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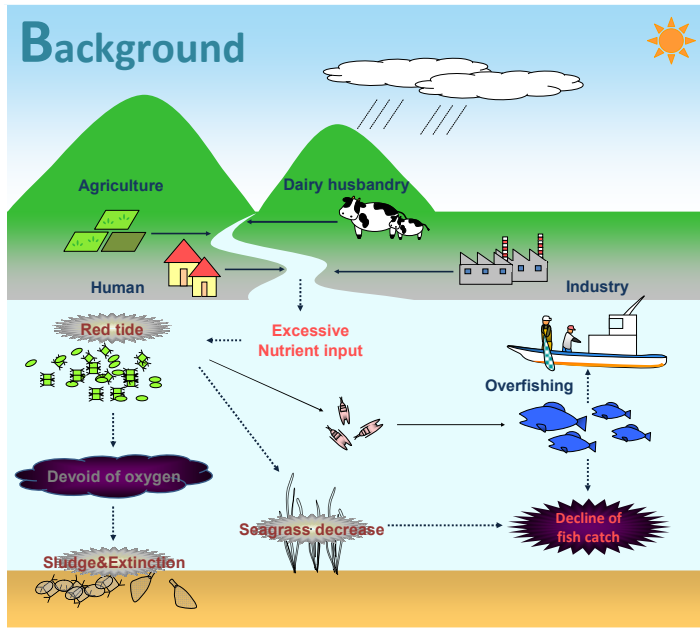
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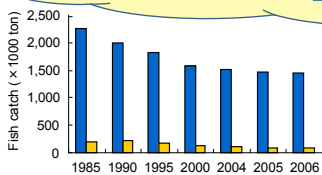
# Seasonal change of nitrogen cycling in Hichirippu-lagoon: Get tough for sustainable use of the coastal area

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## Background



Coastal problems are increasing!  
Can we learn from unpolluted ecosystem?



The most of researches have been conducted on polluted area in the face of problems...

■ Coastal fishery  
■ Inland water fishery

## Results and Discussion

### Question1

In Hichirippu-lagoon, Which of the biological process is supporting the bird's population and fish catch?

Answer 1: Benthic ecosystem (Benthic micro algae and seagrass)

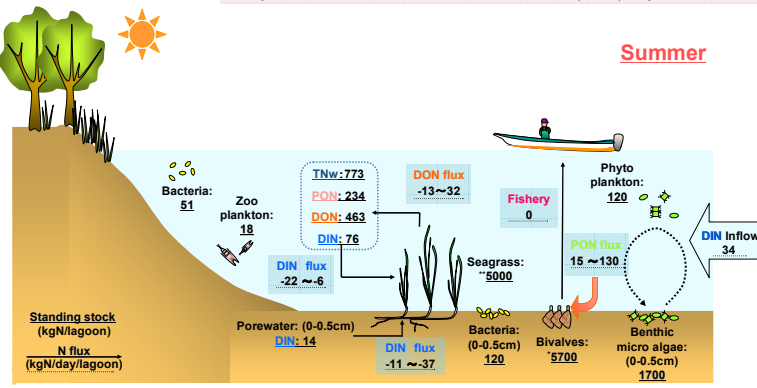
In polluted area: Benthic ecosystem has been destroyed!

### Question2

Nitrogen budget in Hichirippu-lagoon is considered well-balanced?

Answer 2: The mass balance of Hichirippu lagoon is perfect for sustainable use.

In polluted area: Excessive nutrient (DIN) input and overfishing



Phytoplankton: N/Chl a=16.5 Benthic micro algae: N/Chl a=5.6 Bacteria: fgN/cell=7.3 (Antia et al., 1963) (Montani et al., 2003) (Fukuda et al., 1998)

- Resuspension of benthic micro algae is a major contributor to nitrogen cycling.
- Bivalves filtrate overlying water and feed resuspended benthic micro algae.

These results suggest 2 recommendations for coastal problems.

- To restore benthic ecosystem
- Maintenance of mass balance (nutrient inflow and fish catch)

## Materials and Methods

### Study area

Unpolluted estuary, Hichirippu-lagoon

- Wetland under the Ramsar Convention
- Fish catch: 90 ton/yr (bivalves: clam)

### Sampling schedule

Bimonthly sampling  
April 2003-present

### Sample collection

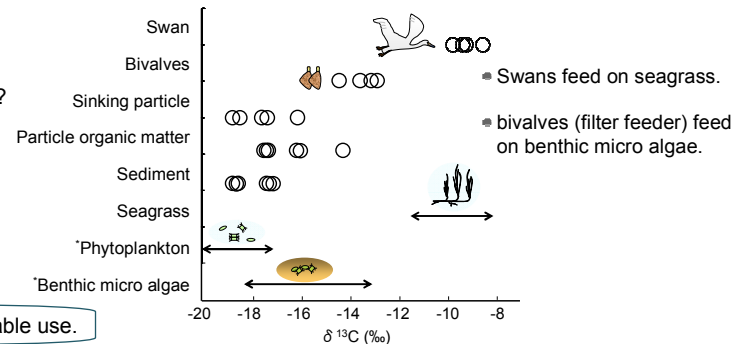
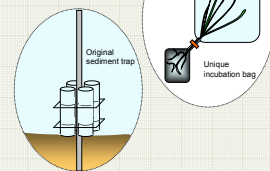
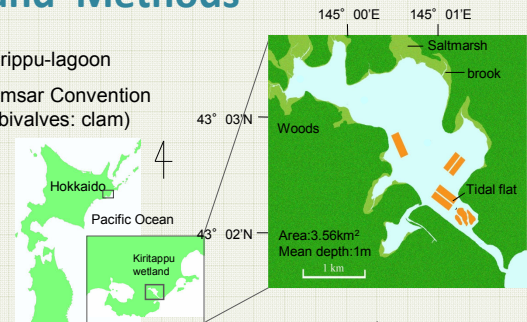
- Migratory birds: Number of species, population
- Excretion of migratory birds: Nitrogen content,  $\delta^{13}\text{C}$
- Water samples: Chlorophyll a,  $\delta^{13}\text{C}$  and

PON: Particulate organic nitrogen  
DON: Dissolved organic nitrogen  
DIN: Dissolved inorganic nitrogen

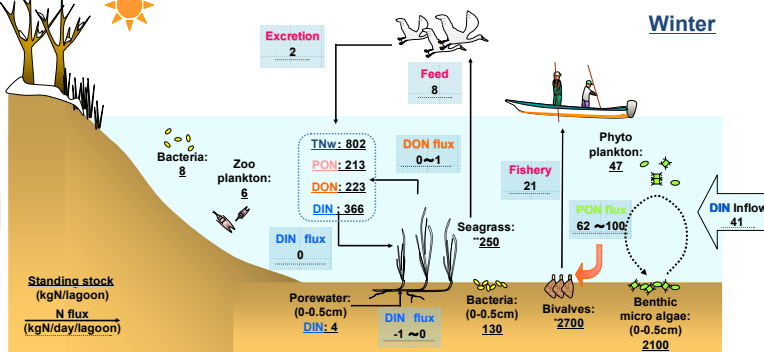
- Sediment samples (0-0.5cm): Chlorophyll a, Water contents,  $\delta^{13}\text{C}$
- Bacteria abundance (DAPI staining)
- Zooplankton abundance: Dry weight, Nitrogen content
- Sinking particle: Chlorophyll a, PON,  $\delta^{13}\text{C}$

### Flux estimation

- DIN inflow flux (36 hours survey)
- Sinking particle flux using sediment trap
- Nitrogen uptake rate and excretion rate of migratory birds
- DIN uptake rate, DON release rate of seagrass (*Zostera marina* L.)



- Swans feed on seagrass.
- bivalves (filter feeder) feed on benthic micro algae.
- The  $\delta^{13}\text{C}$  of sinking particle suggests that it is sourced from resuspended benthic micro algae.



Total nitrogen in water column  $TN_w = PON + DON + DIN$

\*Kajihara, 2010 \*Hamada et al., 2006

- Nitrogen outflow (feed, fishery) is nearly equal to DIN inflow.
- Nitrogen flux of seagrass is controlling seasonal variation.

Yes, we should learn from  
unpolluted area!