

Database for monitoring the spatial management plans of the Polish marine areas. Update and practical use of data

Baza danych do monitoringu planów zagospodarowania przestrzennego polskich obszarów morskich. Uaktualnianie i praktyczne wykorzystanie danych

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Abstract: Planning and marine spatial development is based on an exceptionally wide range of knowledge and information used in the process of creating plans and their later evaluation. The first type are spatial data describing the present state of the natural and anthropogenic environment within a widely-understood spectrum. The second type of data are statistical information describing spatial occurrence in the environment. Geoinformation within a planning process is hugely important, as the quality of spatial data influences the decisions made and the final results of planning work. Undoubtedly, efficient spatial database management and creating a compatible system to operate it are the key elements of effective work in a planning process. In Europe, the monitoring process together with creation of tools supporting database management is highly developed. There is a range of examples for the use of spatial information systems in work linked to the preparation and evaluation of spatial management plans at sea. Due to the specifics of works related to spatial planning in Poland, this paper presents a new solution for the future monitoring of the generated plans. The nature of this paper is determined by the local approach to taking advantage of the ArcGis software related with the use of a range of tools in the monitoring approach to plans of spatial management of the Polish marine areas. The purpose is to demonstrate a selected tool which is supposed to improve the planners' work, from the point of view of the use of statistical data linked to the dynamics of changes in the coastal area. This is an exemplary use of the tool which might be modified at will, according to the needs of the user. This solution allows for adjustment of the tool to the most of required data based on statistical tables.

Keywords: spatial planning, monitoring, database, Geodatabase, system, model builder, data update, open source data, ArcGis

Streszczenie: Planowanie i zagospodarowanie przestrzeni morskiej opiera się na wyjątkowo szerokim zakresie wiedzy oraz informacji, które są wykorzystane w procesie tworzenia planów oraz ich późniejszej ewaluacji. Jednym rodzajem są dane przestrzenne opisujące aktualny stan środowiska naturalnego i antropogenicznego w szeroko pojętym spektrum. Geoinformacja jest niezwykle istotna w procesie planistycznym, gdyż jakość danych przestrzennych wpływa na podjęte decyzje i wyniki końcowe pracy planistycznej. Niewątpliwie sprawne zarządzanie bazą danych przestrzennych oraz tworzenie kompatybilnego systemu jej obsługi to kluczowy element efektywnej pracy w procesie planistycznym. W Europie proces monitoringu wraz z tworzeniem narzędzi wspomagających zarządzanie bazami danych jest wysoko rozwinięty. Istnieje szereg przykładów wykorzystywania systemów informacji przestrzennej w zakresie pracy związanej z przygotowaniem i ewaluacją planów zagospodarowania przestrzennego na morzu. Z uwagi na specyfikę prac w Polsce, poniższy tekst przedstawia nowe rozwiązanie dla przyszłego monitoringu powstałych planów. Charakter pracy określa regionalne podejście do wykorzystania możliwości oprogramowania ArcGis związanej z użyciem narzędzi w podejściu monitoringu planów zagospodarowania przestrzennego polskich obszarów morskich. Celem jest ukazanie wybranego narzędzia, mającego usprawnić pracę planistów, w ujęciu wykorzystania danych statystycznych związanych z dynamiką

zmian strefy brzegowej. Jest to przykładowe wykorzystanie narzędzia, które może zostać dowolnie zmodyfikowane na potrzeby użytkownika. Dzięki takiemu rozwiązaniu narzędzie może zostać przystosowane do większości potrzebnych danych bazujących na tabelach statystycznych.

Słowa kluczowe: planowanie przestrzenne, monitoring, baza danych, geobaza, system, model builder, uaktualnienie danych, open source data, ArcGis

INTRODUCTION

Spatial planning of marine areas in Poland, developing effectively in the recent years, is a relatively new issue, strengthening the methodological basis and instrumentarium linked to marine development. The cooperation associated with implementation of international projects and the activity contributing to joint achievements of the Baltic working group VASAB-HELCOM, have led to a significant progress in our country's spatial planning development (Zaucha J., 2014). An improvement in terms of integration between scientific communities and marine administration authorities, which is also notable in the form of proprietary supervision of marine areas representing the society's needs and is directly responsible for matters regarding spatial development at sea (Malczak M., Szelfer K., 2011). Undoubtedly, the whole planning process, due to its multidisciplinary nature, imposes some changes within the exploitation of the Polish marine areas which may lead to solving spatial conflicts (Malczak M., Zaucha J., 2009; Zaucha J., 2009 a). The first approach to spatial planning of the Polish marine areas was development of pilot plans which were a prelude to commencing planning works but were not included in the legal system (Malczak M., Zaucha J., 2011; Zaucha J., 2009 b). Poland, as a country with access to the sea, in accordance with the requirements of the European Parliament Directive, is obliged to prepare a spatial planning program, providing a framework and principles for the exploitation of marine areas, together with a sustainable development approach coordinating economic, social, and environmental development (Turski J., 2017).

The origins of spatial planning in the Polish marine areas were associated with numerous limitations linked with the lack of knowledge, lack of spatial reference to the existing knowledge, lack of interaction in the process, an institutional gap, as well as lack of a wide range of data regarding spatial information (Zaucha J., 2012). However, preparation of the first document was commenced, and it constituted a foundation for the present and future spatial planning at sea, i.e., Studium Uwarunkowań [ang. Study of Conditions] (Malczak M., Zaucha J., 2015). This work led to creating a basic document together with a spatial database, in order to collect existing knowledge regarding marine management hitherto, as well as to indicate directions for the development of particular sectors of the marine economy. At this stage, the revealed information gaps were subjected to analysis which could have solved these issues in the recent years (Malczak M., Szelfer K., Zaucha J., 2016).

One of the tools that could influence the improvement of the quality in the future spatial planning of marine areas is creating an intelligent and versatile system related to the evaluation and monitoring of generated plans. The role of monitoring is to periodically and on an ongoing basis check the actual state of the natural environment and the human activity influencing project concepts of spatial plans. In its essence, spatial planning is a process aiming to provide sustainable development and maintaining spatial order. Monitoring is a tool used to ensure correct performance of the tasks of this process. Through the analysis of various type indicators, planners are able to determine levels and diversity of changes occurring during the period of evaluation of spatial development plans for marine areas. Every time a person implements a plan according to the regulations of the Act on marine areas and maritime administration, they are obliged to use the monitoring process and to evaluate the plan within 10 years from its approval.

Creating a scientific research elaboration, which the system of monitoring of spatial development plans for marine areas undoubtedly is, each time requires creating an optional database, which constitutes its integral part. Collecting spatial information broadens knowledge on a given issue and gives an opportunity to promptly integrate it with other databases (Pardus J., 2016). The text below describes selected solutions, used during creating a database and tools supporting the monitoring process in an ongoing planning process. For the purposes of creating an operation methodology, a functional and ergonomic system of databases was generated; they served a practical purpose in the process of monitoring marine plans. The research was carried out in stages, operating on physical collections. These were:

- ◆ review and description of database structure up to date,
- ◆ inventory of all known and available sources of spatial data (open sources), preparation of compiled potential sources of the GIS data,
- ◆ assessment and evaluation of possible structure scheme of data flow in the process of monitoring spatial development plans for marine areas,
- ◆ formulating conclusions regarding proposed changes in the structure of databases up to date, observations regarding maintenance of a sequence of common attributes in tables with spatial data layers,
- ◆ developing a methodology of data updates within the monitoring process,
- ◆ identifying the monitoring indicators and proposing a model that could improve their calculations in the process of monitoring plans for marine areas.

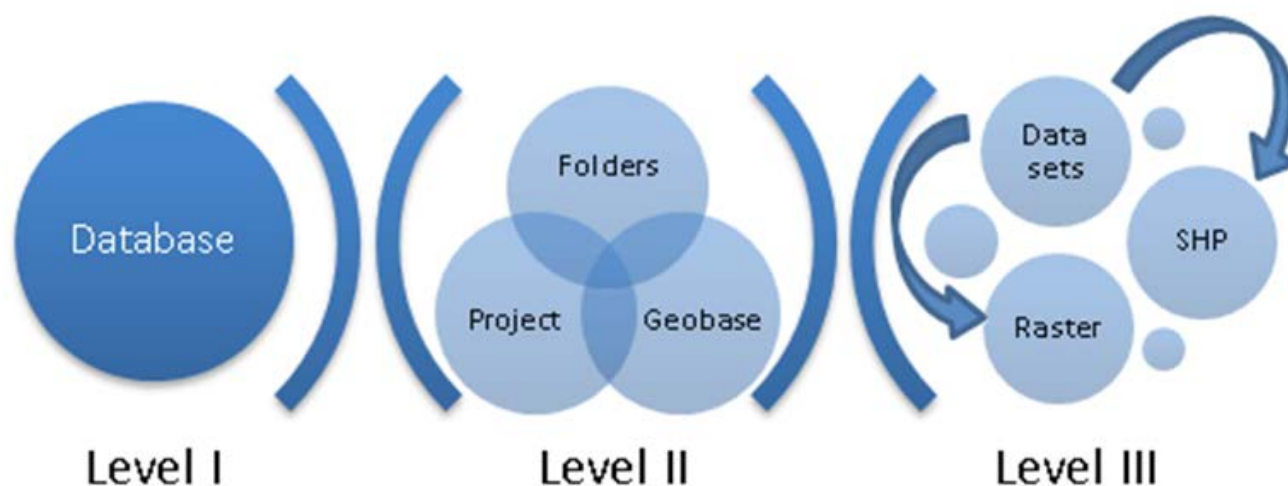


Fig1. Structure of the database created in the planning process (source: author's materials).

DATABASE

Works conducted to create the spatial database were prepared by the team of the Independent Spatial Policy Workshop of the Maritime Institute in Gdańsk in their entirety for the purposes of the planning process implementation. As part of this work, a practical system serving data management and spatial information management was created. The database used so far should be perceived as an integrated system of data extended by the spatial factor. In practice this means that the data range, apart from descriptive attributes, contains a record of geometry of the objects presented as the main elements of the spatial information system (Gaździcki J., 2001). The database structure is based on a standard division according to their type, i.e., vector and raster layers, as well as the final elements of a cartographic composition - projects. Data are collected on three levels respective to their destination. The figure below (Fig. 1) presents a graphic distribution of respective components of the database of spatial objects. The presented structure of data division sets out the easiest option of grouping information according to obtained data. It is a tree structure where the first level constitutes the main information base, successively entering further levels. The data are allocated to particular sections in terms of their nature, where on the last level the information is used in connection to the generated relations.

DATA AND CONNECTIONS

One of the main concepts of the work on creating a new system of management of the data contained in the base was the inventory and identification of their connections regarding the open source information. For the most part, databases regarding marine matters (marine space use) were used, but portals collecting land data were also used, e.g., the National Register of Boundaries. Geoportals having "land" data at their disposal will have a great impact on shaping the model of plan monitoring,

as a part of the plan monitoring indicators will fluctuate in the coastal zone (with the principles of the integrated approach ZZOP¹). Obtaining a significant number of connections of data used in the planning process with information from external sources was the outcome of the work carried out. They included: Baltic Sea Hydrographic Commission (Baltic Sea Bathymetry Database), Geological Central Database, EEA Database, The European Marine Observation and Data Network – EMODnet, The European Nature Information System – EUNIS, European Atlas of the Sea, General Bathymetric Chart of the Oceans – GEBCO, HELCOM, International Council for the Exploration of the Sea – ICES, Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB), National Centres for Environment Information (National Oceanic and Atmospheric Administration – NOAA), OffshoreGrid, Polish Geological Institute (MIDAS), National Register of Boundaries, and SeaGIS. The database for monitoring should operate based on the fullest set of information possible, therefore carrying out an analysis of opportunities for obtaining data from external sources was crucial. Such an operation will allow us to obtain independence of the information updates necessary in the process of monitoring marine spatial plans, where the database administrator has full control over the use of the previously obtained information in the future work.

DATABASE AND MONITORING

A database for monitoring spatial management plans should always determine the range of rules defining its structure, guidelines for accessing data, their modification and updating. A practical implication is that a general spatial database is a physical Geodatabase showing and collecting the representation of objects existing in the real world, enabling storing and editing of these data (Cichociński, P., Dębińska E., 2010). When implementing the proposed thesis and developing a system for

¹ ZZOP - integrated management of coastal areas

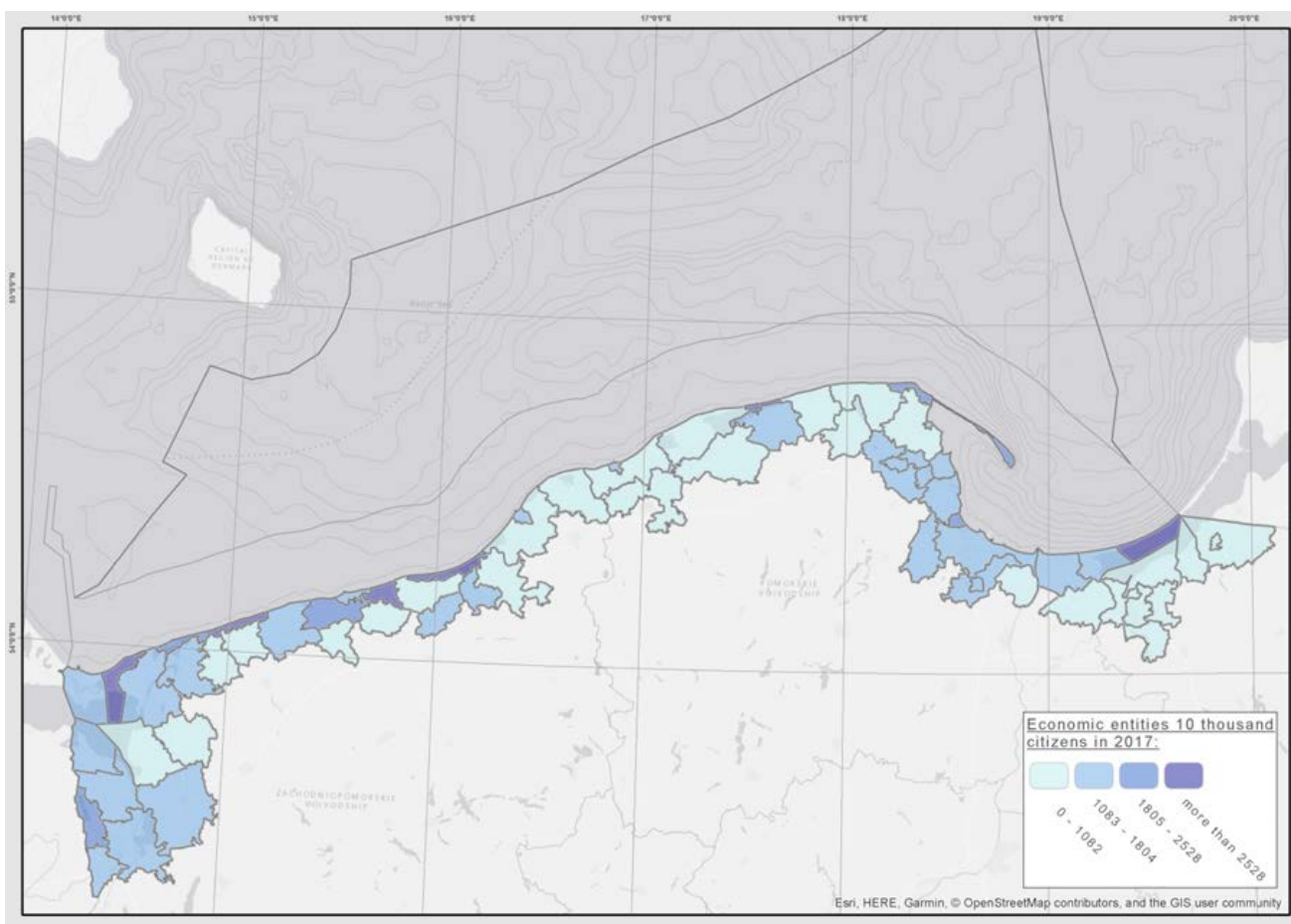


Fig 2. Economic entities 10 thousand citizens based on the data from the BDL (source: author's materials).

the purposes of a monitoring vision, a bi-dimensional database system with a division between “preliminary” and a “final” should be created. This is conditioned by the necessity of updating spatial data, so that the information entered into the monitoring process remains in line with the current state. However, most of the new data will be raw, i.e., will not be adjusted to the required structure of the data management in a base. The need to produce a supporting base called “preliminary” will allow a range of data to be classified and sorted according to the final structure. Projects of databases were designed according to three basic stages of action (Connolly T., Begg C., 2004). An assumption of the first stage of design was building a concept model of data with collecting detailed information regarding the objects located in the base. The second stage consisted in designing proposed relations occurring between them and attributes allowing the features of recorded objects to be maintained. Finally, the last stage was a transformation of the concept data model into a logical database structure and a proposed physical implementation of the logical model of data.

METHODOLOGY OF DEVELOPING STRUCTURES OF THE SYSTEM

Creating a compatible system supporting management of spatial data in a planning process is a hugely useful, but also

complicated task. The main problem resulting from taking control over a significant amount of data is the lack of automation of some processes affecting the improvement in quality of the database used. The idea of works on creating an optimum operating system is to meet a practical purpose, as the created tools will be implemented systematically during the period of verification of plans of marine areas’ management. Any tools and works carried out were set in the context of principles of the spatial information system, with the use of an ESRI software, and precisely –ArcGIS. All concepts were transformed into a form of models involving tools of the ArcGIS software. Thanks to the Unified Modelling Language (UML) and a graphic presentation of description of real database management together with a specification of their connections, any modifications of the structure in these models are possible. The UML allows thoughts to be expressed with the use of models depicting any fragment of reality through the choice of simple measures (tools) that build a collection of readable symbols and marks, the understanding of which should not constitute a problem even for people with minimum knowledge on informatics and functioning of the spatial information systems (Dębińska E., 2006). In the case of statistical data updates, which undoubtedly are an important information in the process of monitoring coastal zone indicators, a particular pattern enabling data to become spatial occurs – the analysis



Fig. 3. Structure of the basic model of automatic statistical data update (source: author's materials).

of spatial phenomena based on the Local Data Bank (further BDL). The database of the Main Statistical Office, due to systematic and periodical updates of the statistical data, is valuable in terms monitoring the coastal zone indicators in many domains. In order to calculate these indicators, a layer containing a spatial administrative division range, municipalities encompassed within the area of interest was created. Each of the coastal municipalities has an allocated unique municipality code, allowing particular municipalities to have an added value. A collection of these spatial data will constitute a base for producing an automatic model for updating the statistical data translated into visualizations in the form of maps. Thanks to adjusting the so-called municipality code, the user will be able to precisely allocate specific data regarding space, in this case—municipalities. The process of choosing particular data on the BDL website is often time-consuming, but thanks to operation of the model presented below, these actions are reduced to a minimum. The map shown (Fig. 2) illustrates a spatial range of the topic of monitoring spatial development plans in the aspect of the dynamics of changes in socio-economic phenomena taking place in coastal areas.

The resource constitutes 68 coastal municipalities, that will be analyzed in relation to monitoring of the coastal zone change indicators. In the layers based on statistical data, the basic information allowing to join generated BDL tables will be a unique code of each municipality within a selected spatial range, necessary to carry out the statistical analysis. The allocation of non-spatial data to geometry allows for an automatic update of data, while maintaining chronological continuity of data issued by the Main Statistical Office. In this case, "Join field" is

the basic ArcToolbox tool, because thanks to this, the model can join automatically the raw input data with the main table. Moreover, it is possible to automatically converse a table generated from a BDL website, available in a standard Excel table format (.xls), to a correct format operated in the ArcGIS context, i.e., a dbf table, with the use of the "Excel to table" tool. A separate part of this tool is the "Spreadsheet choice" parameter; it is helpful when the initial table with statistical data has more than one sheet (data from BDL usually contains two sheets—values of the first correspond to particular municipalities, the other one contains a description). In the case of an automatic choice of a suitable sheet, another, additional models is not considered in the model's operation. Additionally, another tool called "Alter field" was included in order to adjust the name of a new column depending on the needs. To be precise, a default name with new values would have been saved according to its name in a basic BDL table, i.e., "in general". This operating scheme allowed to create a basic frame for a functional model using the Model Builder extension of the ArcGIS software to be generated. Fig. 3 shows a general view of the model's core on which further operations related to expanding its usefulness will be based. This will result in introducing subsequent tools enabling calculations of many indicators responsible for visualization of changes within a one-layer range, like in the chosen case, namely the population dynamics.

Adding further tools from the ArcToolbox package allows to change the model's configuration in such a way that it will meet the required conditions. Inclusion of the "Add field" function allows to add a new column in the layer of analyses of coastal municipalities; depending on the need, it is possible

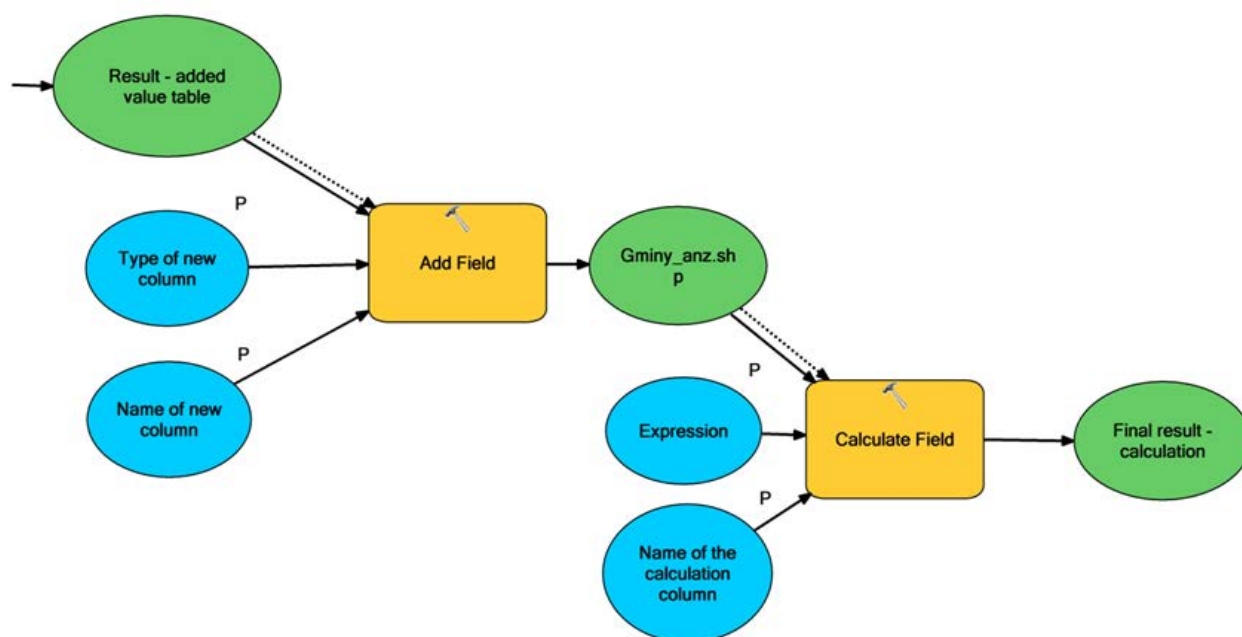


Fig 4. Extension of the model part 1 (source: author's materials).

to add the name and type of new column in the two configured parameters. Another tool used in the model's exemplary extension is "Calculate field", a common mechanism for calculating simple operations in attribute tables of shapefile layers. Thanks to this, values of new columns are calculated based on the existing data contained in the attribute table.

The characteristics of data used for calculating indicators for municipalities, describing changes and types of dynamics of phenomena taking place in coastal areas, are based on multilevel features of statistical values. Apart from the basic value supplemented regularly, i.e., population, the input data taken from the BDL website includes: registered unemployment rate, number of deaths and births, migration index, number of flats or economic entities in municipalities, as well as many other data used to calculate coastal statistical indicators. In such a case, it will be necessary to extend the basic data update model with further tools in order to be able to enter a wide range of spatial data matters into one model at the same time. It has been designed to operate with any number of tables entered by a user, so that it meets the basic requirements for monitoring indicators in the process of spatial planning at sea. In the example presented below, a similar addition of tools corresponding to basic functions of the model can be noted. A sequence of entering a downloaded excel table is repeated, but the order of its joining changes in relation to the basic structure and is moved to the stage of making calculations.

The final look of the model, as well as its principles and operation can change under the influence of modifications resulting from the choice of calculated indicators as well as the very process of evaluation of the monitoring indicators in a planning process. The above example may be widely used in all layers

using external data in the form of tables that can be joined thanks to this tool's functioning. A user is able to configure the model freely by entering the "Input layer" parameter. The aforementioned model belongs to the group of practical tools, which use basic elements of the ArcGIS software operations. It can demonstrate how the elementary principles of the software's operation can be used easily in order to enhance and improve the quality of work of people collecting and processing data in the planning process.

MULTIFUNCTIONAL USE OF THE MODEL BUILDER

Updating data in the process of monitoring is an activity based on a wide range of available spatial data. In such a case, synchronization and strictly determined rules for arranging the input data constitute the foundation of an efficiently working system of their use. Undoubtedly, good knowledge of the ArcGIS software context and the versatility of many spatial data geoprocessing tools allows to systemize and better manage data in a planning process, and proves helpful in the evaluation of spatial development plans. Administering such a great and complex system results in great amounts of data and information inflowing to the created structure. Proper selection of data will result in their correct entry into the base so that they become incorporated into the created and established structures. In such a situation, the user can also use the abilities of the ArcGIS software. Designing the basic tools operating the database in the Model Builder extension is definitely possible. In the case described above, the tool had an operating nature within a narrow range of statistical data. The next model presents a tool that enables data to be automatically allocated to appropriate catalogues in a database. In the case of a one-off

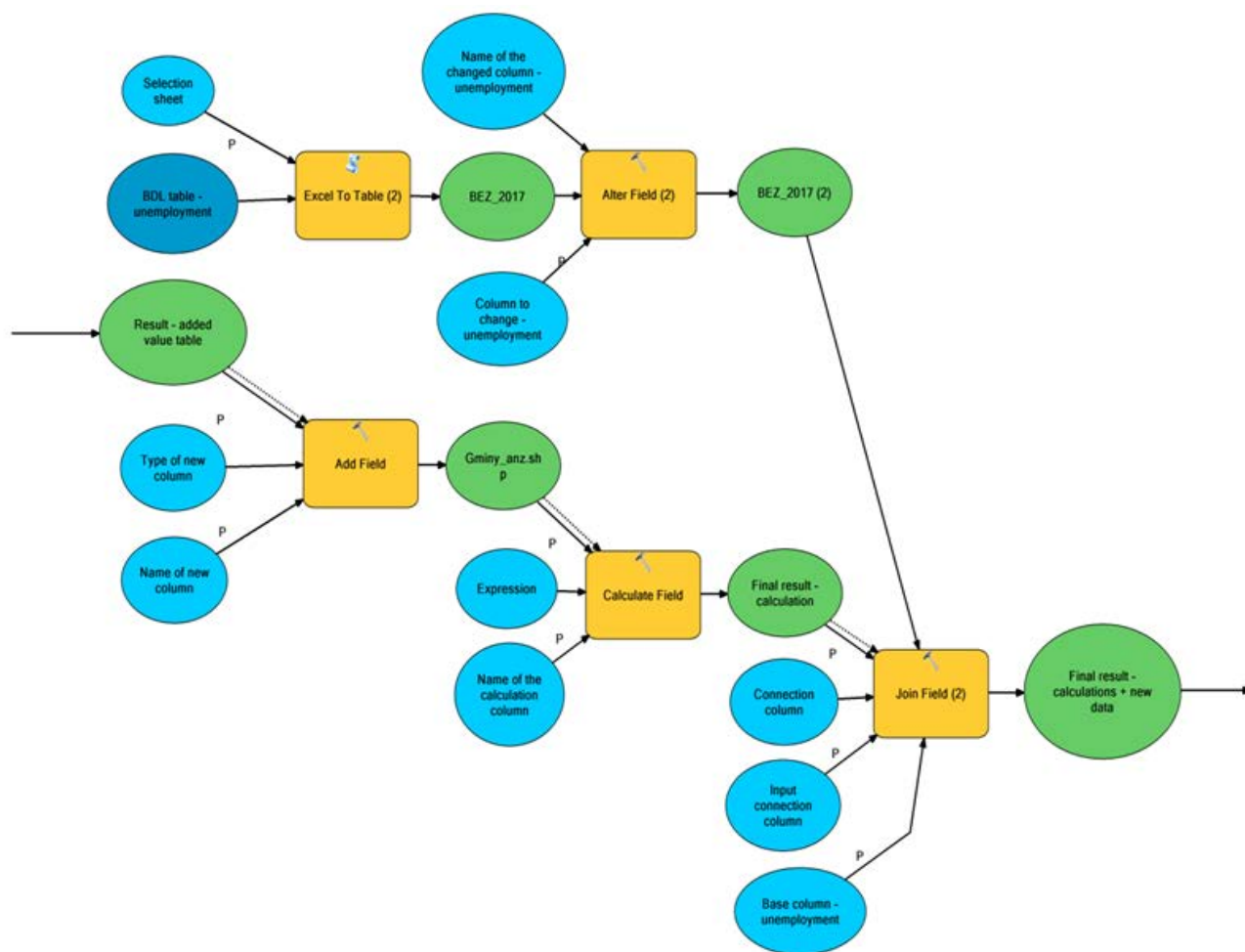


Fig 5. Expanding the model part 2 (source: author's materials).

download of a data package from various fields and subject ranges, use of the tool below (Fig. 6) will be helpful. It helps to adjust the range of many various layers to specific theme sets of spatial data.

The presented model is based on simple, but necessary assumptions regarding the selection and correct choice of ultimate sets of data in a Geodatabase. All three parameters of the model, i.e., "Selected data set", "Input layers", and "Coordinate system" were specified as lists of values, thanks to which the user can determine the ultimate location of new layers in the base for a larger amount of data at the same time. The example of a model supporting the work on data presented below can constitute a base for many modification options created as a result of interpreting tasks by the user or a person managing the database.

SUMMARY

Working with a database is inseparably associated with ongoing improvement of the spatial Geodatabase structures, in a way that it matches to the task given and the general destina-

tion in the best possible manner. Nowadays, opportunities based on data management techniques allow the user to model work based on the available software in a free and potentially unlimited way so that ultimately, it meets the requirements; in this case it will be the process of generating spatial management plans for marine areas and their future evaluation.

The example presented in this paper was tested during the planning works carried out so far. Updating data using the model was successful and met the requirements customized by the database user. The results are satisfactory, the tool performed the task correctly, in the shortest possible time, leaving a proper result of its operation. Opportunities offered by the software allow to carry out much more efficient work related to updating data tailored to the process of monitoring of spatial management plans. They allow for an ergonomic system improving the functioning of a database which is necessary for a correct evaluation of plans to be developed. Thanks to the knowledge obtained so far as well as technical opportunities, the future of monitoring spatial plans of marine areas has been directed to the right track for its correct implementation.

This text describing issues related to the use of potential tools

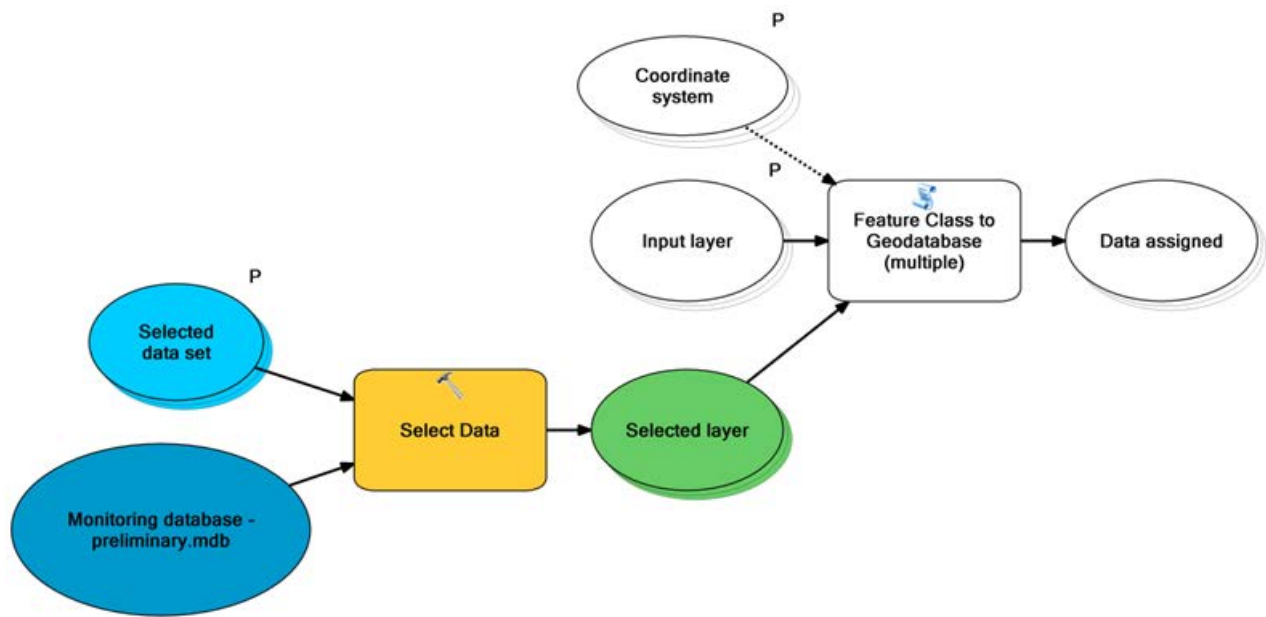


Fig 6. Automatic allocation of the newly obtained data (source: author's materials).

which may improve the quality of work during the planning process has been written based on the scientific research carried out in the Maritime Institute in Gdańsk. All examples in the text have been chosen from the work range including the greater part of the raised issue, namely creating a data management system in a planning process. This paper presents other examples of the use of the ArcGis software tools, which may be used in the future monitoring process. These tools will be gradually tested, checked and improved during the current planning process, with the use of knowledge associated with the issues of correct spatial management principles, and in the process of deepening knowledge and creating optimal

canons of the monitoring of plans for spatial management of coastal areas in Poland. It must be noted that the above paper focuses mainly on solutions supporting the improvement of work related to the creation and evaluation of spatial management marine plans in Poland in a rather local manner. All the presented models are based on the use of elementary knowledge related to the work of the Model Builder tool, where simple and applied solutions have been used. Its purpose is to illustrate the potential opportunities created by the software in its use for planning work, as inspiration for further research on improvement of the database's functioning within the monitoring process.

References:

- [1] Cichociński P., Dębińska E., 2010, Baza danych przestrzennych jako podstawa do planowania wielofunkcyjnego rozwoju obszarów wiejskich, Wydawnictwo PAN, Cracow, p. 159–167.
- [2] Connolly T., Begg C., 2004, Systemy baz danych. Praktyczne metody projektowania, implementacji i zarządzania. Volume 1, Wydawnictwo RM, Warsaw.
- [3] Dębińska E., 2006, Modelowanie pojęciowe w języku UML dla potrzeb wyceny nieruchomości, Polskie Towarzystwo Informatyki Przestrzennej – Roczniki Geomatyki, Cracow.
- [4] Gaździcki J., 2001, Leksykon geomatyczny, Wydawnictwo PTIP, Warsaw.
- [5] Matczak M., Szeffler K., 2011, Planowanie przestrzenne obszarów morskich w działaniach Instytutu Morskiego w Gdańsku. Instytut Morski w Gdańsku jako ośrodek przetwarzania i priorytetyzacji informacji. [in:] Dendewicz S. (ed.): II International Conference „Transgraniczne planowanie przestrzenne” [ang. transnational spatial planning]. Zagospodarowanie przestrzenne w korytarzu Odry oraz planowanie przestrzenne na obszarach morskich, Regionalne Biuro Gospodarki Przestrzennej Województwa Zachodniopomorskiego, Szczecin.
- [6] Matczak M., Zaucha J., 2009, Main Potential and Conflicts in Polish Sea Space. [in:] Cieślak A. (ed.): Compendium on Maritime Spatial Planning Systems in the Baltic Sea Region Countries as Result of Co-Operation within the Framework of Vision and Strategies around the Baltic Sea, Maritime Institute in Gdańsk, Gdańsk.
- [7] Matczak M., Zaucha J., 2011, Developing a Pilot Maritime Spatial Plan for the Southern Middle Bank, BaltSeaPlan report t.10, Maritime Institute in Gdańsk, Gdańsk.
- [8] Zaucha J., Matczak M. (eds.), Studium Uwarunkowań Zagospodarowania Przestrzennego Polskich Obszarów Morskich wraz z analizami przestrzennymi, Maritime Institute in Gdańsk, Gdańsk
- [9] Matczak M., Szeffler K., Zaucha J., 2016, Dynamika zmian luk informacyjnych w planowaniu przestrzennym obszarów morskich w Polsce w latach 2008–2015, „Barometr regionalny” Volume 14 No. 2, p. 63–71.
- [10] Pardus J., 2016, „Standard danych GIS w ochronie przyrody” w opracowaniu projektów planów ochrony morskich obszarów Natura 2000, Maritime Institute in Gdańsk, Gdańsk.
- [11] Szydłowski Ł., 2018, Baza danych do monitoringu planów zagospodarowania przestrzennego polskich obszarów morskich, Maritime Institute in Gdańsk, Gdańsk.
- [12] Turski J., 2017, Planowanie Przestrzenne Obszarów Morskich oraz omówek jadalny i racicznica zmienna. Studium przypadku dla Polskiego wybrzeża oparte na zestawieniu istniejących przykładów z Kanady i Australii, Maritime Institute in Gdańsk, Gdańsk.
- [13] Zaucha J., 2009a, The Marine Economy in the Face of New Development Trends (Spatial Aspects). [in:] Markowski T. (ed.): The Polish Spatial Development Perspectives, Studia Regionalna vol. 22, Polska Akademia Naukowa, Warsaw.
- [14] Zaucha J., 2009b, Planowanie przestrzenne obszarów morskich. Polskie uwarunkowania i plan pilotażowy, Maritime Institute in Gdańsk, Gdańsk.
- [15] Zaucha J., 2012, Offshore Spatial Information – Maritime Spatial Planning in Poland, „Regional Studies”, No. 46 (4), p. 459–473.
- [16] Zaucha J., 2014, Sea Basin Maritime Spatial Planning: A Case Study of the Baltic Sea Region and Poland, „Maritime Policy”, No. 50, p. 34–45.

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