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Feeding habitat selection by *Sebastiscus marmoratus* in Shengsi Ma'an Archipelago Special Marine Protected Area, China

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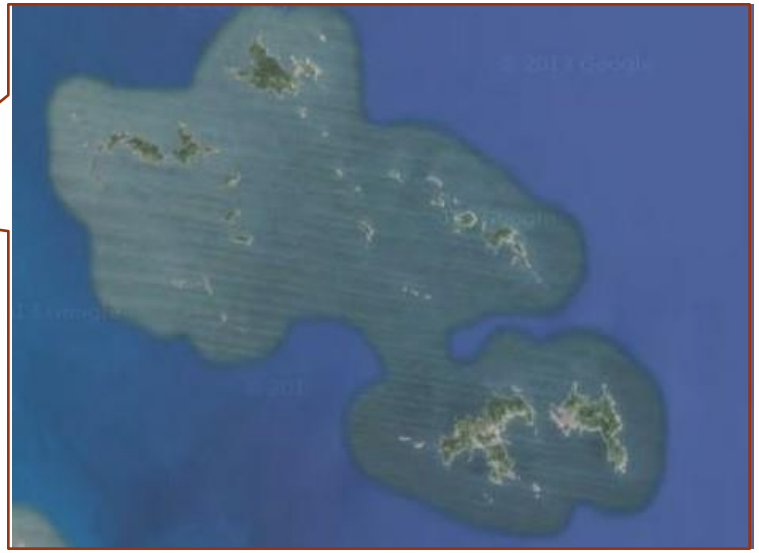
1. Introduction

- Fish may use different habitats for different purposes.

- Feeding habitat is one of the most important key habitat for fish. Many studies have been done in the reef-seagrass/reef-mangrove-seagrass system(Nagelkerken IA,2004).

- The research on the fish feeding habitat selection is conductive to clarify the ecological function of habitat and the habitat preference of fish.

Shengsi Ma'an Archipelago Special Marine Protected Area



The area is influenced by the Yangtze and Qiantang Rivers and highly productive with abundant plankton. There are four typical habitats: rocky reef, seaweed beds, mussel farm, and marine ranching.

Seaweed beds, dominant specie is
Sargassum horneri

Mussel farm
Mytilus Coruscus and *M. edulis*

Marine ranching,
Artificial reefs were deployed along the islands. Cage culture are performed in the upper water.

Marbled rockfish, *Sebastiscus marmoratus* is the dominant species in the community.

Collected from seaweed beds (a), mussel farm (b) and rocky reef ©.

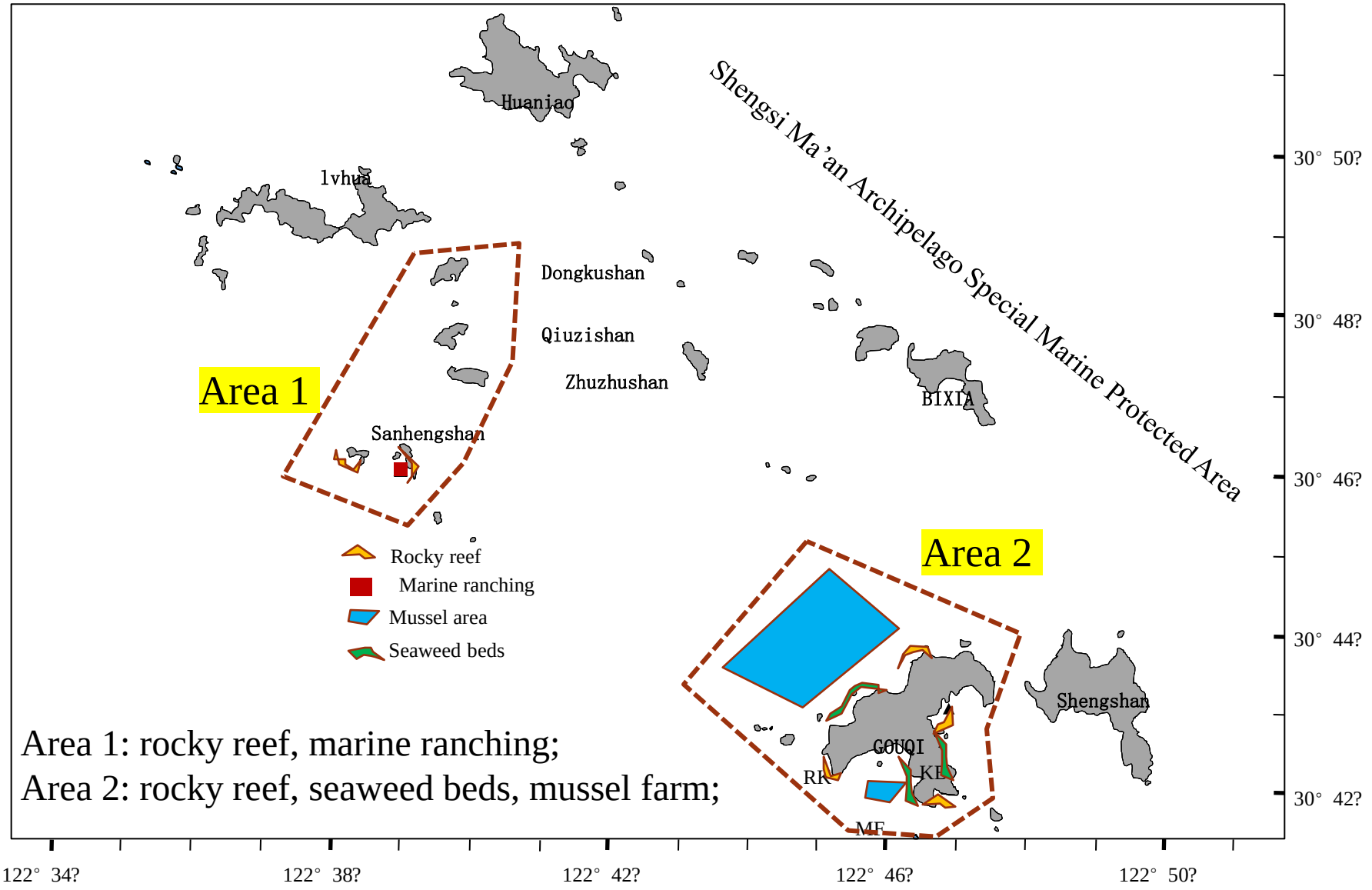
- Typical rocky fish, inhabiting in the rocky reef habitat.
- Feed on amphipoda, fish, carbs, shrimps, also preyed by many fish, so this fish specie plays an important role in the food web and local fishing, especially in the recreational fishing.

The aim of this study:

To provide qualitative and quantitative information on the ontogenetic variations in their feeding habitat selection.

2 Materials and methods

2.1 Study areas and sampling



- 2.1 Study areas and sampling

- Fish samples were caught by multi-mesh trammel nets (25, 34, 43, 50, 58, 60 and 80 mm) and crab trap.
- The fish collected were immediately placed on ice and transported to the laboratory for identification and measurement.

➢ **Sampling time**: from Jan,2009 to Jun,2015; Apr 2016 to Feb 2017.

- 2.2 Dietary analysis:

- **Stomach contents analysis:** the percentage frequency of occurrence **(*%F*)** , numerical percentage ***(%N***)percentage of total weight **(*%M*)** of the prey categories were calculated. Index of relative importance (*IRI*) was used to assess the importance of prey items:

$$IRI=(W\%+N\%)\times F\% \qquad \%\ IRI=(IRI_{prey\ item}/IRI_{total})\times 100$$

- **Stable isotope analysis**: Carbon isotope ($\delta^{13}C$) values of predators directly reflect those of their prey, changing only 0.5 to 1.5‰ per trophic level. They are useful for providing information on organic source materials (Fry & Sherr, 1984).
- Nitrogen isotope values ($\delta^{13}N$) increase approximately 3 ‰ per trophic level between the animal and its diet, and are used to infer trophic relationships (Peterson & Fry, 1987).

$$\delta^{13}C = \left(\frac{\left({}^{13}C/{}^{12}C\right)_{sample}}{\left({}^{13}C/{}^{12}C\right)_{PDB}} - 1\right) \times 1000 \qquad \delta^{15}N = \left(\frac{\left({}^{15}N/{}^{14}N\right)_{sample}}{\left({}^{15}N/{}^{14}N\right)_{atmosphere}} - 1\right) \times 1000$$

Stable isotope can provide the feeding information of a fish species during a long time (days, week, month).

The **combination** of stomach contents analysis and stable isotope analysis can provide increased insight into dietary composition and feeding habitat selection for the marbled rockfish.

Trophic level:

$TL = 2 + (\delta^{15}N_{consumer} - \delta^{15}N_{baseline}) / TEF$,

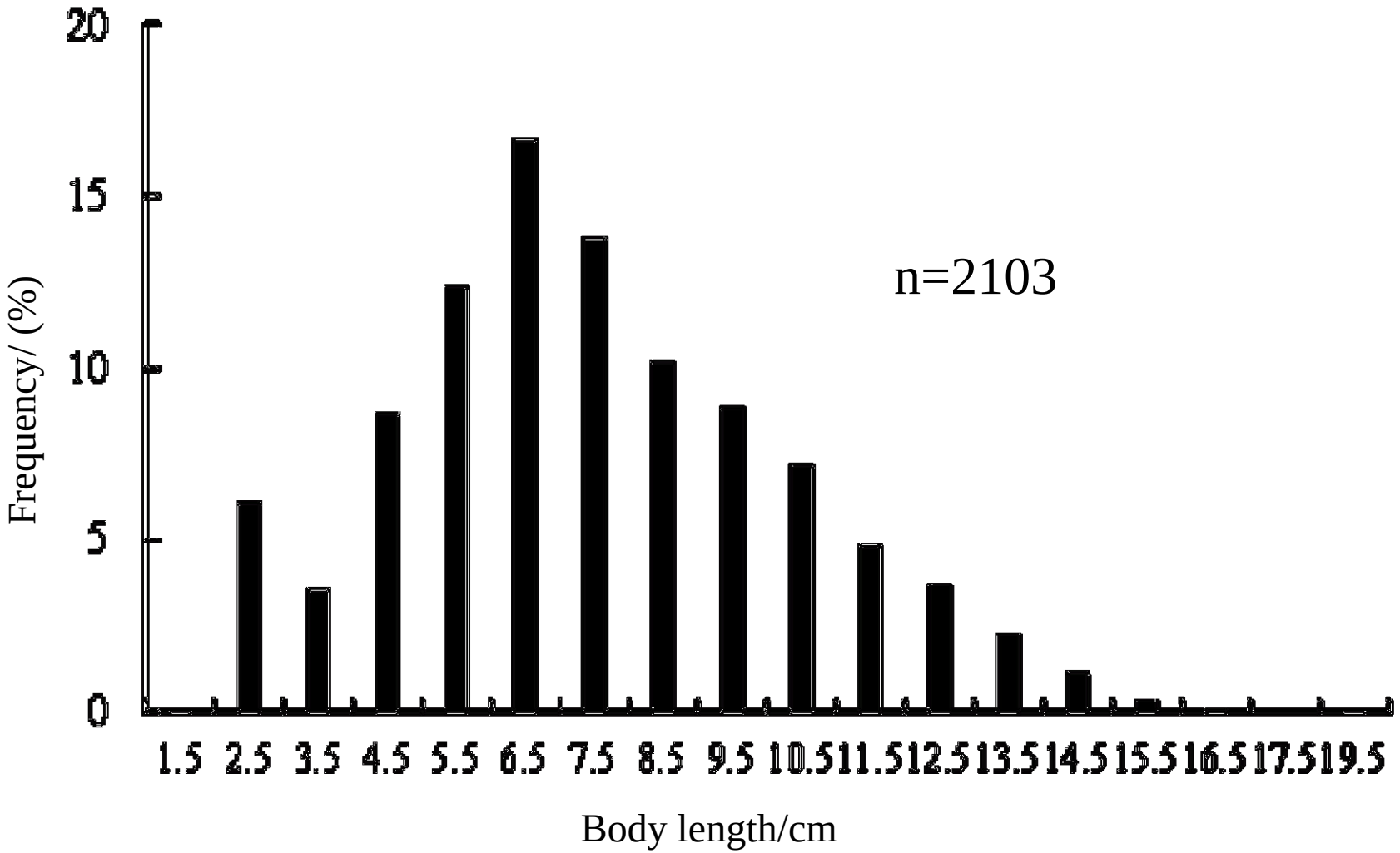
$\delta^{15}N_{baseline} = 3.98‰$ (*Mytilidae*)， $TEF = 3.35‰$（Chen, 2016）

Size-related diet variations:

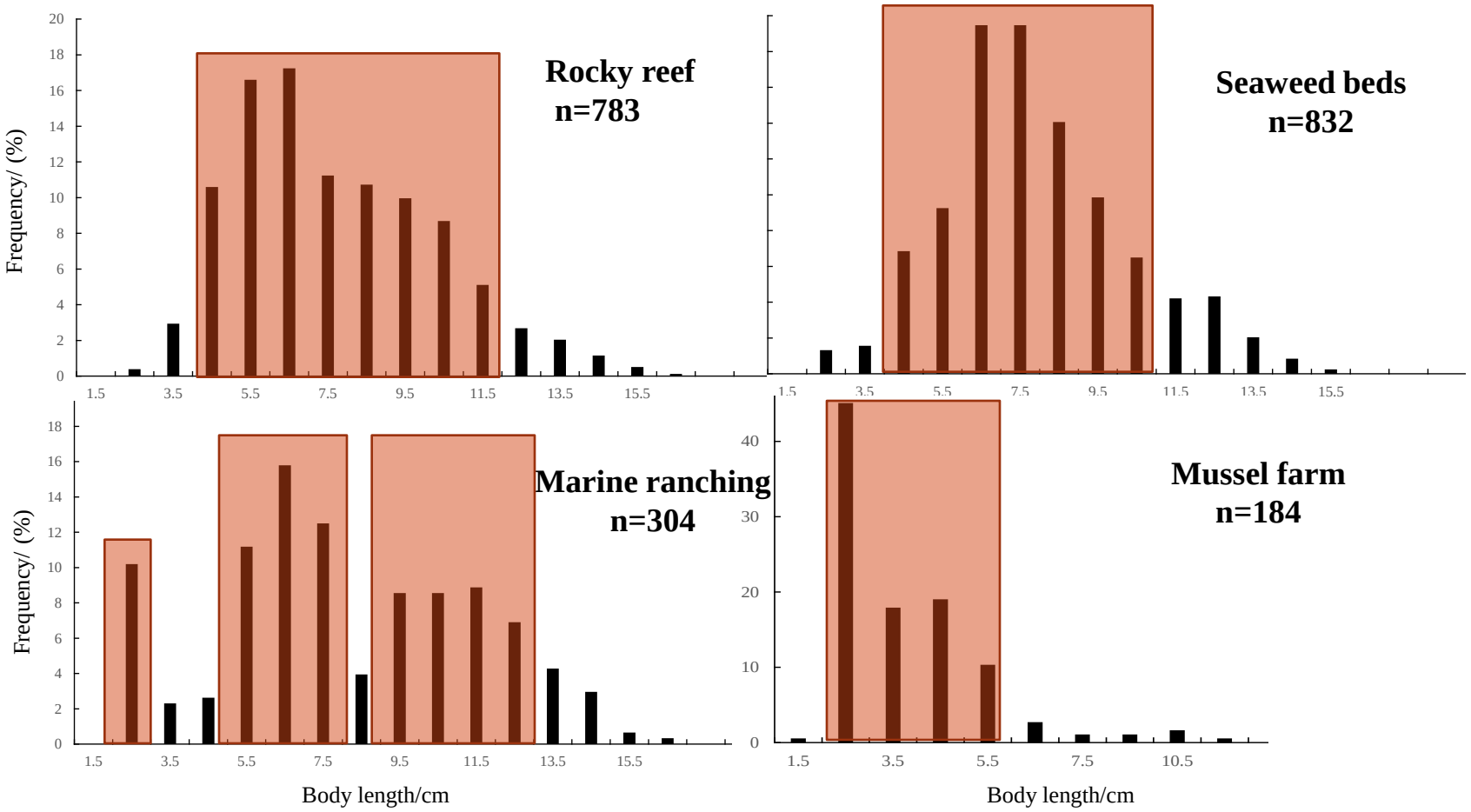
Size classes were divided by 1cm interval

3. Results and discussion

3.1 Population structure

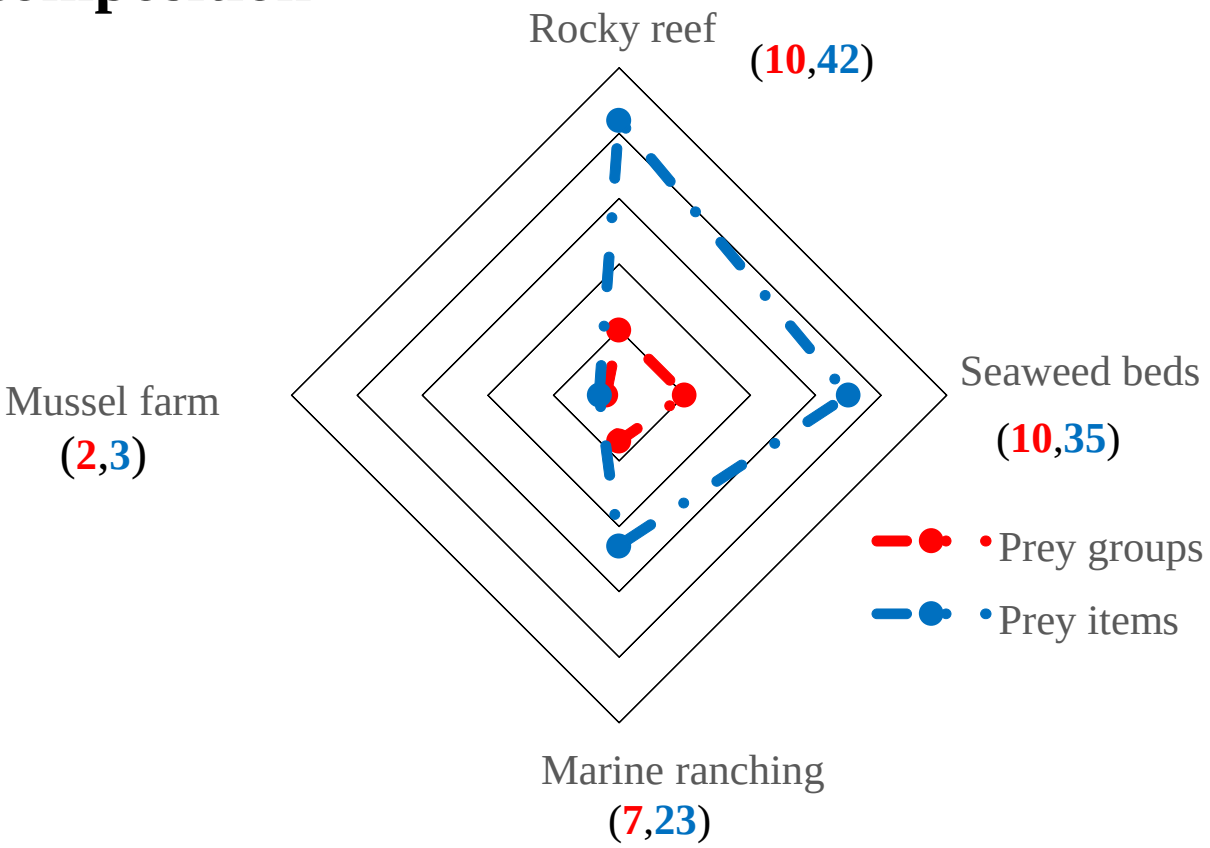


Body length ranged from 1.9cm-19.1cm;
Average body length:7.5cm; Dominant body length: 4.0m-10.9cm, occupied 78%



Rocky reef: dominant size classes were 4.0cm-11.9cm;
Seaweed beds: 4.0cm-10.9cm;
Marine ranching: 5.0cm-12.9cm
Mussel farm: 2.0cm-5.9cm

3.2 Dietary composition



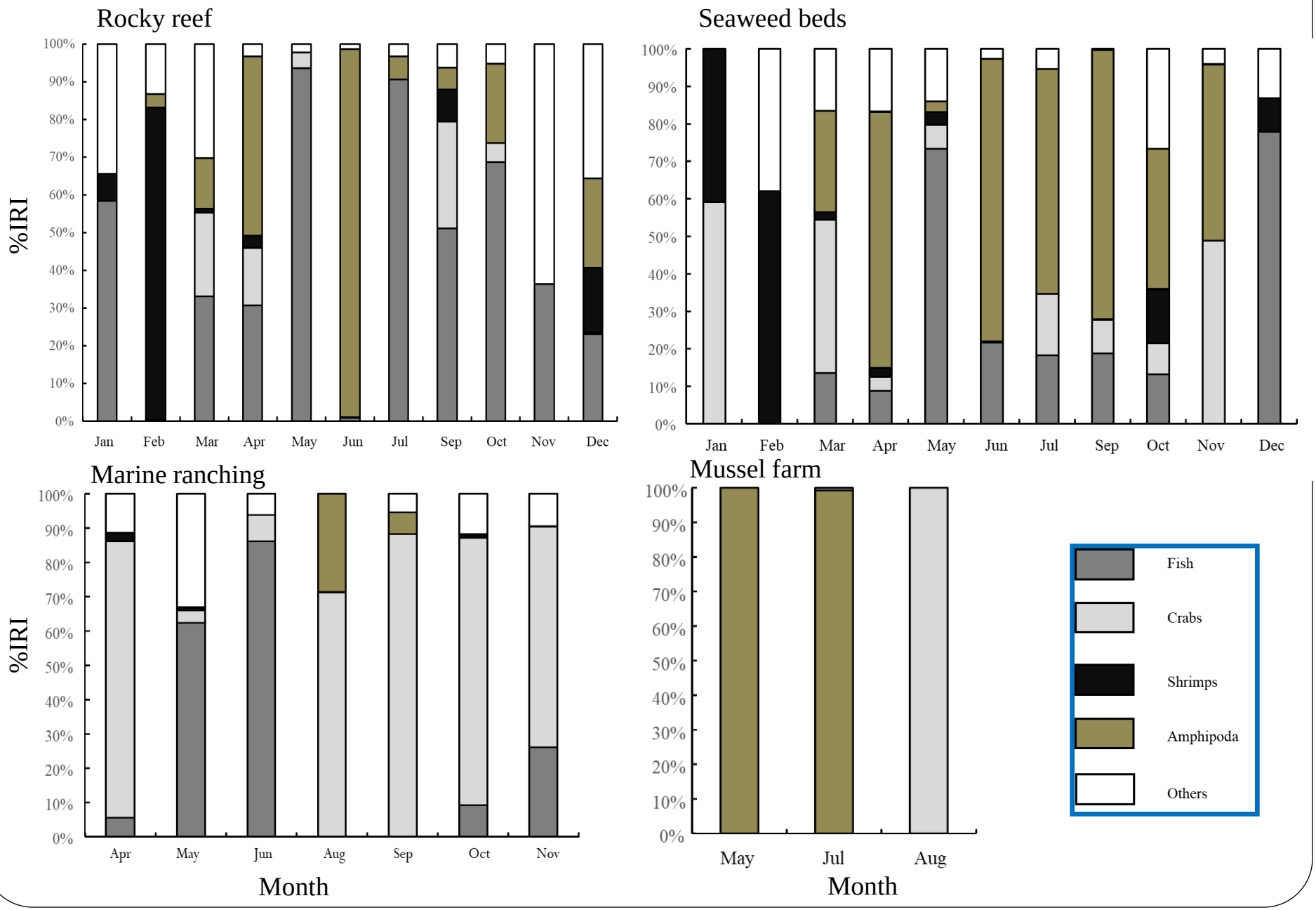
Showed a generalist feeding habits, total 52 prey species belonging to 10 categories.
Rocky reef: amphipoda and fish;
Seaweed beds: amphipoda;
Marine ranching: carabs and fish;
Mussel culture area: amphipoda;

Anchovy
Engraulis japonica

Two important prey species

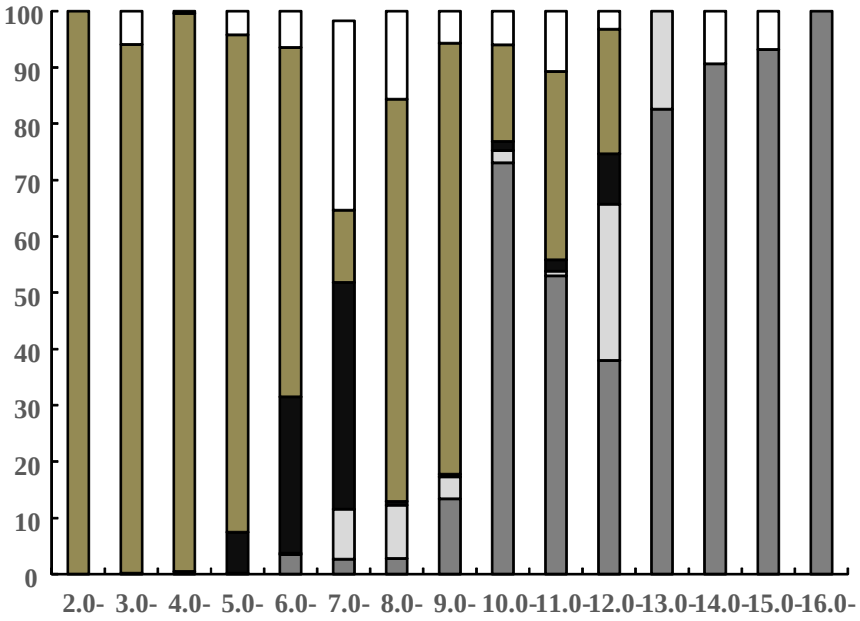
Amphipoda Caprella sp
Dominant prey species, inhabiting adhere on the aquaculture facilities, seaweed, *et al*

3.3 Monthly changes of diet composition

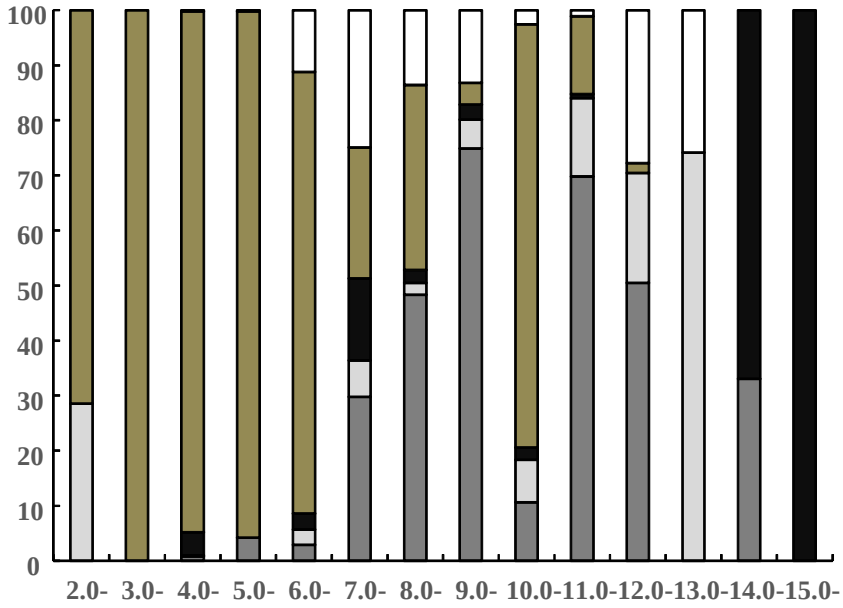


3.4 Ontogenetic changes

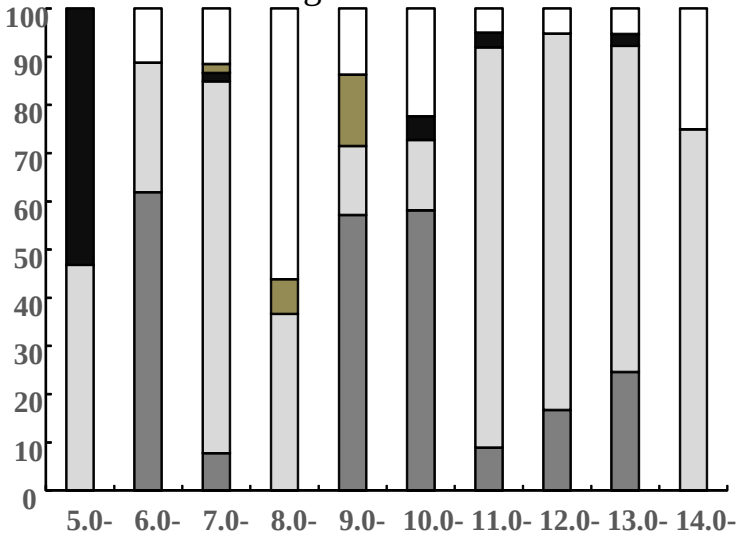
Rocky reef



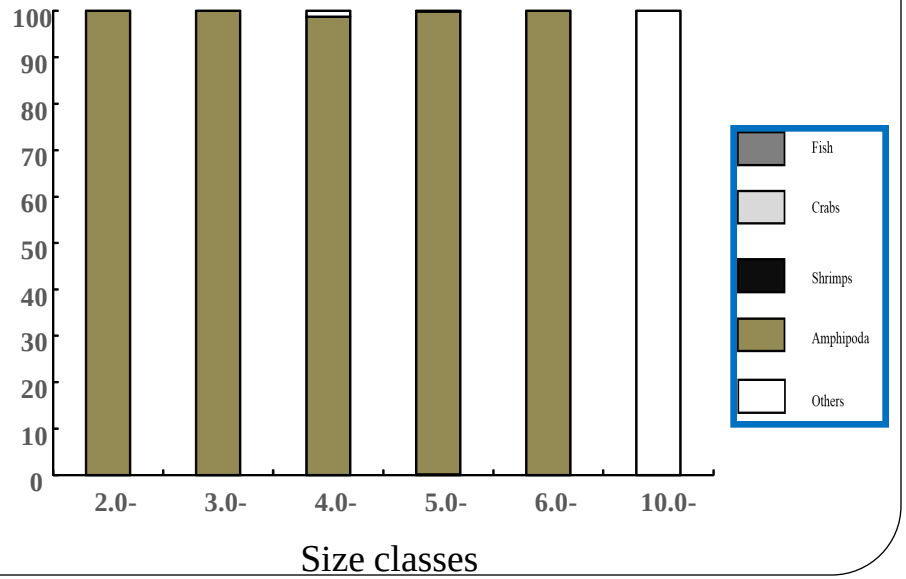
Seaweed beds



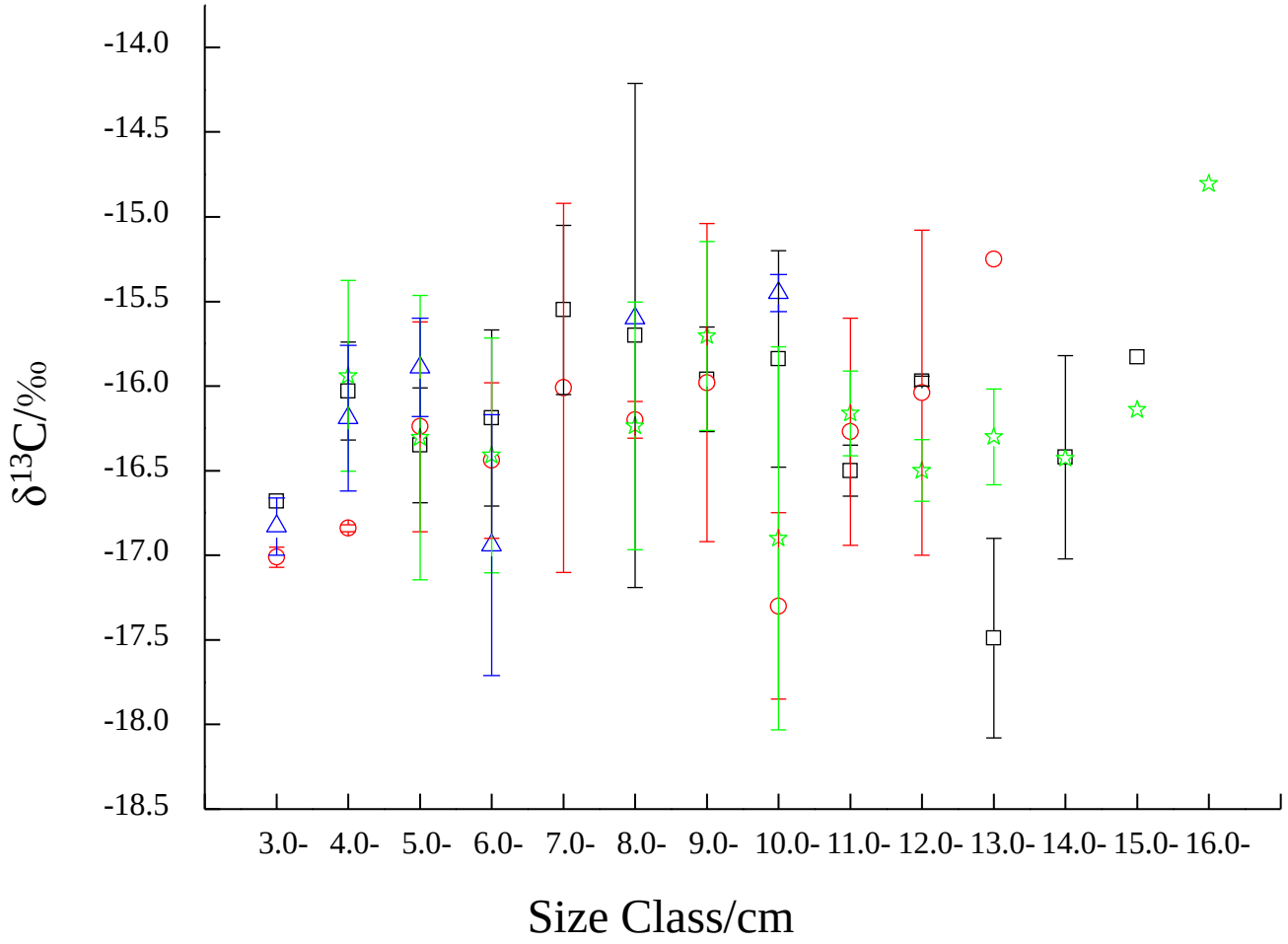
Marine ranching



Mussel farm



3.5 Isotope stable analyses

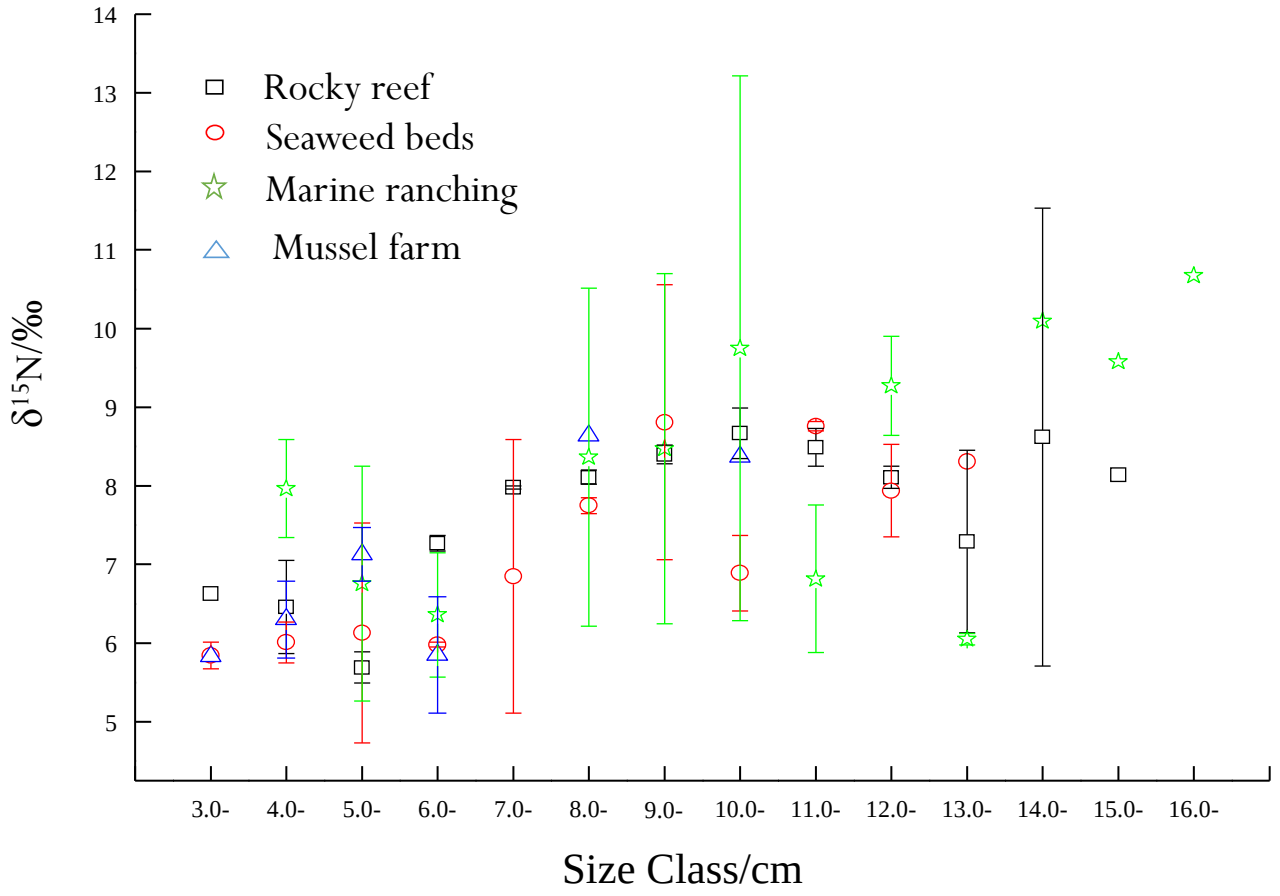


Rocky reef -17.91‰～-14.65‰

Seaweed beds -17.70‰～-15.24‰

Marine ranching -17.70‰～-14.81‰

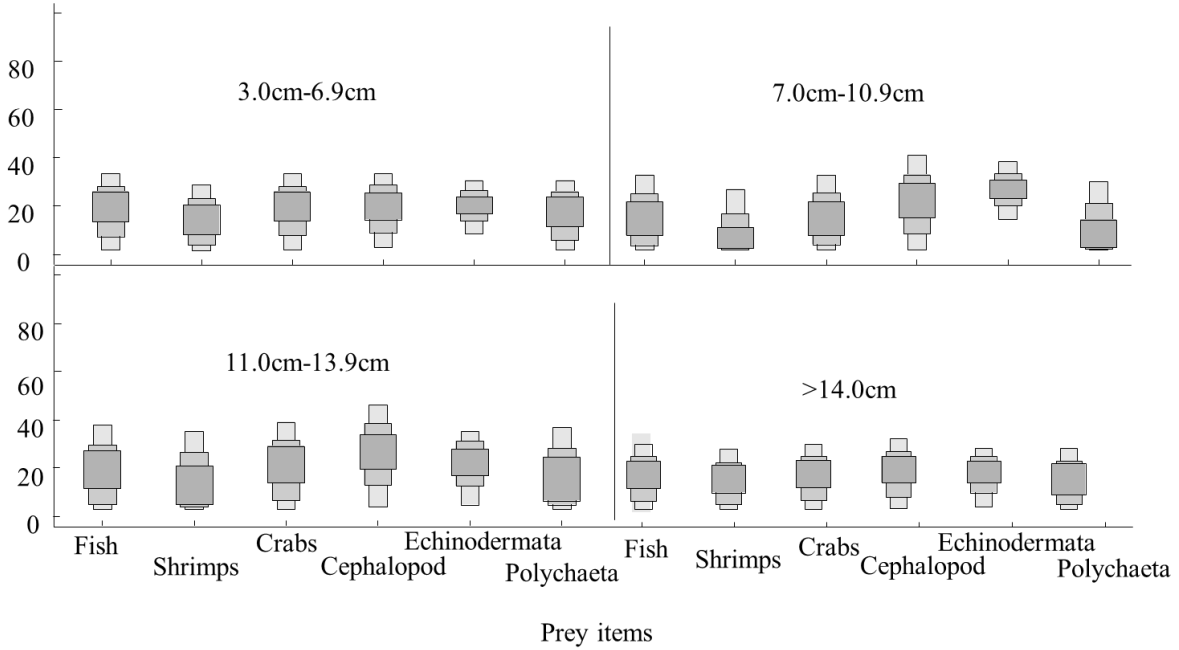
Mussel culture area -17.48‰～-15.37‰



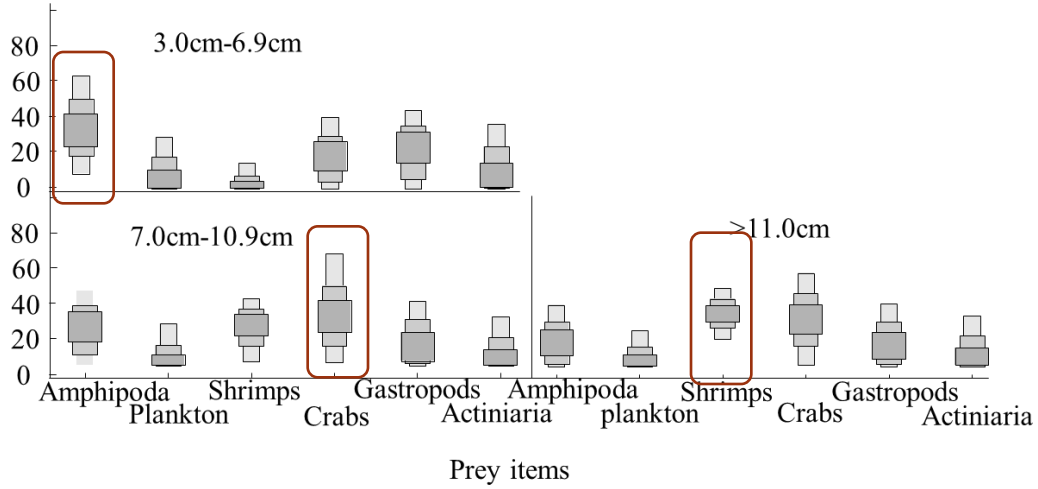
	δ15N range	Trophic level
□	Rocky reef:5.55‰～8.90‰	2.47～3.47
○	Seaweed beds:5.14‰～10.05‰	2.35～3.81
☆	Marine ranching:5.78‰～12.23‰	2.52～4.46
△	Mussel culture area:5.33‰～8.64‰	2.40～3.39

3.6 Food resource contribution

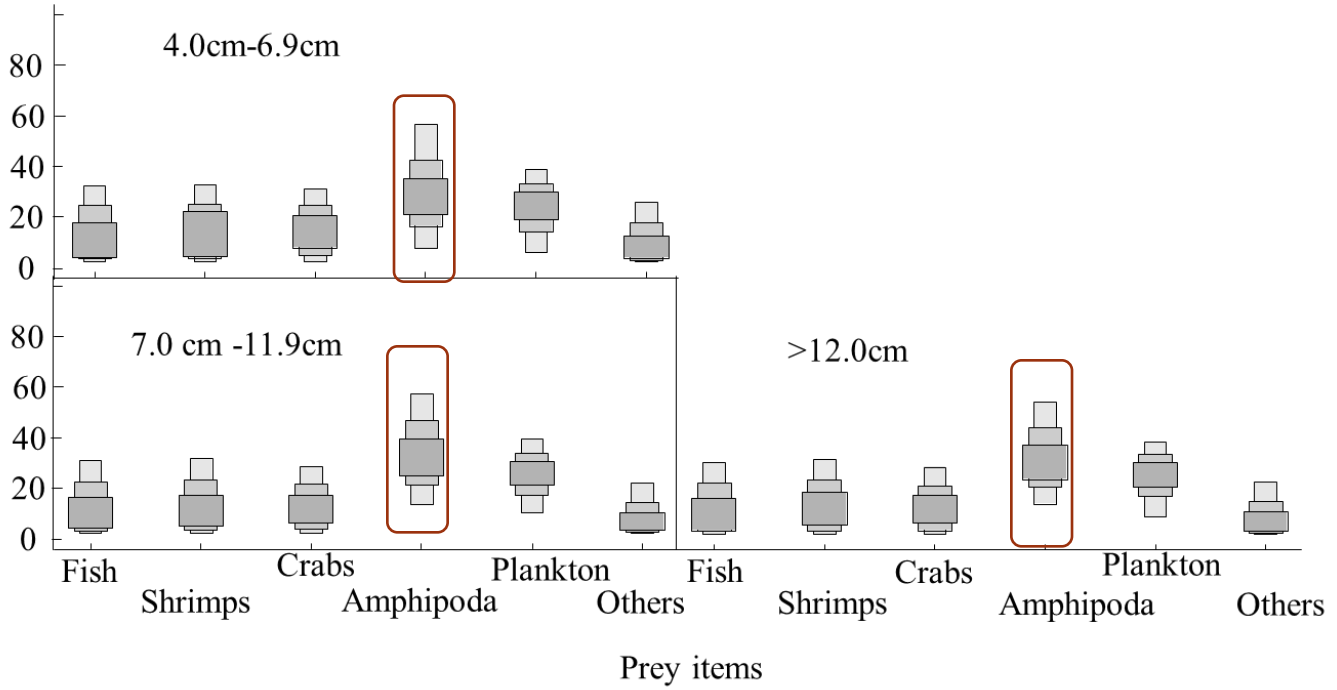
Rocky reef



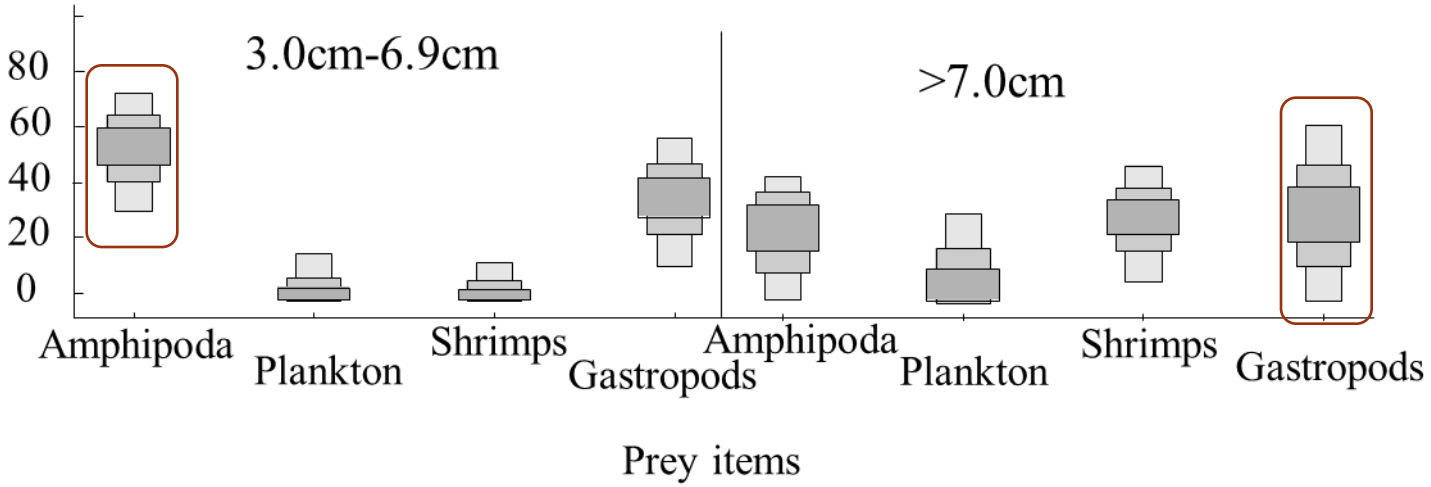
Seaweed beds



Marine ranching



Mussel farm



3.7 Feeding groups and habitat selection

Comprehensive analysis on the population structure, feeding habits and prey resource's contribution, feeding groups can be divided as:

Rocky reef
4 groups

- 3.0cm-6.9cm (amphipoda)
- 7.0cm-10.9cm (amphipoda, fish)
- 11.0cm-13.9cm (fish)
- >14.0cm (fish)

Seaweed beds
3 groups

- 3.0cm-6.9cm (amphipoda)
- 7.0cm-10.9cm (amphipoda)
- >11.0cm (fish)

Marine ranching
3 groups

- 4.0cm-6.9cm (shrimps)
- 7.0 cm -11.9cm (fish)
- >12.0cm (fish)

Mussel farm
2 groups

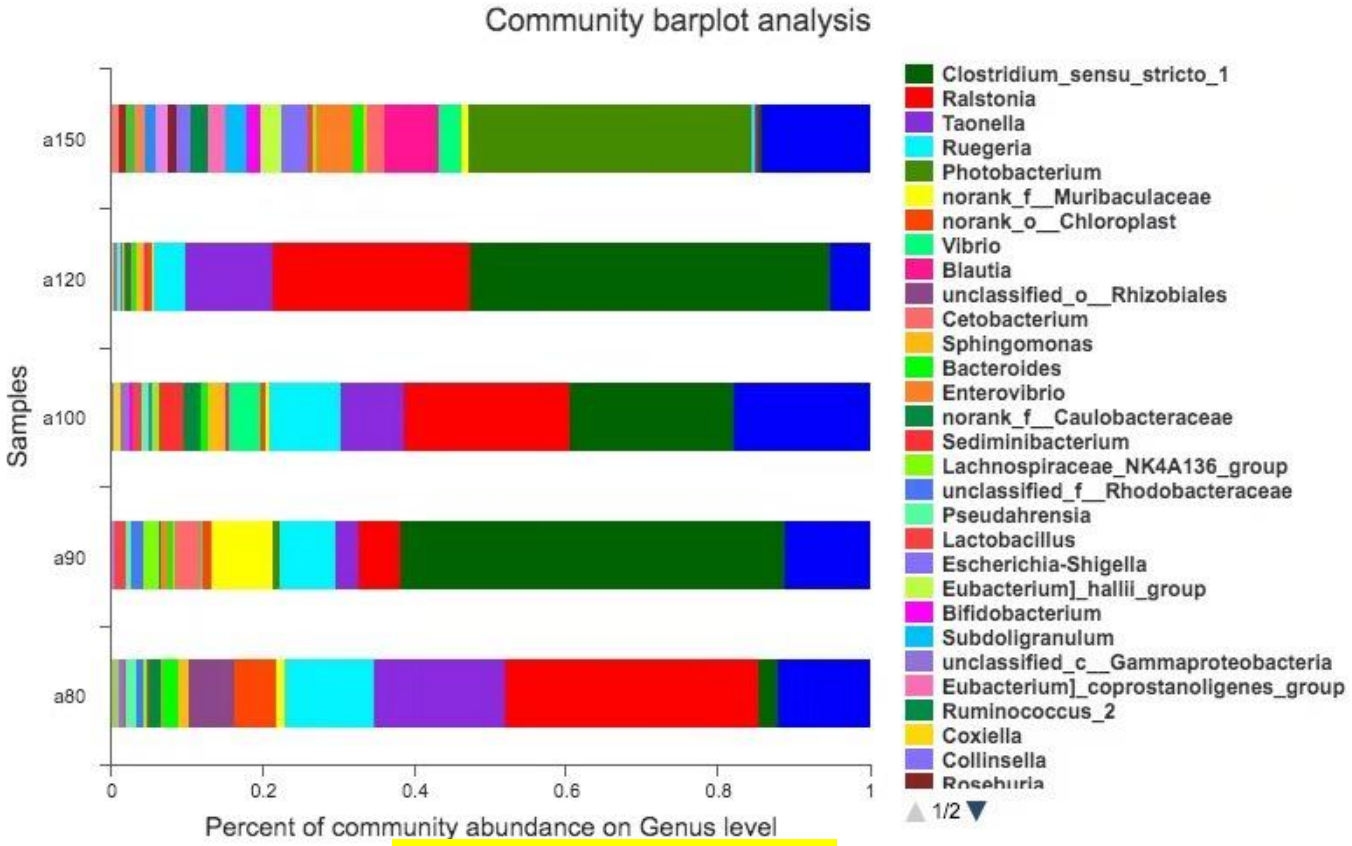
- 3.0cm-6.9cm (amphipoda)
- >7.0cm (others)

Feeding habitat selection:

In area 1: the groups <7cm body length selected rocky reef as feeding habitat, groups >10.0cm select marine ranching, especially during Summer.

In area 2: the groups <7cm body length selected mussel farm as feeding habitat, then selected rocky reefs and seaweed beds. Mussel farm provides an important feeding habitat for juveniles.

3.7 Future's work



Rocky reef, July, 2019

Intestinal microflora varied with body length, may be caused by habitat, but how?.

The next work, we will add habitat type and body length influence on the rocky fish's intestinal microflora and feeding habits.

Thanks for your attention!