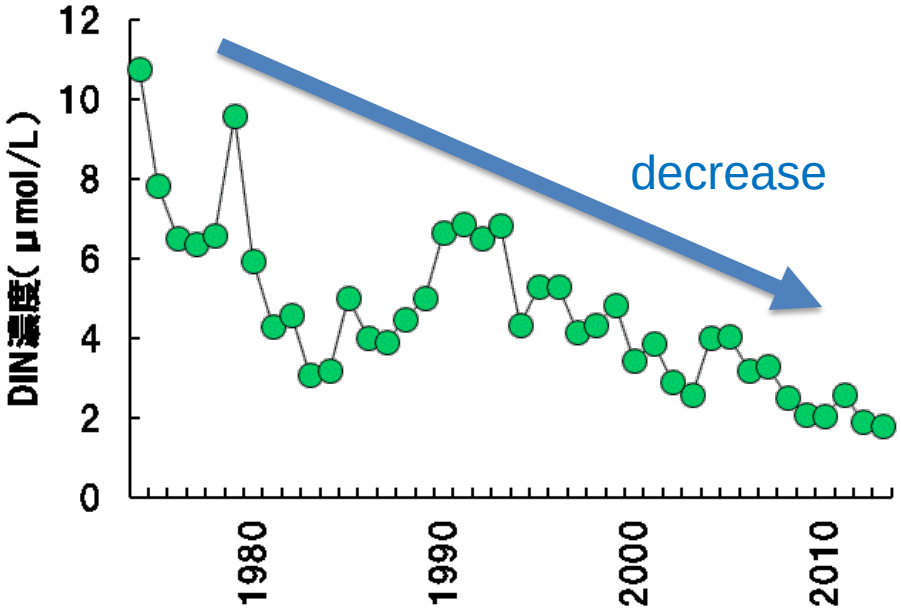
# Background: High productivity fishing ground



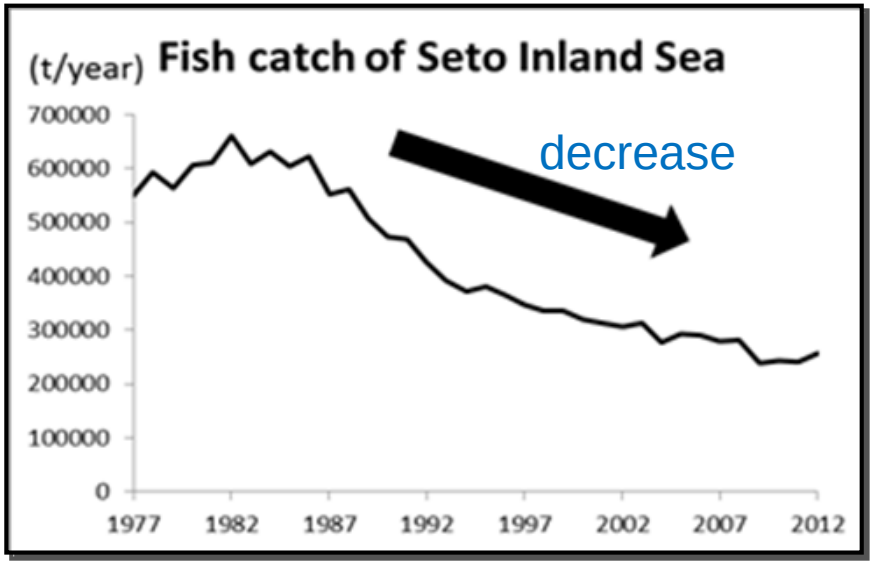

Seto Inland Sea is one of the most productive sea in the world.

# Background: decreasing nutrients and fish catch

## DIN concentration



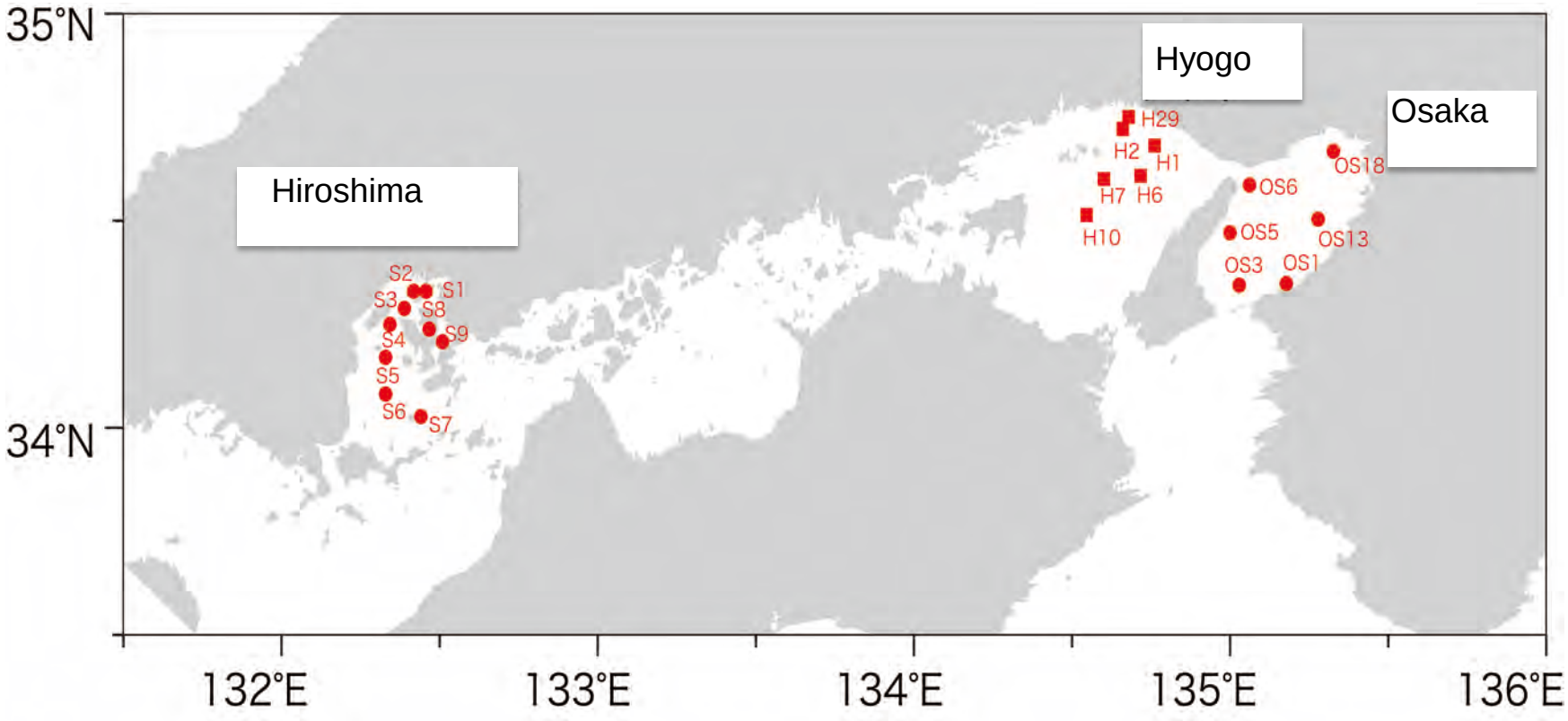

## Fish catch




Eutrophication was a serious problem in the Seto Inland Sea from 1970s to 1980s. However the nutrient concentration has decreased since the end of the 1980s because of limiting of the discharge. Fishery production (or Catch amount of fishes) also has decreased since the 1980s. The decreasing of nutrient concentration is suspected as one of the causes of decrease in fish production. However the mechanisms have not been clarified. copepod is an important prey for fishes and the study of the productivity of copepod is necessary to understand the mechanisms of change in fishery production. Therefore we studied the productivity copepod in the Seto Inland Sea.

# Materials and Methods

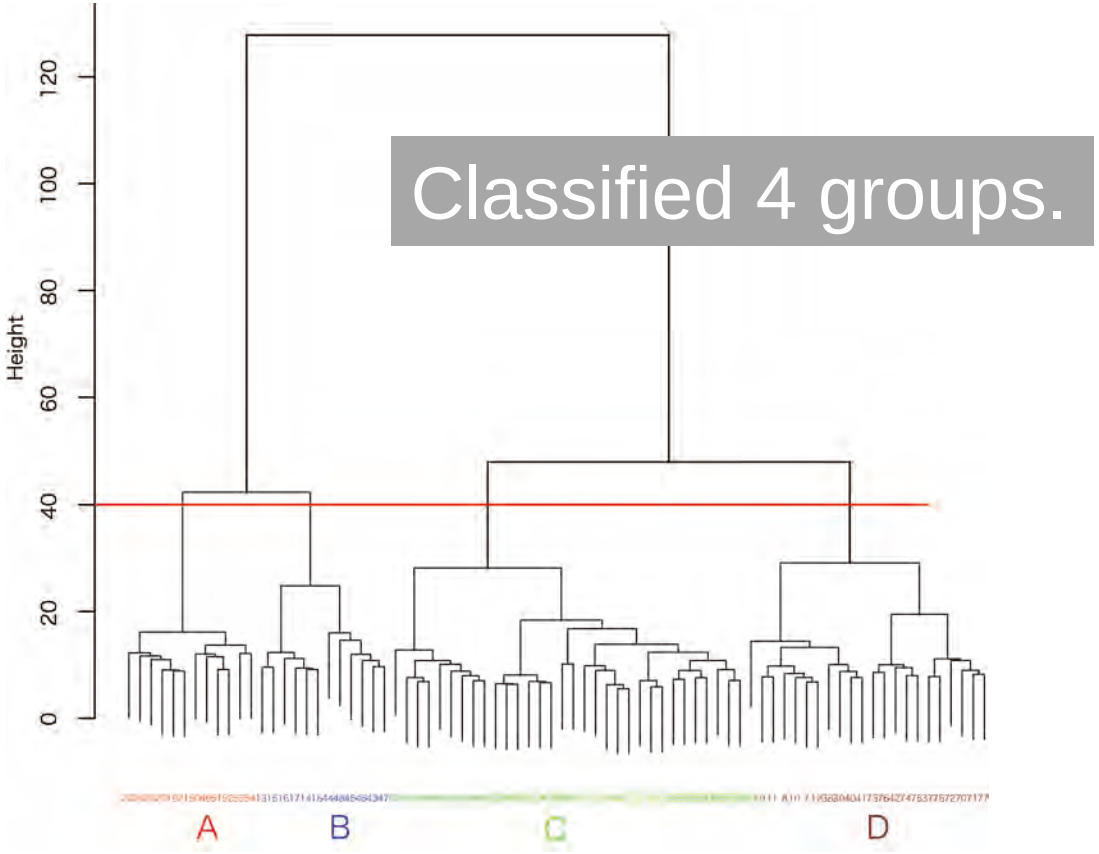
- Period: April 2016- January 2018 (184 samples)
- Gear: Norpac net (diameter: 45cm,  mesh size: 0.1mm)
- Vertical haul from bottom to surface
- Species level abundance, body length
- Production rate was estimated equation of Ikeda & Motoda (1978)



# Classification of community structure by cluster analysis

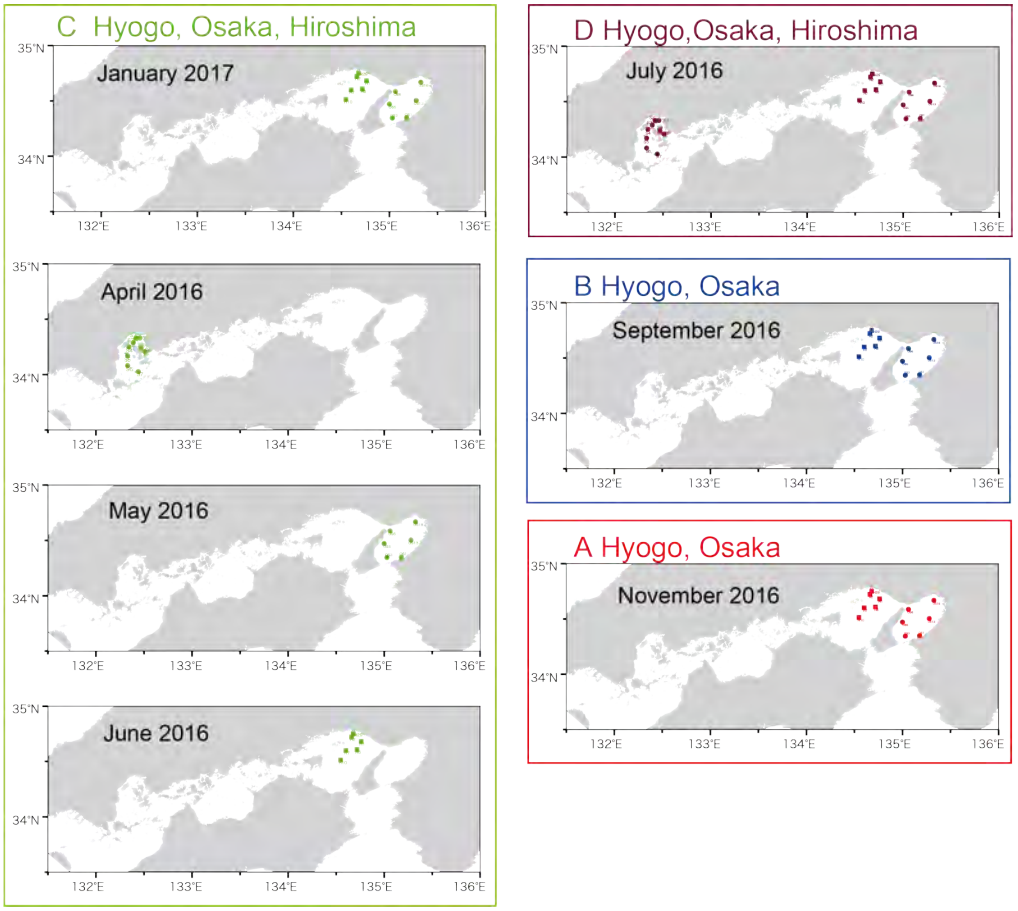
## Method

- Species level abundance data for each station (data 78)
- Logarithm transformed
- Similarity index: Bray-Curtis
- Clustering method: Ward



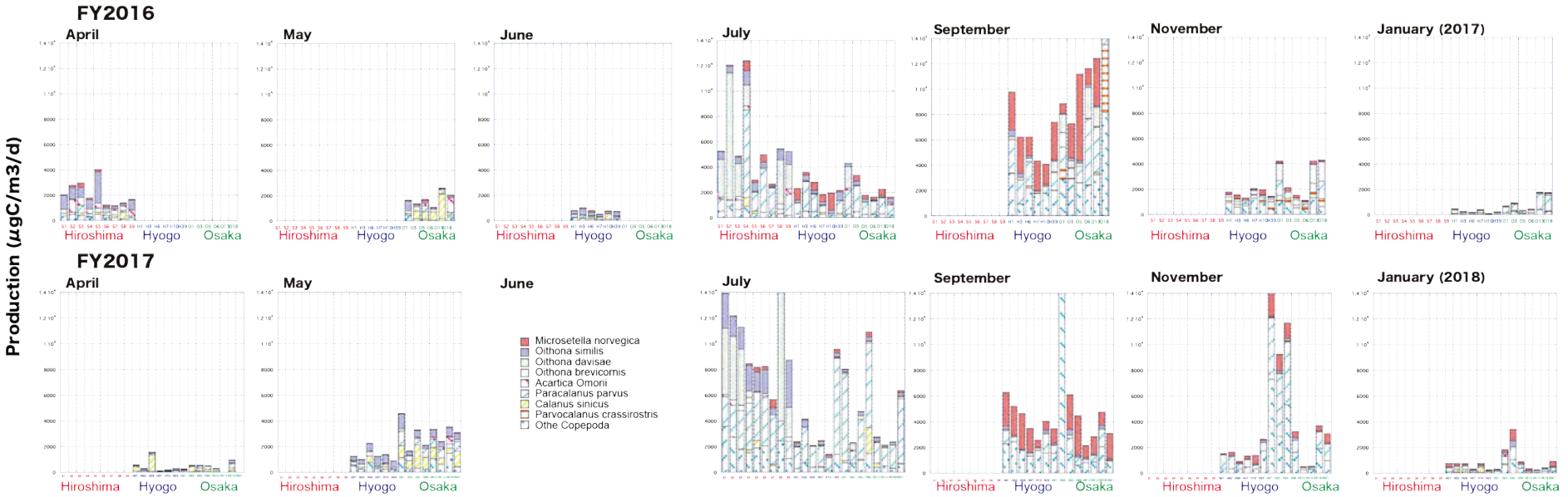

Classified 4 groups.

# Geographical variation of 4 groups for each months




- Samples collected in same month grouped same cluster in the all stations.
- January to June were grouped same cluster.
- July, September, and November were grouped same cluster for each month.
- It is considered that seasonal variation of community structure synchronized in the whole area.

# Production of copepods in the each month




## Dominant species

- Apirl-June :Oithona similis, Calanus sinicus
- July :P. parvus,Oithona davisae, Micorsetella norvegica
- September :M. norvegica, P. parvus
- November :M. norvegica、P. parvus, Oithona brevicornis
- January : Paracalanus parvus

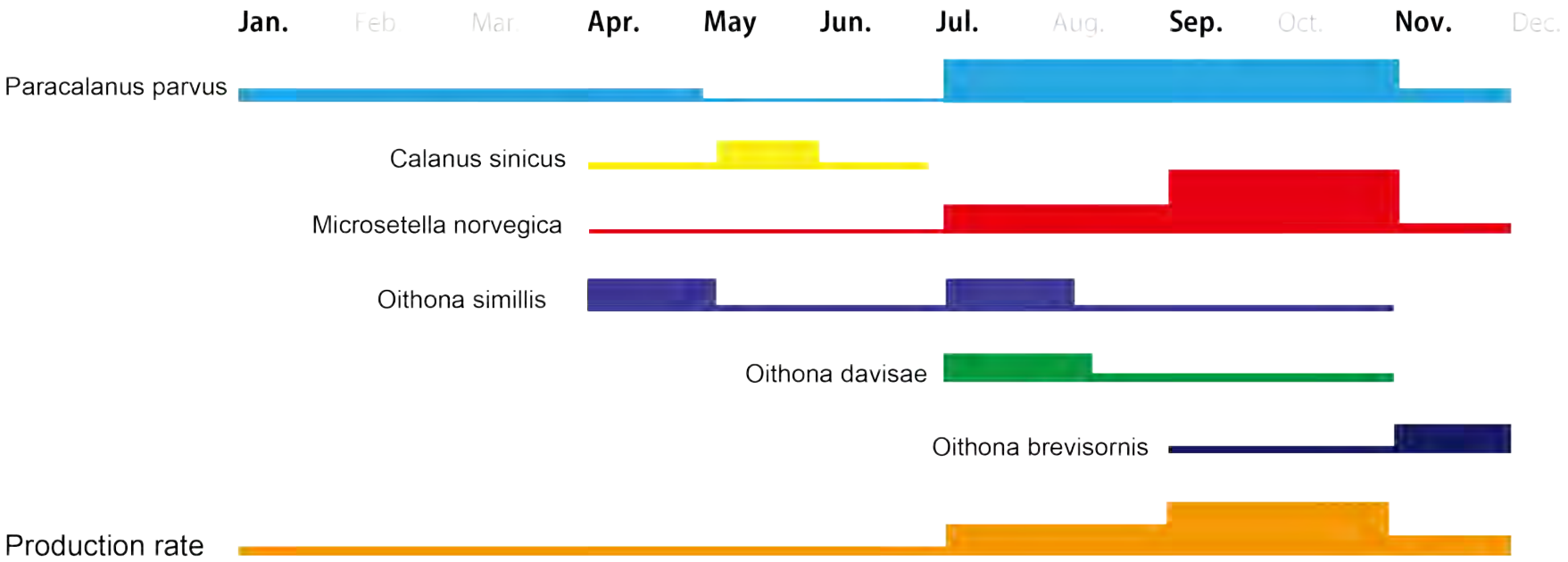
High production rates were represented from July to November in the both year.
Production rate of November increased in 2017.

# Summary of geographical and seasonal variation

Change of the community structure

Geographical variation < Seasonal variation

Schematic of seasonal variation of copepoda production



# Comparison to past studies :seasonal variation


## Dominant species

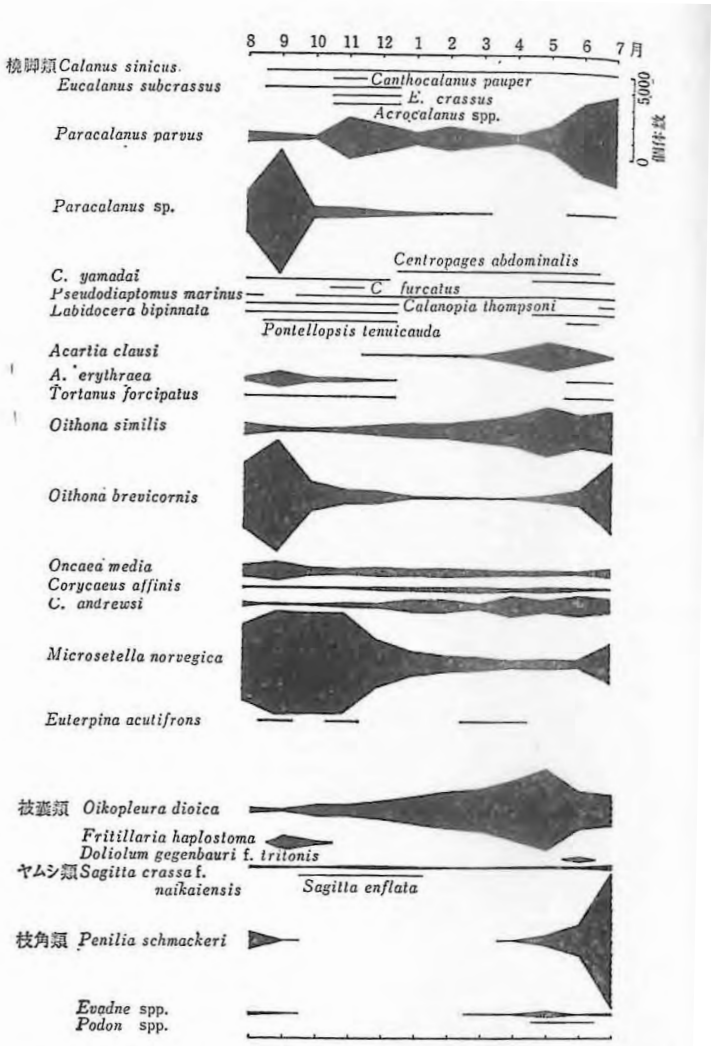
P. Parvus : Jun.-Jul.

O. Similis : May-Jul.

O. brevicornis : Oct.-Dec.

M. norvegica : Oct.-Dec.

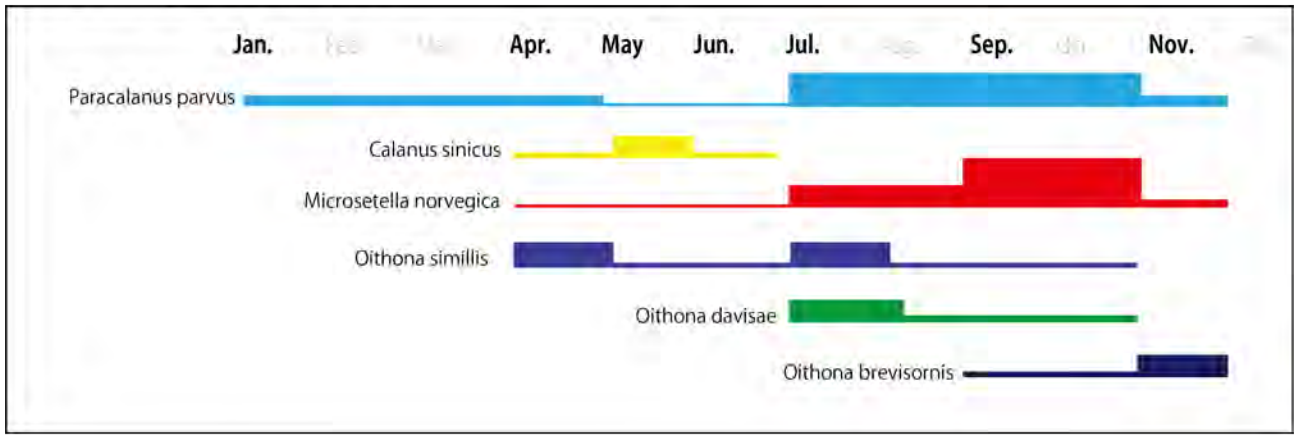
Results near to Hiroshima from 1959-60



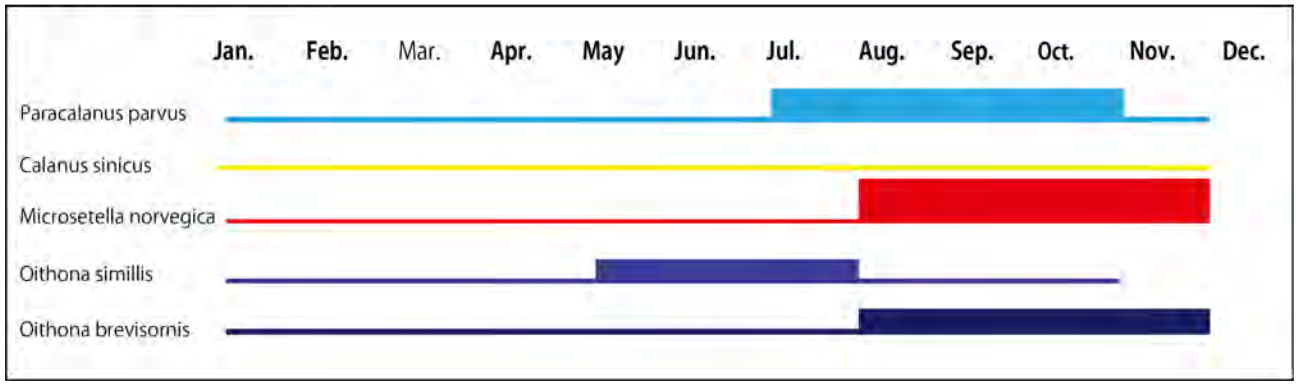

第4図 1959年8月から1960年7月にかけて，備後灘の34調査点で調査された，動物プランクトン主要種の出現状況（海水1 m³当りの個体数）(Hirota 1962を一部修正)

# Comparison: past (1959-60) vs present (2016-18)

Present 2016-2017




Past 1959-1960




Seasonal pattern roughly corresponded among the two periods.

# Comparison: productivity

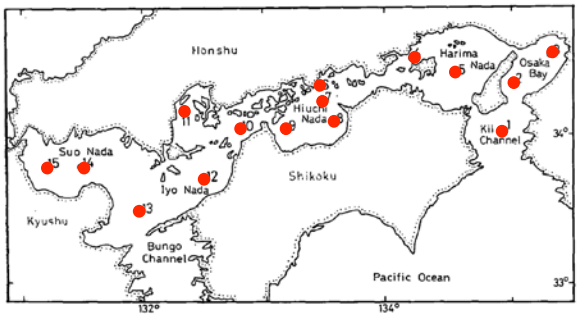



Fig. 1. Location of sampling stations in the Inland Sea of Japan.

Results in 1979-80

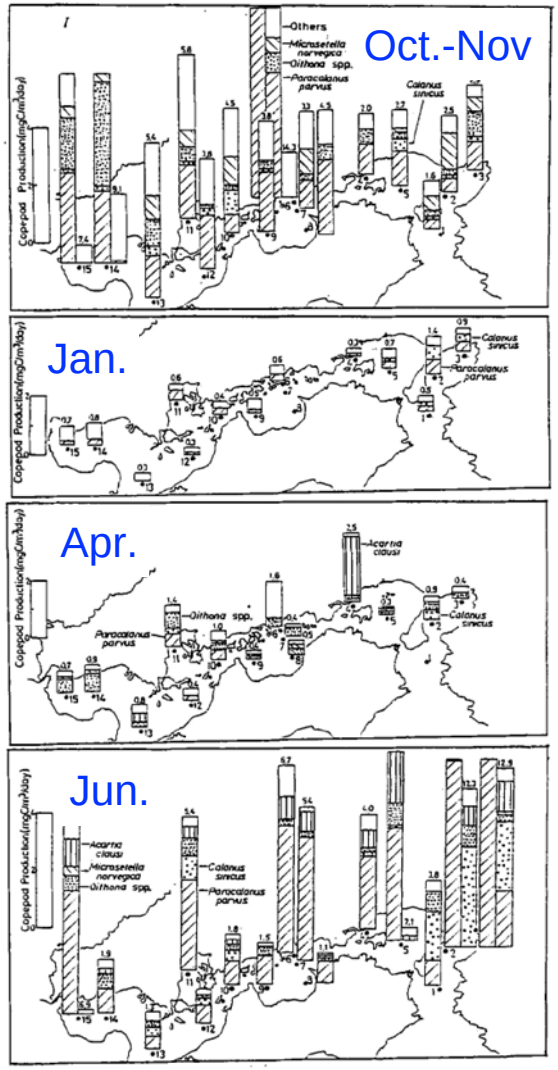


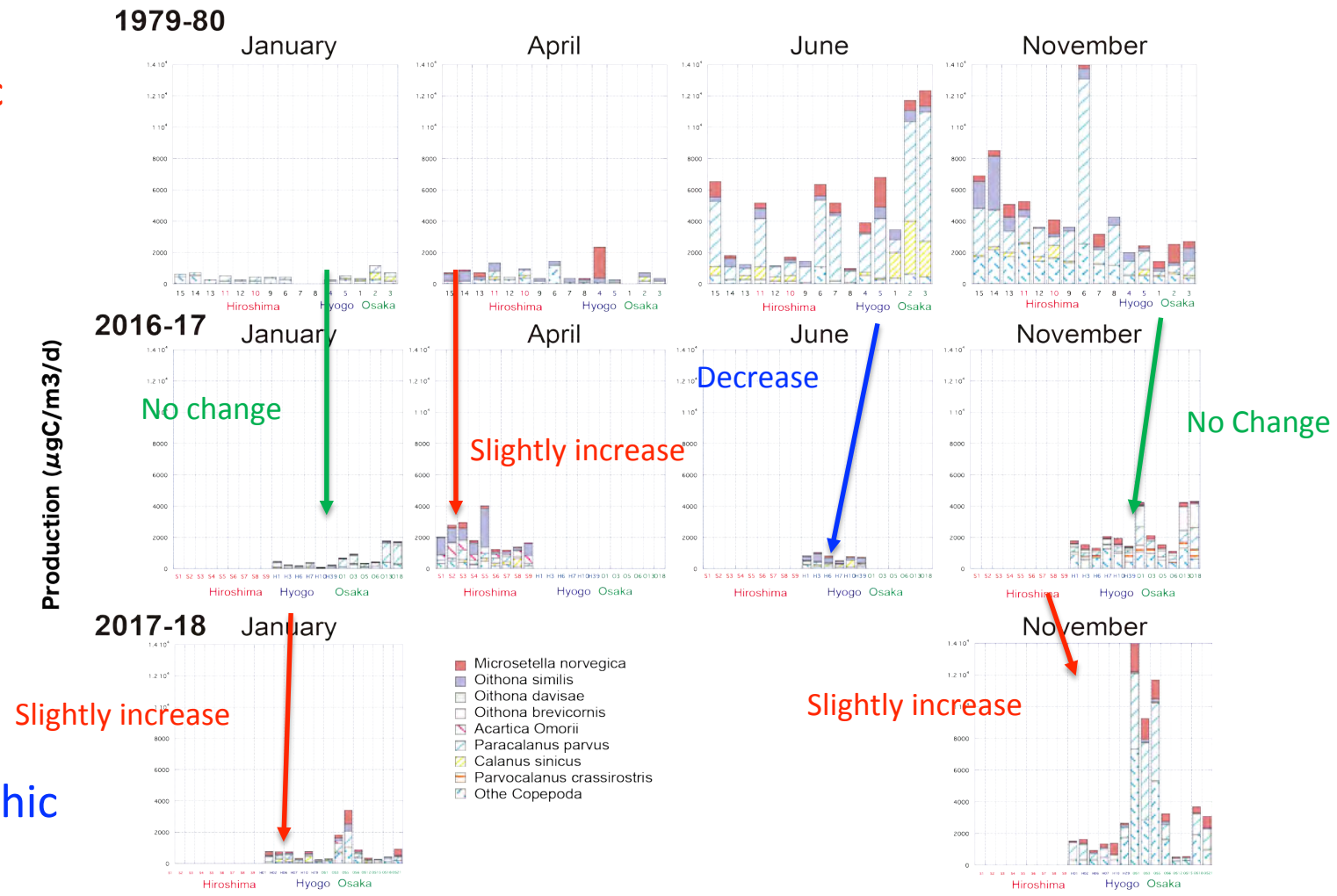

Fig. 8. Copepod production at respective stations in Cruises I to IV.

Production in January and April was low and it increased in June and October-November.

To compare the past production to the present, we digitized the results.

Uye et al., (1987)

# Comparison: past (1979-80) vs present (2016-18)

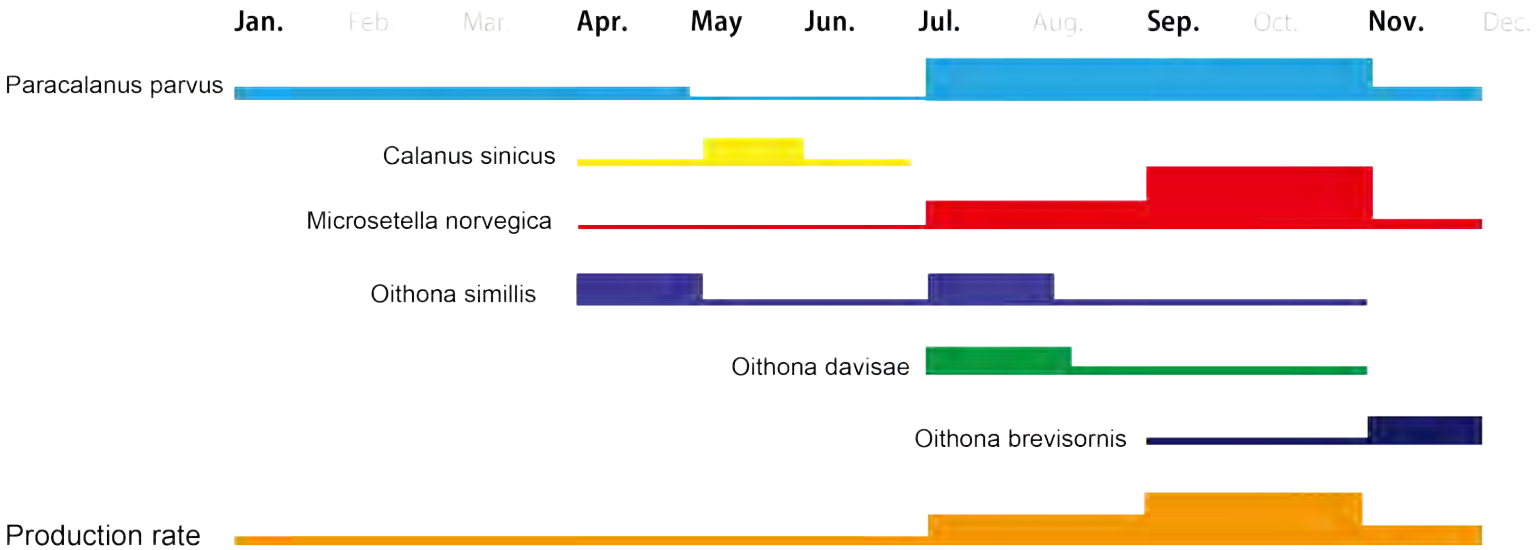



Production of present seems to be decrease from 1979-80. However comparing In same month and area, there is decrease and no change areas. We could not confirm the decrease of copepd production in the Seto Inland Sea.

# Summary

1) Seasonal variation was dominant comparing with geographical variation. However the high production appeared in Hiroshima-bays.

2) Pattern of the seasonal variation of community structure was similar between 1959-60 ,79-80, 2016-17 and 2017-18.




3) We could not confirm the decrease of copepod production in the Seto Inland Sea from present data.