

## Information and database range used for maritime spatial planning and for integrated management of the coastal zone – case study in Poland, Baltic Sea

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*Intensive exploitation of coastal and maritime areas, together with climate changes, natural hazards and erosion, have increased pressure on coastal and maritime resources. They require integrated and consistent management in order to ensure sustainable development and to preserve coastal and marine ecosystems for future generations. Spatial development planning for maritime areas is commonly understood to denote an open process of analysis, planning and temporal distribution of components of human activity, which results in accomplishment of economic, social and environmental goals. Such actions require a wide range of information. The main objective of the study was to identify the range of data used in maritime spatial planning, integrated coastal zone management in the Polish part of the Baltic Sea and the possibility of acquiring such data. A high degree of generalisation prevents a lot of available data for MSP and ICZM from being used. An analysis of information resources (databases, registers, information systems) for the Polish Baltic zone and the coastal area has shown it to be dispersed and incomplete. However, considering the rapid development of the sector and the commitment of the stakeholders, one can predict that the new tools and projects will fill the gaps in this regard.*

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**Key words:** marine spatial planning, coastal zone management, Baltic Sea, database

### INTRODUCTION

The sea is the driving force of Europe. Maritime and coastal areas are essential for Europe's welfare – they provide trade routes, regulate the climate, provide food, energy and resources and are a favourite place to live and enjoy leisure. The main problems encountered in coastal and maritime areas are associated with shortage of a space, which results in conflicts between various methods of use, with seasonal fluctuations of the population size and employment as well

as degradation of natural ecosystems which support coastal areas (CASTELLARI *et al.*, 2006). Coastal areas are particularly susceptible to the risk of climate change. The possibility of the sea level raising increases the probability of storms, the risk of coastal erosion and floods, forces salt water flow inland and increases the threat to natural buffer zones, such as marshy land. Such sectors as tourism, fisheries (MATIĆ-SKOKO *et al.*, 2011) and agriculture are among those most vulnerable to climate change. Susceptibility to the threats to people and the environment on

the coast has increased because more and more buildings and structures are constructed in the close vicinity of the coastline and the space to accommodate rising sea waters is insufficient. The variability of the coastal areas in Europe makes their problems considerably different. However, there is one common feature of all the coastal zones in Europe – the growing risk of possible climate change. On the other hand, coastal zones have a considerable and positive effect on the process of generating some forms of renewable energy, thereby contributing to the formulation of a sustainable, safe and competitive energy policy for the European Union. This will entail additional need for space as well as another potential source of conflict in coastal areas and in the sea.

Because of these and other factors, maritime and coastal areas require integrated and consistent management in order to ensure sustainable development and to preserve the ecosystems for future generations (ODDO *et al.*, 2006). Therefore, integrated coastal zone management is a management tool for all the processes which affect the coastal zone, which is applied, in a coordinated manner, to interactions between the land and the sea as part of the coastal activities aimed at ensuring sustainable development of maritime and coastal areas. This tool makes it possible to make development decisions in all the sectors in a consistent manner (COM (2013) 133 final). As a consequence of a recommendation from the European Union (2002/413/EC), member states have started to implement maritime spatial planning and integrated coastal zone management to regulate the deployment of business activities and to develop systems of spatial planning for European coastal waters (RECOMMENDATION of 30 May 2002). Both MSP and ICZM should take into account regional specificity and sectoral activity. In particular, their objectives include:

- contribution to energy supply in the EU, using maritime sources of energy (currents, tides, waves, wind, etc.);
- effective propagation of the expansion of maritime transport;
- supporting sustainable development of fisheries and aquaculture;

- ensuring preservation and improvement of the natural environment;
- providing the possibility of coastal zones adapting to climate change and increasing their resistance in this regard (COM (2013) 133 final).

The main instruments of maritime management on the EU level include the European system of maritime supervision and monitoring (Automatic Identification System – AIS, SafeSeaNet, Long Range Identification and Tracking - LRIT, CleanSeaNet, Integrated System of Radiolocation Supervision – linked with the European Border Supervision System – EURO-SUR, Global Monitoring for Environment and Security – GMES), maritime spatial planning and the European network of maritime data and observations – EMODNET) (POLISH MARITIME POLICY, 2009). Owing to these instruments, it is possible to execute management tasks. The thematic scope for the Polish zone is specified in the recently adopted resolution of the Minister of Transport, Construction and Maritime Economy and the Minister of Regional Development of 5.08.2013 *spatial management plans for Polish maritime areas*. The information collected on maritime areas should concern, in particular: sailing routes, protected nature areas, sites where natural deposits are prospected for, identified or excavated, the location of technical infrastructure, shipwrecks, storage of mine output, military areas, cultural heritage areas, live fish resources and fisheries, tourism, existing and planned management of land and maritime areas adjacent to the area to which the plan applies and models of environmental risk (REGULATION of 5 August 2013).

Spatial planning and integrated coastal zone management in Europe are new issues (QUI & JONES, 2013) at the stage of intensive development. The main reason why these documents have emerged in different countries are not only environmental issues, but also those associated with the development of the power industry (e.g. Germany, Belgium) or aquaculture (e.g. Norway) (ZAUCHA, 2008). The goals of maritime areas spatial management and coastal zone management should be accomplished with the

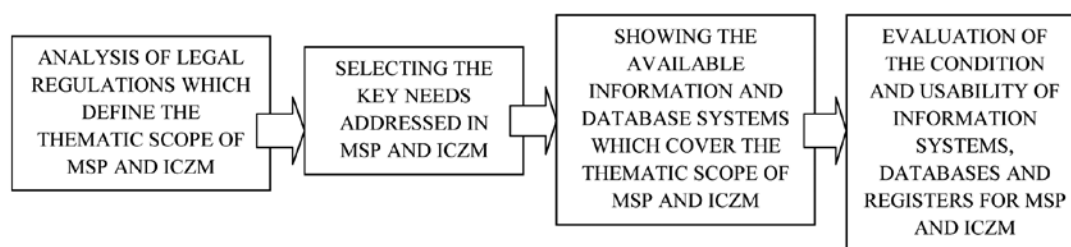


Fig. 1. Study organization diagram. Source: prepared by the author

## MATERIAL AND METHODS

use of appropriate data acquired from various sources. These are environmental, social, cultural, economic data, acquired in compliance with the EU regulations, maritime physical data for sea waters and geomorphological data for the coastal zone. In management and spatial planning, information is essential for making the right decisions (CICHOCIŃSKI & PARZYCH, 2006; KOCUR-BERA, 2010A, B; KOCUR-BERA, 2011; DAWIDOWICZ & ŻRÓBEK, 2012; DAWIDOWICZ *et al.*, 2013). The multi-aspect nature of managing spatial resources, the complexity of management systems, the multitude of institutions as well as a broad scope of use – all of these are arguments for the integration of information resources, especially in the form of databases and cartographic materials (CZOCHAŃSKI, 2009).

This study analyses the thematic scope which should be covered by the maritime area spatial management plan as well as integrated studies supporting coastal area management. It identifies the key needs which are to be addressed by the two instruments and identifies the projects and databases on the EU level which are used by the states in the Baltic Region. It also gathers and analyses the information systems, databases and registers used in MSP and ICZM in the Republic of Poland. It also presents the scope of information deficit which emerged when the pilot plan of development of the Bay of Gdansk was being prepared. These detailed goals were accomplished in order to show the state and usability of information and database systems in planning and management of the maritime and coastal zone.

Accomplishment of the goals was preceded by four studies shown in the diagram (Fig. 1), logically linked to each other.

The study procedures employed qualitative methods, especially logical analysis and construction, including identification. As a result, it was possible to identify the needs which are to be addressed by the spatial planning of maritime areas and coastal zone management. This was followed by analysing the projects, information and database systems used in MSP and ICZM in the Baltic Region and databases and registers used in Poland. The pilot plan for the Bay was used as an example to point out the information shortages encountered in the process of its implementation.

## RESULTS

### Databases in the Baltic Region

The issue of spatial information in the Baltic Region has been part of the international agenda for many years (VASAB, 2001). Important spatial planning projects for the Baltic Sea included

Balance and BaltSeaPlan. The former was initiated by the Helsinki commission (HELCOM); it made use of the knowledge of ecological issues (related to geomorphology, thermohydrodynamic, hydrochemical, hydrobiological, maritime meteorology, lithology, hydrographics, hydrooptics) to point out the necessity of defining the maritime landscape and blue corridors (AL-HAMDANI & REKER, 2007, MARTIN & NILSSON, 2006). BaltSeaPlan (the other project devoted to spatial planning in the sea) accumulated huge amounts of information on the current use

Table 1. Projects and initiatives associated with planning of the Baltic Maritime areas.  
Source: prepared by the author

Name of the project	Main research area
BeaTSeaPlan	Methods and testing of MSP in pilot areas
MyOcean	Integrated European capability for ocean monitoring and forecasting
ESaTDOR	Investigation of current uses of Europe's seas
PLAN BOTHNIA	MSP pilot project of the EU Commission
MASPNOSE	MSP pilot project of the EU Commission
ODEMM	Developing a set of ecosystem management options
MESMA	Support the implementation of marine spatial planning in Europe's sea (including data model)
COEXIST	Evaluation of competing activities and interactions In European coastal areas
KnowSeas	Tools for ecosystems based marine management
GAP2	Application of science and management to fisheries and the Marine environment
CHEMSEA	Detection and mapping of underwater chemical weapons
PlanCoast	Development of tools and methods for MSP
BALANCE	Development of tools and methods for MSP, "blue corridors" concept
MSP Initiative	Collection of worldwide good practice for MSP

of the Baltic Sea in the following areas: transport, fishing, tourism, protected areas, military areas, wind farms, use of the sea bed, cables and pipelines, anthropogenic objects on the sea bed, aquaculture and others, which makes up a database for three transgenic plans of the spatial development of maritime areas.

Gathering information is the first step of the design and management phase. The next step involves an evaluation of their usability. A project entitled "Development of a Data Model and Recommendations for a Maritime Spatial Data Infrastructure Planning in the Baltic Sea Region" was developed in 2011 and issued by the Federal Maritime and Hydrographic Agency (BSH) – as part of the BaltSeaPlan (BSP).

The document identifies requirements for spatial planning in maritime areas and gives a summary of transnational, national and regional initiatives, projects and cooperative structures relevant to MSP. Existing databases, geoportals and other data sources, potentially valuable for Maritime Spatial Planning (MSP) purposes in the region of Baltic Sea, are also identified. This comprises a review of ongoing and projected European, national and transnational initiatives and projects with regard and relevance to marine /maritime data and Maritime Spatial

Planning (e.g. INSPIRE, SEADATANET, EMODNET, MESMA, ICES - WKCMSP etc.). Relevant existing transnational and national databases and their hosts (e.g. HELCOM, ICES databases, BSH databases - CONTIS etc.), the way data are being / have been used in MSP processes and for decision making (e.g. in the Netherlands, Scotland, Norway, USA, Germany, Poland, BSP pilot projects, etc.) (WICHROWSKI *et al.*, 2011).

On the EU, international and national levels there are currently numerous initiatives and projects attempting to provide information on themes related to marine environment and uses (see Table 1). Other more broadly marine or geospatial initiatives are also exploring ways of making use of marine and other data for SMEs. However, the great majority of these projects have a demonstration or research character, limited timeframe and funds, and thus and selective scope of data coverage.

Table 2 presents the main sources of information indispensable in the spatial planning of the maritime areas. They apply to the Baltic Region issues, those which meet the BaltSeaPlan Vision 2030 of sustainable development of the Baltic Sea and take into account: nature conservation, shipping, energy and fisheries, cables and pipelines.

Table 2. Databases which can be used in spatial planning in the Baltic Region.  
Source: prepared based on (WICHROWSKI *et al.*, 2011)

Database	Data format	Data sharing/restrictions	Application for MSP
EMODnet 5 pilot portals: EMODnet - hydrography, marine, biology, marine, chemistry, marine, geology and marine habitats	no data	No restrictions (free data access for business users)	Scale 1:1000000, too large for MSP, due to lack restrictions easy and cheap source of spatial data
INSPIRE GeoPortal	metadata only	Restrictions depend on data owner	metadata of only limited application for MSP purposes + useful when searching for a specific data set
ICES GeoPortal	metadata and charts showing data distribution only	No restrictions. It is possible to download the data, but for efficient work (visualization of CTD-profiles) special software is necessary	requires of specialist software and knowledge
HELCOM Map and Data Service	based on ESRI's ArcGIS Server and Flex development platform	Allows the user to: visualise, analyse and search data, draw and save or print own maps, download ESRI shapefiles, access Layers in OGCWMS Standard protocol	Good source of information of marine environment and protected areas. Technical problems with zooming into a better resolution. Data on human activities not very comprehensive and/or reliable. Not always up-to-date
EUROSION GIS Database	shapefiles for download, however no online visualization. GIS software required	No restrictions	Data cannot be viewed before download, so it is difficult to find the right data
European Atlas of the Seas	data show as maps only	No restrictions	Very general overview. Practically none only awareness raising function
ESPON database	different formats	Some data with no restriction, some for registered project members only	Database not suitable for marine purposes
Continental Shelf Information System (CONTIS)	maps in pdf format, Shapes of uses upon request	Free access only to certain preselected maps	Developed as a special tool for MSP purposes. However, so far it is applicable for general overview only. Good source for data on imminent human activities, insufficient zooming capability
MDI-DE database	under construction	under construction	Very interesting Idea of decentralized data storage. If the map resolution Fine enough MDI-DE portal, could be a perfect tool for MSP purposes

The analysis has shown that current environmental data on the sea are not available on one information platform or in one database. They are accumulated and made available by different organisations, institutions or agencies and they can be used only to a certain extent in the spatial planning of maritime areas.

### **Current condition of the Polish Zone of the Baltic Sea**

The legal instruments in Poland regarding the planning of the Polish coastal and maritime area are: the Act of 27 March 2003 on spatial planning and management (ACT of opizp, 2003), the Act of 21 March 1991 on maritime areas of the Republic of Poland and maritime administration (ACT of oomRP, 1991), Regulation of the Council of Ministers of 29 April 2003 on determination of the minimum and maximum width of the technical and protective belt and the method of determination of borders (REGULATION of 29 April 2003) and the Regulation of 5 August 2013 on spatial development plans for the Polish maritime areas (REGULATION of 5 August 2013). The coastal area management is executed under local or regional regulations. The most important ones, which are essential for the coastal line management include: local plans developed by communes, local plans for provinces, spatial development conditions and direction studies, natural valuation of communes, strategic action plans for institutions which are responsible for management and development, development strategies for communes, counties, provinces and for the country, taking into account European integration tasks, protection plans for national parks, landscape parks, reserves, Nature 2000 areas, forest development plans as well as other planning and specialist studies.

Development plans for Polish maritime areas must take into account the provisions of current: local plans for coastal communes, spatial development conditions and direction studies for coastal communes, protection plans for national parks, nature reserves and landscape parks (ACT of oop, 2004), protection plans for Nature 2000

areas and valid permits for the construction and use of artificial islands, structures and devices in Polish coastal areas and concessions for prospecting, identifying and excavation of mineral deposits within the maritime areas of the Republic of Poland. In particular, development plans should specify the intended purpose of individual maritime areas to be used by: sea-borne transport, sport, tourism and recreation, maritime breeding and cultivation, fisheries, construction of artificial islands, structures and devices, technical infrastructure, provision of safety and public order, restrictions and concessions in the ways of using maritime areas (regarding scientific research, sailing, fisheries, construction of artificial islands, structures and devices, technical infrastructure, swimming and practising powerboating), deployment of protected basins, public objective investments, areas with mineral deposits, documented or confirmed by tests, concession-covered mining areas, boundaries of zones closed for sailing and fisheries as well as periodically dangerous, permanent protected zones (REGULATION of 5 August 2013).

Furthermore, detailed requirements regarding the strategy for integrated coastal zone management cover such forms of activity as using specific natural resources, including installations for energy acquisition and energy production from renewable resources; development of infrastructure, power plants, transport, ports, maritime facilities and objects and other objects, including green infrastructure; agriculture and industry; fisheries and aquaculture; protection and replacement of coastal ecosystems and their management, ecosystem services and nature, coastal landscape and islands as well as reducing the effects of climate change and adapting to them (COM(2013) 133 final). In practical terms, gathering information on the zone management focuses on the land and on the immediate vicinity of the coastal zone, whereas the spatial planning of maritime areas focuses on space allocation and on achieving balance in using maritime areas. The stakeholders and scope of information are similar in both cases.

## Defining the Polish maritime areas and the coastal zone

Polish coastal zones consist of the internal sea waters, territorial waters and the exclusive economic zone. Their total area (excluding the disputed area which is also claimed by Denmark) is about 33,037 km<sup>2</sup>, i.e. over 10% of the land area of Poland (Fig. 2).

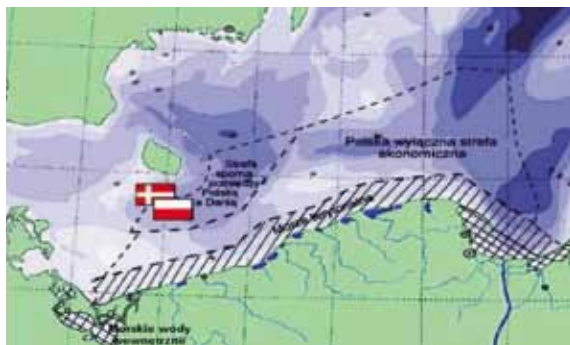


Fig. 2. Division of the Polish Baltic Sea Zone – internal sea waters, territorial sea and exclusive economic zone.  
Source: (ZYCH, 2012)

**Internal sea waters include** part of the Bay of Gdansk, the Szczecin Lagoon, the Vistula Lagoon and harbour waters with the total area of about 1,991 km<sup>2</sup>. In particular, they include: part of Lake Nowowarpieńskie and part of the Szczecin Lagoon together with the Świna and the Dziwna Rivers and the Kamień Lagoon, which is situated to the east of the border between the Republic of Poland and the Federal Republic of Germany, and the Oder between the Szczecin Lagoon and the Szczecin harbour; part of the Bay of Gdańsk; part of the Vistula Lagoon, situated to the south-west of the border between the Republic of Poland and the Russian Federation on the Lagoon; waters of the harbours, delimited on the sea side by the line which connects the permanent harbour devices which are integral parts of the harbour system and which are most distant from the land.

**Boundaries of internal sea waters and the territorial sea waters** are specified by the provisions of the Act of 21 March 1991 on the maritime area of the Republic of Poland and the maritime administration (Journal of Laws 2003, No. 153 item 1502). It is an area of sea

waters, which is 12 miles wide, counting from the primary line of the sea, and is 8 682 km<sup>2</sup> in total. The primary line of the territorial sea is understood to denote the line of the lowest sea level along the coast or the internal sea waters.

**Exclusive economic zone (EEZ)** borders on the territorial sea and its boundaries are specified in international agreements. To the south of Bornholm, there is a disputed area which is also claimed by Denmark. Without this area, the area of the Polish exclusive economic zone is about 22,364 km<sup>2</sup>. The Baltic Sea, which is a closed sea with limited water exchange with the North Sea, is a water body with quite intensive traffic, connected with the main global sea routes. According to the classification of the International Maritime Organisation, the Baltic Sea is a Particularly Sensitive Maritime area (PSSA), i.e. a region which – due to its unique character – should be especially protected and which requires that strict standards of the maritime environmental protection be observed.

All maritime areas within national territory belong to the Treasury, and on its behalf ownership rights are exercised by the Minister of Infrastructure, who is the head of Polish maritime administration. Ownership does not extend into the EEZ, but on behalf of the State, the Ministry of Infrastructure acts, as far as provisions of the United Nations Convention on Law of the Sea allow, as if it were the owner (CIEŚLAK *et al.*, 2009).

**The coastal strip is a coastal area** adjacent to and running along the coastline. It is situated in the provinces: Zachodniopomorskie, Pomorskie and Warmia and Mazury. The coastal strip includes:

1) the technical belt – it is a zone of interaction between the sea and the land; its purpose is to maintain the coast in a condition which complies with the safety and environmental protection requirements; it covers the area from the shore towards the land, with a width of 10 to 1000 m, depending on the type of coast, excluding the areas lying within the harbours and ports as specified in separate regulations;

2) protective belt – it covers the area in which human activity directly affects the condition of

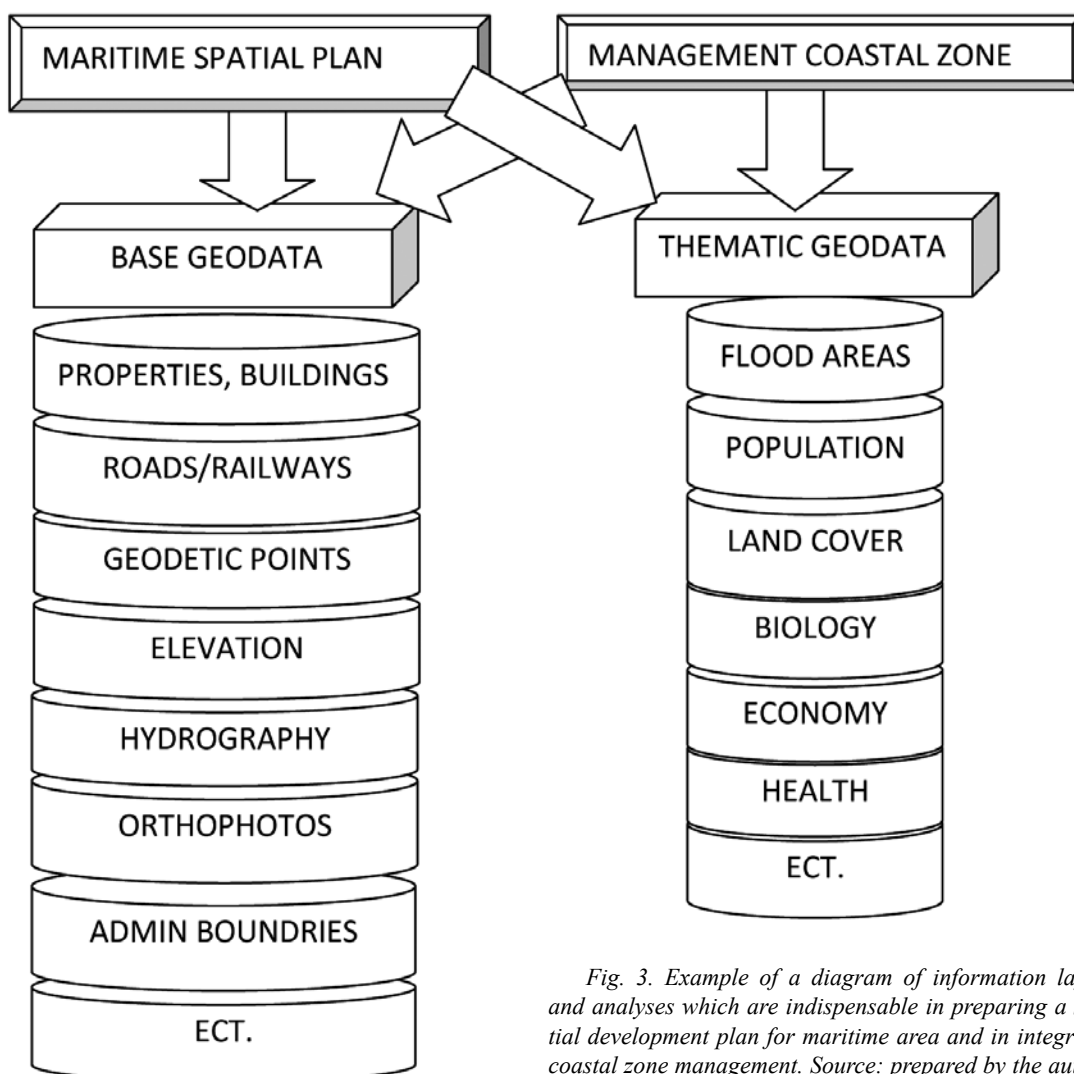


Fig. 3. Example of a diagram of information layers and analyses which are indispensable in preparing a spatial development plan for maritime area and in integrated coastal zone management. Source: prepared by the author.

the technical belt; it covers the area which is adjacent to the land-side boundary of the technical belt or the sea harbour, with a width of 100 to 2500 m and Lakes Kopań, Bukowo and Jamno with a 200 m wide land belt adjacent to them, counted from the boundaries of the plots on which the lakes are situated, excluding the land within sea ports and harbours, as specified in separate regulations.

Thus formed, the maritime and coastal zone requires two types of information (see Fig. 3). One is related to geographical information on the object (GIS) and the other is related to statistical data. Geographical information, such as land use and its evolution, the boundaries of protected areas, hydrography and outlines of riv-

ers, bathymetry, etc. allows the inclusion/understanding of how the territory is organized and provides visualization of the interface between land and sea. Statistical data: this information is often represented according to an administrative grid. This information can support an understanding of the level of sustainability of the coastal development and the impact of the implemented policies (MARTI *et al.*, 2007).

#### **Databases – a case study: the Polish Baltic Sea Zone**

Databases, registers and the spatial information systems built on them perform a lot of functions. The most important of them include



Table 3. A list of example databases used in creating maritime area development plans and coastal area management.

Source: prepared by the author

DATABASE AND REGISTERS	EXAMPLES OF DATABASE COMPONENTS
Central Geological Database	Geoecho, Drilling Geophysics, Seismic Features, Petrophysical Measurements Of Rock Samples, System Of Management And Protection Of Mineral Resources (Midas), Surface Geophysical Measurements, Geoelectric Probing – Sge, Ikar, Caves In Poland, Geological Collections, Boreholes, Infogeoskarb, Anti-Landslide Protection System (Sopo), Etc.
Central Geoenvironmental Database	Geochemical Atlases, Geoenvironmental Database, Central Register Of Geosites In Poland, Geotopes Of The Polish-Lithuanian Border, Excavation Waste, Etc.
Central Geological And Engineering Database	Geological And Engineering Factors Which Affect Roads And Railways Construction, Urban Geological And Engineering Atlas Database, Etc.
Central Hydrogeological Database	Hydro Bank, Monitoring Of Underground Waters, Main Underground Water Bodies, Hydrogeological Map Of Poland – First Aquiferous Level, Areas Threatened By Flooding, Water Intake Sites, Etc.
Forest Database	Central Forest Valuation Description Slip, Forest Ownership System, Calculations And Reporting System, Forest Management Plans, Park Protection Plans, Etc.
Gugik System (Główny Urząd Geodezji I Kartografii - Central Office For Geodesy And Cartography)	Integrated Cadastral System, Perpetual Registers, Pesel, Regon, Teryt 2, Georeference Database Of Topographic Objects, Etc.
Biodiversity Information Exchange System (Chm)	Foreign Species Database, Biodiversity Projects Database, Etc.
National Environmental Monitoring	Monitoring Of Waters, Monitoring Of Noise, Air Quality, Soil And Earth Quality, Monitoring Of Precipitations, Electromagnetic Fields, Ionising Radiation, Nature, Environmental Reports, Etc.
Integrated System Of Environmental Information	Refugia, Nature 2000, Central Register Of Nature Protection Forms, Infoos, Register Of Environmental Verifiers (Emas), Monitoring Of Birds, Soil – Monitoring Of Soil Chemistry, Monitoring Of Nature, Nature 2000 - Monitoring Of Species And Natural Habitats, Corine Land Cover, Monitoring Of Precipitation Chemistry, Oph – Noise Protection, Emep Database, Jpoat, River And Lake Deposits Database, Polprtr, Etc.
Zoning Studies (For Land And Coastal Zone)	The Concept Of Spatial Development Of The Country, Local Plan For A Province, Local Plan, Spatial Development Conditions And Directions Study, Etc.
Integrated System Of Agricultural Production Space	Soils With Potential Erosion And A Model Of Real Erosion For A Commune, Model Of Agroclimate, A Model Of Real Erosion For The Country, Forecasting Crop Yields By Teledetection, Etc.
Integrated System Of Maritime Security And Protection	Radiolocation System, Ship Tracking And Identification System, Early Warning System, Etc.
National System Of Contamination Detection And Alarming	Extraordinary Emergency Protection System (Isok), Ecofailures, Hazardous Plants, Etc.
Institute Of Meteorology And Water Management	Weather Forecasts And Current Weather Data, Hydrological Forecasts And Current Data, Agrometeorological Protection, Evaluation Of Wind Energy Resources, Etc.
Integrated System Of Maritime Security And Protection	Radiolocation System, Ship Tracking And Identification System, Early Warning System, Etc.
Navigation And Hydrographic Security Database	Polish Navy Database, Hydrographic Security Division, Maritime Administration Database, Sar Search And Rescue Database, Maritime Border Guards Detachment Database, Etc.
Central Statistical Office – Centre For Maritime Statistics	Intrastat, Local Data Bank, Sdds, Demography, Teryt, Regon, Themes: Prices, Trade, Population, Living Conditions, Environment, Energy, Work, Wages, Industry, Etc.

Table 4. A list of the information shortage areas encountered when preparing the pilot plan of spatial development for the maritime areas of the Bay of Gdańsk. Source: prepared by the author based on (ZAUCHA, 2009)

Scope of data shortages	State of information
Ichthyologic and macrophyte monitoring	none
The protection aims in the internal Bay of Puck, included in the Coastal Landscape Park and the Bay of Puck, which includes areas of protected habitats and birds Nature 2000	none
Actual fragmentation of maritime habitats	scarce
Mineral deposits under the sea bed	none
Mineral deposits on land	none
Development and future use of maritime areas	none
Obsolescence and lack of spatial precision of the position of maritime cultural heritage – objects and coastal and land structures which are currently under water	scarce
Number of boats and fisheries output – no spatial references	scarce
Transport corridors	contradictions
Local plans, spatial development conditions and directions studies, especially regarding: information on the directions and the actual priorities of spatial development in communes in future, issues related to development of the touristic facilities, parking spaces, etc.	insufficiently up to date
Overlapping functional basins, for example military areas or transport routes with naturally valuable areas	scarce
Maritime tourism and recreation: - the Baltic prospects and directions of development of surface and undersea forms of tourism; - solutions aimed at minimising conflicts between different forms of maritime tourism; - qualitative and spatial requirements for the maritime areas used for tourism; - spatial conflicts associated with maritime tourism; - coexistence of maritime tourism with other ways of using maritime space; - capacity of maritime area in relation to other forms of maritime tourism;	scarce
Energy from renewable sources: - innovative methods of acquisition of energy other than from wind in maritime areas, - potential development directions and existing trends; - innovative methods of storage and use of energy acquired from maritime areas and the current development trends;	none
Mariculture in the world and in Europe: - breeding species and their ranges (what species will be bred in the Baltic environmental and climatic conditions, on what scale, how will they be used: e.g. bioenergy, medicine, cosmetology, environmental protection, what is the focus of interest of the R&D activities – for example, in pharmacology, cosmetology, in the area of “green” technologies); - economic and legal prospects of mariculture in the EU and in Poland (productivity, legal conditions, the role of maricultures in national economies, role of scientific research in development of maricultures); - what are the opportunities for and threats to development of mariculture in Poland (state of knowledge, national policy, legal environment, environmental aspects, public opinion and decision makers’ attitude, socioeconomic aspects, possible threats from mariculture (conflicts) and coexistence with other methods of use of maritime area);	none
wind power generation: - innovative methods of acquisition of energy, other than wind energy, from maritime areas, - potential development directions and existing trends; - innovative methods of storage and use of energy acquired from maritime areas and current development trends (e.g. producing potable water or water for household use from sea water);	none

<p>environmental protection:</p> <ul style="list-style-type: none"> <li>- what types of environmental protection can ensure the most effective accomplishment of long-term environmental goals;</li> <li>- which systems should be fully protected and which can coexist in space with other forms of human activity; how have the climate changes and socioeconomic development affected long-term protection of maritime areas, how will the protection affect future forms of spatial conflicts associated with the use of maritime areas;</li> <li>- to what extent is the spatial scope (percent of protected maritime areas) of the maritime environment protecting on the Baltic sufficient and consistent with the ecosystem approach and to what extent can its tendency for growth be predicted, considering the EU and HELCOM policy,</li> <li>- what new requirements regarding the Baltic nature protection can appear in the long term, especially those regarding a decrease in fragmentation of natural systems,</li> <li>- what new forms of the Baltic environment protection can appear and why (e.g. protection of undersea landscape) and how will this affect the use of maritime landscape for economic purposes;</li> <li>- what should be the major quantified objectives and indexes used for medium-term maritime space management, considering the environmental requirements.</li> </ul>	none
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the information function (gathering information and making it available), data management and processing, integration and analysis. Ideally, all of these functions should be linked to spatial visualization of the distribution of a phenomenon under study. For many areas, operating without spatial visualization information systems seems impossible. On the other hand, analyzing various spatial phenomena and gathering data and their visualization requires the involvement of specialists in many areas. In Poland, there are a number of institutions which gather information for their own needs. At the same time, a number of European project are also underway, portals have been created which publish spatial information, there are superregional information systems with a lot of data useful for administration and management and development institutions. Due to the divided competences of many administrative entities, information as well as databases and registers are often duplicated and dispersed. Integration of a lot of important information, databases and monitoring systems into one or several information systems allows spatial phenomena to be tracked which are necessary for administrative and business entities. This also applies to coastal areas and the maritime zone. However, this requires technical and general competence of all the partners and stakeholders in the management and planning process at the point where land and maritime zones meet. In Poland, there are many avail-

able databases, registers, subsystems and central information systems with GIS graphic layers. The most important databases used in the process of planning and management of maritime and coastal areas, together with examples of subsystems, are shown in Table no. 3. Most of them are studies with some degree of generalization, dispersed among different entities responsible for maintaining them, in which data are duplicated, which increases the cost of their acquisition.

Modern sources of information are a key to development of regional and thematic systems; only this level of generalization allows them to be used for sea and coastal area development and management. Therefore, integration, updating and supplementing of dispersed sources of information, especially in areas of strategic importance for implementation of the maritime policy, should be an important step in the proper management of development and making location decisions aimed at sustainable development and achieving spatial order.

Managing sea and coastal areas and the conditions for spatial development as well as the need for creation and distribution of information are characterized by the specificity which arises both from the dissimilarity of the geographical environment and the organizational, technological and economic features of the entities which operate in the area (CZOCHAŃSKI, 2009). This requires perfect recognition of spatial details,

especially natural features and resources as well as technical features associated with the area. The growing number of functions which can be performed by sea basins increases a potential for conflict and puts a limit on the freedom of their use.

### **A pilot plan for part of the Bay of Gdańsk**

The pilot project of the spatial development plan for part of the internal sea waters of the Bay of Gdańsk, financed by the funds of the INTERREG IIIB "PlanCoast" project enabled testing the possibility of preparing maritime plans under the specific legal, information and staffing conditions of Poland. The process of the plan implementation revealed severe information shortages in the Bay of Puck area and adjacent waters. The availability of information differed spatially, some documents were not sufficiently up-to-date and the information acquired was not precise. There were also contradictory data, acquired from different sources. Table no. 4 presents the thematic scope of the obstacles together with the information shortages, encountered by the personnel who prepared the pilot development plan for the maritime areas of the Bay of Gdańsk.

## **DISCUSSION**

Planning maritime area development and coastal zones management is extremely important for the development of the entire country. Both instruments support actions which reduce the conflicts between different sectors which operate in the areas, improve cooperation capabilities, favor investments, and through the clarity and transparency of the methods of use and protection of the areas, they help to create maritime protected areas, excavate natural resources and deposits (e.g. oil and natural gas). They also improve the coordination of the activities of different countries and regions, intensify international cooperation regarding cables, pipelines, sailing routes and installations for wind power production, etc., by early identification of the effect of diverse spatial use and allow for protection of valuable habitats and species.

However, they require comprehensive, up-to-date and precise information from many sources and in many areas. Such sources are dispersed in various institutions, agencies and organizations, which makes access to them difficult. Studies conducted in such information databases as: EMODENT, INSPIRE GeoPortal, ICES GeoPortal, HELCOM, EUROSION GIS, European Atlas of the Seas, ESPON, CONTIS and MDI-DE created with the aim of assisting spatial planning in the maritime areas of the Baltic Sea have shown that (1) data on the sea are not available on one information platform or in one database, (2) they are gathered and made available by various institutions, (3) only to a certain extent can they be used for planning maritime areas development, e.g. for comparison of general phenomena, (4) the scale of most GIS data prevents them from being used for detailed purposes, (5) in some cases, access to data requires specific software (e.g. ESRI, GIS), (6) the accessibility of data is limited (administration, business), (7) the scope of data is not always adequate to the needs, (8) visualization of some issues is insufficient, (9) different systems of reference in data (systems of coordinates, systems of reference, etc.) are an obstacle.

An analysis of databases, registers and information systems regarding the territory of Poland, which were used to prepare a pilot development plan for the maritime areas of the Bay of Gdańsk, has shown that (1) the information is also dispersed; (2) in some cases, it is not accessible to an average person (only for administration personnel); (3) data require higher spatial precision (e.g. ichthyofauna); (4) the quality (adequateness) of the available information is sometimes insufficient, (5) inconsistent systems of reference for collected data have also proven to be a significant problem. For example, socio-demographic data gathered for governments to support decision making at different administrative levels (usually a county or a commune) on data on water quality, maritime leisure, ship traffic in ports, fish unloading or sea level, are gathered and referred to measuring sites, whose position is identified by geographic coordinates, whereas data, for example, regarding tourism,

are often gathered and combined for several communes, towns, sets of information points or sampling sites. In addition, indexes for the coastline are defined differently, as land zones, buffer zones or as objects equidistant from the coast. Such a great diversity of systems of reference makes identification of many issues and the direct use of data in planning the development of and management of maritime and coastal areas difficult.

## CONCLUSIONS

The main goal of spatial planning for maritime areas is to define the forms of spatial use and conflicts in maritime areas and to manage them. To achieve this goal, member states should provide a comprehensive map showing different methods of using maritime space, taking into account the long-term changes caused by climate variability. Furthermore, integrated management of coastal areas is a tool for coordination of all political actions which affect a coastal area, dealing in a coordinated manner with interactions between land and sea as part of coastal activities in order to ensure sustainable development. Owing to such tools, decisions regarding management or development are taken in a consistent way in all sectors. At present, the intensity of Polish sea space use is rather low, especially when compared with some other maritime areas (e.g. German, Danish,

Dutch, Belgian or some UK areas). However, the increasing trend to use sea space for the needs of industry (wind farms, other energy production installations, future production/processing plants), various types of mining, communications, power, oil and gas transfer, transport, storage, dumping, recreation, waste water and sewage discharge, together with the extensive newly-established and planned nature protection areas, and fishing and national defense requirements, is already forcing the very intense use of Polish sea space and requires careful, farsighted spatial management. Except for a narrow strip along the coast and most port areas, data and knowledge are rather patchy and are based on broad generalizations, which make them insufficient for detailed spatial planning (CIEŚLAK *et al.*, 2009). Moreover, information resources are dispersed and incomplete. However, this is not different than the condition of the information systems in other countries of the Baltic region, which can be concluded from analyses of projects and databases gathered in connection with the issue. It is clear that planning and management of maritime and coastal areas is relatively new and is now at the development stage and intense work to obtain data and making them available will be required to improve this state. All stakeholders also realise that management instruments will work properly only if information about the sea and coastal areas is clear, exhaustive and easily accessible.

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## **Informacije i raspon baza podataka koje se koriste za pomorsko prostorno planiranje i za integrirano upravljanje obalnim područjem - primjer slučaja u Poljskoj, Baltičko more**

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### **SAŽETAK**

Intenzivna eksploatacija obalnih i morskih područjima, zajedno s klimatskim promjenama, prirodnim nepogodama i erozijom, čine povećan pritisak na obalne i pomorske resurse. Ovi resursi zahtijevaju integrirano i konzistentno upravljanje kako bi se osigurao održivi razvoj, te omogućilo očuvanje obalnih i morskih ekosustava za buduće generacije.

Planiranje prostornog razvoja pomorskih područja obično podrazumijeva otvoren proces analize, planiranja i vremenske raspodjele dijelova ljudskog djelovanja, što rezultira provođenjem ekonomskih, socijalnih i ekoloških ciljeva. Takvi postupci zahtijevaju širok raspon informacija. Glavni cilj našeg istraživanja bio je utvrditi raspon podataka koji se koriste u pomorskom prostornom planiranju, integriranom upravljanju obalnim područjem u poljskom dijelu Baltičkog mora, kao i mogućnost stjecanja takvih podataka. Visok stupanj generalizacije sprječava korištenje većine raspoloživih korisnih podataka za MSP i ICZM. Analiza informacijskih izvora (baze podataka, registri, informacijski sustavi) za poljski dio Baltičke zone i obalnog područja pokazala je da su podaci raspršeni i nepotpuni. Međutim, s obzirom na brzi razvoj sektora i predanost sudionika, može se predvidjeti da će novi alati i projekti doprinjeti rješavanju problema s podacima.

**Ključne riječi:** prostorno planiranje morskih područja, upravljanje obalnim područjem, Baltičko more, baze podataka