

# Numerical simulations of spatio-temporal distribution of juvenile walleye pollock around Hidaka Bay

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# 1. Introduction (Research Motivation)

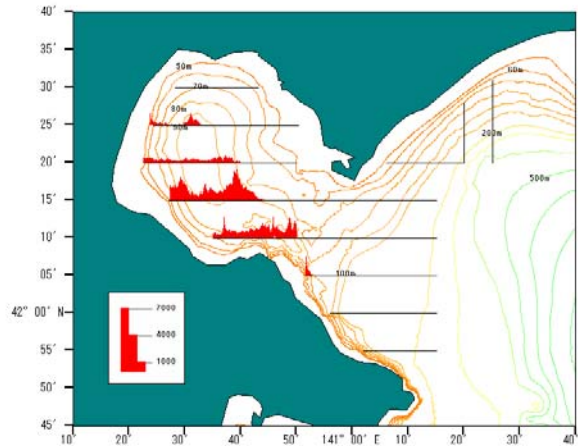
Spatial distribution pattern of juvenile walleye pollock in Funka Bay (northeastern of Hidaka Bay) in April



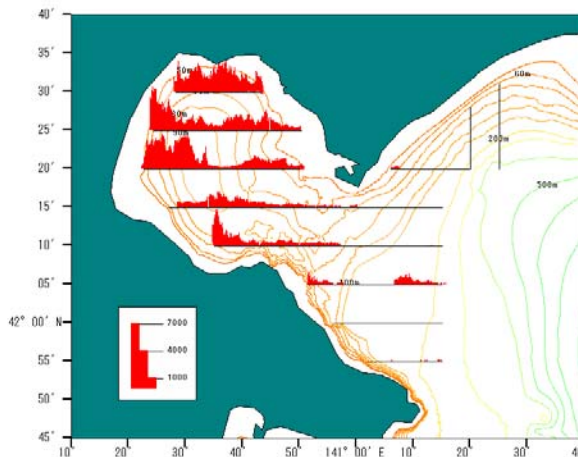
Being biased spatially [Funamoto, 2010, *in prep.*]

# Spatial distribution pattern of juvenile walleye pollock in Funka Bay (SA values)

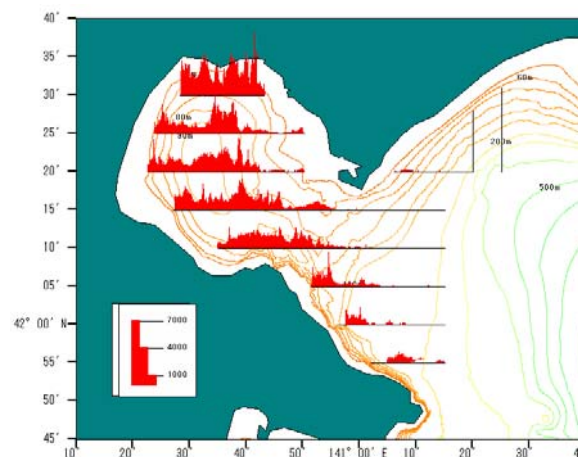
2005



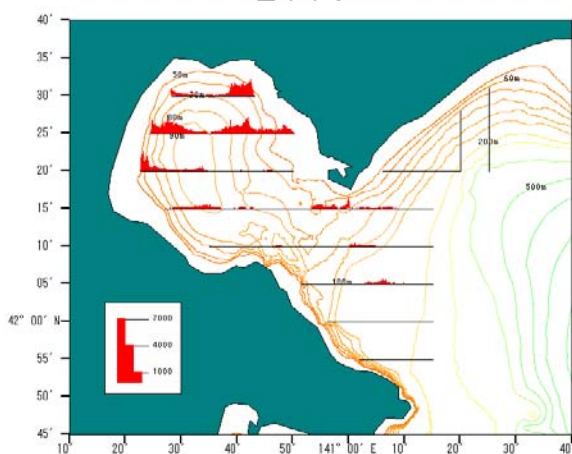
2006



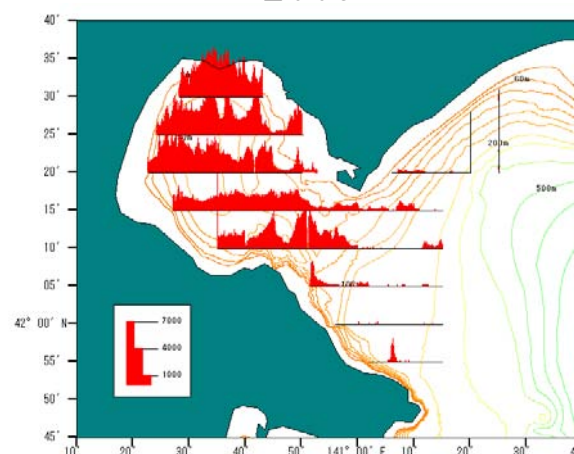
2007



2008



2009



[Funamoto, 2010, *in prep.*]

# 1. Introduction (Research Motivation)

Spatial distribution pattern of juvenile walleye pollock in Funka Bay (northeastern of Hidaka Bay) in April



Being biased spatially [Funamoto, 2010, *in prep.*]



#) Why being biased?

#) Where & How the juveniles come from?



It is difficult to clarify by observations...?



Let's carry out the numerical simulations!; using numerical model...

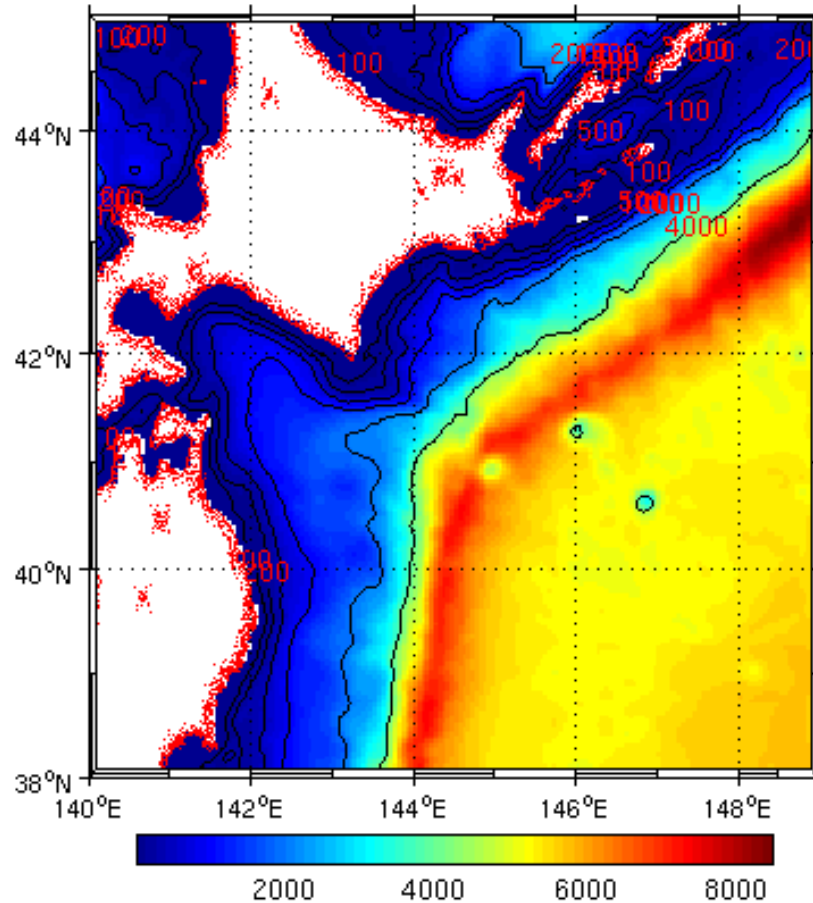
#) Particles Tracking Experiments

#) Individual Based Model (IBM) Experiments

## 2. Specifications of Numerical Simulations

Using ...  
Calculated  
For Particle  
Using the

Use  
#  
#



IF Ver. 1.1)

To clarify

\*) Whe

come from?

\*) When & How juvenile walleye pollock in Funka Bay in April hatch & glow?

ROMS Calculation Region

in April

### 3. Particle Tracking Experiment; part 1

Based on 1) [Maeda, 1990]

2) "Temporally Backward Particle Tracking Experiments"

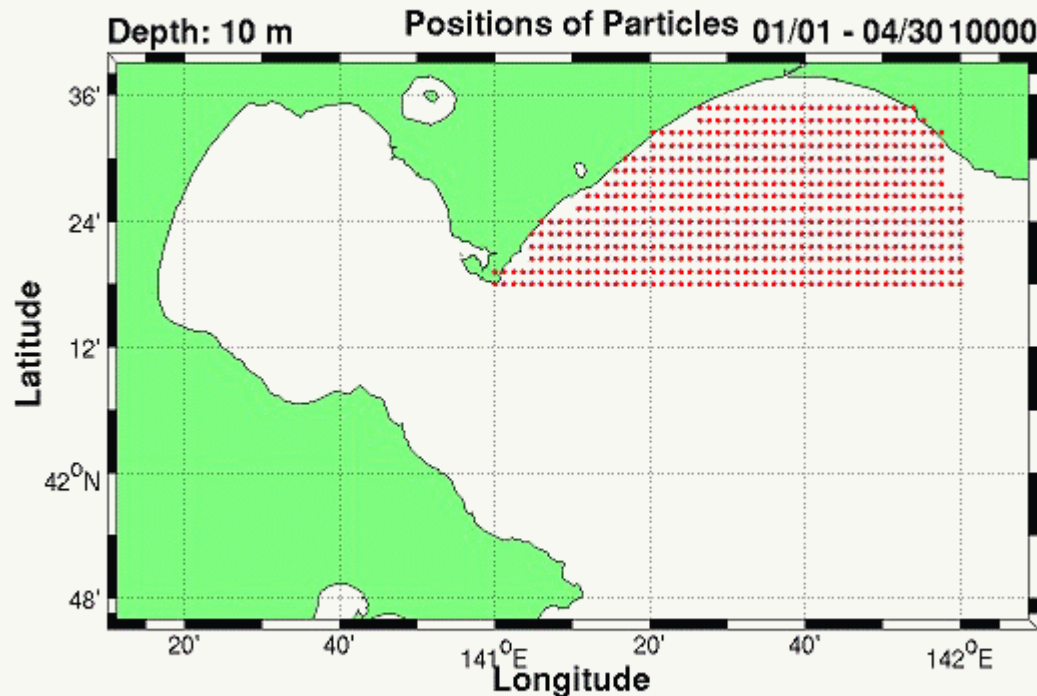


Method

\*) P

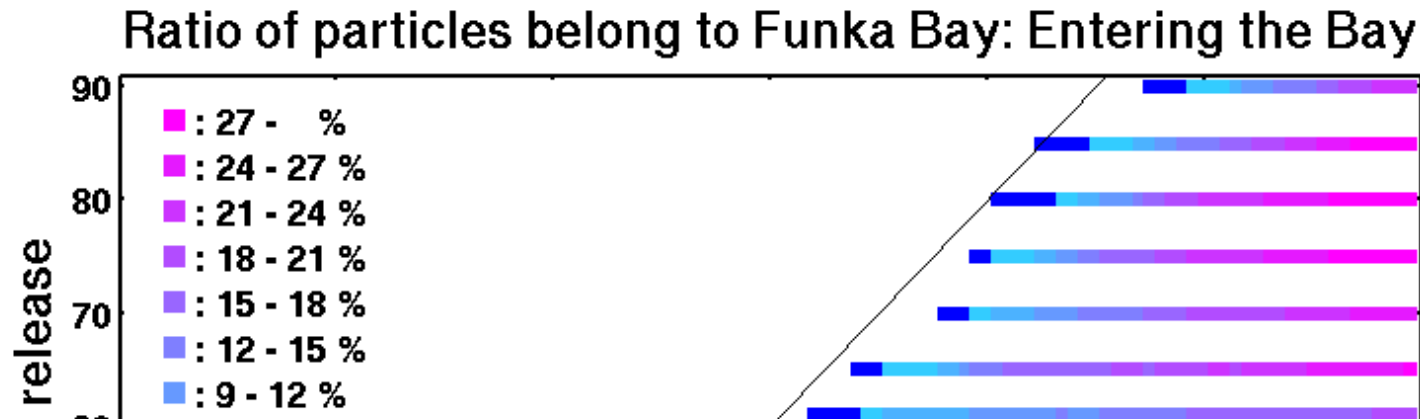
\*) P

\*) T

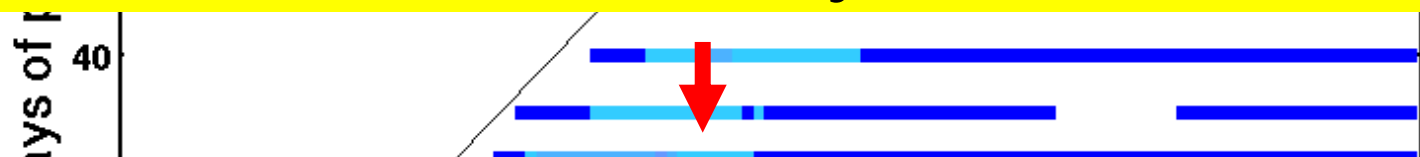


pth:  
Bay),

# Time series of ratio of particles in Funka Bay to all released particles in off-Tomakomai at each released day



Released in Jan. & Feb. → Hard to enter into Funka Bay  
 Released in March → Easy to enter into Funka Bay



“Particles in Funka Bay in April”

→ “Come from off-Tomakomai in March”

- \* ) Enter into Funka Bay along with Coastal Oyashio
- \* ) Anticlockwise Flow in Funka Bay
- \* ) Therefore, spatial distribution pattern is biased

Serial elapsed days

## 4. Particle Tracking Experiment; part 2

Purpose:

Investigating Residence Time of Particles in Funka Bay

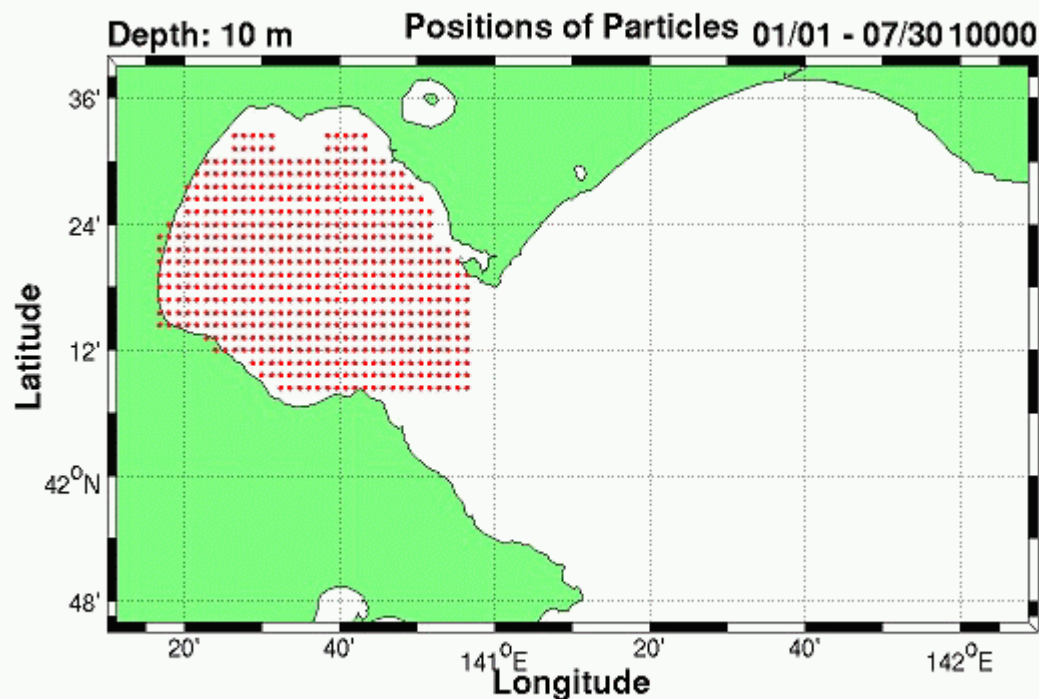


Method

\*) Pa

\*) Pa

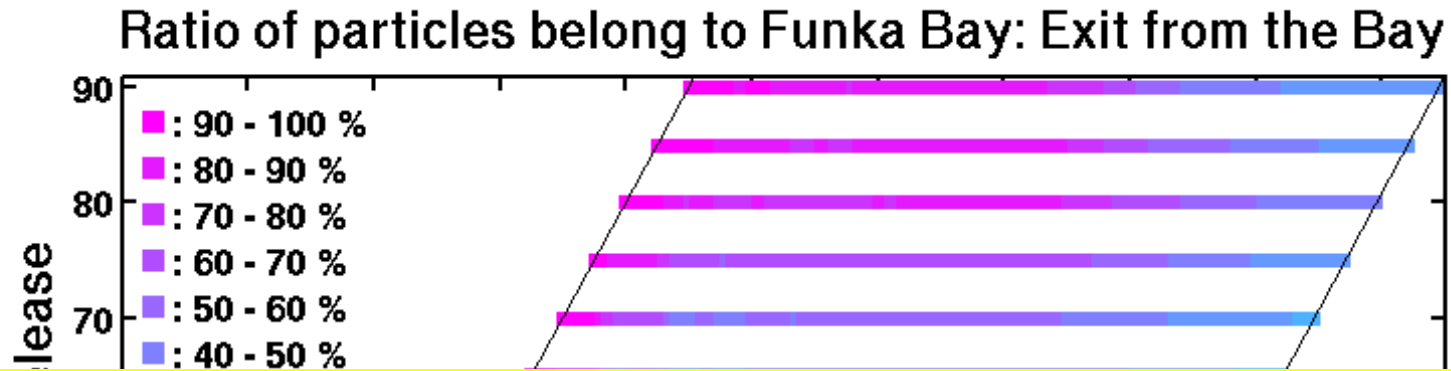
\*) Tr



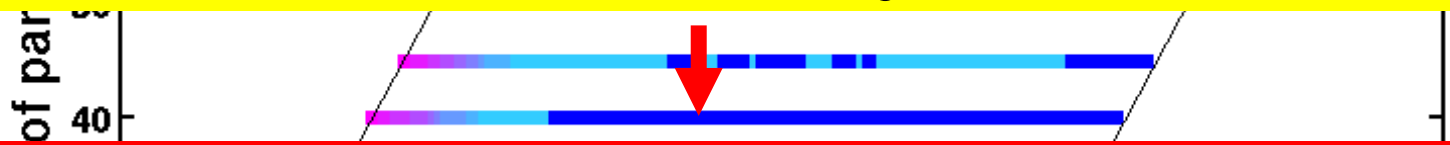
Method:



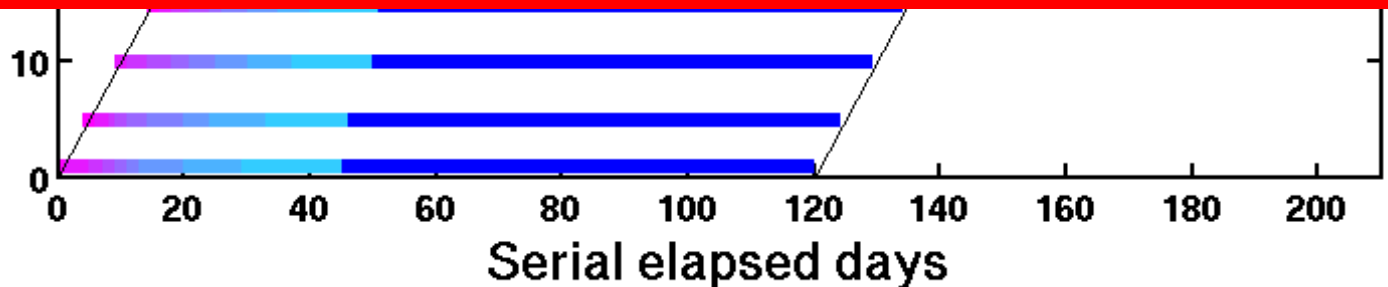
Time series of ratio of particles remaining in Funka Bay to all released particles at each released day



Jan. – Feb. : Soon Exit from Funka Bay within 1 month  
 March : Remain in Funka Bay for 2-3 months



Particles released in off-Tomakomai in March enter into Funka Bay along with Coastal Oyashio, then remain in Funka Bay with flowing in anticlockwise direction



## 5. Individual Based Model (IBM) Experiments

### Purpose:

Investigating when & how juvenile walleye pollock in Funka Bay in April hatch & grow



### Method:

Apply ...

- 1) Equations of Temperature-dependent Embryonic Developmental 4 Stages [Yabe *et al.*, 2010, *in prep.*]
- 2) Equation of 'Climatological' Time-dependent Estimated Fork Length at Juvenile Stage [Nishimura *et al.*, 2007, FO]

To ...

Consequences of "Particle Tracking Experiment; part 1"

Then ...

Compare with Observed (2005-2007) Hatch Day & Fork Length

# Time series of mean embryonic developmental stage & estimated fork Length in Funka Bay at each released day

## Mean Embryonic Developmental Stage & Estimated Fork Length

### IBM Experiments

→ Reasonable Qualitatively

But ...

Uncertain Quantitatively : Little particle is around the Observed

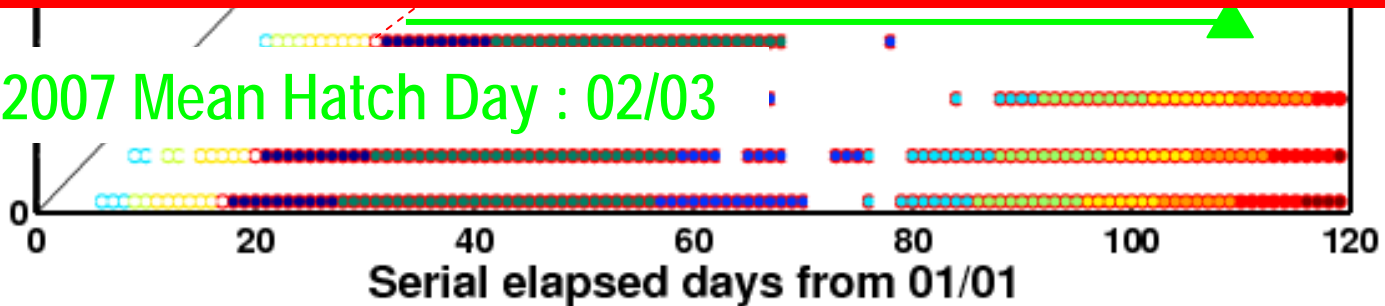


Spawning ground (i.e., Particle release place) of juvenile walleye pollock in Funka Bay in April in 2005-2007 is

NOT off-Tomakomai?;

→ Different from Climatology?

2005-2007 Mean Hatch Day : 02/03



## 6. Summary

Spatial distribution pattern of juvenile walleye pollock in Funka Bay (northeastern of Hidaka Bay) in April

### #) Why being biased?

→ Eggs and/or the juveniles enter into Funka Bay along with Coastal Oyashio, then remain there with flowing in anticlockwise direction

### #) Where & How the juveniles come from?

From previous study & this time numerical simulations ...

“Spawned in off-Tomakomai in March, and enter into Funka Bay along with Coastal Oyashio” ... (#)

From observational mean (2005-2007) data ...

(#) : Uncertain ... (Not Confirmed ...)

**Need to execute NOT the Climatological  
BUT the Real Condition numerical simulations**

# Acknowledgements

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**Thank you very much!**

**And... thanks in advance ever.**