Sea Dumped Chemical and Conventional Munitions in Japanese Waters

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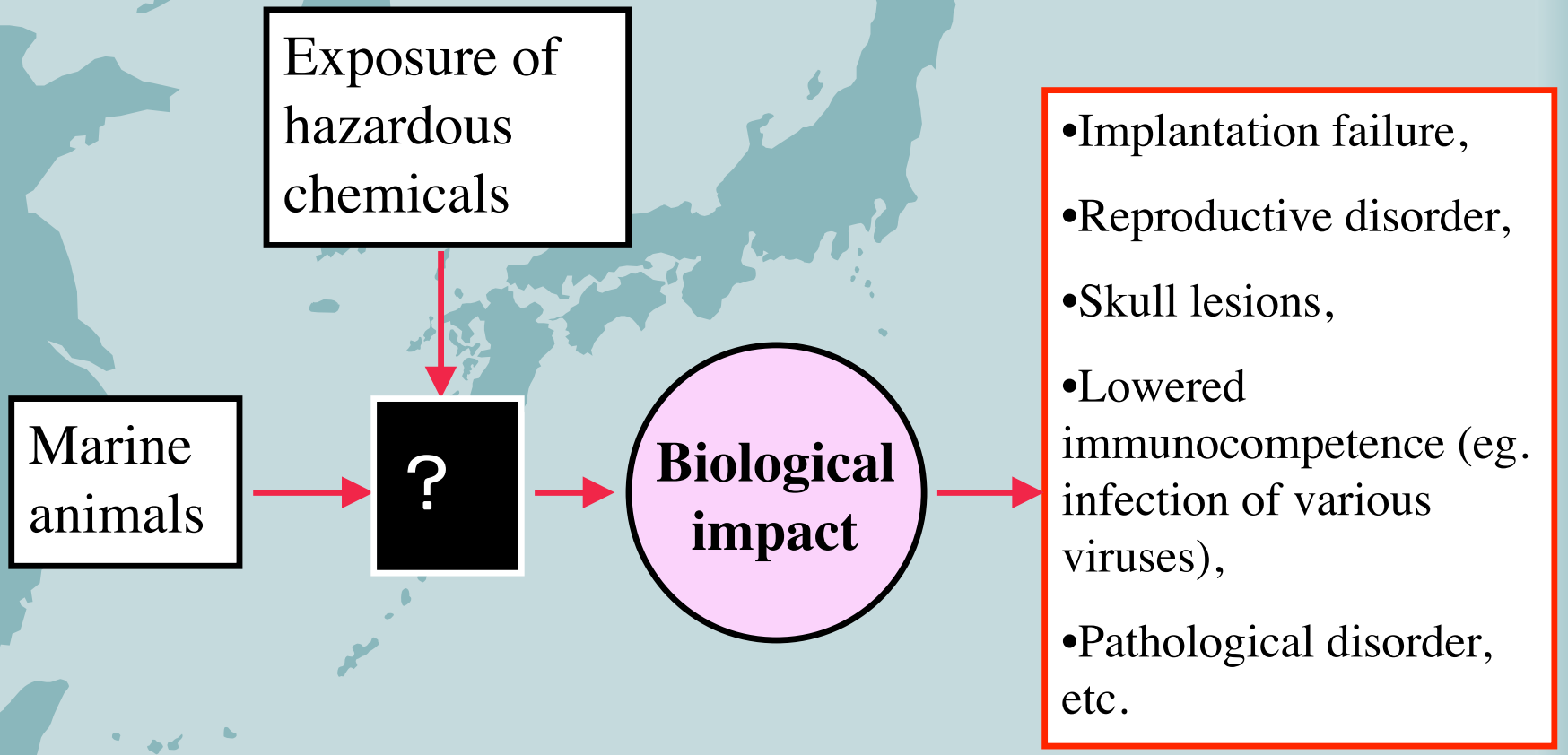
- to explain several research findings of marine pollution of hazardous chemicals in the marine ecosystem,
- to show some information on munitions dumped in Japanese waters on a report “Survey on Poisoning Gas Used in the Former Japanese Military” (Ministry of Environment, Japan, 2005),
- to show information on radioactive wastes dumped in the Sea of Okhotsk and the Sea of Japan by the former Soviet Union and Russian Federation.(Yablokov, 2001),
- to discuss the necessary steps to be taken in the future about this issue

Scientific topics for monitoring study on marine pollution by hazardous chemicals in the marine ecosystem

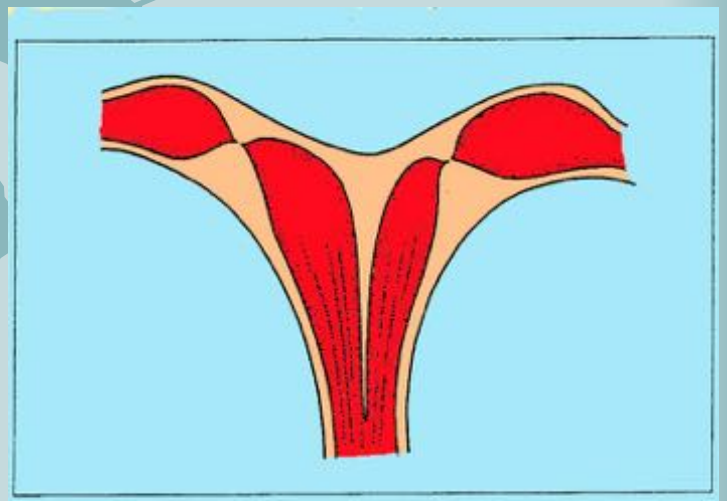


Representative events of mass die-off of marine mammals

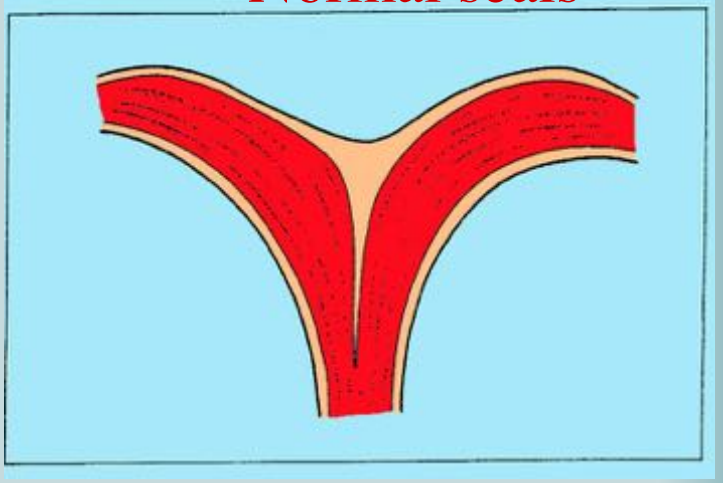
- •Mass die-off of ringed, grey and harbour seals in the Baltic Sea and the North Sea occurred in 1960s and 1988 (Helle, 1972; Reijinders et al., 1994).
- •Population size of beluga whales in the St. Lawrence was tremendously decreased from about 5000 in 1970s to about 500 animals (Martineau et al., 1994).
- •Several thousands Baikal seals were died from virus infection in 1987-1988 and 1998 (Grachev et al., 1989)
- •Mass die-off of several thousands striped dolphins in the Mediterranean Sea occurred in 1990-1992 (Aguilar et al., 1994).
- •Several thousands Caspian seals died off in the spring of 1997 and 2000 (Eybakov, 1997; Ohashi et al., 1998, Kennedy et al. 2000, Ohishi et al., 2002).

Mass die-off of seals in the Baltic Sea and uterus occlusion

Uterus occlusion



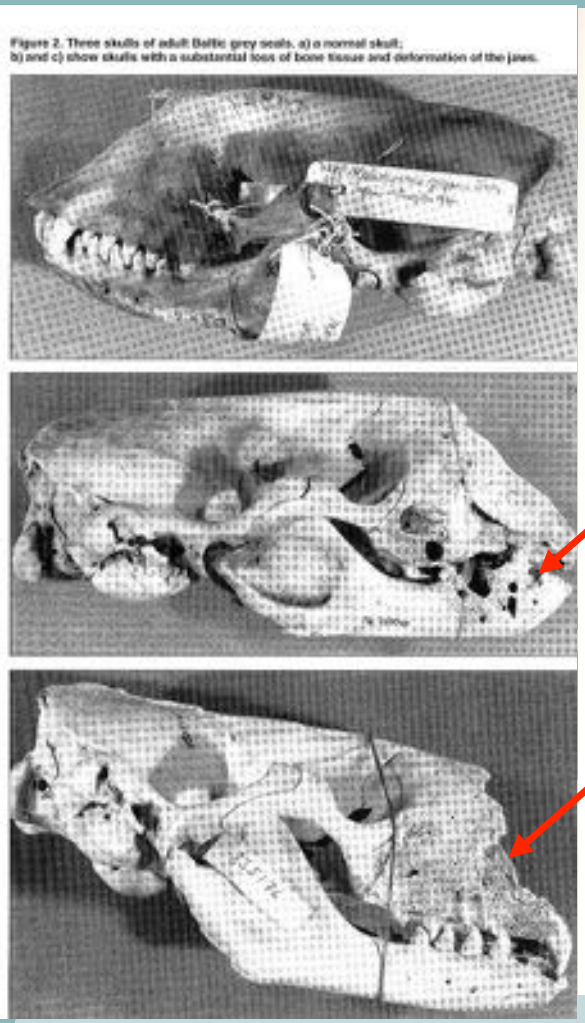
Normal seals



- Seals population decreased to a half of the initial population size
- Adult females having higher concentration of PCB and DDT showed uterus occlusion

Helle et al. (1972)

Skull-bone lesions of grey seals in the Baltic Sea



Grey seal, Svenska Björn in the Stockholm outer archipelago. Photo: B. Helander.

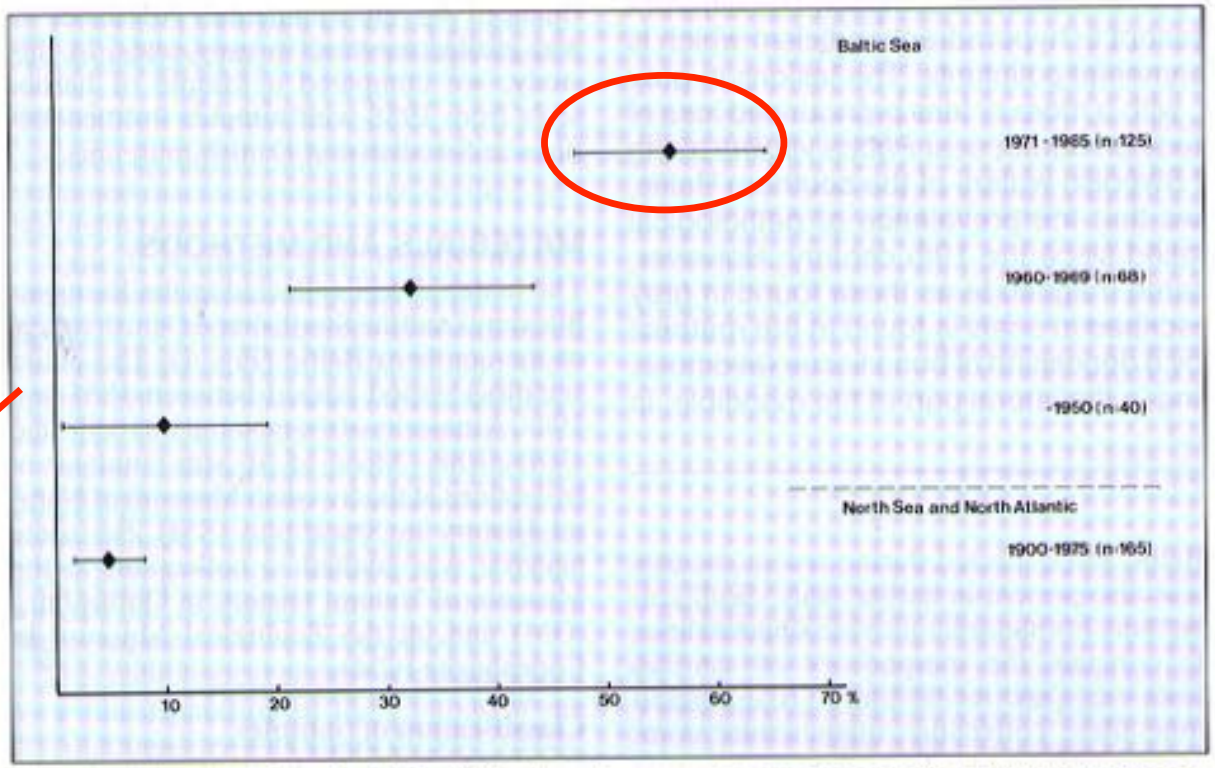
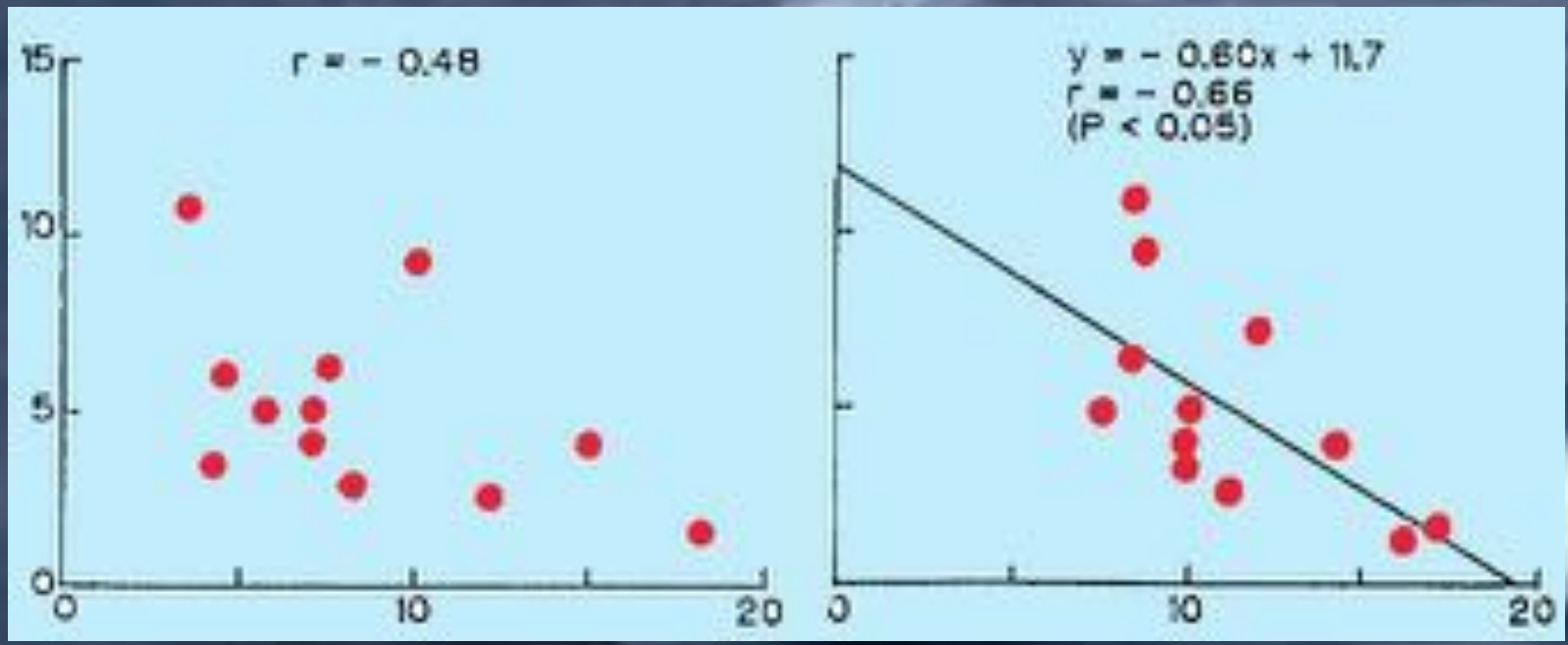


Figure 3. The proportion of skulls with lesions in grey-seal samples collected in the Baltic and in the North Sea and North Atlantic at various time periods. The number of specimens (n) in each group is indicated. The 95% confidence limits for the proportions according to the binomial distribution are displayed in the figure.

- OCs might disorder their calcium metabolic system
- 60% of the die-off animals showed skull lesion

Bergman et al. (1992)

Relationship between DDE and PCBs levels and testosterone in adult male Dall's porpoises in the western North Pacific



Testosterone Concentration (μg/l)

PCBs Concentration (μg/g)

DDE Concentration (μg/g)

Subramanian et al. (1987)

Comparison of organochlorine compounds in blubber among three species

	Caspian seal		Baikal seal	Ringed seal
	1993 (Watanabe et al., 1999)	2000 (Kajiwara et al., 2002)	(Natata et al., 1995)	(Nakada et al., 1998)
	mean	range	mean	mean
PCBs (μg/g)	9. 7	6. 3 - 470 *	27	4. 2
DDTs(μg/g)	19	2. 4 – 320*	55	3. 6
BHC (μg/g)	1. 3	0. 69 - 9. 9*	0. 077	0. 18
Total TEQ (pg/g)	51	-	570	-

* Die-off Seal

Infection of influenza virus A and B in Caspian seals (Ohishi et al. 2002)

Microbiol. Immunol., 46(9), 639–644, 2002

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Serological Evidence of Transmission of Human Influenza A and B Viruses to Caspian Seals (*Phoca caspica*)

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***Abstract*: Seroepidemiological surveillance of influenza in Caspian seals (*Phoca caspica*) was conducted. Antibodies to influenza A virus were detected in 54% (7/13), 57% (4/7), 40% (6/15) and 26% (11/42) of the serum samples collected in 1993, 1997, 1998 and 2000 by enzyme-linked immunosorbent assay (ELISA). In an hemagglutination-inhibition (HI) test using H1–H15 reference influenza A viruses as antigens, more than half of the examined ELISA-positive sera reacted with an H3N2 prototype strain A/Aichi/2/68. These sera were then examined by HI test with a series of naturally occurring antigenic variants of human H3N2 virus, and H3 viruses of swine, duck, and equine origin. The sera reacted strongly with the A/Bangkok/1/79 (H3N2) strain, which was prevalent in humans in 1979–1981. The present results indicate that human A/Bangkok/1/79-like virus was transmitted to Caspian seals probably in the early 1980s, and was circulated in the population. Antibodies to influenza B virus were detected by ELISA in 14% (1/7) and 10% (4/42) serum samples collected from Caspian seals in 1997 and 2000, respectively. Our findings indicate that seal might be a reservoir of both influenza A and B viruses originated from humans.**

***Key words*: Influenza virus, Seal, Marine mammal**

Influenza virus is a member of the *Orthomyxoviridae* family, and influenza A and B viruses cause epidemics in humans. Influenza A virus infects a variety of avian and mammalian species including humans and marine mammals such as seals and cetaceans (13, 20). On the other hand, influenza B virus had been believed to be a pathogen only for humans until virus isolation was recently achieved in a harbor seal (*Phoca vitulina*) (15). It has been established that waterfowls are the primary host for all of the influenza A virus strains that have been introduced into mammals, including humans, as pandemic strains. It was experimentally demonstrated that pigs serve as intermediate hosts to generate human pandemic strains (10). It is, therefore, important to monitor the distribution of influenza virus in wild animals to achieve a better understanding of the ecology and interspecies transmission of influenza viruses. However, little information is available on influenza virus infection in marine mammals.

Influenza A virus infection occurred in harbor seals (*Phoca vitulina*) on the northeast coast of the U.S.A. in 1979–1980. Six hundred seals, approximately 20% of the regional harbor seal population, died of severe pneumonia during this outbreak, and A/seal/Massachusetts/1/80 (H7N7) influenza virus was isolated from the dead animals (2, 11, 19). Some other subtypes of influenza A viruses (H4N5, H4N6 and H3N3) were also

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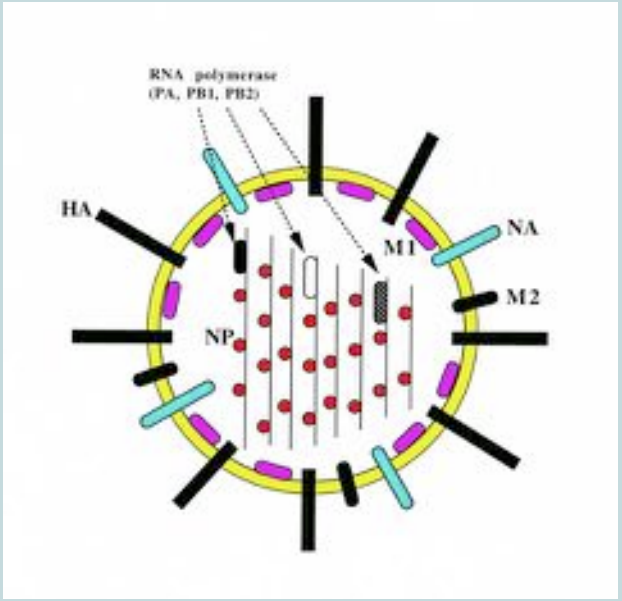
Abbreviations: ELISA, enzyme-linked immunosorbent assay; HI, hemagglutination-inhibition; SD, standard deviation.



Structure of influenza virus

Three species of seals are infested by influenza virus

N=6

1.A/Aichi/2/68 (H3N2)
(Infection rate: 4/6)

2.A/seal/Massachusetts/1/80
(H7N7) (1/6)

N=42

1.A/Bangkok/1/79
(H3N2) (12/42)

2.Influenza B (4/42)

N=7

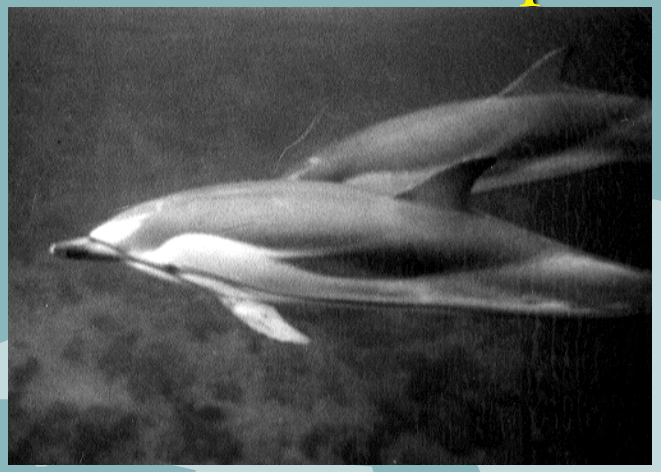
1.A/Aichi/2/68 (H3N2) (1/7)

2.A/Bangkok/1/79 (H3N2) (1/7)

Microbiol. Immunol. (Ohishi et al. , 2002 & 2004)

Why are marine mammals disordered in their metabolic system by hazardous chemicals?

Relationship of PCBs to age in striped dolphin

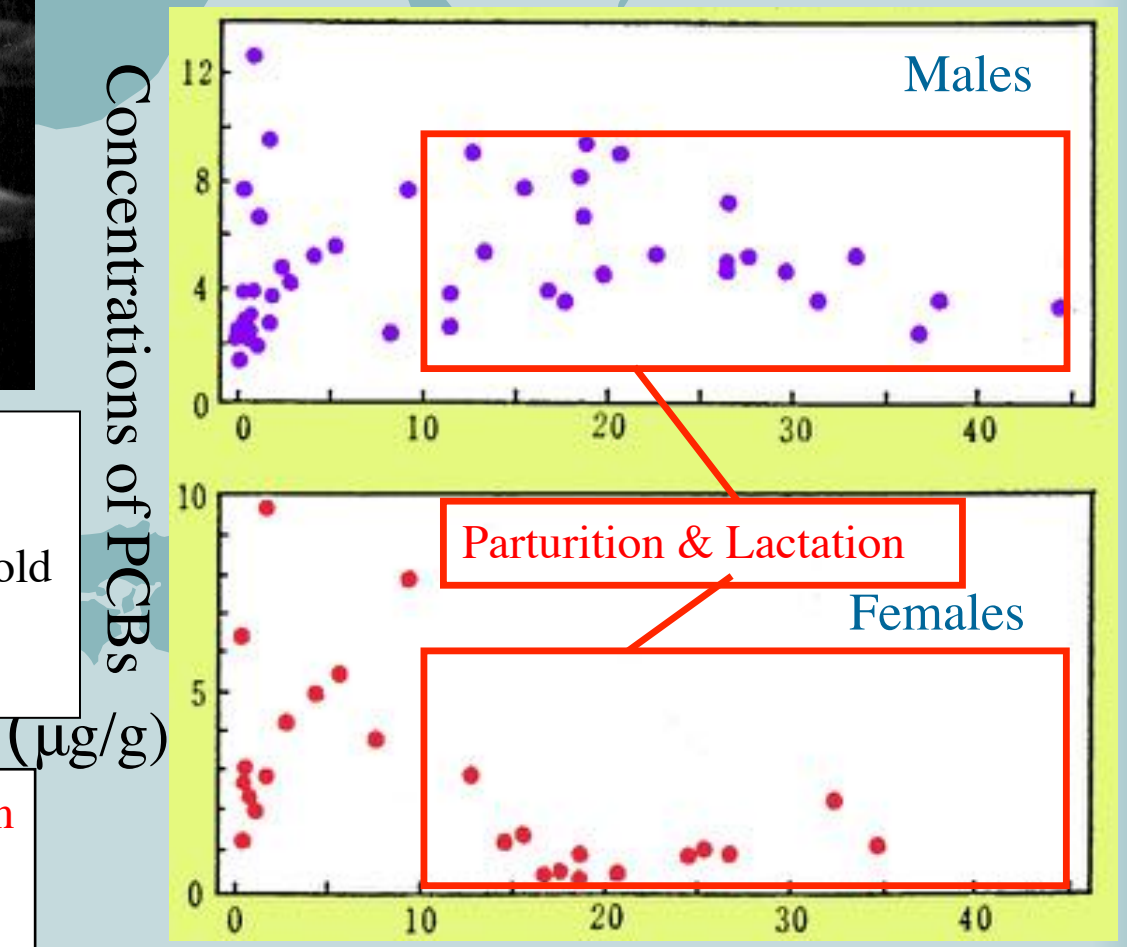


Life history

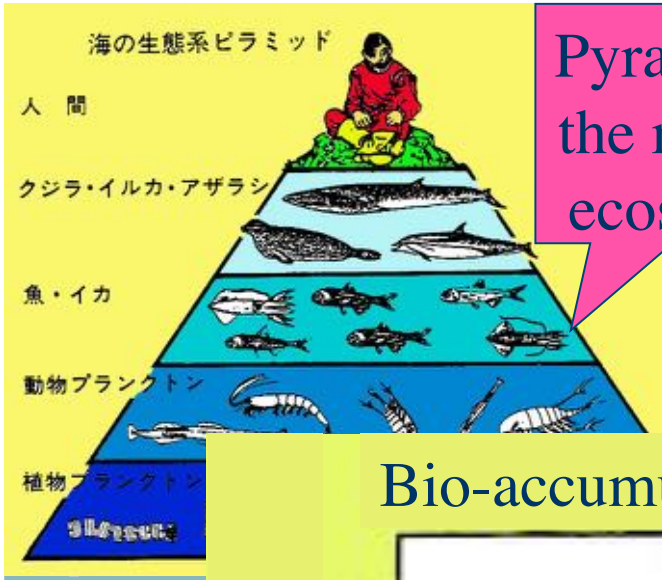
- Weaning age: 1.5 years old
- Sexual maturity age: 9 years old
- Pregnant period: 1 year
- Reproductive cycle: 3 years

Characteristics of accumulation

- Adult males accumulated higher concentration of OCs than Adult females
- OCs in mother transfer to fetus through placenta (4-9%)
- OCs in mother transfer to calf through milk (70-90%)



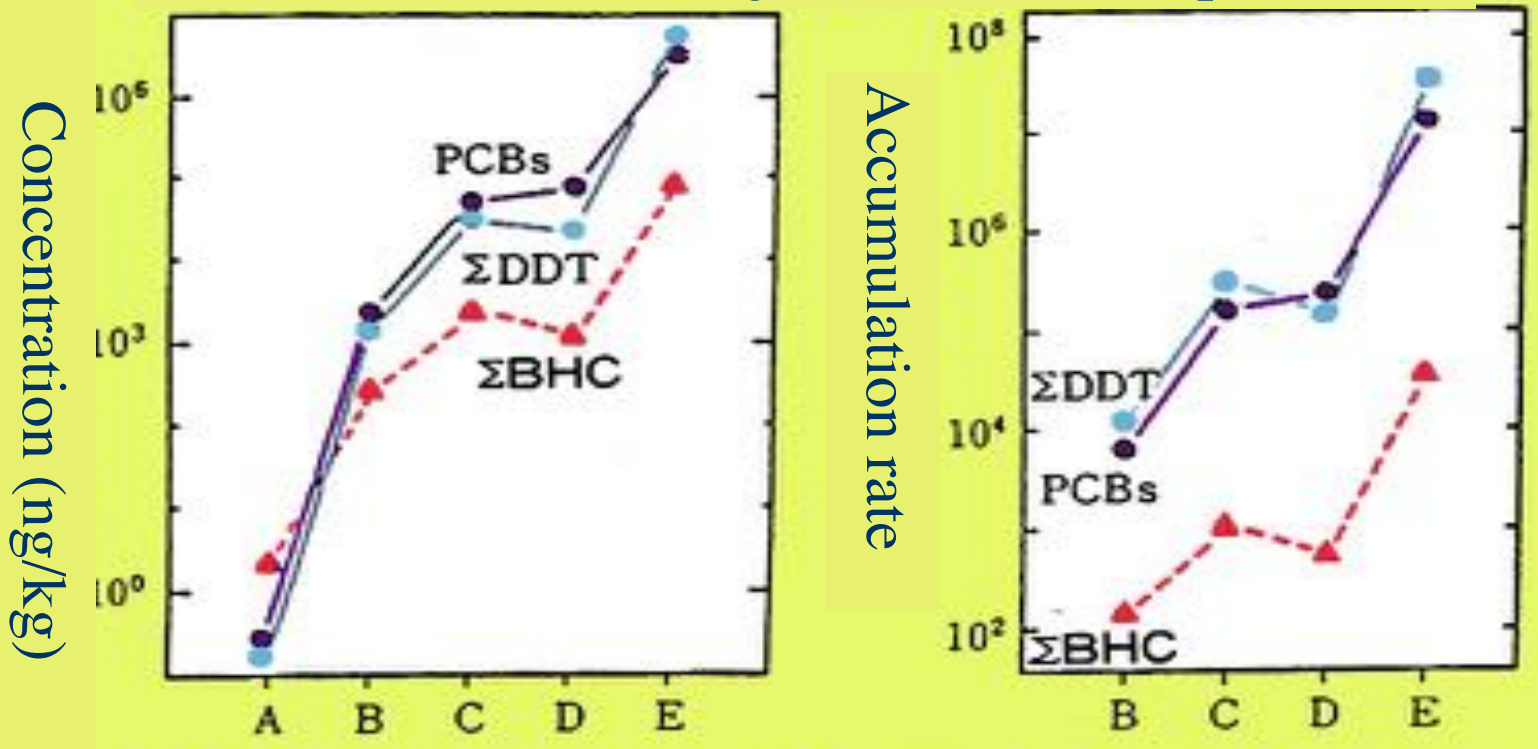
Tanabe (1988)



Pyramid in the marine ecosystem

Concentration of OCs in the striped dolphin is 1-10 million times than that of sea water

Bio-accumulation of organochlorine compounds



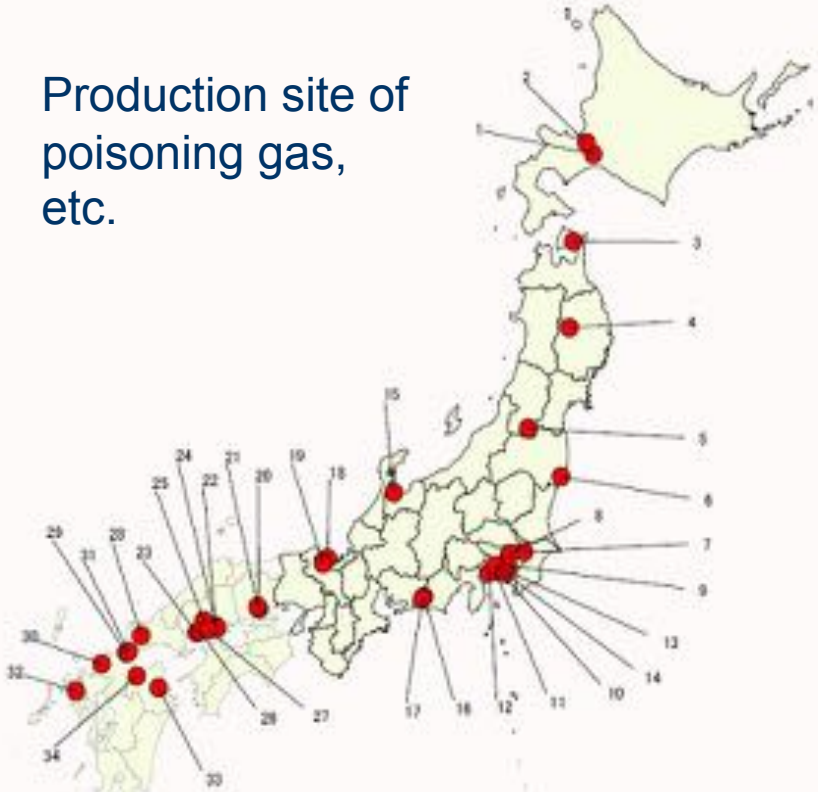
A: sea water, B: plankton, C: fish, D: squid, E: striped dolphin

Tanabe et al. (1984)

Munitions dumped at sea on a report "Survey on Poisoning Gas Used in the Former Japanese Military" (2005) based on news paper articles and hearing survey to the former staff of Japanese military

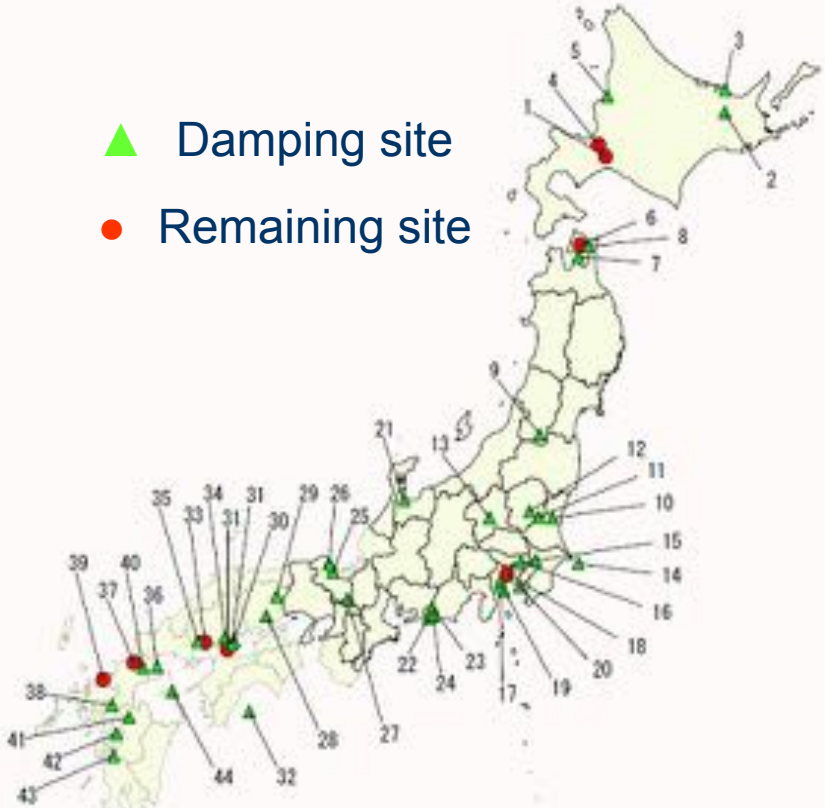
Sea dumped chemicals in Japanese waters (Ministry of Environment, Japan,2005)

Production site of poisoning gas, etc.



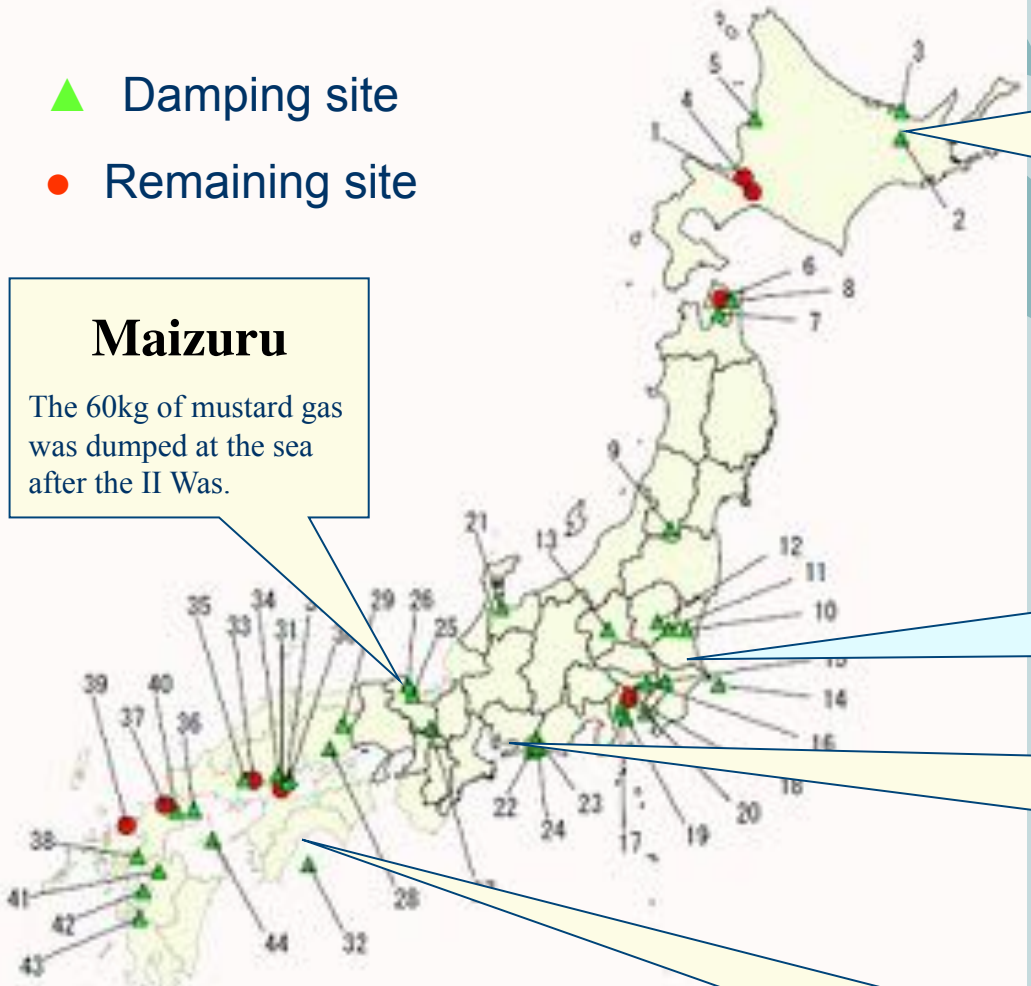
▲ Damping site

● Remaining site



▲ Damping site

● Remaining site



Lake Kusharo

•The gas bombs more than 300 were dumped at the lake.
The 60 bombs (mustard gas & lewisite) were dumped after the II War, and 26 were recovered and treated in 1997
•The normal bombs and others were dumped in the sea off Abashiri.

Maizuru

The 60kg of mustard gas was dumped at the sea after the II Was.

Kamisu town

The local people were polluted by arsine compounds through drinking waters from the well in 2003. Direct reason is still unknown

Lake Hamana

The 100 cases (20 tons) of mustard gas were dumped after the II war, and they were salvaged and dumped at the sea again.

Kochi

The poisoning liquid waste of 1,845 ton & 70 kg poisoning gas were dumped at three positions of the sea after the II War, . (1:32-37N, 134.14E; 2:30.38N, 132.22E; 3:32.30N, 133.55E).

Okinawa

Several hundred cases of poisoning gas were found at the near USA base, however, no explanation by the base.

Radioactive wastes dumped in the Sea of Okhotsk and the Sea of Japan by the former Soviet Union and Russian Federation

International Conference "Man and the Ocean" at United Nations University in 1998 with UNU, Iwate, and ORI)

Radioactive wastes dumped in the sea by the former USSR (Yablokov, 2001)

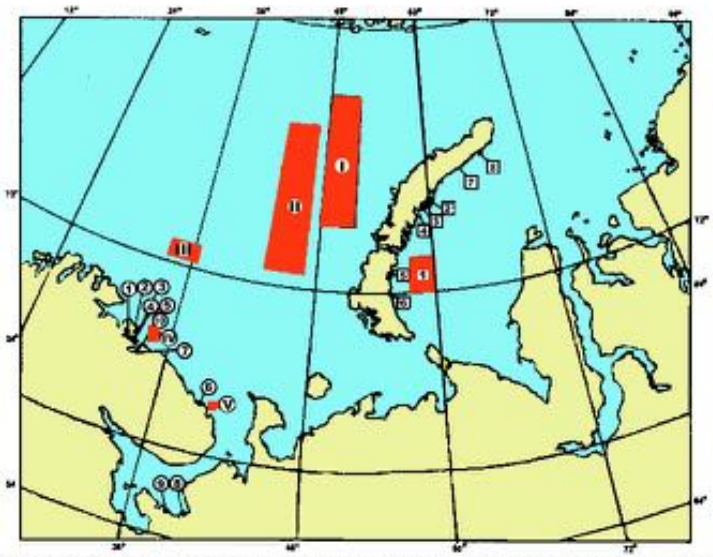


Fig. 1 Location of major radioactive sources and disposal areas in Northern Seas. Northern Fleet Bases: 1 - Nerpichia Bay; 2 - Andreyev, Bolshaya Lopatka and Malaya Lopatka Bays; 3 - Olenya and Sayda Bays; 4 - Ara Bay; 5 - Pala Bay; 6-Yokanga; 7- murmansk (nuclear fleet radio regiment); 8- Severodvinsk (water area of Zvezdochka Shipyard, north production association). Temporary storage sites for spent nuclear fuel: 1- Andreyev Bay; 6- Yokanga; 7- Mother ship Imandra, Lepse, and Litsa; 2- Navy tender for refueling reactors of NS's. Shipyards: 8- Severodvinsk (Northern Machinery Enterprise Production Association, Northern Production Association); 4 - Polyarny (Naval Shipyard); 4 - Vyazhny (Nerpa Shipyard). Not shown on map: Saint Peresburg (Baltic Yard Production Association, Admiralty production Association), Nizhniy Novgorod (Krasnoye Sormovo Production Association).

*About 443TBq of liquid and 141TBq solid radioactive wastes have been dumped during the last three decades in the East Sea/Japan Sea by the Russian Federation and the former Soviet Union (the White Book, 1933).

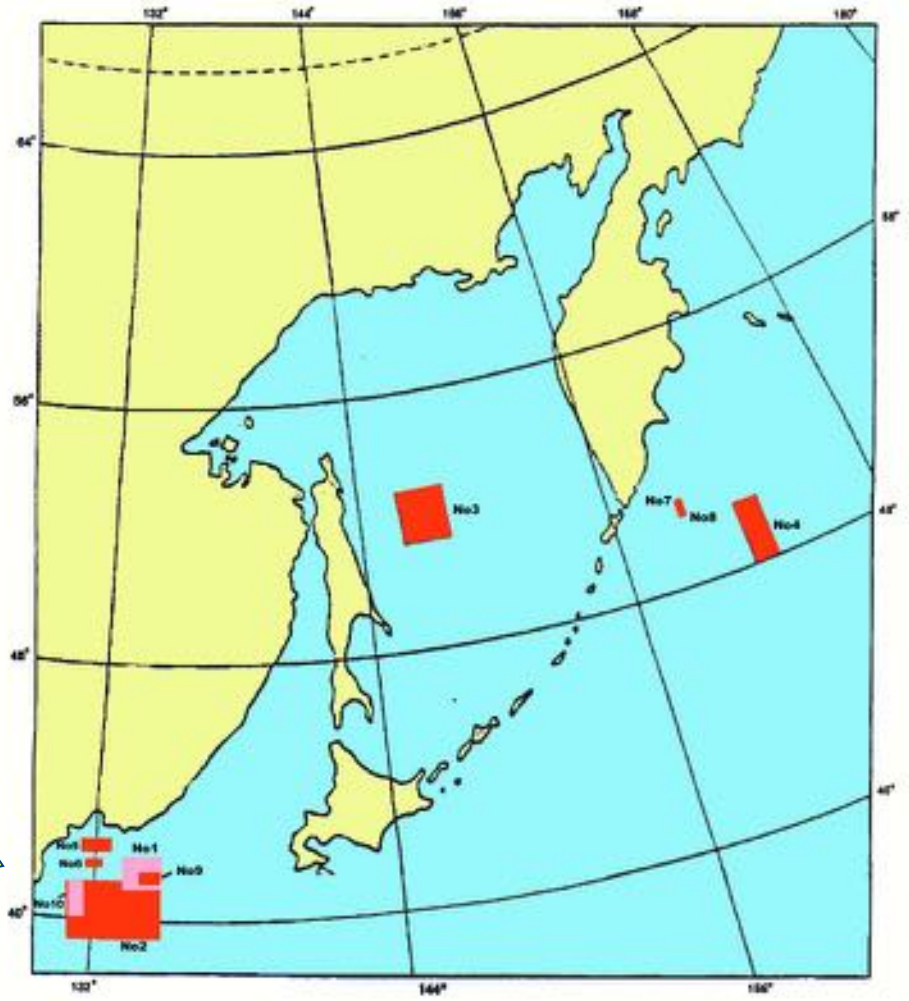


Fig. 3 Radioactive waste disposal areas in far Eastern Seas. 1–5, 7 – liquid waste dumping areas; 8 – solid waste dumping area; 6, 9, 10: solid and liquid waste dumping areas. 1 cm = 100 km.

Japan-Russia-Korea cooperative research survey of radionucleides in the Sea of Japan (Hirose et al. 1999)

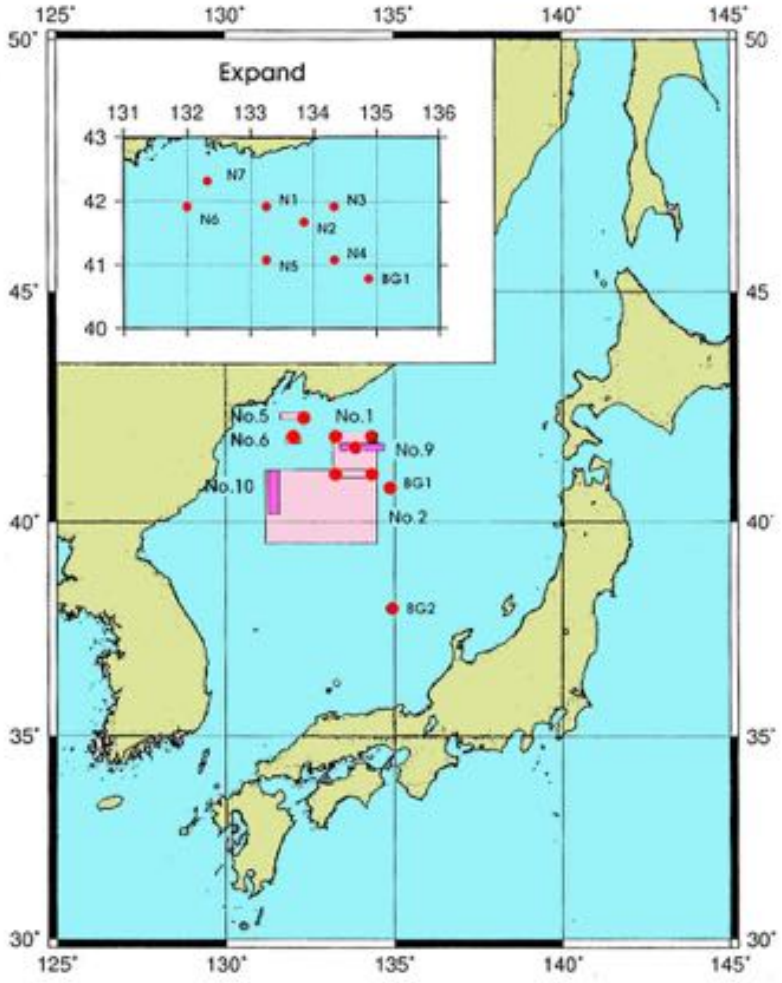
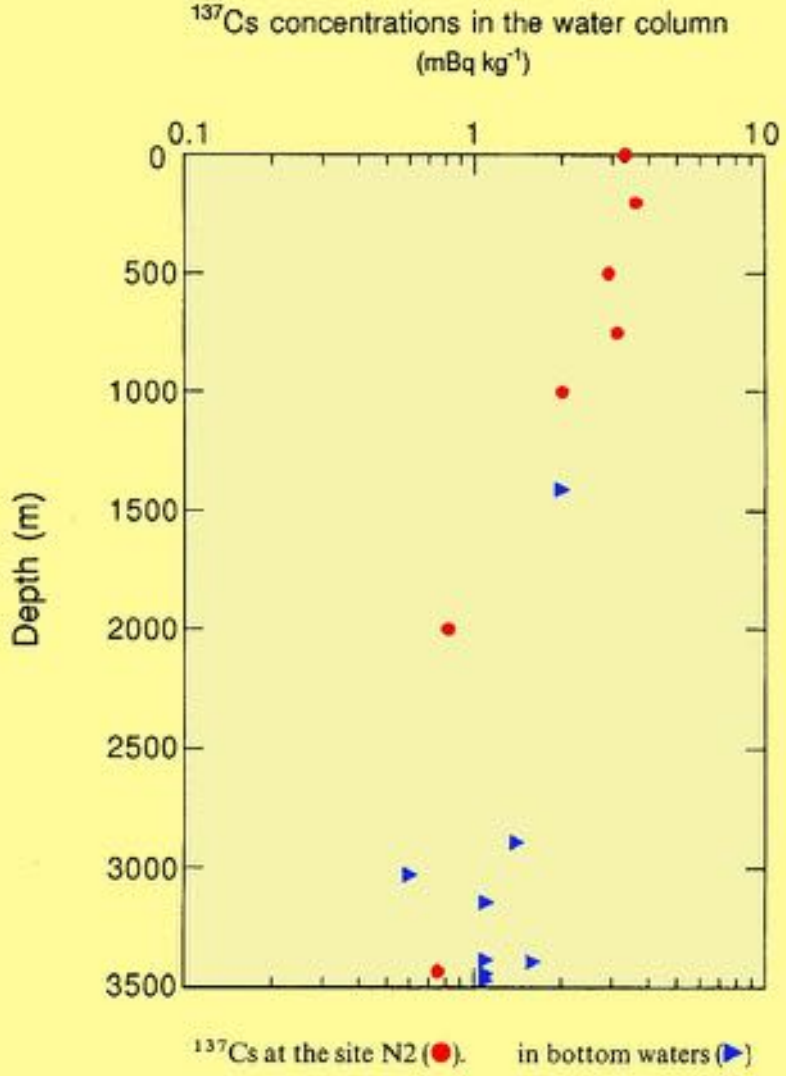


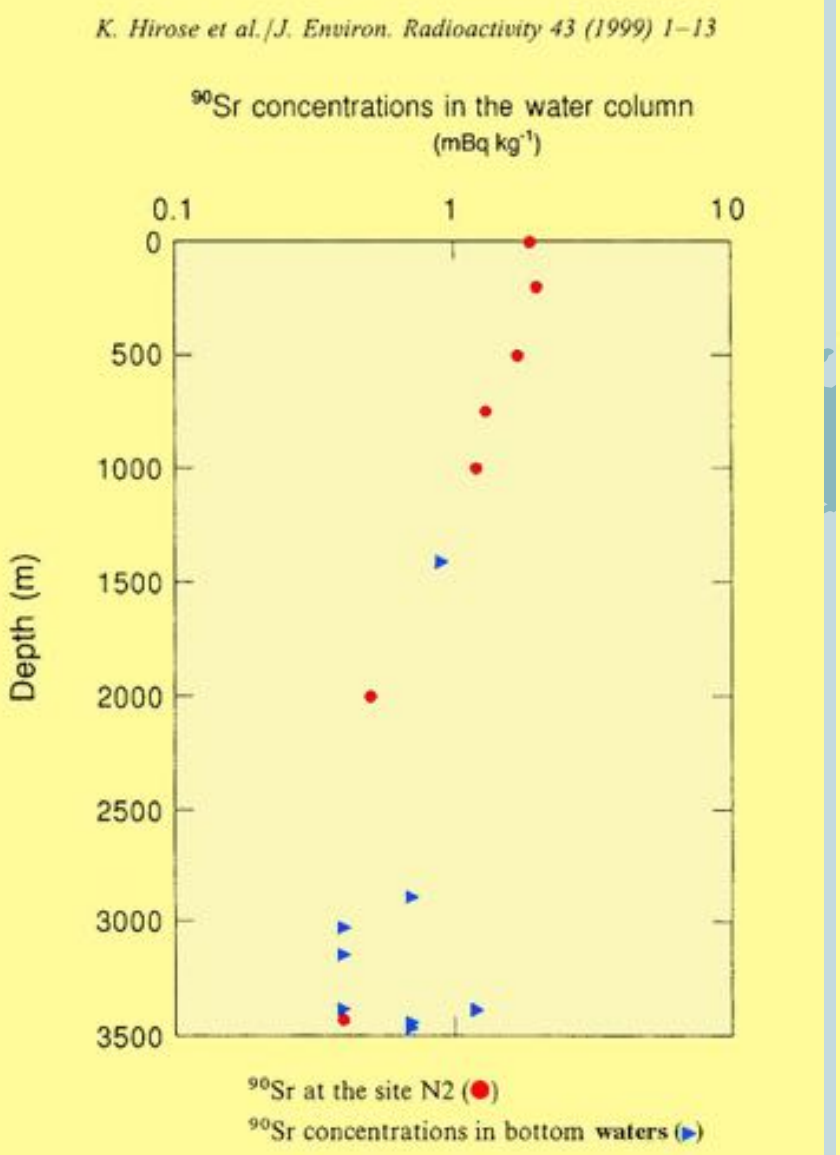
Fig. 1. Radioactive waste dumping sites and sampling stations in the first Japanese–Korean expedition in the north central East Sea/Japan Sea.

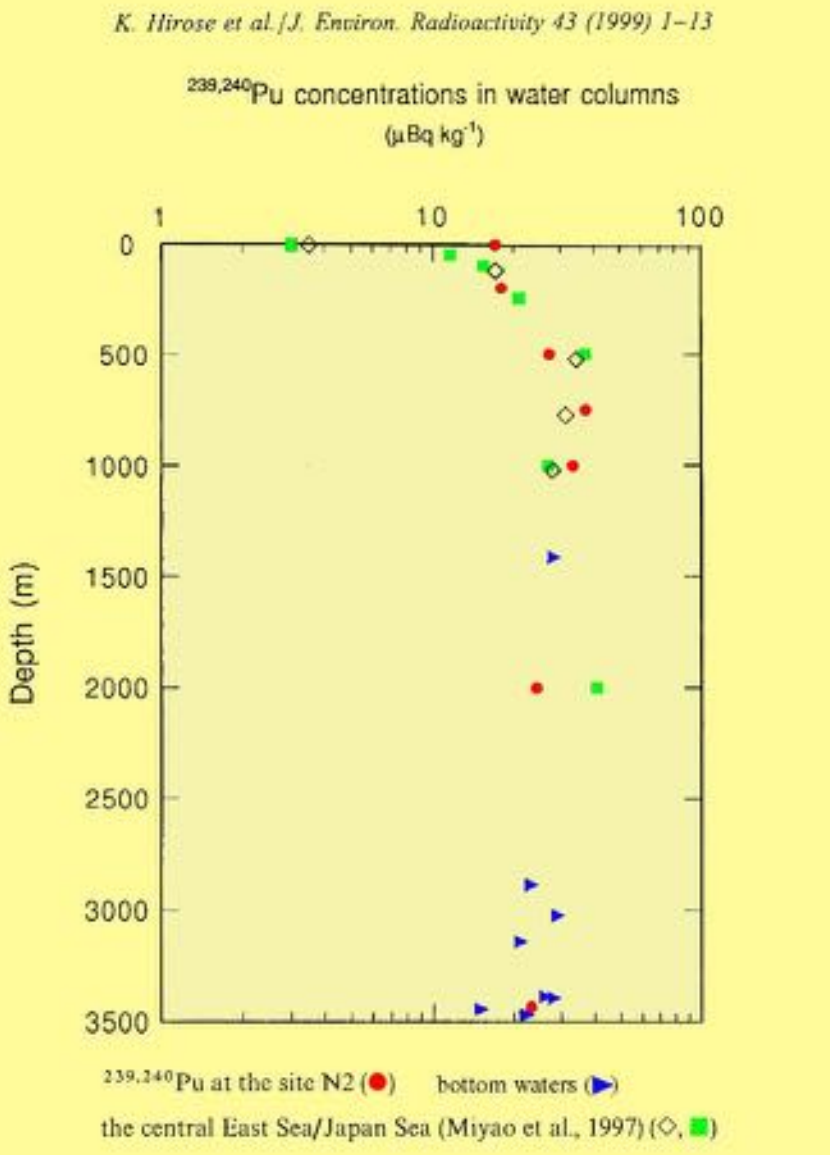
K. Hirose et al./J. Environ. Radioactivity 43 (1999) 1–13



137Cs at the site N2 (●). in bottom waters (▶)

Vertical distribution of radionucleides in the waters in the Sea of Japan (Hirose et al. 1999)





Anthropogenic radionuclides in seawater in the East Sea/Japan Sea: Results of the first-stage Japanese-Korean-Russian expedition. Hirose et al. (1999)

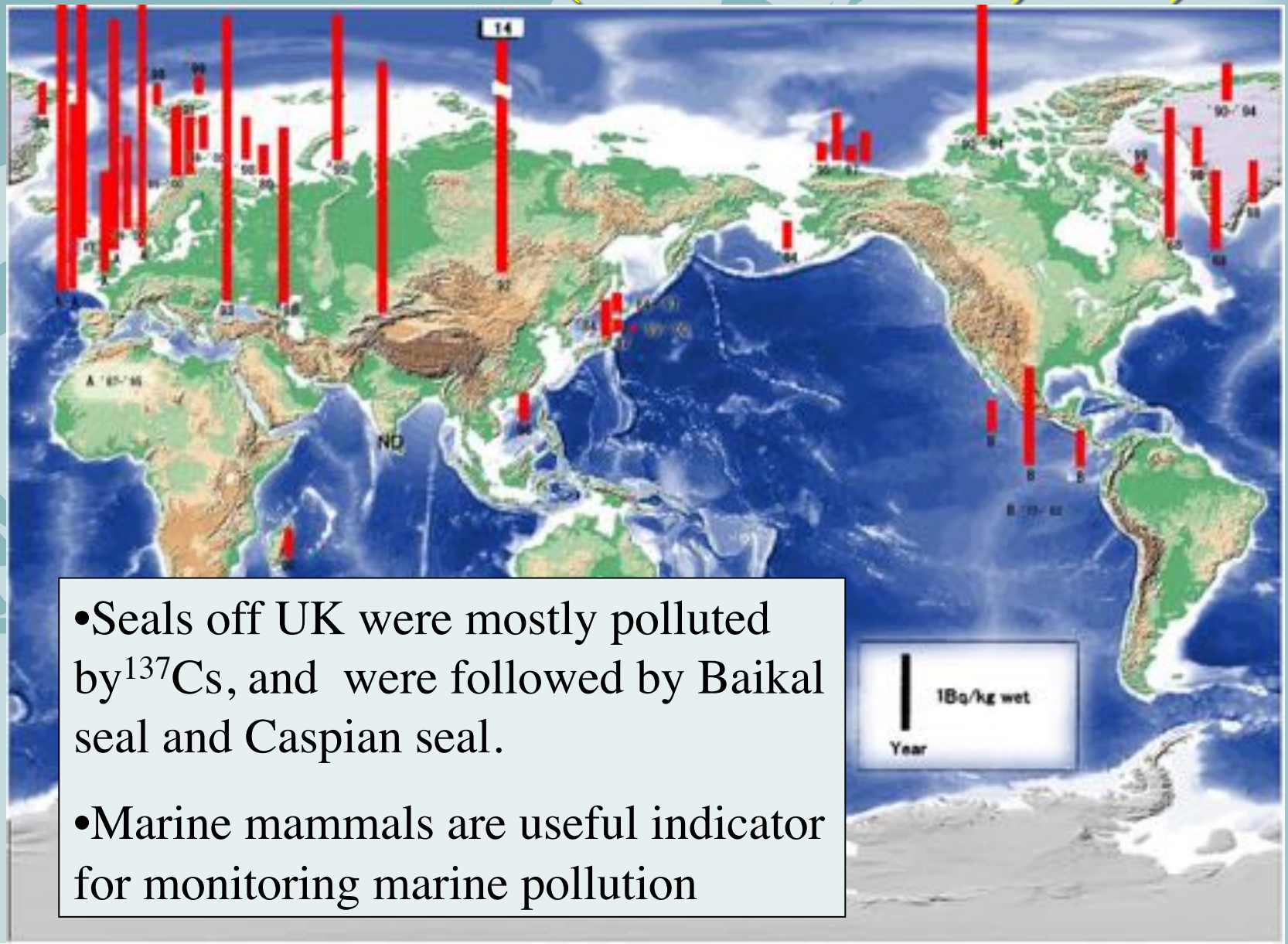
They reported that most of the recent radioactivity observed in the north central East Sea/Japan Sea was of global fallout origin from atmospheric nuclear testing and partly the Chernobyl fallout, and that there was no clear evidence of an increase in radionuclide concentrations due to the dumping of radioactive wastes by the former Soviet Union and Russian Federation.

Concentration of ^{137}Cs and $^{139\cdot140}Pu$ of Dall's porpoises in Japanese waters (Sugiyama, 1999)

	Range	Mean	CF*
^{137}Cs (mBq/kg) in muscle			
Sea of Japan/Okhotsk Sea (SJ)	267-410	333	89-139
Pacific Ocean (PO)	119-275	198	40-92
(Ratio: SJ/PO)		1.7	
$^{139\cdot140}Pu$ (mBq/kg) in liver			
Sea of Japan/Okhotsk Sea (SJ)	1.2-116	32.5	4062
Pacific Ocean (PO)	0.4-19.9	7.6	950
(Ratio: SJ/PO)		4.3	

Concentration of sea water: 3 mBq/L for ^{137}Cs (Kasamatsu, 1998) and <0.01mBq/L for $^{139\cdot140}Pu$ (Yamada et al.,1999).

Comparison of ^{137}Cs contamination in marine mammals in the world (Yoshitome et al, 2003)



- Seals off UK were mostly polluted by ^{137}Cs, and were followed by Baikal seal and Caspian seal.
- Marine mammals are useful indicator for monitoring marine pollution

Future direction for chemicals dumped at sea

- Declaration on the conference “Chemical munitions dumped at sea” would be made during discussion of this conference
- Distribute this documentation to all countries in the world as well as International Organization (UNEP, UNESCO, UNU, etc.) and brush up it to the international treaty
- Make international network of this issue and exchange useful information among the members
- Establish the international society using website for banning chemical munitions damped at sea
- Systematic monitoring survey concerning this issue should be conducted with cooperation of member countries of the society

太古より
生きとし生ける
ものみなの
母なる海を
ともに守らん

酒井雅子

Since ancient time, the sea has been a mother for all living creatures. We will go hand in hand to protect the sea!

Photo from Dr. Khauskin