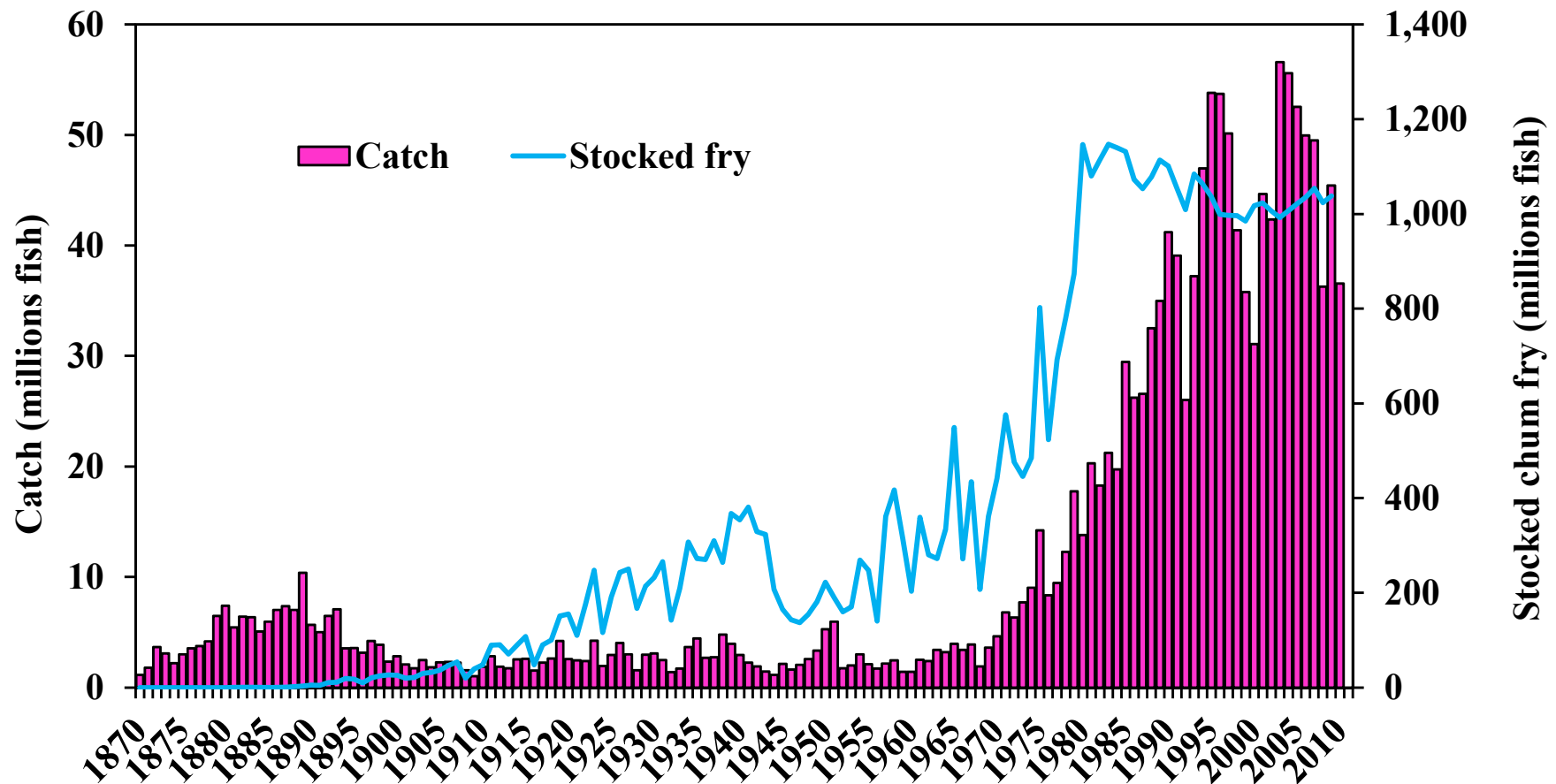


Perspectives of co-existence of wild and hatchery chum salmon for sustainable fisheries in Hokkaido, Japan based on ecosystem and autonomous management

Mitsuhiro Nagata

**Salmon and Freshwater Fisheries Research Institute, Hokkaido
Research Organization and Salmon Science Society**





Chum salmon have remarkably increased thanks to improvement of hatchery techniques and better ocean conditions since 1970s (Kaeriyama, 1999). But

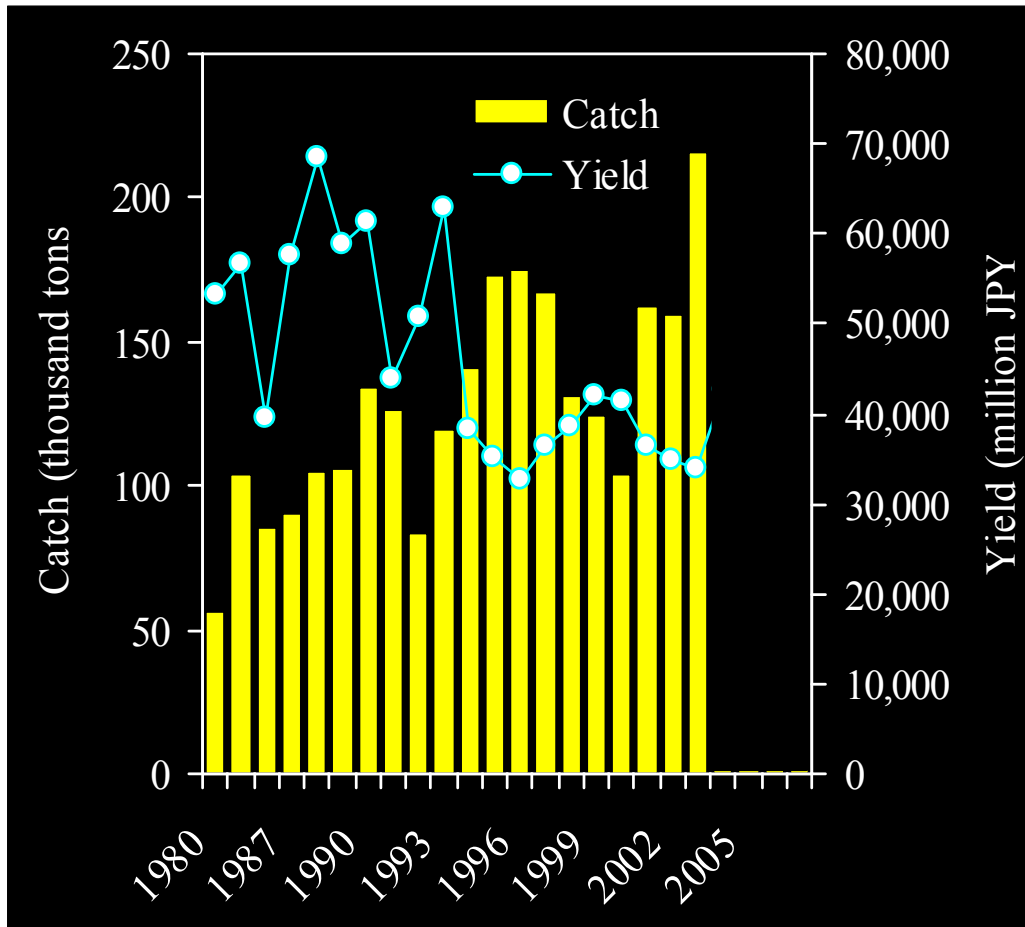


Fig.1 Annual changes in commercial catch and economical yield of Hokkaido chum salmon from 1980 to 2003.

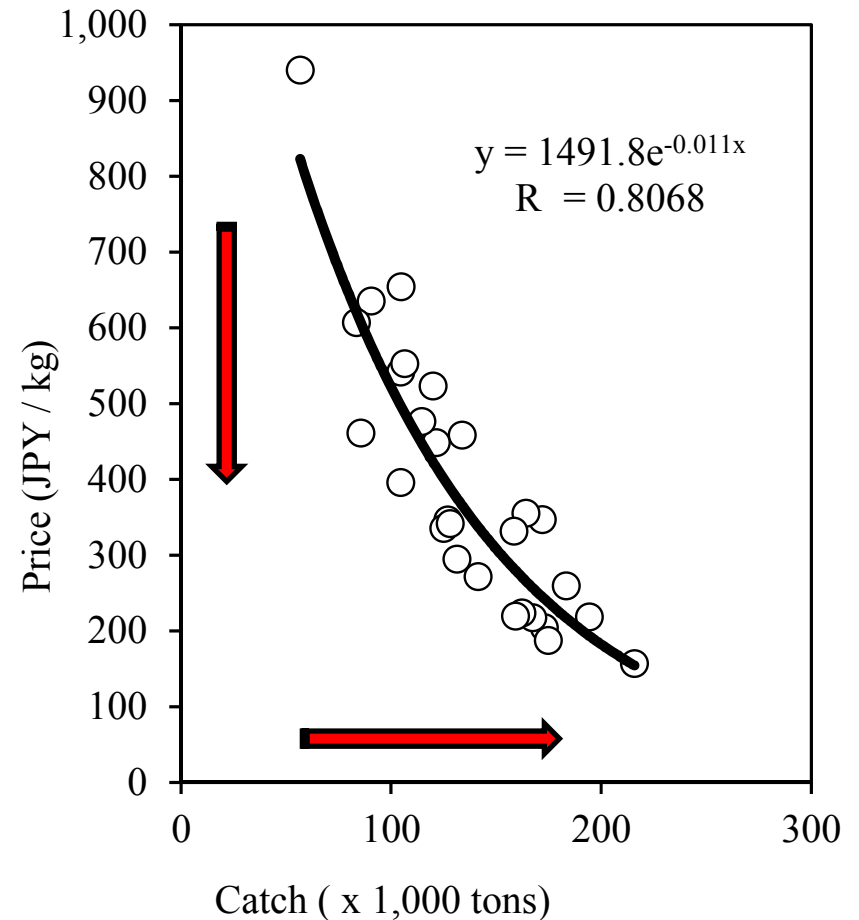
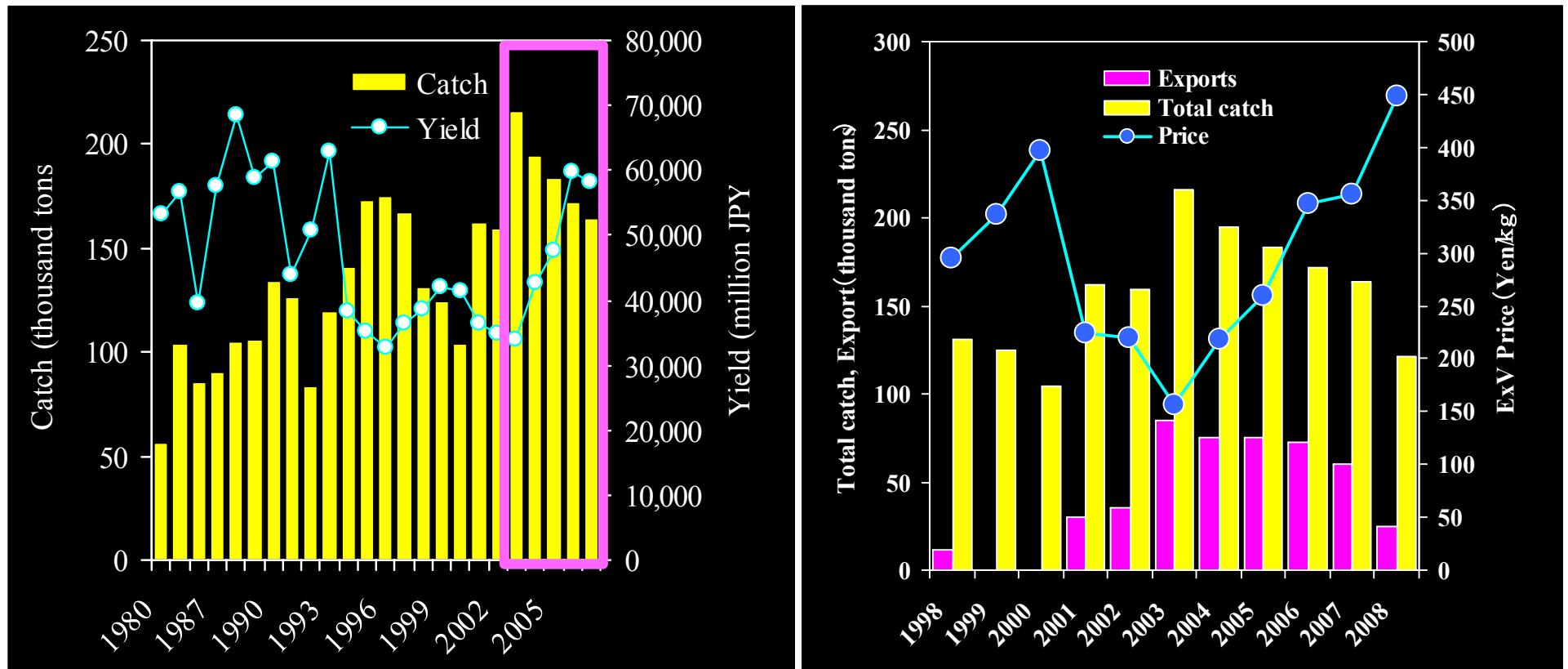


Fig.2 The relationship between commercial catch and price in chum salmon fishery.

Chum economical yields decreased dramatically from mid 1990s to early 2000s with increase in catch (Fig.1), because of too many catches causing extreme price down (Fig.2).

Recovery of economical yield since 2004

- > The HFFCA (Hokkaido Gyoren) exporting the extra fish to Europe and North America via China market.
- > Exports contributing to recovery of price and yield.



Alaskan MSC-certified salmon joining the China market.

the HFFCA (Hokkaido Gyoren) >>>> challenging MSC certification for Hokkaido chum salmon set net fishery.



the TAB of MSC

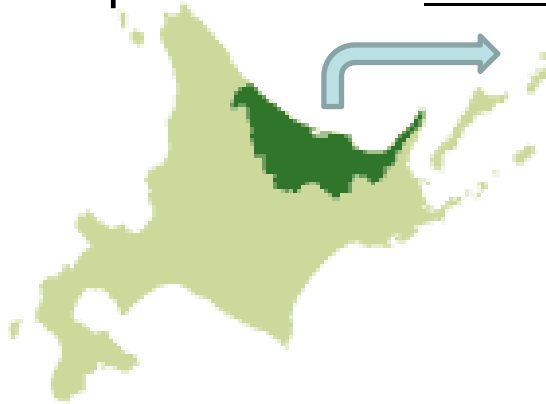
>>> Hokkaido chum set net fishery has **no sufficient evidences for the wild salmon management.**

Before entering full-assessment of MSC, Hokkaido fishery focuses on not only hatchery-based management but also wild salmon management.

Wild salmon policy and management

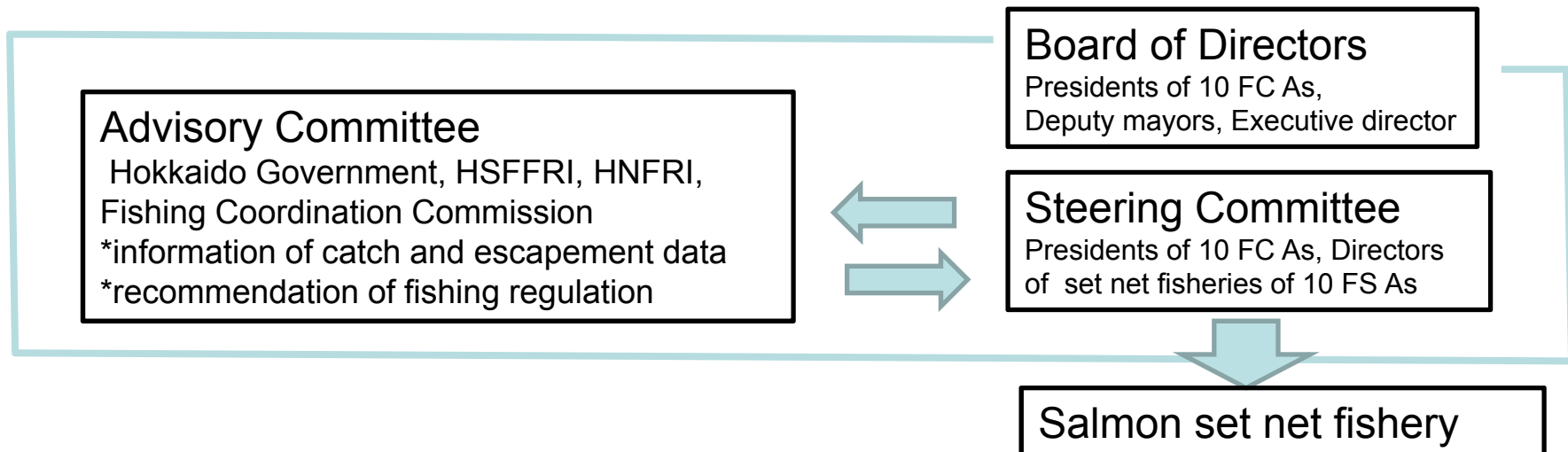
Different management system between Japan and North America

- 1.Hokkaido Government >>>> Wild Salmon Policy
- 2.Kitami SEP association >>>> Wild Chum Salmon Management Plan
in cooperation with local Fisheries Cooperative Associations (FCA).

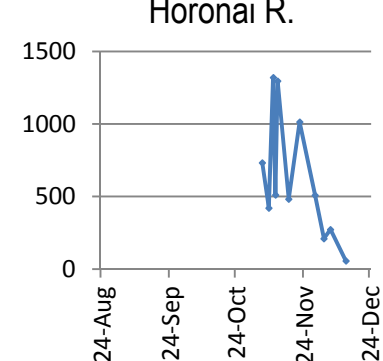
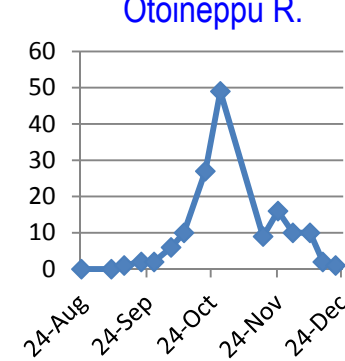
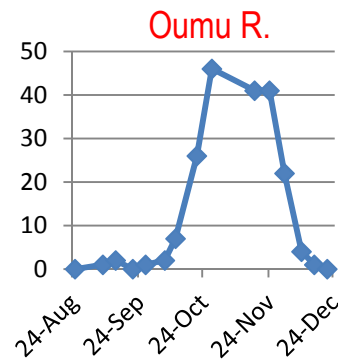
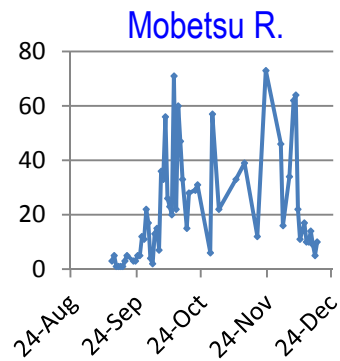
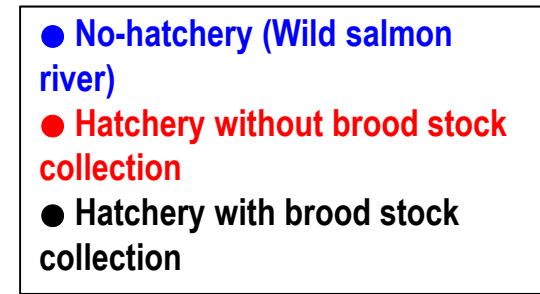
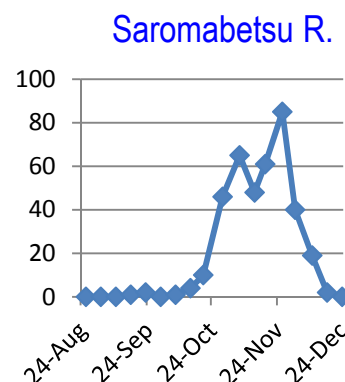
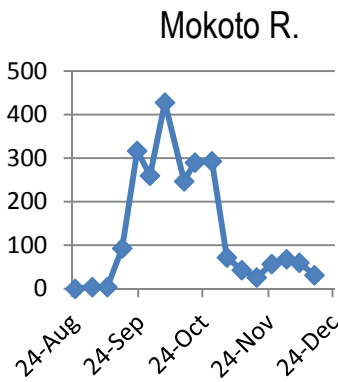
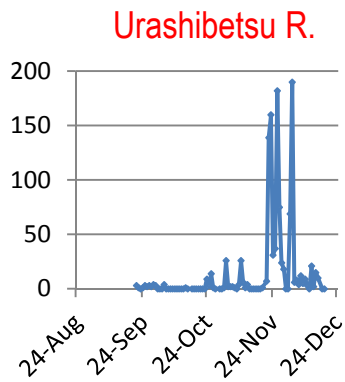
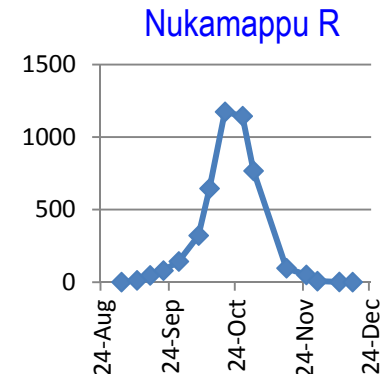
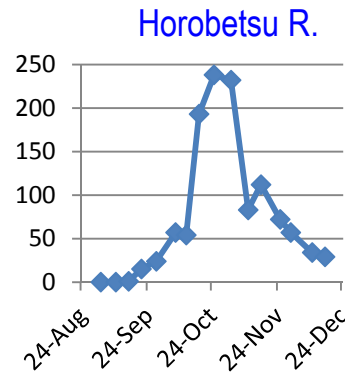
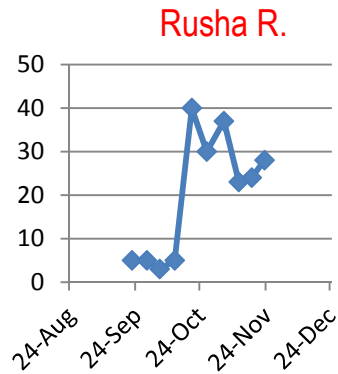
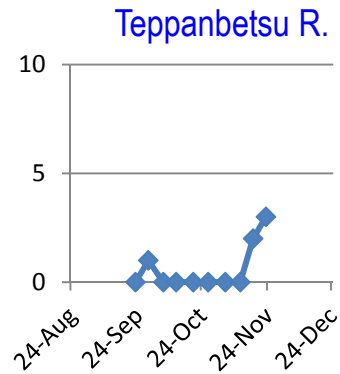


10 local FCAs in the Kitami Region
>> Autonomous Management in coastal fisheries
(Bottom Up Control)
>> Fishers of each FCA in the local community
>> Strong protection : illegal and over-fishing
destroy their fishery and community.

Management system by Kitami SEP association



Results of wild salmon counting in the Kitami region of 2010



Final Principle Scores of MSC assessment of Hokkaido chum salmon set net fishery



Principle 1 - Target species < 80 pts

Principle 2 - Ecosystem > 80 pts

Principle 3 - Management > 80 pts

Over 80 pts are required to pass.

Main reasons for low score at PL1

1. Small population size of wild chum salmon and in shortage of recovery plan.
2. Insufficient data on straying of hatchery salmon
3. Insufficient practice on the segregation of hatchery salmon from wild populations to conserve wild salmon.

Population size of natural spawners and straying of hatchery chum salmon in the Kitami region (2010)^{*1}

River	Population size	No. of otolith-marked fish*	% of marked fish ^{*2}	Estimated of total number of stray fish
Rusha	15	1	6.7%	13
Iwaobetsu	186	0	0%	0
Horobetsu	125	4	3.2%	38
Nukamappu	484	4	0.8%	38
Mokoto	448	1	0.2%	38
Sarobetsu	217	3	1.4%	38
Mobetsu	662	18	2.7%	34
Oumu	113	2	1.8%	30
Otoineppu	50	1	2.0%	25

No-hatchery (Wild salmon river)

Hatchery without brood stock collection

Hatchery with brood stock collection

*2Marked fish is originated from the Shari River where is enhanced

Ne (effective population size)
will be > 500 (FAO/UNEP 1981)

*1 Unpublished data from Dr. Urabe et al. of SFFRI

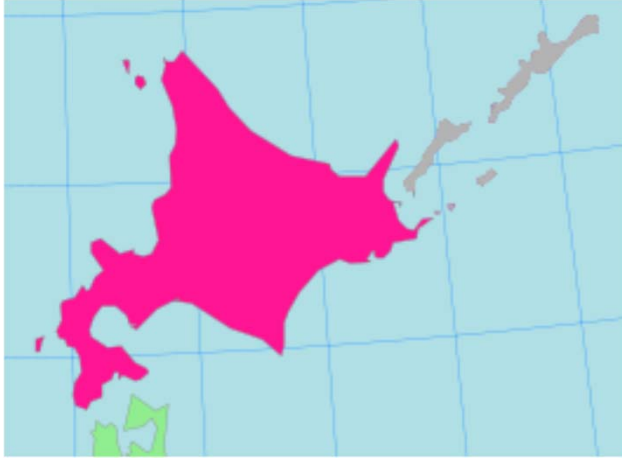
MSC CB >> Main action plan to improve

1.To increase natural spawning habitats and wild population sizes of chum salmon in the Kitami region because of less habitat and wild salmon.

2.To segregate hatchery programs from wild population to conserve wild salmon and to avoid negative impact of hatchery program such as reduction of genetic diversity and fitness, and expanding fish disease.

But, not easy to implement these plans!

Different natural and human factors



*Hokkaido >>>

Human Population: 5.5 million (9 x Alaska),
Land Area: 83,000 km² (5% of Alaska)

*Alaska >>>

Human Population: 0.6 million,
Land Area: 1,720,000 km²

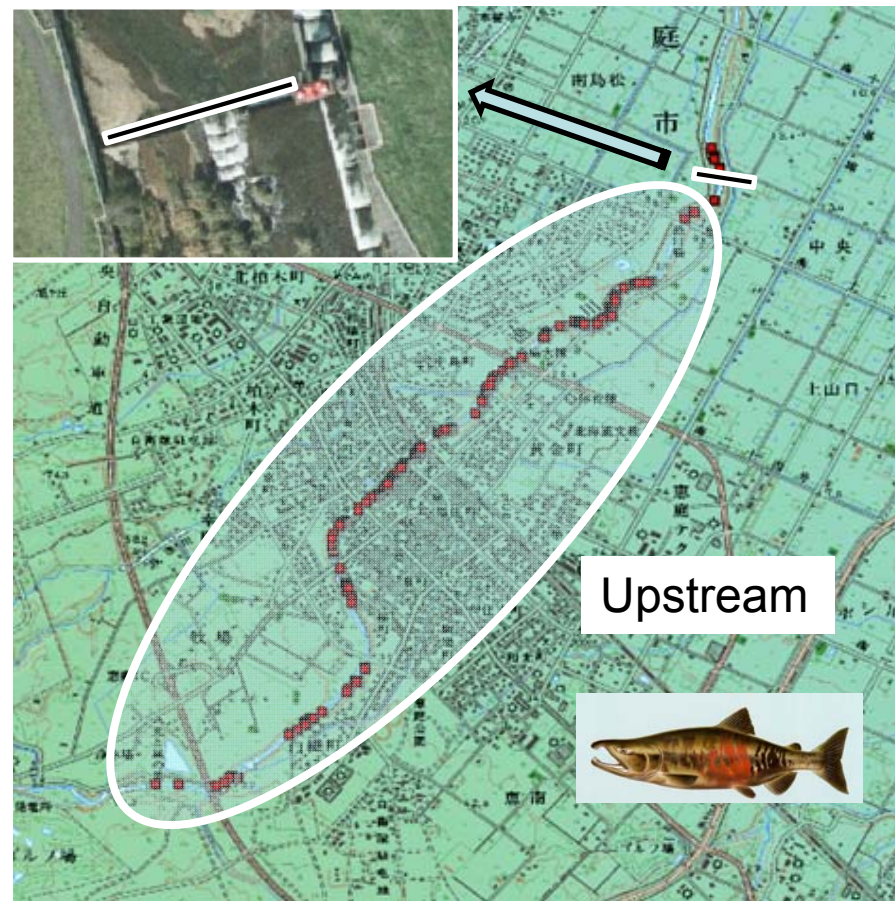
Many man-made constructions such as dams, channelization, irrigation in Hokkaido, differing from Alaska.

Not easy to restore salmon habitats because too many private and government sectors involved in river and watershed management and construction.

Therefore, we have to restore the salmon habitats very slowly in negotiation and agreement with such sectors.

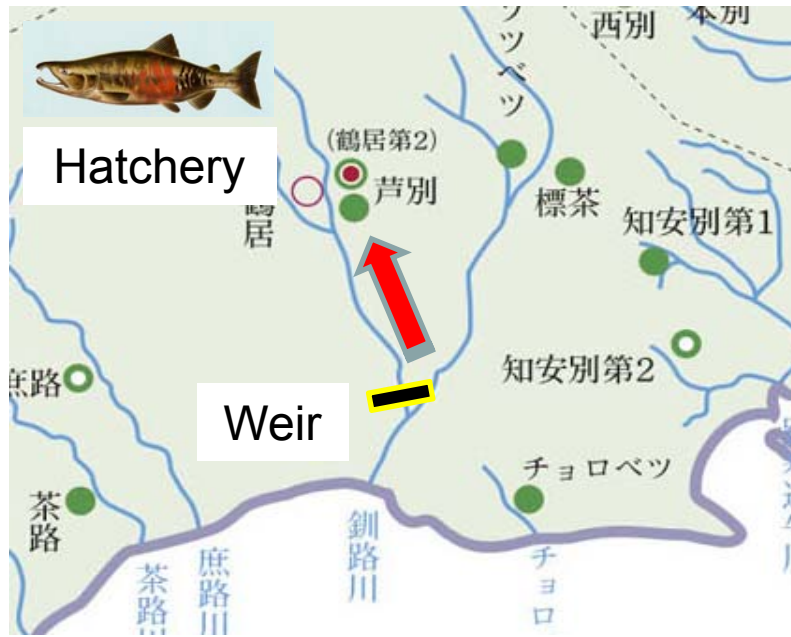
Expanding natural spawning by improvement of obstacles

Old fish ladder did not work well because of too rapid velocity (Yabe et al., 1995). New fish ladder was installed in 2001. As the results, many chum salmon came up and spawned naturally. This improvement contributes to increasing population size.



Red circles showing redds (nests) by chum salmon (Unpublished data from SFFRI)

Movement of weir's site to upstream



Improvement of holding box in the weir



Shari River

Kitada (2014, Fisheries Science)

Improvement programs of coexistence of wild and hatchery chum salmon in Hokkaido

Wild salmon

1. Accumulation of scientific data such as population dynamics, genetic trait, carrying capacity of spawning and habitat in the enhanced and non-enhanced rivers
2. Estimation of escapement goal, management unit based on GSU, restoration of river environments to meet capacity considering human activity

Improvement programs of coexistence of wild and hatchery chum salmon in Hokkaido

Hatchery salmon

1. Accumulation of scientific data such as straying rate and gene flow by mass marking
2. Evidence of reduction of genetic diversity and fitness by hatchery programs of chum salmon ? >>> Controversial issues between Japanese and North-American scientists in MSC assessment and scientific review

Do hatchery activities reduce fitness?

Hatchery steelhead trout >>> Reduction of RRS (relative reproductive success) to wild fish (Araki et al. 2007)

Hatchery chum salmon >>> No reduction of RRS (Berejikian et al., 2009)

Negative impact of hatchery depending on species ;

>>> Steelhead juveniles spend more than two years in freshwater before seaward migration. Chum juveniles go to the sea soon after they swim up.

>>> Reduction of fitness of steelhead trout may be easily caused by selection and hurry-up growth in hatchery.

High survival rate of chum salmon in the Kitami Region of Hokkaido (Kitada, 2014), suggesting

>> No evidence of fitness reduction by hatchery activities.

>>> Too much precautionary approach causes the shrink of sound commercial fishery. So, withdrawal from MSC!

Perspectives of co-existence of wild and hatchery chum salmon for sustainable fisheries in Hokkaido, Japan based on ecosystem and autonomous management

**So, we are very expecting FIP
programs and O2 to resolve large
gaps between Japan and North
American**

