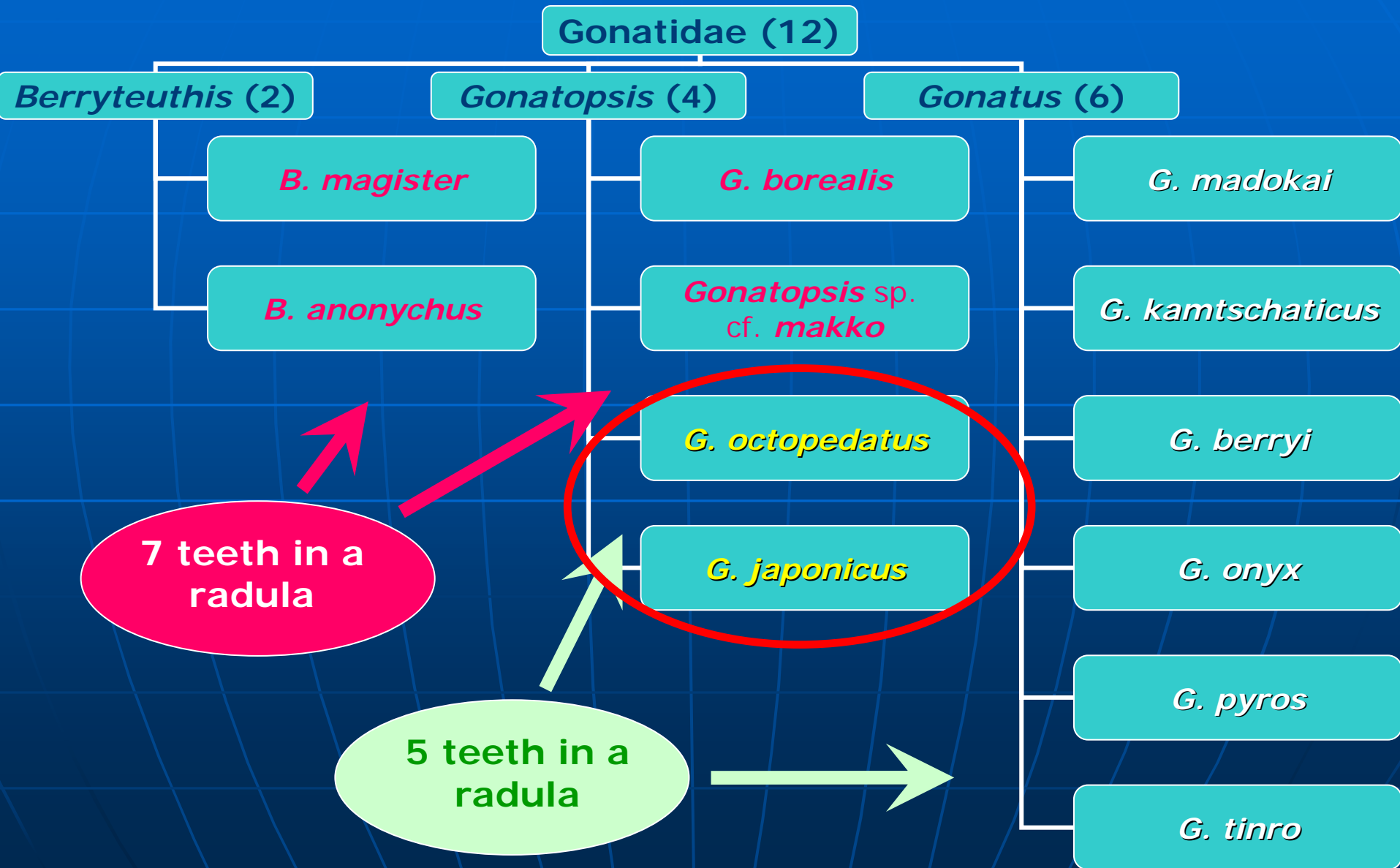


**Distribution and life cycle patterns of
the squids *Gonatopsis octopedatus*
and *Gonatopsis japonicus*
(Cephalopoda: Gonatidae)
in the northwestern Pacific Ocean.**

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Squids of the family Gonatidae inhabiting the northwestern Pacific Ocean and its marginal seas



External characters of the squids

Gonatopsis japonicus v *Gonatopsis octopedatus*



- ***Gonatopsis japonicus***

Mantle length 40-60 cm

Fin sagittate, with long posterior "tail"

Tetraserial armature along the entire length of the arms



- ***Gonatopsis octopedatus***

Mantle length 12-16 cm

Fin round, without long posterior "tail"

Arm tips with numerous tiny suckers

Major Goal

To reveal specific traits in distribution, biology and life cycle patterns of two gonatid squids *Gonatopsis octopedatus* and *G.japonicus* in the Okhotsk Sea and adjacent Pacific Ocean in order to evaluate the position of these species in pelagic ecosystems

Obectives:

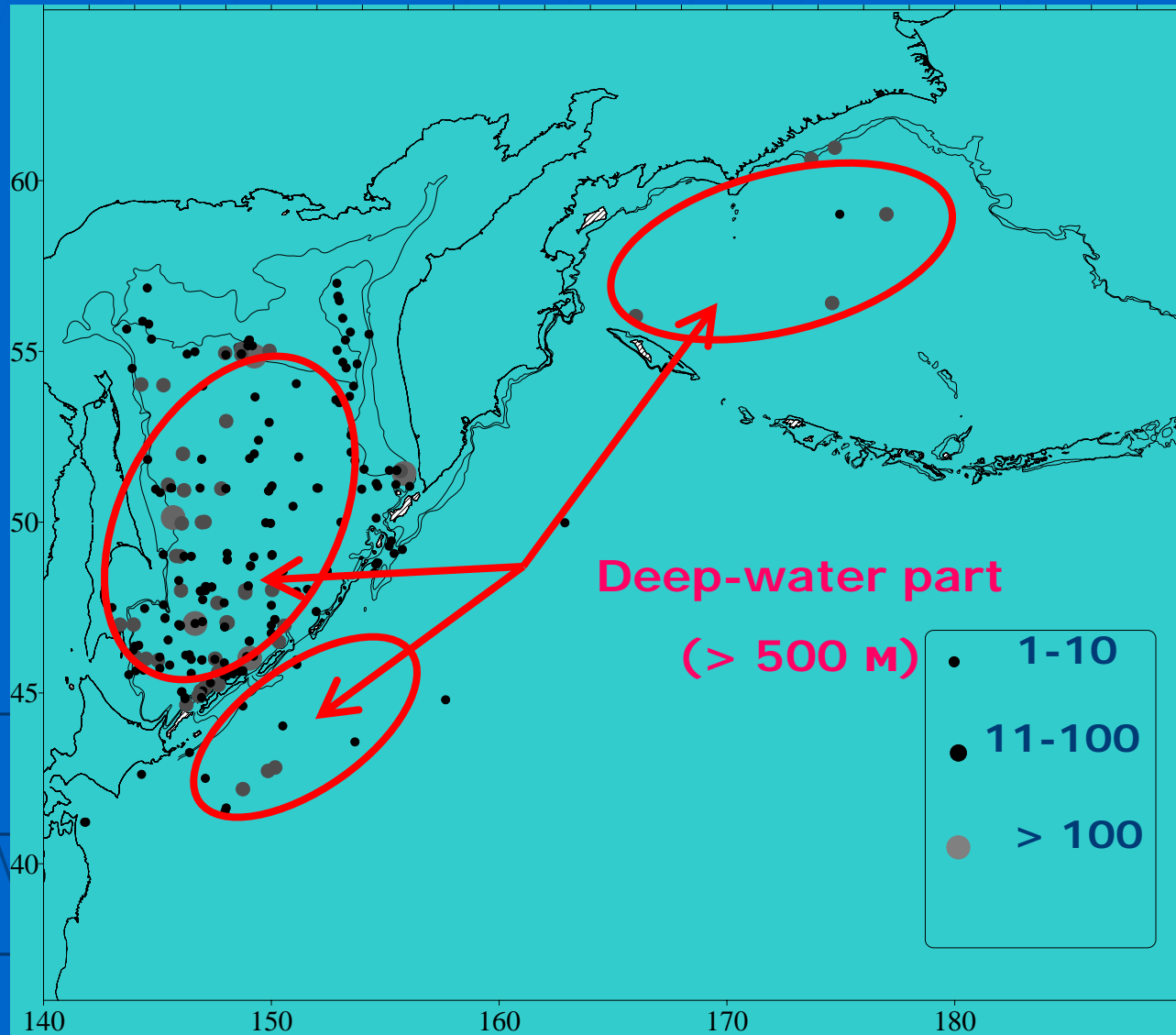
- 1) to analyze database collected in TINRO-Centre research cruises;
- 2) to look at the spatial distribution of squids (by months, depths and ontogenetic stages);
- 3) to reveal the size structure of squid catches (by months);
- 4) to look at biological characters of squids (maturity, feeding);
- 5) to suggest hypothetical schemes of squid life cycles

Material

Species	Cruises	Stations	Catch (N)	Analysis (N)
<i>G. octopedatus</i>	25	264	4749	1086
<i>G. japonicus</i>	29	264	1790	697
Total	37	549	6539	1783

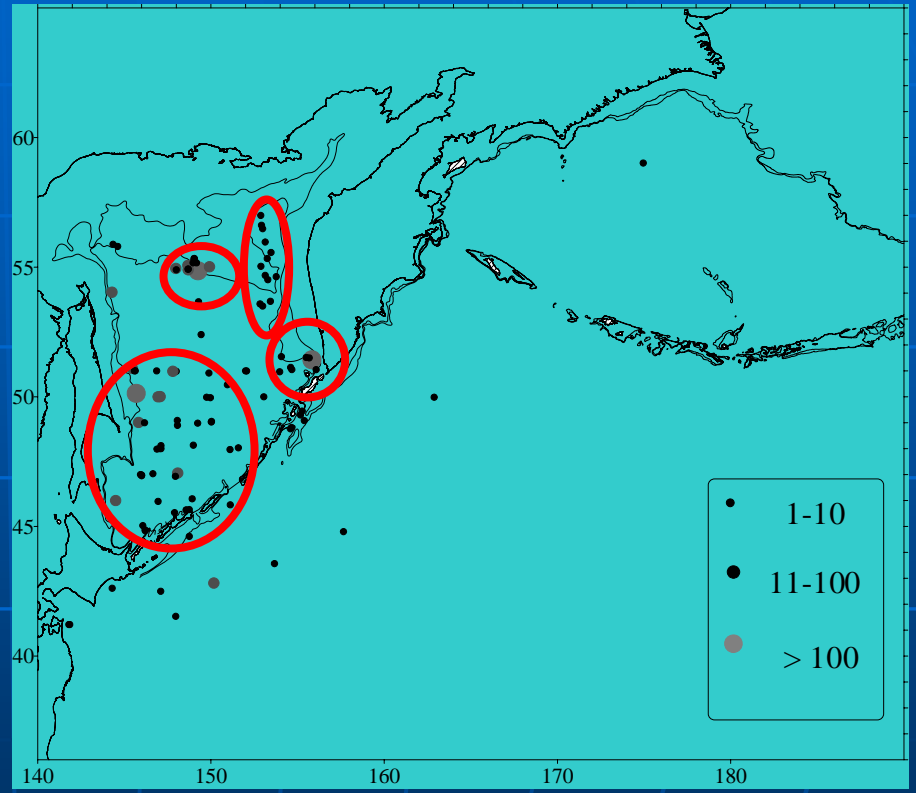
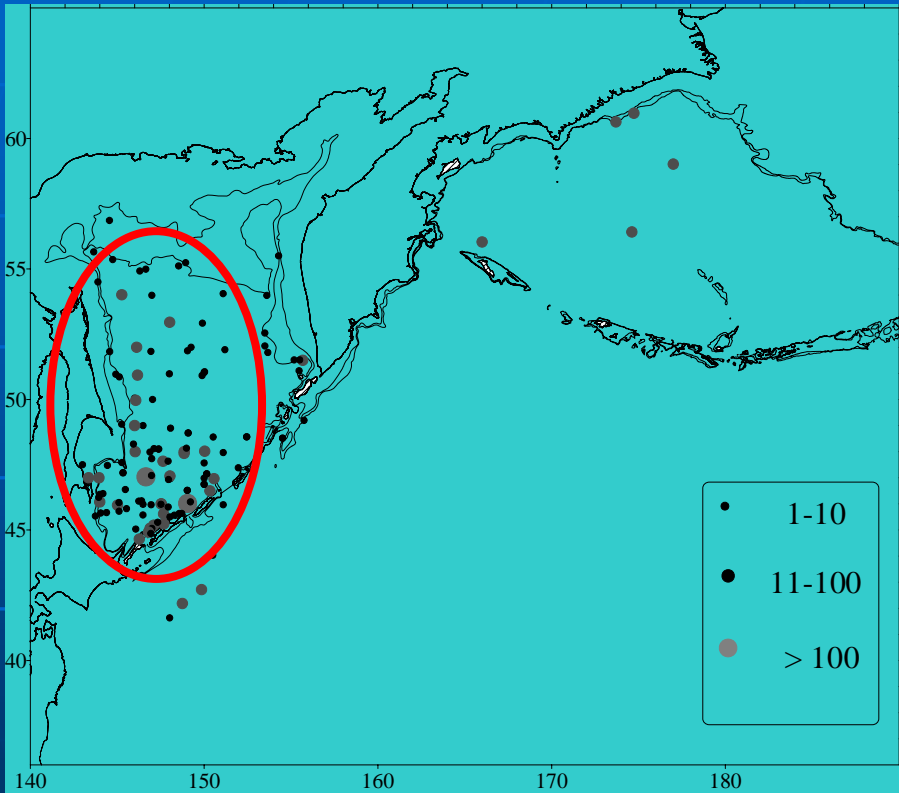
Gonatopsis octopedatus

Distribution in all seasons and depths
(individuals per square km)



Gonatopsis octopedatus

Distribution of juveniles and adults



Juveniles ($DML < 70$ mm)

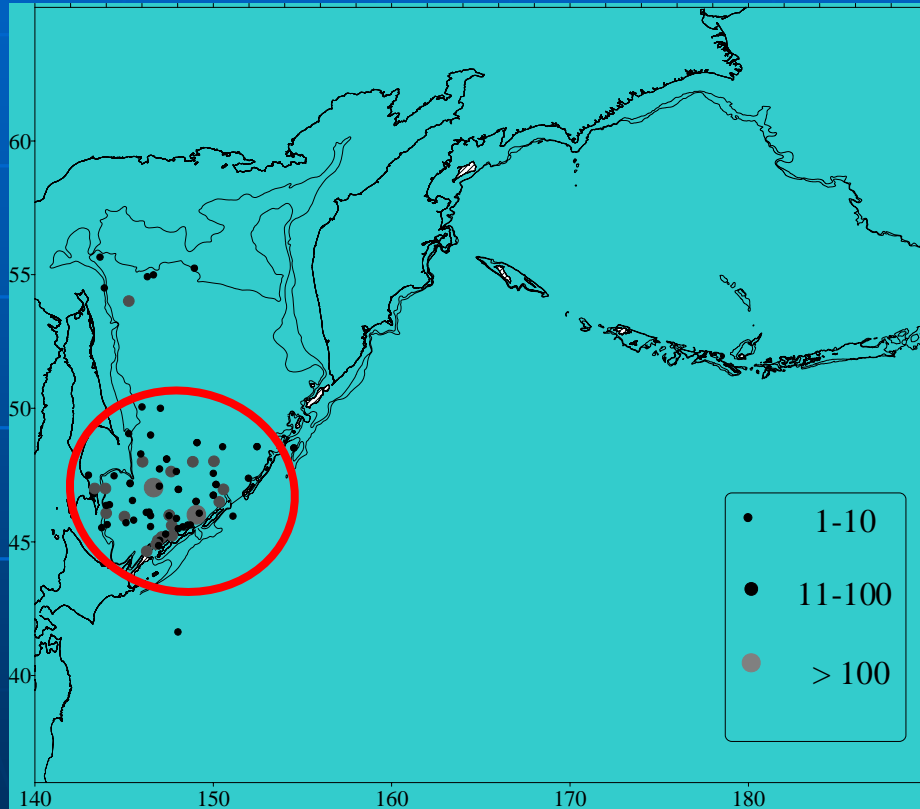
More or less evenly
over deep-water areas

Adults ($DML > 70$ mm)

Patchily
over deep-water areas

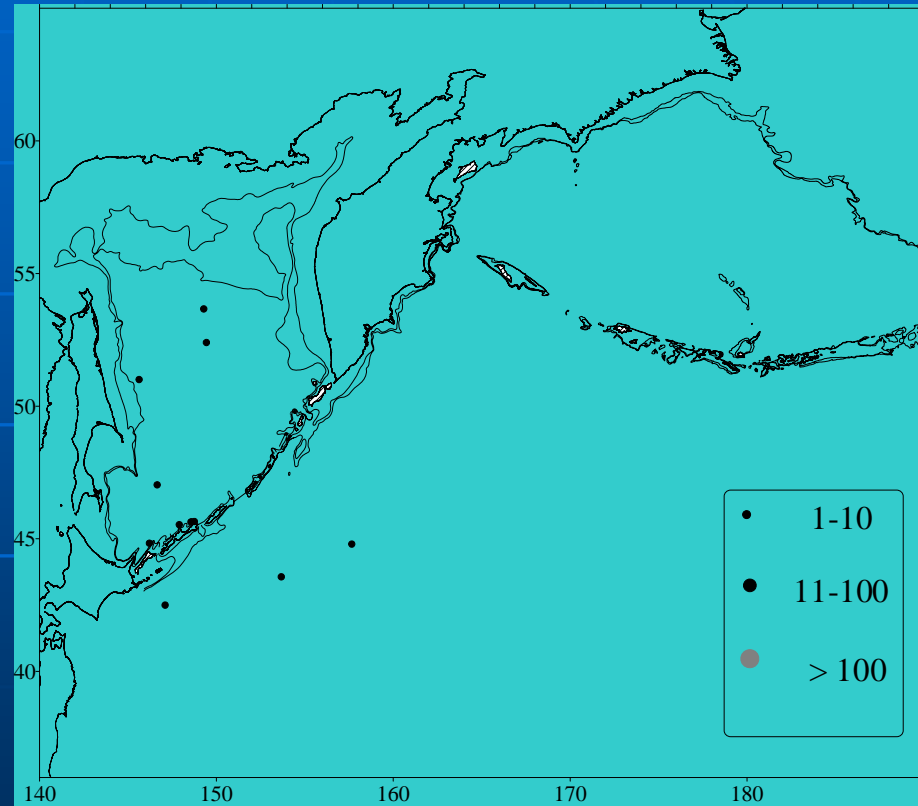
Gonatopsis octopedatus

Epipelagic zone



Juveniles (DML < 70 mm)
0-200 m

Very abundant; in the south

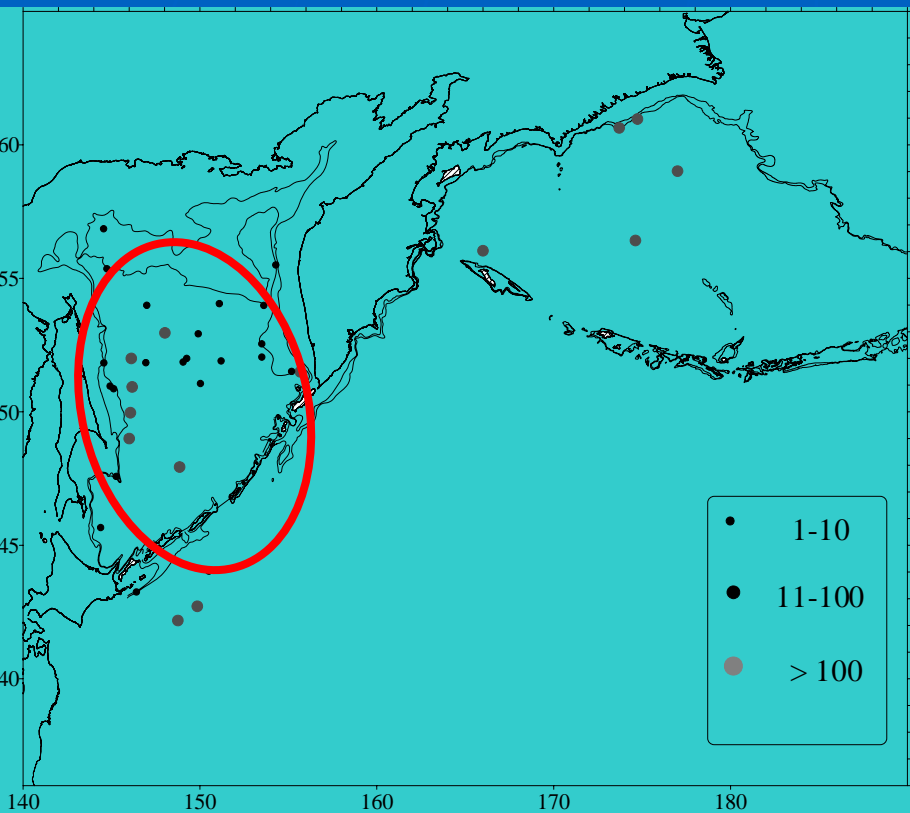


Adults (DML > 70 mm)
0-200 m

Rare

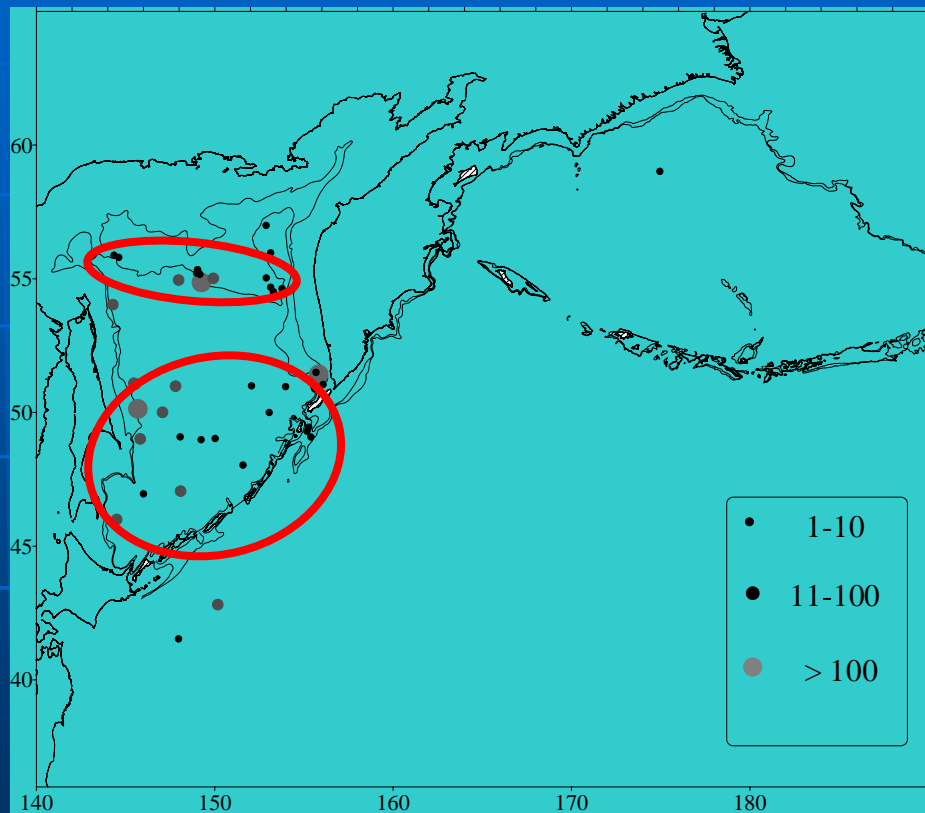
Gonatopsis octopedatus

Upper mesopelagic zone



Juveniles (DML < 70 mm)
200-500 m

In the center

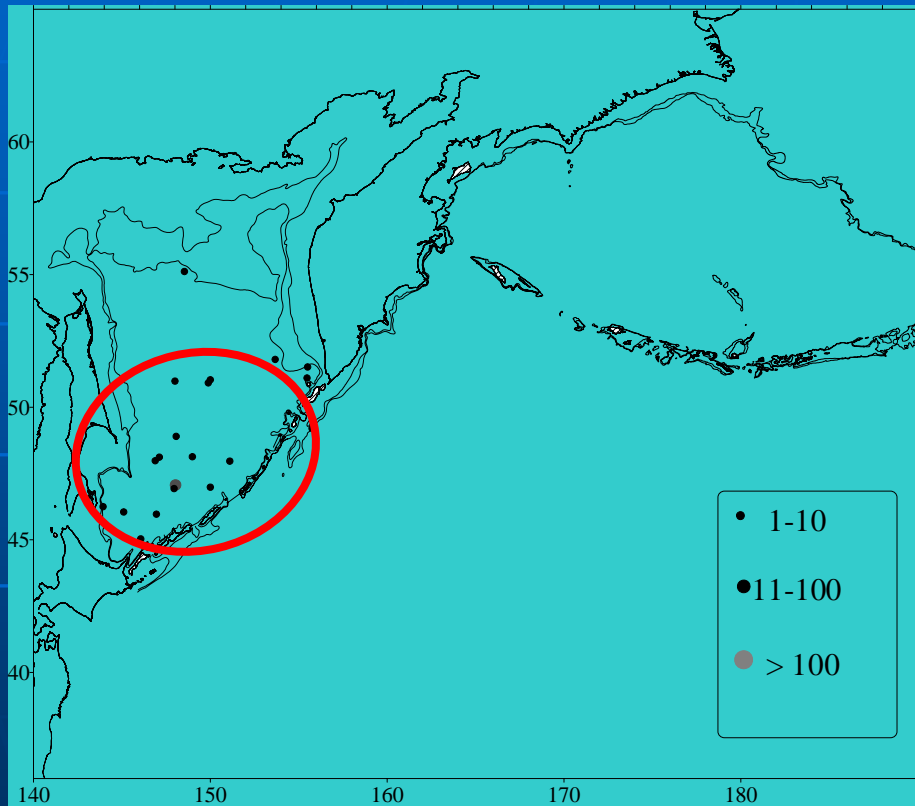


Adults (DML > 70 mm)
200-500 m

More common;
on the slope and in the south

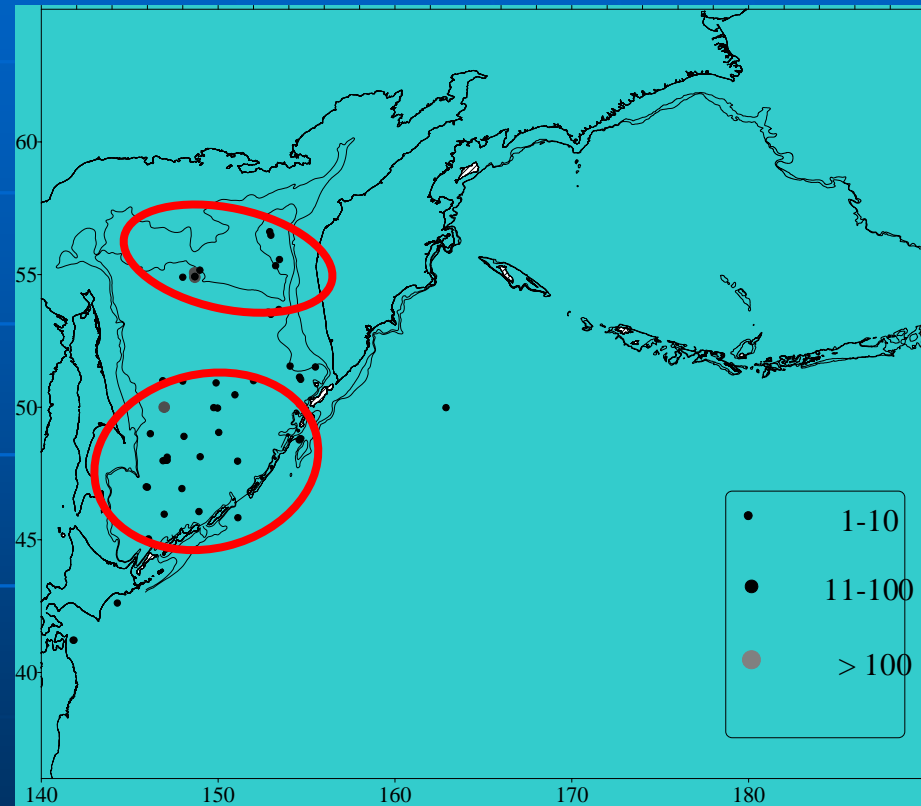
Gonatopsis octopedatus

Lower meso- and bathypelagic zones



Juveniles (DML < 70 mm)
> 500 m

Rare; in the south

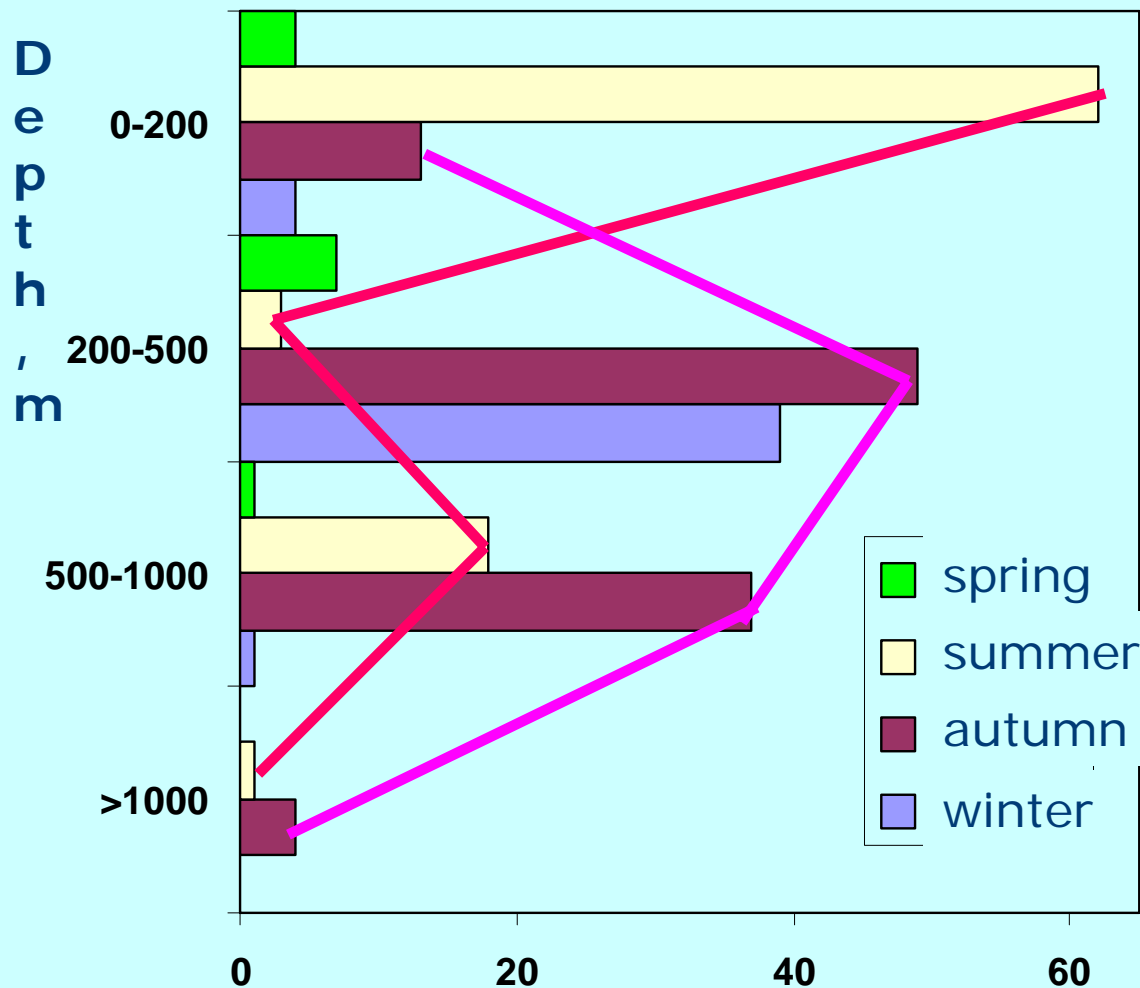


Adults (DML > 70 mm)
> 500 m

More frequent;
on the slope and in the south

Gonatopsis octopedatus

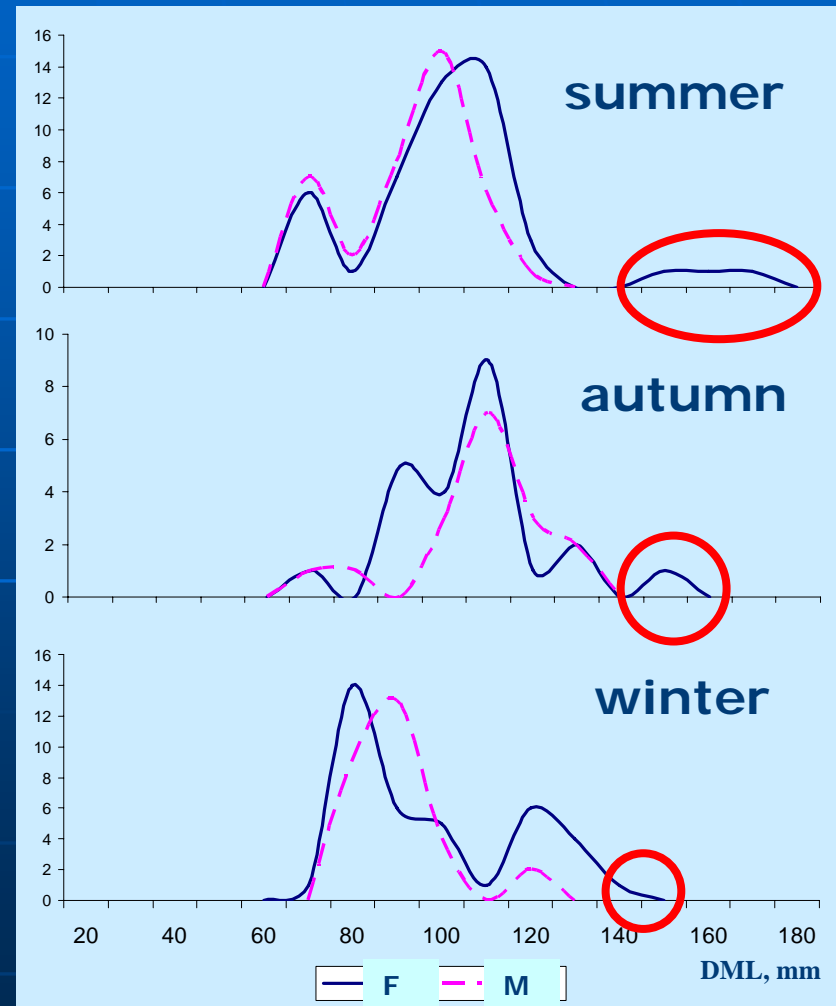
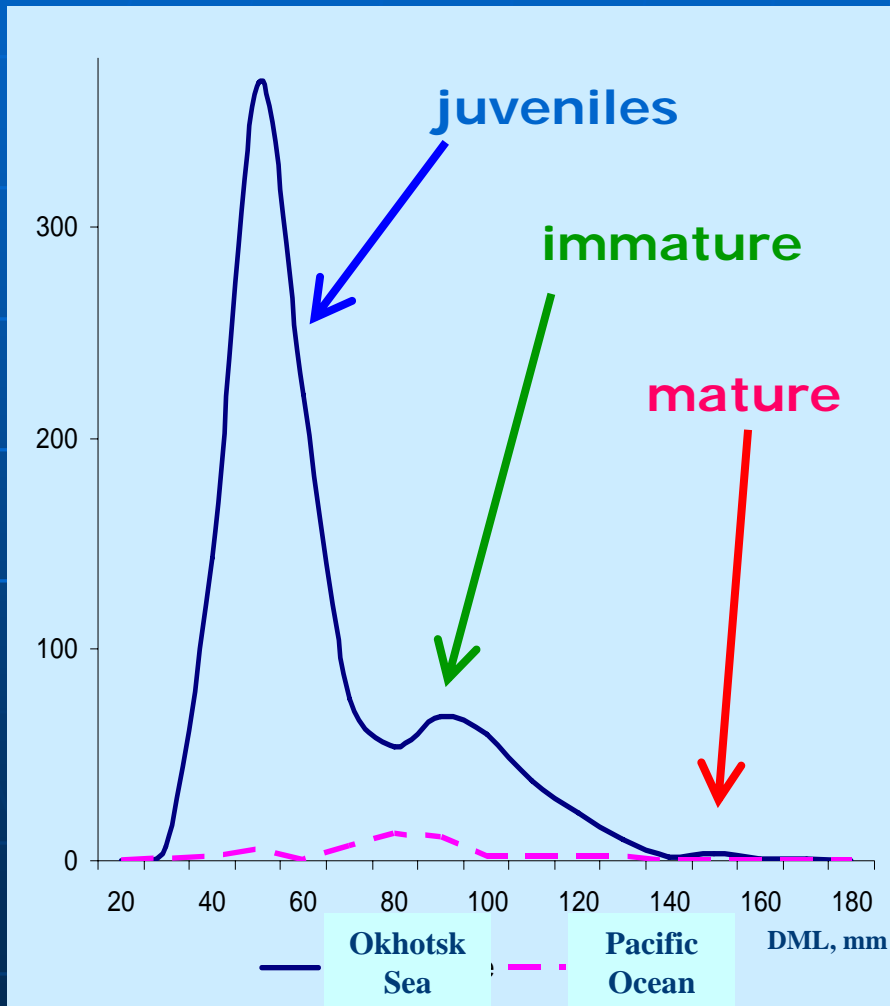
Seasonal Vertical distribution



- (1) Spring rare and even across depth range 0-500 m
- (2) Summer two peaks (at 0-200 m and 500-1000 m)
- (3) Autumn descend from epi- to meso- and bathypelagic zones
- (4) Winter mainly in the upper mesopelagic zone

Gonatopsis octopedatus

Size structure



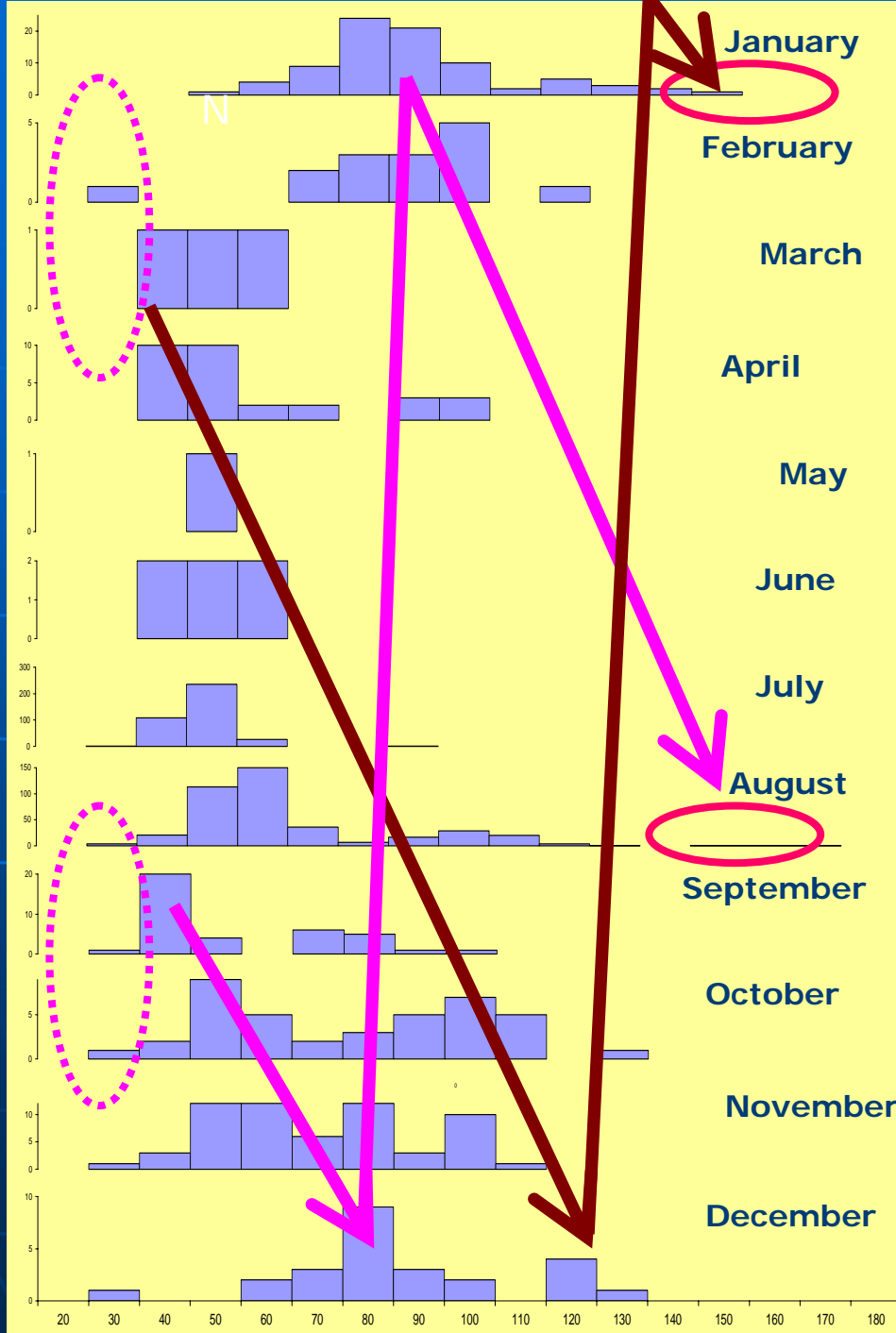
1) Three size groups in both areas; 2) Females mature at larger size

Gonatopsis octopedatus

Monthly changes in size structure in the Okhotsk Sea

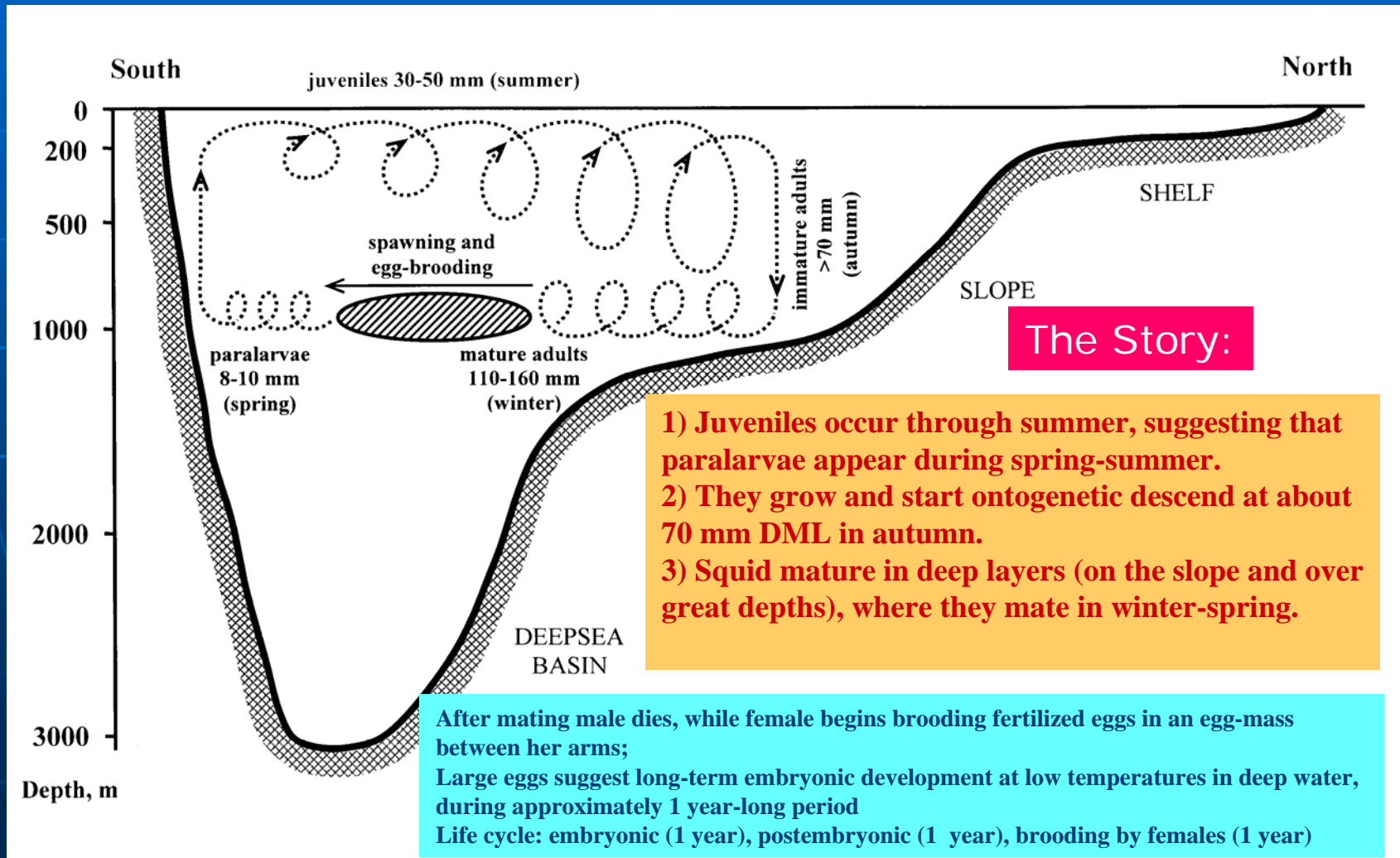
- 1) Mature animals occur in the late summer-autumn and winter
- 2) Early juveniles occur in the same seasons
- 3) Two generations could be traced from succession of modal classes

No time for embryonic development, or long-term embryonic development !!!



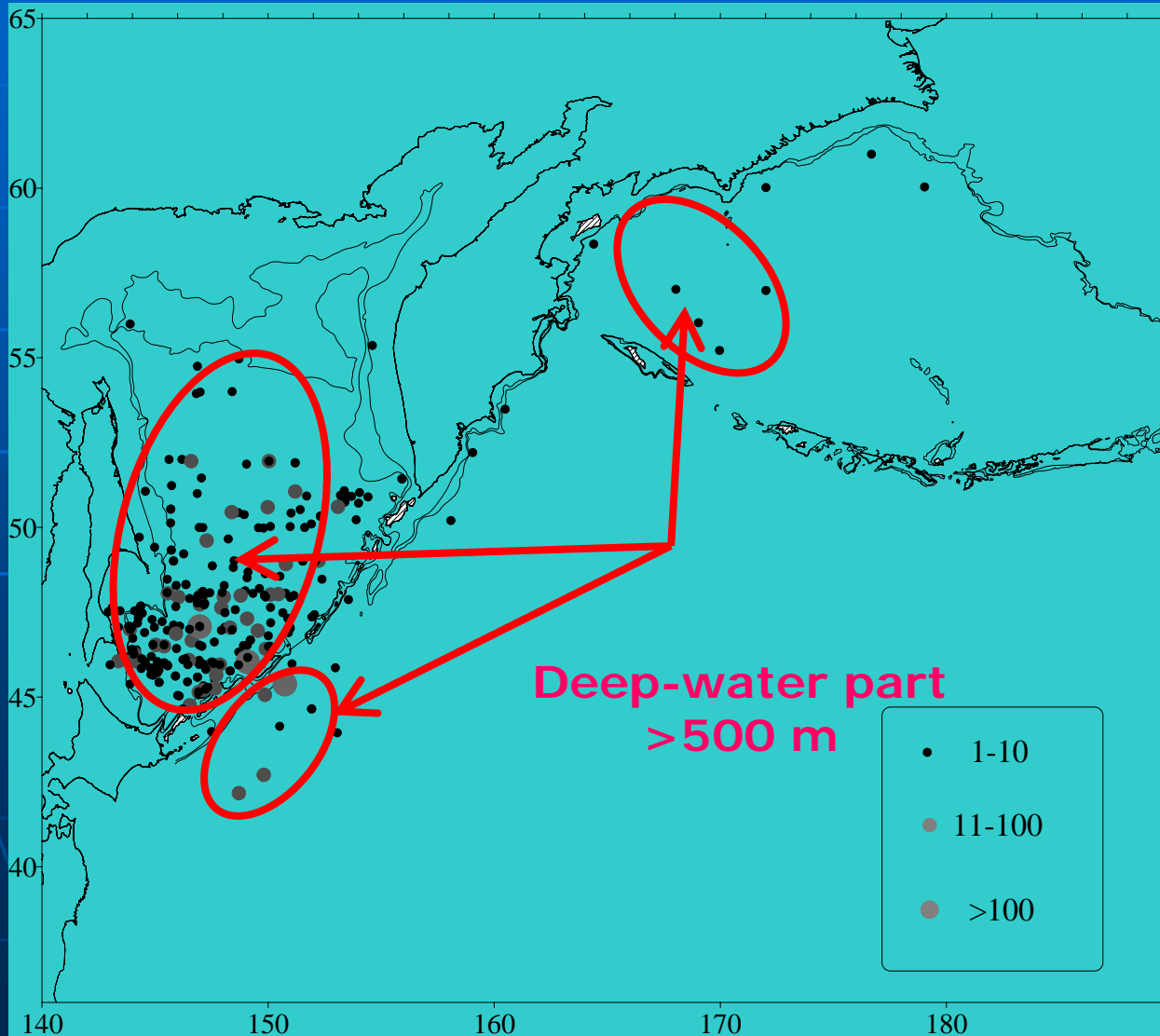
Gonatopsis octopedatus

Hypothetical scheme of the species life cycle in the Okhotsk Sea

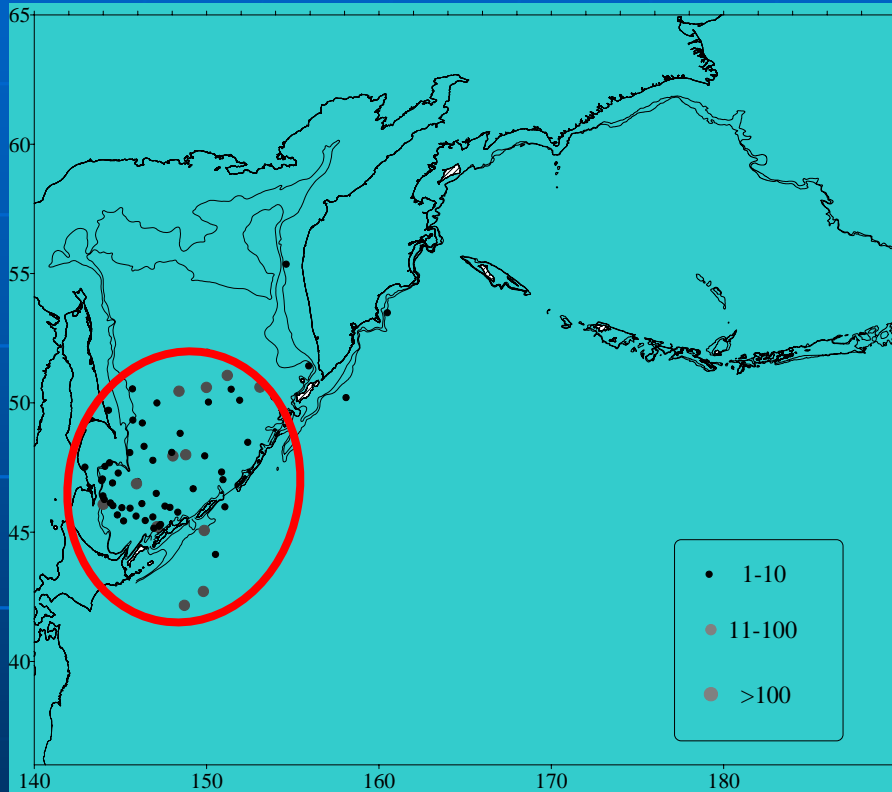


Gonatopsis japonicus

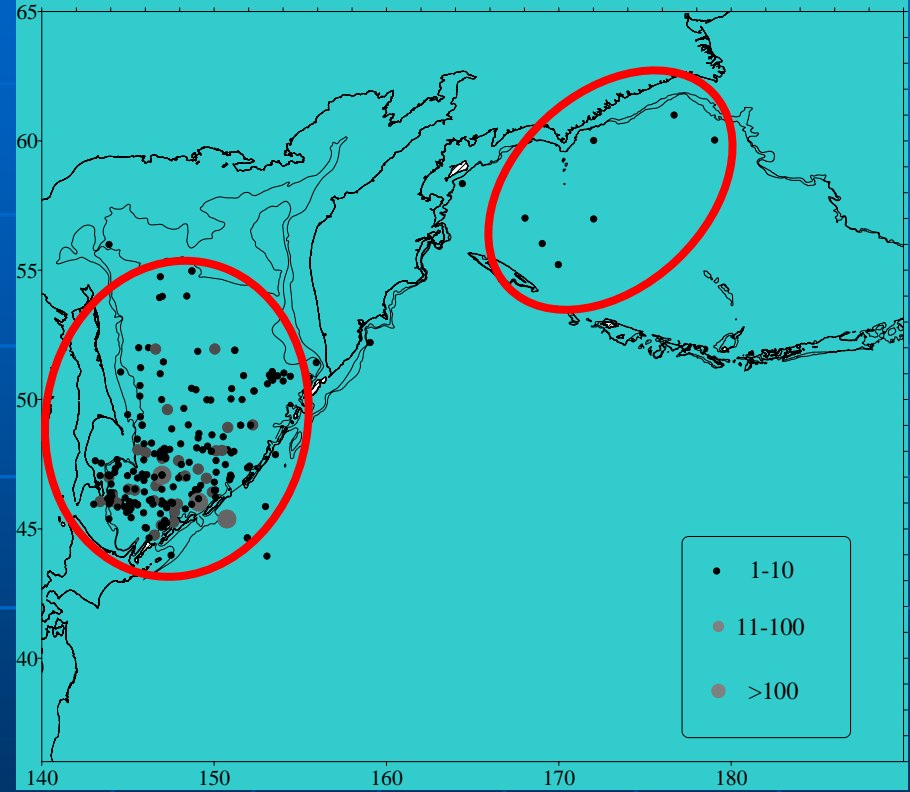
All depths and seasons



Gonatopsis japonicus



Juveniles (DML < 80 mm)

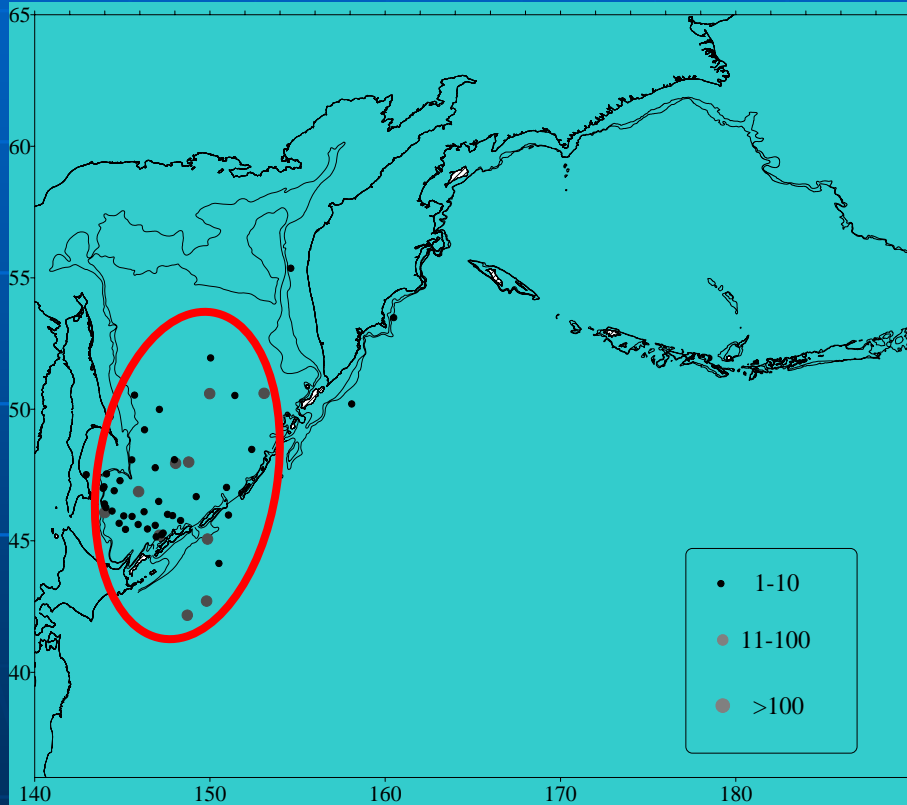


Adults (DML > 80 mm)

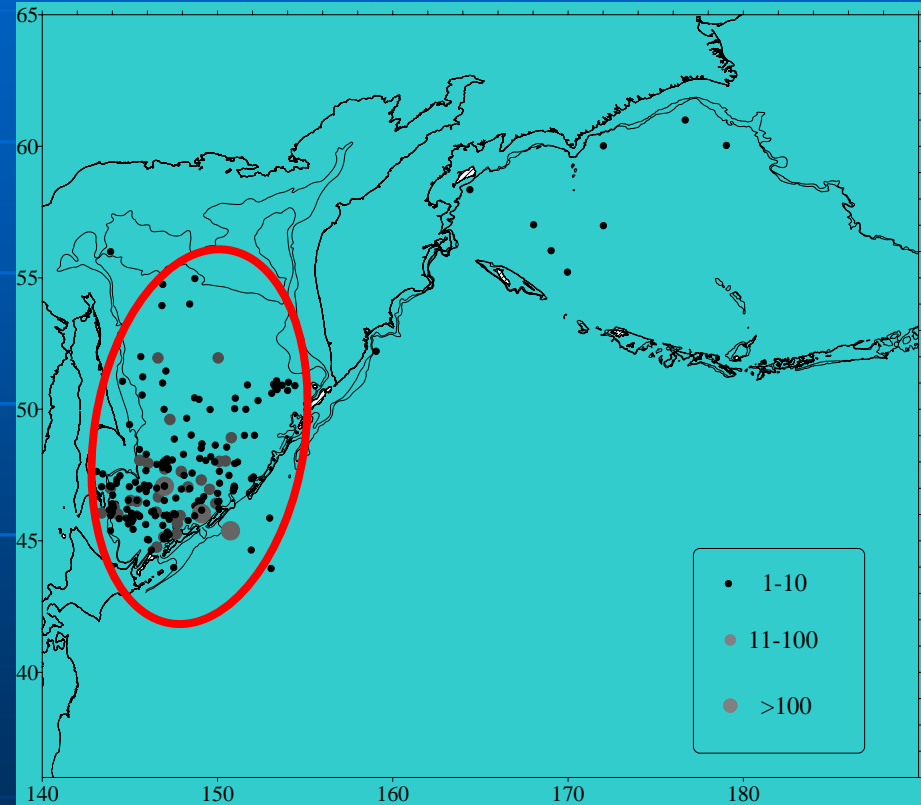
Juveniles and adults are distributed mainly over deep-sea areas. Similar patterns; adults are more abundant and occur over larger area.

Gonatopsis japonicus

Epipelagic zone



Juveniles (DML < 80 mm)
0-200 m

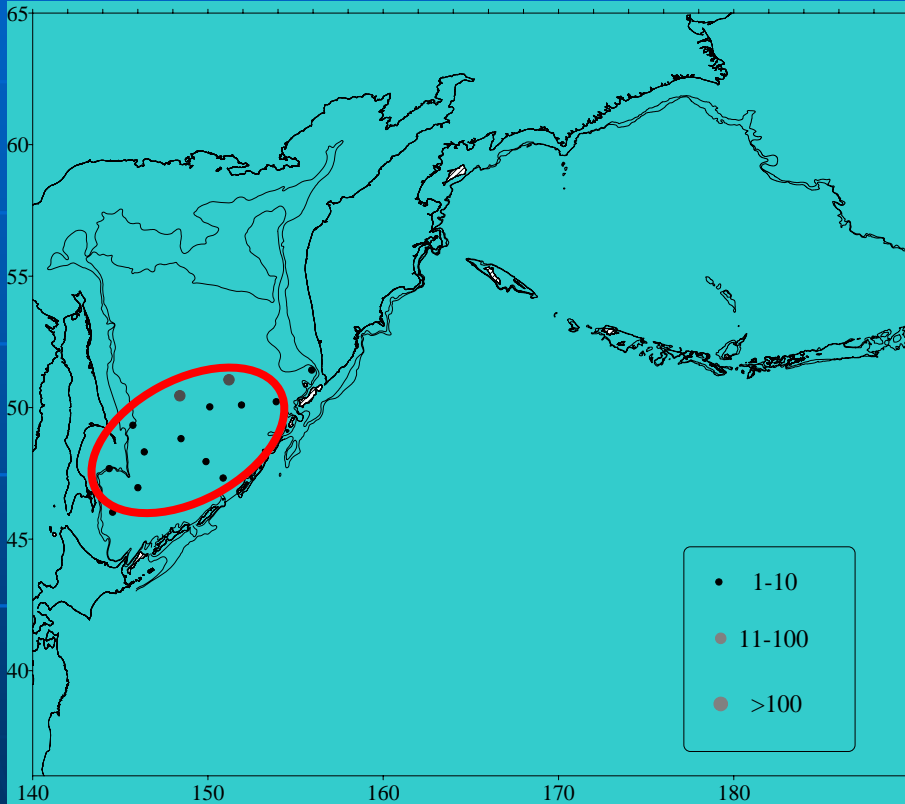


Adults (DML > 80 mm)
0-200 m

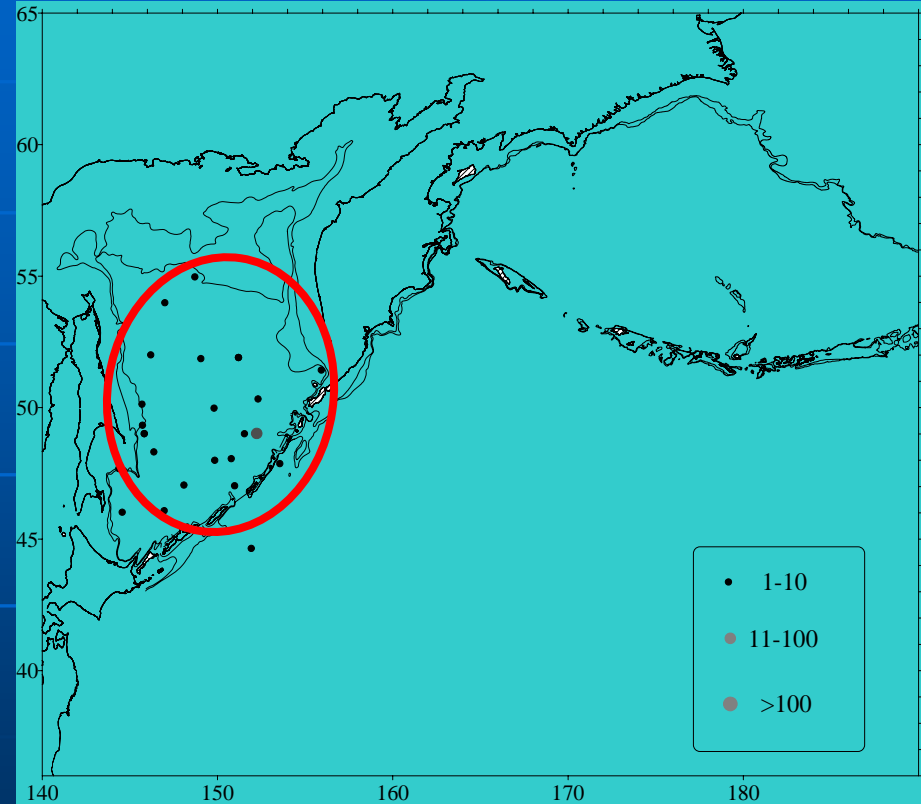
Distribution patterns of juveniles and adults are similar

Gonatopsis japonicus

Upper mesopelagic zone



Juveniles (DML < 80 mm)
200-500 m



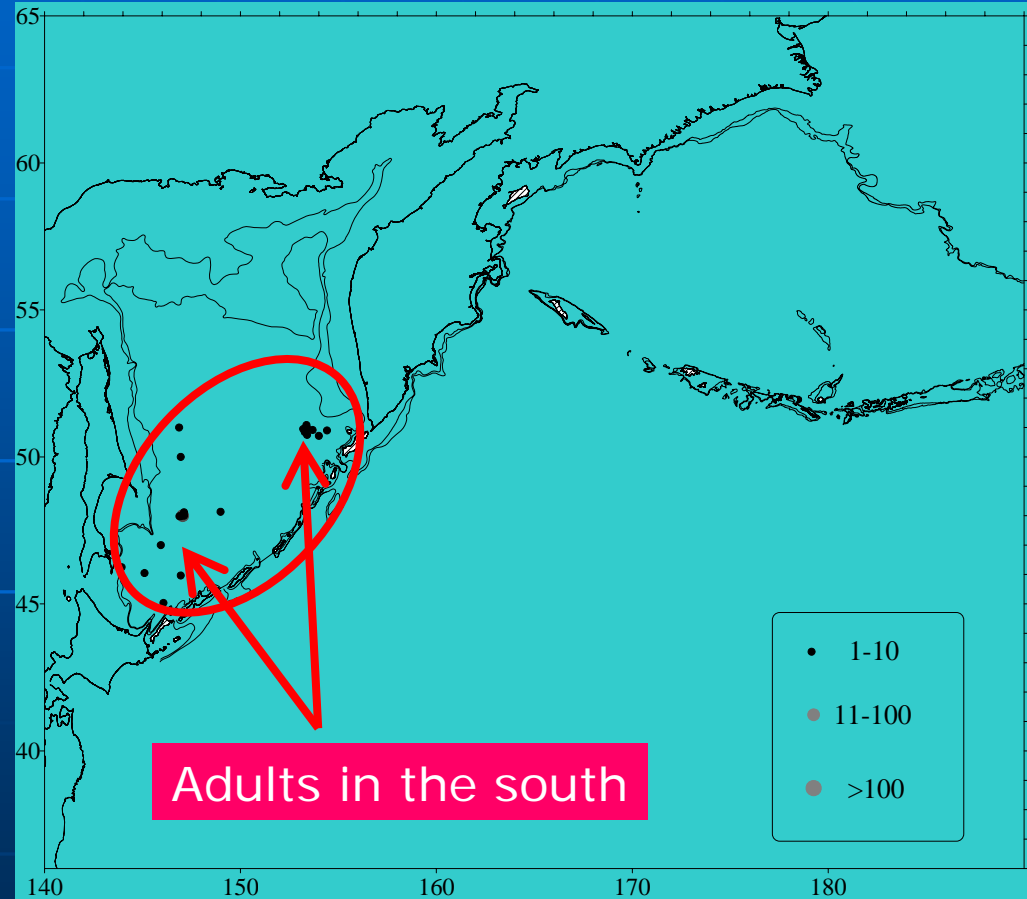
Juveniles (DML > 80 mm)
200-500 m

Distribution patterns of juveniles and adults are similar, though adults occur over somewhat wider area

Gonatopsis japonicus

Lower meso- and bathypelagic zones

No juveniles at great depths

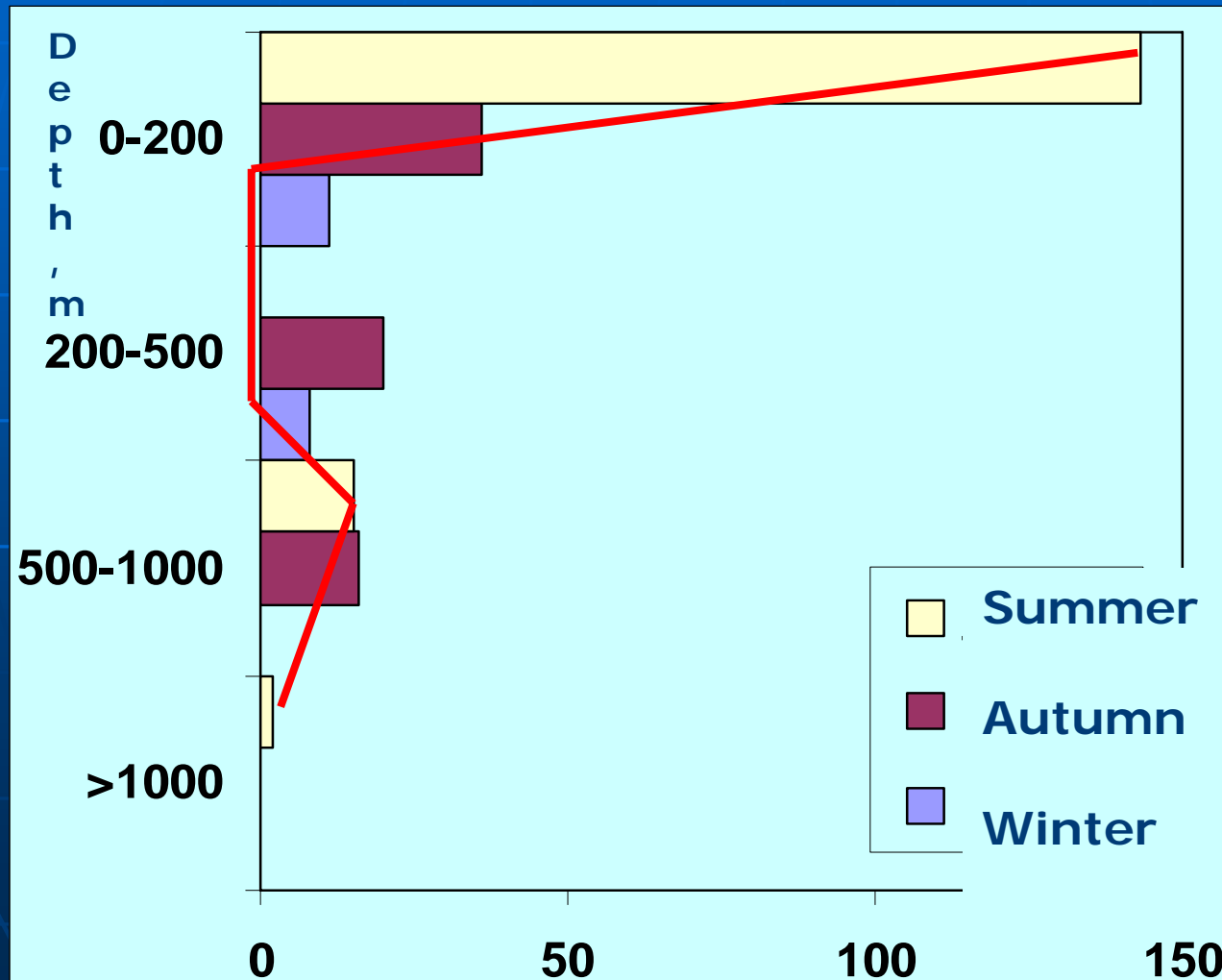


Adults in the south

Adults (DML > 80 mm)
> 500 m

Gonatopsis japonicus

Seasonal vertical distribution



(1) Summer
two peaks
(strong at 0-200 m,
weaker at >500 m)

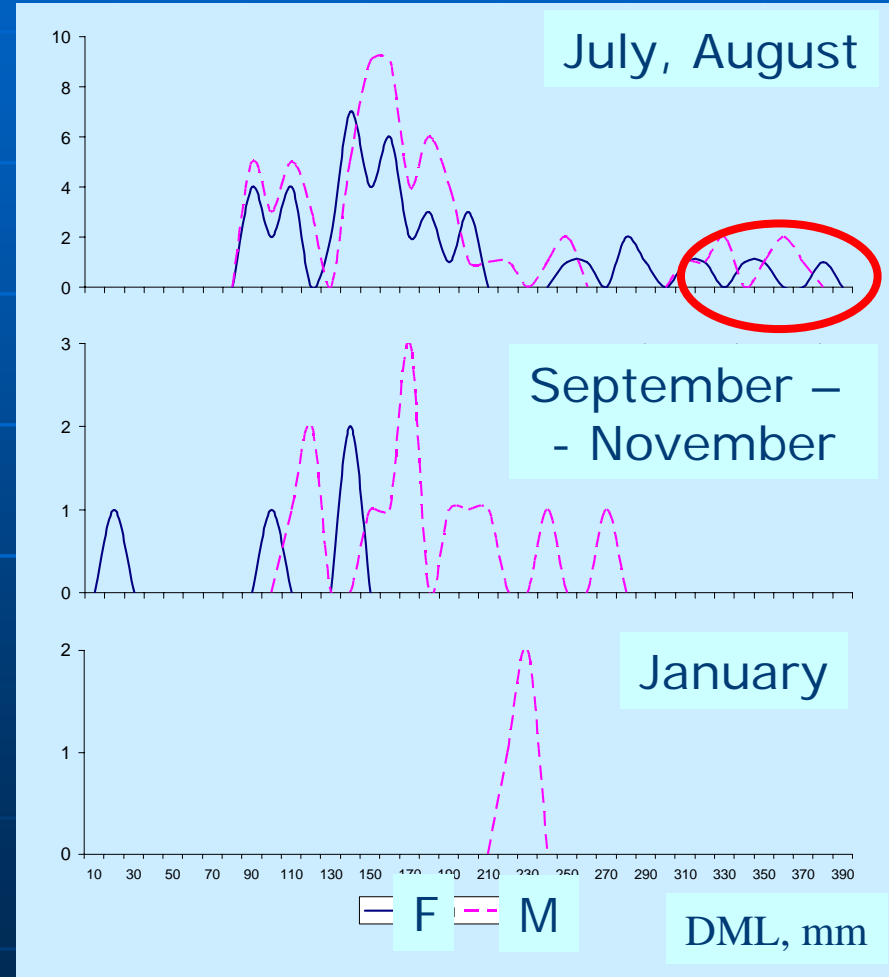
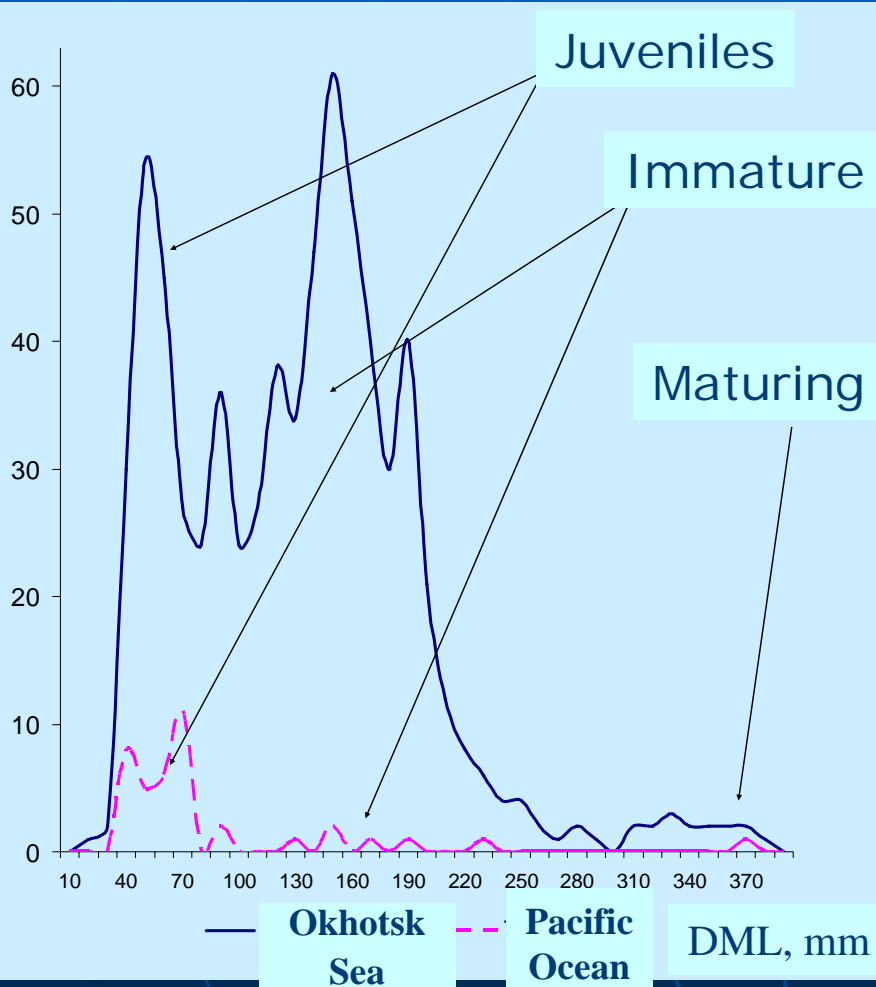
(2) Autumn
more or less evenly
across depths
(due to the descend?)

(3) Winter
rare and within depths
0-500 m

Mainly in the upper
layers

Gonatopsis japonicus

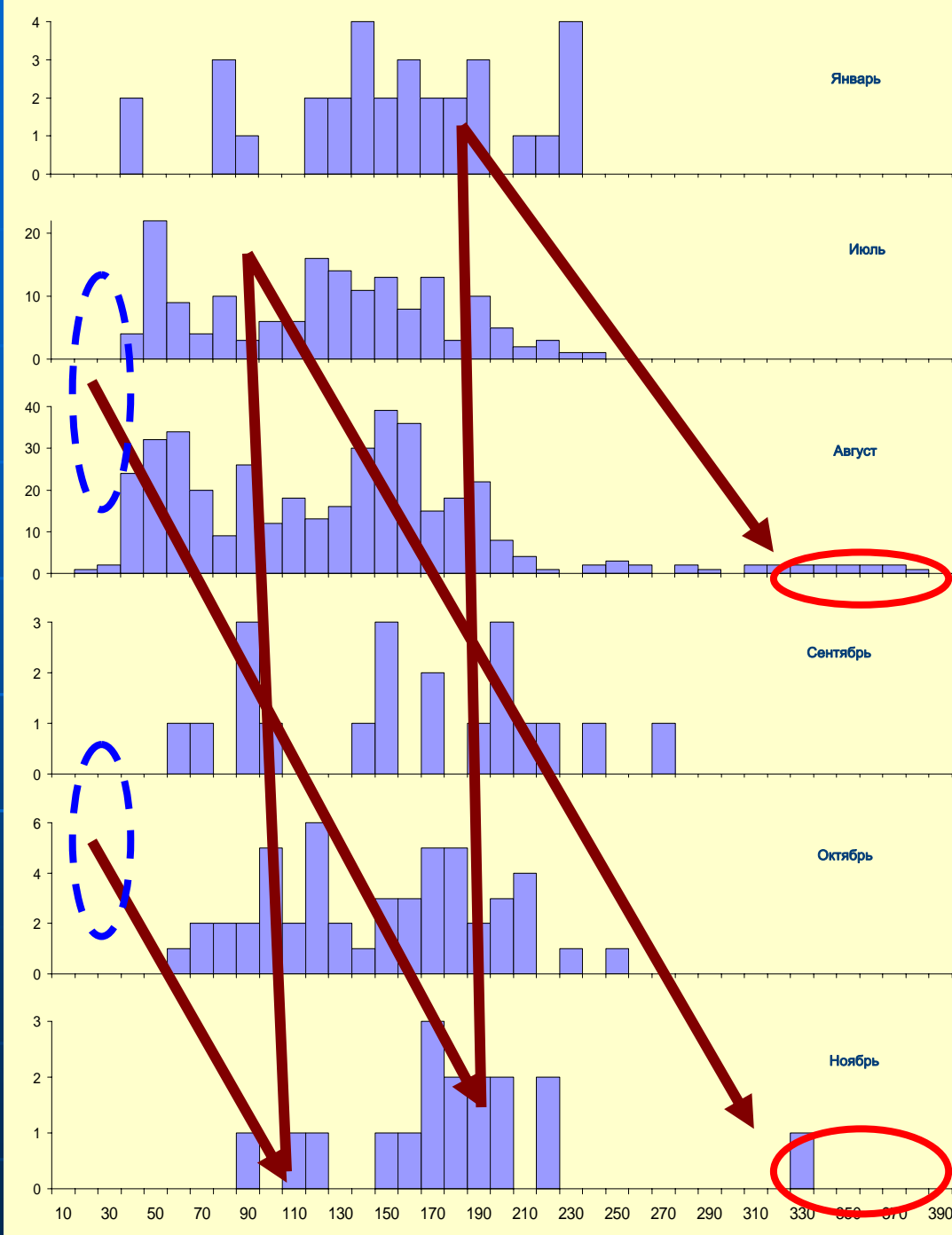
Size structure



Peaks that correspond to ontogenetic stages are hardly discernible

Gonatopsis japonicus

Monthly changes in size structure in the Okhotsk Sea



- 1) Two generations
- 2) Hard to distinguish between size classes (hence, hard to trace them in time)
- 3) No spawning squid have ever been found
- 4) Difficult to come up to life-cycle scenario for this species

Major conclusions

- *G. octopedatus* and *G. japonicus* are widely distributed **beyond the shelf zone** in the Okhotsk Sea and in the Pacific Ocean off the Kuril Islands
- Early ontogenetic stages and juveniles of *G. octopedatus* and *G. japonicus* are found mainly in the **epipelagic layers**
- Immature *G. octopedatus* start living in the **bathypelagic zone**, while *G. japonicus* continue **vertical migrations to the surface layers**, most likely, till maturation
- Adult *G. octopedatus* and *G. japonicus* are **deep-water dwellers**, and spawn presumably in the bathyal zone
- Seasonal groupings of *G. octopedatus* and *G. japonicus* indicate **different spawning events** during a year