Planning for Cushioning Japanese Salmon Fisheries against Climate Change Effects

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• Characteristics of hatchery salmon

• Three phases in Japanese salmon enhancement: growth, stabilizing and changing

• Planning for cushioning Japanese salmon fisheries against climate change effects

• Characteristics of local, regional and global connection to stabilize resources and prices

• Importance of a combination among hatchery, set-net fishery and processing in Japanese salmon industry
Atlantic croaker juveniles spend their first winter in the estuarine nursery habitats. Temperature during winter period is very important to juvenile survival. **The recruitment is determined by winter temperature.** *(FISHupdate.com)*

Some fish populations will increase and others decrease as a result of climate change *(NEFSC)*. **Climate change affects variability of fish populations.** *

Japanese salmon juveniles spend their first autumn season in the Okhotsk Sea and their first winter season in the northwest Pacific Ocean. **Global warming is expected to have significant influences on salmon inhabiting subarctic waters.**
Comparison between farmed salmon and hatchery salmon

<table>
<thead>
<tr>
<th>Farmed Salmon</th>
<th>Hatchery Salmon</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resource:</strong> Atlantic salmon</td>
<td><strong>Resource:</strong> Chum salmon</td>
</tr>
<tr>
<td><strong>System:</strong> Farming</td>
<td><strong>System:</strong> Hatchery enhancement</td>
</tr>
<tr>
<td><strong>Artificial management in coastal areas</strong></td>
<td><strong>Growing in the north Pacific Ocean</strong></td>
</tr>
<tr>
<td><strong>Scheduled production</strong></td>
<td><strong>Resource variability</strong></td>
</tr>
<tr>
<td><strong>Corresponding to market needs:</strong> improve quality</td>
<td><strong>Effected on natural productivity</strong></td>
</tr>
<tr>
<td><strong>High cost:</strong> feeding, disease, environmental load</td>
<td><strong>Low cost and low load</strong></td>
</tr>
<tr>
<td><strong>Necessary environmental management</strong></td>
<td><strong>Healthy, natural quality</strong></td>
</tr>
<tr>
<td><strong>Production:</strong> Norway</td>
<td><strong>Necessary fisheries management</strong></td>
</tr>
<tr>
<td><strong>Processing:</strong> Denmark, Germany</td>
<td><strong>Production:</strong> Japan</td>
</tr>
<tr>
<td><strong>Distribution:</strong> EU and whole world</td>
<td><strong>Processing:</strong> Japan, China</td>
</tr>
<tr>
<td></td>
<td><strong>Distribution:</strong> Domestic market, EU and USA</td>
</tr>
</tbody>
</table>
Three phases in the roadmap of Japanese salmon enhancement

1. Growth Phase
2. Stabilizing Phase
3. Changing Phase
Salmon fisheries are one of the most important industries in northern Japan. Survival of Japanese salmon returns is affected by the ocean productions in the Okhotsk Sea and the Bering Sea.

We have not been able to predict climate change effects on the ocean production to the present. Price and landed value of salmon fisheries change by salmon returns.

The stability of resources and prices is important as the basis for building economic strategies.

We thought that a combination of local, regional and global economic strategy could cushion salmon fisheries against the effects of climate change.

What kind of strategies do we need to plan?
### Contents of three phases

<table>
<thead>
<tr>
<th>Phase</th>
<th>Period</th>
<th>Fry Release</th>
<th>Adult Return</th>
<th>Wholesale Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>1970-80</td>
<td>Increase</td>
<td>Bit increase</td>
<td>High stable</td>
</tr>
<tr>
<td>Stabilizing</td>
<td>1981-1990</td>
<td>Stable</td>
<td>Increase</td>
<td>Declining</td>
</tr>
<tr>
<td>Changing</td>
<td>1991-2009</td>
<td>Stable</td>
<td>Changing in high order</td>
<td>Changing in low order</td>
</tr>
</tbody>
</table>

- It is difficult to predict short-term or long-term effects of climate change.
- However, it is important to stabilize resources and prices for stability of fisheries management.
- Therefore, it is necessary to plan to cushion salmon fisheries against the effects of climate change.
Four scenarios of salmon capture

Thinking climate change effect on salmon capture using historical data

Classified variation types

- **Rising (a)**
  - 1982-1990
- **Varying (b)**
  - 1990-2003
  - Decrease to increase
- **Varying (c)**
  - 1992-2000
  - Increase to decrease
- **Declining (d)**
  - 2003-2008
Rising type and Declining type of salmon capture

- **Rising type (1982-1990)-(a)**
  - Capture is rising. Wholesale price is declining.
  - Raw material price is declining, too.
  - Processing low price products and expanding domestic/foreign demand.

- **Declining type (2003-2008)-(d)**
  - Capture is declining. Wholesale price is rising.
  - Raw material price is rising. Processing cost is increasing.
  - Developing local resources to complement regional core resources by farming and ranching.
Varying types of salmon capture

- **From decrease to increase (1990-2003)-(b)**
  - Capture changed rapidly from decrease to increase. Wholesale price is up and down quickly.
  - **Saving fishing profits in rich years and using them as funds for lean years.**

- **From increase to decrease (1992-2000)-(c)**
  - Capture changed rapidly from increase to decrease. Wholesale price is down and up quickly.
  - **Maintaining prices of local resources by cooperation between salmon hatcheries, set-net fisheries and seafood processing industries.**
Local strategy to activate management of salmon set-net fishery

- Comparison of set-net fishery management
  - Increase of absolute profit ratio
  - Decrease of fixed charge ratio and break-even point ratio of landed value

- Cooperative management
  - Increase of management efficiency
Regional strategy to stabilize salmon resources

- Planning the coexistence of hatchery salmon and wild salmon, and letting both resources stabilize.
- Examining methods of raising the return rate of salmon based on joint Japanese and Russian observation of the Okhotsk Sea in the future.
Global strategy to stabilize salmon prices

- Planning differentiation by eco-labeling to evaluate hatchery salmon in the global market.

- Regarding East Asia countries as an extension of the Japanese market.
Export of Japanese domestic salmon

- Connection: Japan, China and EU (France, Germany)
  - Trigger of export: Wholesale price down of Japanese salmon
  - Cause: Increase of supply in Japanese domestic market
  - Result: Control of supply by export of raw materials, processed in China and export of products to EU.

- Export of Japanese salmon supported wholesale price of one.

**Fishery production and Price**

**Exported quantity and Price**
Recommendation: Strategies for salmon fisheries

- **Local strategy** for variability of price
- **Regional strategy** for stability of resource
- **Global strategy** for expansion of demand

Local strategies in changing phases of salmon capture:

1. **Step 1:** Saving fishing profits in rich years and using them as funds for lean years.
2. **Step 2:** Processing low price products and expanding domestic/foreign demand.
3. **Step 3:** Maintaining prices of local resources by cooperation between salmon hatcheries, set-net fisheries, and seafood processing industries.
4. **Step 4:** Developing local resources to complement regional core resources by farming and ranching.
Demand of Japanese salmon

- Increase of expenditure volume of Japanese salmon (fresh and cold) in households using Tsukiji wholesale market data.

Demand of domestic salmon has increased in Japanese market in the 2000s.
Relationship among local, regional and global cooperation

- **Local cooperation**: domestic areas
  - **Local communities**: hatcheries, fisheries and processing industries
  - **Local units**: municipality, prefecture, province

- **Regional cooperation**: between countries
  - Japan and Taiwan
  - Taiwan and China
  - China and Japan

- **Global cooperation**: 
  - East Asian and EU
  - EU and North America
  - North America and East Asia
  - Other global connections
Combination strategy for salmon industry

- Hatchery enhancement
  - Set-net fisheries
  - Fish processing
  - Distribution
Conclusion and next research

- Combination strategy is important to stabilize fisheries management.
- This strategy is likely to help to improve the basis of fisheries management and to cushion against the effects of climate change.
- Combination among salmon hatcheries, set net fisheries and processing companies from an economic viewpoint
- Scale of local, regional and global distribution of Japanese salmon
- Rebuilding process of fisheries communities in afflicted districts in eastern Japan
Thank you very much for having the opportunity of this presentation.

- We will greatly appreciate American helps and supports for rebuilding Japanese after the 3.11 disaster.