The marine fisheries resource utilization, ecosystem impacts and fisheries management in China

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Over-reported China coastal fisheries;

Under-reported China distant-water fisheries;

Towards sustainability in world fisheries

Daniel Pauly, Villy Christensen, Sylvie Guénette, Tony J. Pitcher, U. Rashid Sumaila, Carl J. Walters, R. Watson & Dirk Zeller
What is the truth of China fisheries?
Goal of this presentation

- What is the truth of China fisheries?
- What are current and expected ecosystem impacts?
- What mitigation actions are in the fisheries management?
What is the truth of China fisheries?
What is the current status of fisheries?

2014 (Tons)
- Total: 64.61 million
- Marine capture: 14.827 million (12.80 million + 2.027 million)
- Mariculture: 18.12 million
- Freshwater culture: 29.35 million
- Freshwater capture: 2.295 million

<table>
<thead>
<tr>
<th>Year</th>
<th>Marine fisheries</th>
<th>Mariculture</th>
<th>Freshwater fisheries</th>
<th>Freshwater culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950s</td>
<td>60.2</td>
<td>5.5</td>
<td>21.6</td>
<td>14.2</td>
</tr>
<tr>
<td>1960s</td>
<td>63.0</td>
<td>6.4</td>
<td>16.2</td>
<td>14.4</td>
</tr>
<tr>
<td>1970s</td>
<td>66.4</td>
<td>11.0</td>
<td>7.5</td>
<td>15.0</td>
</tr>
<tr>
<td>1980s</td>
<td>50.6</td>
<td>16.6</td>
<td>6.6</td>
<td>26.2</td>
</tr>
<tr>
<td>1990s</td>
<td>39.7</td>
<td>22.9</td>
<td>5.5</td>
<td>31.9</td>
</tr>
<tr>
<td>2000s</td>
<td>29.1</td>
<td>26.9</td>
<td>4.9</td>
<td>39.1</td>
</tr>
<tr>
<td>2010s</td>
<td>23.5</td>
<td>27.8</td>
<td>4.0</td>
<td>44.5</td>
</tr>
</tbody>
</table>
Landings/catch data?

- **Discard (developed countries) --30%, FAO;**
- **No discard in China, and the catch data also included Acetes shrimps, shellfish, jellyfish, algae.**

**Low trophic level harvest**
- ✓ phyto---seaweeds
- ✓ Zoo- Acetes shrimps, jellyfish
- ✓ mollusks (shellfishs, squids)
- ✓ Small sized fish (so called trash fish)
- ✓ Predators

**Whole food chain**

**Food culture; Huge population**
China coastal fisheries
Changes of mean trophic level of China mariculture; much lower than 3-3.5 (the TL in the other countries from mariculture).
No-feeding production (shellfish & algae) in mariculture: 15.17 million, 83.69%;

No feeding production in freshwater culture and mariculture: 29.7 million, 54.8% (>30% average no feeding production ratio, Orsen, 2011)
Changes in fishery production mode and structure

0.5 million tons  C:A=92:8

5 million tons  C:A=54:46

51.16 million tons  C:A=27:73

64.61 million tons  C:A=27:73

C:A=Capture production/Aquaculture production
• China consumes about 30% world fishmeal and produce about 60% aquaculture production;
• China aquaculture provides food for the world and then reduces the demand on wild fisheries;
What are current and expected ecosystem impacts?
Stresses on the marine fisheries

• The main:
  – Overfishing
  – Reclamation
  – Pollution
  – Climate Change
  – Ecological disasters
Overfishing

**0.2/10 years** in China coastal waters, Zhang & Tang, 2004)

**0.1/10 years** in global waters

**Fishing**
- **Cod, largehead hairtail, Spanish mackerel, etc.**
- **Anchovies, sandlance, Loligo etc.**
- **Acetes & Euphausia**

**Fishing**

**Small sized fish species** (& invertebrates)

**Top predators**

**Zoo-**

**Phyto-**
Sharp decline in important fish stock

Increasing ratio of low-valued species
Great changes were found from 1960s to 2008: Smaller size, lower age structure, faster growth rate, smaller $L_\infty$, $t_r$ earlier, higher mortality.
China coastal fisheries

The abundances of the many economically important species have been depleted due to the change of environmental conditions and overfishing.

The community structure changed considerably.

The large-sized demersal species have been replaced by the low-valued and small-sized pelagic fish, early maturity.

Changes in food web and food chain.

To restock and conserve fishery stocks is needed in coastal fisheries.

Changes in food web and food chain.
What mitigation actions are in the fisheries management?
## Management measures

<table>
<thead>
<tr>
<th>Management measures</th>
<th>Year of issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed season/areas</td>
<td>Since 1950’s in limited areas; Trawling was banned from 1988 in whole Bohai Sea; Two or three months closed season were issued from 1995 in Bohai Sea, Yellow Sea and East China Sea, and from 1998 in South China Sea</td>
</tr>
<tr>
<td>Fishery genetic resource protection area system</td>
<td>2007</td>
</tr>
<tr>
<td>The fishing license system</td>
<td>1979</td>
</tr>
<tr>
<td>Limits of catchable size and the proportion of juveniles in the catch</td>
<td>2000</td>
</tr>
<tr>
<td>Environmental fee system for stock protection and enhancement activities</td>
<td>2000</td>
</tr>
<tr>
<td>Control fishing capacity</td>
<td>1987</td>
</tr>
<tr>
<td>The fishing vessel scrapping program</td>
<td>2003</td>
</tr>
<tr>
<td>Reduce fuel subsidies-(40%)-2019</td>
<td>2015</td>
</tr>
</tbody>
</table>

Since 1995, China has launched summer ban fishing, involving 11 marine provinces, 110,000 fishing vessels and 1 million fishermen.
Mitigation measures

National fishery stock enhancement programs

- Stock enhancement was carried out in China since the 1980s.

[Image of a news conference on conservation plans.]
More than 100 species of fish, shrimp, mollusca and other species with economic value were released.

The total number of animals released was 30.07 billion.

Total investment on release was 970 million Yuan (RMB).
A case of Chinese shrimp stock enhancement

<table>
<thead>
<tr>
<th>Year</th>
<th>Fishing vessels (ind)</th>
<th>Production (tons)</th>
<th>Production value (10000 RMB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>4,844</td>
<td>1,686</td>
<td>28,053</td>
</tr>
<tr>
<td>2011</td>
<td>4,938</td>
<td>1,009</td>
<td>17,908</td>
</tr>
<tr>
<td>2012</td>
<td>4,896</td>
<td>2,163</td>
<td>35,194</td>
</tr>
<tr>
<td>Average</td>
<td>4,893</td>
<td>1,619</td>
<td>27,052</td>
</tr>
</tbody>
</table>

Releasing number, catch, and production value of Chinese shrimp *Fenneropenaeus chinensis* from the 1980s to 2012 (Southern waters of Shandong Peninsula, From Qiu, 2014)
Sea ranching
Mitigation measures

Integrated multi-trophic aquaculture (IMTA)
Developed the IMTA for Sea Ranching practiced in China

The IMTA Practiced for Suspending Mariculture in Sungo Bay, China

From Fang, J
“In the penultimate chapter on the Yellow Sea LME, Professor Qisheng Tang and Dr. Jianguang Fang review the variable states of productivity and biomass yields under the influence of climate change and anthropogenic forcing. ……The IMTA technology includes the production of algae (kelp), mollusks (abalone) bivalves (bay scallop), and echinoderms (sea cucumber) to help close the fisheries protein gap, while capture fisheries recover to sustainable levels. Preliminary results suggest that the IMTA pilot should be expanded throughout the YSLME and into other Asian LMEs, where applications could provide job opportunities and food security. The pilot IMTA project proved to be highly energy efficient and optimized the carrying capacity of coastal embayment while improving water quality, increasing protein yields, and, through carbon capture, contributing to mitigation of the effects of climate change.”

Dr. K. Sherman, NOAA, 2012
Some challenges in China fisheries

1. **Social and economic issues**
   - Increasing demand on aquatic products
   - Fast development of mariculture area along coastal waters

2. **Scientific and EBFM issues**
   - Overfishing
   - Pollution
   - Reclamation

There is no free lunch
Some National Basic Research Programs launched in China

MARINE ECOSYSTEM

2015-2019

2001-2010

2011-2015
Final remarks

Communication: Science ↔ human information, knowledge ↔ decision-making

Cooperation: Decision-maker, scientist, the public

Resolve scientific and social issues during management

Resolve management and social issues based on scientific information

Resolve management issues based on scientific and social information

Stock assessment-based fisheries management

Ecosystem-based fisheries management

Restoration and conservation oriented fisheries management

Sustainable fisheries

GOAL
Thank you for your attention!