Jellyfish of the Far Eastern Seas of Russia: Composition, spatio-temporal variations and significance for ecosystems and economics

Alexander Zavolokin

Pacific Research Fisheries Center, Vladivostok, Russia
OUTLINES

Jellyfish of the Far Eastern Seas (FESs) of Russia

- Species composition
- Spatial distribution
- Biomass trends

- Small-sized jellyfish distribution and biomass

- Comparison with other regions of the World Ocean

- Significance of jellyfish blooms in the FESs for ecosystems and economics
Materials and methods

Trawl surveys
1990-2011
51 surveys
More than 10,000 trawl operations
Big-sized (> 1 cm) jelly
Studied area covered more than 7 mln square km
Species composition

**SCYPHOZOA**
- Aurelia limbata
- Cyanea capillata
- Atolla wyvillei
- Chrysaora melanaster
- ?Chrysaora pacifica
- Phacellophora camtschatica
- Periphylla periphylla

**HYDROZOA**
- Aequorea sp.
- Calycopsis nematophora
- Staurophora mertensii
- Tima sachalinensis
- Ptychogena lactea
Distribution of *Cyanea capillata* biomass

**Summer and autumn**

Aurelia, Chrysaora and Ptychogena had similar distribution patterns
Distribution of *Phacellophora camtschatica* biomass

**Summer and autumn**

**Winter and spring**

Aequorea, Calycopsis and Periphylla had similar distribution patterns
Vertical distribution of jellyfish biomass and abundance

Biomass, kg/km²

Abundance, th. ind./km²

Depth, m

Pacific Ocean, summer

Pacific Ocean, spring

Bering Sea, summer
Vertical distribution of jellyfish biomass at daytime (white columns) and nighttime (black columns) in the Bering Sea.
Percentage composition (in terms of biomass) of jellyfish species in the epipelagic layer

- Aurelia aurita: 34%
- Aurelia limbata: 3%
- Chrysaora spp.: 3%
- Cyanea capillata: 3%
- Phacellophora camtschatica: 15%
- Aequorea spp.: 50%
- Calycopsis nematophora: 12%
- Ptychogena lactea: 37%
- Tima sachalinensis: 1%
- Others: 14%
Seasonal changes of jellyfish biomass (kg/km²)
Annual changes of jellyfish biomass (kg/km²) in the Okhotsk Sea

Fall
- all jellyfish
- Chrysaora spp.
- Cyanea capillata

Spring
- average
- standard error
Annual changes of jellyfish biomass (kg/km^2) in the Okhotsk Sea in fall

Northwestern Bering Sea

- all jellyfish
- *Cyanea capillata*

Southwestern BS

- *Aequorea spp.*
- *Chrysaora spp.*
Distribution of *Aglantha digitale* biomass
(Volkov 2007)

http://www.arcodiv.org
Examples of jellyfish blooms in the some regions of the World Ocean

<table>
<thead>
<tr>
<th>Region</th>
<th>Biomass</th>
<th>Year</th>
<th>Species</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Bering Sea</td>
<td>90-100 t/km²</td>
<td>1999</td>
<td><em>Chrysaora melanaster</em></td>
<td>Brodeur et al., 2002</td>
</tr>
<tr>
<td>South-Eastern Japan Sea</td>
<td>640 t/km²</td>
<td>2009</td>
<td><em>Nemopilema nomurai</em></td>
<td>Uye, 2011</td>
</tr>
<tr>
<td>Black Sea</td>
<td>900-1000 t/km²</td>
<td>1984</td>
<td><em>Aurelia aurita</em></td>
<td>Shushkina, Arnautov, 1985</td>
</tr>
<tr>
<td>Black Sea</td>
<td>1900 t/km²</td>
<td>1989</td>
<td><em>Mnemiopsis leidyi</em></td>
<td>Kovalev et al., 1999</td>
</tr>
<tr>
<td>Eastern Atlantic, Benguela current</td>
<td>140 t/km²</td>
<td>2003</td>
<td><em>Aequorea forskalea, Chrysaora hyoscella</em></td>
<td>Lynam et al., 2006</td>
</tr>
<tr>
<td>Japan Sea, Amursky and Ussuriysky Bays</td>
<td>30 t/km²</td>
<td>2010</td>
<td><em>Rhopilema asamushi</em></td>
<td>Sedova L.G., unpub. data</td>
</tr>
<tr>
<td>Eastern Okhotsk Sea</td>
<td>25 t/km²</td>
<td>2001</td>
<td><em>Aurelia limbata, Chrysaora spp.</em></td>
<td>Chetvergov et al., 2002</td>
</tr>
<tr>
<td>North-Western Bering Sea</td>
<td>4 t/km²</td>
<td>2000</td>
<td><em>Chrysaora melanaster</em></td>
<td>our data</td>
</tr>
</tbody>
</table>

Russian waters
Some Russian fishermen have turned to harvesting jellyfish for Chinese market.

Amursky Bay, Japan Sea, 2010

Photo & video: Maxim Shapovalov
CONCLUSIONS

• The highest concentrations of jellyfish occur in the northwestern Bering Sea, eastern Okhotsk Sea and Pacific waters off Kamchatka

• In comparison with many other regions of the World Ocean, jellyfish biomass in the Far-Eastern Seas is relatively low

• Jellyfish outbursts do not significantly influence marine ecosystems, fisheries and tourism

• In northwestern Japan Sea, jellyfish outbursts are profitable for fishermen because of the great demand of jellyfish for Chinese market

ACKNOWLEDGMENTS

I thank all my colleagues who collected and processed data on jellyfish during the surveys in the Far Eastern Seas in 1990-2011: Vyacheslav Shuntov, Igor Melnikov, Vladimir Radchenko, Alexander Starovoytov, Igor Glebov, Sergey Loboda, Alexey Khoruzhiy, Elena Strezhneva, Vladimir Sviridov, Evgeniy Ovsyannikov and many others
THANK YOU FOR ATTENTION!
THANK YOU FOR ATTENTION!
THANK YOU FOR ATTENTION!