

Comparison of Ecological Safety of the Harbor Terminals on the Base of Original Observations

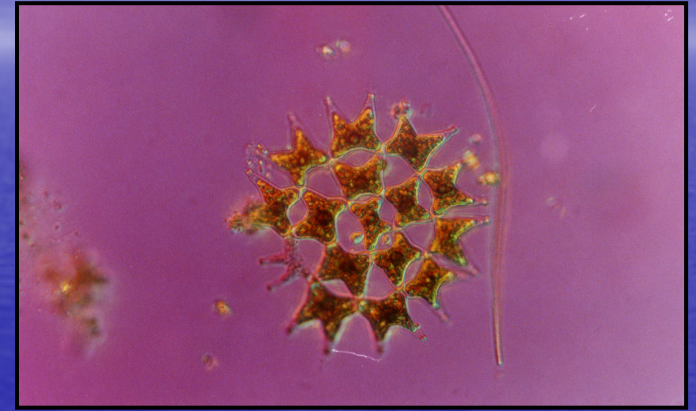
Prof. Dr. Michael SHILIN, Dr. Tanya Eremina

Russian State Hydrometeorological University,
St Petersburg

Terminals observed

1. Batareynaya bay (Baltic Sea, 1995 – 1996)
2. Primorsk – 1st terminal / Strait of Bjerkesund (Baltic Sea, 1999 – 2005)
3. Ust' Luga – Coil terminal / Luga bay (Baltic Sea, 1997 – 2004)
4. Konstantinovsky Palace in Strelna (Baltic Sea, 2000 – 2001)
5. Kandalaksha Trade Harbour (White Sea, 1996 – 2002)
6. Oil terminal Vitino (White Sea, 1996 - 2002)

Objects of bio monitoring



Mapping of benthic communities


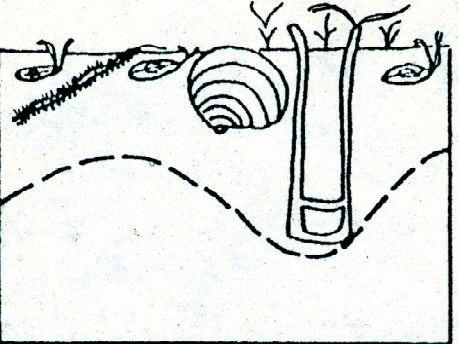
$$S_c = \frac{2c}{a+b} \cdot 100$$

Simpson index

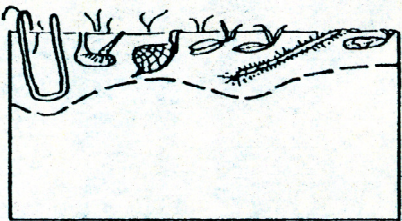
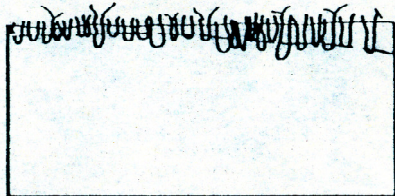
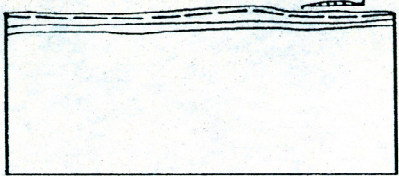
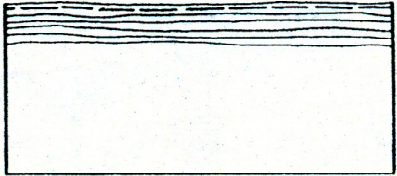
$$I = 1 - (Z_n - Z_f) / Z_n$$

- I – Changes in biota;
- Z_n – Biomass / diversity before anthropogenic impact;
- Z_f – Biomass/ diversity after impact

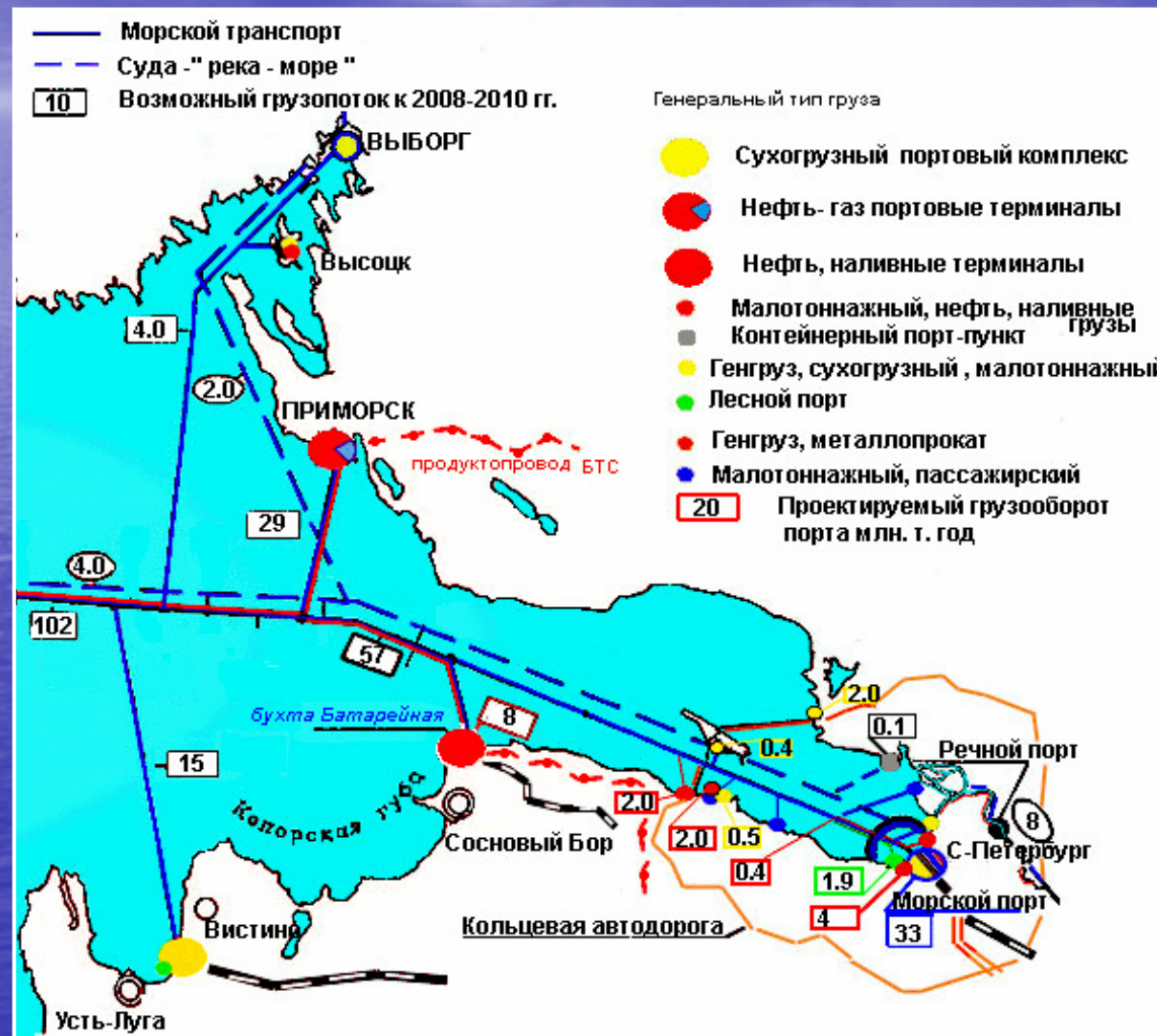
Scale of the intensity of anthropogenic impact on benthos

Сообщество мягких грунтов	Индекс изменения биоты ИИБ	Качественная оценка состояния	Оценка, баллы
 <p>A cross-sectional diagram of a soft-bottom benthic community. It shows a diverse and dense assemblage of organisms including a large clam, a segmented worm, a polychaete worm, and several smaller invertebrates. The organisms are distributed throughout the upper layers of the sediment, indicating a healthy and resilient community.</p>	<p>> 1</p>	<p>Улучшенное</p>	<p>6</p>
 <p>A cross-sectional diagram of a soft-bottom benthic community. The diversity and density are significantly reduced compared to the top diagram. Only a few organisms, such as a clam and a small worm, are visible. The sediment surface is mostly bare, indicating a degraded and less resilient community.</p>	<p>0.9 – 1.0</p>	<p>Норма</p>	<p>5</p>

Шкала оценки интенсивности нарушений состояния биоты морских экосистем

Сообщество мягких грунтов	Индекс изменения биоты ИИБ	Качественная оценка состояния	Оценка, баллы
	0.75 – 0.9	Хорошее	4
	0.55 – 0.75	Посредственное	3
	0.3 – 0.55	Плохое	2
	<0.3	Катастрофическое	1

Harbor complexes in the Gulf of Finland



Ust' Luga Harbor

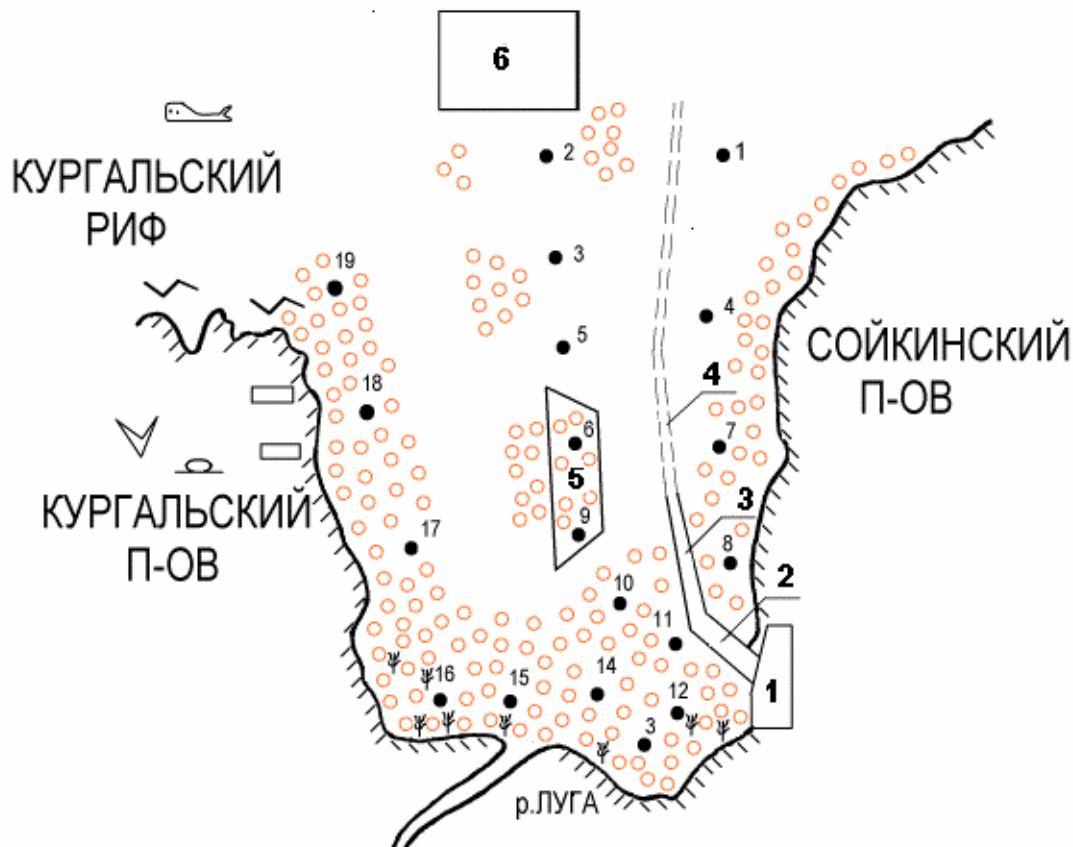









Harbor planned for 120 000 000
 m^3 cargo

Dredging of 4 mln m^3 sandy
bottom,

Using 2 mln m^3 for the artificial
ferry platform.

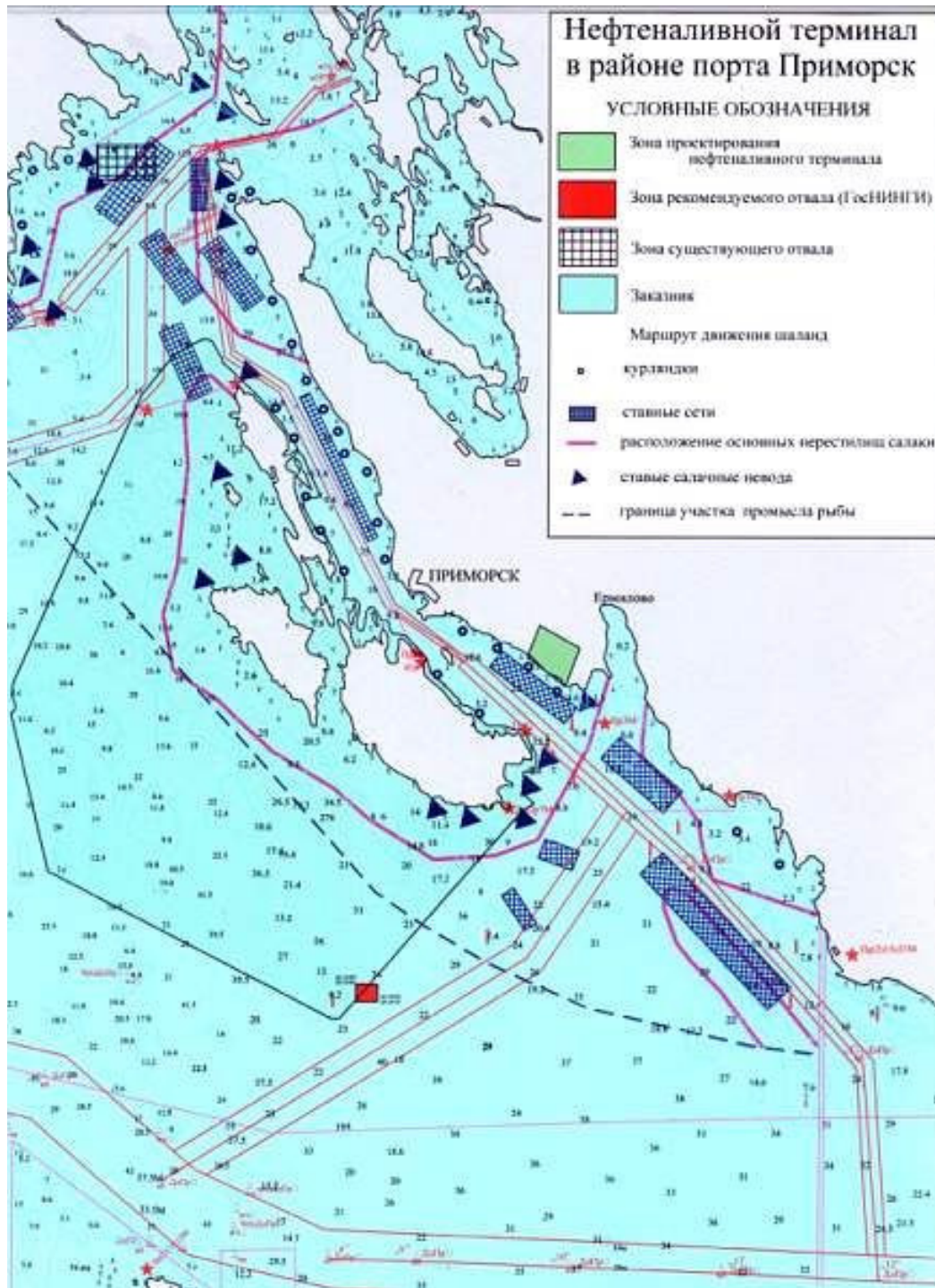




-  Лежка серого тюленя (*Halichoerus grypus*)
-  Места обитания европейской норки (*Mustela lutreola*)
-  Места гнездования скопы (*Pandion haliaetus*)
-  Места гнездования орлана-белохвоста (*Haliaeetus albicilla*)
-  Лёжки нерпы (*Phoca hispida bothnica*)
-  Камыш
-  Нерестилища салаки

- 1, 2 – coil terminal,
- 3, 4 – farwater,
- 5 – dumping zone (projected),
- 6 – dumping zone (alternative)

Geosystem of the Luga bay

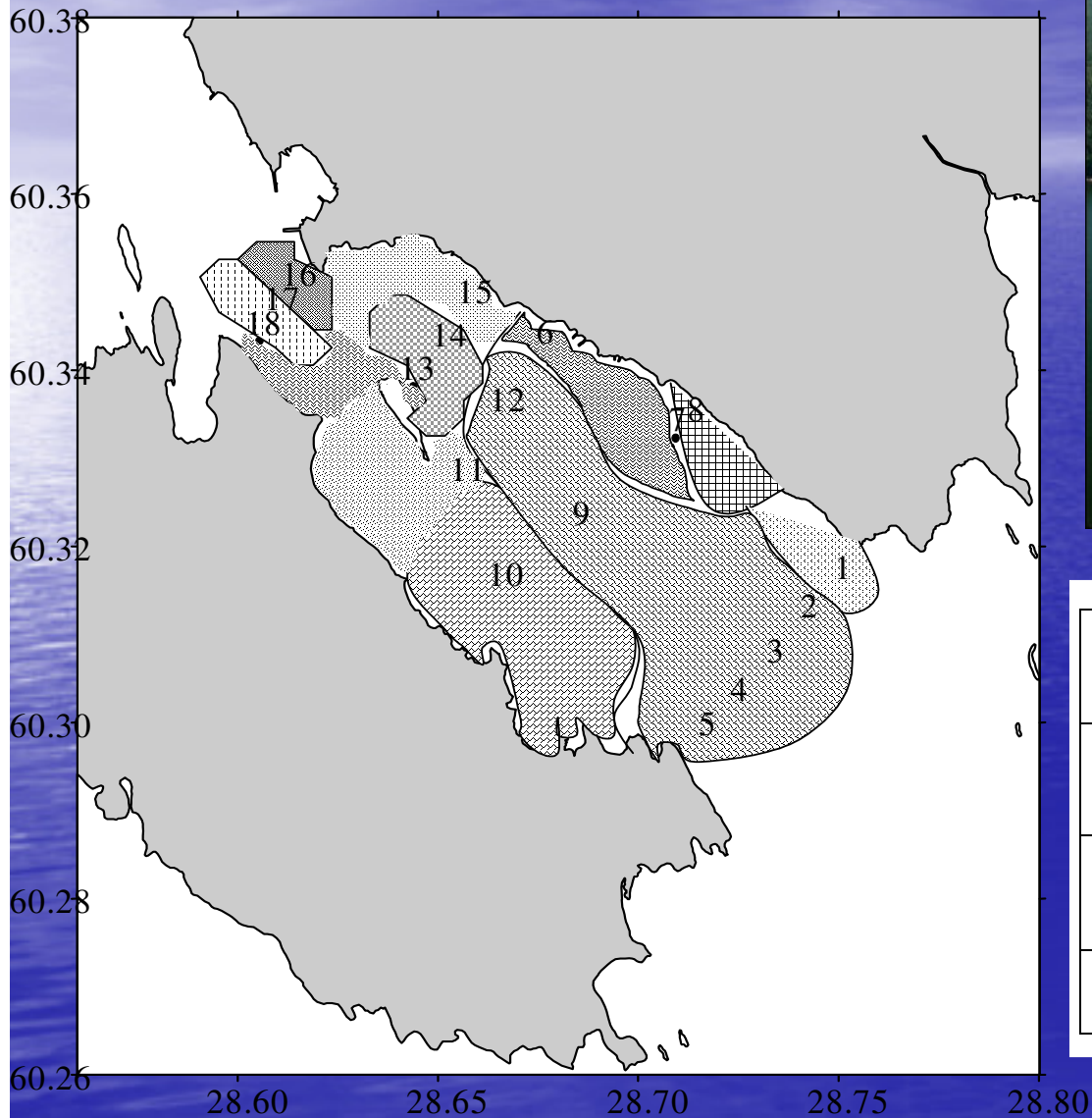


Geosystem of
the Strait of
Bjerkesund

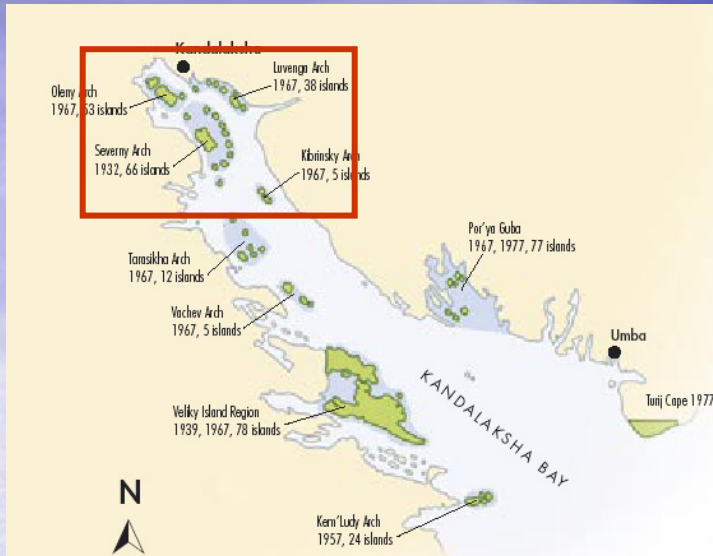
Monitoring of the 1st Terminal Construction in the Primorsk Harbor



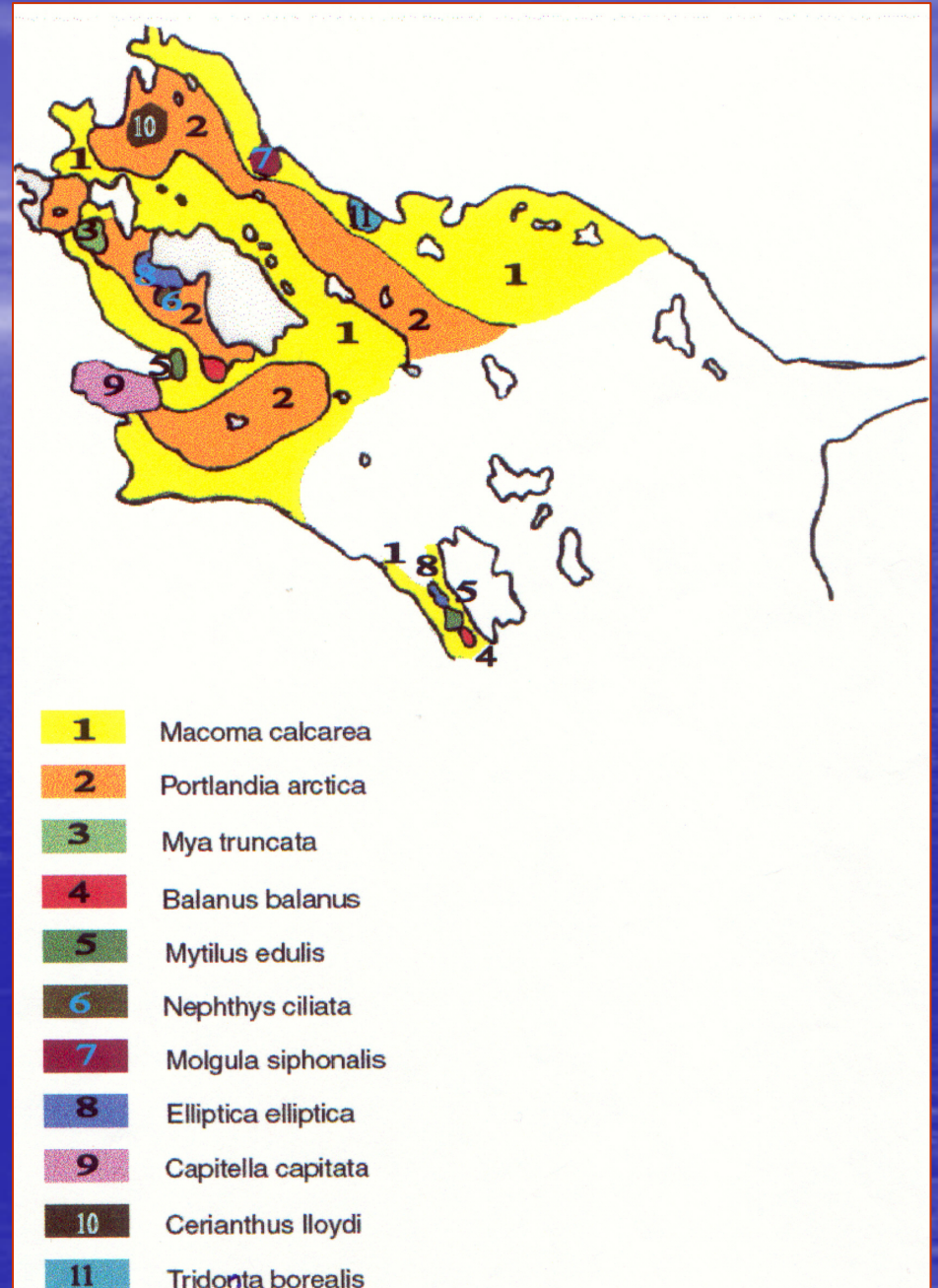
Benthic communities



	Бентос отсутствует		Сообщество <i>Chironomida+Oligochaeta+Tubificidae</i> на мелком песке с глиной и камнями
	Сообщество <i>Chironomida</i> на заиленном песке над илом		Сообщество <i>Chironomida+Oligochaeta+Saduria entomon</i> на мелком песке с глиной и камнями
	Сообщество <i>Saduria entomon</i> на мелком песке с камнями		Сообщество <i>Chironomida+Saduria entomon</i> на заиленном песке с ЖМК
	Сообщество <i>Chironomida+Oligochaeta</i> на мелком песке		Наиболее разнообразное сообщество с ключевым видом <i>Macoma balthica</i>



Geosystem of the Gulf of Kandalaksha (White Sea)



Changing in Benthic Communities in the Luga Bay under Harbor Construction

Type of Community	Before dredging	After dredging
1. Обедненное открытого района	3	3
2. Смешанное мелководное западного берега	5	5
3. «Мягкие кормовые» центрального района	5	2
4. Хирономидные южного побережья	5	2
5. «Мягкие кормовые» восточного побережья	3	1
6. Макомовое	5	4
In average	4,5	3

Changing in Benthic Communities in Primorsk Area under the Harbor Construction

Type of Community	Before Dredging	During dredging	After dredging
1. <i>Chironomida + Oligochaeta</i>	4	2	4
2. <i>Chironomida + Oligochaeta + Saduria</i>	4	4	4
3. <i>Chironomida+Oligochaeta+Tubificidae</i>	4	2	4
4. <i>Chironomida+Saduria</i>	4	2	4
5. <i>Chironomida</i>	3	3	4
6. <i>Saduria</i>	2	2	3
7. <i>Macoma balthica</i>	5	1	5
8. Отсутствие бентоса	1	1	1
In average	3	2	3,5

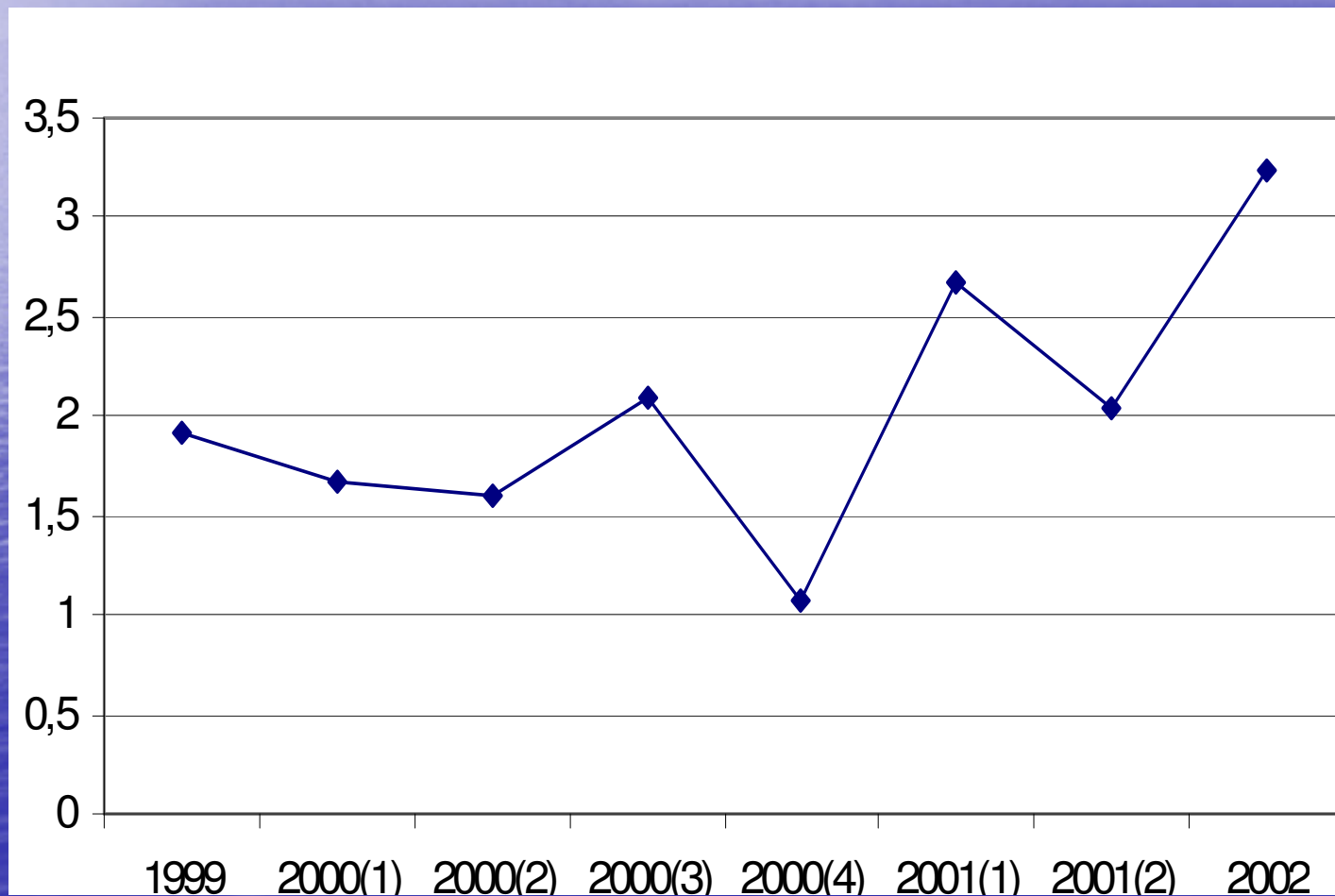
Changing in Benthic Communities of the Gulf of Kandalaksha (White Sea) under the Harbor Construction

Type of community	Before dredging	After dredging
1. <i>Macoma balthica</i>	4	4
2. <i>Portlandia arctica</i>	4	4
In average	4	4

Ecological Safety of Different Terminals

Terminal	Scale of impact	Time of impact	Intensity of impact	Ecological Safety
Coil terminal in Ust-Luga	Meso-scale	Short time	Intensive	Dangerous
1 st terminal in Primorsk	Local	Short time	Medium	Not dangerous
Kandalaksha trade harbor (modernizing)	Local	Short time	Not intensive	Not dangerous

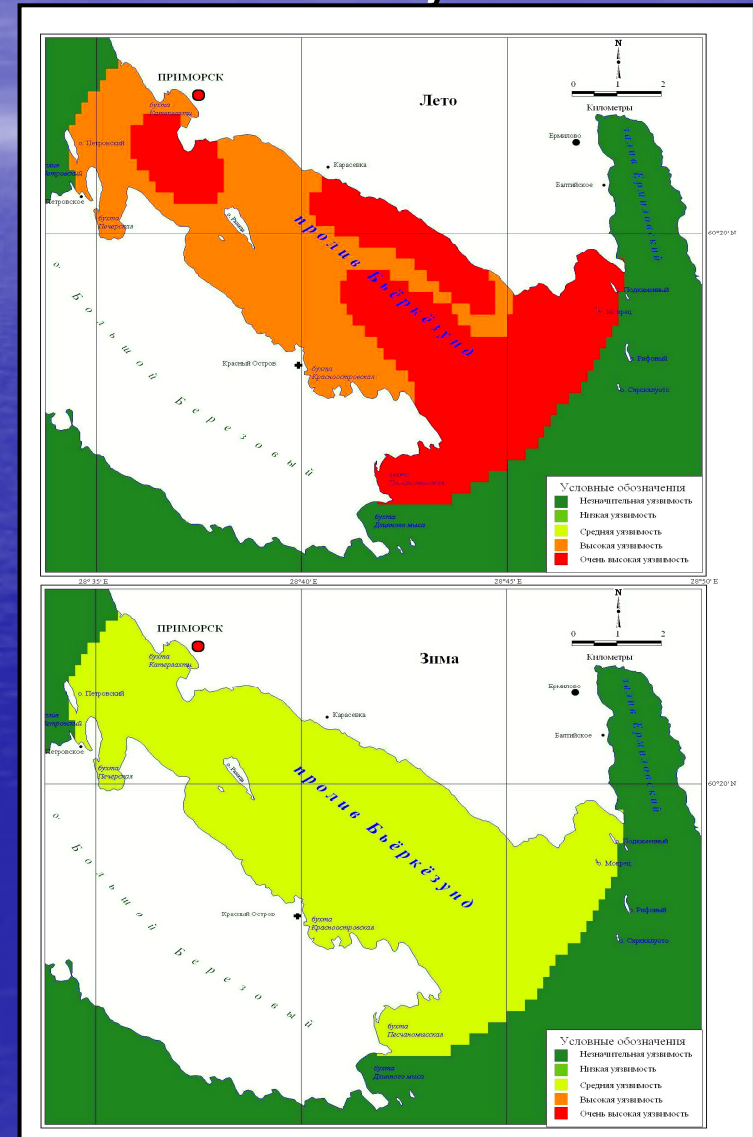
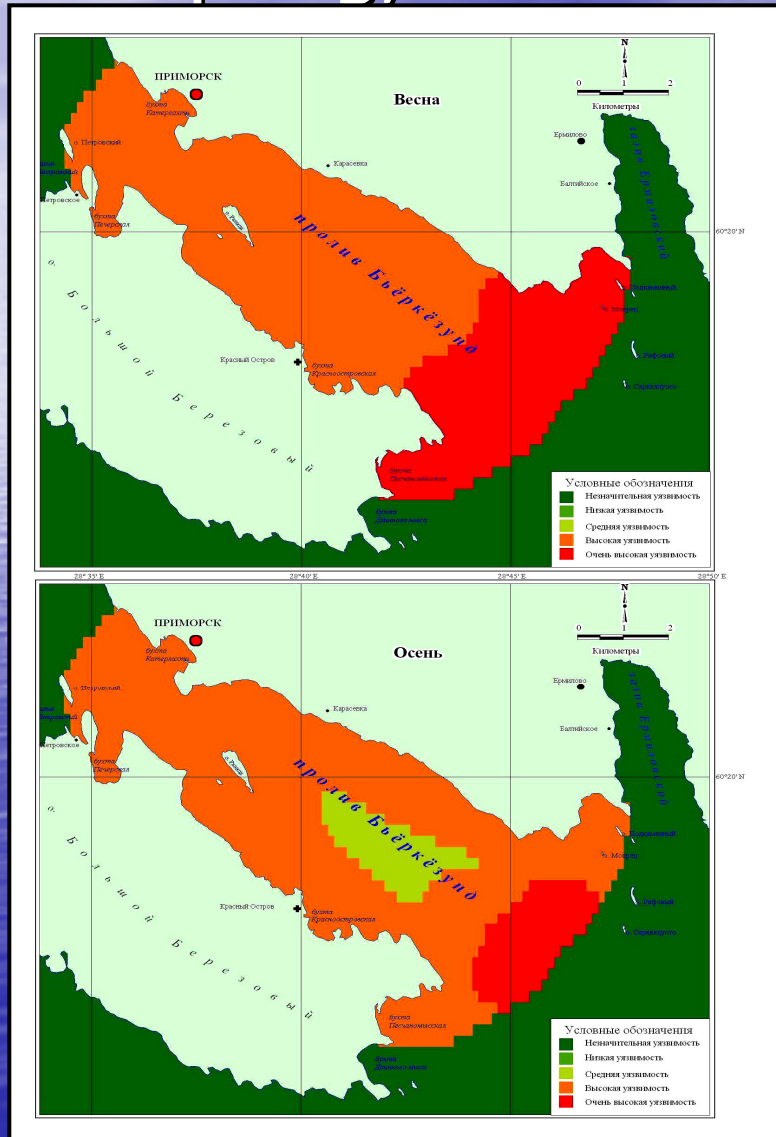
Changing of Biodiversity Indexes in Benthos of the Strait of Bjerkesund (Primorsk Area) from 1999 until 2002



Sensitivity to Suspended Material

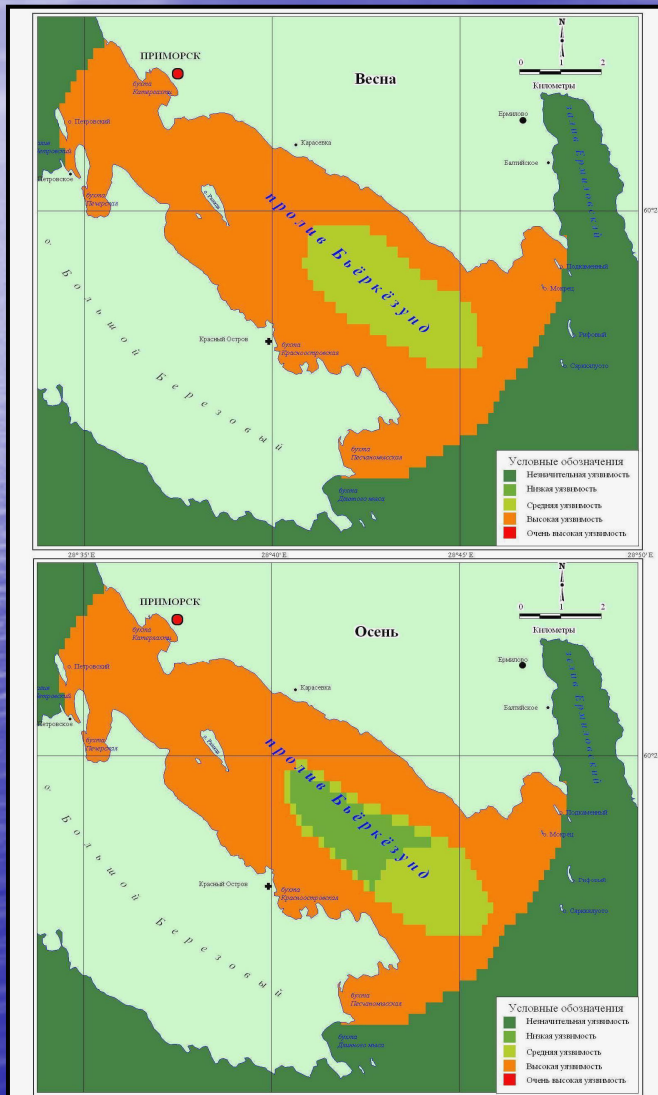
Spring, Autumn

Summer, Winter

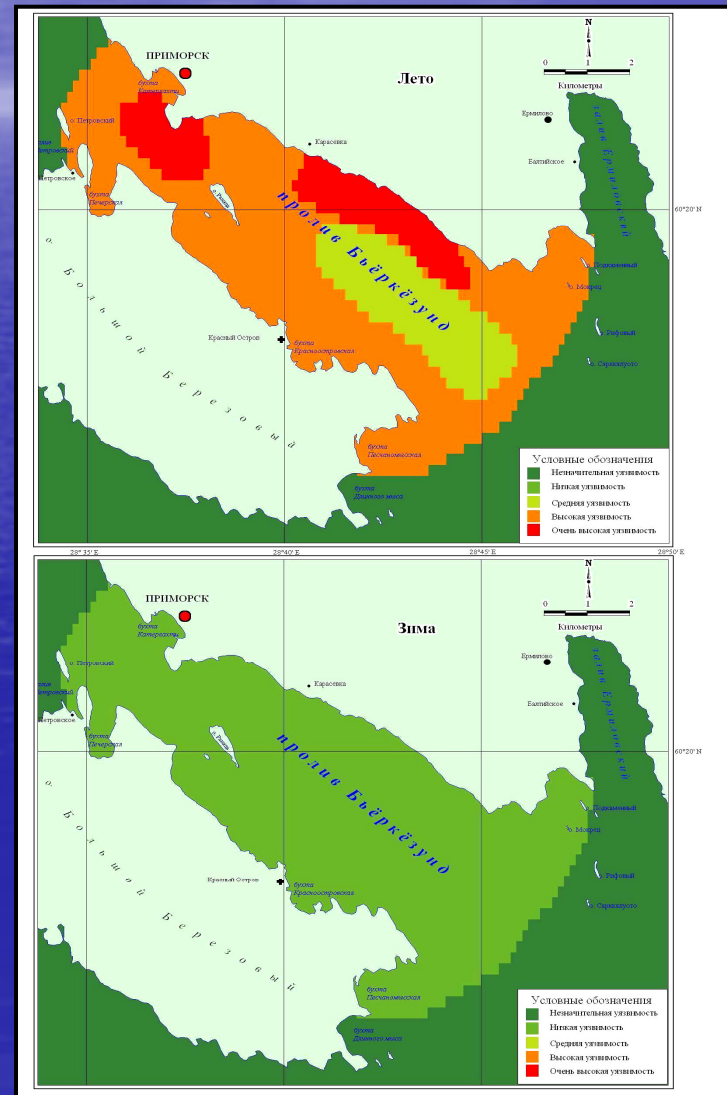


Sensitivity to Dumping

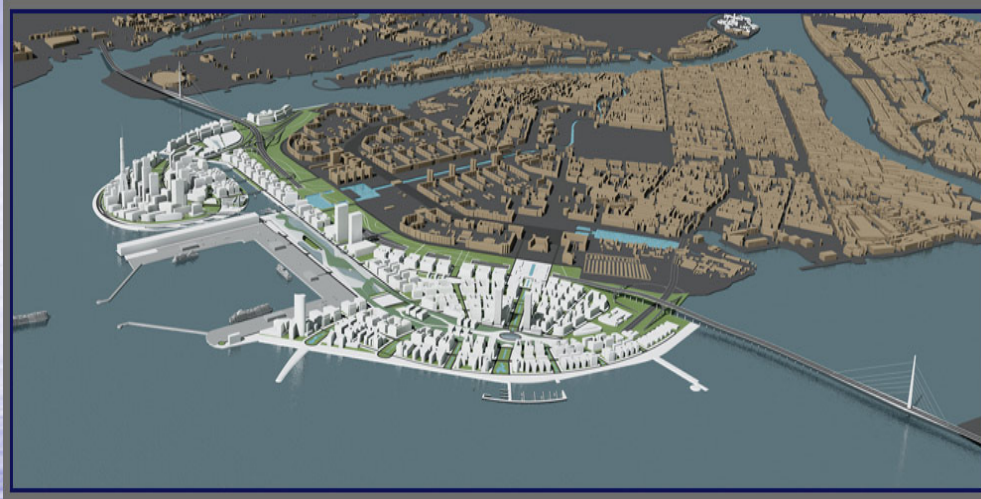
Spring, Autumn



Summer, Winter



NEW ANTHROPOGENIC OBJECTS



Project

“Sea Facade”

- **Total Project Surface - 476,7 ha:**
- **1st period - 2008, 155 ha**
- **2nd period - 2009, 85 ha**
- **3rd period - 2010, 50 ha**
- **Artificial Island - 2011, 75 ha**



Distribution of turbidity and suspended materials (by satellite film)

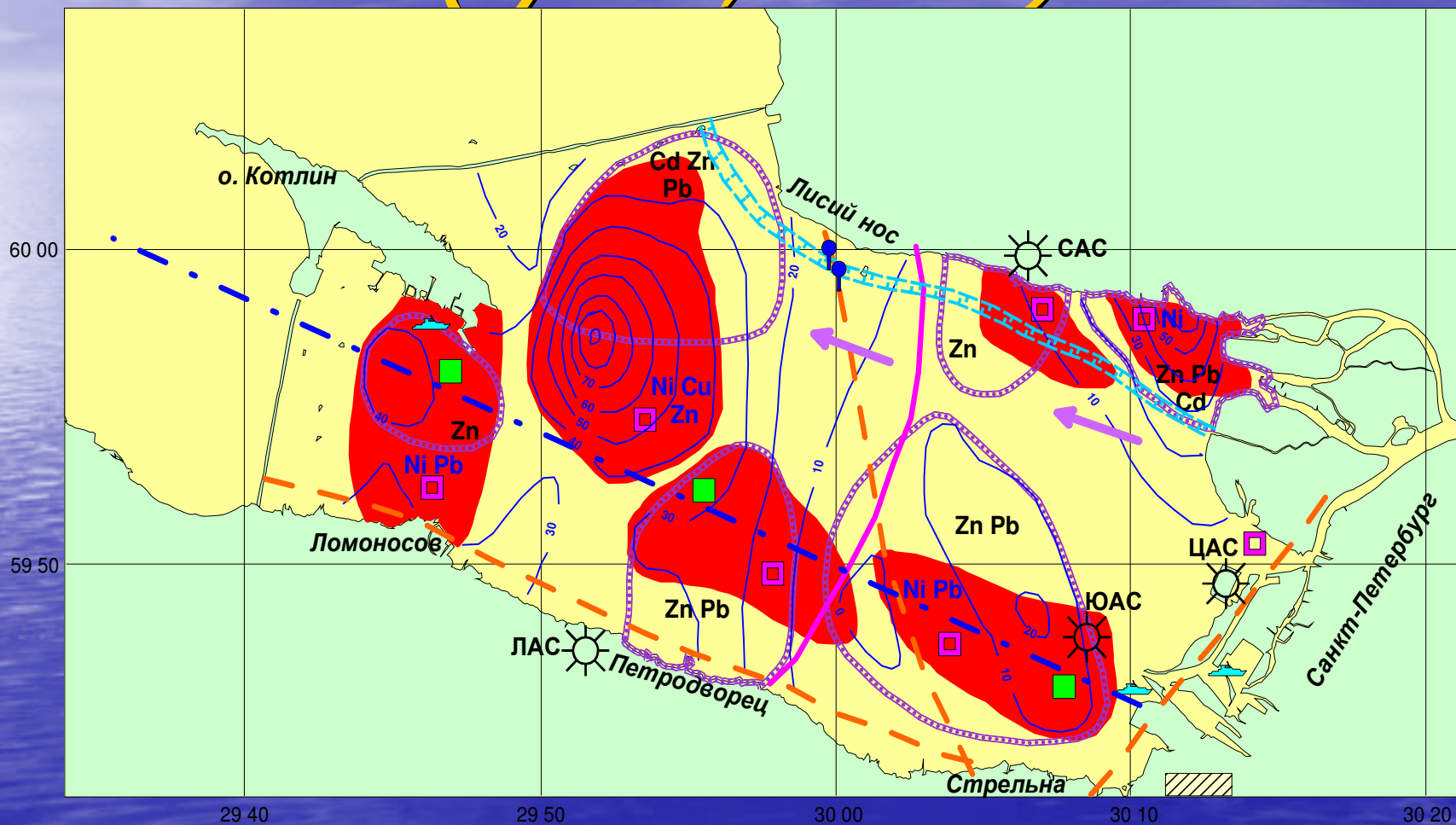


. MODIS/Terra, 250m, 22.07. 2007.

Suspended Material in the Gulf of Finland



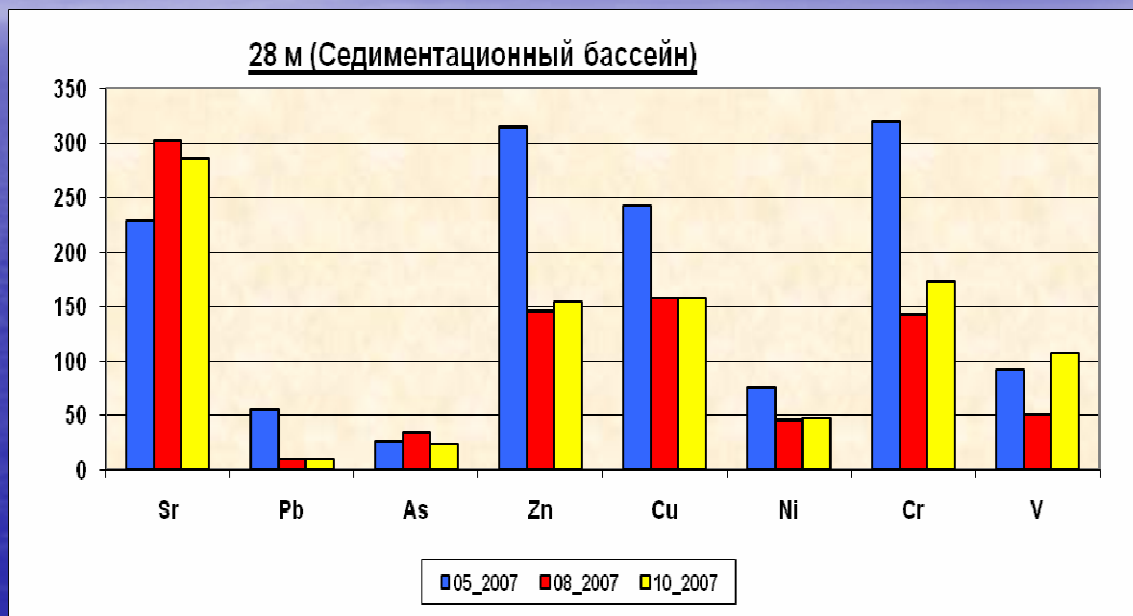
Hydrochemical map of the Bottom of the Neva Bay in 2007 (Rybalko, Eremina)



The concentrations of Σ heavy metals, 11/2007

№№ of the stations	Zn
6	9,85
7	12,82
17	10,24
23	9,76
28	10,74

The change of heavy metals concentration in bottom sediments from May to October 2007 (St. 28)



Средние концентрации тяжелых металлов в донных осадках Невской губы максимальные по сравнению с другими районами, особенно это стало заметно со второй половины 2006 г.

Partners

- 1. UNESCO, Dep. of Coastal Zones and Small Islands
- 2. Lenmorniiproject Ltd., St. Petersburg
- 3. Local administrations in Primorsk and Kandalaksha
- 4. Royal Technical university at Stockholm, Sweden
- 5. Baltic Fund for Nature, St. Petersburg