

PRIMORSKY KRAY SHORELINE POLLUTION MONITORING METHODS AND RESULTS

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The amount of human-caused environmental impact can be evaluated by the degree of pollution.



● ● ● | Marine litter can be found virtually in any sea, whether involved in anthropogenous activities on the large scale or geographically remote from the apparent sources of pollution.



● ● ● Marine litter is no longer just an aesthetic problem but the one of ecology and economy, being harmful for people's health and life activities.



The sources of its introduction into coastal waters are not only land-based objects (ports, coastal sanatorium-and-spa institutions), but some sea-based objects as well (marine transport, sea farms, etc.), where currents and winds carry it over great distances.



When planning shoreline cleaning-up activities for the south-western coast of Primorye the following should be taken into account:

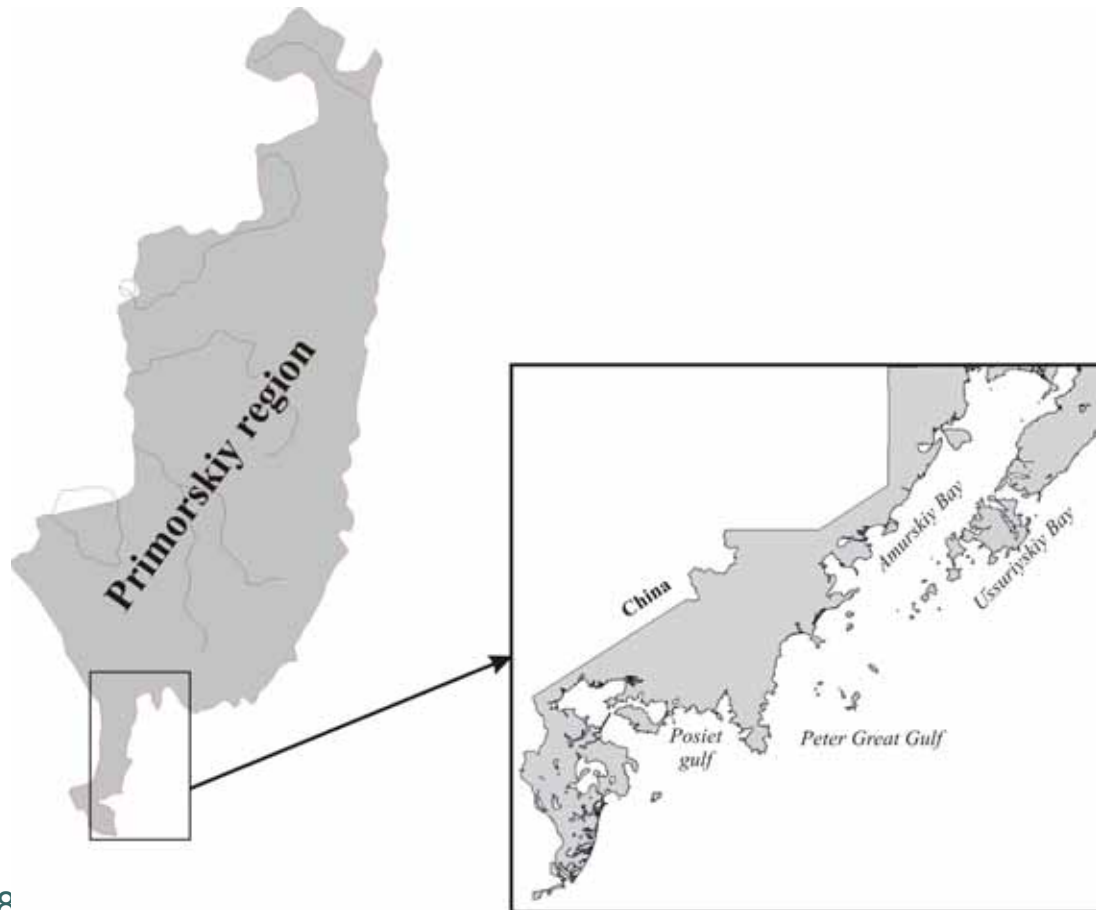
- ✓ the distance from the polluted areas to the utilization sites officially established by local authorities,
- ✓ the extent of the shoreland involvement into the economic activities,
- ✓ supervision of pollution sources within the coastal waters.



Region under Research, its Peculiarities



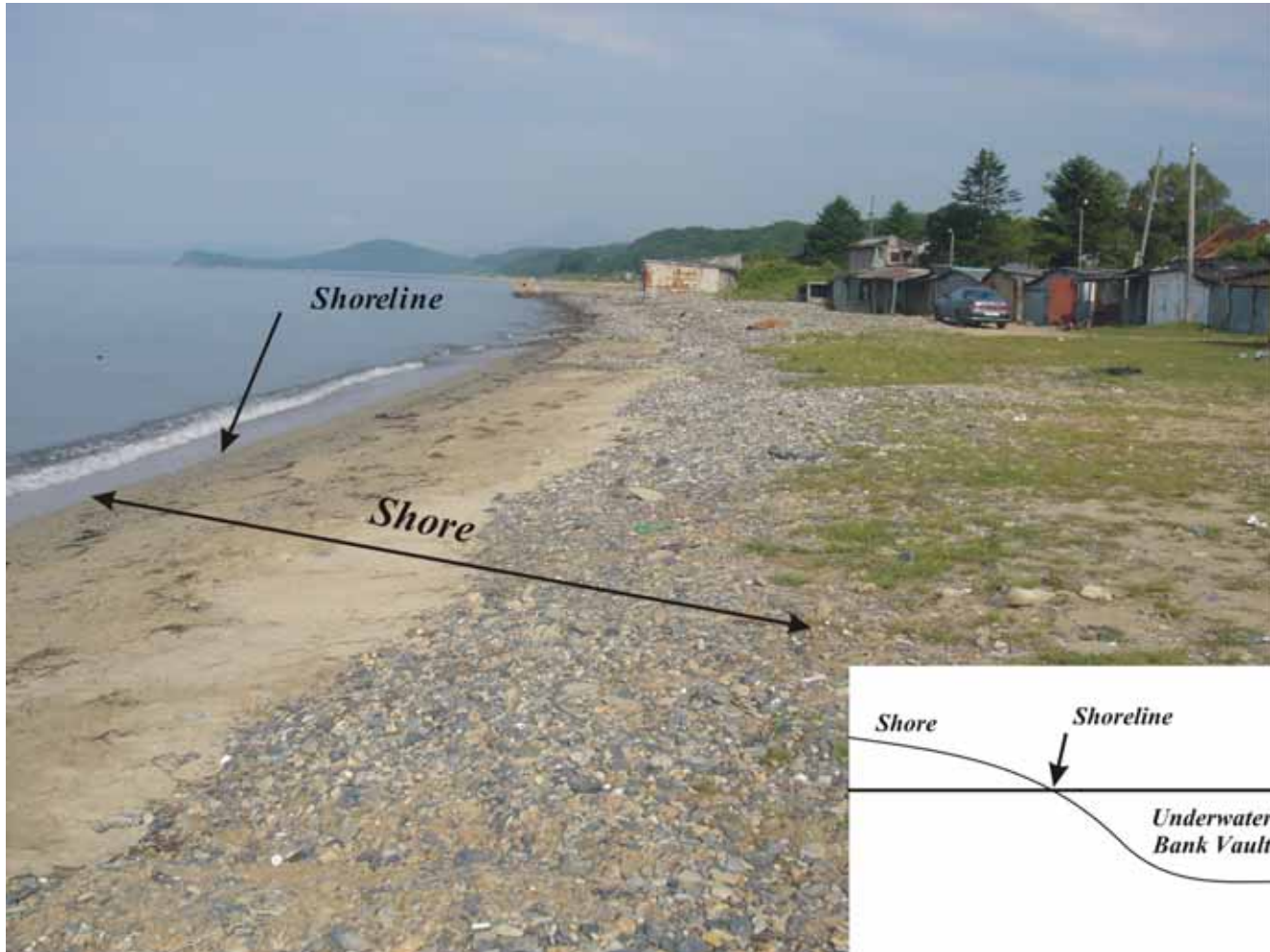
The south-western shores of Primorsky Krai are washed by Peter Great Gulf waters



Different coast types are presented here



The region under research is one of the most dynamic zones of the geographical envelope where land and sea interact.



● ● ● The period of time allowing to evaluate the change in the degree of the shoreland pollution with litter is that from 1999 till 2005.



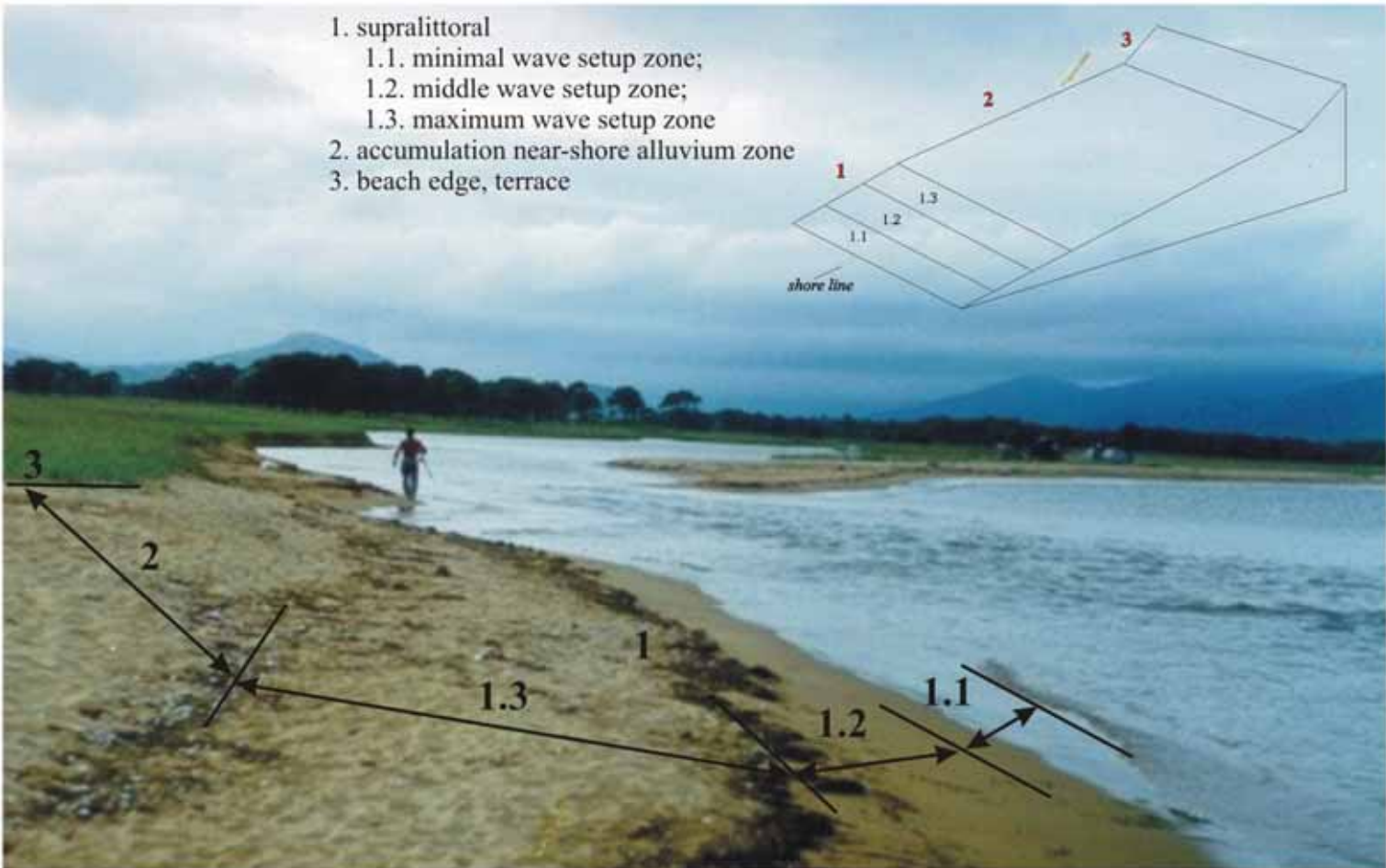
The work was conducted by the staff of the Seascope Lab, Pacific Institute of Geography (Far Eastern branch of the Russian Academy of Science) and by the staff and students of the Sea Protection Institute, Maritime State University named after admiral G.I. Nevelskoy.



Methods of Research

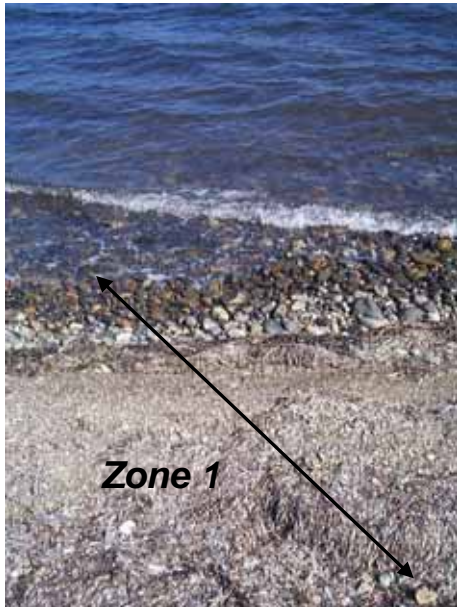


To facilitate the monitoring of litter in shoreland and coastal waters the shoreline division scheme was developed, based on the analysis of the physiographic processes occurring in land and sea interaction.



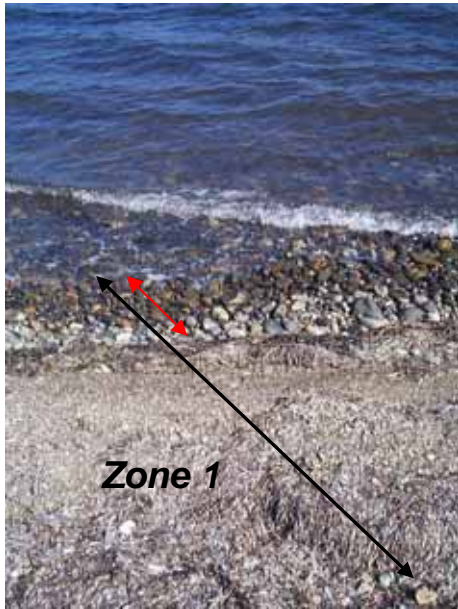
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Zone 1 is the supralittoral, is that part of the shore which is wetted by wave setup and by sprays. It is subject to the strongest hydrodynamic influence and is divided into three sub-zones depending on the wave setup recurrence rate.



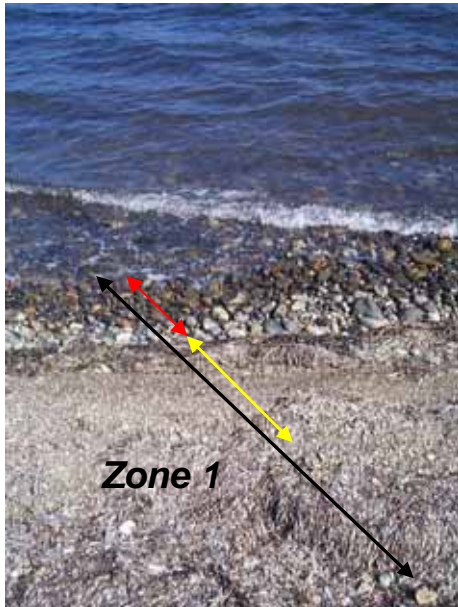
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sub-zone 1.1 (minimal wave setup) is characterized by the greatest extent of hydrodynamic variability and prolonged sea effect, which predetermine active differentiation of fragmentary material. This sub-zone is generally composed of deposits. Its sectional structure of this zone is reorganized with every storm; its width varies from 0.3m to 1.5m



↔ **sub-zone 1.1**

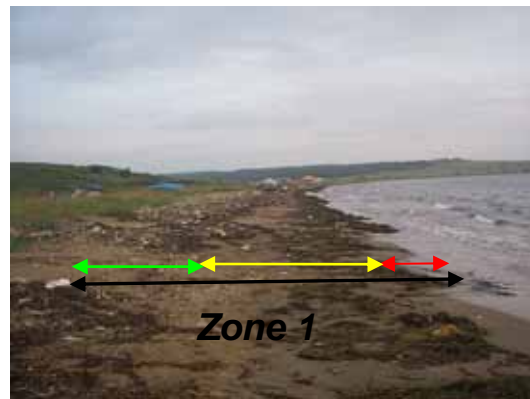
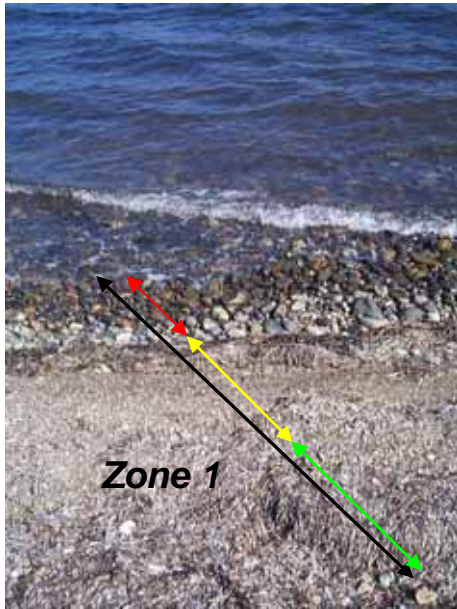
sub-zone 1.2 (middle wave setup) is formed with moderate sea during gales force Beaufort 4 – 6, coupled with low-level billows. Its width varies from 1m to 6m in dependence on the size of deposits. This sub-zone is characterized by good sizing, moderate saturation with heavy fractions concentrated at the top of the storm billows and the foot of the spill concessions in the form of linear stretched spots



 **sub-zone 1.1**
 **sub-zone 1.2**

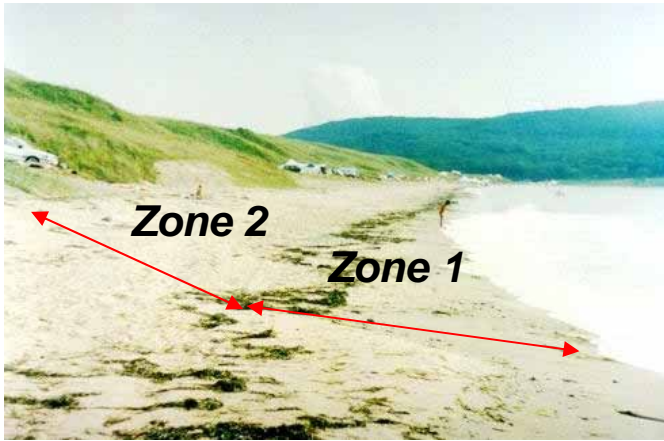
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sub-zone 1.3 (maximum wave setup) is subject to the sea effect during heavy storms only and cover the whole width of the active beach and with the highest (springs) tides. This sub-zone deposits formation is connected with intensive supply of fragmentary material from water boundary to the upper part of the beach. This accounts for generally low presence of heavy fractions here. Its width varies from 1.5m to 7m or 8m.

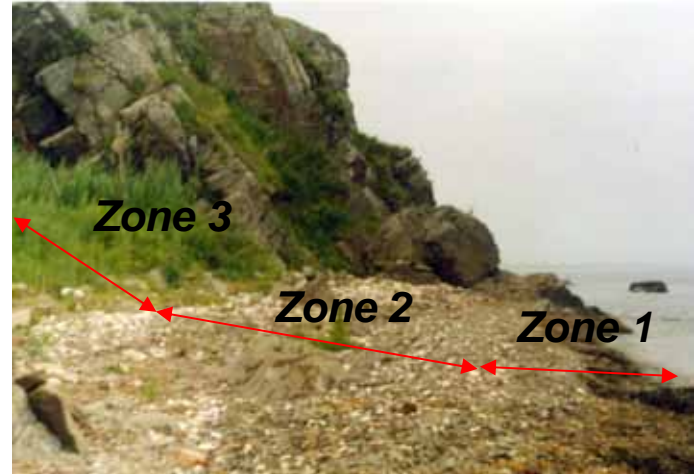
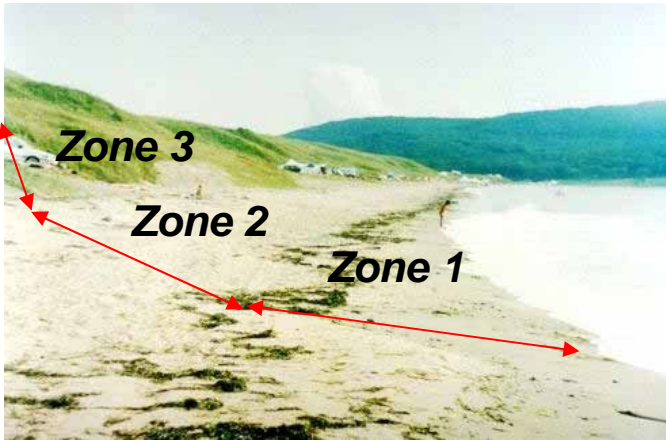


- ↔ *sub-zone 1.1*
- ↔ *sub-zone 1.2*
- ↔ *sub-zone 1.3*

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Zone 2 is the part of the beach shaped as a result of intensive accumulation of near-shore alluvium, coming from longitudinal or transverse shifts. Its width varies from 2m to 30m.



● ● ● | **Zone 3** is the beach edge generally represented in various forms of terraces.













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This division principle makes it possible not only to evaluate the overall degree of pollution for every physiographic area, but also to determine the rate of litter supply within this or that sub-zone.







Litter can be classified both by qualitative and quantitative character.

Qualitative character litter

organic substance	garbage		
	wood		
non-organic substance	glass		
	plastics		
	rubber		
	metal		

As to the size there are three categories

small litter	objects up to 5cm in size	
middle litter	objects from 5cm to 50cm	
large litter	over 50cm	
Objects of more than 1m are beyond categories.		

At those stretches of the beach which are involved in economic activities the research is done at 100m intervals,

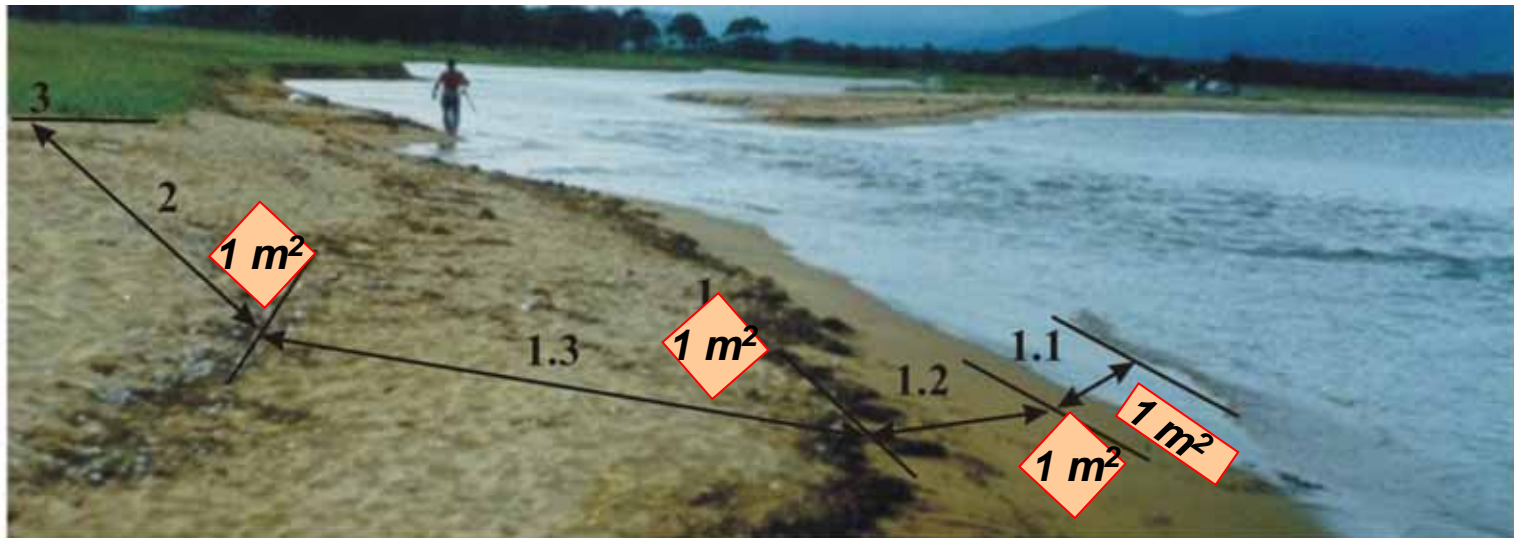


those relatively homogeneous and not suffering from human-caused pressure the data is gathered every 500m.



The method used implies calculation of litter concentration for every zone.

No. of the point		zone 1			zone 2	zone 3
		zone 1.1	zone 1.2	zone 1.3		
	<i>width (m)</i>					
	<i>garbage</i>					
	<i>wood</i>					
	<i>plastics</i>					
	<i>rubber</i>					
	<i>metal</i>					
	<i>glass</i>					
	<i>width (m)</i>					
	<i>garbage</i>					
	<i>wood</i>					
	<i>plastics</i>					
	<i>rubber</i>					
	<i>metal</i>					
	<i>glass</i>					



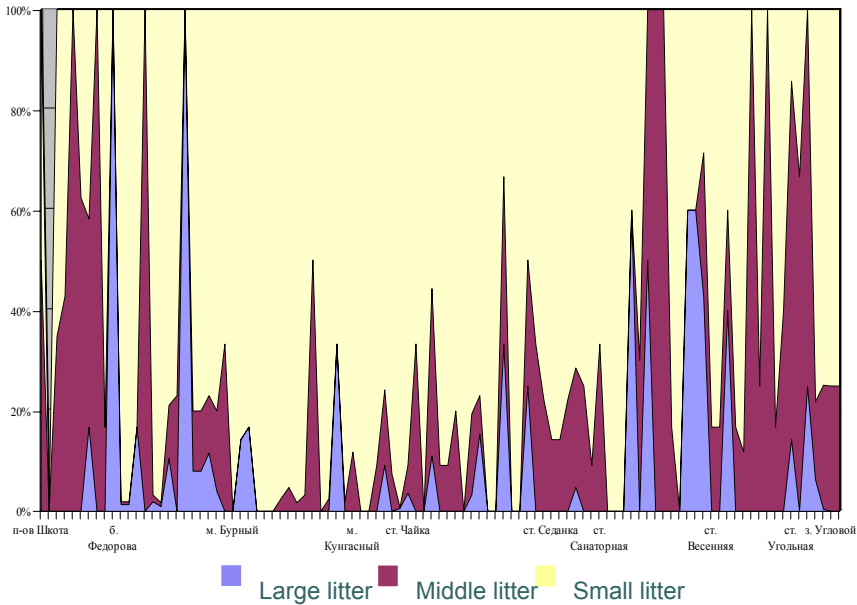
Results of the Research



The city shoreline is quite homogeneous. Coarse sands and shingle prevail in the deposit structure. The shoreline is involved into anthropogenous activities to a very great extent.

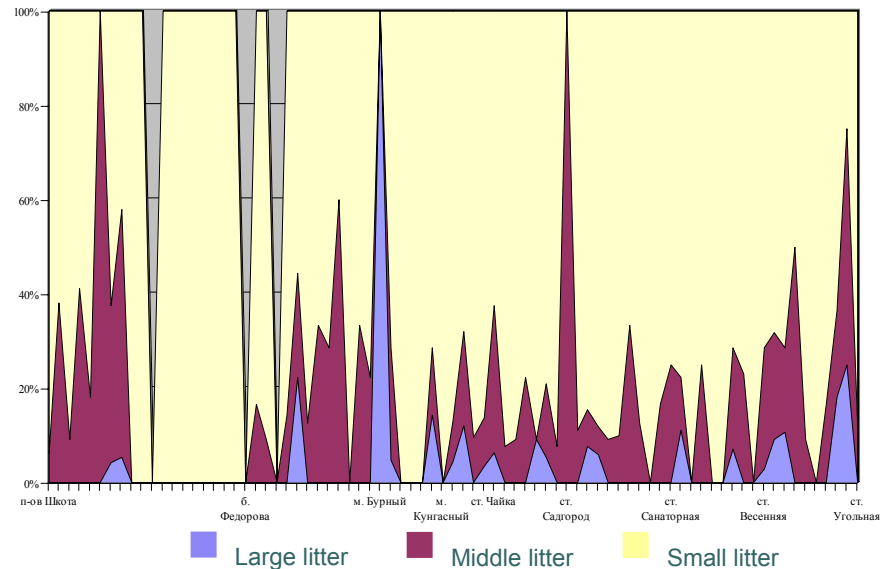


Litter distribution throughout different years of research is shown on diagrams.



Vladivostok Shoreline Litter Distribution (1999)

As it is seen from the above diagrams the amounts of large and middle litter within Vladivostok beach zone has reduced greatly.



Vladivostok Shoreline Litter Distribution (2005)

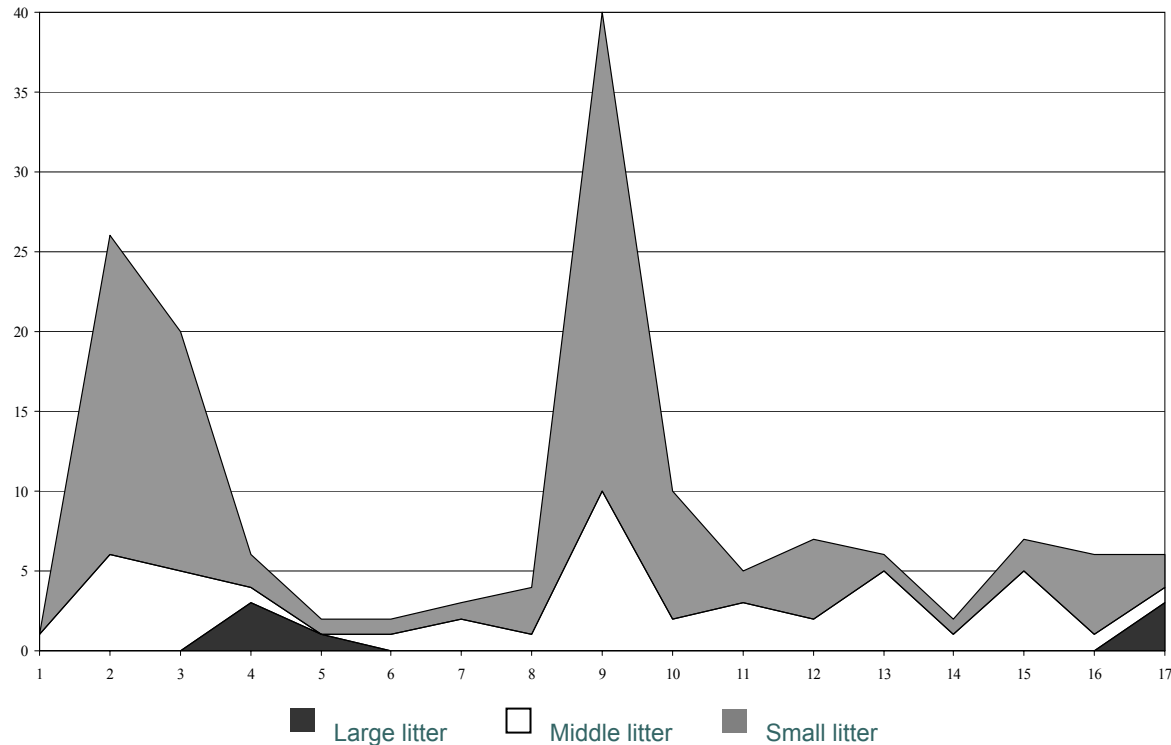
Decrease in the amounts of litter within the city shoreline is accounted for by the implementation of the Primorsky Krai Administration program for the city territories improvement and charging various (usually recreational) companies with responsibilities for good order and condition of beach stretches. Beach owners are to keep their territory clean by themselves. However, unattended recreation sites (so-called “wild” sites) remain polluted.



South-western shore of Primorye and islands in vicinity are most heavily used as recreational areas. These are characterized by predominant wide sandy and sand-and-shingle beaches.



Mostly polluted zones are those of maximum and middle wave setup, thus allowing for the conclusion of the prevailing sea-based source of pollution.

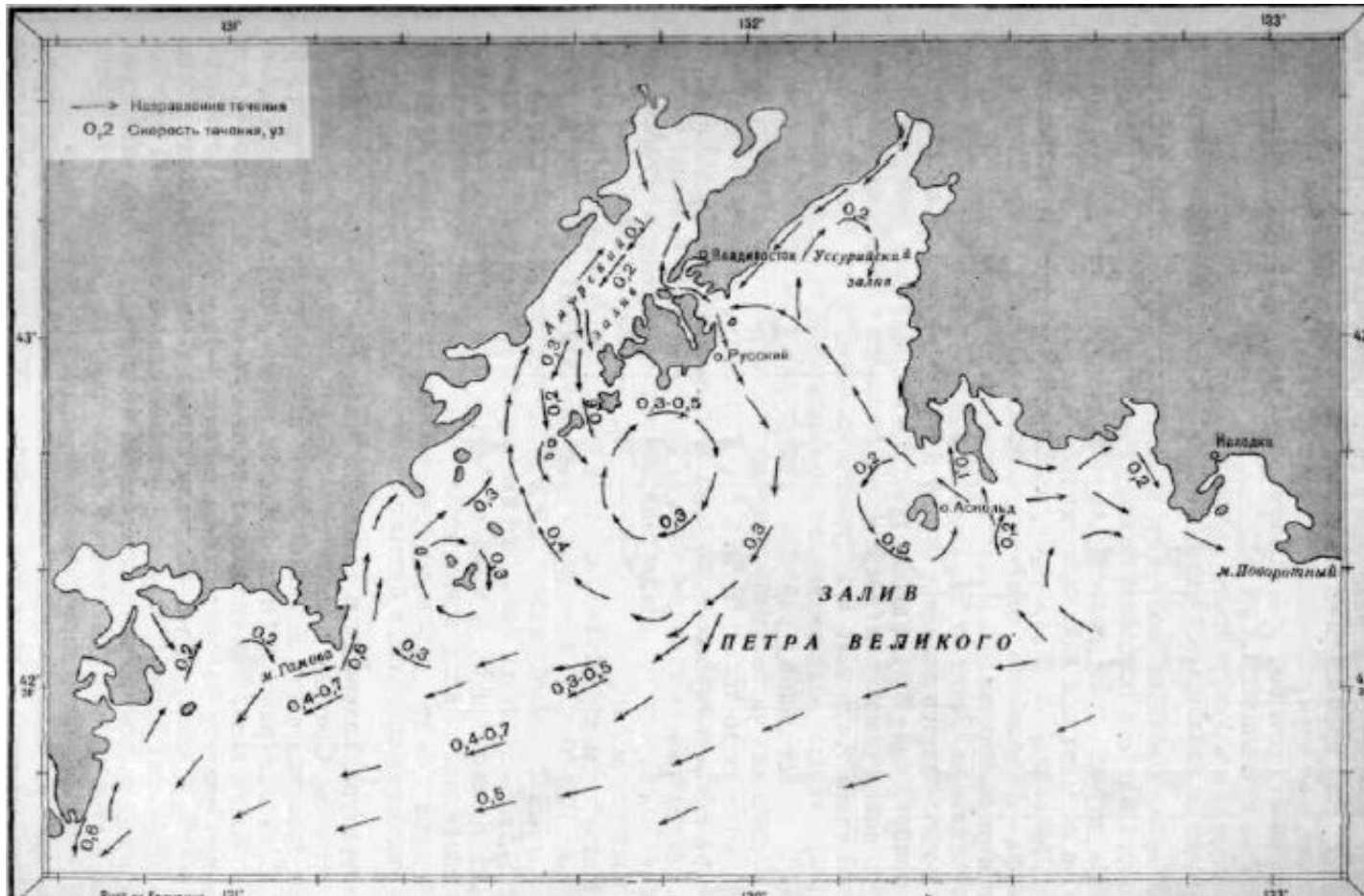


South-western Shoreline Litter Distribution (2005)

For example, in the southern part of the Khasan beach it is foreign-made objects that predominate in the litter structure.



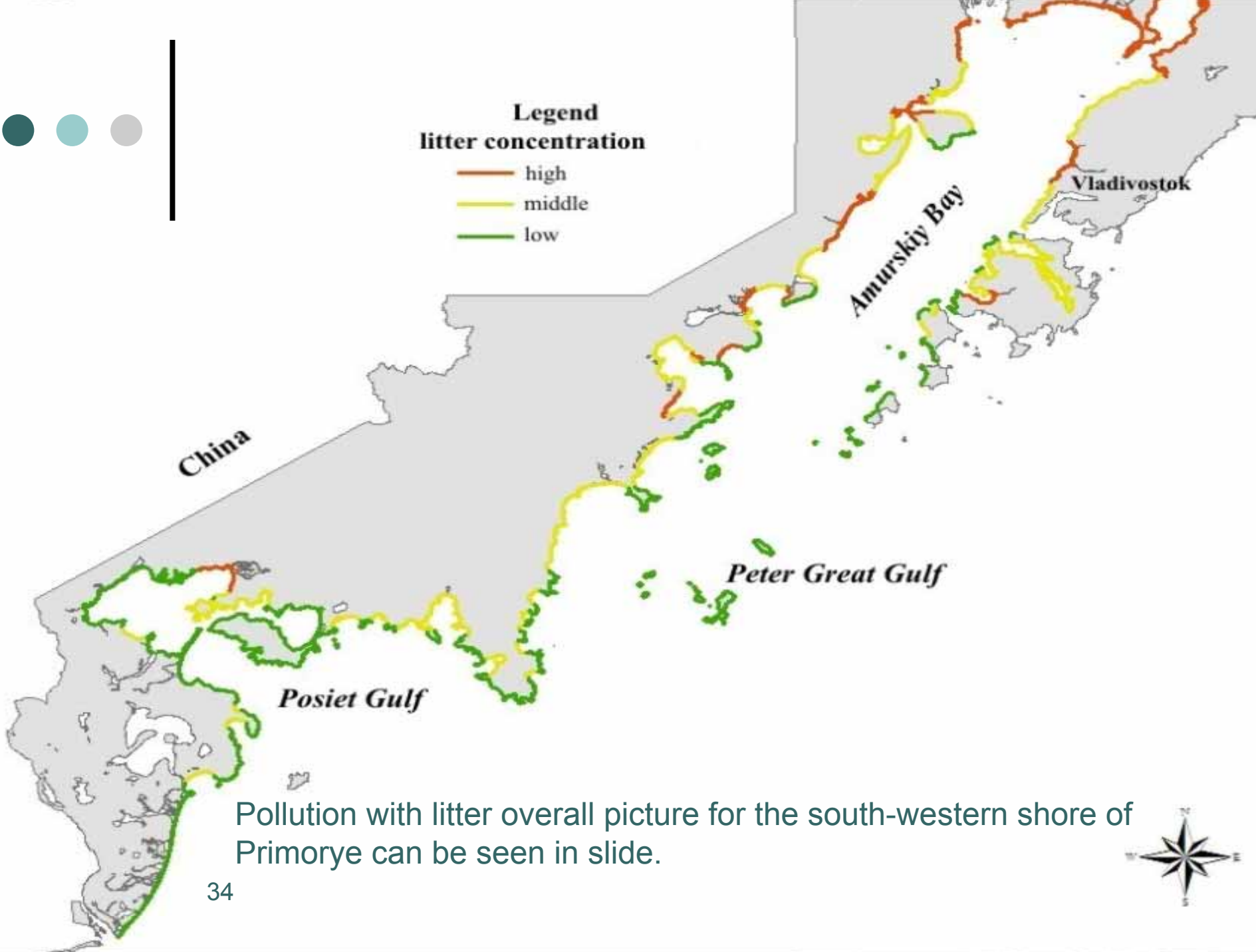
Corresponding conclusions can be made as to the sources and ways of such litter introduction into environment. Among these sources there may be tidal streams bringing litter from the open sea, or the river flow followed by litter distributing by sea currents.





Legend
litter concentration

- high
- middle
- low

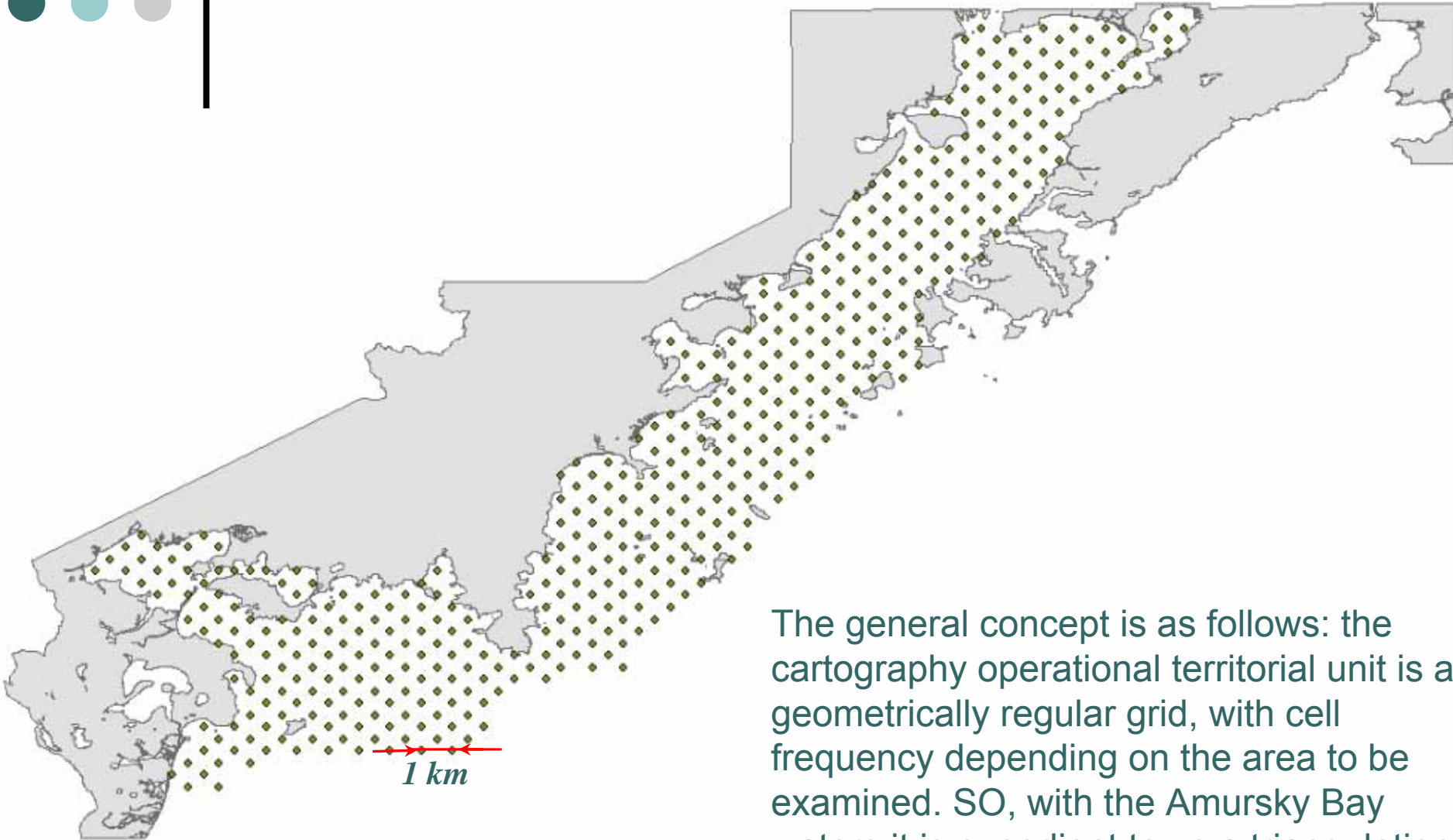


Pollution with litter overall picture for the south-western shore of Primorye can be seen in slide.

Waters monitoring can be of great importance for the purposes of determining the sources of polluting sea waters with litter.



Grid for Amursky Bay



The general concept is as follows: the cartography operational territorial unit is a geometrically regular grid, with cell frequency depending on the area to be examined. SO, with the Amursky Bay waters it is expedient to us a triangulation grid with cell side of 1km.

In order to obtain sufficiently comprehensive data on waters pollution the samples were taken with due regard to wind changes, which allowed to find out the areas of litter concentration and pollution sources.



Presently this waters monitoring method is being adjusted, and during 2006 field examination new more complete research will be carried out followed by publication of the results.



We are certain of the prospects of the said monitoring method for open sea waters of NOWAP region as well. It will make it possible to determine the major marine litter migration tracks and to find out the pollution with litter sources.





Thank you for attention