Salmonid status and its relation to environmental conditions in Hokkaido, Japan

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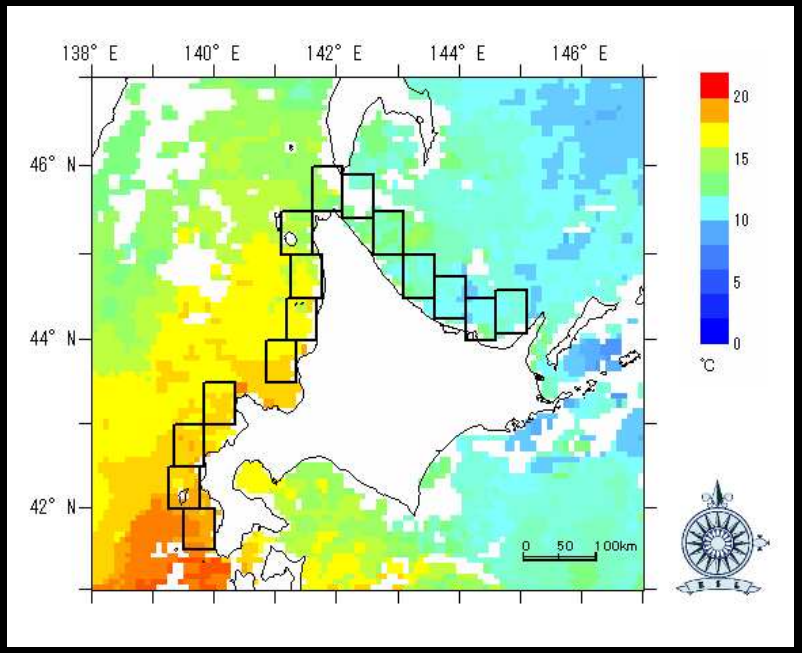
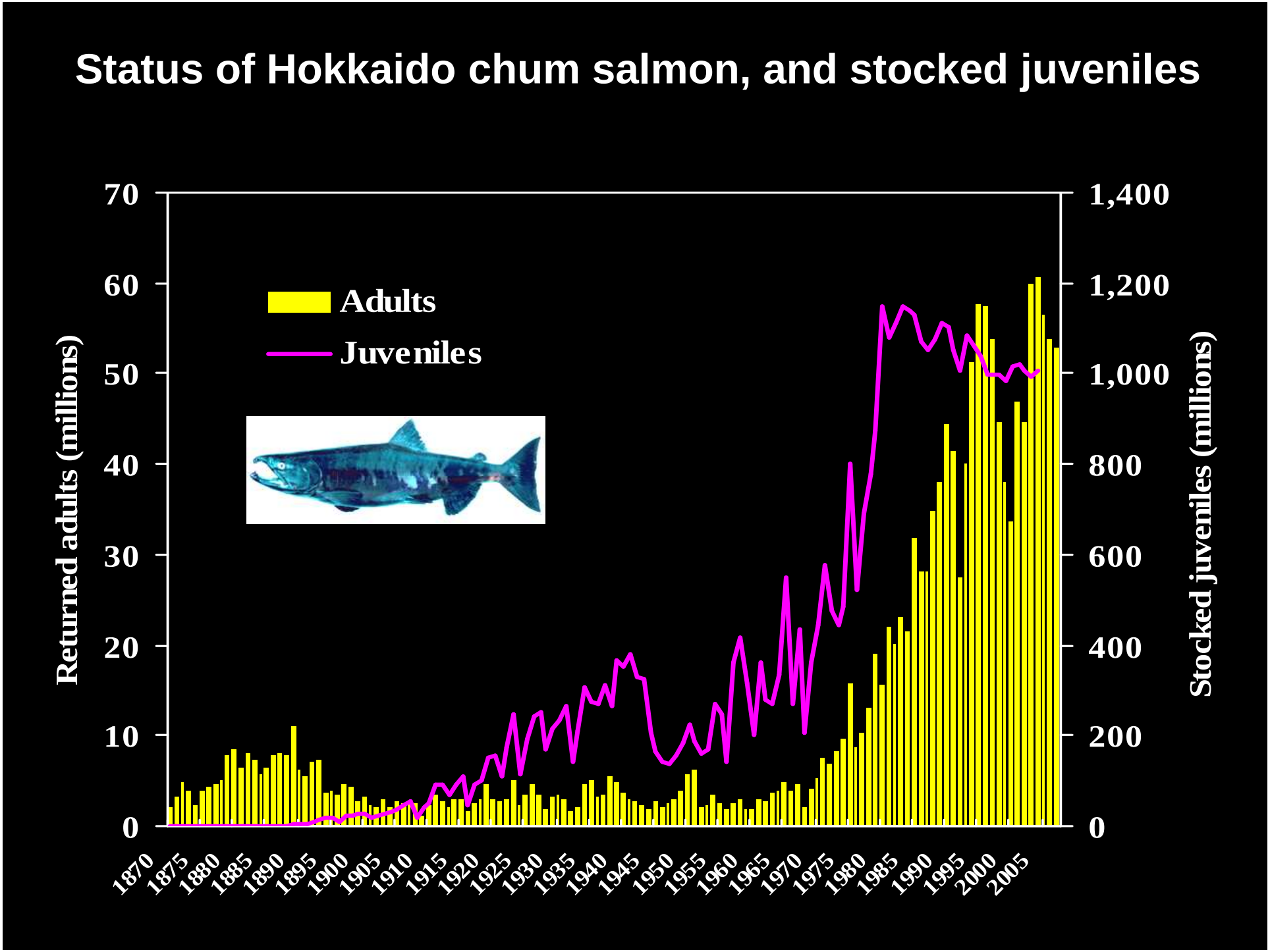
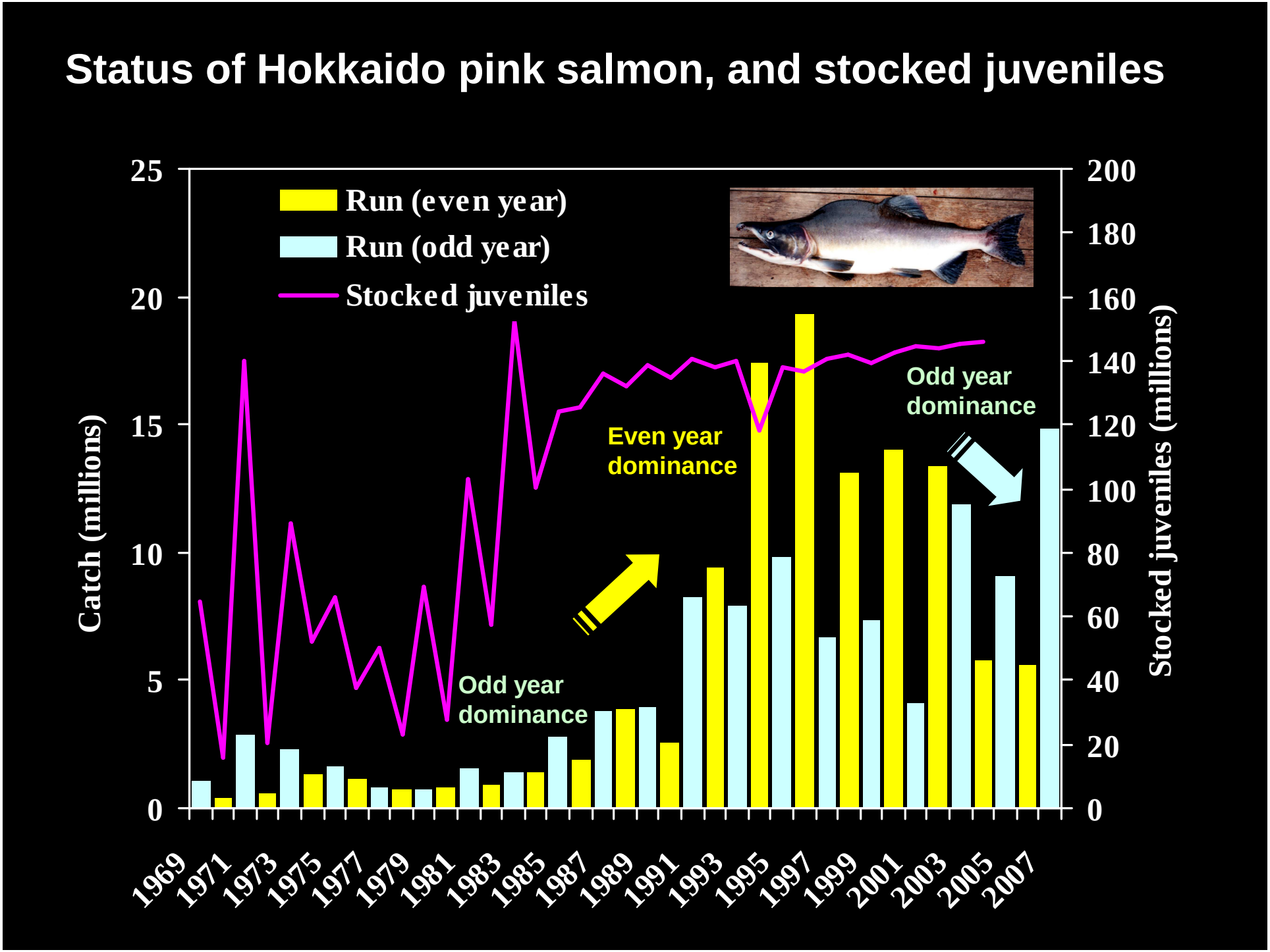
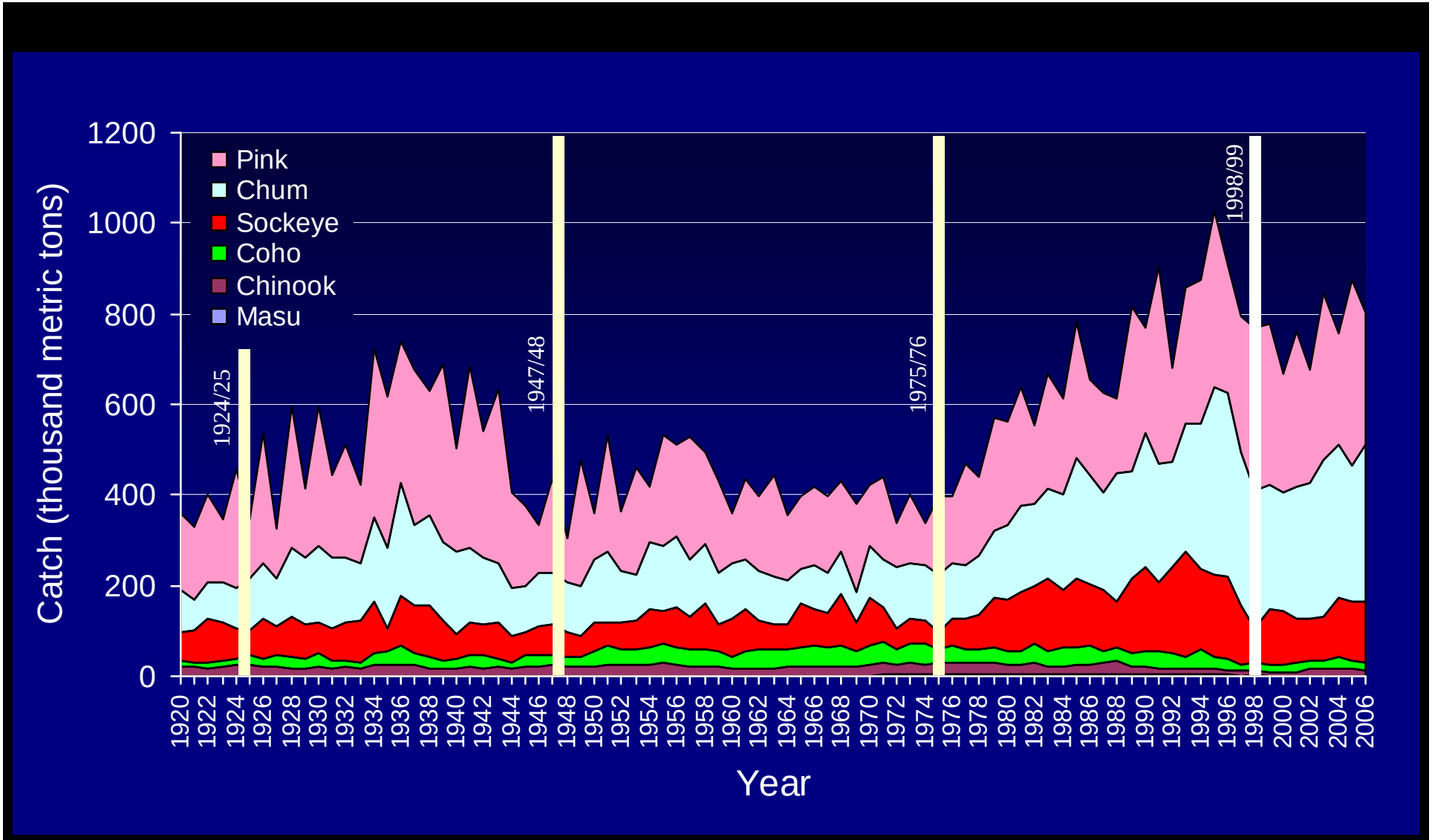


Status of Hokkaido chum salmon, and stocked juveniles



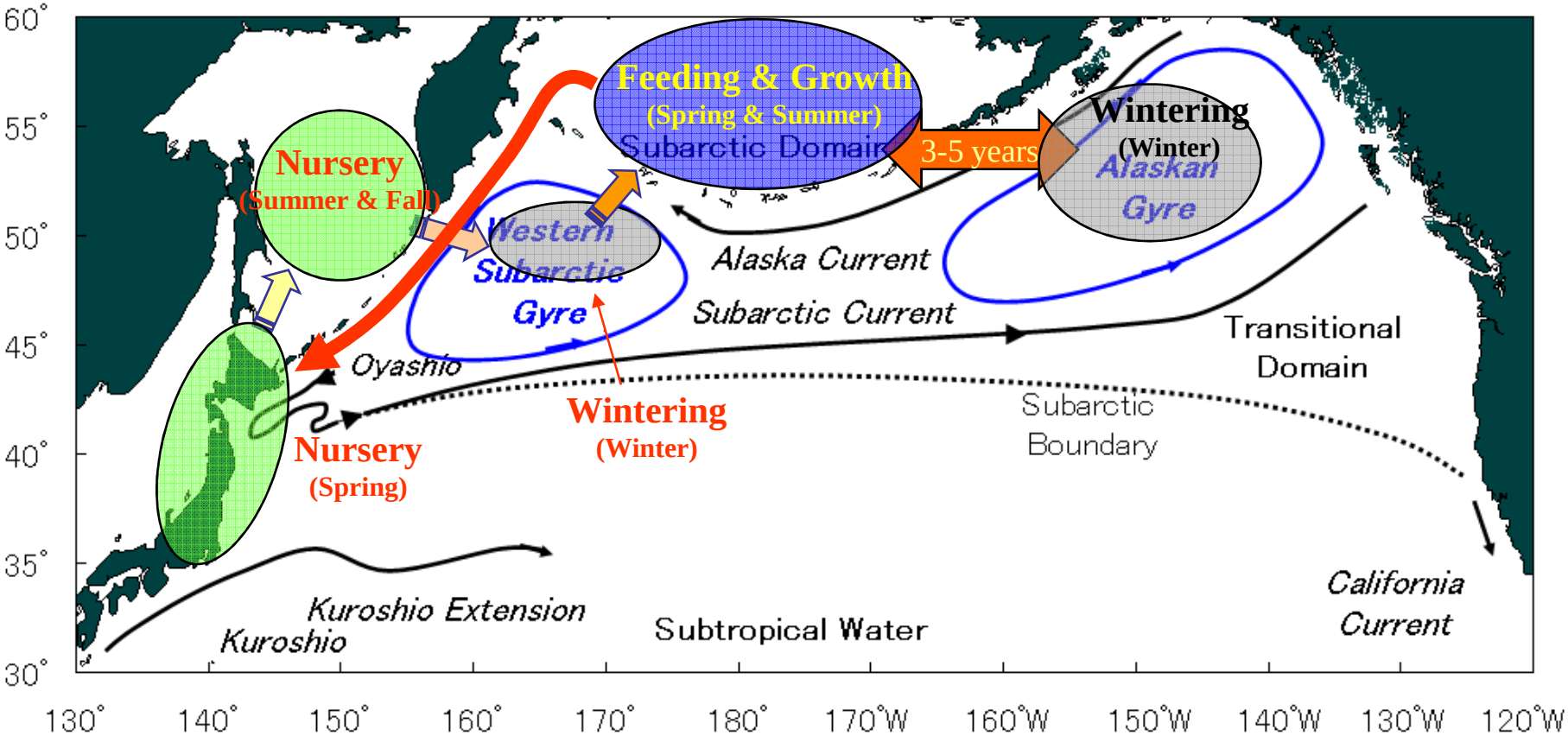
Status of Hokkaido pink salmon, and stocked juveniles



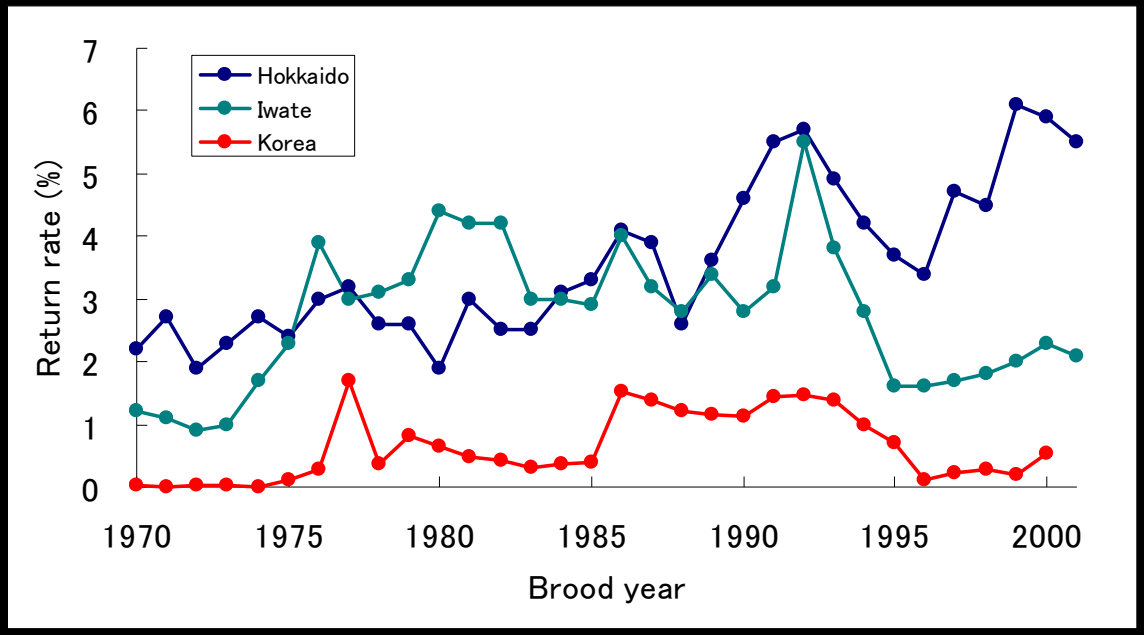


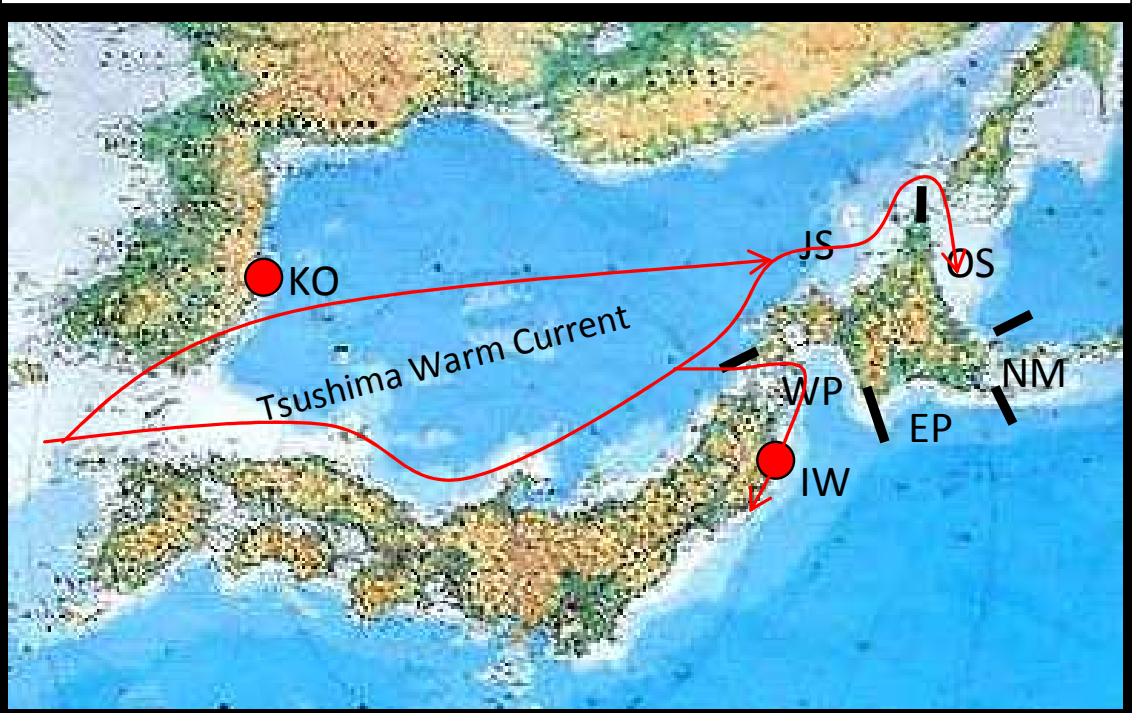
Change in annual catch of Pacific salmon in the North Pacific Ocean from 1920 to 2006 (from FAO fisheries statistics). The statistics for aquaculture production is excluded. Vertical bar is the climate regime-shift years shown by Minobe (1999 and 2002).

Migration of Japanese stocks of chum salmon



Urawa (2000)





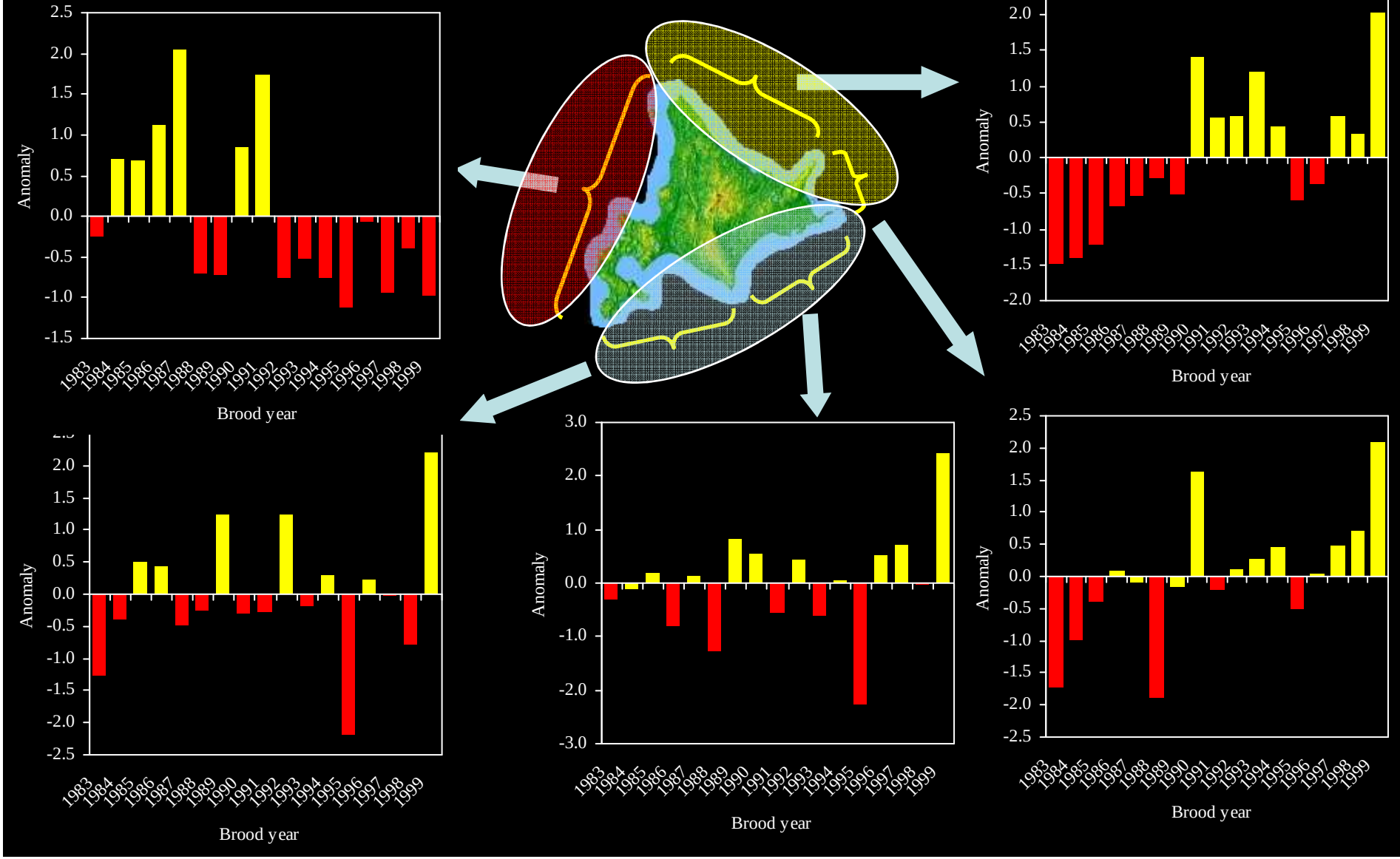
Temporal change in return rates of chum salmon released from Japan and Korea.

While return rates in Honshu and Korea chum have decreased remarkably since early 1990s, those in Hokkaido remain high.

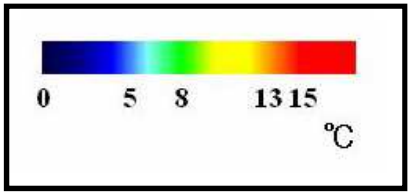
> Global warming effect?

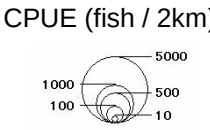
How about return rates within Hokkaido?

1983-1999 anomaly time series of chum salmon return rates in five coastal regions.



Spatial distribution of chum juveniles in relation to SST in the Abashiri Bay (Miyakoshi et al., 2007)





Early May | Mid May | Late May | Early June | Mid June | Late June

2002

2003

2004

2005

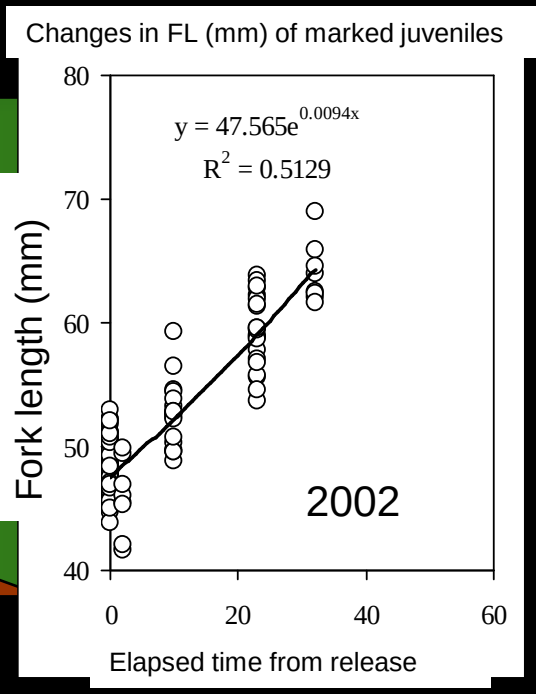
Littoral water

Coastal water

SST >8℃

2002 & 2004: warm year

Coastal water was occupied by sea water over 8 C in May

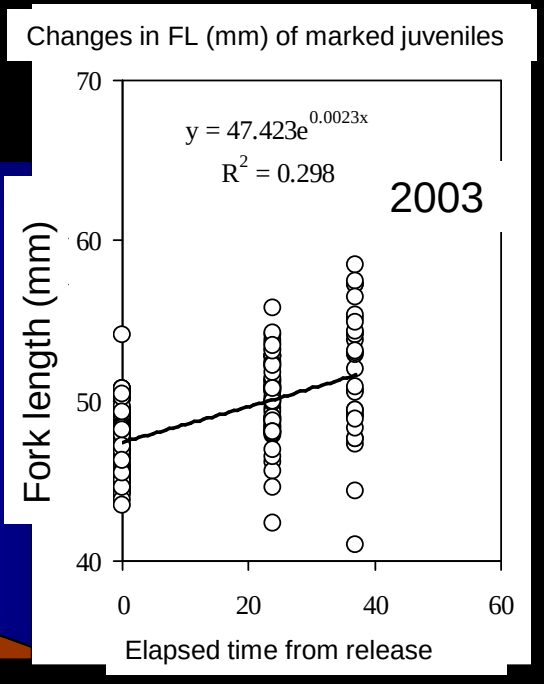


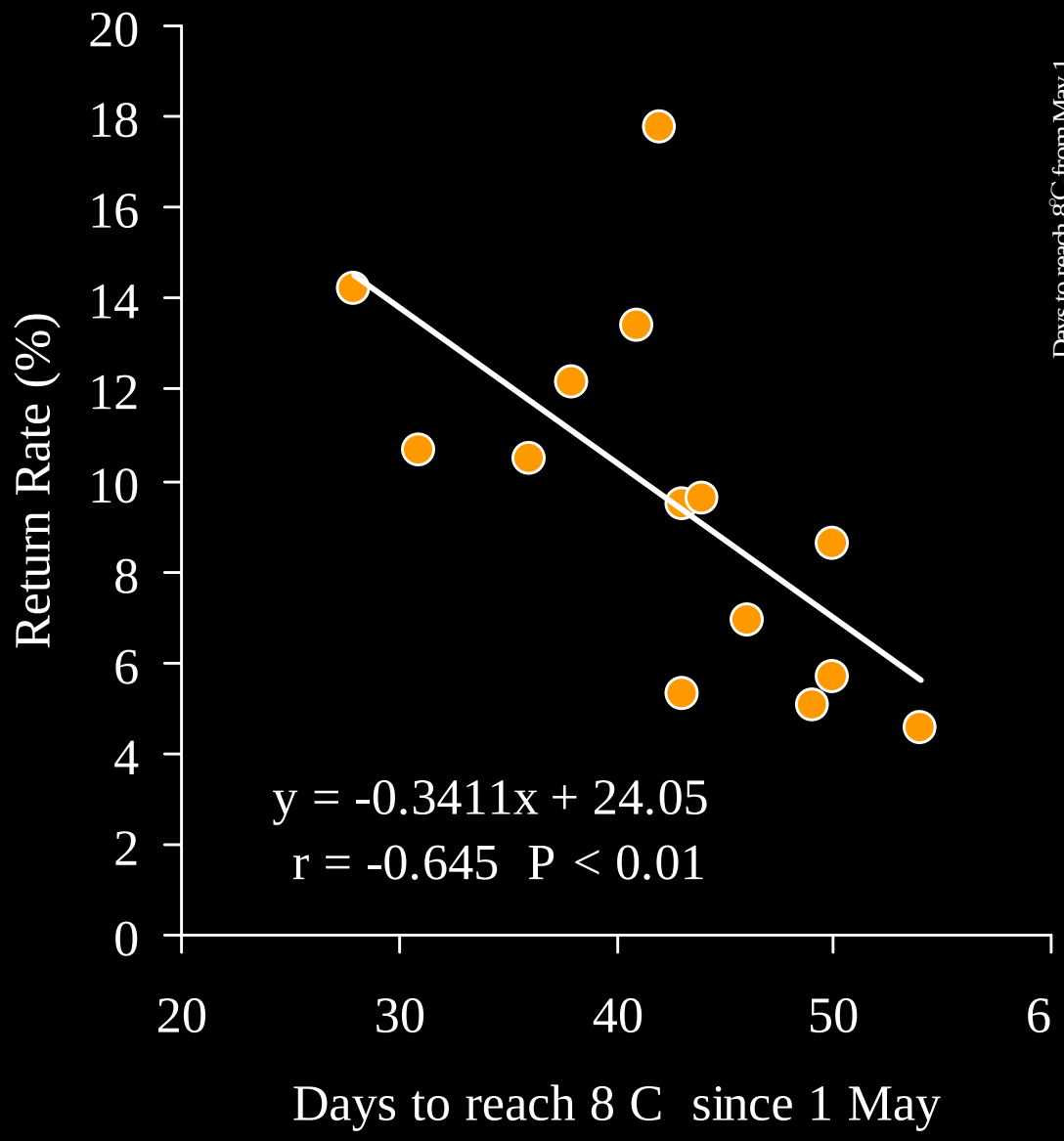
Behavior of chum juveniles after seaward migration depends on seawater temperature (Nagata et al., 2008).

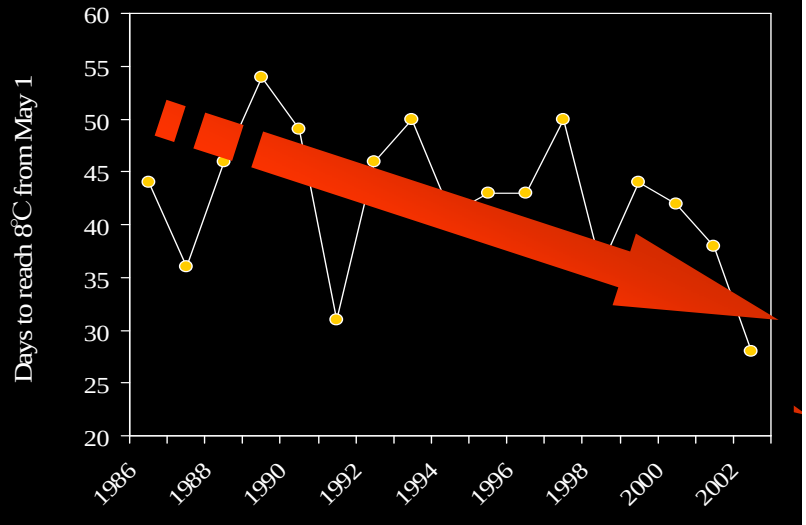
SST < 8℃

2003 & 2005: cool year

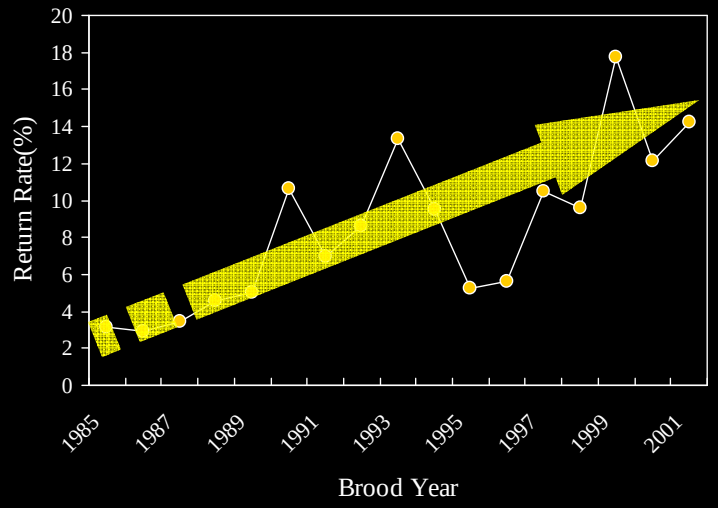
Coastal water was occupied by sea water below 8 C in May





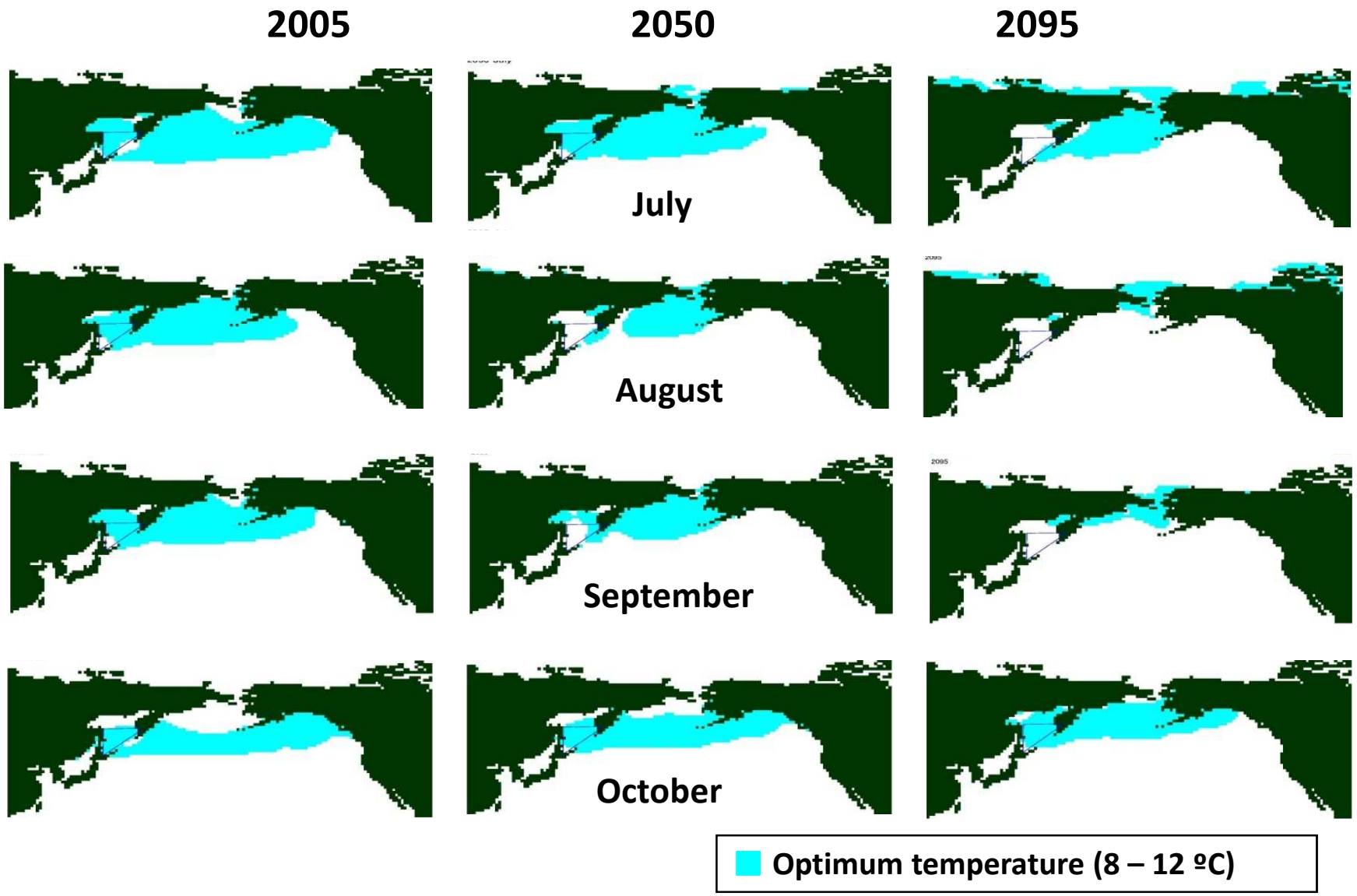


Return rate of chum salmon in the Eastern Okhotsk Sea



A relationship between return rate and days to reach 8 C since 1 May in the coastal water of eastern Okhotsk Sea of Hokkaido (Nagata et al., 2007) .

Global Warming effect on chum salmon in the North Pacific Ocean by the SRES-A1B scenario of IPCC (Kaeriyama, 2008)



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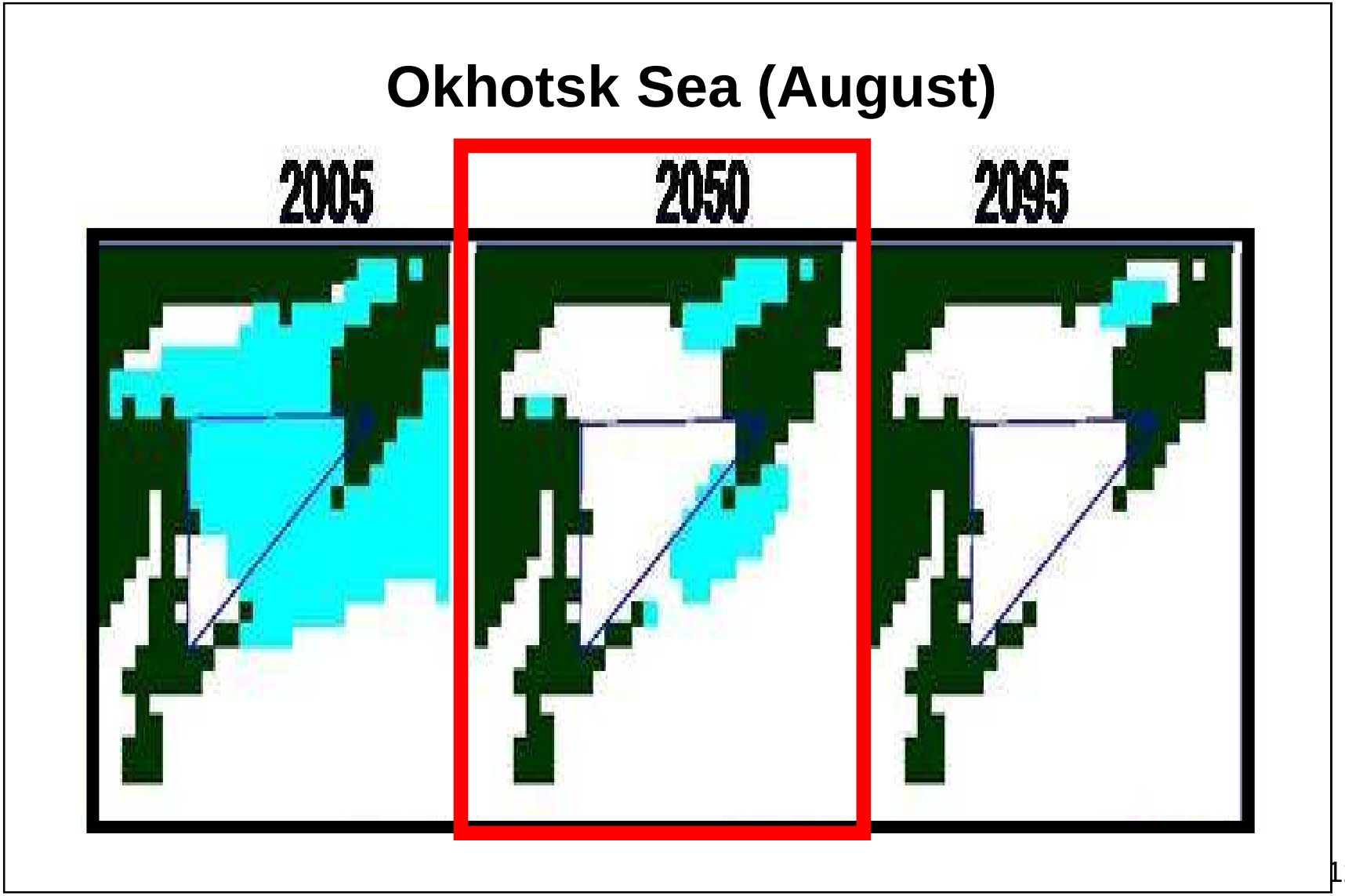
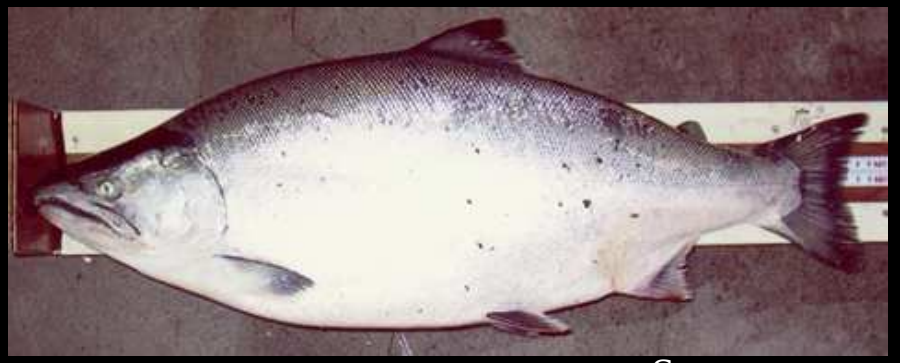


Masu salmon, *Oncorhynchus masou*

Fry & parr



Sea run type

Mature male

Resident type

Mature female

Status of Hokkaido masu salmon, and stocked juveniles

Catch

Stocked juveniles

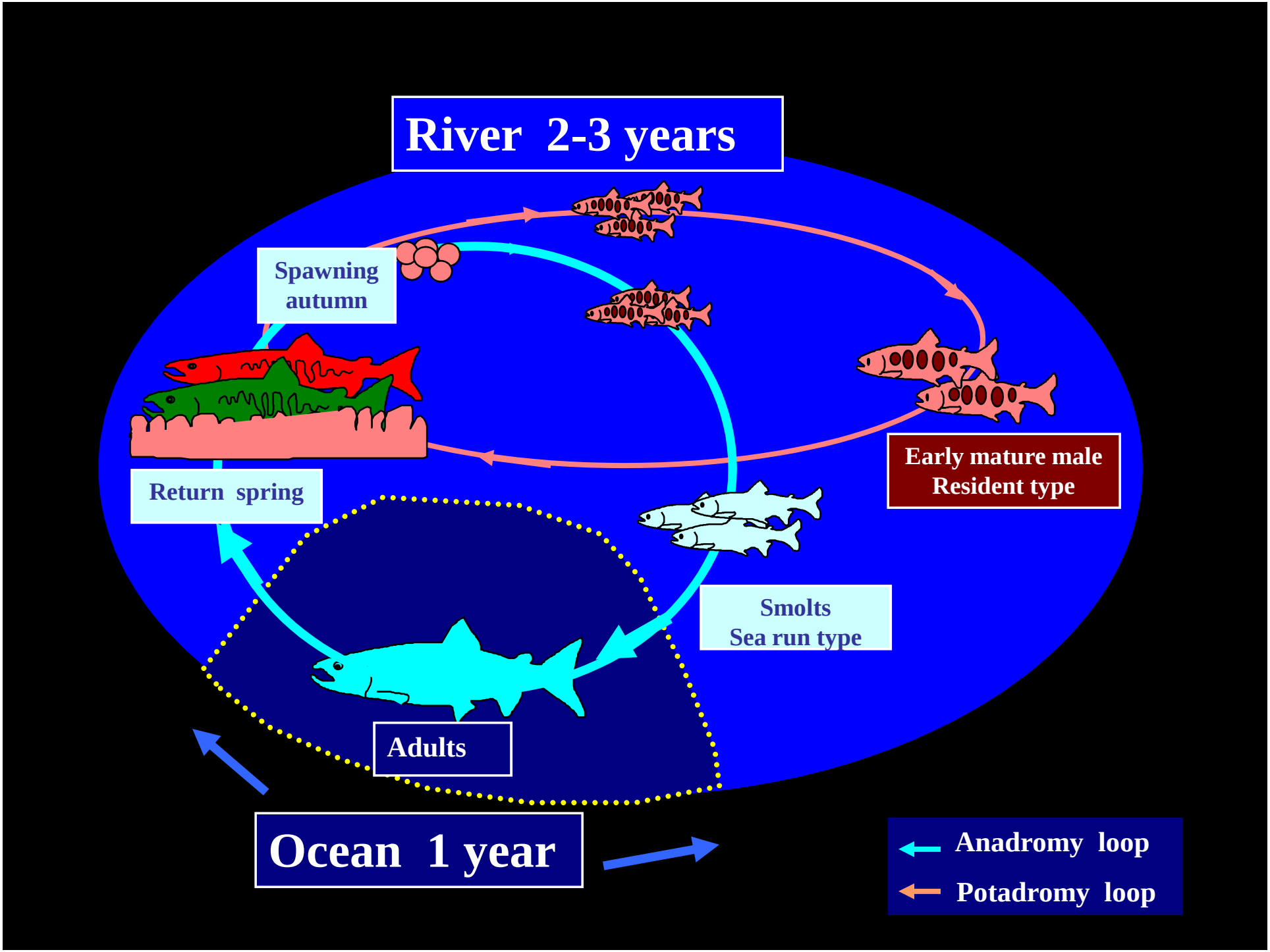
Catch (southonds)

Stocked juveniles (thousands)

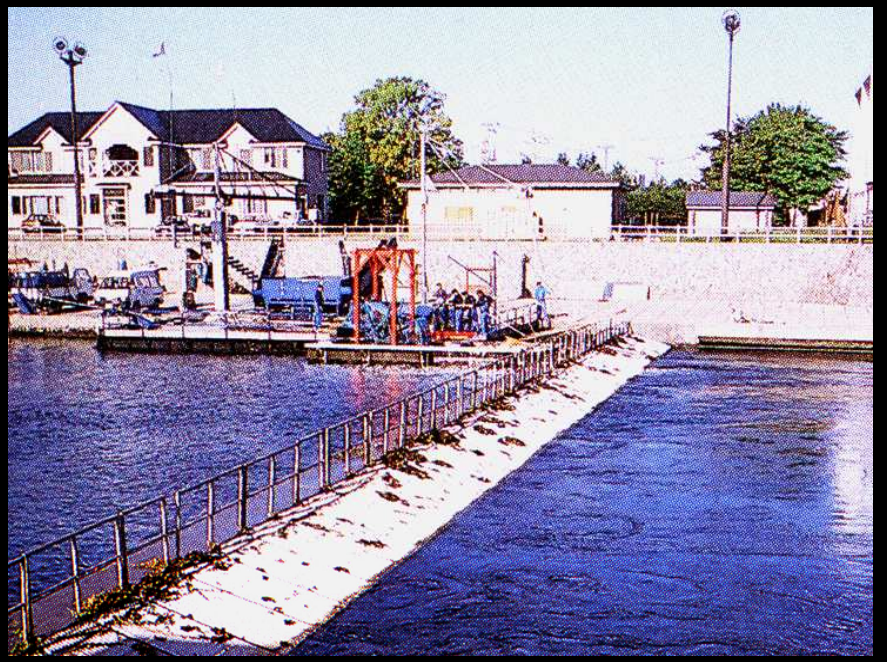
2500
2000
1500
1000
500
0

16000
14000
12000
10000
8000
6000
4000
2000
0

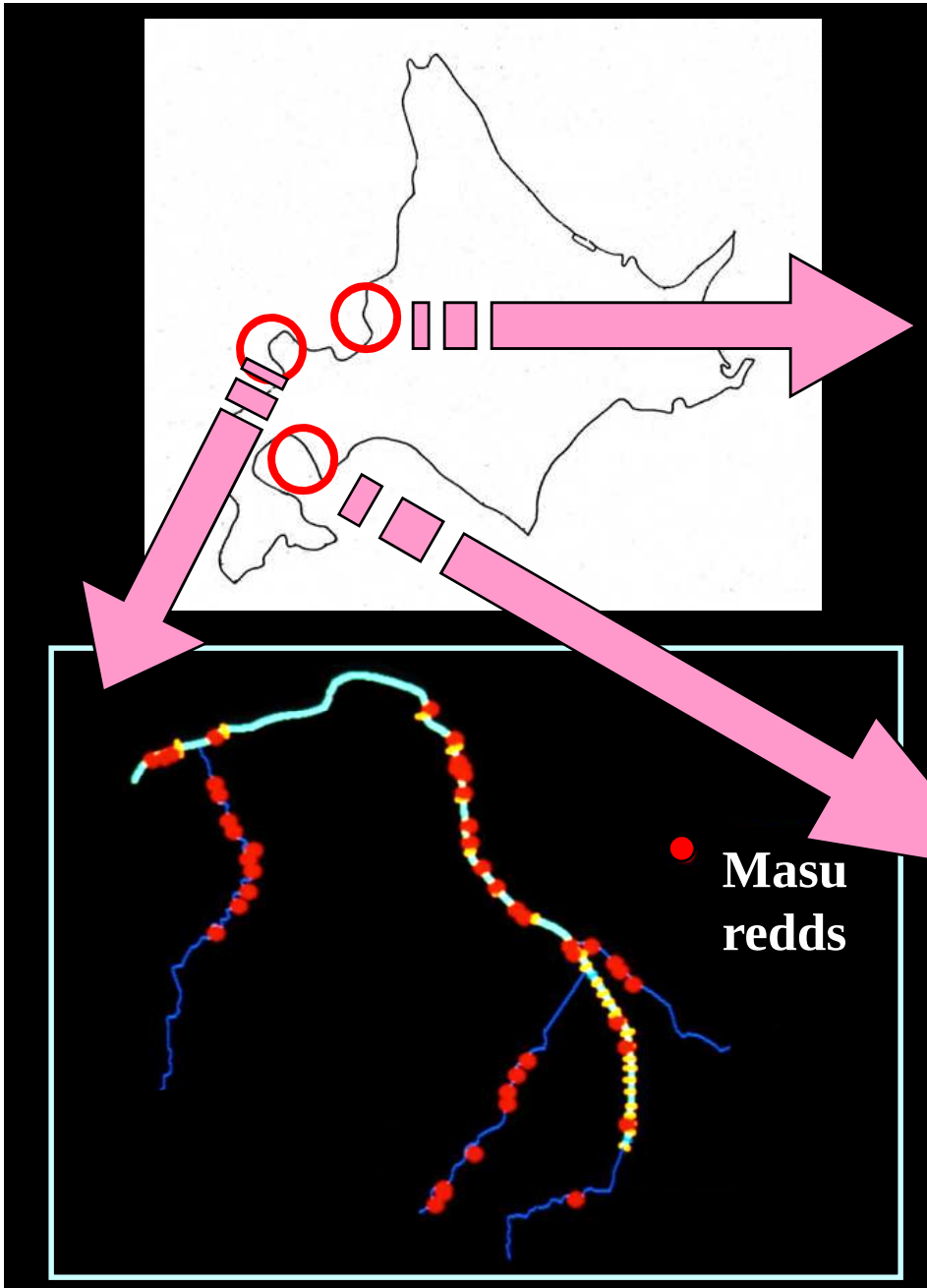
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004


River 2-3 years
Spawning
autumn
Return spring
Early mature male
Resident type
Smolts
Sea run type
Adults
Ocean 1 year
Anadromy loop
Potadromy loop

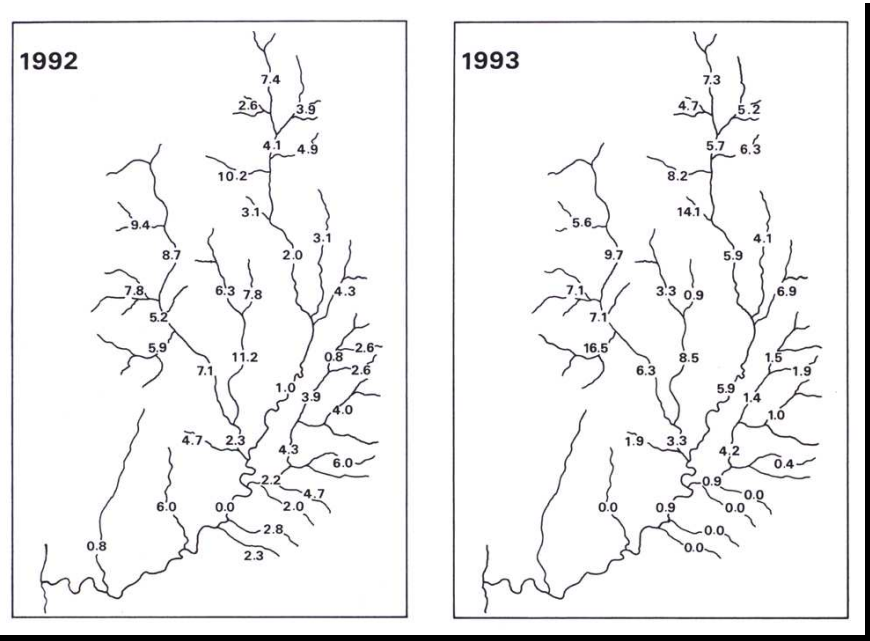
Habitat loss due to channelization, dam, clear cut and so on



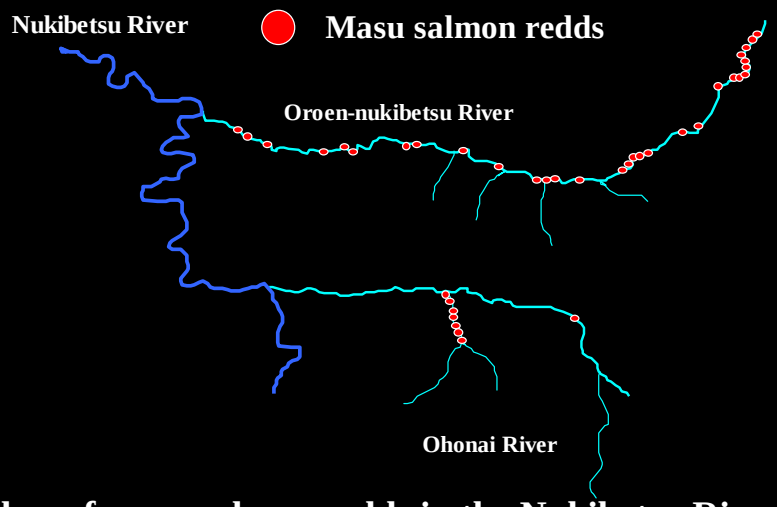
Impacts of hatchery activity such as mass-catch by weir in rivers and replacement by hatchery salmon to wild salmon



Number of masu salmon redds in the Shakotan River of mid-western part of Hokkaido (Yanai et al., 1996)



Number of masu salmon redds per km in the Atsuta River of mid-western Hokkaido (Sugiwaka et al., 1999)



Number of masu salmon redds in the Nukibetsu River of southern Hokkaido (Omori, 1998)

In conclusions

- There have been higher abundances in chum and pink salmon of Hokkaido thanks to favorable ocean conditions and hatchery programs except for recent chum in Japan Sea and southern Pacific Ocean. But, global warming may give a threat to the future salmon, even though in the Okhotsk.
- Hatchery program could not always contribute to recovering masu salmon due to deterioration of freshwater environments and immature hatchery techniques.
- Therefore, people should pay more urgent attention on conservation of wild salmon having higher biodiversity than hatchery ones, and on restoration of freshwater environments.