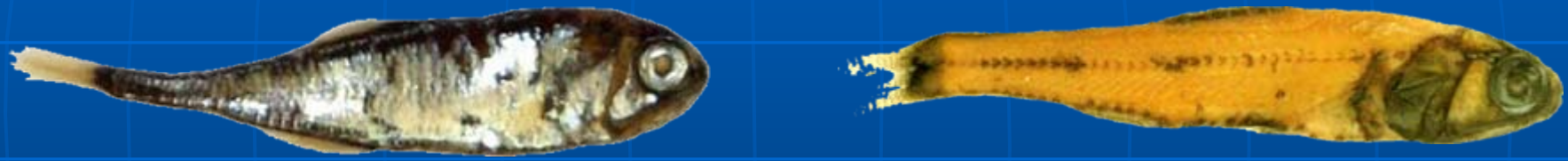
# Reproductive biology of the mesopelagic fishes *Tarletonbeania crenularis* and *Ceratoscopelus warmingii* (Osteichthyes: Myctophidae) from the northwestern Pacific Ocean



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# INTRODUCTION

- *Tarletonbeania crenularis: T. crenularis taylori* and *T. crenularis crenularis*
- Endemic
- belongs to the south-boreal-subtropical faunistic complex

- Mesopelagic (0 – 710 m)
- Eurythermic
- Biomass reached 19, 000 t in the epipelagic zone of the subarctic waters, - 15, 900 t in Kuril and open waters

- No subspecies of *Ceratoscopelus warmingii* have been distinguished
- Cosmopolitic
- belongs to the subtropical faunistic complex

- Meso- bathypelagic (0 – 2014 m)
- Eurythermic
- Biomass reached 120, 000 t in the epipelagic zone of the subarctic waters, and 26,500 t in Kuril and open waters

**Reproductive biology of these species has not been investigated so far**

# New data on the biology of these fishes were obtained during investigations conducted by TINRO-Centre

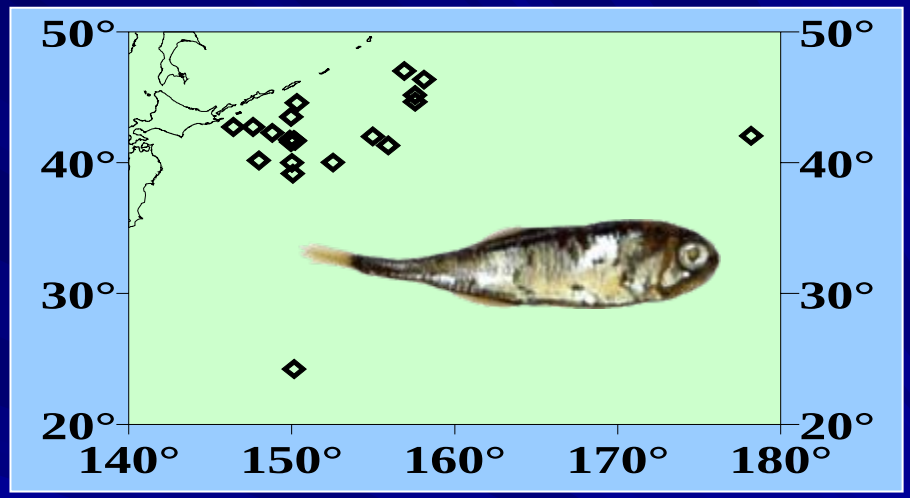
**Samples of *T.crenularis taylori* - 375 and *C. warmingii* - 458 individuals**

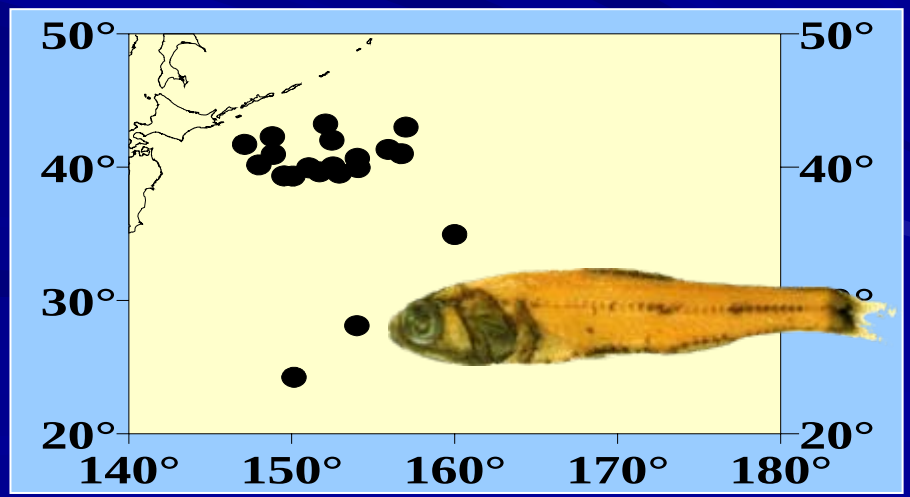
**were collected in subtropical waters**

**- in April 1984, February 1990.**

**and in Kuril and open waters of the northwestern Pacific Ocean**

**- in November 2001, 2005, July-August 2002.**



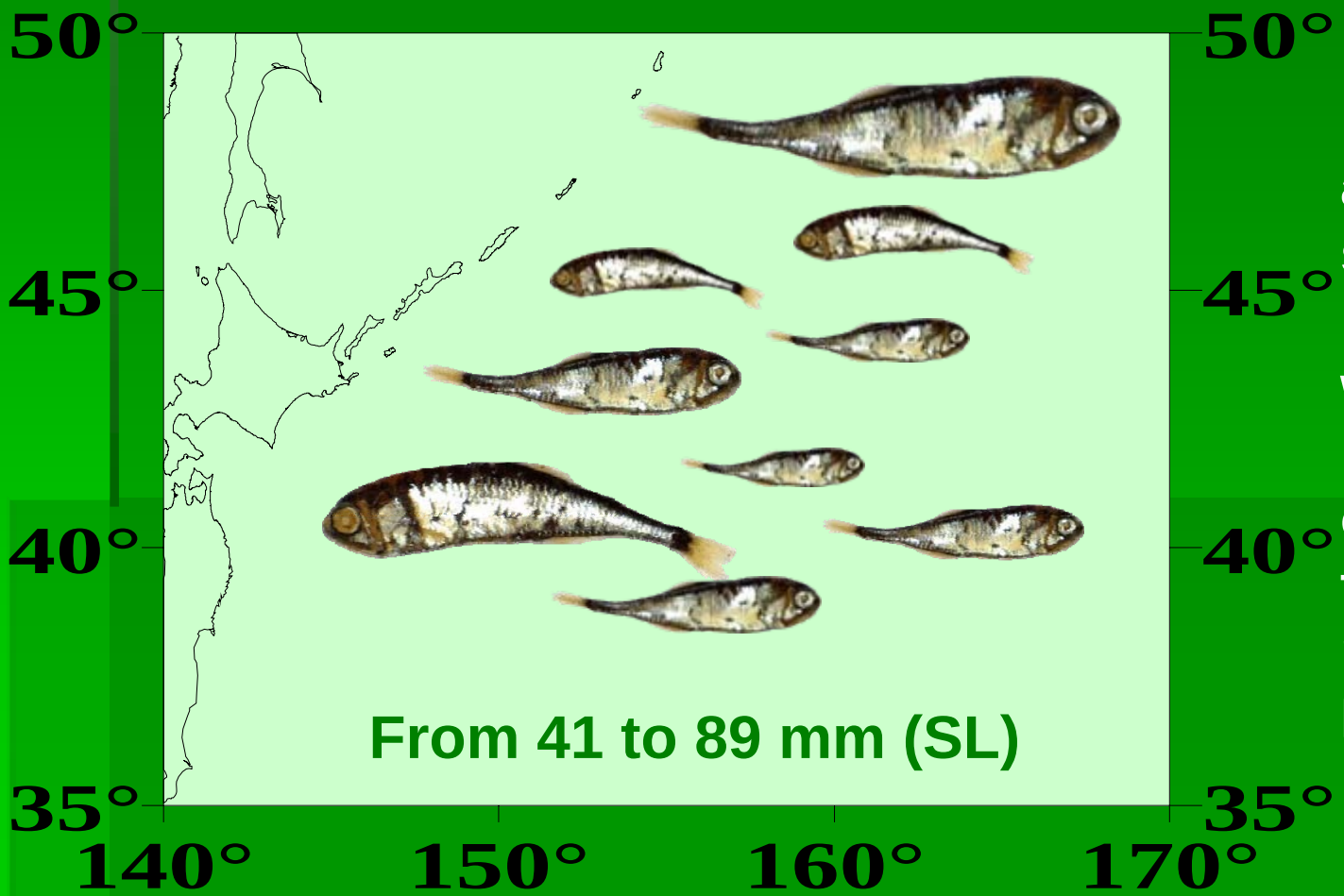
# Main OBJECTIVE

To investigate reproductive biology of these two species

- - size structure;
- - spawning;
- - oogenesis;
- - fecundity.

# *Tarletonbeania crenularis taylori*

## Size structure




**Small-sized and large-sized individuals were captured in Kuril and open waters of the northwestern Pacific Ocean.**

# Size characters

**Female** > **Male**

**From 41 to 89 mm (SL)**

**Mean = 71 ± 10 mm**

**From 49 to 87 mm (SL)**

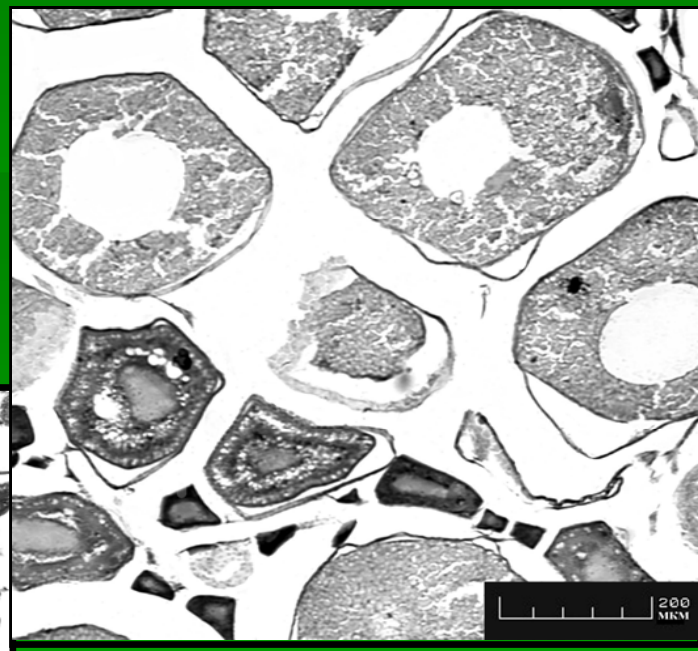
**Mean = 69 ± 8 mm**

# Gonad maturity stages

MATURE

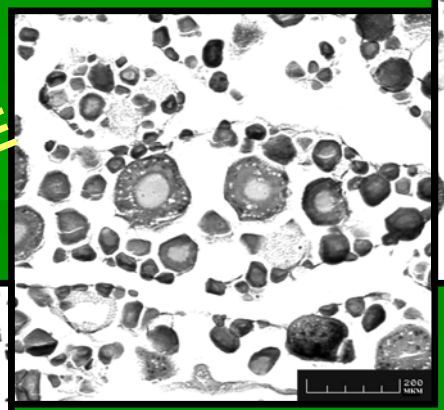
MATURING

IMMATURE

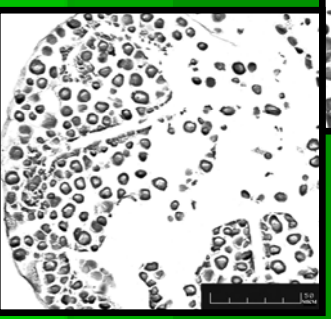



Stage IV


Stage III b



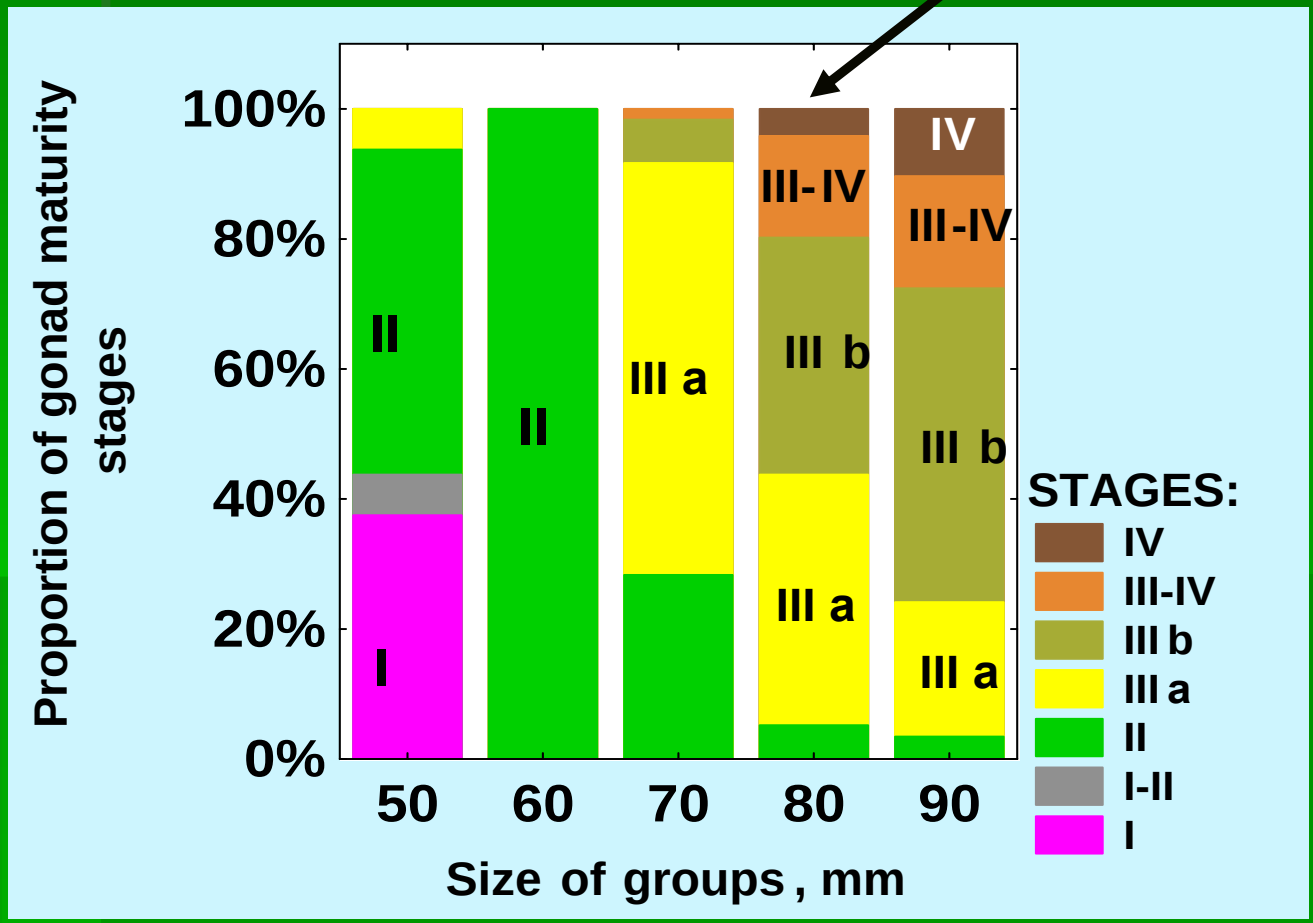

Stage III a



Stage II

# Maturity stages of the different size Females

## in Kuril and open waters

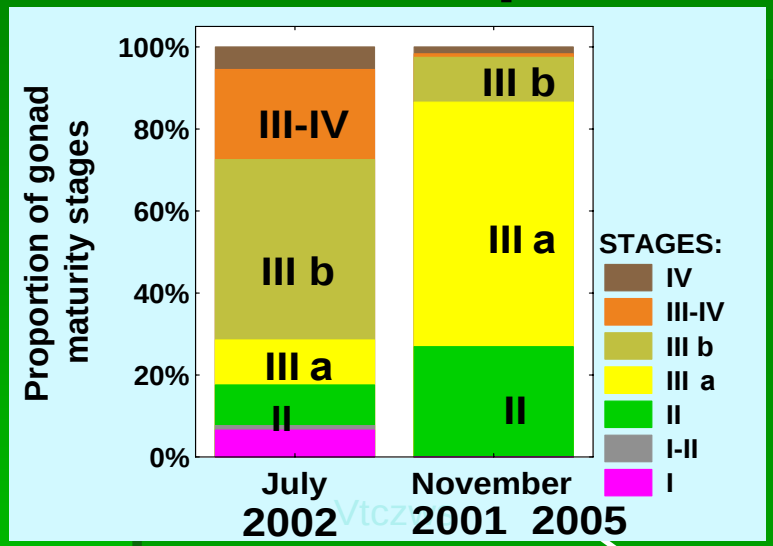


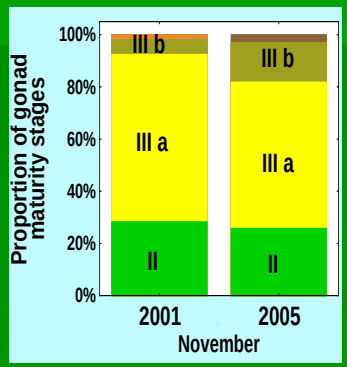

The first-maturity length (SL) is

>71 mm

# Gonad maturity stages

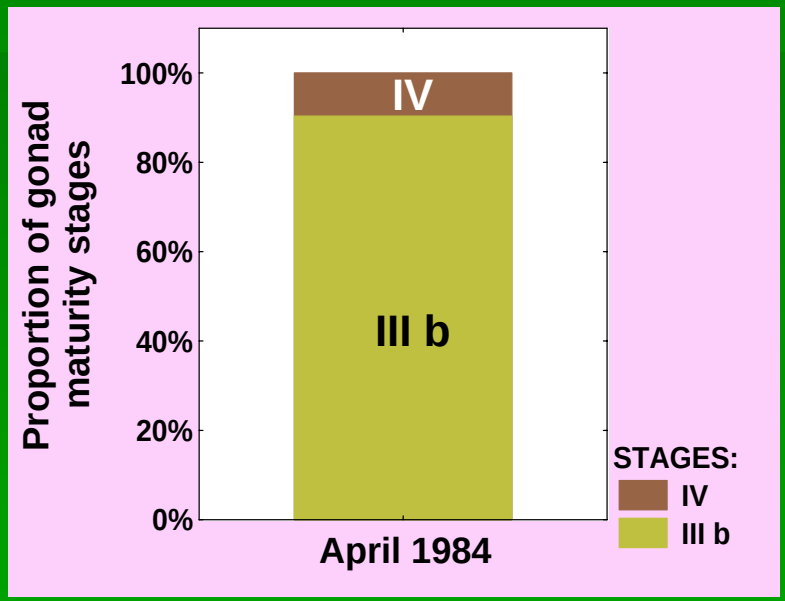
## Kuril and open waters



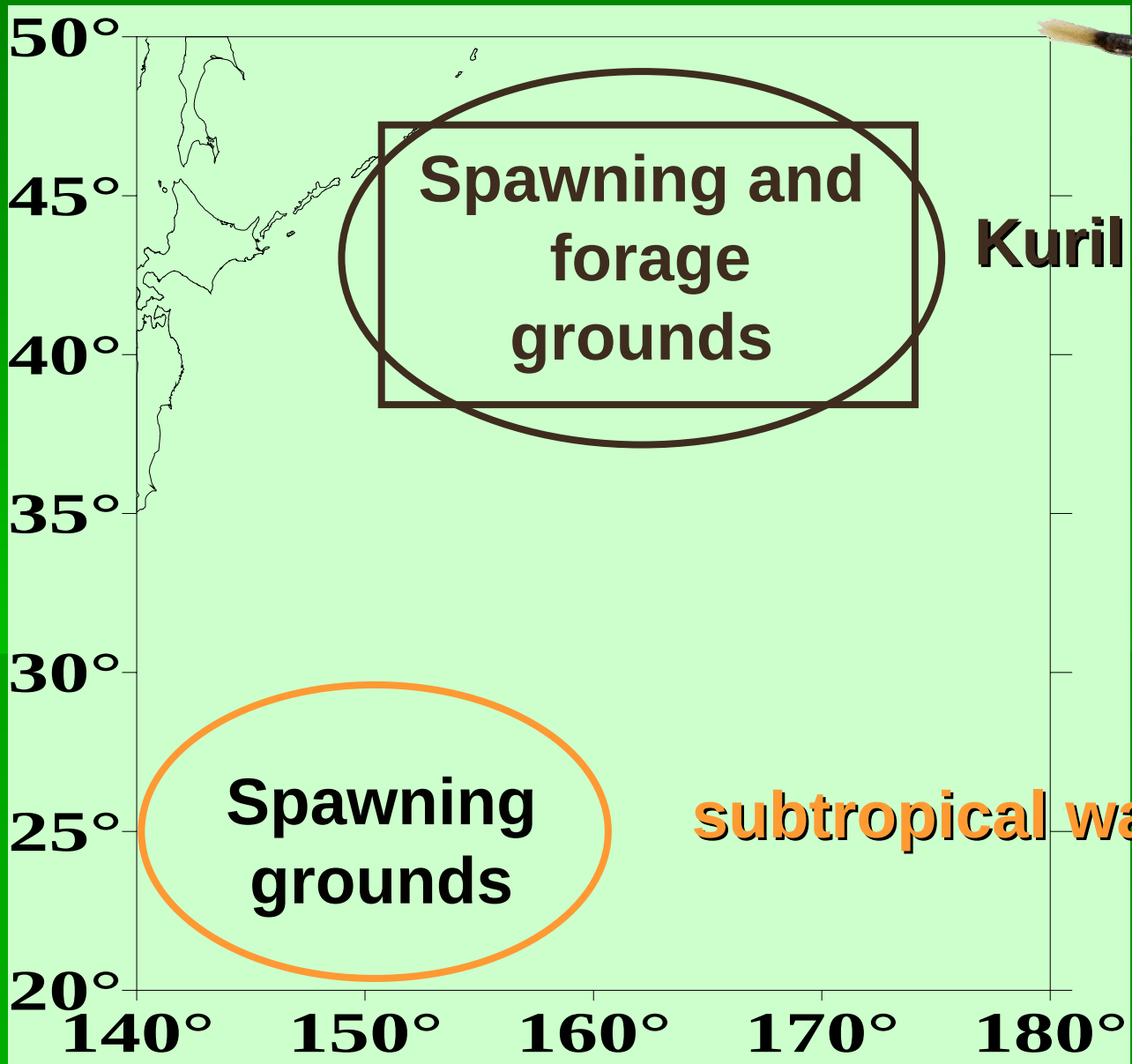

The mass spawning began in July-August in Kuril and open waters, few individuals spawn in November.

## subtropical waters




*T. crenularis taylori* spawned in April-May in subtropical waters

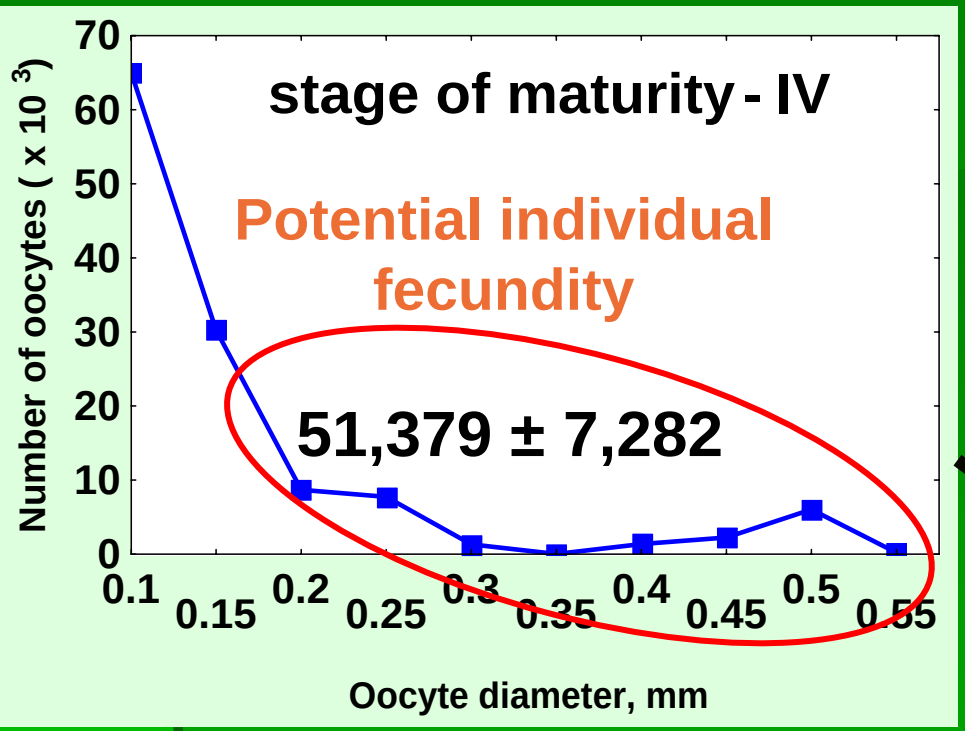
# *Tarletonbeania crenularis taylori*




**Kuril and open waters**

**subtropical waters**

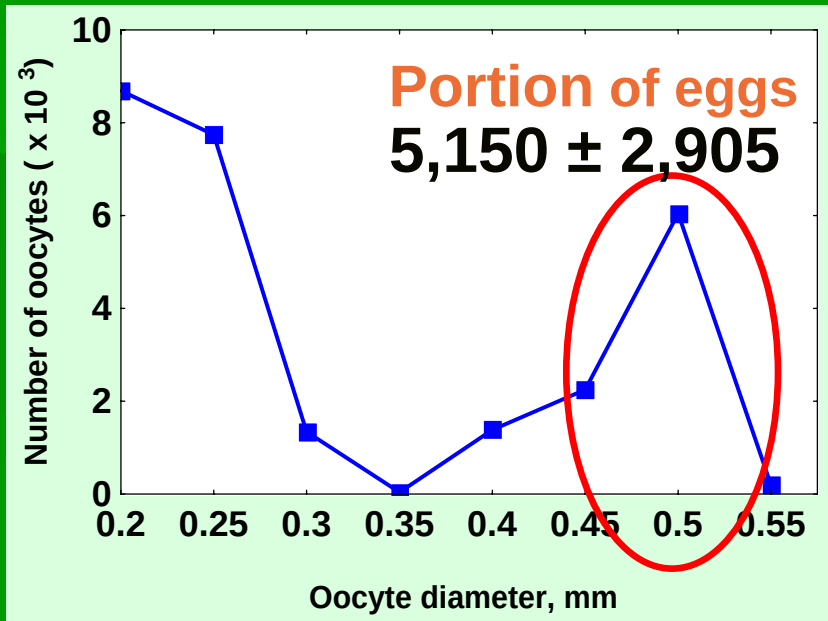
# The type of oogenesis and Fecundity




enlarged

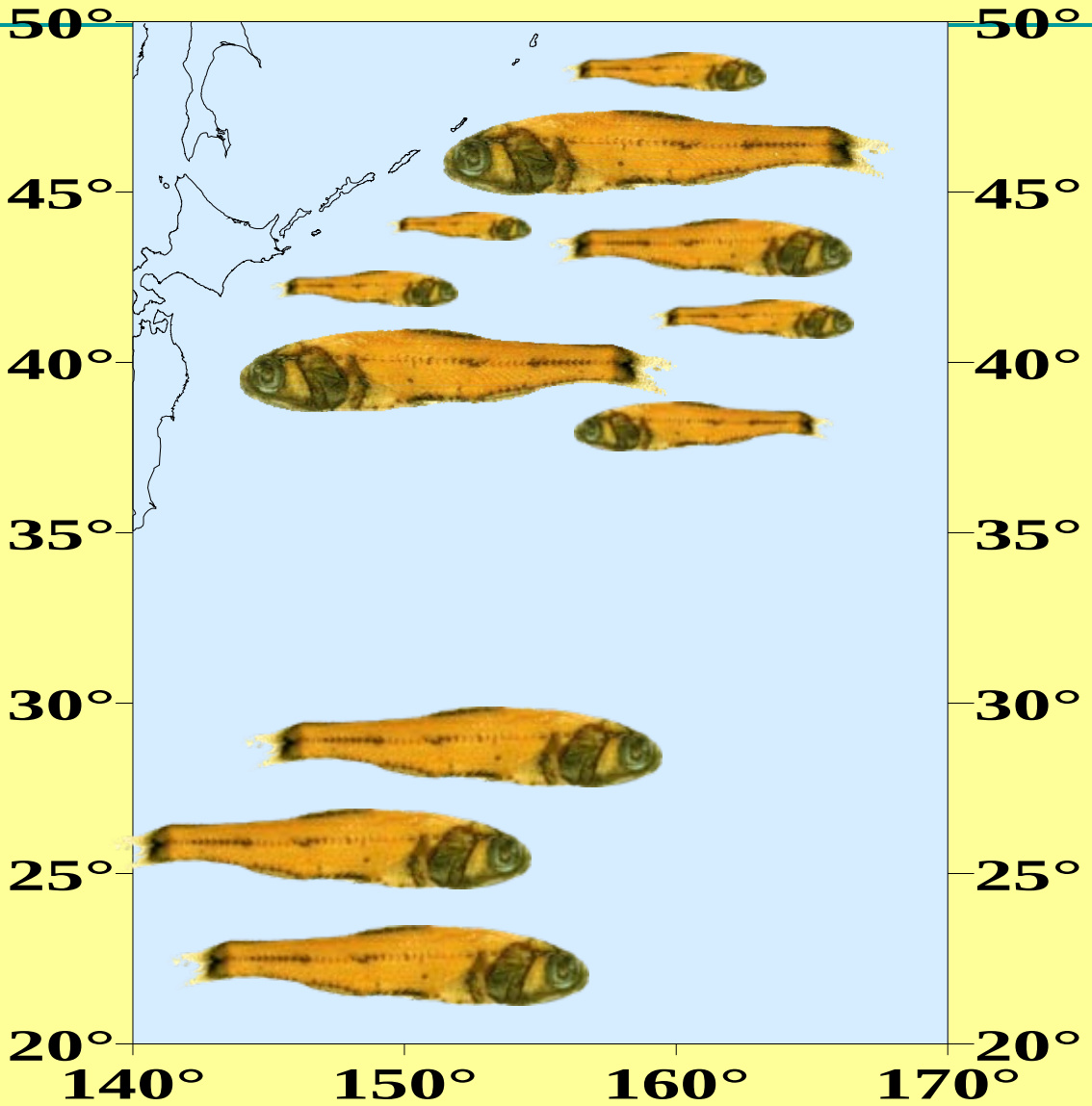
The oogenesis is of continuous and accumulated type


Phases of oocyte development



# *Ceratoscopelus warmingii*

## Size structure




**Small-sized and large-sized individuals were captured in Kuril and open waters.**

**Only large-sized individuals were captured in subtropical waters.**

# Size characters

**Female** > **Male**

**From 23 to 89 mm (SL)**

**Mean = 67 ± 11 mm**

**From 47 to 83 mm (SL)**

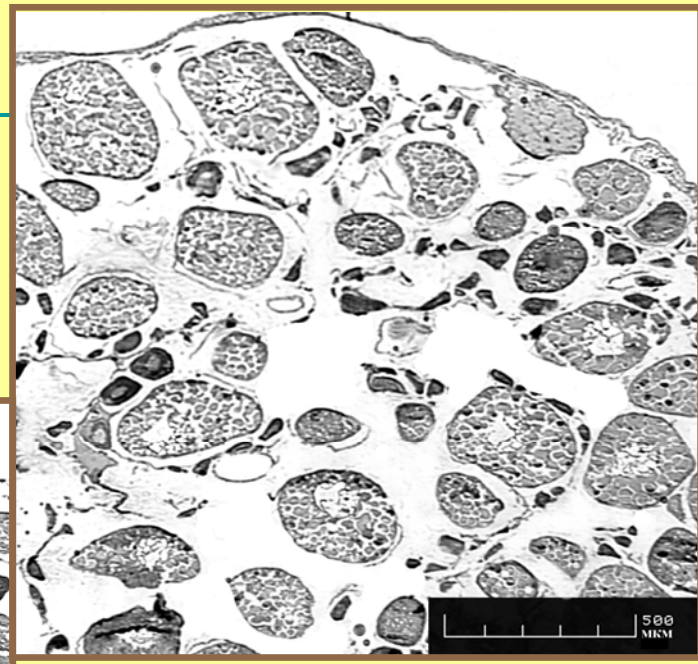
**Mean = 66 ± 8 mm**

**Individuals of *C. warmingii* live approximately one year.**

***C. warmingii* is a monocyclic species**

# Gonad maturity stages

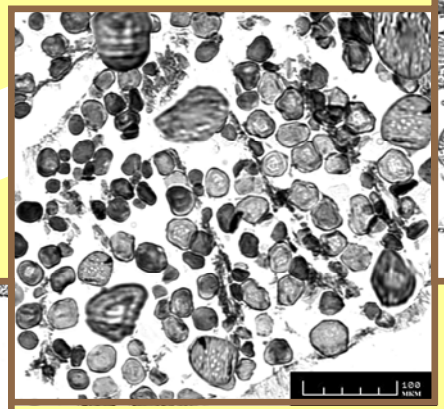
MATURE




Stage IV

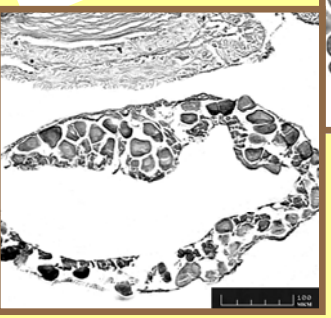
MATURING


Stage III b




Stage III a

IMMATURE

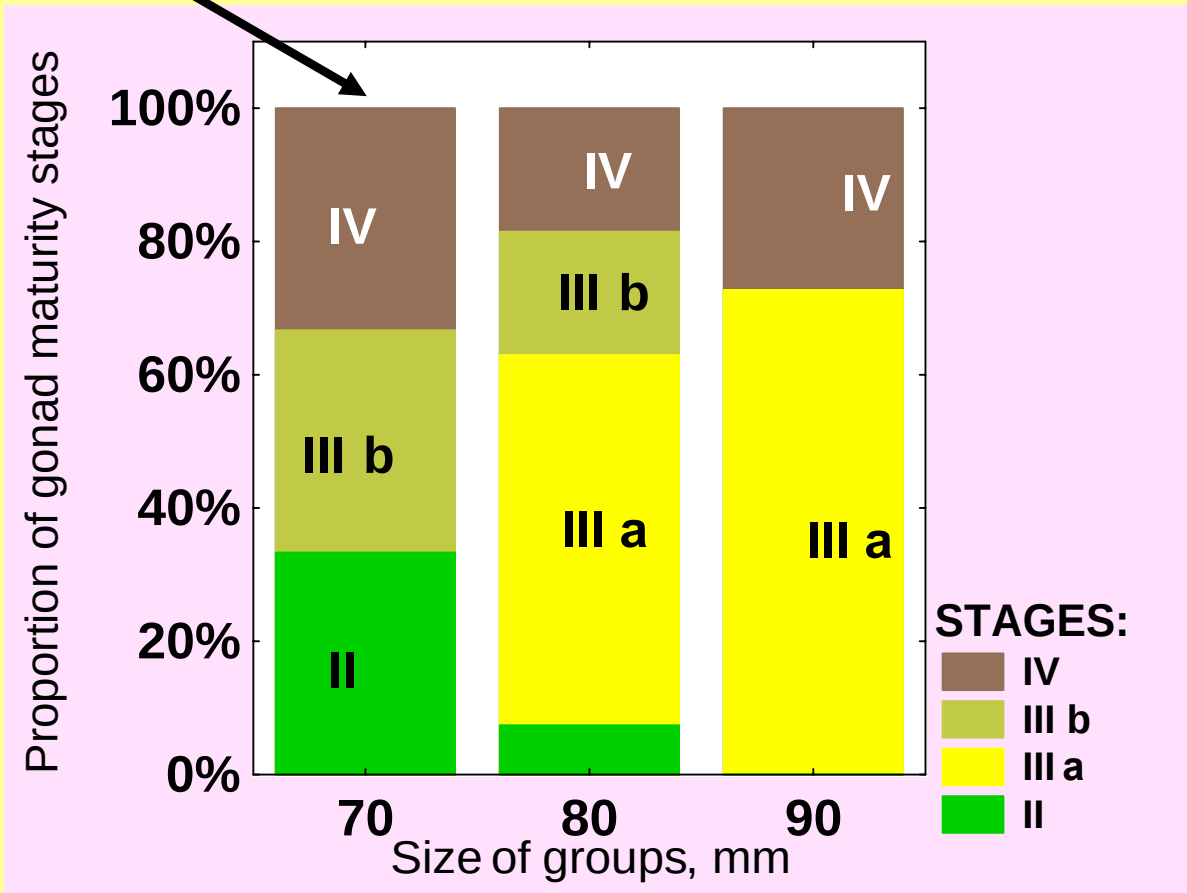



Stage II

# Maturity stages of females

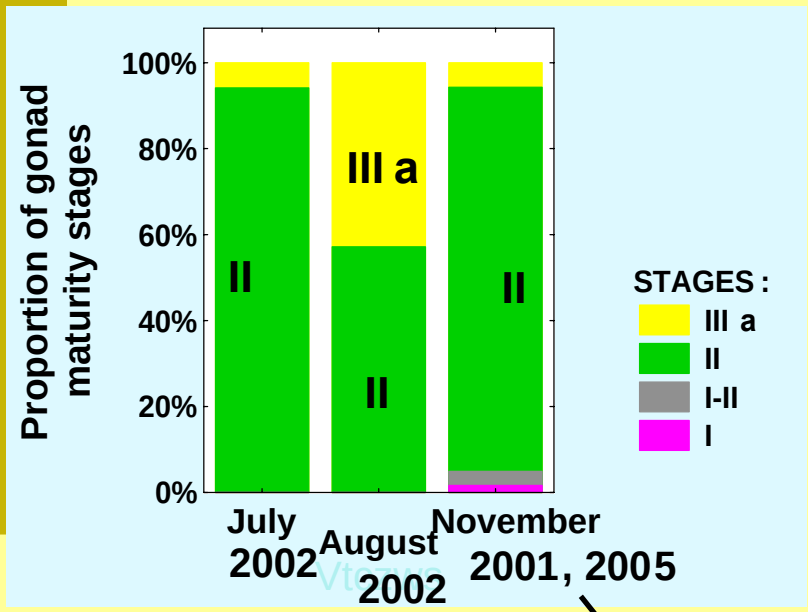
**in subtropical waters**

**Females mature at a length (SL) of 61 mm, probably, at a smaller size.**

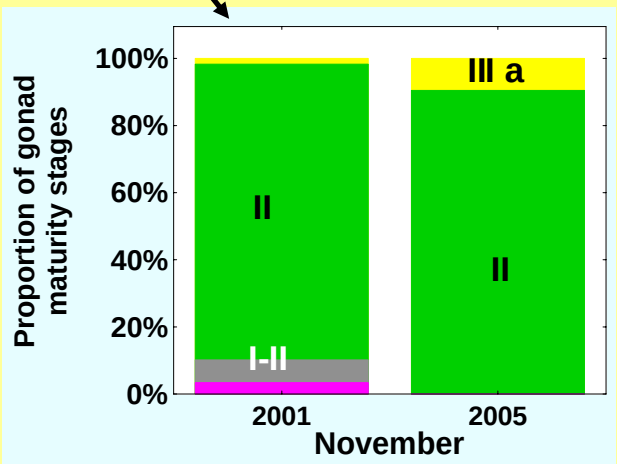


# Gonad maturity stages

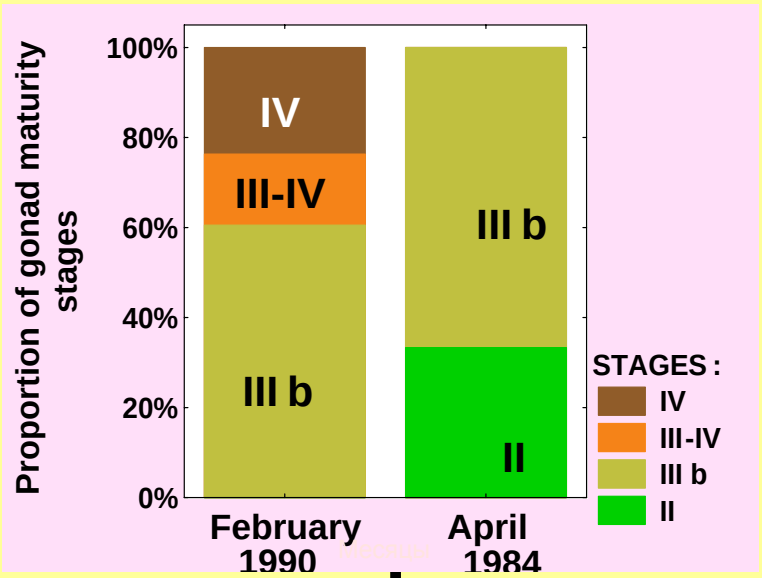
## Kuril and open waters




Mature females were not found in Kuril and open waters

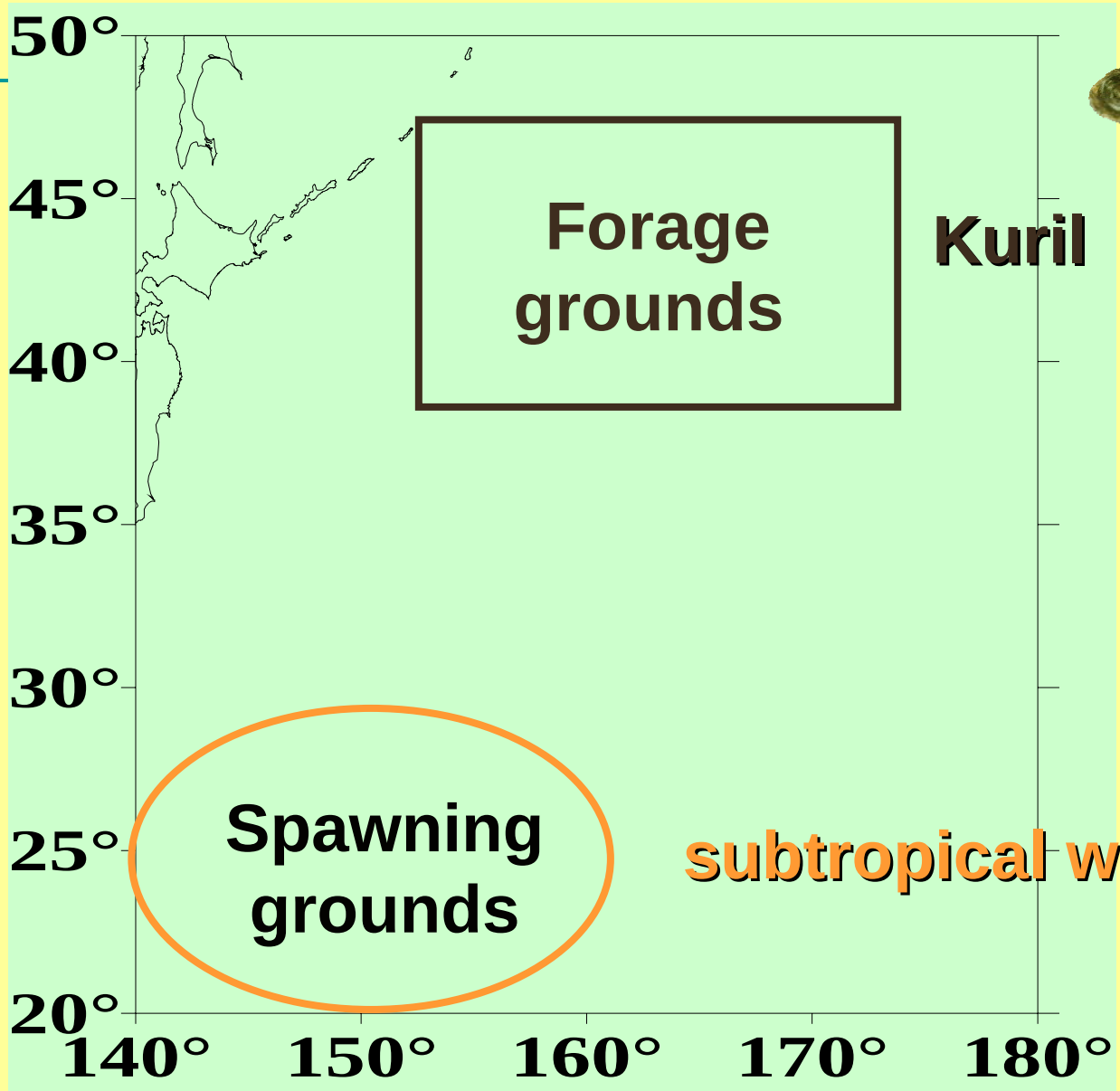



## subtropical waters




The presence of females at stage IV in the early February suggests that spawning may occur in winter and spring in subtropical region

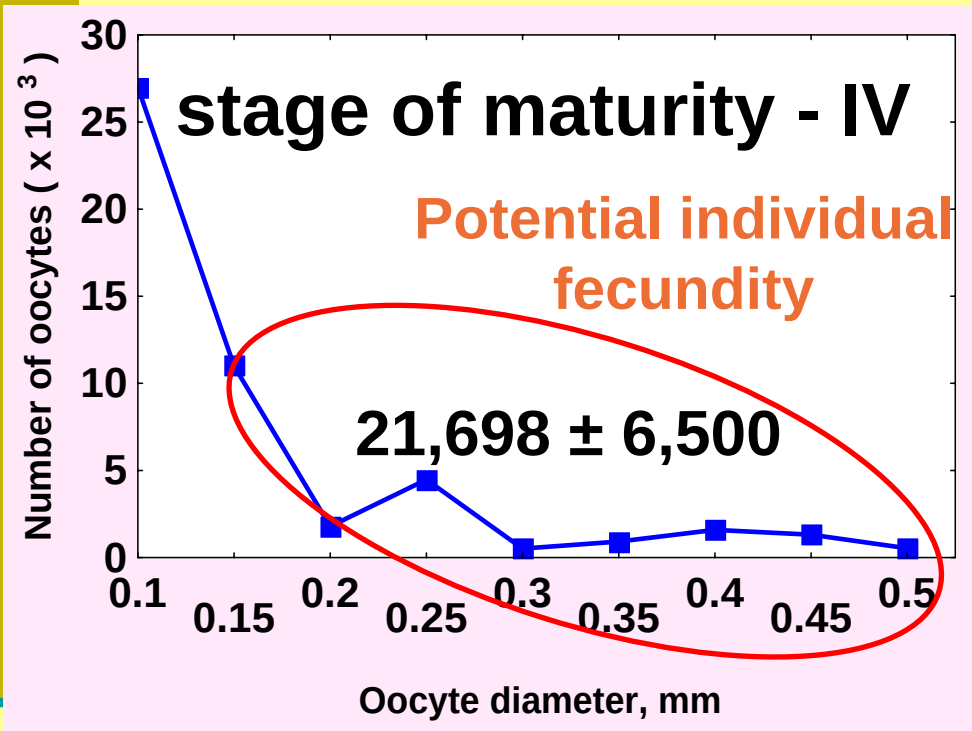
# *Ceratoscopelus warmingii*




**Kuril and open waters**

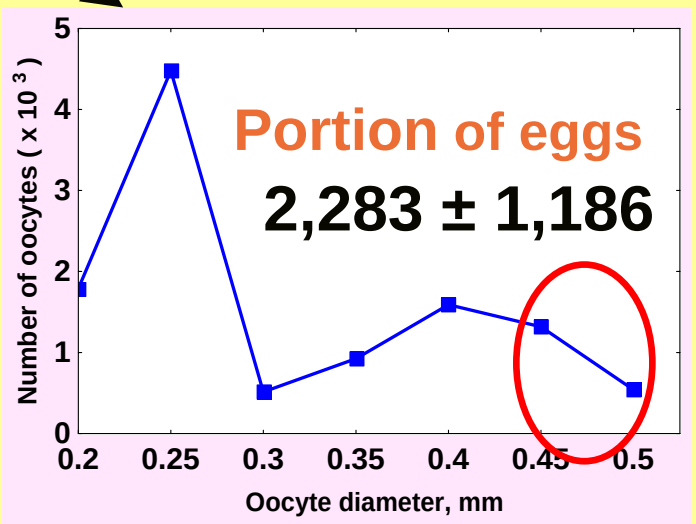
**subtropical waters**

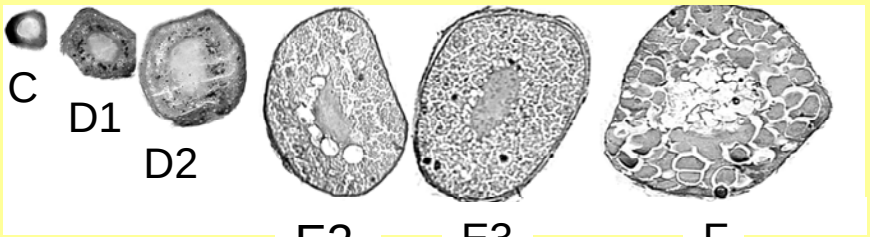
# The type of oogenesis and Fecundity




enlarged

**The oogenesis is continuous and oscillating**

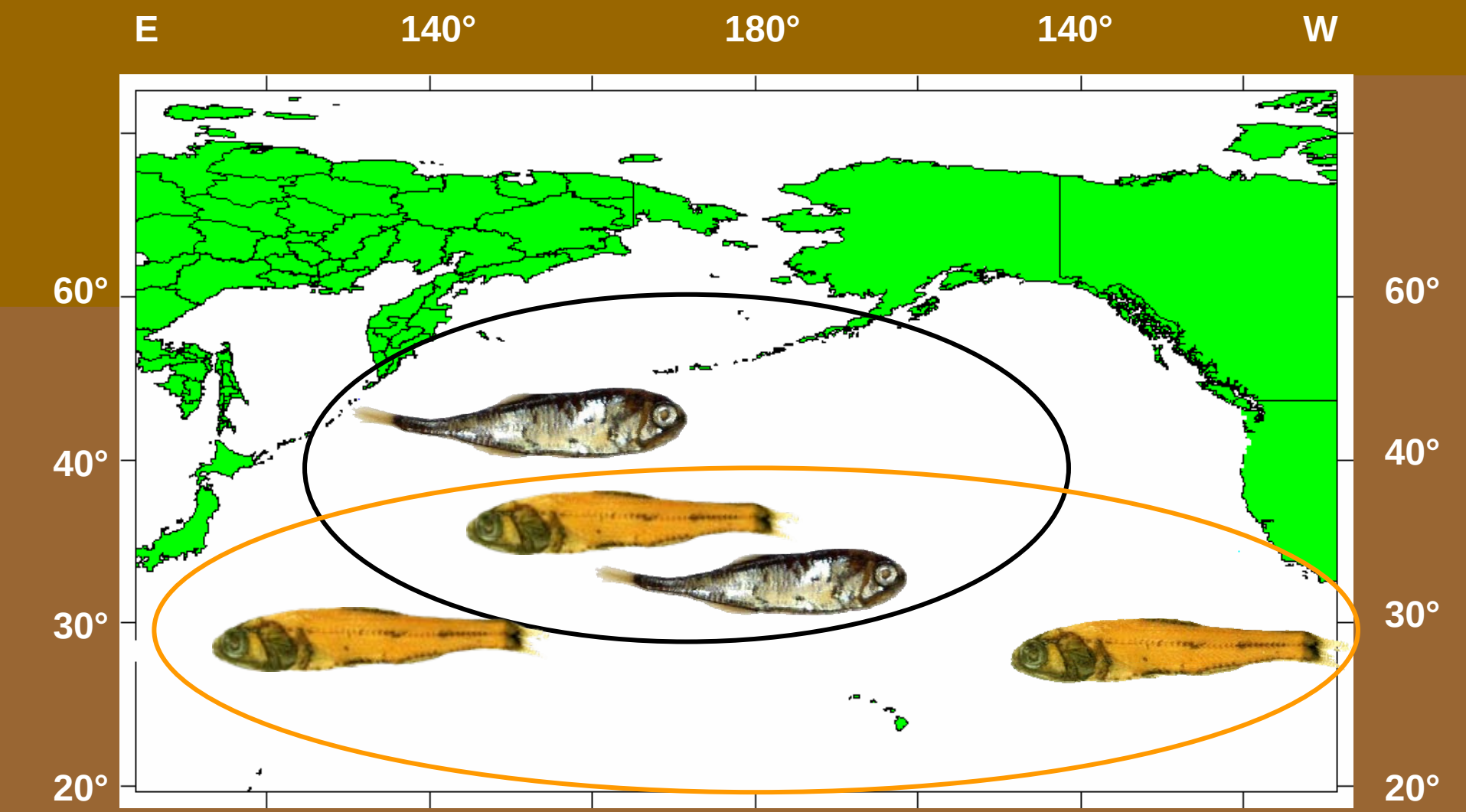



**Development phases of the oocytes**

| | Potential individual fecundity | Egg portion | Biomass in the subarctic waters | Biomass in the epipelagic zone of Kuril and open waters |
|---|---|---|---|---|
| *T. crenularis taylori* | 51,379 ± 7,282 | 5,150 ± 2,905 | 19, 000 t | 15, 900 t |
| *C. warmingii* | 21,698 ± 6,500 | 2,283 ± 1,186 | 120, 000 t | 26,500 t |

The frequency of spawning events is higher and the spawning season is longer in *C. warmingii*, than those in *T. crenularis taylori*




***T. crenularis taylori*** **is characterized by latitudinal distribution.**

***C. warmingii*** **is characterized by meridional distribution.**

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Both species are well adapted to the environment

# CONCLUSIONS:

- **- *T. crenularis taylori* spawn (summer-autumn: July-August, November) and forage in Kuril and open waters of the northwestern Pacific Ocean; in subtropical waters, only spawning of this species occurs (spring: April-May).**

- **- *C. warmingii* spawn in subtropical waters (winter-spring: February-April) and forage in Kuril and open waters (summer-autumn: July-August, November).**

- **- number of eggs in one spawning portion is 5,250±2,905 in *T. crenularis taylori*, and 2,283±1,186 in *C. warmingii*.**

- **- potential individual fecundity is 51,379±7,282 eggs in *T. crenularis taylori*, and 21,698±6,500 in *C. warmingii*.**

- **frequency of spawning events is larger and spawning season is longer in *C. warmingii* than in *T. crenularis taylori*;**
- **- oogenesis is continuous and accumulated in *T. crenularis taylori,* and continuous and oscillating in *C. warmingii*;**
- **- Both species are well adapted to the environment: they are eurythermic, widely distributed, have high fecundity and relatively high biomass. *T. crenularis taylori* is characterized by latitudinal distribution pattern. *C. warmingii* is characterized by meridional distribution pattern.**

# THANK YOU FOR YOUR ATTENTION