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## **Integration of marine research results into a maritime spatial plan for Lithuania**

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**Abstract** This paper presents the results of integration of the environmental, economic and social data into comprehensive spatial plan of Lithuania. The main driving forces for the economic developments at sea are offshore wind energy growth and demand for exploration and exploitation of potential oil deposits. The developed spatial plan is a practical step towards implementation of the strategy for the Baltic Sea region and particularly focused on proper management of the marine resources. The concept of location of existing and future marine activities along with regulatory framework was created. The developed spatial solutions create the pre-conditions for future development at the sea and at the same time highlights the demand for new quality of the scientific research while investigating the marine resources and evaluating the economic effect as well as environmental consequences.

**Keywords** • maritime spatial planning • sustainable use • marine resources

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## **INTRODUCTION**

In April 2014, the European Parliament endorsed the new Framework Directive for Maritime Spatial Planning, which should help Member States coordinate the various activities that take place at sea better, ensuring that they are as efficient and sustainable as possible (Meiner 2010). The activities planned within this study required changes in thinking regarding management of marine environment, land-sea interconnection and development of new sector of commercial activities that demand for the sea space. Implementation of marine related EU recommendations and directives, i.e. Integrated Coastal Zone Management (2002), Marine Strategy Framework (2008), Habitat (1992) and Birds (2009) Directives, made the MSP topic extremely apposite.

The Lithuanian territorial waters (TW) and exclusive economic zone (EEZ) borders with those of Latvia, Russian Federation (Kaliningrad Oblast) and Sweden (Fig. 1). The area of EEZ is delineated according to the *Decision of Government of Republic of Lithuania (Valstybės žinios, No. 1597, 6 12 2004, Vilnius)*. The

area accommodates deep-water Klaipėda Port, recreational Šventoji Port, number of small jetties, protected areas, oil terminals in Būtingė and Klaipėda as well as offshore military training zones. Recently, certain areas have been investigated for offshore wind energy and sand extraction purposes. All these activities together with new planned high voltage electricity link to Sweden intersect with fishery areas, traverse the area of dumped chemical weapons and *Natura 2000* sites.

Along with the European initiatives to foster maritime spatial planning, the demand for maritime space allocation for specific uses is continuously increasing. Additional sea space is demanded by wind energy developers, oil companies seeking for prospecting and exploitation of new oil deposits at sea. At the same time new marine related projects are being implemented. Those are – offshore LNG terminal development, reconstruction of Šventoji Port, NORDBALT offshore high voltage (HVDC) energy link between Sweden and Lithuania, developments of the Klaipėda Port. Those entire projects are influencing the shipping traffic pattern, require for reshaping roadsteads and relocating anchorage sites. In addition, there are new projects/

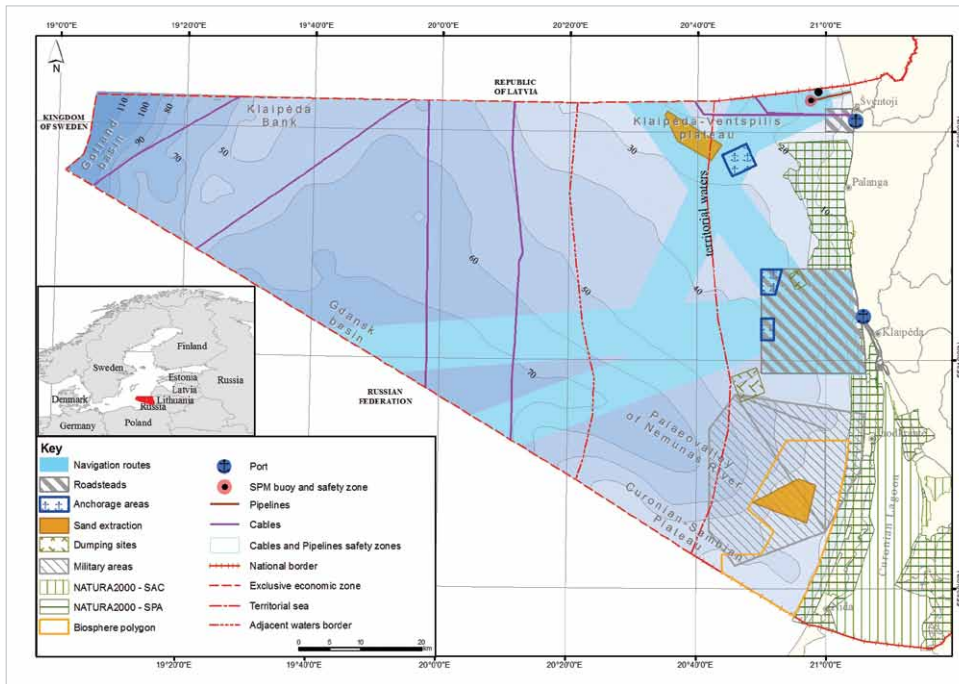


Fig. 1 Study/planning area. Compiled by V. Jurkin, 2013.

initiatives related to extension of marine *Natura 2000* sites. In order to harmonize interests of different existing and new marine users emerging spatial planning of the marine space of Lithuania had to be implemented.

## PLANNING PRINCIPLES AND METHOD

### Planning environment

The planning procedure of the Republic of Lithuania is regulated by the Law of Territory Planning issued in 1995 and post-statutory legal acts. According to the Law of Territory Planning, the general plans of whole territory of the Republic of Lithuania, territories of counties, municipalities and their parts are obligatory planning documents in order to ensure the long-term sustainable development and reasoned use of the area, finances and natural resources. The General Plan of territory of the Republic of Lithuania was approved by Seimas of the RL in 2002 (*Valstybės žinios*, No. IX-1154).

The principles of planning of Lithuanian TW and EEZ were developed following main international strategic documents such as EU Integrated Maritime Policy, HELCOM Baltic Sea Action Plan and VASAB Long-Term Perspective for the Territorial Development of the Baltic Sea region as well as methodology developed in *BaltCoast*, *PlanCoast*, *BaltSeaPlan*, *EastWest Window*, *Plan Bothnia*, and currently *PartiSEApate* projects (Zauchka 2014 b). Planning of the maritime space was implemented via integrated, cyclic and iterative process, which included:

- Identification of demand for planning. This involved analysis of (1) ongoing initiatives requiring of- /competing for- sea space and (2) future targets

defined in the maritime related strategic documents as well as (3) investigation of their coherence, i.e. conflict analysis among the different stakeholders and potential sea-users.

- Investigations of natural and socio-economic environment. Action that required precise and various data sets to be developed, analysed, harmonized and interpreted in order to illustrate and set the environmental conditions and pre-define environmental limitations for certain uses; assess social positive and negative aspects, trends and obstacles important for maritime sector development; evaluate economic development trends, opportunities

and threats. The crucial moment in this task was data accessibility and quality. As well as introducing the possibilities for filling data gaps by using existing modelling results when data from direct investigations is not yet available or too expensive to carry out.

- Analysis of institutional set up, capacities and legal framework. Implementation of the plan, especially when it addresses the innovative solutions, modern technologies, new uses, requires setting up or adaptation of legal framework, allocation of suitable financial resources and clear distribution of responsibilities among the involved/responsible authorities.

- Acquiring public acceptance and ensuring the stakeholder involvement. This was essential element of the integrated maritime spatial planning process. Planning involved visions of future developments and maritime space usage, which should be discussed among stakeholders and supported by the public? Therefore, proper scientific grounding and research-based evidences were of very high relevance and importance.

- According to the concept, the MSP process covers four main phases: pre-planning, stocktaking, planning, implementation and monitoring (Gilliland, Laffoley 2008).

### Pre-planning

First task was to delineate the area where MSP is needed. Whole territorial waters and exclusive economic zone was selected as an area to be planned. Secondly, the spatial and time scale for the plan was selected. Spatial scale of the mapping was set to 1:200 000 and planning periods set to 20 and 30 years. Next step was to identify (map) the relevant stakeholders and compare the interests of involved stakeholders as well as national priorities, existing visions and strategies

on international, national, regional and local level, strategic coherence and potential conflicts. As a result, number of strategic documents have been analysed in order to define the trends and quantitative targets of maritime space development in Lithuania (Table).

The analysis revealed that most of the national policies do not cover maritime related issues and are specifically focused on land activities. It was also noted that analysed documents lacks clearly defined strategic vision for the promotion of marine renewable energy development, long-term objectives for the management of Lithuanian coast and actions of their implementation. It was identified, that strategic focus on the use of marine mineral resources, for example sand or gravel or offshore oil, is also missing. In general the policies do not address properly the maritime issues such as transport/port development or land - sea integration, which is the key task for complete planning of the maritime space and the coastal zone (Flannery, Cinneide 2012).

### Stocktaking

Secondly, analysis of existing ecological and socio-economic conditions: biodiversity assessment, evaluation of trends and possible impacts induced by climate change as well as development trends was carried out. Further, the current marine uses were mapped and existing spatial conflicts identified. The analysis of legal basis (establishment and regulations) for existing uses was carried out in order to understand the existing or possible conflicts (“hot spots”) concerning the actual environmental sensitivity as well as changing socio-economic situation.

Management of spatial conflicts was based on grouping of the potential conflicts according to their nature and possible impact/influence to the development of other maritime related activities. Taking into account the character of the conflict, areas identified as conflicting were divided into:

- *Areas of special concern* – determined by certain risks, existing assets, particular sensitivity, and specific environmental conditions. Sea-user planning new activity in those areas needs to consider existing risks, foresee mitigation measures, avoid specific obstacles, but does not need to compete for the sea space.
- *Areas already reserved* (occupied) by other sea-users with specific regulations and restrictions. New sea-users have to consider compensation measures, re-planning and negotiation process additionally to the concerns mentioned above.
- *Priority areas* identified during feasibility studies or prioritized for national needs as most suitable for specific uses (f.e. wind energy, oil, protected areas). Those are the main object of discussion as different sea-users can apply for the same sea space.
- *No go areas* are the zones that have to be avoided by any of sea-users because of existing high level priority, danger or strong reservation for future needs.

### Planning

It was focused on finding the relevant solutions for harmonization of identified conflicts, priorities, opportunities and benefits, setting objectives (see also Gilliland, Laffoley 2008). Several alternative solutions/visions were drafted and presented to stakeholders in order to explain delineated functional zones, targets, costs and benefits of each developed scenario.

### INTEGRATION OF ENVIRONMENTAL DATA

Environmental data availability, quality, spatial resolution and applicability for the planning purposes are main concerns nowadays (Schultz-Zehden, Gee 2013). In general some data is available but it often has to be spatially attributed and generalized to be easy understandable and applicable for the planners. The environmental data usually is a set of dynamic information representing conditions that are changing in time and space. First objective is to define what type of information is important for the planning process. Current study took the attempt to systemize the available environmental data developed during number of scientific projects and transform it into the format that is the most suitable for the planning. The main datasets used for the development of maritime spatial plan for Lithuania were: topography of the seabed, geological conditions, valuable bottom habitats, nursery and spawning grounds, areas important for wintering birds, hydrodynamic conditions, distribution of mineral resources (sand and oil).

### Bottom topography

Sea bottom topography and depth was analysed in order to understand the engineering conditions, light penetration, oxygen depletion, and consequently bottom habitat distribution. The main geomorphological structures – determining the pattern of underwater relief of Lithuanian sea bottom are: Klaipėda–Ventspils Plateau (Fig. 1); northern slopes of Gdansk Basin and the small part of the Gdansk Basin itself; palaeovalley of Nemunas River; Curonian–Sambian Plateau; eastern part of Gotland Deep and Klaipėda Bank (Gelumauskaitė 1986). The most attractive features of the sea bottom are elevations. Those are most suitable for the marine wild life and suitable for the offshore installations. Klaipėda–Ventspils Plateau in the northern part of Lithuanian EEZ area extends southwest from Riga Bay. The Plateau has several elevations and one of those – Klaipėda Bank with sea depth less than 50 m (Gelumauskaitė *et al.* 1999). The sea bottom topography of Curonian–Sambian Plateau in the southern part is also quite changeable, sea depth in this zone varies from 18–20 to 50–60 m (Gelumauskaitė, Šečkus 2005).

There are three comparatively deep areas in the Lithuanian EEZ = Gdansk and Gotland basins and

**Table** MSP relevant policies. Compiled by N. Blažauskas, 2011.

Policy	Consequences for MSP
CROSS-SECTORAL: National Sustainable Development Strategy	Expected additional areas with limitations due to establishment/expansion of marine protected areas; Reserving sea space for the port development; Reserving sea space for the construction of marinas; Expected new legal basis on marine environmental protection – possible conflicts and/or harmonization with other sea use via strict regulations; Possible wind energy development in marine areas, demand for new space closed for other activities at sea; Reserved sea space for the development of new transport links; New space (or rather new share of maritime space) will be required for recreational fishing with apparently new regulations – limitations for other uses.
STRUCTURAL FUNDS/ COHESION: Lithuanian strategy on the use of European Union Structural Funds during the period from 2007 to 2013	Expected additional limitations due to development of marine protected areas; Development of marine transport links, limitations for other sea use in the transport corridors; Possible development of offshore wind energy - designation of potential places for the wind parks with restricted access for other sea use.
ENVIRONMENTAL: Biodiversity protection and protected territories planning and management program during the period from 2007 to 2013; Strategy for protection of Baltic Sea environment (2010)	Limitations for sea space use (fishery, shipping, natural resources excavation and offshore energy development) due to establishment of new protected areas; Creates the legal base and introduces the maritime spatial planning as a process helping maritime developments. Required new space for new Natura 2000 sites.
DEVELOPMENT OF PORTS: Port infrastructure development programme	Reserved space for the development of port infrastructure; Reserved space for the construction of marinas for the recreational boating; Reserved space for the development of new shipping routes.
TRANSPORT: Long-Term (until 2025) Transport System Development Strategy	Reserved space for enhanced maritime transport and port development; Expected planning of new shipping routes.
FISHERY: National strategic plan of fishery sector 2007 - 2013	Reduced fishery capacities will foster the development of recreational fishery; Development of the marinas is getting fundings and will have the impact on MSP via spatial planning of the near shore.
ENERGY: National Energy Strategy and implementation plan for the period 2008-2012	Reserved sea space for the underwater installations (cables); Sea space for the development of offshore wind energy will be required; Expected new areas of oil extraction in the shelf.
TOURISM: National tourism development program 2007-2013	Preparation of the amendments for the legal acts, which regulate the purpose of land use and territories planning by defining the borders of resorts; Expected growing resort and marine tourism pressure.
COASTAL PROTECTION: The Law of Coastal Stripe (2002); Regulations of the protection of marine coasts (2000)	Increased demand for off shore sand excavation, conflicts with near shore fishery and nature conservation; Creates the legal base for planning this zone of maritime space.
REGIONAL/SPATIAL: Klaipėda region development plan 2007 - 2013	Reserved sea space for the development of ports and marinas; Possible development of recreational sector; Possible development of new shipping routes.
NATURAL RESOURCES: Strategy on extraction of oil	Reserved sea space for oil extraction and construction of necessary facilities.

palaeovalley of Nemunas River (Gelumauskaitė 2010). Water depth in the Gdansk Basin exceeds 80 m, in Nemunas River palaeovalley – more than 70 m and in Gotland Basin – more than 100 m. The central part of the Lithuanian EEZ is rather flat, determined by south-westerly inclined slopes of Gdansk Basin (Žaromskis, Gulbinskas 2010).

### Lithological composition and bottom habitats

The integration of sea bottom topography/depth, distribution and types of sediments along with biological investigations at the near shore zone resulted in generalized bottom habitats map. Even though, level of knowledge of marine bottom habitats in the near shore zone is much higher comparing with open sea (Bučas *et al.* 2009; Šiaulyš, Bučas 2012), generalization of available information and development of rough map of distribution of bottom habitats (Fig. 2) was an important exercises allowing identification of most biologically valuable areas of the sea bottom. Prevailing sediment type is the indication of hydrodynamic conditions at the sea bottom surface and at the same time creates the background for particular bio communities to establish. As a result of integrated knowledge on water depth, light penetration, lithology of the bottom sediments and biological diversity, nine habitat types (according to EUNIS classification of marine habitat types, revision of September 2004) have been distinguished.

### Wintering birds

Next step was compilation of ready-to-use map introducing the character of birds' concentrations

during the wintertime. The places selected by different types of birds wintering offshore are determined by distance from the shore, distribution of suitable habitats at suitable depths. The map of areas wintered by birds is important due to the growing interest for offshore wind energy developments, mainly. Poorly sited wind farms can have negative effects on biodiversity (Drewitt, Langston 2006). Still, effects of wind farms on birds vary. The possible impact depends on bird species, season, weather, habitat type and topography of the seabed in particular area (Drewitt, Langston 2008, de Lucas *et al.* 2008, Smallwood, Thelander 2008). Data representing the wintering birds density at the near shore was generated during implementation of EU funded *LIFE+* project *DENOFLIT* and *LIFE Nature* project “*Marine Protected Areas in the Eastern Baltic Sea*”. The developed integrated map (Fig. 3) of wintering birds does not represent ‘no go’ areas. Such map can be used as indication where wind farm development is less likely to conflict with bird conservation, thereby facilitating the planning process.

### Energy

Marine areas are also rich in energy resources – mineral and renewable energy (Fig. 4). Mapping of potential structures for oil extraction was based on the results provided by Geological Survey of Lithuania that is responsible for stocking of data of geological - geophysical investigations. The post processing of complicated geophysical data is subject of sophisticated expertizing usually performed by oil exploration companies. This type of data is important, because locations of potential mineral resource are fixed and has to be reserved for national needs.

Wind and wave potential seem to be less location dependant, potential installations of wave or wind power generators very much depend on the water depth and topography of the sea bottom. Offshore installations nowadays are based on foundation technology mainly. Therefore, marine areas deeper than 50 m are not considered as suitable for permanent offshore installations (Blažauskas *et al.* 2013). The developed map (Fig. 4) integrates water depth and wind/wave potential and introduces most suitable areas for renewable energy developments taking into account technology existing as well as the resource availability.

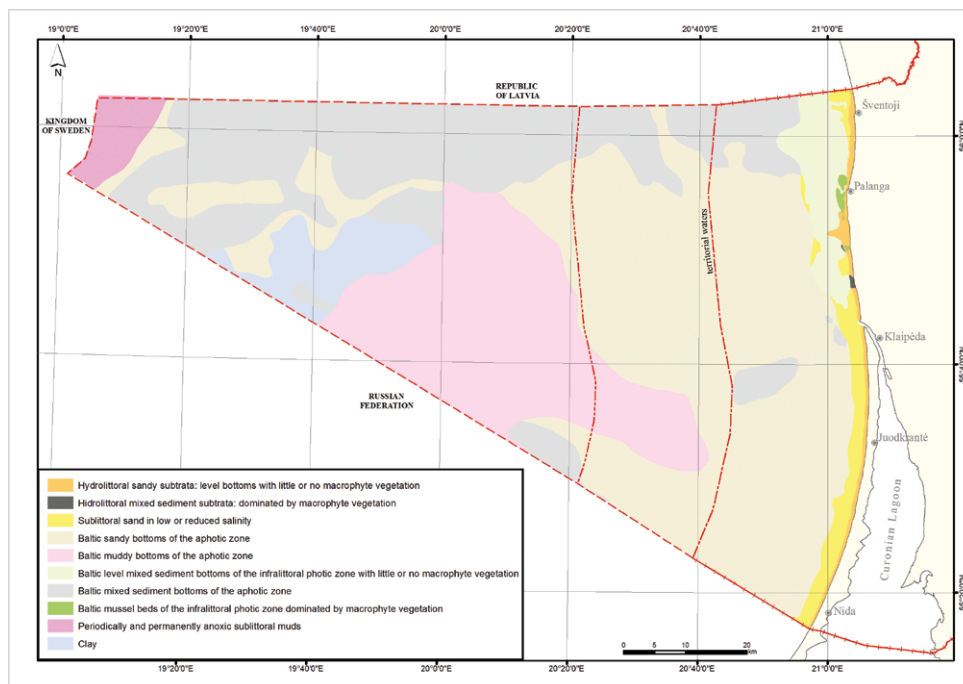
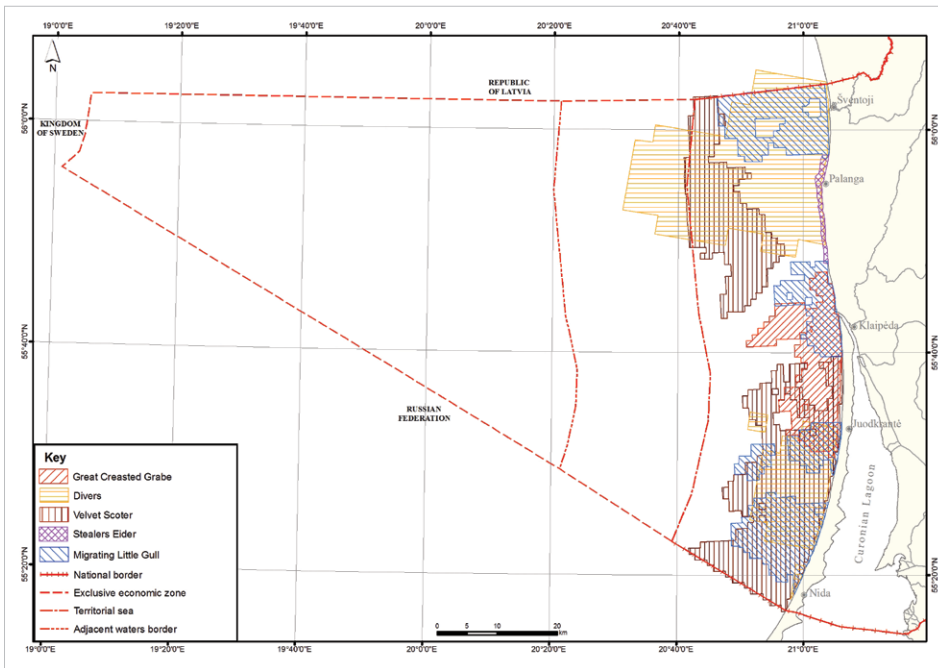
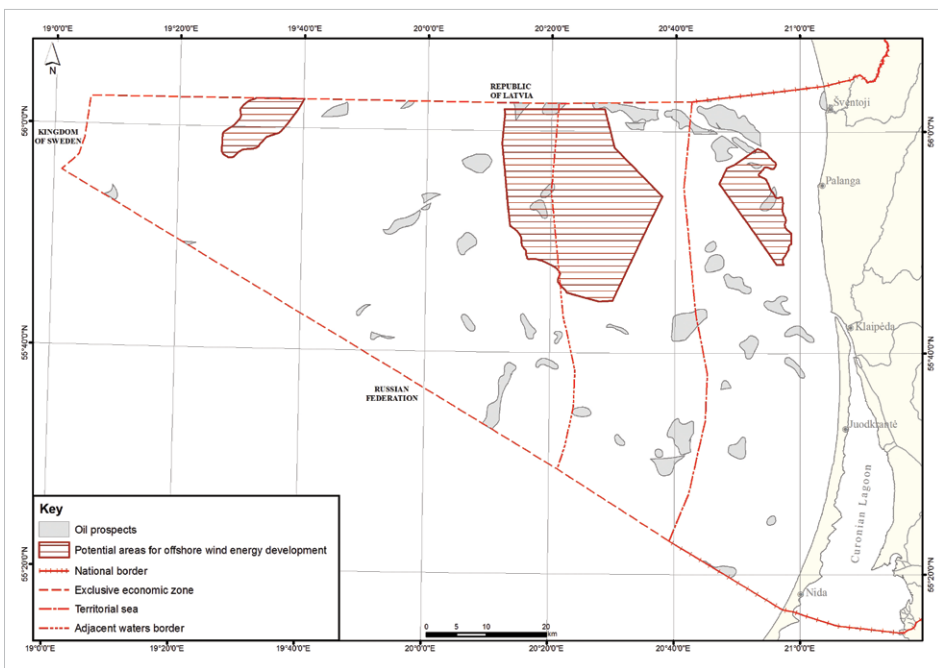


Fig. 2 Sea bottom habitats. Developed by N. Blažauskas, 2011.



**Fig. 3** Potentially important areas for wintering and migrating birds. Compiled by V. Jurkin, 2012.



**Fig. 4** Offshore energy sources. Compiled by V. Jurkin, 2013.

## CONCEPT DEVELOPMENT OF THE SPATIAL PLAN

Current environmental conditions and space already occupied by existing uses influenced the development of the spatial concept for distribution of future economic activities at the sea. Ecological objectives were taken as basics of MSP process. Such approach ensured that marine ecosystems remain functioning and providing the resource for economic growth. The ecological principles were considered along with social,

economic, and governance principles that are being developed through parallel and complementary efforts (Foley *et al.* 2010, Halpern *et al.* 2008). Therefore, the developed concepts of spatial distribution of marine activities is based on properties of marine landscapes, distribution of most valuable sites for biological diversity, sedimentation and hydrodynamic conditions, i.e. elevations, depressions and slopes, near shore of the Curonian Spit and mainland coast.

Coastal zone, including territorial waters of Republic of Lithuania, is distinguished as one of the areas of specific functions. Recreation, nature conservation and fishery as well as transport are among the prioritised activities here. Furthermore, we have identified the open sea as area having slightly different functional role. Defined priorities here are shipping, fishing and development of marine infrastructure for oil and ocean energy projects.

During the planning process, two alternative concepts have been proposed. The priorities set for the spatial use in both alternatives considers possibility for exploration and exploitation of marine mineral resources offshore, except near shore and marine protected areas. Concepts introduce two

slightly different prioritization scenarios for marine activities when considering nature conservation and developments of renewable energy. In the first one, conservation priority is given to the southern, adjacent to the Curonian Spit part of the sea. Whole Curonian Spit and the near shore is considered as most valuable part of Lithuanian landscape and geocological watershed of international importance. Main nature protection and *Natura 2000* areas are concentrated here, and new Baltic Sea biosphere polygon has been created. Prioritization of nature protection in southern area and

possibilities to expand the network of protected areas on the Curonian – Sambian Plateau should ensure the continuity of most valuable seascapes—spatially linked habitats of terrestrial and marine protected assets (Harris, Whiteway 2008). The second concept prioritizes the northern part, on the Klaipėda-Ventspils Plateau and on the Klaipėda Bank as most suitable for infrastructure development and renewable energy projects implementation. Both concepts consider near shore as prioritized for recreation, fishery and development of the port infrastructure, according to the regulations set in the law of Coastal Stripe. Finally, common spatial concept of development (Fig. 5) has been prepared which combines spatial solutions of both alternatives.

## DISCUSSION

Usually, relevant for planning data is research based, limited in time and funding. This often results in discontinuity and fragmentation of the knowledge. Dispersal of data is a problem both at national as well as at the pan-Baltic scale. The spatial and temporal resolution of the available data is also highly influencing the resolution and quality of the plan (Zaucha 2014 a). On the other hand, there is a lack of knowledge when talking about cumulative impacts on the marine ecosystem and interactions of human activities. Data helping establishment of so-called ecological corridors is very much complicated, often without proper indications of susceptibility of species of concern to natural and anthropogenic pressures. In order to facilitate planning, complex environmental information needs to be translated into parameters that can be used in assessment. However, it is not always clear which parameters are actually needed or even suitable for the planning purpose. Usually, planners

cannot use basic ecological information unless there are clear procedure for translating ecological and hydrographic data into relevant planning information – generalized and integrated maps and schemes.

The main objective of the maritime spatial plan is sustainable development of marine activities. Plan is the horizontal measure allowing controlling the potential conflicts on the very early stage. Therefore, the potential conflicts can be easier managed and allows avoiding the negative sequences for socio-economic as well as natural environment. Plan creates conditions for development of existing activities and fostering development of new ones. Nevertheless, in order to start developments proper environmental and policy regulations need to be followed. Considering further, the most important prevention measure remains environmental impact assessment (including collection of missing data sets) and if risk for public health is an issue - the proper health assessment should be executed foreseeing the measures to avoid, reduce and compensate the negative impact in the particular area. The considerations of the EU environmental policies, regulations and directives as well as laws of Lithuania are the main measures in order to avoid the negative impact to the environment. The particular attention should be paid on impact related to shipping, port activities, marine pollution from ships and other economic activities. This study introduces simplified approach of combining different types of information in order to create the environmentally weighted background for the planning purposes and conceptual allocation of maritime activities.

## CONCLUSIONS

Current study presents the results of integration of the environmental, economic and social data into comprehensive spatial plan of Lithuania. The common spatial concept for maritime activities distribution in Lithuanian territorial waters and exclusive economic zone has been developed. This concept foresees that main economic developments, such as oil extraction and offshore wind energy should be concentrated in the north of Lithuanian part of the Baltic Sea. Near shore and southern part are more important for nature conservation as well as recreational and port activities. The developed spatial solutions create the pre-conditions for future development at the sea and at the same time sustaining the ecological balance.

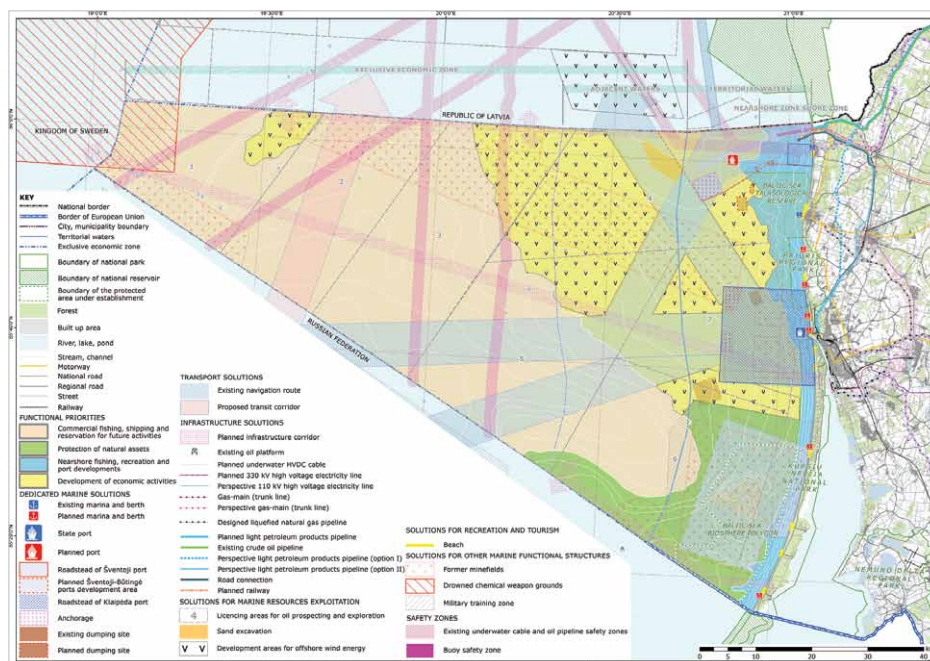


Fig. 5 Concept of development of maritime activities. Compiled by V. Jurkin 2014.



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