Sampling efficiency of ichthyoplankton in the northern Bering Sea : an inter-gear comparison

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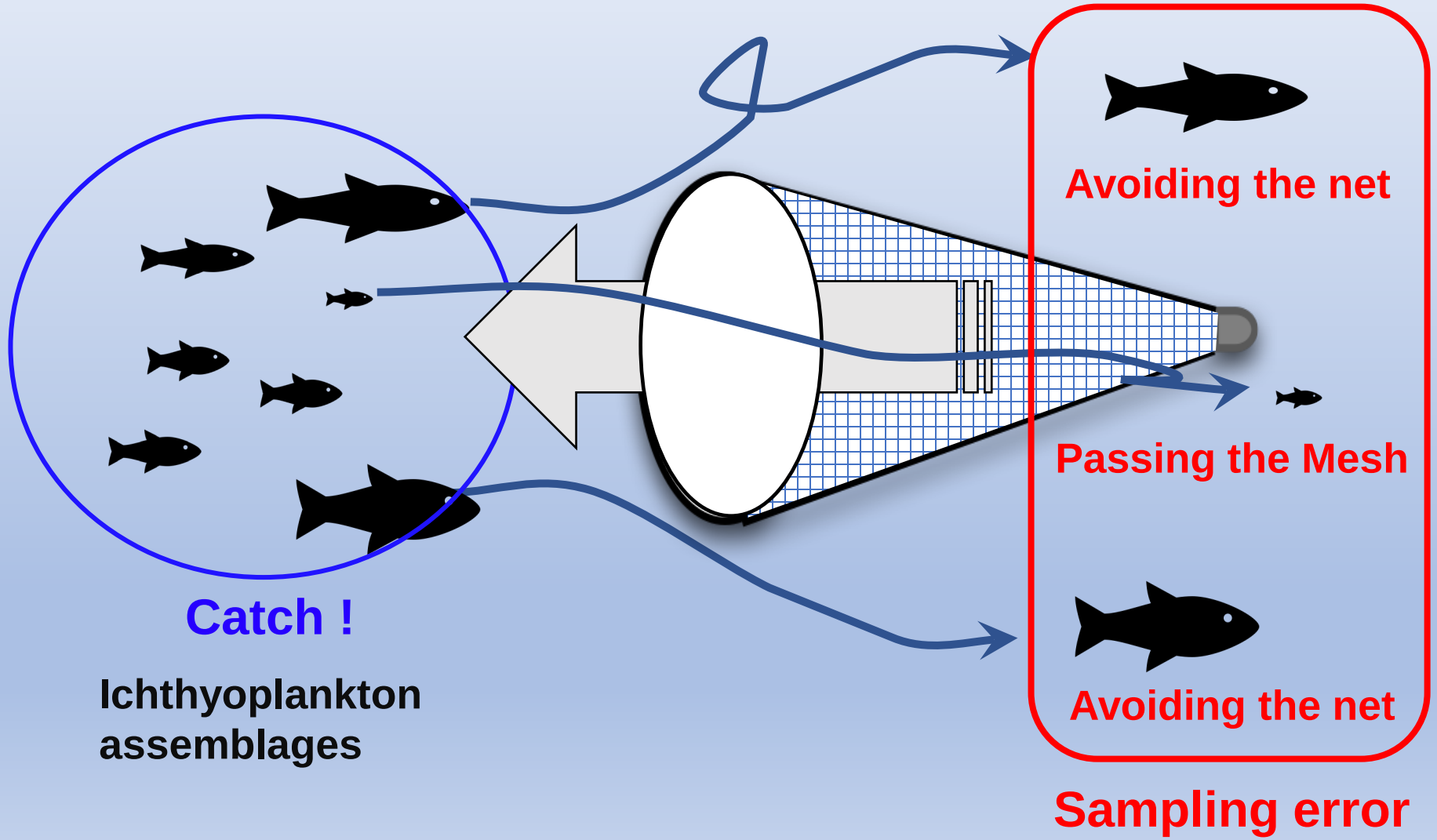
PICES-2018 Annual Meeting: Bio-Paper Session

Errors& biases in ichthyoplankton sampling



Objectives

1. **To compare the sampling efficiency**
   - ✓ **Difference in density estimate**
2. **To evaluate the biases due to gears**
   - ✓**Difference in size selectivity**

Gears compared

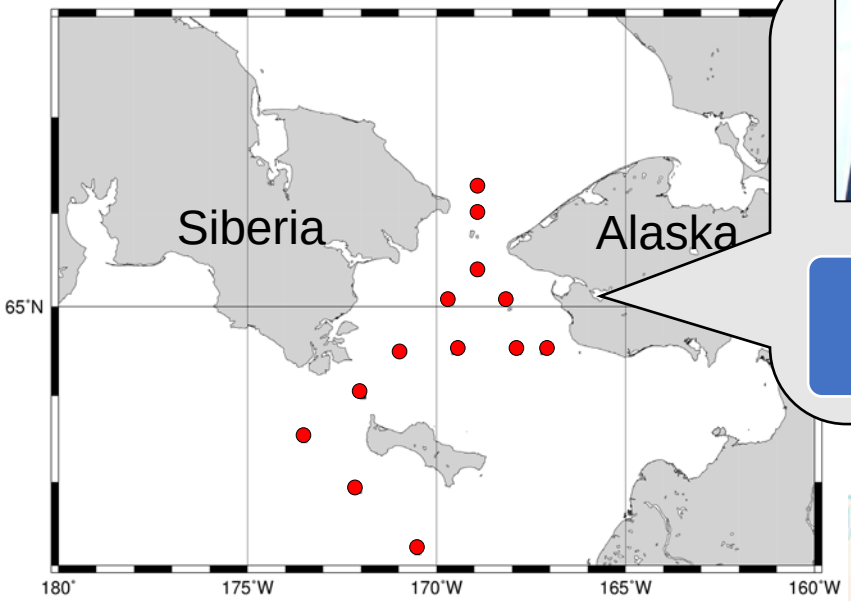
Ring net

Bongo net

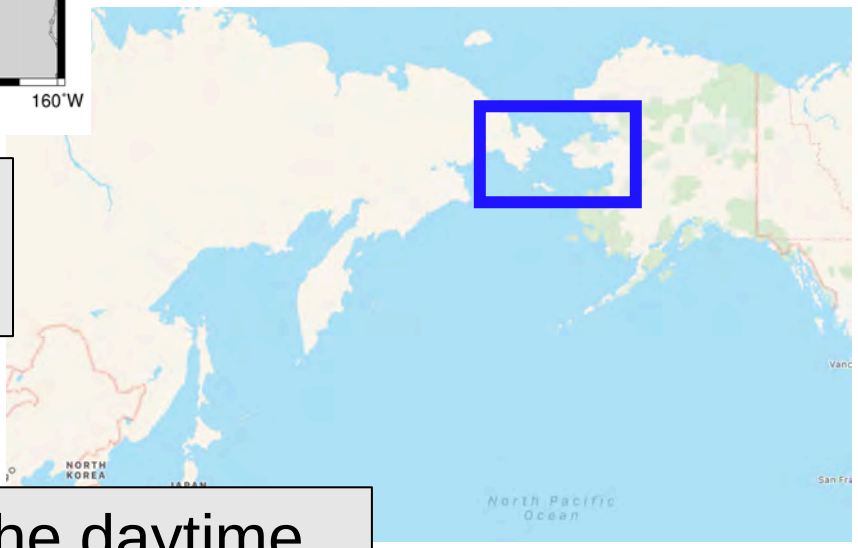
MOHT
（Matsuda-Oozeki-Hu-Trawl）

	Ring	Bongo	MOHT
Mouth opening (m^2)	1.3	0.38	2.0
Mesh size	0.33mm	0.5mm	1.4mm
Towing method	Sea surface	Oblique	Oblique
Towing speed (knot)	2	1.5	3
Main Target	Fish larvae	Plankton	Micronekton

Sampling procedure



1.Ring → 2.Bongo → 3.MOHT



Where: Northern Bering Sea and Bering strait

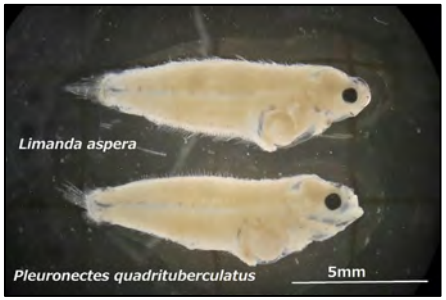
When: July, 2017

How: 13 stations during the daytime

Sample processing & Comparison

Sampling efficiency

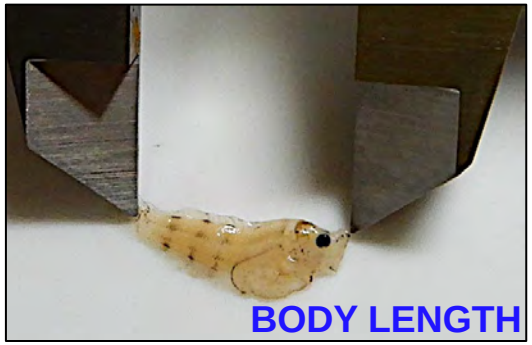
1. Sorting
2. Species ID.
3. Counting
4. Density estimate
5. Measurements
   - Body length
   - Body depth
6. Comparison of size composition

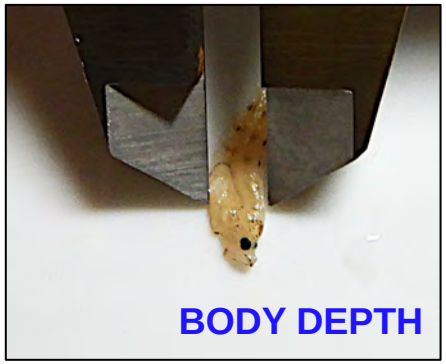


Type 1

Type 2

Sampling biases

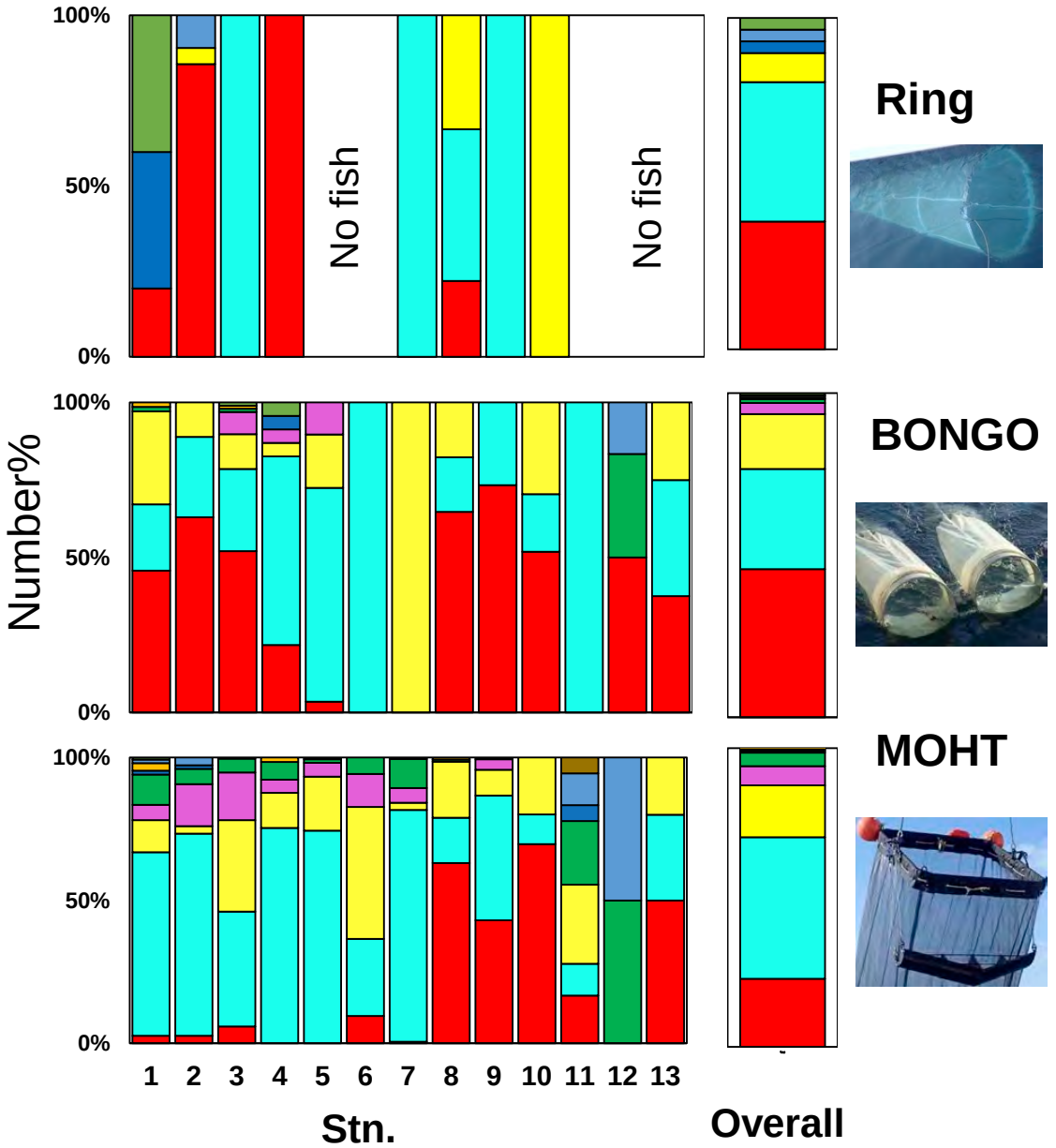




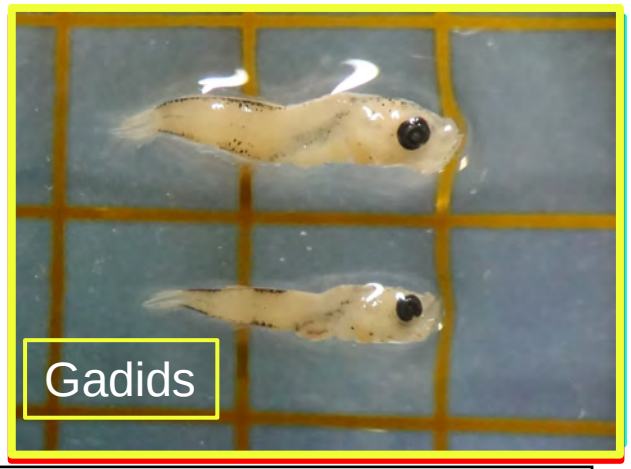
Statistic tests

1. Effect on catch composition: comparison among multiple factors using PERMANOVA
2. Comparison of estimated density: Holm's method of multiple comparison
3. Comparison of estimated abundance of given body size: Man-Whiteny's *U*-test

Species composition



- 10 taxa
- Dominant groups
  - Flatfish (type1)
  - Flatfish (type 2)
  - Gadids (3 spp.)

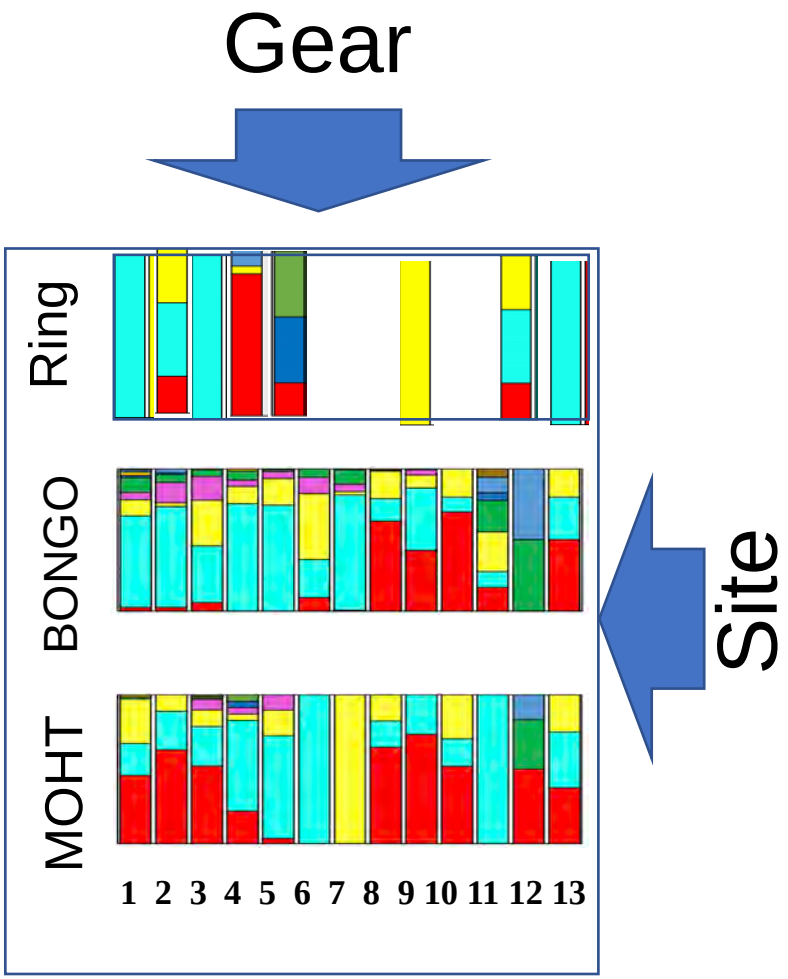


- Flatfish spp.1 (*Ls* +*Pq*)
- Flatfish spp.2 (*Hippoglossoides*)
- Gadids (3 spp.)
- Flatfish spp.3
- Snailfishes
- Alligatorfishes
- Sandlance
- Pricklebacks
- Sculpins
- Greenland halibut

Permutation Analysis of Variance (PERMANOVA)

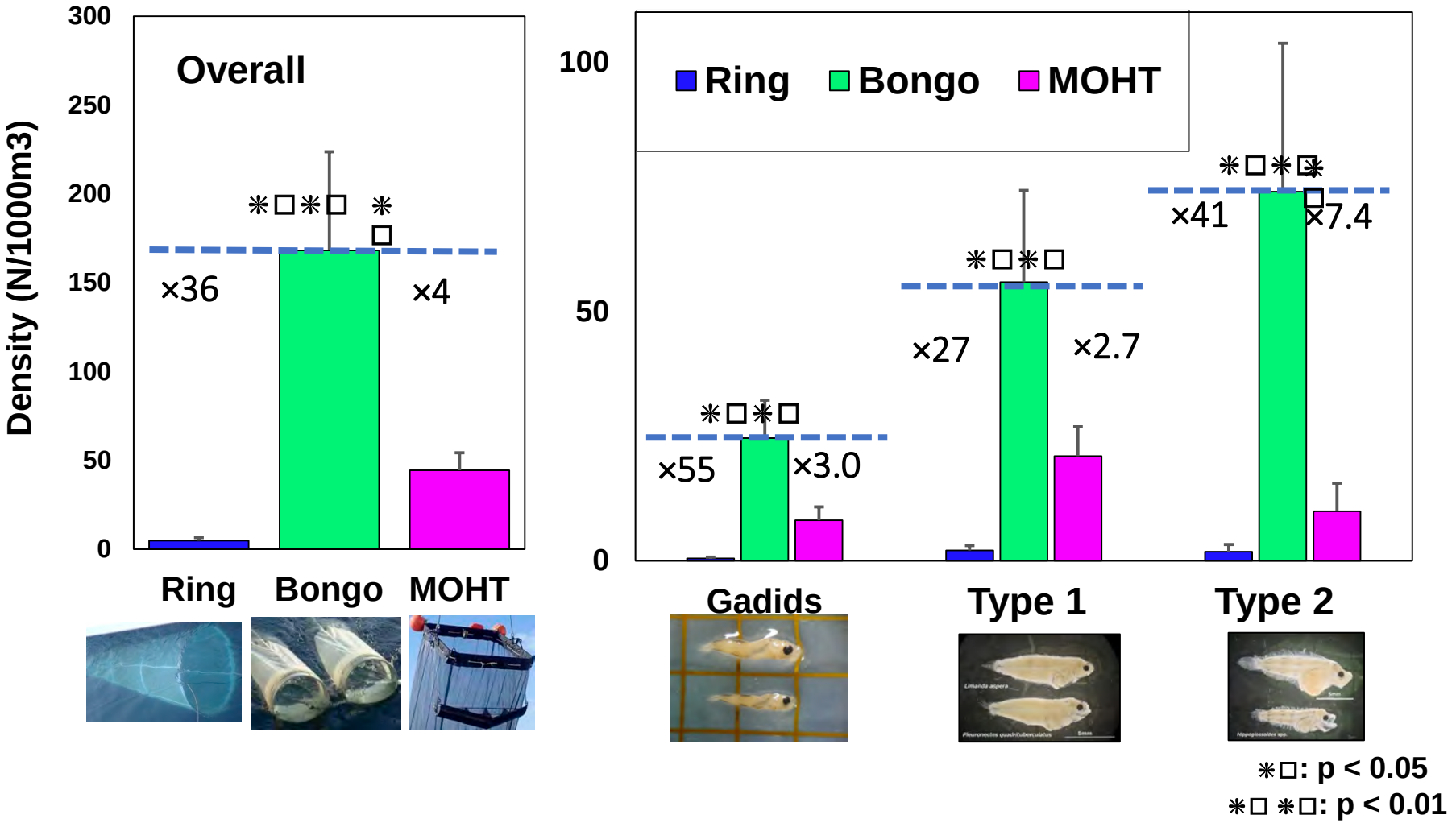
-PERMANOVA-

- Multivariate analysis of variance using permutation
- to test which factor was more important



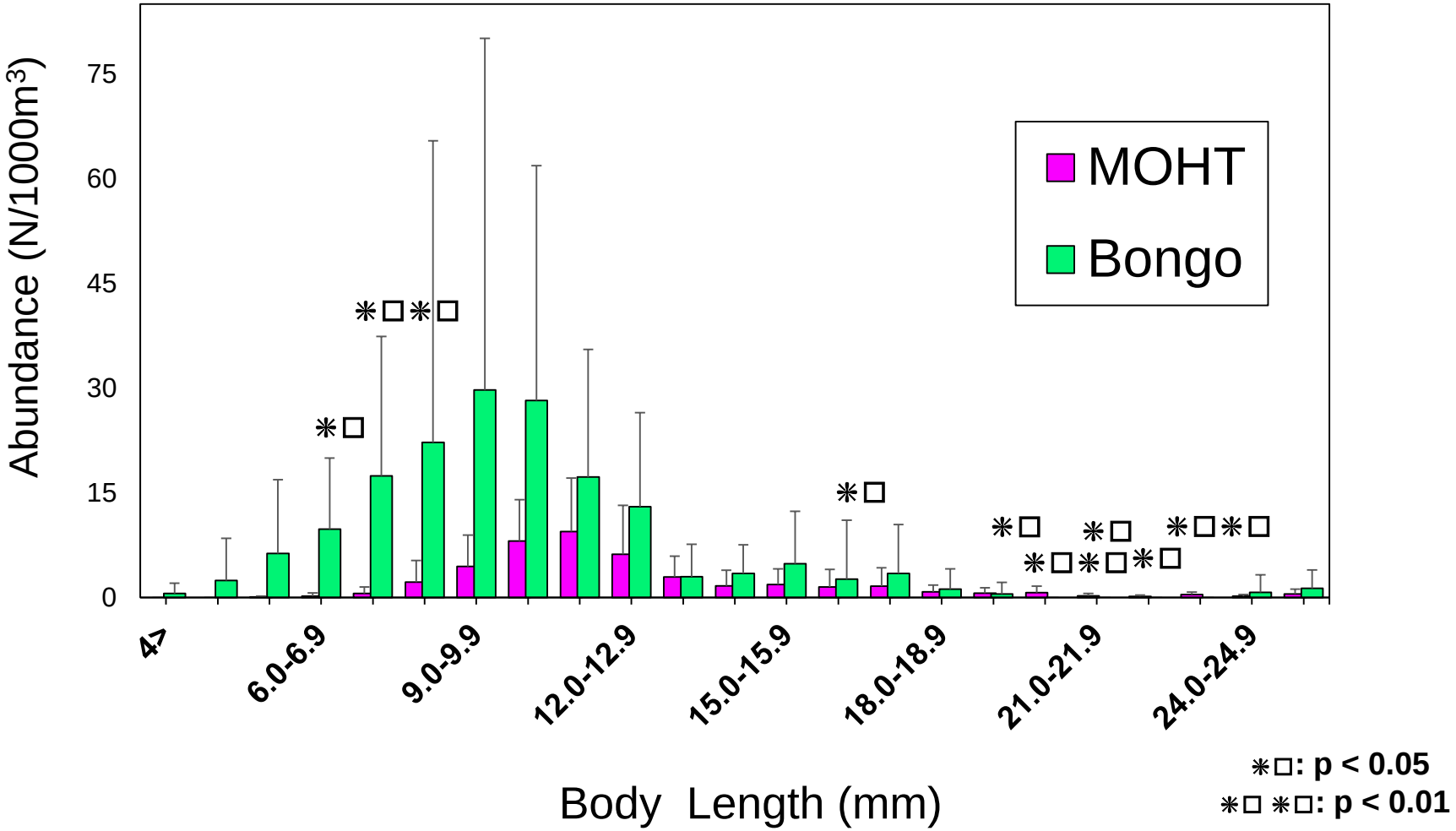
	DF	SS	F. Model	R2	Prob.	
Site	1	0.681	2.573	0.063	0.021	*
Gear	1	1.657	6.260	0.153	0.001	***
Site: Gear	1	0.530	2.003	0.049	0.044	*
Residual	30	7.940		0.735		
Total	33	10.807		1.000		

Comparison of sampling efficiency



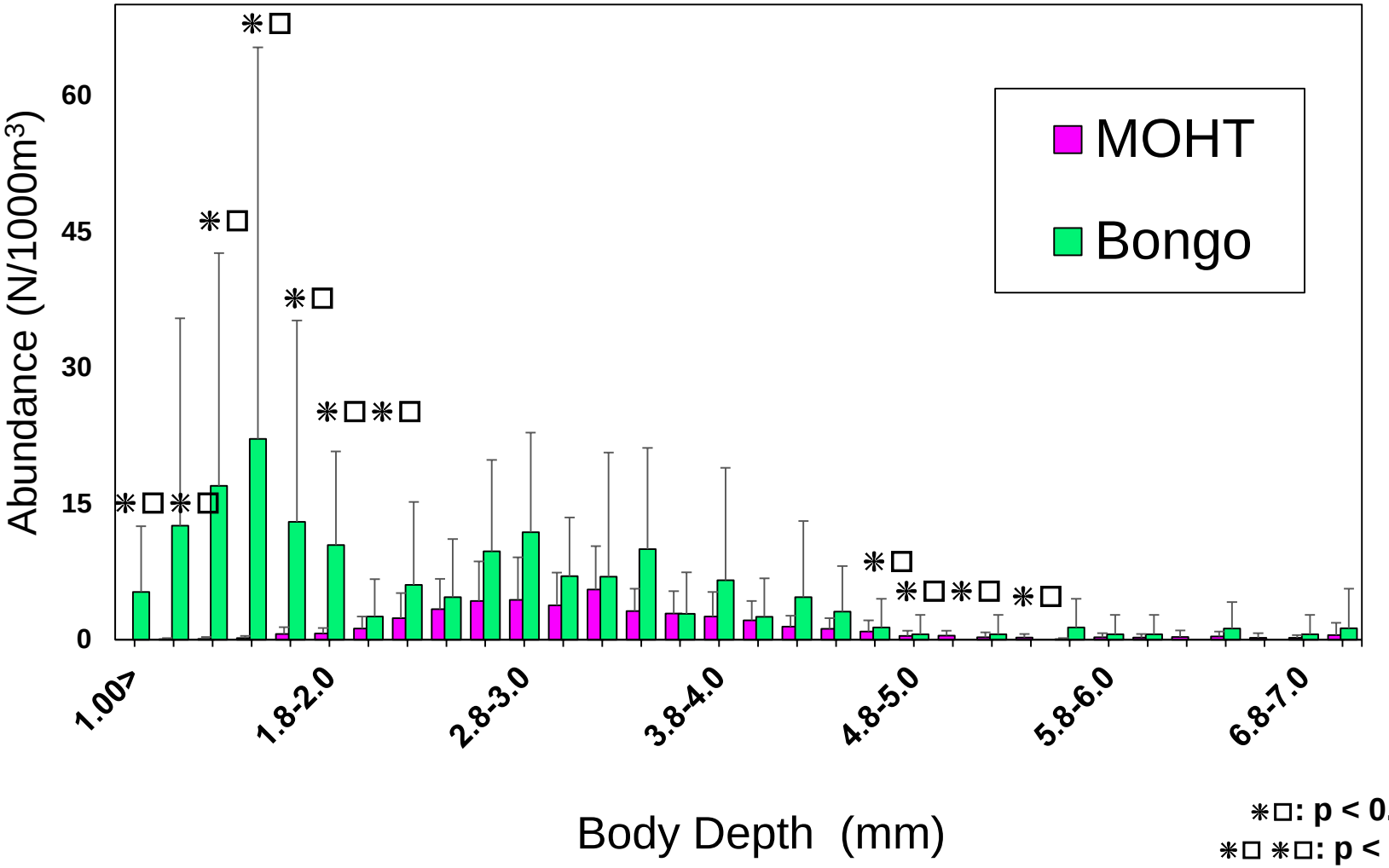
Bongo-net: most effective (in terms of estimated density)

Comparison of BL Freq. Distibution between gears



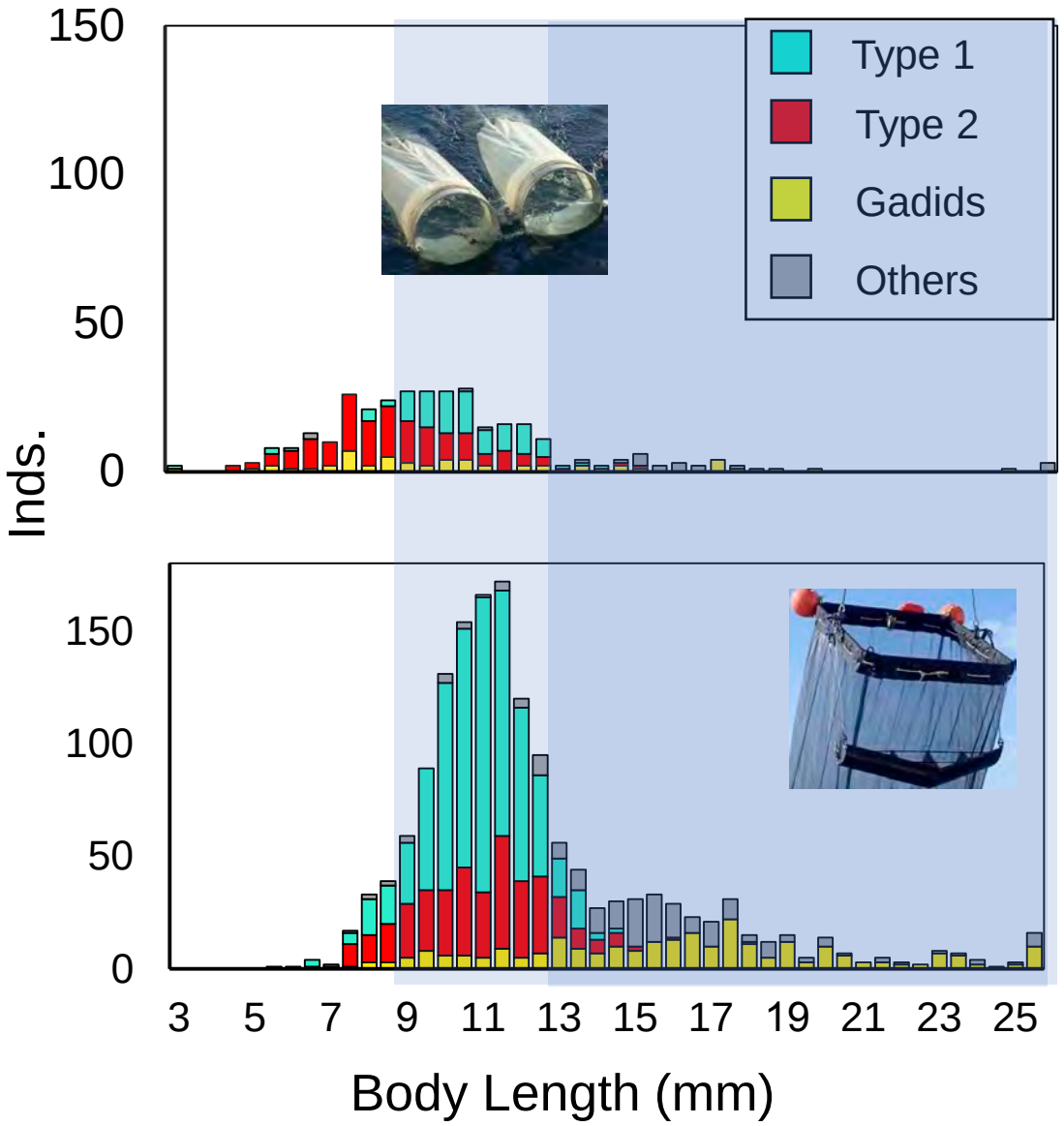
Bongo net favors smaller individuals?

Comparison of BD Freq. Distibution between gears



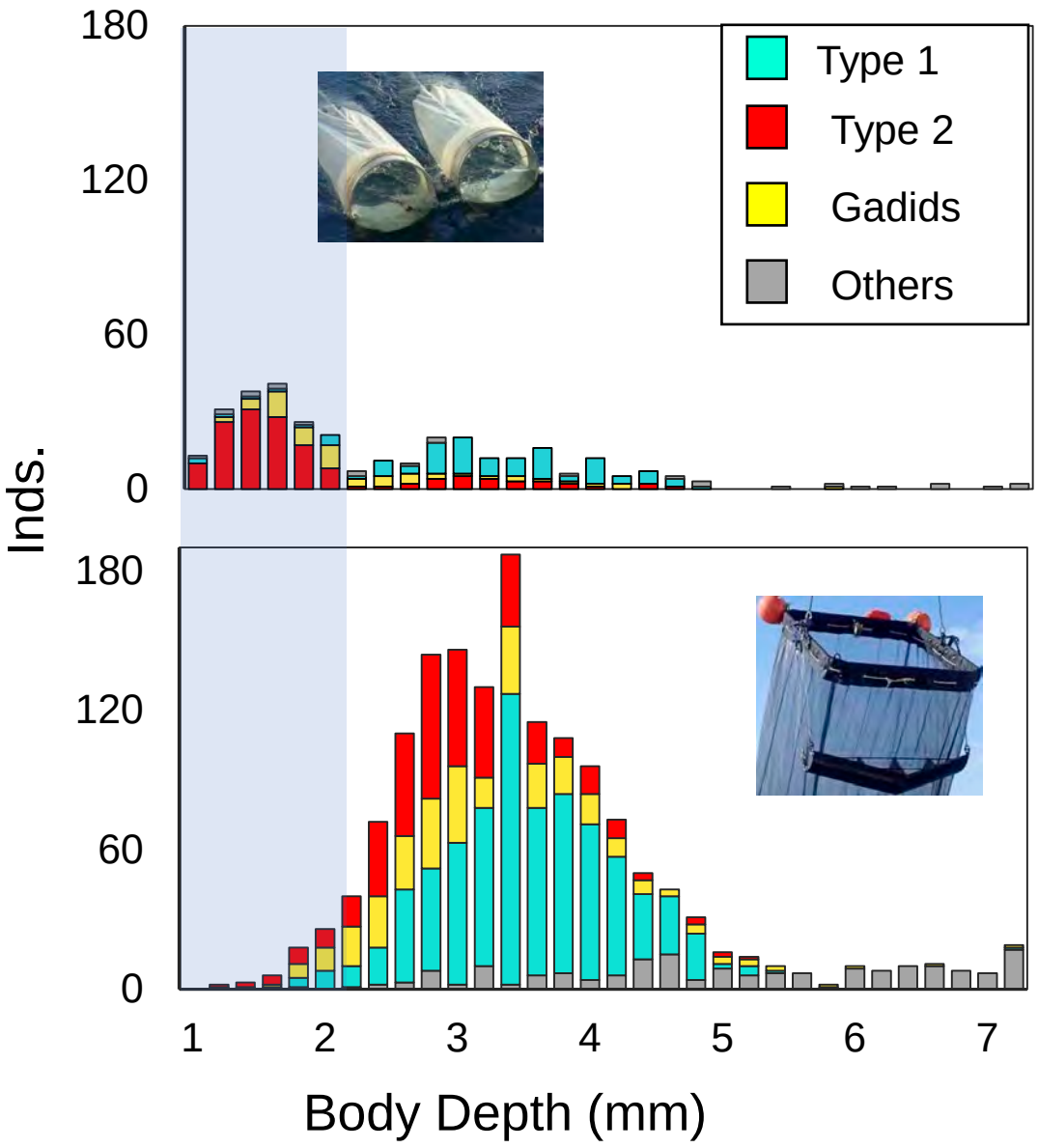
Larvae would slip out the net?

BL Freq. Distibution of overall larvae

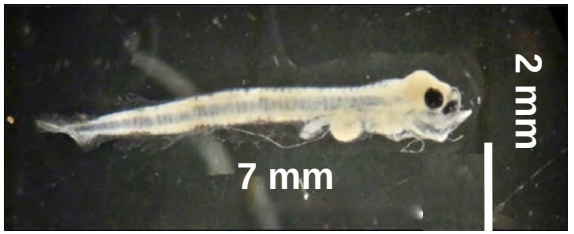


- All species combined
- 13 tows for each gear
- MOHT caught more inds ≥ 9mm BL
- BONGO caught few fish ≥ 13 mm BL
  perhaps due to avoidance
- MOHT: recommended for sampling of late stage larvae and juveniles
  - e.g. when large number of larvae is needed for otolith analysis

BD Freq. Distibution of overall larvae

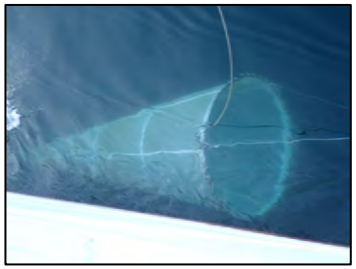


- BONGO caught substantial # of <2 mm fish (i.e. Bering flounder)
- 2 mm BD is equivalent to 7 mm BL (early larvae)
- MOHT is inadequate for sampling of early stages of larvae‥
- but is still effective for collecting >2 mm BD larvae



Type 2

Summary



Ring net

- inadequate for larvae sampling in NBS

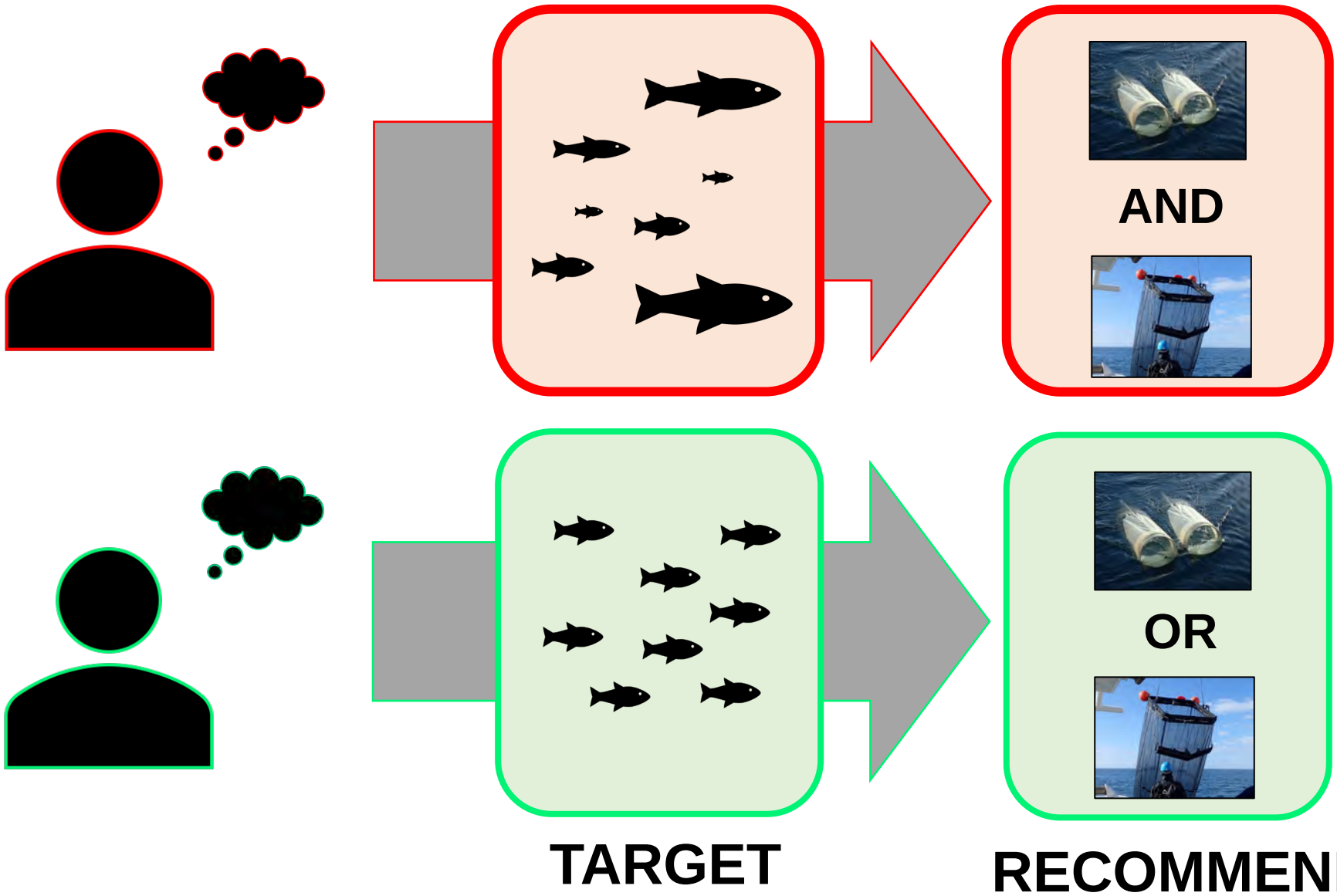
Bongo net

- the best gear when larvae with Body Depths ≤ 2mm are targeted

MOHT

- Useful for sampling late stage larvae with body depths >2 mm (i.e. >10mmBL)

Conclusion



Thank you for your attentions!