

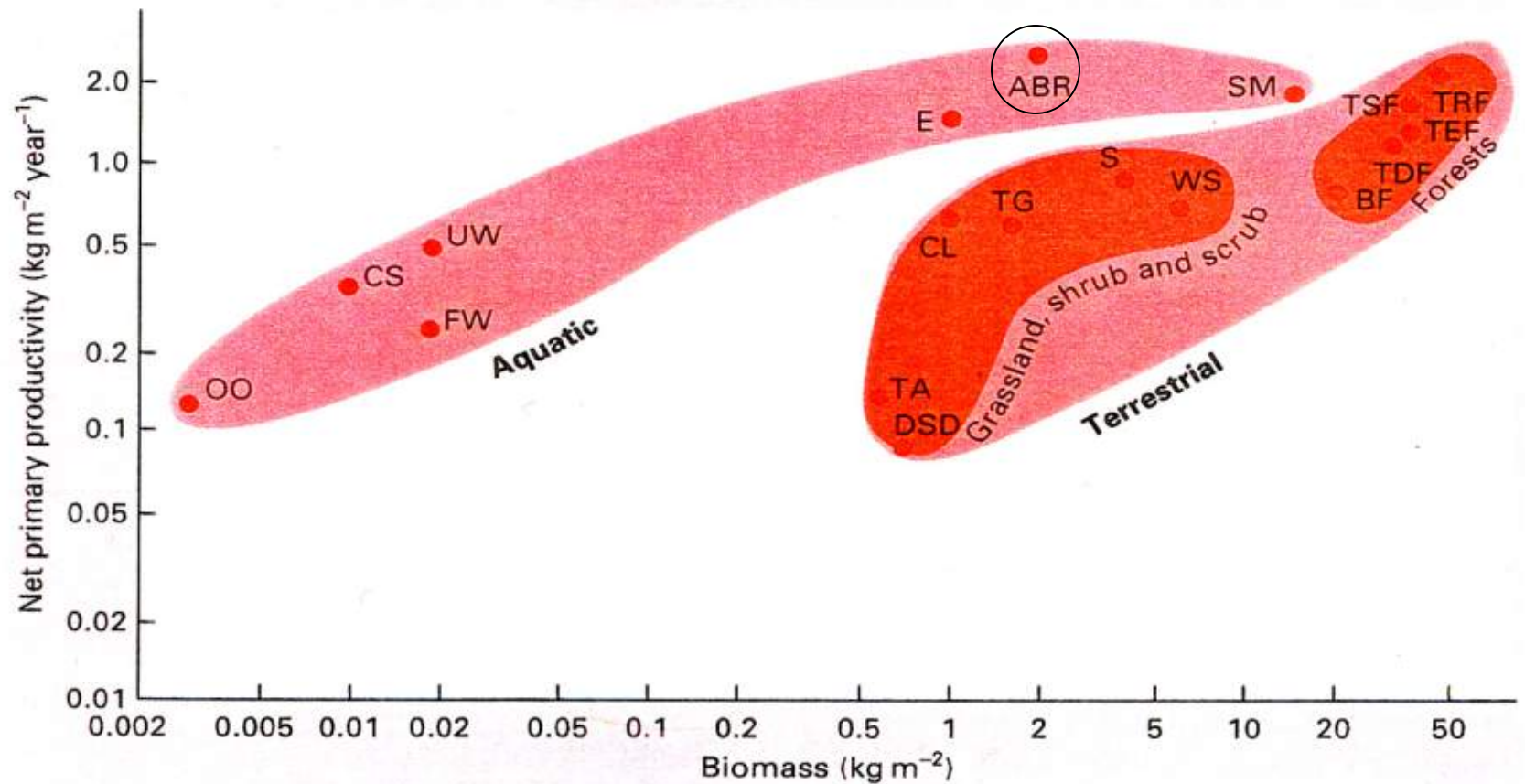
Possible change in seaweed distribution in East Asia under a particular scenario of global warming

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OO	Open ocean	SM	Swamp and marsh	WS	Woodland and scrubland
CS	Continental shelf	TRF	Tropical rainforest	S	Savannah
UW	Upwelling zone	TSF	Tropical seasonal forest	TG	Temperate grassland
ABR	Algal beds and reefs	TEF	Temperate evergreen forest	TA	Tundra and alpine
E	Estuaries	TDF	Temperate deciduous forest	DSD	Desert and semi-desert
FW	Freshwater lakes and streams	BF	Boreal forest	CL	Cultivated land



BACKGROUND

Seaweed key roles:

- Nutrient absorption, buffering water motion, preventing erosion
- Spawning, nursery and feeding grounds



The sensitivity of seaweed to water temperature is well-known:

In Japanese, “*Iso-yake*” means “*fire of seaweed forests*” due to warmer water temperature

BACKGROUND

Indirect effects related to warmer waters:



- Increase of reports about damage of seaweed forests by herbivorous fishes such as *Prionurus scalprum*, *Calotoms muricatum* or *Siganus fuscescens*



Sargassum ringgoldianum

***Sargassum* species**



Sargassum horneri

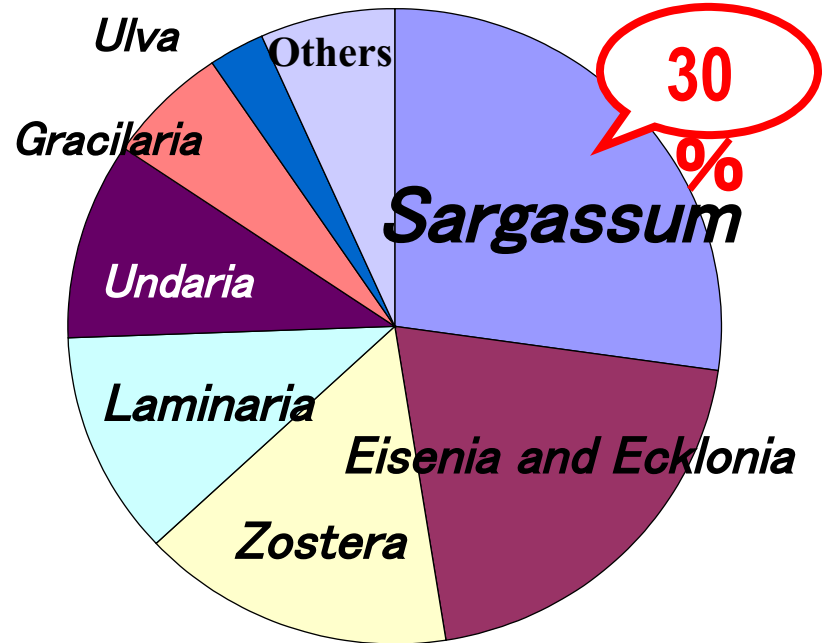


Sargassum patens

WHY SARGASSUM?

Sargassum
species are:

- the most common seaweed species in Japanese waters
- more common than the most common seagrass species (*Zostera*)



(Environment Agency
of Japan, 1994)



*Sargassum
horneri:*

- most
common species
of *Sargassum*

- relatively
high tolerance
with regard to
temperature
variations

Drifting seaweed in East China Sea



Ecological importance of drifting seaweed

- Carry numerous phytal animals
- Spawning substrate for Pacific saury, flying fish and Japanese halfbeak
- Nursery ground for juveniles of yellowtail, jack mackerel and *Sebastes* species





Yellowtail (*Seriola quinqueradiata*) aquaculture



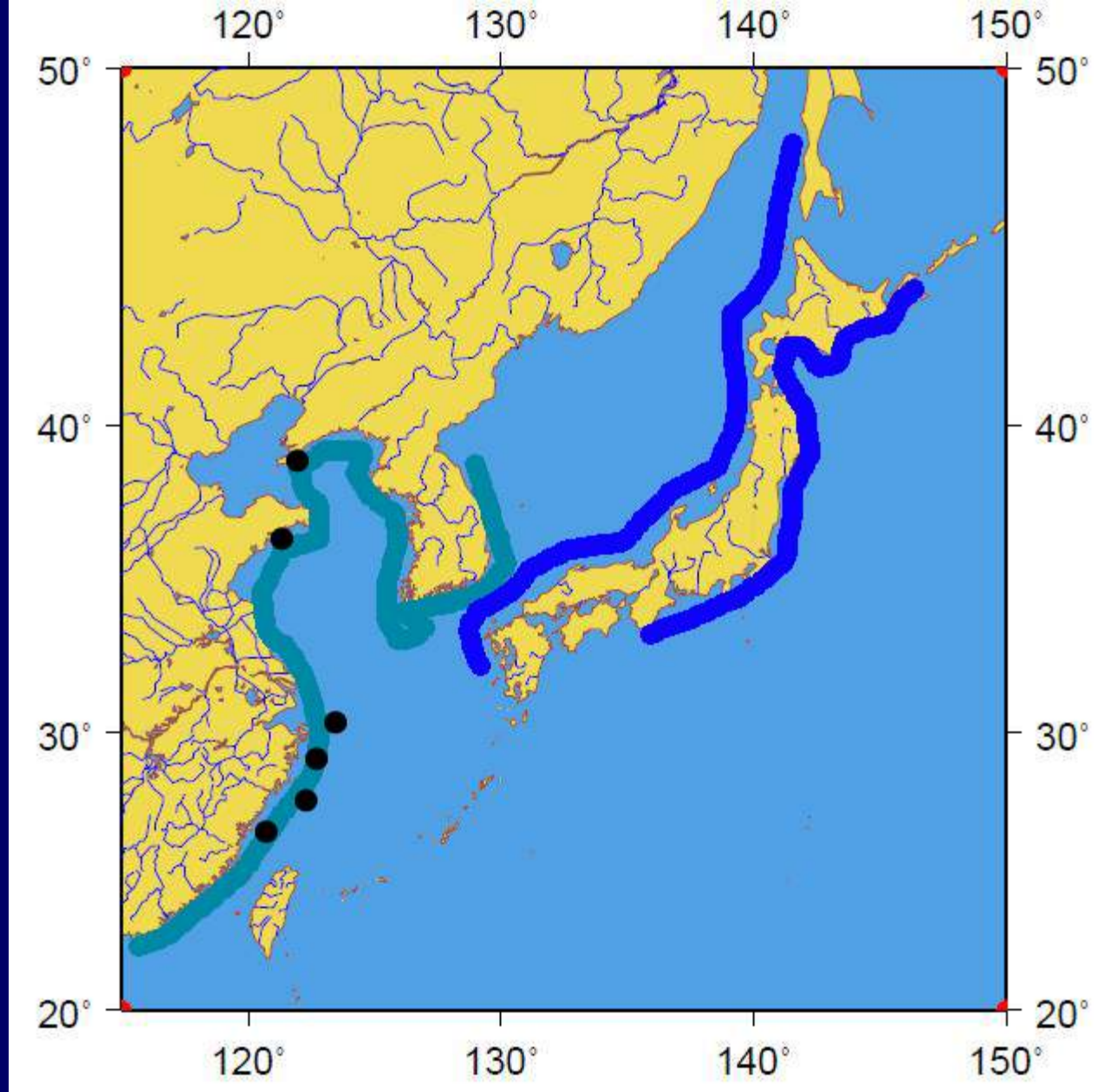
depends on

AIMS

- Predict changes in distribution for the *Sargassum horneri* under a particular global warming scenario
- Present some of the expected consequences associated with these changes (yellowtail aquaculture; *Sargassum tenuifolium* Yamada)

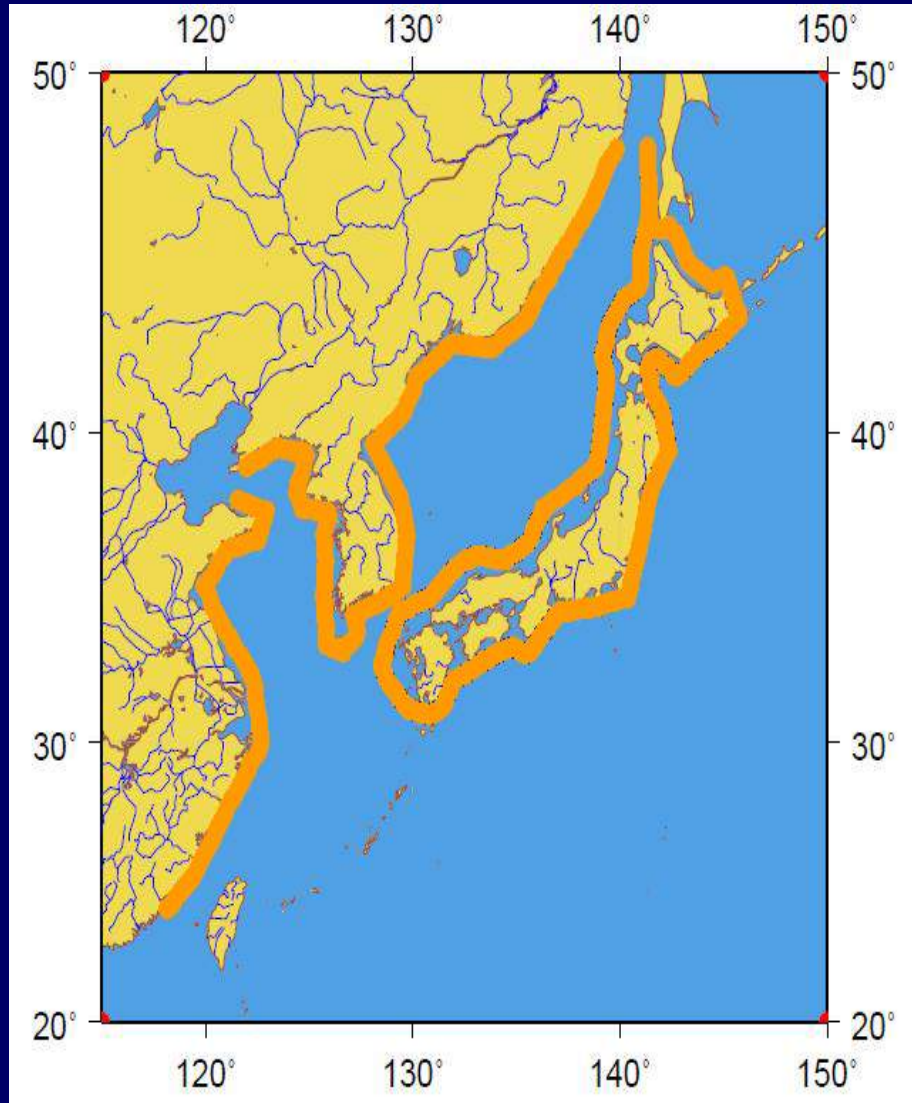
Materials and method

- Collection of water temperature data in winter and summer to determine temperature tolerance range for *Sargassum horneri* (surface; 20 year-long dataset; min-max)
- Surface water temperature predictions drawn from a scenario of global warming (“A2” 2000-2099) developed by the Center for Climate System Research (The University of Tokyo – *calculation details available online*)

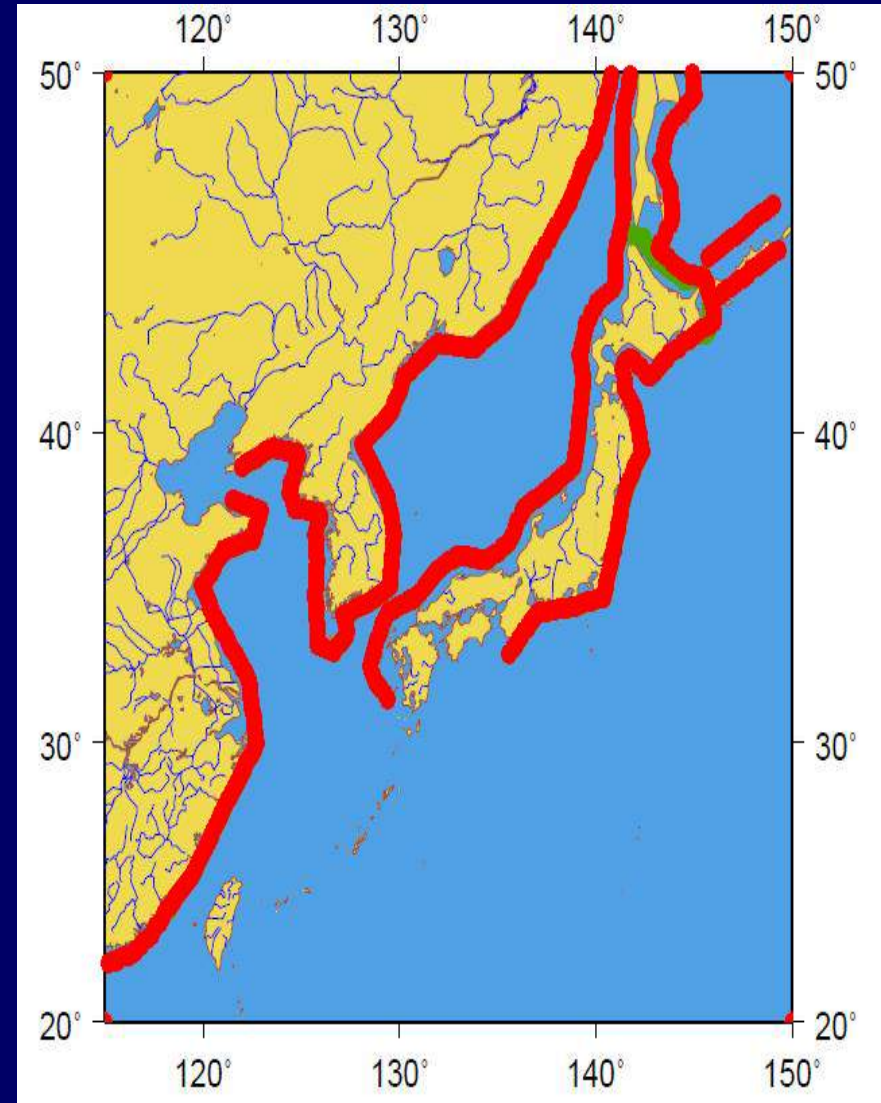


Distribution of *S. horneri* in East Asia according to Umezaki (1984), Tseng (2000), Komatsu et al. (2006)

Predictions for 2006, according to A2 model

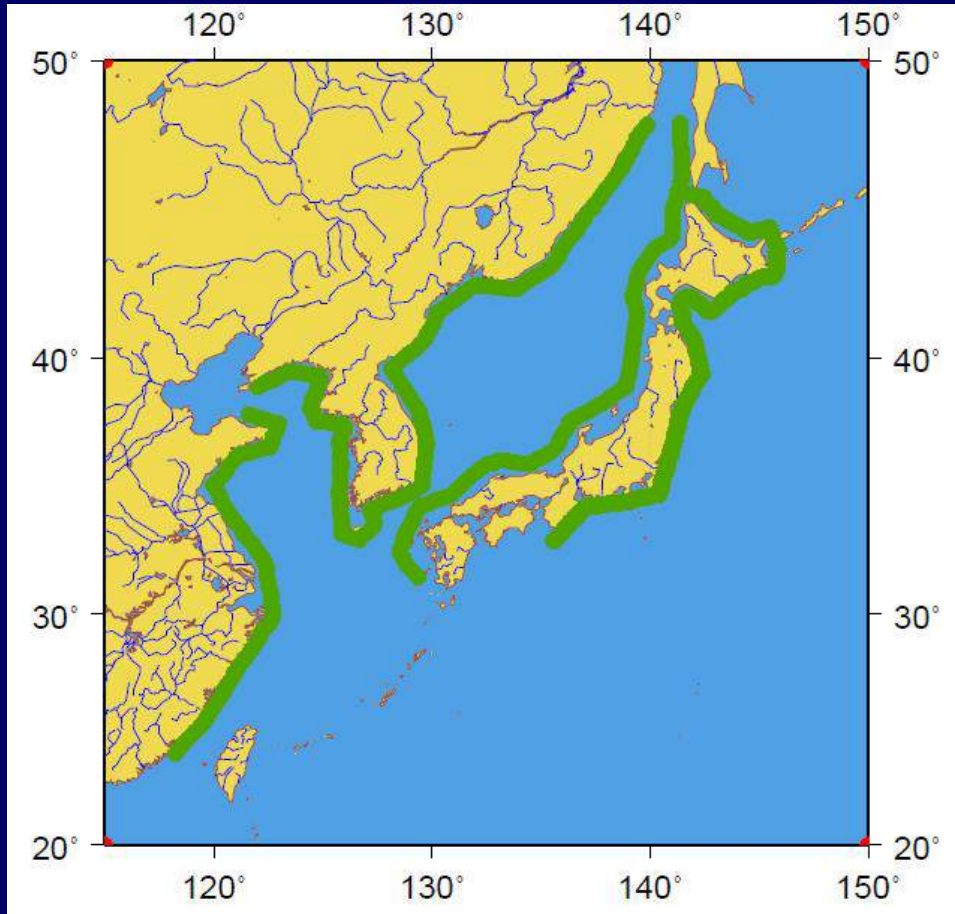


February 2006

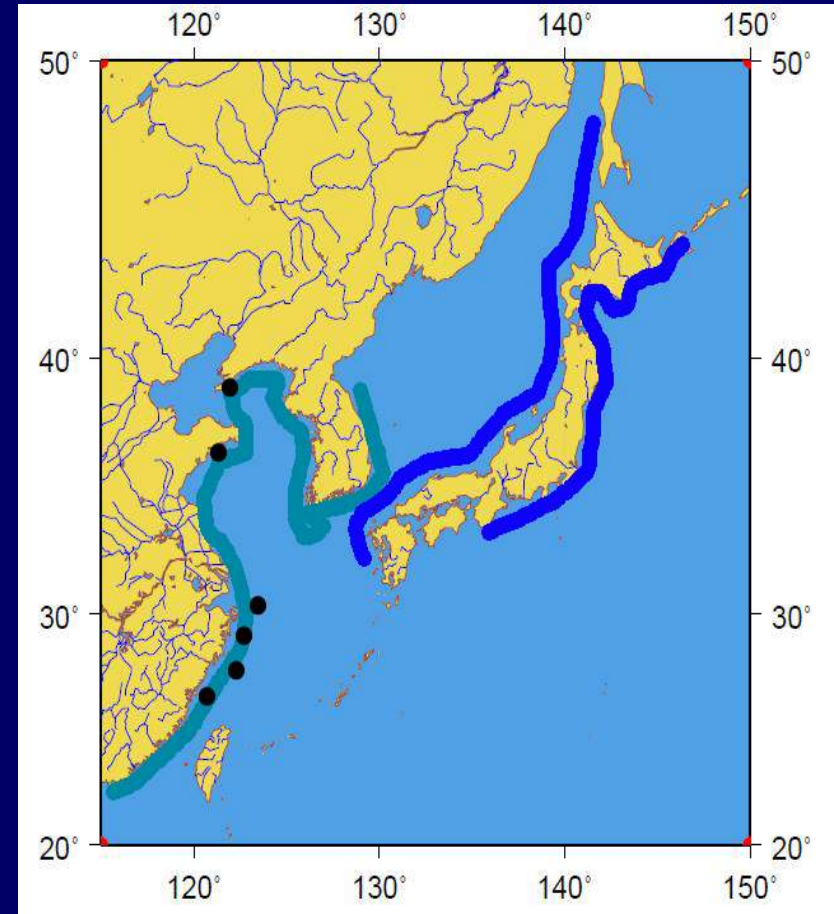


August 2006

Comparing predictions with observations (2006)



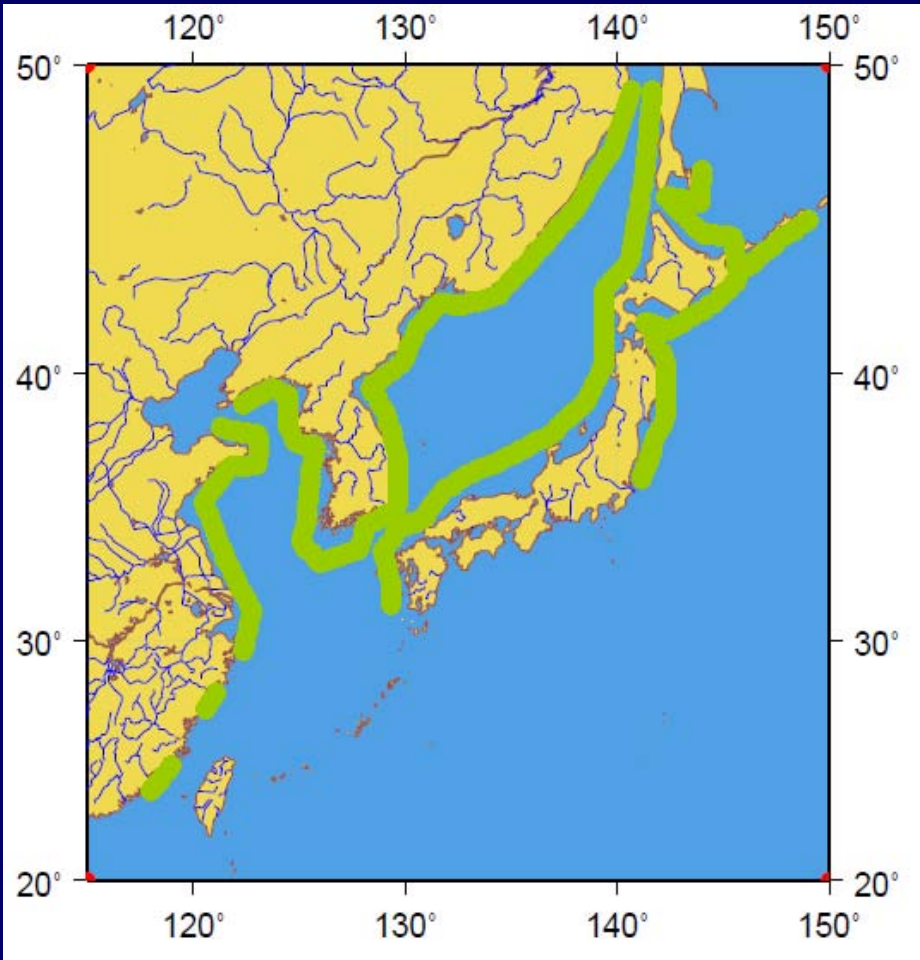
A2 model (combined)



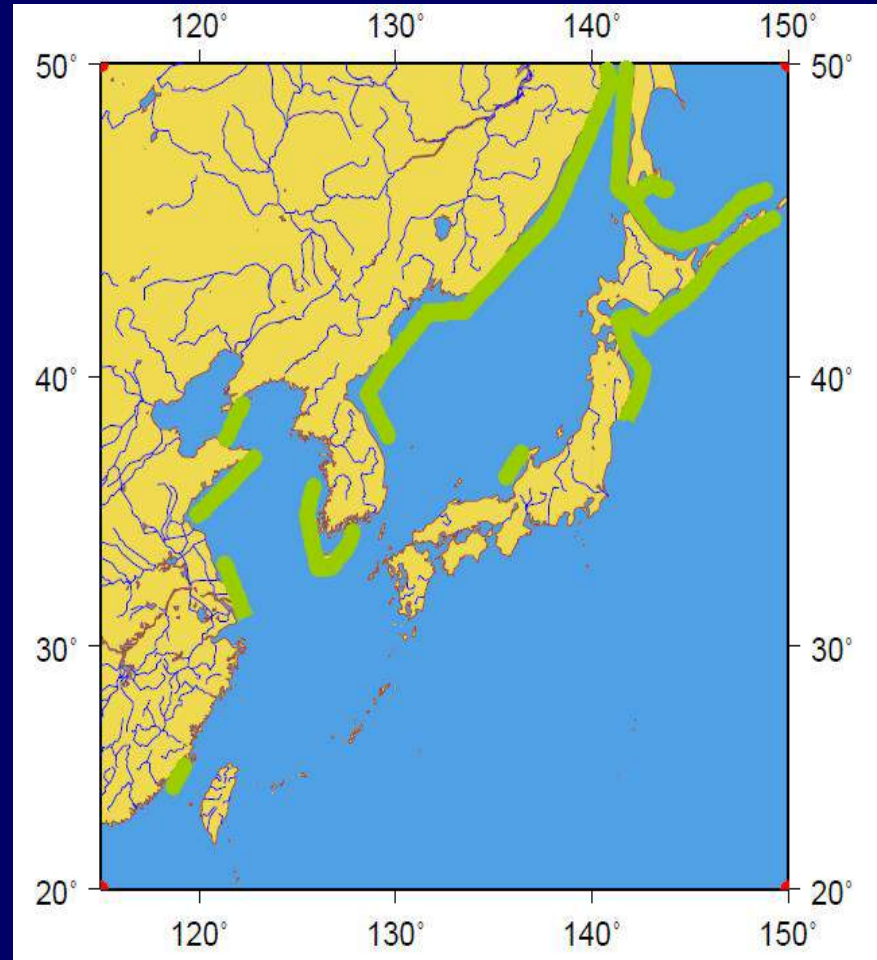
Observations

Differences = lack of data + rough environment (limit)
Hence, predictions = realistic but **OVERESTIMATION**

Predictions: 2050 and 2099



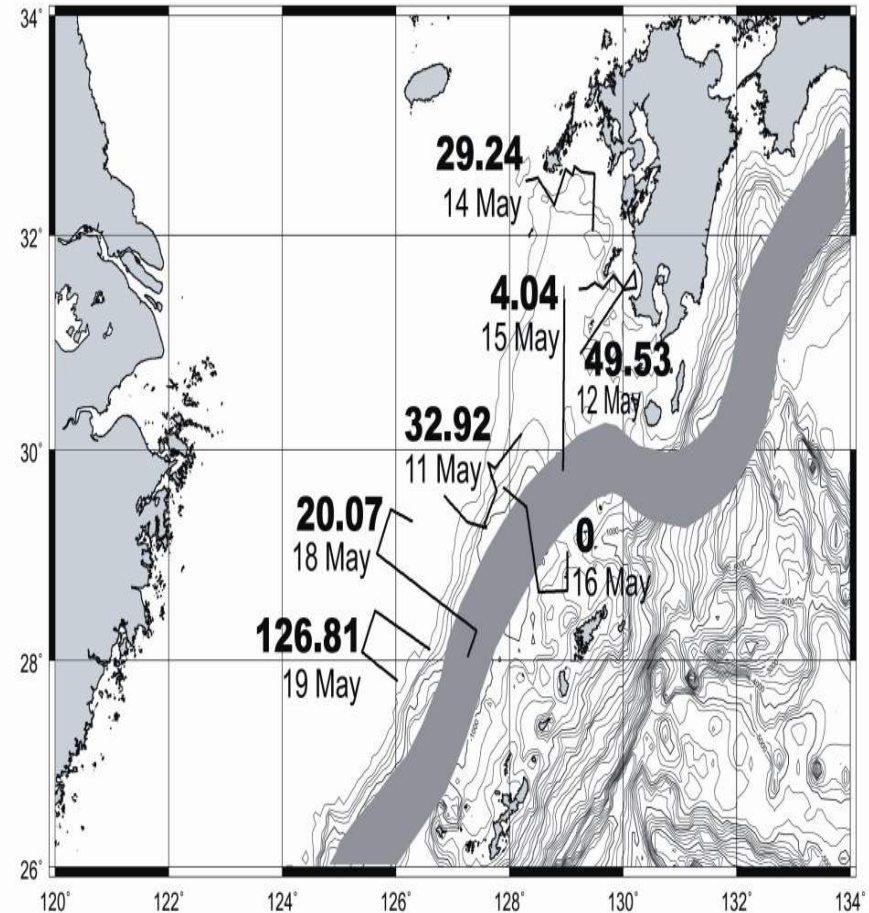
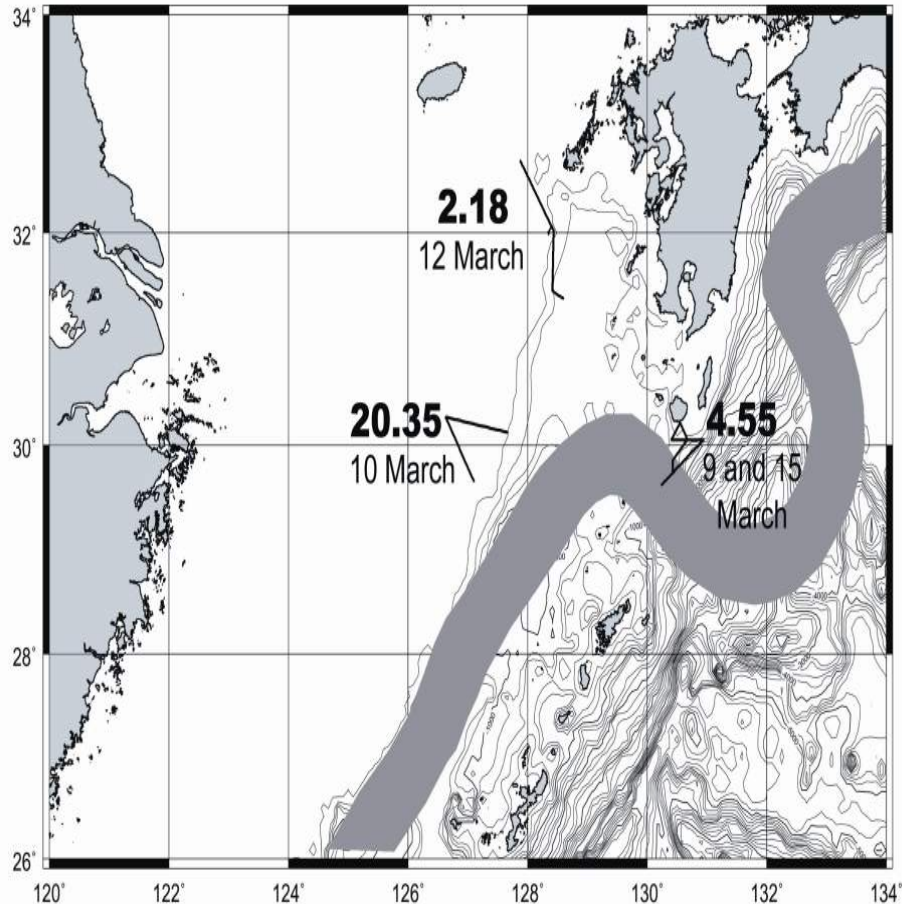
2050



2099

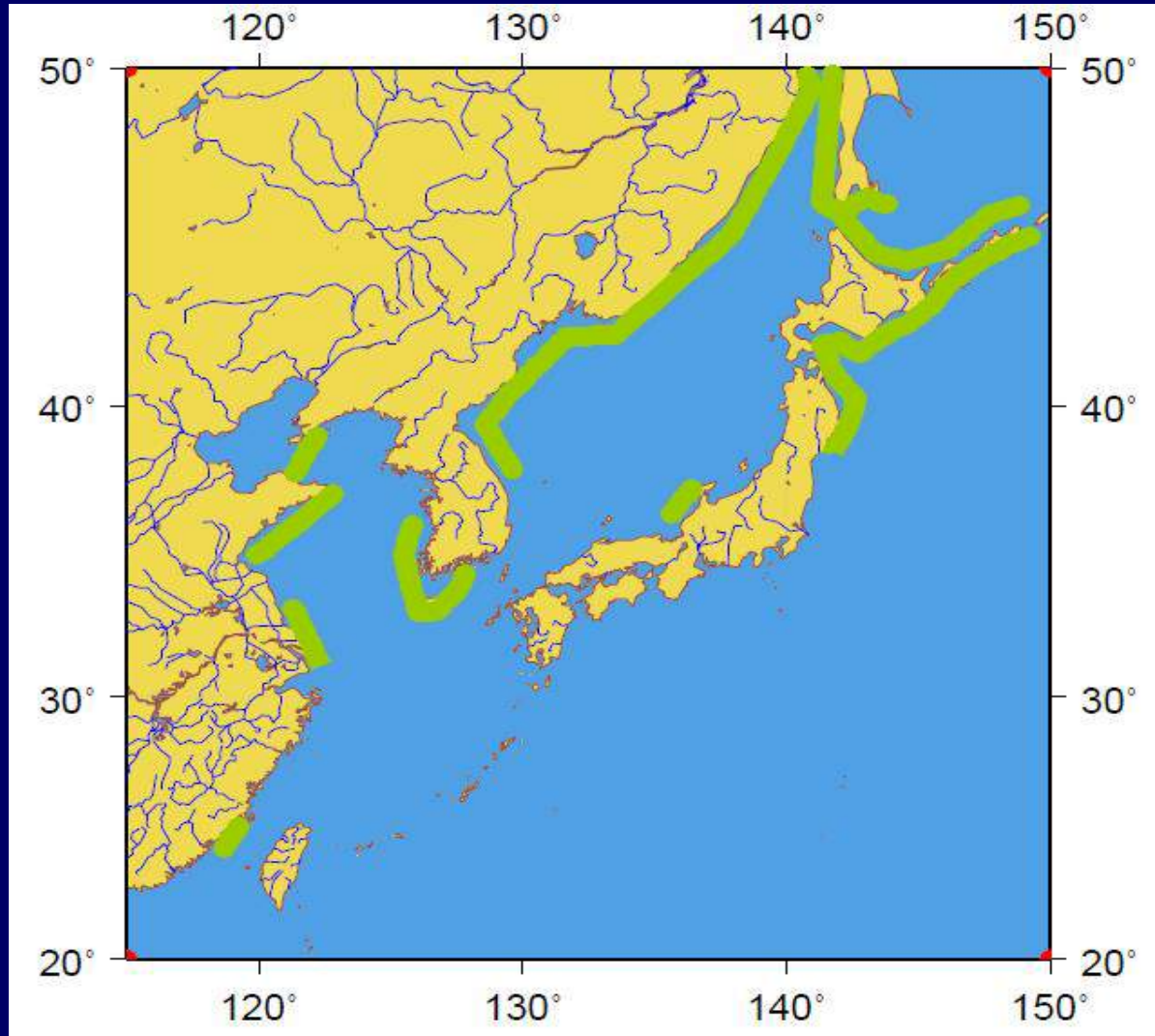


The Chinese population importance



Distribution of drifting *S. horneri* in East China Sea observed from R/V Hakuho-maru in 2006. Standing stock (wet kg km⁻²)

In 2099, where will yellowtail spawn?



Interesting projection with regard to the current aquaculture projects

Which species may benefit from *S. horneri* disappearance?

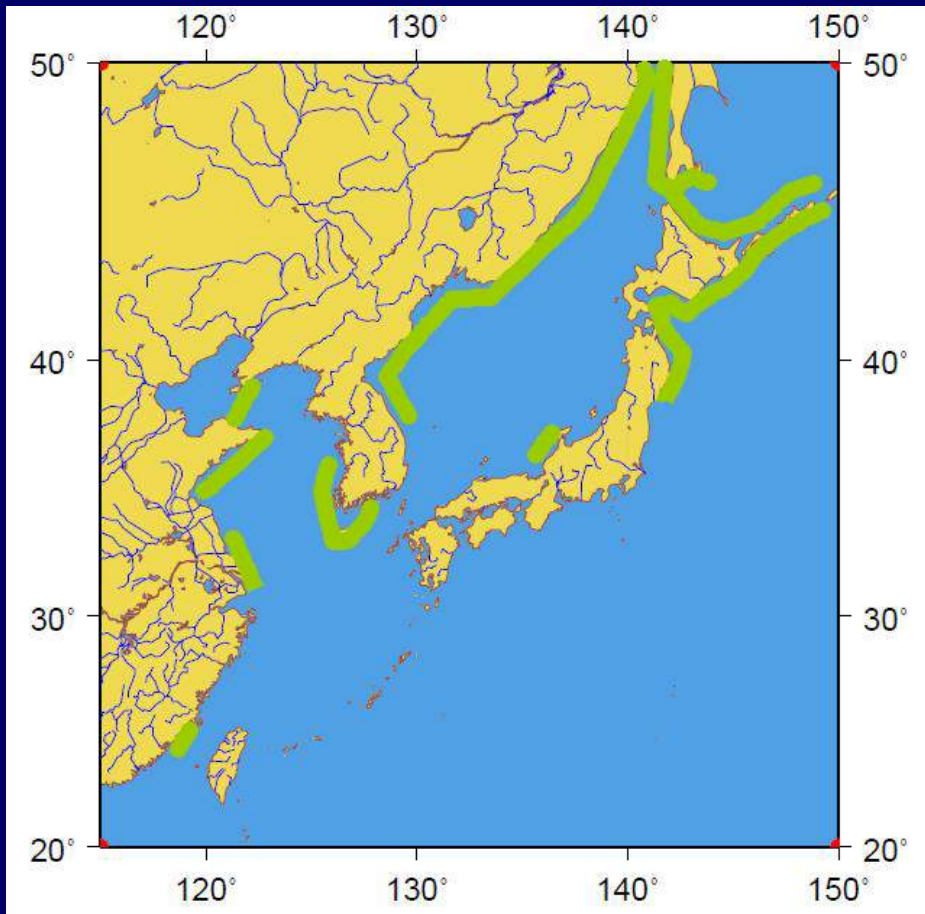


Sargassum tenuifolium Yamada appears as one of the possible candidates

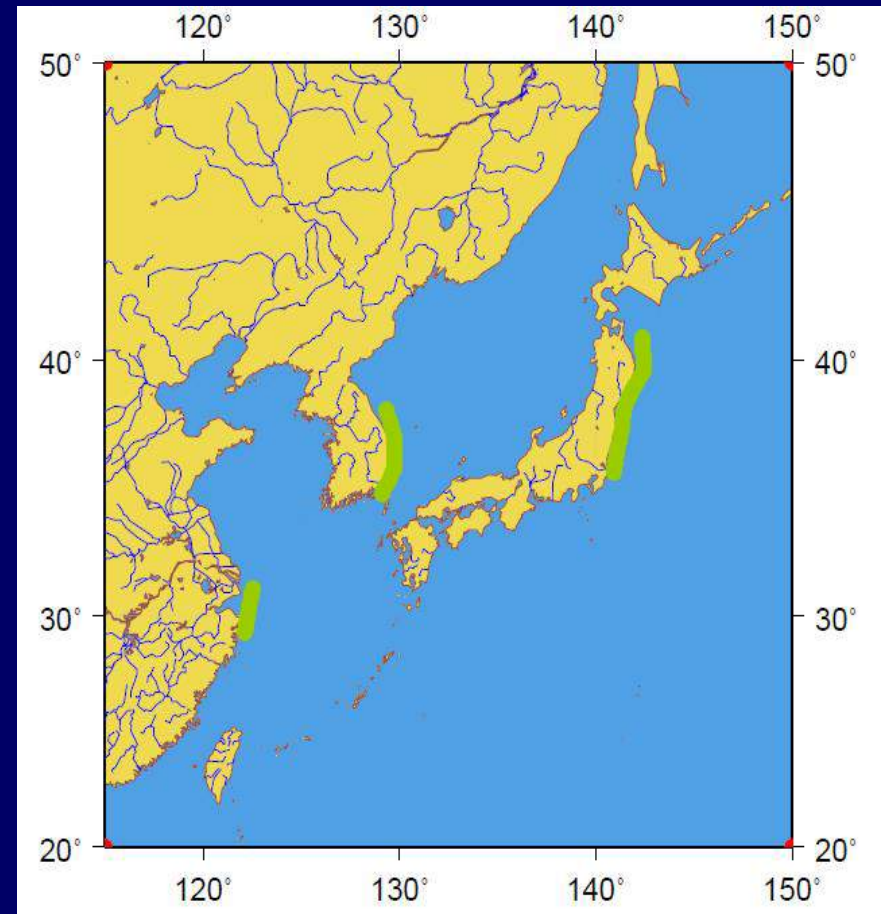
Species living traditionally in subtropical waters

Already recorded in some southern areas

S. horneri and *S. tenuifolium* expected distributions in 2099



Sargassum horneri



Sargassum tenuifolium

Summary

- The abundance of *S. horneri* is expected to decrease significantly by 2099, remaining primarily in northern areas.
- As a result, the abundance of drifting seaweed along the Kuroshio current is expected to drop as well.
- As yellowtail spawning grounds and juvenile survival rate are closely related to these drifting seaweeds, a shift in behaviour is expected.
- Gaps left by *S. horneri* are expected to be bridged by sub-tropical species like *Sargassum tenuifolium*