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

Exposure of hazardous chemicals

Marine animals

Biological impact

• Implantation failure,
• Reproductive disorder,
• Skull lesions,
• Lowered immunocompetence (e.g. infection of various viruses),
• Pathological disorder, etc.
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; Reijnders 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

- 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

- 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

<table>
<thead>
<tr>
<th>Compounds</th>
<th>Caspian seal</th>
<th>Baikal seal</th>
<th>Ringed seal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1993</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>(Watanabe et al., 1999) (Kajiwara et al., 2002)</td>
<td>(Natata et al., 1995)</td>
<td>(Nakada et al., 1998)</td>
<td></td>
</tr>
<tr>
<td><strong>mean</strong></td>
<td><strong>range</strong></td>
<td><strong>mean</strong></td>
<td><strong>mean</strong></td>
</tr>
<tr>
<td>PCBs (µg/g)</td>
<td>9.7</td>
<td>6.3 - 470 *</td>
<td>27</td>
</tr>
<tr>
<td>DDTs (µg/g)</td>
<td>19</td>
<td>2.4 – 320 *</td>
<td>55</td>
</tr>
<tr>
<td>BHC (µg/g)</td>
<td>1.3</td>
<td>0.69 - 9.9 *</td>
<td>0.077</td>
</tr>
<tr>
<td><strong>Total TEQ (pg/g)</strong></td>
<td>51</td>
<td>-</td>
<td>570</td>
</tr>
</tbody>
</table>

* Die-off Seal
Infection of influenza virus A and B in Caspian seals (Ohishi et al. 2002)

Structure of influenza virus
Three species of seals are infested by influenza virus

**Phoca hispida**
- N=6
- 1. A/Aichi/2/68 (H3N2) (Infection rate: 4/6)
- 2. A/seal/Massachusettus/1/80 (H7N7) (1/6)

**Phoca caspica**
- N=42
- 1. A/Bangkok/1/79 (H3N2) (12/42)
- 2. Influenza B (4/42)

**Phoca sibirica**
- N=7
- 1. A/Aichi/2/68 (H3N2) (1/7)
- 2. A/Bangkok/1/79 (H3N2) (1/7)

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

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

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

Concentration (ng/kg) vs. Accumulation rate

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 newspaper 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
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 War.

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.

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

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

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,.
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
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).
Japan-Russia-Korea cooperative research survey of radionuclides in the Sea of Japan (Hirose et al. 1999)
Vertical distribution of radionuclides in the waters in the Sea of Japan (Hirose et al. 1999)

$^{90}$Sr concentrations in the water column (mBq kg$^{-1}$)

$^{239,240}$Pu concentrations in water columns ($\mu$Bq kg$^{-1}$)

$^{90}$Sr at the site N2
$^{90}$Sr concentrations in bottom waters

$^{239,240}$Pu at the site N2
bottom waters
the central East Sea/Japan Sea (Miyao et al., 1997)
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 $^{139}\cdot^{140}$Pu of Dall’s porpoises in Japanese waters (Sugiyama, 1999)

<table>
<thead>
<tr>
<th></th>
<th>Range (mBq/kg)</th>
<th>Mean</th>
<th>CF* (SJ/PO)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>$^{137}$Cs in muscle</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sea of Japan/Okhotsk Sea (SJ)</td>
<td>267-410</td>
<td>333</td>
<td>89-139</td>
</tr>
<tr>
<td>Pacific Ocean (PO)</td>
<td>119-275</td>
<td>198</td>
<td>40-92</td>
</tr>
<tr>
<td>(Ratio: SJ/PO)</td>
<td></td>
<td></td>
<td>1.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>$^{139}\cdot^{140}$Pu in liver</strong></th>
<th>Range (mBq/kg)</th>
<th>Mean</th>
<th>CF*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea of Japan/Okhotsk Sea (SJ)</td>
<td>1.2-116</td>
<td>32.5</td>
<td>4062</td>
</tr>
<tr>
<td>Pacific Ocean (PO)</td>
<td>0.4-19.9</td>
<td>7.6</td>
<td>950</td>
</tr>
<tr>
<td>(Ratio: SJ/PO)</td>
<td></td>
<td></td>
<td>4.3</td>
</tr>
</tbody>
</table>

Concentration of sea water: 3 mBq/L for $^{137}$Cs (Kasamatsu, 1998) and <0.01 mBq/L for $^{139}\cdot^{140}$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 dumped at sea

• Systematic monitoring survey concerning this issue should be conducted with cooperation of member countries of the society
Since ancient time, the sea has been a mother for all living creatures. We will go hand in hand to protect the sea!
Thank you for your attention!

Photo from Dr. Khauskin