Current status of chum salmon populations in the rivers with and without hatchery stock enhancement on the Sanriku coast, Japan

Yuki MINEGISHI · Tatsuya KAWAKAMI · Jun Aoyama
International Coastal Research Center, Atmosphere and Ocean Research Institute, The University of Tokyo
Chum salmon in Sanriku

Green: the areas where adult chum salmon annually migrates
Yellow: the areas where adult chum salmon occasionally migrates
Chum salmon in Sanriku

Set net fishing

Entrance of the town

Hatchery

Stock enhancement

At a local restaurant

Aramaki-sake
Chum salmon catch and juvenile release in Japan

- Chum salmon catch has increased since the late 1970s.
- The peak was 1996, and then the catch has been declining.
- In Sanriku, the stock decline is more serious.
- Juvenile release has been constant.

(Data source: NPAFC)
The 2011 disaster

The 2011 off the Pacific coast of Tohoku Earthquake, March 11, 2011

After Nagasawa (2005)
Study site

Otsuchi Bay

Otsuchi River
with stock enhancement

Koduchi River
without stock enhancement

Natural spawning ONLY

Otsuchi hatchery

Hatchery weir

Otsuchi Bay
Objective

To evaluate the current population status of chum salmon on the Sanriku coast

Compared the returning adults between the rivers with and without hatchery stock enhancement
Methods

Otsuchi River with stock enhancement

Koduchi River without stock enhancement

**Otsuchi River**

- **Method**
  - **Survey reach**: 2 reaches (tot. about 500 m)
  - **Live adults**: counting by eyes
  - **Spawning redds**: recording the numbers and positions by GPS

**Koduchi River**

- **Study period**: Sep. 1, 2017 – Feb. 21, 2018, 1-3 times/week
- **Survey reach**: 8 reaches (tot. about 3 km)
- **Live adults**: counting by eyes
- **Spawning redds**: recording the numbers and positions by GPS
- **Carcasses**: FL measurement, recording sex, scales for aging, fin clips for DNA analyses

- **Hatchery weir**: Oct. 17, 2017 – Jan. 5, 2018
- **Fence at the river mouth**: Sep. 27, 2017 –
Most of the returning adults to the Otsuchi River were caught by the hatchery weir.

The population in the Otsuchi River consisted of mostly the hatchery-origin fish.

The population in the Koduchi River should be wild.
## Discussions

<table>
<thead>
<tr>
<th></th>
<th>Otsuchi River with stock enhancement</th>
<th>Koduchi River without stock enhancement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults</td>
<td>2,959 ((2,787 + 172))</td>
<td>Adults 2,044 Carcasses 1,764</td>
</tr>
<tr>
<td>Juveniles</td>
<td>10 – 20 million</td>
<td></td>
</tr>
</tbody>
</table>

1. Number of females = number of spawning redds = 363
2. Number of eggs per female = 2,592 \(\text{(Iwate Fish. Tech. Center, Salmon report, 2018)}\)
3. Survival rate of wild fish = \(7.5 - 22.2\%\) \(\text{(Aruga et al. 2014)}\)

* Straying and year classes of returning adults are NOT taken into account.

\[
363 \times 2592 \times 7.5 - 22.2\% = 70,567 - 208,879
\]
### Discussions

<table>
<thead>
<tr>
<th></th>
<th>Otsuchi River with stock enhancement</th>
<th>Koduchi River without stock enhancement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults</td>
<td>2,959</td>
<td>Adults 2,044</td>
</tr>
<tr>
<td>Carcasses</td>
<td></td>
<td>Carcasses 1,764</td>
</tr>
<tr>
<td>Juveniles</td>
<td>10 – 20 million</td>
<td>70 – 200 thousand</td>
</tr>
</tbody>
</table>

**OUTPUT:** The difference in the adults returning to the two rivers is about 1.5 folds.

**INPUT:** The difference in the juveniles derived in the two rivers is 5 – 10 folds.
The population in the Otsuchi River consisted of mostly the hatchery-origin fish.
The population in the Koduchi River consists of natural spawning.
The returning adults are more abundant in the Otsuchi River.
Natural spawning is less abundant in the Otsuchi River.
The effect of hatchery stock enhancement on the stock status should be carefully re-evaluated.
Acknowledgement

Naomi KURAMOTO · Kenji YOSHIMURA · Shigenori NOBATA · Yuki IINO · Ryoshiro WAKIYA

This study was supported by KAKENHI, Uchida marine fund and Tohoku Ecosystems-Associated Marine Sciences.