Sika deer (Cervus nippon) management in Japan - Hunting as resource management and culling for ecosystem management -

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Outline

- Background
  - history, distribution, population trends

- Management Policy and Plan
  - established by Hokkaido Government (1998)

- Perspectives for sika deer management
Fig. 1. Expanding of sika deer distributions. [Ministry of Environment (MoE) 2016]
~1890s: overexploitation for furs and meats, extinction of gray wolves (*Canis lupus*)

~1950s: bans on hunting

~1980s: habitat alteration ~ *deforestation and pasture*

Fig. 2. Changes in number of sika deer harvested on the Hokkaido Island. (modified from Uno et al. 2009)
### Table 1. Comparisons for game hunting regulations

<table>
<thead>
<tr>
<th></th>
<th>Japan</th>
<th>U.S.A.</th>
<th>England</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Game</strong></td>
<td><em>res nullius</em> (belong to no one)</td>
<td><em>res communis</em> (belong to everyone)</td>
<td><em>res nullius</em> (belong to no one)</td>
</tr>
<tr>
<td><strong>Hunting rights</strong></td>
<td>Prefectural gov. (registration)</td>
<td>State gov. (license)</td>
<td>Land owner</td>
</tr>
<tr>
<td><strong>Manage. organization</strong></td>
<td>Prefectural gov.</td>
<td>State gov.</td>
<td>Management group (Land owner)</td>
</tr>
</tbody>
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*McCullough (1990), Putman et al. (2011), MoE (2012)*
## Culling (Nuisance Control)

Table 2. Comparisons for culling systems

<table>
<thead>
<tr>
<th></th>
<th>Japan</th>
<th>U.S.A.(^a))</th>
<th>England</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Who is culler?</strong></td>
<td>Hunter*</td>
<td>Hunter</td>
<td>Selected hunter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Selected hunter</td>
<td>Professional hunter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Private company</td>
<td></td>
</tr>
<tr>
<td><strong>Qualification</strong></td>
<td>Non</td>
<td>Nuisance wildlife</td>
<td>Deer Stalking Certificate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>control operators</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) for example, CT, NJ or PA.

McCullough (1990), Putman et al. (2011), MoE (2012)
Near threatened hunter population

Fig. 3. Changes in sika deer harvest and number of hunters in Japan (Data from MoE).

- Near threatened
- Hunter population

Number of deer harvested
Number of hunters

- Hunting
- Culling
- Hunters

Data from MoE.
Population size has increased!

Fig.4. Forty-one Pref. Governments made the Sika Deer Management Plans (Data from MoE).

Fig.5. Changes in estimated population size by harvest-based Bayesian model (MoE 2016).

- **3.0 million** in Honshu, Kyushu and Shikoku, 2015
- **0.5 million** in Hokkaido, 2015

Estimated population size (million)

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>1.0</td>
<td>2.0</td>
<td>3.0</td>
<td>4.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

95% CI

50% CI

median
Our goals are,
1. to avoid irruption with severe damage to agriculture and forestry,
2. to avoid the risk of extinction,
3. to keep sustainable yield of deer.

We would like to maintain \(\%P(t)\) between \(\%P^-\) and \(\%P^+\).

Fig. 6. Concept diagram of feedback management (Hokkaido Gov. 1998; Matsuda et al. 1999).

\(\%P(t)\) denotes population size index,
\(\%P^+\) denotes the irruption level,
\(\%P^*\) denotes the optimal level,
\(\%P^-\) denotes the critical level.
**Sex-specific hunting** is effective for population management.

Table 3. Four management programs based on relative population size index (Matsuda et al. 1999).

<table>
<thead>
<tr>
<th>Programs</th>
<th>Population size index</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergent decrease action (EDA)</td>
<td>%P* &lt; %P(t)</td>
<td>Maximum harvest of females</td>
</tr>
<tr>
<td>Gradual decrease action (GDA)</td>
<td>%P* &lt; %P(t) &lt; %P*</td>
<td>Hunting for females and males</td>
</tr>
<tr>
<td>Gradual increase action (GIA)</td>
<td>%P* &lt; %P(t) &lt; %P*</td>
<td>Male-only hunting</td>
</tr>
<tr>
<td>Ban on hunting (BoH)</td>
<td>%P(t) &lt; %P*</td>
<td>(after severe winter)</td>
</tr>
</tbody>
</table>
Monitoring and Evaluation

Fig. 7. Study area.
It includes 4 management units and occupies about 20,000 km².

Fig. 8. Changes in the five indices, spotlight counts, SPUE, CPUE, aerial survey and damage value for the sika deer population.
Error bars indicate SE.

The index based on **spotlight counts** is most useful!

(Uno et al. 2006)
A population size index was estimated from the data of spotlight counts (GLMM).

We evaluated the response of index to the known amount of harvest. (stage-structured model)

The estimates of indices suffer from large observation errors.

We applied a state-space modeling to the harvest-based estimation.

Fig. 9. Population size index estimated by the function glmmPQL in R.
(Yamamura et al. 2008).
Fig. 10. Bayesian estimates of population size in eastern Hokkaido using the state-space model. (modified from Yamamura et al. 2008)
Adaptive management

Management policy and plan

Design

Assess problem
Uncertainty

Adjust

New information

Evaluate

Outcome

Implement

Action plan

Manipulation
(harvest)

Monitor

Field survey

(We referred to the Government of British Colombia)
For **sustainable resource management**
~ *deer is a natural resource*
~ *In a long-term, **hunting** is very important*

For **ecosystem management**
~ *In the world natural heritage site and the National Park, etc*
~ *It is necessary to **cull deer***
**Perspectives (2)**

- **Hunter**
  - Hunting is a traditional culture
  - Recruit new hunters

- **Culler**
  - Selected (controlled) hunters
  - Establish a new qualification (DCC)

- **Wildlife Manager**
  - Prefectural Gov., Forestry Agency
  - They design and implement the action plan
Conclusion

- Sika deer **distribution** has expanded, and the **population size** has increased from 1990 to 2015.

- Sika deer harvest has increased, however **hunter population** has decreased from 1975 to 2015.

- **Sex-specific hunting** is effective for **resource management**.

- **Culling** is important for **ecosystem management**.

- We need to recruit **young hunters**, and to **encourage cullers**.
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Thank you for your kind attention!