"Conditions of hydrobiological community formation in the lagoons of north-eastern Sakhalin Island"

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Ecological observations were conducted in 1995-2001

The objective— the study of the abiotic and biotic components of ecosystems and evaluation of influence of main environmental factors on formation of biological communities.

<table>
<thead>
<tr>
<th>Period</th>
<th>Sampling areas</th>
<th>Expedition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995 (June, September)</td>
<td>Nyyskiy</td>
<td>SakhNIRO</td>
</tr>
<tr>
<td>1996 (June, August)</td>
<td>Nyyskiy, Nabil, Chayvo, Pilitun</td>
<td>SakhNIRO</td>
</tr>
<tr>
<td>1997 (June, September)</td>
<td>Nyyskiy, Chayvo, Nabil</td>
<td>SakhNIRO</td>
</tr>
<tr>
<td>1998 (June, September)</td>
<td>Nyyskiy</td>
<td>SakhNIRO</td>
</tr>
<tr>
<td>1999 (June-July)</td>
<td>Pilitun, Chayvo, Nyyskiy, Nabil</td>
<td>SakhNIRO+ECS (Ecological company of Sakhalin)</td>
</tr>
<tr>
<td>2000 (July)</td>
<td>Lunskiy, Nyyskiy</td>
<td>SakhNIRO</td>
</tr>
<tr>
<td>2001 (September)</td>
<td>CHayvo</td>
<td>SakhNIRO</td>
</tr>
</tbody>
</table>

The Complex studies in the bays included:
- hydrological and hydrochemical researches;
- The Study of plankton community parameters;
- The Study of granulometric composition of the sediment;
- The Study of benthic communities;
- Ichthyological researches;
- Microbiological researches;
- The Study of the contents of pollutants in the water, sediment and hydrobiont’s tissue.

Data: SakhNIRO+ECS
Sampling areas

Data: SakhNIRO+ECS
The Piltun and Nabil are wide with long narrow entrances. The depth varies from 0.6 to 2 m, 1.2 m in average. The marine water doesn’t cover all area of this Bay on high tide.

Data: SakhNIRO+ECS
Bathymetric map (A) and Bottom and surface salinity (B) on tide in Chayvo and Nyyskiy Bays

The Chayvo and Nyyskiy are narrow with short wide entrances. The depth varies from 0.6 to 2 m, 1.5 m in average. The marine water covers practically all area of these Bays on high tide.

Data: SakhNIRO+ECS
The Lunskiy is the smallest, deepest and the most salinity at any phase of tide.

Data: SakhNIRO+ECS
The main parameters of different types of water in north-eastern Sakhalin lagoons

1- in the rivers and in the its mouths (The highest concentrations of BOD, Silicates, Phosphates, TSS)
2- in lagoons
3- near entrances and tidal channels

Data: SakhNIRO+ECS
The water on low tide brings from the bays more amount of phosphates, silicates, and chlorophyll. The seawater is enrichment by dissolved oxygen (DO) and nitrates.

Data: SakhNIRO+ECS
The grain size distribution of upper sediment layer in north-eastern Sakhalin lagoons

1- in the rivers and in the mouths (gravel and middle sand are predominant here)
2- in lagoons (silty sand and silt)
3- near entrances and channels (gravel)
The fine and middle grain sand are dominant on the nearest shelf (not far from entrances) and their percentage are higher, than inside the bays

Data: SakhNIRO+ECS
There are 8 main types of sediments, but not all of them are presented in each lagoon.
The zone of this metal accumulations is very close to distribution of fine sediment

Data: SakhNIRO+ECS
The concentration of metals and total petroleum Hydrocarbons (HY) in upper sediment layer in the north-eastern Sakhalin lagoons

The concentration of most elements (except As and Hg) and NY were below in marine areas and nearest shelf.

Data: SakhNIRO+ECS; Lab analysis: TINRO-center, Kovekovdova L. T.
Metal concentrations in the upper layer of bottom sediment of Bays, ppm dry weight

<table>
<thead>
<tr>
<th>Bays</th>
<th>Al</th>
<th>Fe</th>
<th>Zn</th>
<th>V</th>
<th>Ni</th>
<th>Cr</th>
<th>Cu</th>
<th>Pb</th>
<th>Co</th>
<th>Cd</th>
<th>Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chayvo</td>
<td>Mean</td>
<td>6414</td>
<td>8643</td>
<td>24.2</td>
<td>28.7</td>
<td>16.6</td>
<td>20.5</td>
<td>6.87</td>
<td>3.13</td>
<td>3.29</td>
<td>0.050</td>
</tr>
<tr>
<td>SD</td>
<td>5799</td>
<td>4994</td>
<td>20.4</td>
<td>15.1</td>
<td>12.1</td>
<td>15.0</td>
<td>3.95</td>
<td>3.34</td>
<td>2.24</td>
<td>0.000</td>
<td>0.010</td>
</tr>
<tr>
<td>Nabil</td>
<td>Mean</td>
<td>4996</td>
<td>6520</td>
<td>21.8</td>
<td>21.7</td>
<td>16.3</td>
<td>17.7</td>
<td>5.89</td>
<td>1.46</td>
<td>2.65</td>
<td>0.081</td>
</tr>
<tr>
<td>SD</td>
<td>3583</td>
<td>3451</td>
<td>15.5</td>
<td>8.2</td>
<td>17.2</td>
<td>18.4</td>
<td>3.53</td>
<td>1.65</td>
<td>2.43</td>
<td>0.082</td>
<td>0.007</td>
</tr>
<tr>
<td>Nyyskiy</td>
<td>Mean</td>
<td>8300</td>
<td>8131</td>
<td>28.2</td>
<td>21.1</td>
<td>11.1</td>
<td>12.6</td>
<td>5.83</td>
<td>2.88</td>
<td>2.92</td>
<td>0.089</td>
</tr>
<tr>
<td>SD</td>
<td>4395</td>
<td>5892</td>
<td>20.2</td>
<td>6.6</td>
<td>9.2</td>
<td>10.2</td>
<td>3.64</td>
<td>2.68</td>
<td>2.29</td>
<td>0.066</td>
<td>0.004</td>
</tr>
<tr>
<td>Piltun</td>
<td>Mean</td>
<td>2718</td>
<td>4429</td>
<td>13.6</td>
<td>20.0</td>
<td>11.4</td>
<td>11.7</td>
<td>4.38</td>
<td>1.15</td>
<td>1.46</td>
<td>0.053</td>
</tr>
<tr>
<td>SD</td>
<td>1950</td>
<td>3456</td>
<td>11.3</td>
<td>0.0</td>
<td>12.5</td>
<td>9.7</td>
<td>1.95</td>
<td>1.27</td>
<td>1.25</td>
<td>0.012</td>
<td>0.005</td>
</tr>
<tr>
<td>Lunksiy</td>
<td>Mean</td>
<td>3839</td>
<td>15490</td>
<td>36.6</td>
<td>29.5</td>
<td>12.7</td>
<td>16.1</td>
<td>10.52</td>
<td>9.85</td>
<td>4.64</td>
<td>0.208</td>
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<tr>
<td>SD</td>
<td>4507</td>
<td>12470</td>
<td>25.3</td>
<td>20.7</td>
<td>9.2</td>
<td>10.8</td>
<td>8.00</td>
<td>7.18</td>
<td>2.44</td>
<td>0.171</td>
<td>0.034</td>
</tr>
</tbody>
</table>

Data: SakhNIRO+ECS
Data: SakhNIRO+ECS

Ratio of ecological groups of phytoplankton in surface water of different sampling areas

Lunskiy
- Near rivers
- Central parts of bay
- Near entrance

Chayvo
- Near rivers
- Central parts of bay
- Near entrance

The dynamic of phytoplankton density and biomass during 24 hours in Chayvo
- the quantity is increasing on low tide

Data: SakhNIRO+ECS
Distribution of Total biomass of phytoplankton in the north-eastern Sakhalin lagoons, mg/m³
Data: SakhNIRO+ECS

Ratio of phytoplankton taxonomic groups biomass in the north-eastern Sakhalin lagoons, %

- Diatoms dominated over the whole Bays
- In Piltun the part of fresh water green and green-blue algae was increased
- In Lunskiy – golden and dinoflagellates were more abundant
- In Chayvo – Euglenophyta share was higher

Data: SakhNIRO+ECS
Distribution of the Total biomass of macrozoobenthos in the north-eastern Sakhalin lagoons, wet weight, g/m²

In most cases very similar with distribution of fine sediments

Data: SakhNIRO+ECS
- **Bivalve** (*Macoma balthica, Liocyma fluctuosa*) were more abundant in all bays
- **In Lunskiy** – Cumacea, Polychaeta, Cirripedia and Echiurida were significant
- **In Nyyskiy and Piltun** – oligochaets had visible biomass.

Data: SakhNIRO+ECS
Distribution of the biomass of Macoma balthica, wet weight, g/m²

Data: SakhNIRO+ECS
### Bottom Community structure of Chayvo and Piltun Bays

#### Piltun

<table>
<thead>
<tr>
<th>Communities</th>
<th>Station</th>
<th>Dominant species</th>
<th>Biomass, g/m²</th>
<th>Density, ind/m²</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>9, 12, 15, 16, 19, 26, 29, 54, 56, 57</td>
<td>Macoma baltica+Liocyma fluctuosa</td>
<td>2982±2921</td>
<td>2.28±0.6</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>6, 20, 32</td>
<td>Macoma baltica+Hediste diversicolor</td>
<td>980±968</td>
<td>1.48±1.0</td>
<td>9</td>
</tr>
<tr>
<td>III</td>
<td>64, 63, 61, 60, 58, 55</td>
<td>Nephtys caeca + Spio filicornis</td>
<td>9800±19423</td>
<td>1.42±0.8</td>
<td>0</td>
</tr>
<tr>
<td>IV</td>
<td>41, 45, 13, 27, 7</td>
<td>K. kutchae</td>
<td>map.41</td>
<td>1.62±0.5</td>
<td>6</td>
</tr>
<tr>
<td>V</td>
<td>42, 3, 31</td>
<td>N. awatchensis +Amphiporidae gen. sp.</td>
<td>723±1058</td>
<td>0.76±0.6</td>
<td>6</td>
</tr>
</tbody>
</table>

#### Chayvo

<table>
<thead>
<tr>
<th>Communities</th>
<th>Station</th>
<th>Dominant species</th>
<th>Biomass, g/m²</th>
<th>Density, ind/m²</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>10, 15, 16, 22, 26, 27, 35, 41, 42, 47</td>
<td>Kamaka kutchae+Eogamma rus kygí</td>
<td>8932.4 ± 6794.0</td>
<td>2.28±0.6</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>1, 2, 5, 6, 7, 8, 12, 14, 21, 28, 29, 30, 31, 32, 43</td>
<td>K. kutchae</td>
<td>123.2 ± 86.7</td>
<td>4234.8 ± 4467.4</td>
<td>1.41 ± 0.68</td>
</tr>
<tr>
<td>III</td>
<td>11, 13, 17, 18, 19, 23, 24, 25, 44, 45, 46</td>
<td>Corbicula sirotski+Macoma balitica+ (Potamocarbula amurensis)</td>
<td>123.2 ± 86.7</td>
<td>4234.8 ± 4467.4</td>
<td>1.41 ± 0.68</td>
</tr>
<tr>
<td>IV</td>
<td>1P, 2P, 36, 37, 38, 39, 40</td>
<td>M. baltica+Liocyma fluctuosa</td>
<td>174.7 ± 289.8</td>
<td>2817.4 ± 1442.5</td>
<td>1.98 ± 0.51</td>
</tr>
</tbody>
</table>

Data: SakhNIRO+ECS
Conclusion

1. The environmental conditions allow to divide the Bays on three groups. The Lunskiy affected on the biggest influence of marine water, the Piltun and Nabil – the lowest. Chayvo and Nyyskiy have intermediate position.

2. Three types of water were detected in the bays.

3. The bays are geochemical barrier for suspend solids and metals.

4. The hydrodynamic conditions are more important factor, which forms different types of pelagic and benthic communities. Peculiar phytoplankton communities are formed near the river mouths under an influence of river run-off.

5. Benthic communities in brackish water have higher biomass and species diversity than both fresh and marine communities.

6. Fresh water benthic communities have the widest spreading in Piltun. The brackish water benthic communities covered the most area of Nyyskiy, Chayvo and Lunskiy bays.

7. Relatively high content of some trace metals in lagoons are the result of natural geochemical conditions with terrestial concentrations of metals.

Data: SakhNIRO+ECS