The coastal zone of the East-Baltic region in the process of spatial fragmentation and reconstruction in recent years

Les littoraux de la Baltique-Est face aux processus de décomposition et de recomposition spatiales depuis quelques années

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Abstract: After downfall of the Soviet Union and the restoration of independence in the Baltic states, the geopolitical and geoeconomic situation of the East-Baltic region has radically changed. After sudden demilitarization of the sea coast zone, the problem of its state public utilization, its potential preservation and further development arose. An important problem, firstly, is the development of common intergovernmental coordinated actions among Russia, Lithuania, Latvia and Estonia for protection and rational use natural resources of the Baltic Sea eastern coast, as well as integrated development within common structures involving European Union and Northern countries. Legal statements, which would normalize intergovernmental vexed questions in this field, are lacking. It is inadmissible and impossible to solve many problems (fishing, tourism, construction and exploitation of seaports, search and exploitation of mineral resources, oil processing and transportation, etc.) in the interests of one country alone, not taking into account the peculiarities and constraints associated with other countries and the common functioning of the natural system. It is necessary, if we want to avoid conflict situations and to provide solutions in the framework "nature-technical elements-interests-policy". The political geography of each country must be integrated with the political geography of its neighbouring states. To establish such a common geographical policy, a scientific research programme for the analysis of the Baltic basin and the formulation of planning measures supported by European organisations are necessary.

Keywords: East Baltic region - Coastal zone - Management - Baltic Sea - Geopolitical and geoeconomic changes - Pollution - Environment

Résumé: Après la chute de l'Union Soviétique et l'indépendance des Etats Baltes, la situation géopolitique et géoéconomique de la Baltique-Est a complètement changé. La brusque démilitarisation de la zone côtière a posé la question de son utilisation, de la préservation de son potentiel et de son développement ultérieur. Un problème important réside dans la mise en place d'actions coordonnées interétatiques entre la Russie, la Lituanie, la Lettonie et l'Estonie pour la protection et l'exploitation rationnelle des ressources naturelles des littoraux de la Baltique-Est, également dans celle d'un développement intégré impliquant une collaboration avec l'Union Européenne et les pays Nordiques. Les bases juridiques susceptibles de régler les questions litigieuses dans ce domaine font défaut. La plupart des questions (la pêche, le tourisme, la construction et la gestion des ports, la recherche et l'exploitation des ressources minérales, le traitement et le transport du pétrole, etc.) ne peuvent pas être résolues localement, dans l'intérêt d'un seul Etat, sans prendre en compte les particularités et les contraintes des autres pays, de même que la dynamique du milieu naturel commun. Cela est indispensable pour éviter les conflits et trouver des solutions valables dans le cadre du système "nature - technique - intérêts - politique". La géographie politique de chaque pays doit être intégrée à celle de ses voisins. Afin de mettre en place une telle démarche, il est nécessaire de lancer un programme de recherche sur la Baltique et de planifier un certain nombre de mesures avec l'aide des organisations européennes.

Mots-clés: Régions de la Baltique-Est - Zone côtière - Gestion - Baltique - Changements géopolitiques et géoéconomiques - Pollution - Environnement

Geological composition and geomorphological position of the sea bottom predetermined the distribution of recent accumulative, neutral and abrasive zones in the east coast of the Baltic sea. The morphogenetic scheme of the Baltic Sea coasts is represented by V. Gudelis (1967).

In the East Baltic region the coastal zone of Baltic Sea is an important area for human habitation, location of centres of energy production, military activities, fisheries, bird life, industry and recreation. This inevitably leads to a conflict of use, which effects on the quality of the coastal
environment. The lack of effective coastal zone management leads to the loss of important components of the ecosystem and habitats. Changes such as the construction of ports and tourist facilities result in the loss of habitats.

The most important contaminants in the coastal zone are synthetic organic compounds, microbial organisms, oil, nutrients, litter, and generally to a lesser extent, heavy metals and radionuclides. Coastal zones pollution is seen to be a problem in all Peribalticum.

At present no comprehensive coastal zone management scheme exists for the East Baltic. For an integrated coastal zone management (Nikon, Thyssen, Parker, 1995) three principal elements are required: development of an understanding of the coastal zone as a system made up of interlinked components and processes, using this knowledge to create a plan for its best use and implementation and enforcement of the plan.

Geopolitical and geoeconomic changes

After downfall of the Soviet Union and independence restoration in the Baltic countries (Lithuania, Latvia and Estonia), the geopolitical and geoeconomic situation of East Baltic region, has changed radically.

Until the summer of 1940, when Soviet Army occupied the East Baltic states and incorporated them into the Soviet Union, the land on sea-side was privately owned. The war, and the new social order that followed, ruined the traditional way of life that had prevailed in these countries. For several decades, the coastal zone (including islands in Estonia and Latvia) were preserved as a border zone for the Soviet Union. Sailing was restricted for the coastal private fishermen and for the islanders (Ratas, Puurmann, 1995). In the former Soviet Union sea coast zone has been carried by frontier troops as restricted area with strict regimentation of visitation and activity. Thus the supervision of the East Baltic sea coast has not belonged to the economic community, but to a military jurisdiction with limited and localized social economic activity. In many places of coastal zone, military objects (closed military sea ports, airfields, rocket-grounds, military polygons, etc.) have been localized (Baubinas, Taminskas, 1994). It has restricted very much normal socio-economic evolution of this important to community sphere.

Since 1940, land has been state-owned in East Baltic republics. The Soviet farming system and the creation of collective farms completely changed the system of land distribution and land use on sea-side. Fields remained untiled, meadows and park meadows were overgrown with brush, and even grazing on the Estonian islets decreased significantly (Ratas, Puurmann, 1995).

After the sudden demilitarization of the sea coast zone in the 1990th years, the problem of its state public utilization, its potential preservation and further development arose. The urgent problem in policy and economics of the Baltic Sea surrounding states is demilitarization of the Kaliningrad region of Russia and establishment of three economic zones.

An important problem, firstly, is the development of common intergovernmental coordinated actions among Russia, Lithuania, Latvia and Estonia for protection and rational use natural resources of the Baltic Sea eastern coast, as well as integrated development within common structures involving European Union and Northern countries. Legal statements, which would normalize intergovernmental vexed questions in this field, are lacking. The limitation of marine borders is the actual recent question for the Lithuania with Latvia and Kaliningrad district of Russia. Without limitation of marine limits may be the problems in the field of exploration and exploitation of natural resources in coastal zone of the different states, for example, oil structures in Lithuanian and Latvian marine border line, etc.

It is inadmissible and impossible to solve many problems (fishing, tourism, construction and exploitation of seaports, search and exploitation of mineral resources, oil processing and transportation, etc.) in the interests of one country alone, not taking into account the peculiarities and constraints associated with other countries and the common functioning of the natural system. It is necessary, if we want to avoid conflict situations and to provide solutions in the framework "nature-technical elements-interests-policy". Sea does not recognize borders, so natural processes, occurring in one country, are important to another country too.

Near-shore zone

Sedimentary area of near-shore coastal zone East-Baltic belongs to its shallow part. With it the major natural-historical mineral complexes and bioresources are connected. It is the place of
dispersion of biogenic and technogenic components coming with runoff waters from the surrounding lands.

Changes in the natural dynamics of sedimentation, geochemical and biological processes which determine sediment balance, geochemical conditions and ecological state of the near-shore are still inadequately investigated. The paragenetical association of sediments in the shallow water is determined by the above mentioned correlated groups of processes. On this basis is suggested to distinguish paragenetical series of processes, sediments and ecological conditions depending on technogenic press (Gaigalas, Gulbinskas, 1991).

The zonation of the shallow part of the Baltic Sea is carried out taking into consideration the inherited abiotic processes technogenic load and functioning of marine ecosystem. The following sedimentation environments are distinguished: lagoonal, river mouth, and marine. The internal division of sedimentation is based on the degree of dynamical activity: accumulative, abrasive, no sedimentation, wave action. Every sedimentary mite has a formation of smaller lithotypes of sediments depending on hydrolithodynamics, unevenness of relief, water hydrochemistry, biological factors.

In the influence of technogenic processes upon the functioning of natural system led to disturbance of established marine ecosystems. The intensity of technogenic press on sedimentary conditions is different. Nevertheless, the ecological consequences in different sedimentary units are not be same. For example, with Klaipėda port channel exploitation and increase of technogenic load on the established natural ecosystem, sand facies has been shortly changed into silt.

**Heavy metals**

In all investigated environments the highest values of pollution with heavy metals are observed in water-rich clayey sediments, the lowest in coarse-sandy sediments (Joksas, 1995). Such distribution is preconditioned by the content of fine particles (< 0,001 mm) in sediments and the linking of most metals with clay rainers.

Metals get into sediments from natural sources and sources related to human economic and domestic activity (contamination). As a result of the rapid development of industry, transport and rural economy, the natural flux of metals in near shore zone was supplemented during the last decades with anthropogenic pollution. The highest concentration values of heavy metals in all granulometric types of sediments were formed in sediments of the ports. The amount of metals in the sediments, particularly in the clay fraction, is a good indicator of the degree of environmental pollution. The content of organic matter is another important parameter including the concentration of metals in sediments (Joksas, 1995).

**Inflow of water**

The Baltic Sea gathers waters from a large drainage area, but 5,8 % of it from the Kursiu marios lagoon through the Klaipėda port strait (Dubra J., Dubra V., 1994). The marios receives a lot of industrial waste waters, fertilizers and dungwash due to intensive agriculture and an increasing municipal sewage too. The main part of the sewage waters flow to the rivers, lagoons and Baltic Sea without any cleaning or after passing through water treatment plants for a mechanical cleaning only.

The main load of nutrients was seen in 1986-88, when about 3-4 000 t of phosphorus and 60-70 000 t of nitrogenous flew to the Baltic Sea every year (Dubra J., Dubra V., 1995). The situation improved by 2-3 times now when at the present time enterprises work at about 25 % of their capacity, most cattle breeding farms were eliminated and the farmers use very little of fertilizers in comparison to the amount used some years ago. The danger lies in a new increase of contamination during and after a restoration of the national economy of Lithuania, Latvia, Estonia, Byelorussia and Kaliningrad district of Russia.

The main load of this polluted water from the Kursiu marios lagoon enter the sea and most frequently in flows along the coast to the North. The winds change the direction of eddies and complicate the situation of the circulation of polluted water.

**Transition of sediments and pollutants**

The longitudinal sediment flow along the Baltic Sea eastern shore carries over products of coastal sedimentation and pollutants from south to north in the territorial waters of the states. In the
Lithuania the accumulative sandy beaches, suitable for recreation, depend on intensity of coast abrasion on Sambian peninsula in Kaliningrad region of Russia, i.e. in the south. An artificial stopping of coast abrasion there tells on state of beaches located to the north, i.e. in the coastal zone of Lithuania. Pollutants, getting to the sea in Lithuania, are transported northwards, i.e. to Latvian coastal zone. So, exploitation of polluting objects in Lithuania and its coastal zone tells on ecological state of coast zone in neighbouring country.

Whereas changes of sediment balance in the longshore flow have led to widening of abrasion shores, occurrence of new focuses of washout and narrowing of accumulative beach and shore of dynamical equilibrium in connection with liquidation of the consequences of local ecological catastrophes, for example wreck of "Globe Assimi", etc., and as a result of storms and bringing to life projects not corresponding to natural environment.

Sediments are important components of the coastal environment in East Baltic sea-shore. The sediments coming from the inland part reaches the sea and deposited in the shallow calmer waters of coastal zone.

**Balance of erosion and sedimentation**

The natural balance between erosion and sedimentation can be affected by these human activities, which decrease the amount of sand available to erosion. Extraction of sand from rivers close to the coast weakens the coast locally; dredging and construction reservoirs on rivers have decreased the riverine sand load to coast waters, increasing the *in situ* demand for sand. Increased the coastal erosion due to lack of riverine and marine sand may by a future problem along East Baltic coast. Caution needs to be exercised in constructing defense designed to protect coast since, by interfering in the natural erosion-deposition balance, these can create their own unwanted knock, affecting neighbouring localities, leading to increased erosion or silting.

Marked local phenomena are strengthened on the background of global tendencies of natural processes: general water level rise, increased frequency of catastrophic storms, etc. Essential changes of sedimentation conditions and compositions of sediments, throwing of polluted water, damping of sediments from port aquatories change the general geochemical background of marine near-shore ecosystems.

**Eutrophication**

During the recent decades, a clear tendency towards eutrophication has been seen in Baltic Sea (Nixon, 1995). The lack of oxygen in the bottom is accompanied by a deterioration of the bentic community and a disappearance of highest forms of life. In the Baltic Sea, a continuous oxygen deficiency was largest during 1968 and 1969. The area of bottom water and sediments was about 100 000 km². There are some examples when the beaches of East Baltic were closed to bathers because of contaminating human pathogens arising from inadequately treated sewage.

As a result of increasing eutrophication, the intensity of toxic blooms has increased in East Baltic coastal zone. Together with the microbiological contamination, eutrophication decreases the value of coastal areas for recreational purposes. A decline of bentic vegetation and a changed composition of species, for example from perennial brown and red algae to filamentous green algae, is reported from all coastal zone in East Baltic area. The pelagic fish stocks partly benefit from the moderate eutrophication. All after herring and sprat stocks are either well exploited or still underfished.

The levels of DDT and PCBs have decreased since the 1970, as a result of the ban on certain harmful substances. Some positive changes have been observed. However, the concentrations of organochlorine residues in fish from the Baltic proper are still three to ten times higher than in the fish from the northern Atlantic (Nixon, 1995). Baltic Sea seal populations are slowly recovering from the reproductive failures, possibly caused by the accumulation of toxic substances. The relatively high concentrations of toxic organic compounds probably represent an even greater threat than eutrophication of the ecosystem in the long term.

The fresh water supply by rivers to the Baltic Sea generates a brackish surface layer of outflowing water, and incoming subsurface flow from North Sea forms layers of more saline deep and bottom waters. The salt water inflow from the North Sea causes a successive renewal of the bottom water. A large inflow occurred in 1975 and 1976, followed by a period of stagnation which lasted until January 1993, when the last inflow of saline water into Baltic Sea occurred (Nixon, Parker, 1995).
**Estonian islands**

The strategic location of Estonian islets made them in Soviet time particularly suitable for military staging posts and as sites for military facilities. Specific problems are connected with the islands that have been used for intensive military action. Some the islands were used as a rocket base and as store of explosives, and as targets for training military pilots (Ratas, Puurmann, 1995).

The villages on the Estonian islets are in ruins now, and the fields and meadows are overgrown with bushes. The environment still bears the marks of man’s work-roads are still visible, stone fences are still standing. Nowadays, the islets provide nice sites for rest and recreation. First and foremost, they offer destinations for short outings and function as halting places for anglers and yachtmen.

Today many Estonian islands and archipelago areas are placed under nature protection. As more of the 1500 islets are being investigated for natural and cultural values, the reasons for protection of their landscape types, rich biodiversity and history grow increasingly strong. In 1990, the West-Estonian Archipelago Biosphere Reserve was formed. It covers a large part of the Estonian section of the Baltic Sea and includes most of the islets surrounding the islands of Saaremaa, Hiiumaa, Muhumaa, Vormsi and Ruhnu. Several islets in Northern Estonia are included into the Lahemaa National Park, which was established in 1971. In 1991 the Nature Reserve of Kolga Bay Islets (ten islets) was established on country level for protection of the complex of ecological systems, plant and birds species and the colony of gray seals (Lahtvee, 1995).

Similar situation are on other islets which were occupied by former Soviet military areas. However, there is a great need also to make additional studies of the natural values in untouched areas in many of the other islets in the former Soviet border zone in East-Baltic waters.

**Riga gulf**

The objective of Gulf Riga Project, which started in 1993, is to study environmental problems in the Gulf of Riga and its drainage areas, as well as the influence of the Gulf of Riga on the rest the Baltic Sea. Gulf of Riga is a popular site for recreation. For 1995, a new sub-program has been opened (Hägerhäll, 1995).

It is considered important that studies on the littoral-sublittoral zone: phytal zone, ecosystems of shallow waters can start as soon as possible in the Gulf of Riga and its neighbouring areas. The studies carried out within the sub-project Drainage Basin and Lood of the Gulf of Riga have already generated a first assessment of the riverborne load of nutrients to the Gulf of Riga. The preliminary results from a special study made on River Daugava in Latvia indicate that no major decrease of the concentrations of nutrients discharged into the Gulf has occurred. The mixture of sewage discharged from the city of Riga and input to River Daugava from the large arable land area around the river itself is, however, a complicating factor.

Studies of biological, chemical, physical and geographical mechanism sand processes of quantitative significance for the flow of nutrients and toxic substances in the littoral-sublittoral zone, as well as interactions between the littoral and pelagic zones, will be given priority.

**Final remarks**

The effort to create the plan for spatial planning and development in the Baltic Sea Region was made by representatives of national ministries in 1992. The report on vision and strategies around the Baltic Sea till 2010 was presented to the Third Conference of Ministers for spatial planning and development of the Baltic Sea Region, held at Tallinn in 1994. The next meeting of the Ministers of spatial planning and development was in Germany in 1995. The aim of the Vision and strategies around the Baltic Sea 2010 initiative has been to create a common spatial development project for the Baltic region (Hägerhäll, Anianson, 1995).

Assimilation of natural environment, technology and interests of states are telling on concrete geopolicy. Geopolicy of each country must be integrated with the geopolicy of its neighbouring states. Programme of scientific investigations supported by associated organizations of Europe integration, to provide exploration of the Baltic Sea basin and to work out plan of measures is necessary for foresight of such a common geopolicy of states.

The pollution of the East Baltic Sea has now become a threat to its fauna and flora. Pollutants contain more toxic substances. The natural situation has progressively deteriorated since the 1950s. The intensity of toxic blooms has increased.
At present no comprehensive coastal zone management scheme exists for East Baltic region. Without appropriate administrative arrangements in states, and without appropriate financial resources, there is little possibility of achieving any desire improvement in the environmental quality of coastal zones. There is a clear need for international agreement and collaboration.

References


