



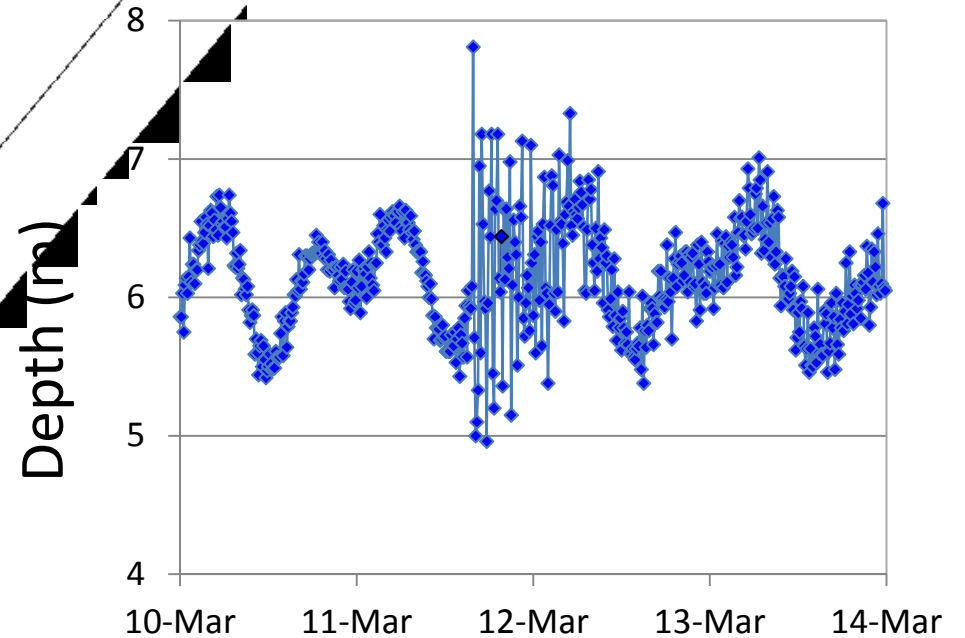
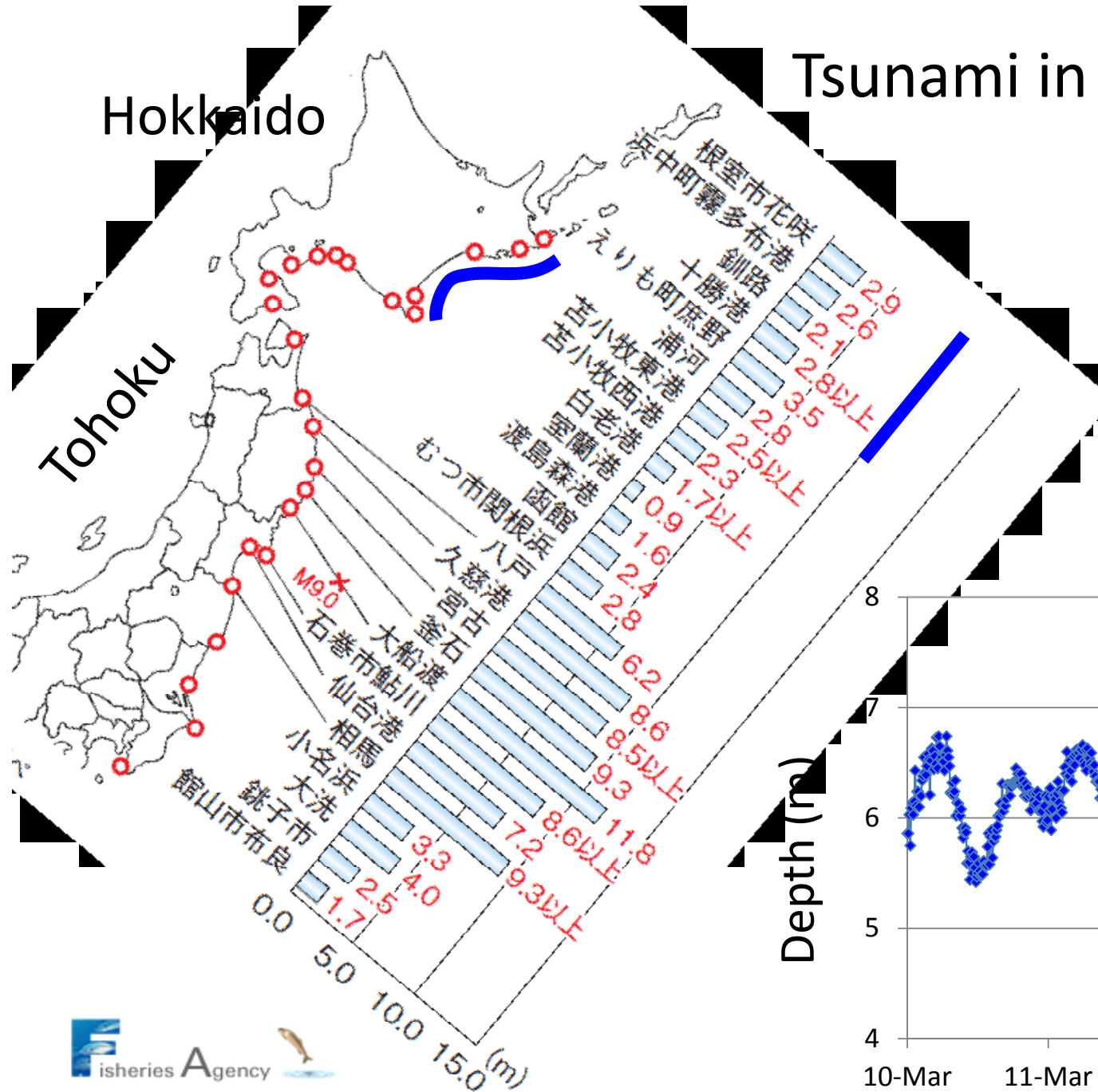
S11 8352

Damage of the tsunami to the Asari clam fisheries in east Hokkaido, Japan and the problems in its recovery process

Natsuki Hasegawa & Toshihiro Onitsuka



Tsunami in East Hokkaido





Akkeshi area in East Hokkaido

- Pacific oyster culturing (200 ton yr⁻¹)
- Asari clam fishery (900 ton yr⁻¹)
(*Ruditapes philippinarum*)



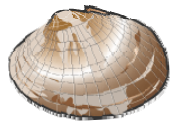


An aerial photograph showing a large body of water, likely a bay or estuary, with numerous rectangular and irregularly shaped plots of land or mudflats extending into the water. These plots are arranged in a grid-like pattern, indicating organized clam fishing grounds. The water is a light, milky blue-grey color, and the plots are a darker, brownish-grey. A small white boat with a red roof is visible on one of the larger plots in the lower right quadrant. The background shows a distant shoreline with some greenery.

Clam fishing grounds

by K. Watanabe (Hokkaido Univ.)

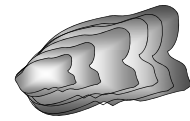
Tsunami damage



Clam fishing ground



Sediments with clams were either washed out or locally re-arranged.



Oyster culture



Rearing facilities were destroyed & lost.

In Akkeshi-ko estuary,
monitoring the clams & the environmental conditions
before the tsunami in the projects.



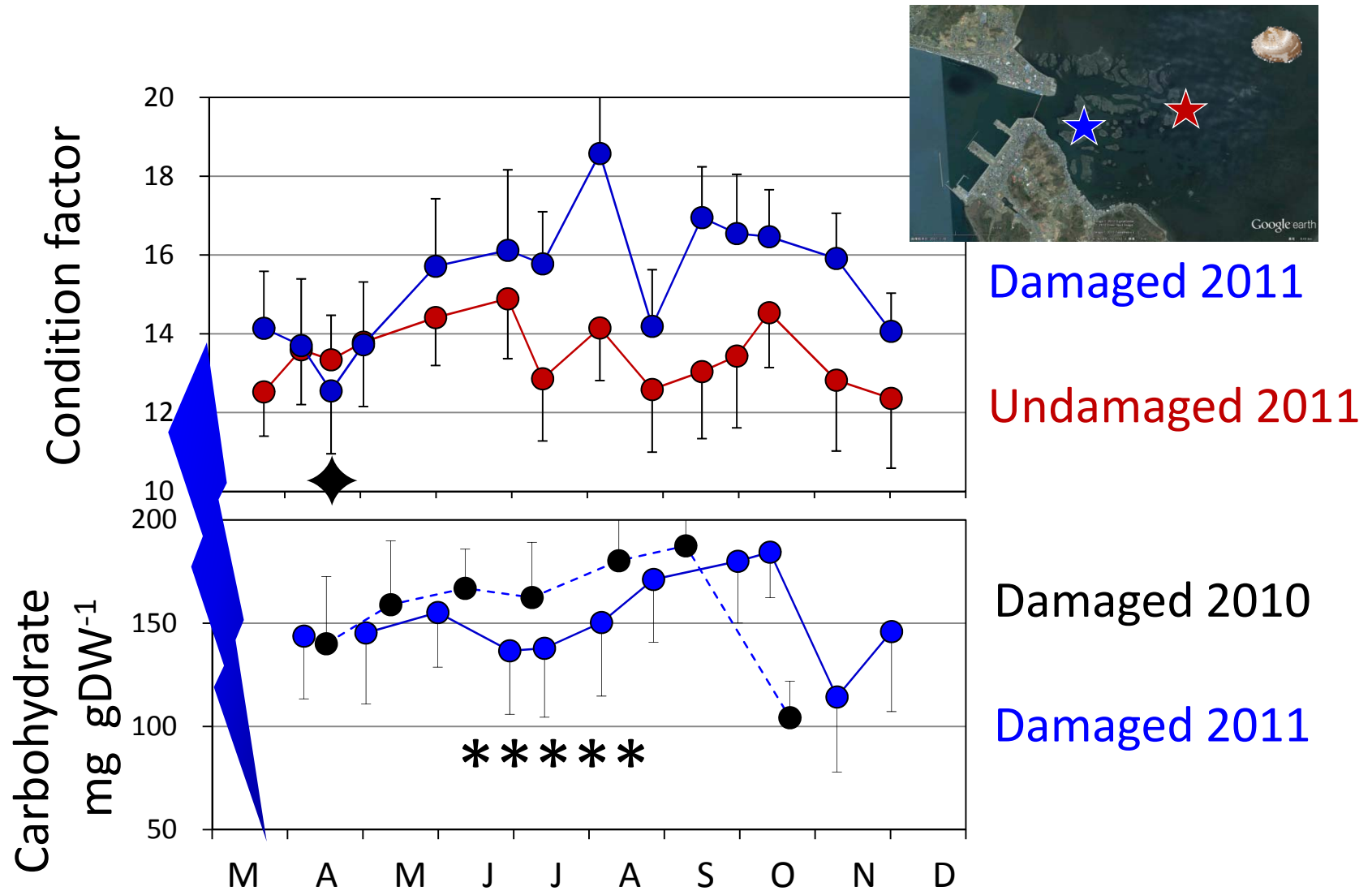
Clam



Environments

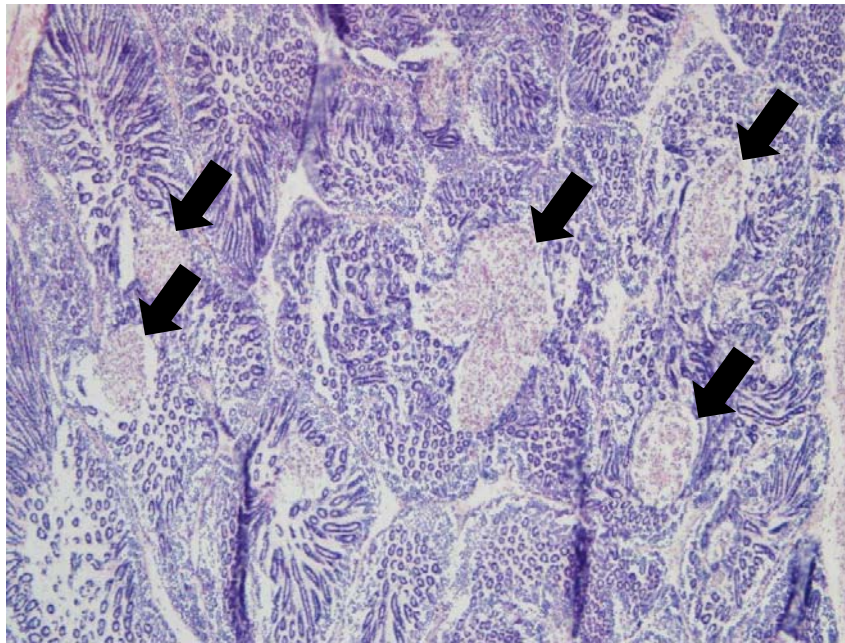


Through continuous monitoring after the tsunami ,
finding out the type and degree of the damage to Asari
clam fishery and the problems encountered in the
recovery process.



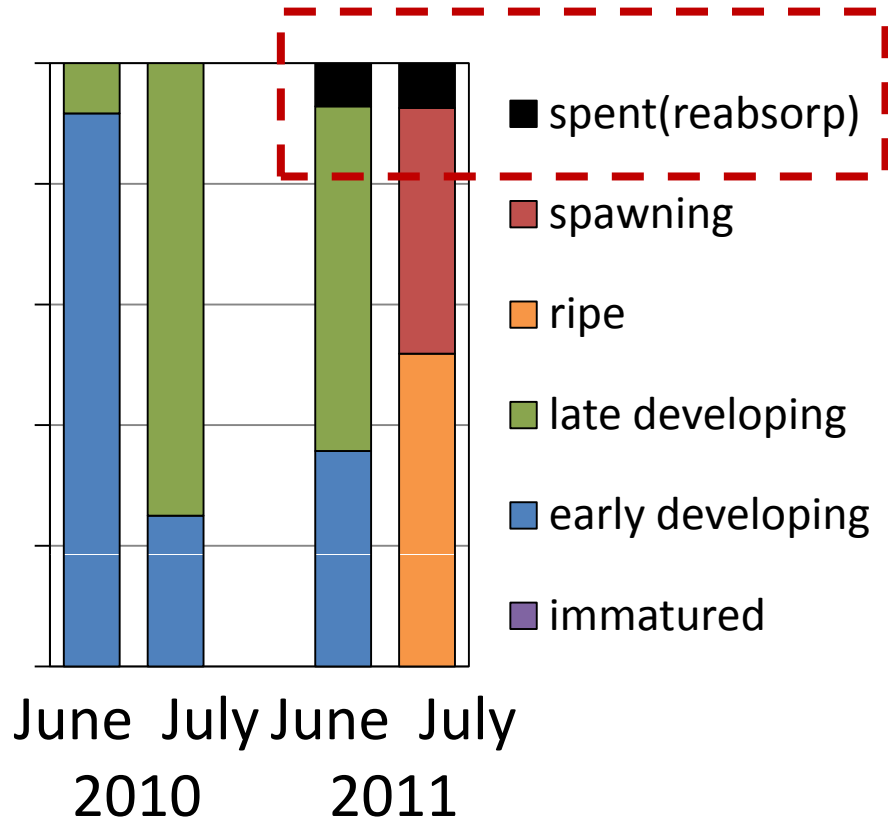
- ◆ Decline of condition factor at one month after tsunami
- * Low carbohydrate contents during summer 2011

Effects of tsunami in clam reproduction?



Matured male

↙ Reabsorption
(cancel of gamete production)



One month after tsunami, a massive clam die-off was happened(coinciding the decrease of condition factor)



Any remaining clams could not dig themselves into grounds without enough sediment ➡ various stresses

Expansion of damage by clam rescue work?



Active individuals may have been harmed unintentionally through the aggravation of the benthic environment when fishermen re-buried the dying clams.

Even in summer,



Damaged Undamaged



Anoxic condition

- High density of clam
- Unsuitable condition in sediments

Remaining clams were negatively affected even in summer.

Recovery from the tsunami damage



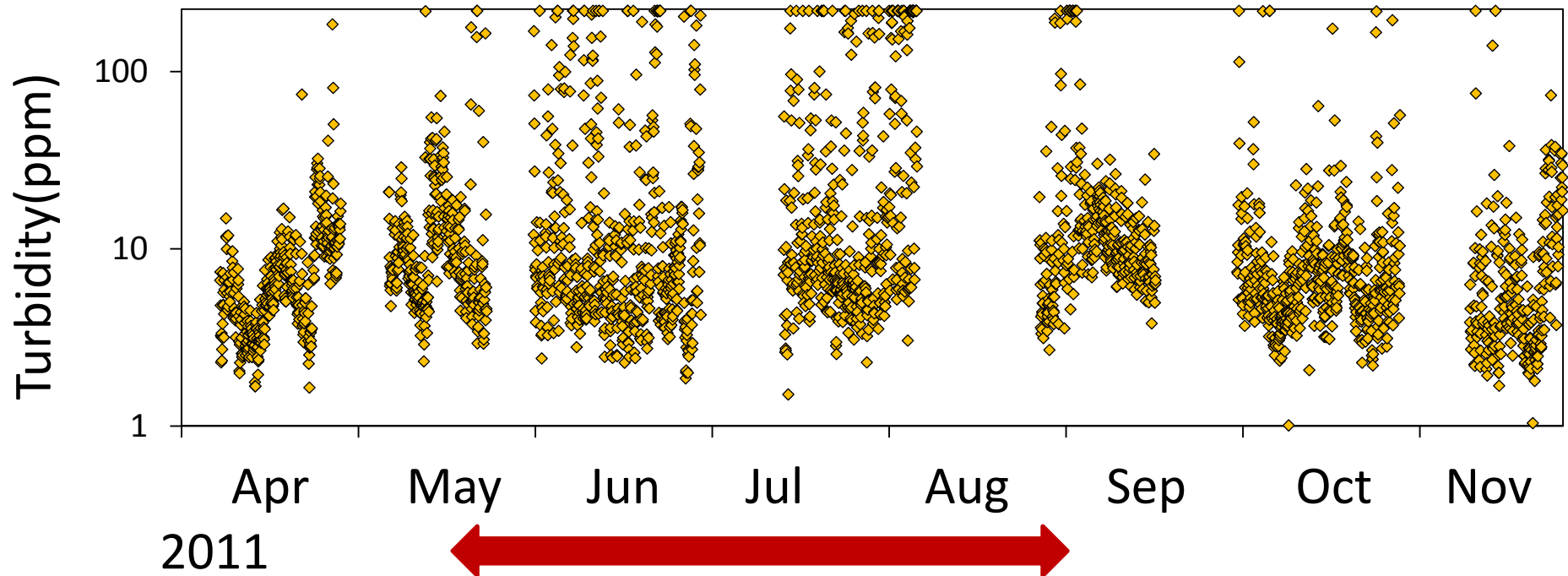
Sand capping for reconstruction of the fishing grounds

- Personal sand capping from May
- Large-scale sand capping in winter (supported enterprise)

Fear of effect of water quality in recovery

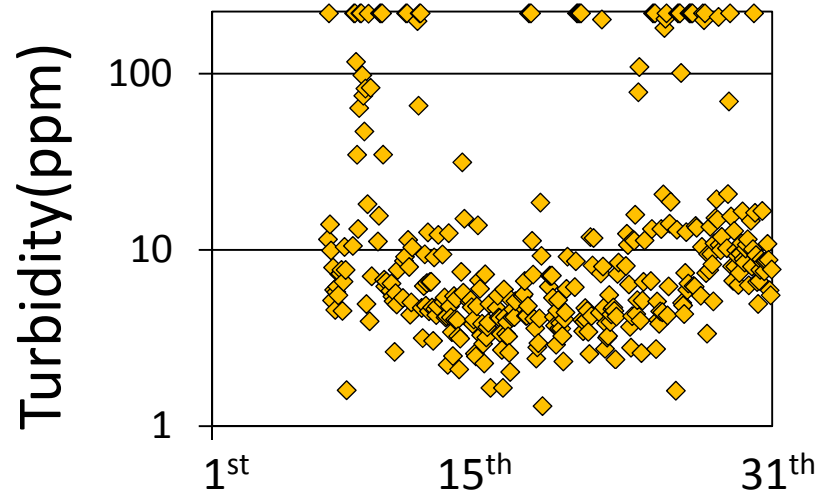


Nov 2011

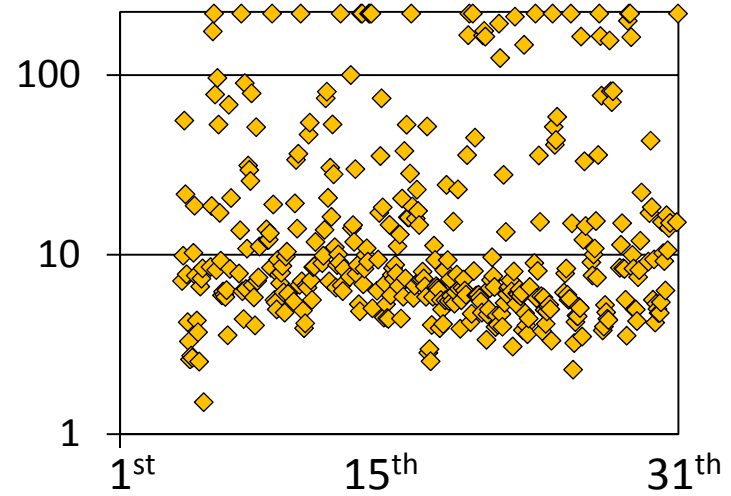


High turbidity with sand capping was observed.

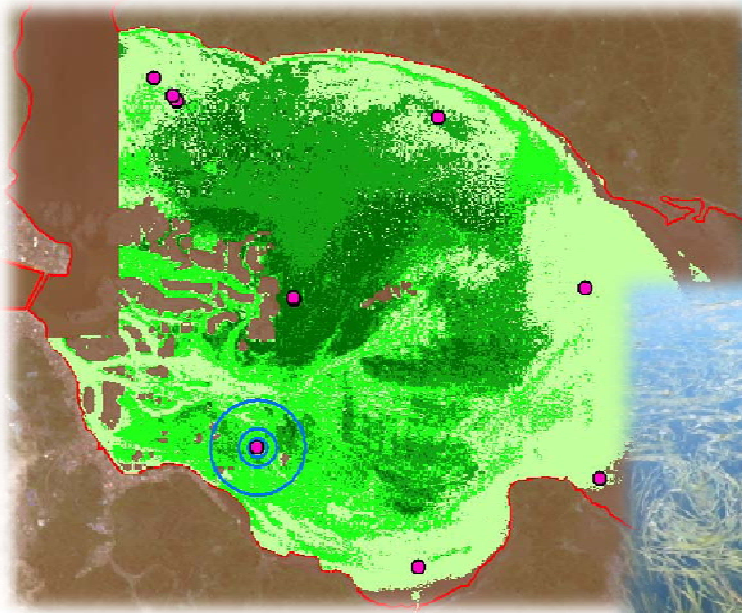
Before tsunami
(July 2010)



After tsunami
(July 2011)

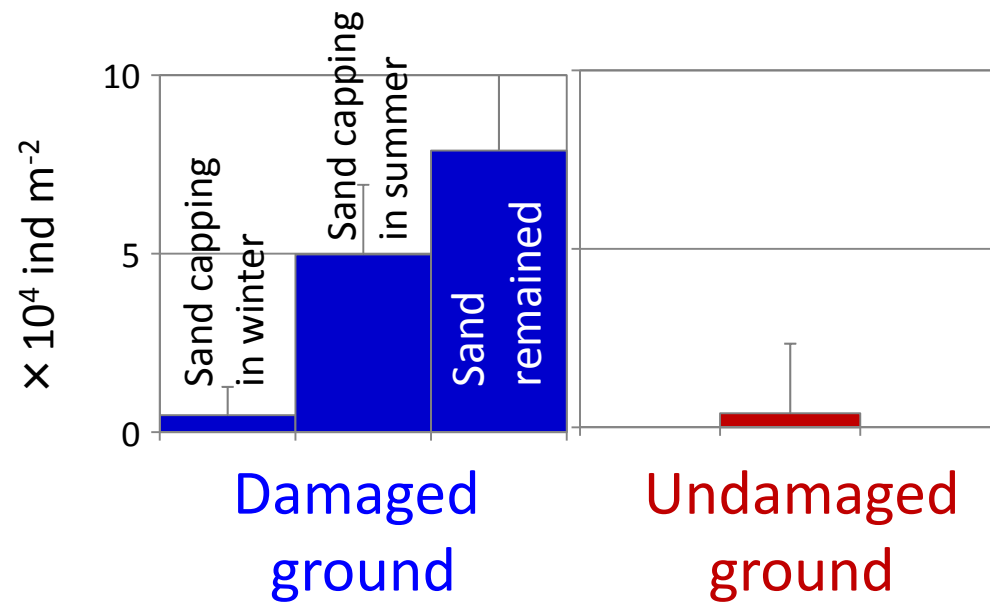


High turbidity with sand capping
was more frequent after the tsunami.



by K. Watanabe
(Hokkaido Univ.)

High turbidity might be affect the estuarine ecosystems, particular **seagrass beds**, which is the ecosystem engineer and modify the estuarine ecosystems



Dense population of juveniles in spring 2012 (spawned after tsunami).

Use of “Local” juveniles

for avoiding the need to transplant clams from other areas,
with an invasion of alien organisms and diseases.

Predator

ex. *Euspira fortunei*



Disease

ex. Perkinsosis

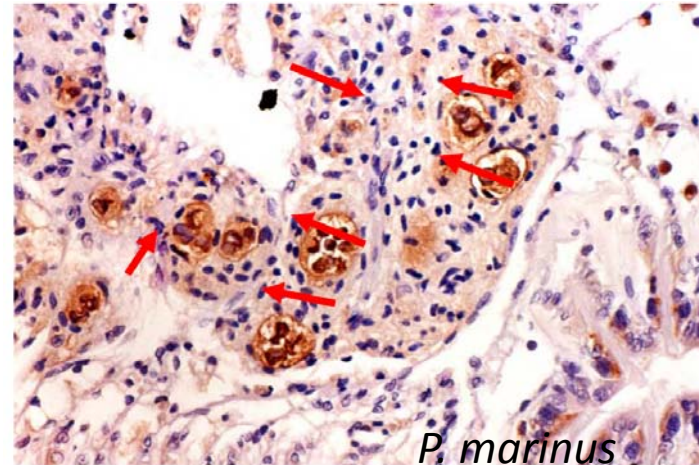


図 3-2-16 アサリ髯にみられたパーキンサス属原虫の trophozoites (矢印)
抗-*Perkinsus marinus* 抗体による免疫組織化学染色、ヘマトキシリンによる対比染色

from Guideline for improvement of productivity
in tidal flats by Fisheries Agency



Monitoring of the clams and the environmental conditions before and after tsunami revealed,

- Tsunami damaged the clam fishery, directly & indirectly. Indirect damage might be mitigate ?
- Sand capping was required, but turbidity were increased. Its effects to the estuarine ecosystem are not clear, although this estuary is heavily used in local fisheries.
- Beyond catastrophic damage of tsunami and the problems in recovery activities, juvenile clams was densely recruited.

Speed is required for recovery,
but care must be taken to sustain the fishery,
because fishery is supported by the ecosystems.

Acknowledgements

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- Akkeshi Marine Station, Hokkaido Univ.
- Mr. H. Abe, Mr. K. Watanabe (Hokkaido Univ.)



A catastrophic tsunami on March 11, 2011 damaged the Asari clam fishery in Akkeshi-ko estuary, located on the Pacific coast of Hokkaido, Japan (N43°02', E144°52'). Sediments with clams from the fishing grounds were either washed out or locally re-arranged by the tsunami. We monitored the clams and their environmental conditions before and after the tsunami to find out the type and degree of the damage to Asari clam fishery and the problems encountered in the recovery process. The condition of the clams deteriorated after the tsunami and their numbers reached a minimum one month after the tsunami when a massive clam die-off occurred. Immediately after the tsunami, it was thought that any remaining clams could not dig themselves into the fishing grounds without enough sediment, and so might be subject to various stresses. Moreover, active individuals may have been harmed unintentionally through the aggravation of the benthic environment when fishermen buried the dying clams. The condition of the clams recovered after a few months but some individuals showed abnormal tissue in their gonads during the summer spawning season. Environmental monitoring showed that high turbidity with sand capping caused by reconstruction of the fishing grounds, which might affect the estuary ecosystem, was more frequent after the tsunami than before the tsunami. Although there was catastrophic damage to Asari clam population and fishery, a dense population of juvenile clams was observed in spring 2012, which is important for the reconstruction of fishery in the long term. This will avoid the need to transplant clams from other areas, which could possibly lead to an invasion of alien organisms and diseases. Speed is required for recovery, but care must be taken to sustain the fishery.