

Criteria for the conservation status assessment of the marine habitats. Case study: habitat 1160 'Large, shallow inlets and bays'

Kryteria oceny stanu ochrony siedlisk morskich na przykładzie siedliska 1160 'Duże płytkie zatoki'

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Abstract: Planning effective conservation measures in relation to particular habitats and species, which are the subjects of protection, require, above all, assessing their conservation status and identifying factors that have influenced this state.

Although the scope of monitoring and the number of investigated species and habitats from Annex I, II, IV and V of the Habitats Directive is gradually increasing, no formal assessment of 1160 habitat has been performed so far. Methodological guidelines don't include any assumptions to investigation and valuation of this habitat.

In Europe the habitat 1160 is protected in 462 Natura 2000 sites. Due to its significant structural and functional diversity in particular European countries, there is a necessity of working out specific site indices for the state assessment.

The aim of this work was the review of methods used in the 'Large, shallow inlets and bays' state assessment in selected European countries and presentation the assumptions for the assessment in Polish special area of conservation: PLH220032 Puck Bay and Hel Peninsula.

Keywords: Natura 2000 network, habitat 1160 'Large, shallow inlets and bays'; PLH 220032 The Puck Bay and Hel Peninsula; conservation status assessment; methodology

Streszczenie: Planowanie skutecznych środków ochronnych w odniesieniu do poszczególnych siedlisk i gatunków, wymaga przede wszystkim oceny stanu ich zachowania oraz identyfikacji czynników, które wpłynęły na ten stan. Pomimo tego, że zakres monitoringu siedlisk i gatunków z załączników I, II, IV i V Dyrektywy siedliskowej stale się rozszerza, w Polsce dotychczas nie przeprowadzono formalnej oceny stanu siedliska morskiego 1160 'Duże płytkie zatoki', a przewodniki metodyczne nie zawierają odpowiednich wytycznych.

W Europie siedlisko 1160 jest objęte ochroną w 462 obszarach Natura 2000. Ze względu na znaczne zróżnicowanie strukturalne i funkcjonalne siedliska w poszczególnych rejonach istnieje konieczność wypracowania specyficznych dla danego miejsca wskaźników do oceny jego stanu.

Celem pracy jest przegląd kryteriów stosowanych do oceny stanu siedliska 1160 w wybranych krajach oraz prezentacja założeń do przeprowadzenia takiej oceny w specjalnym obszarze ochrony siedlisk PLH220032 Zatoka Pucka i Półwysep Helski.

Słowa kluczowe: Sieć Natura 2000; siedlisko 1160 'Duże płytkie zatoki'; obszar PLH 220032 Zatoka Pucka i Półwysep Helski; ocena stanu ochrony; metodyka

Introduction

Article 11 of the Habitats Directive (Directive 92/43/EEC) requires EU member states to monitor (observe) the conservation status of natural habitats (Annex I) and species of European interest (Annex II, IV and V). In order to comply with the above requirements, in 2006, developing and testing methodology of assessment for first group of the conservation subjects was commissioned in Poland by the Chief Inspector for Environmental Protection.

Although the scope of monitoring in Poland and the number of investigated species and habitats from Annex I, II, IV and V of the Habitats Directive is gradually increasing, no formal assessment of 1160 habitat has been performed so far. In the recent report to the European Commission: 'Assessment of marine habitats in the Baltic region' (www 1), the status of the habitat 1160 was assessed (reported) as xx – unknown. Also 'Guidelines for monitoring of the natural habitats' (Mróz 2010) does not include any proposals of appropriate methodology.

The habitat 'Large, shallow inlets and bays' (1160) is protected in 462 Natura 2000 sites (www 2). In Poland, habitat 1160 occurs only in one Natura 2000 site – PLH220032 Puck Bay and Hel Peninsula.

The habitat 1160 is widespread throughout the coasts of Europe, although its specific character varies significantly from region to region (www 3).

For instance in the UK, three main sub-types 1160 can be identified (www 3):

- ◆ Embayment – A type of marine inlet where the line of the coast typically follows a concave sweep between rocky headlands, sometimes with only a narrow entrance to the embayment.
- ◆ Fjardic sea loch – A series of shallow basins connected to the sea via shallow, sometimes intertidal, sills. Fjards are found in areas of low-lying ground which have been subjected to glacial scouring. They have a highly irregular outline, no main channel and lack the high relief and U-shaped cross-section of fjardic sea lochs.
- ◆ Ria – A drowned river valley in an area of high relief; most have resulted from the post-glacial rise in relative sea level. In Scotland this sub-type is called a voe.

These shallow indentations are generally sheltered from wave action and contain a great diversity of sediments and substrates with a well-developed zonation of benthic communities. These communities feature generally high biodiversity. The range of shallow water is sometimes defined by the distribution of the Zosteretea and Potametea associations (Interpretation Manual 2013). The biological elements of this habitat from Annex I Habitats Directive can therefore be exposed to salinities from 34 PSU to 8 PSU depending on location. The bottom types can vary from stony or sandy sediments to soft

muddy bottom. Exposure to wind and fresh water run-off can also differ. Together with the previously described large differences in salinity, this can shape different animal communities and plant cover in this habitat. The definition of 1160 habitat is so broad that other smaller habitats from Annex 1 can be found within it. The major anthropogenic pressure factors are eutrophication, fishing with towed bottom gears, extraction of sand, and hazardous substances. Introduced invasive non-endemic species may influence the quality of the habitat. Human induced climate change (global warming) may also turn out to be a pressure factor in the future (NERI Technical Report 2004).

The above conditions have caused the necessity of working out specific indices for assessment of the state of 'Large, shallow inlets and bays' (1160) in particular region.

The aim of this paper is to review the methods of habitat 'Large, shallow inlets and bays' conservation status assessment, applied in selected European countries and the presentation of the assumptions for development of such methodology for this habitat in the Polish marine areas.

General approach to the habitats conservation status assessment

'Favourable Conservation Status' (FCS) is the overall objective to be reached for all habitat types and species of community interest and it is defined in Article 1 of the Habitats Directive. It can be described as a situation where a habitat type or species is prospering (in both quality and extent/population) and with good prospects in future as well. The fact that a habitat or species is not threatened (i.e. not faced by any direct extinction risk) does not mean that it is in favourable conservation status. The target of the Directive is defined in positive terms, oriented towards a favourable situation, which needs to be defined, reached and maintained. This is therefore more than avoiding extinctions (Assessment and reporting 2011).

The overall conservation status assessment of particular habitat consists of the evaluation of three separate parameters (Joint Nature Conservation Committee 2007, Mróz 2010, Regulation 1):

1. range/area – evaluation of this parameter results based on data on surface area of the habitat, its fragmentation and isolation.
2. specific structures and functions – based on information on the habitat condition and the status of typical species associated with the habitat. Structure includes the underlying geological structures, first of all sediments; hydrological features e.g. water transparency; and biogenic components, such as vegetation structure etc. Function includes the natural physical, chemical and biological processes. To precisely determine this parameter a number of indicators should be applied.

3. future prospects – based on the assessment conservation measures carried out already in place, the potential future threats to the habitat.

In order to determine the favourable conservation status of a habitat, the measures of both physical and biological features that define that habitat should be applied. These measures help to delineate and determine the quality of a habitat. The range of physical and biological parameters measured will depend largely on the habitat type and its location (Lawler et al. 2015). Moreover, it is recommended to determine the typical species of each habitat and to consider them in the assessment of the structure and function. Selected typical species should be good indicators for favourable habitat quality, sensitive to environmental changes, and observable by non-destructive means. Typical species are often not constant throughout the range of the specific habitat type and can be defined at regional or national level for the purpose of assessing conservation status (Joint Nature Conservation Committee 2007). Besides, a number of additional factors, which had a significant influence on the way the viability of the habitat should be taken into account e.g. the degree of habitat fragmentation and isolation (ibidem).

Table I provides the general features in assessing the status of the habitat 'Large, shallow inlets and bays' (1160), includes both physical and biological group.

Review of the 1160 habitat assessment methods applied in selected European countries

As it was mentioned above, the character of habitat 'Large, shallow inlets and bays' (1160) varies significantly from region to region. Moreover, this habitat may incorporate other

Tab. I. The principles of assessment of the habitat 'Large, shallow inlets and bays' (1160) status

GROUP	FEATURE	ASSESSMENT
Physical	Area	Surface of the habitat, based on the geomorphological characteristics of the habitat
	Structure/function	Non specified
Biological	Species communities	Macrozoobenthos communities Fish communities Other fauna Plants

The source: Lawler et al. 2015.

habitats from Annex 1 Habitats Directive e.g. 'sandbanks', 'mudflats and sandflats', 'estuaries' or 'reefs' within its area. That's the reason why a different approach of the assessment methods has been applied in European countries.

In Denmark indicators proposed for assessing conservation status of habitat 'Large, shallow inlets and bays' are listed according to possible anthropogenic pressure factors (Table II).

In Germany the assessment scheme for habitat 1160 is comprehensive and includes habitat structure and function criteria as well as the list of typical species and finally threats and disturbance (Table III).

Polish proposition to the 'Large, shallow inlets and bays' conservation status assessment

In Poland, the first proposal of methodology regarding the 'Large, shallow inlets and bays' (1160) conservation status

Tab. II. Danish proposals for potential indicators for assessing conservation status of the habitat 'Large, shallow inlets and bays'

PRESSURE FACTORS	INDICATOR	UNIT OF MEASUREMENT	METHOD FOR DEVELOPING INDICATORS
Extinction of sand, fishing with bottom toward grass	Macrofauna density, biomass in area, and species composition	N ind. · m ⁻² , g · m ⁻²	Empirical modelling
	Vegetation present		Old maps
Eutrophication, non-endemic species	Macrofauna density and biomass per area	N ind. · m ⁻² , g · m ⁻²	–
	Vegetation coverage and depth distribution	%, m ² , m	–
	Species diversity	Number of species, various indices, similarity	–
Climat change (global warming)	Species composition	Similarity	–
Hazardous substances	Concentration in biota and sediment	Concentration	–
	Reproductive disorders in <i>Viviparous blenny</i> – general effect indicator	Activity/frequency	Activity/frequency levels compared to reference area
	Specific effects for PAH-like substances	Activity/frequency	Activity/frequency levels compared to reference area
	Imposex and intersex in snails (specific effect indicator for TBT)	Indices	–
	Species composition	Similarity	–

Source: NERI Technical Report (2004)

Tab. III. Criteria of the 'Large, shallow inlets and bays' state assessment applied in Germany

CRITERIA	DESCRIPTION
Habitat structure	Sediments structure
	Hydrology and geomorphology
	Floodplain
	Macrophytes
	Macrozoobenthos (Species composition, abundance, biomass)
	Avifauna and ichthyofaunal
Typical species	Macrophytes:
	♦ North sea: <i>Zostera marina</i> , <i>Zostera noltii</i>
	♦ Western Baltic Sea: <i>Ceramium rubrum</i> , <i>Delesseria sanguinea</i> , <i>Enteromorpha intestinalis</i> , <i>Fucus serratus</i> , <i>Furcellaria lumbricalis</i> , <i>Laminaria saccharina</i> , <i>Ulva lactuca</i> , <i>Zanichellia palustris</i> , <i>Zostera marina</i> , <i>Zostera noltii</i>
	♦ Eastern Baltic Sea: <i>Ceramium rubrum</i> , <i>Chara baltica</i> , <i>Chara aspera</i> , <i>Chara canescens</i> , <i>Chara tomentosa</i> , <i>Enteromorpha intestinalis</i> , <i>Fucus vesiculosus</i> , <i>Furcellaria lumbricalis</i> , <i>Potamogeton maritima</i> , <i>Potamogeton pectinatus</i> , <i>Ruppia cirrhosa</i> , <i>Ruppia maritima</i> , <i>Tolipella nidifica</i> , <i>Ulva lactuca</i> , <i>Zanichellia</i> , <i>Zostera marina</i> , <i>Zostera noltii</i>
	Macrozoobenthos:
	♦ North Sea: <i>Macoma balthica</i> , <i>Abra alba</i> , <i>Balanus crenatus</i> , <i>Bathyporeia elegans</i> , <i>Bathyporeia pelagica</i> , <i>Crangon crangon</i> , <i>Ensis directus</i> , <i>Gastrosaccus spinifer</i> , <i>Lanice conchilega</i> , <i>Macoma balthica</i> , <i>Magelona johnstoni</i> , <i>Mytilus edulis</i> , <i>Nephtys hombergii</i> , <i>Ophelia limacina</i> , <i>Polydora holmquisti</i> , <i>Sagartia troglodytes</i> , <i>Scoloplos armiger</i> , <i>Spiophanes bombyx</i> , <i>Tellina fabula</i> , <i>Tubificoides (Peloscolex) benedii</i>
♦ Western Baltic Sea: <i>Abra alba</i> , <i>Anatides mucosa</i> , <i>Arctica islandica</i> , <i>Arenicola marina</i> , <i>Bylgides sarsi</i> , <i>Capitella capitata</i> , <i>Cerastoderma lamarckii</i> , <i>Ciona intestinalis</i> , <i>Corophium crassicornis</i> , <i>Cyathura carinata</i> , <i>Diastylis rathkei</i> , <i>Dipolydora quadrilobata</i> , <i>Eteone cf. longa</i> , <i>Gastrosaccus spinifer</i> , <i>Halicryptus spinulosus</i> , <i>Hediste diversicolor</i> , <i>Heteromastus filiformis</i> , <i>Peringia ventrosa (Hydrobia)</i> , <i>Peringia ulvae (Hydrobia)</i> , <i>Lagis koreni</i> , <i>Macoma balthica</i> , <i>Manayunkia aestuarina</i> , <i>Microdeutopus gryllotalpa</i> , <i>Mya arenaria</i> , <i>Mya truncata</i> , <i>Mysella bidentata</i> , <i>Mytilus edulis</i> , <i>Nemertea undet.</i> , <i>Nephtys caeca</i> , <i>Nephtys ciliata</i> , <i>Nephtys hombergii</i> , <i>Parvicardium ovale</i> , <i>Polydora ciliata</i> , <i>Pygospio elegans</i> , <i>Scoloplos armiger</i> , <i>Scrobicularia plana</i> , <i>Streblospio shrubsolei</i> , <i>Terebellides stroemi</i> , <i>Trochochaeta multisetosa</i> , <i>Tubificoides benedii</i> , <i>Varicorbula gibba</i>	
♦ Eastern Baltic Sea: <i>Arenicola marina</i> , <i>Cerastoderma lamarckii</i> , <i>Ciona intestinalis</i> , <i>Corophium volutator</i> , <i>Cyathura carinata</i> , <i>Cyathura cyathura</i> , <i>Hediste diversicolor</i> , <i>Heteromastus filiformis</i> , <i>Peringia ulvae (Hydrobia)</i> , <i>Peringia ventrosa (Hydrobia)</i> , <i>Macoma balthica</i> , <i>Manayunkia aestuarina</i> , <i>Marenzelleria viridis</i> , <i>Mya arenaria</i> , <i>Mytilus edulis</i> , <i>Pygospio elegans</i> , <i>Scoloplos armiger</i> , <i>Sphaeroma hookeri</i> , <i>Tubifex costatus</i>	
Fish:	
♦ North Sea: <i>Platichthys flesus</i> , <i>Lampetra fluviatilis</i> , <i>Hyperoplus lanceolatus</i> , <i>Callionymus lyra</i> , <i>Buglossidium luteum</i> , <i>Eutrigla gurnardus</i> , <i>Hyperoplus lanceolatus</i> , <i>Liparis liparis</i> , <i>Ammodytes tobianus</i> , <i>Trachinus vipera</i> , <i>Limanda limanda</i> , <i>Arnoglossus laterna</i> , <i>Microstomus kitt</i> , <i>Pleuronectes platessa</i> , <i>Taurulus bubalis</i> , <i>Cyclopterus lumpus</i> , <i>Zoarcetes viviparus</i> , <i>Pholis gunellus</i> , <i>Gasterosteus aculeatus</i> , <i>Clupea harengus</i> , <i>Syngnathus rostellatus</i> , <i>Pomatoschistus minutus</i> , <i>Myxocaphalus scorpius</i> , <i>Agonus cataphractus</i> , <i>Pomatoschistus microps</i>	
♦ Eastern Baltic Sea: <i>Pholis gunellus</i> , <i>Gasterosteus aculeatus</i> , <i>Platichthys flesus</i> , <i>Perca fluviatilis</i> , <i>Liparis liparis</i> , <i>Esox lucius</i> , <i>Clupea harengus</i> , <i>Gadus morhua</i> , <i>Nerophis ophidion</i> , <i>Ctenolabrus rupestris</i> , <i>Pomatoschistus minutus</i> , <i>Pleuronectes platessa</i> , <i>Cyclopterus lumpus</i> , <i>Spinachia spinachia</i> , <i>Pomatoschistus microps</i> , <i>Stizostedion lucioperca</i> , <i>Cobiusculus flavescens</i>	
Birds:	
♦ North Sea: <i>Sterna hirundo</i> , <i>Sterna paradisaea</i> , <i>Gavia arctica</i> , <i>Gavia stellata</i> , <i>Alca torda</i> , <i>Melanitta nigra</i> , <i>Uria aalga</i> , <i>Calidris alpina</i> , <i>Haematopus ostralegus</i> , <i>Tadorna tadorna</i> , <i>Tringa erythropus</i> , <i>Somateria mollissima</i> , <i>Numenius arquata</i> , <i>Tringa nebularia</i> , <i>Pluvialis squatarola</i> , <i>Calidris canutus</i> , <i>Anas crecca</i> , <i>Larus ridibundus</i> , <i>Anas clypeata</i> , <i>Anas penelope</i> , <i>Limosa lapponica</i> , <i>Numenius phaeopus</i> , <i>Branta bernicla</i> , <i>Tringa totanus</i> , <i>Recurvirostra avosetta</i> , <i>Charadrius hiaticula</i> , <i>Anas strepera</i> , <i>Calidris ferruginea</i> , <i>Larus argentatus</i> , <i>Anas acuta</i> , <i>Anas platyrhynchos</i> , <i>Larus canus</i> , <i>Calidris minuta</i>	
♦ Eastern Baltic Sea: <i>Aythya marila</i> , <i>Anser albifrons</i> , <i>Somateria mollissima</i> , <i>Clangula hyemalis</i> , <i>Mergus merganser</i> , <i>Anser anser</i> , <i>Podiceps cristatus</i> , <i>Cygnus olor</i> , <i>Mergus serrator</i> , <i>Aythya fuligula</i> , <i>Podiceps griseogenus</i> , <i>Anser fabilis</i> , <i>Bucephala clangula</i> , <i>Cygnus cygnus</i> , <i>Melanitta nigra</i>	
Mammals:	
♦ North Sea: <i>Halichoerus grypus</i> , <i>Phocoena phocoena</i> , <i>Phoca vitulina</i>	
Threats and disturbance	Biogenic substances, dumping, water construction, drainage, oil and gas searching and extracting, sediments extracting, fishery, tourism and recreation, non-indigenous invasive species.

Table IV. 'Large, shallow inlets and bays' (1160) state assessment scheme – Polish proposition

CRITERIA	INDICATOR AND DESCRIPTION
Area	Surface of the habitat – based upon seasonal measurement of coastal line done by Maritime Office in Gdynia.
Habitat structure and function	<p>Ecological status of the water according to the Water Framework Directive (2000/60/WE) in two transitional waters covering habitat 'Large, shallow bay' – PLTWII: inner Puck Bay, PLTWIII: outer Puck Bay (Regulation 2). Assessment focuses on biological parameters (macrophytes, macrozoobenthos, ichthyofauna, phytoplankton) as well as on supporting hydromorphological and physicochemical elements (hydrological regime; oxygen, organic carbon, biogenic substances concentrations; water transparency; pH).</p> <p>Salinity Natural salinity in the Puck Bay varies from 4,27 PSU to 8,15 PSU, on average 7,4 PSU.</p> <p>State of the sandbank – assessment of the anthropogenic pressure on the sandbank in high season. Occurrence of the reed community in the coastal zone – the ratio of the length of the coastal zone cover with reed to the length of the whole coastal zone within habitat 'Large, shallow bay'.</p>
Typical species	<p>Occurrence of the viable populations of some typical fish species – roach <i>Rutilus rutilus</i>, pike <i>Esox Lucius</i>, perch <i>Perca fluviatilis</i>, Baltic whitefish <i>Coregonus lavaretus</i>, sea trout <i>Salmo trutta</i>, broadnosed pipefish <i>Syngnathus typhle</i>, straightnose pipefish <i>Nerophis ophidion</i>.</p> <p>Occurrence of the typical macrophytes species – <i>Zostera marina</i>, <i>Chara spp.</i>, <i>Zannichellia palustris</i>, <i>Potamogeton spp.</i></p>
Threats and disturbance	<p>Non-indigenous species (NIS) – trends in arrival of new NIS, and impact assessment based on 'Biopollution level index'.</p> <p>Indicator of anthropogenic pressure in the coastal zone – the ratio of the length of the coastal zone with hard engineering constructions (seawalls, breakwaters, jetties etc.) or buildings that change the natural character of the coast, to the length of the whole coastal zone within habitat 'Large, shallow bay'.</p> <p>Moreover, the following threats and pressures should be taken into account in the assessment: marine constructions and investments, water pollution, tourism and recreation.</p>

assessment, was developed within the project 'Development of conservation plans for Natura 2000 sites located in the Gulf of Gdańsk', commissioned by Maritime Office in Gdynia (Błęńska et al. 2014). As it was mentioned above, in Poland, the habitat 1160 occurs only in one Natura 2000 site – PLH220032 The Puck Bay and Hel Peninsula. Distinguishing feature of the natural communities in this area is high biodiversity. Macrophytes form multispecies underwater meadows. The habitat-forming reed community occurs in the coastal zone. Fish fauna consist of freshwater species such as: roach, pike and perch, as well as marine species, among others: broadnosed pipefish, flounder. Important element of the habitat is sandbank called 'Tern Shoal', which is the resting and feeding place for birds and potentially for seals (Michałek & Kruk-Dowgiało 2014, Kruk-Dowgiało & Szaniawska 2008, Warzocha 2004). On the other hand, the Puck Bay area remains under great anthropogenic pressure. Due to unique natural, cultural and landscape heritage, different forms of tourism are the most rapidly growing sector of the economy in the region. In the past, the Puck Bay was productive fishing ground what is reflected in the number of fishing ports. There are two commercial harbours in the immediate vicinity. Other significant activities in the area of habitat 1160 are: coastal zone protection, military activities and public utilities (Michałek & Kruk-Dowgiało 2015, Błaszowska 2007). All these conditions had to be taken into account while developing the list of indicators for the habitat state assessment. Ultimately the scheme proposed in this work is comprehensive and includes habitat structures and functions criteria as well as the list of typical species and threats and disturbance (Table IV).

Summary and conclusions

The habitat 'Large, shallow inlets and bays' occurs in considerable number of Natura 2000 sites and it varies from region to region. It consists of very different biological communities that shape its structure and function and should be taken into account in the assessment. The assessment schemes have to be comprehensive and should include the list of typical species as well as threats and disturbance.

A number of different approaches to determine the state of conservation, as well as the different criteria for favourable state of conservation objectives have been applied in the EU member states. Each country has its own interpretation. In Denmark the features of the conservation status of the habitat 'Large, shallows inlets and bays' are listed according to the possible anthropogenic pressure factors. In Germany the assessment scheme is comprehensive and includes physical and biological parameters.

The Polish proposition is close to the German one, it focuses on site specific list of typical species. It includes also the assessment of the ecological status of water and assessment of the site specific elements of the habitat such as: reed community and sandbank 'Tern Shoal'.

To accomplish EU demands regarding favourable status of habitats it is recommended that the institutions responsible for environmental monitoring include the habitat 'Large, shallow inlets and bays' in the methodological guidance and national monitoring programs.

References:

- [1] Assessment and reporting under Article 17 of the Habitats Directive Explanatory. (2011). Notes & Guidelines for the period 2007-2012. 123 pp.
- [2] Błaszczowska, B. 2007. Plan lokalnej współpracy na rzecz ochrony obszaru Natura 2000. Zatoka Pucka i Półwysep Helski. Wykonano w ramach projektu TFPL2004/016-829.03.03. Gdańsk. 65 pp.
- [3] Błęńska, M., Boniecka, H., Gawlik, W., Kruk-Dowgiało, L., Kuczyński, T., Michałek, M., Osowiecki, A., Olenyż, M., Opięta, R., Piecki, P., Szulc, M., Solon, J., Falkowski, M., Fac-Beneda, J., Meissner, W., Nowacki, J. (2014). Zestawienie metodyk do oceny stanu ochrony siedlisk przyrodniczych i gatunków (z wyjątkiem ptaków) w rejonie Zatoki Puckiej i Ujścia Wisły. Wykonano na zlecenie Urzędu Morskiego w Gdyni w ramach projektu pn. Opracowanie projektów planów ochrony obszarów Natura 2000 w rejonie Zatoki Gdańskiej i Zalewu Wiślanego. WW IM w Gdańsku Nr 6825. 52 pp.
- [4] Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) L 206/7.
- [5] Interpretation Manual of European Union Habitats, version EUR 28 (2013).
- [6] Joint Nature Conservation Committee. (2007). Second Report by the UK under Article on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough: JNCC. Available from: www.jncc.gov.uk/article17.
- [7] Kruk-Dowgiało, L., Szaniawska, A. (2008). Gulf of Gdańsk and Puck Bay. In: Ecology of Baltic Coastal Waters. Ecological Studies 197, 139-165.
- [8] Lawler, M., Harris, P.T., Rommens, W., Sørensen, M. (2015). International practices on setting criteria for favourable conservation status and baseline status of marine habitats. EEA Grant project number EE02-0012GRID- Arendal. 39 pp.
- [9] Michałek, M., Kruk-Dowgiało, L. (Ed.). (2014). Program zarządzania dla rejonu Zatoka Pucka. Praca zbiorowa. Wykonano na zlecenie Urzędu Morskiego w Gdyni w ramach
- Zadania pn.: Opracowanie projektów planów ochrony obszarów Natura 2000 w rejonie Zatoki Gdańskiej i Zalewu Wiślanego. WW IM w Gdańsku Nr 6855. 396 pp.
- [10] Michałek, M., Kruk-Dowgiało, L. (2015). Public consultations as a part of the planning protection of Natura 2000 sites – the Puck Bay case study. Ecological Engineering. Vol. 42, 95-104.
- [11] Mróz, W. (Ed.) (2010). Monitoring siedlisk przyrodniczych. Przewodnik metodyczny. Cz. I. GIOŚ, Warszawa. ISBN: 978-83-61227-52-6. 321 pp.
- [12] NERI Technical report. (2004). No. 488. Tools to assess the conservation status of marine Annex 1 habitats in Special Areas of Conservation. ISBN 87-7772-800-9. 97 pp.
- [13] Regulation 1. Regulation of Ministry of the Environment of 30 March 2010 on drawing up a draft conservation plan for Natura 2000 area (Journal of Laws No 64, item 401).
- [14] Regulation 2. Regulation of Ministry of the Environment of 22 October 2014 on ecological state classification and environmental standards for priority substances (Journal of Law 2014, item 1482).
- [15] Warzocha, J. 2004. Duże płytkie zatoki. In: Siedliska morskie i przybrzeżne, nadmorskie i śródlądowe solniska i wydmy. Poradnik ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny. Tom 1. Red. Herbich J. Ministerstwo Środowiska. Warszawa, 54-60.
- [16] [www 1. http://siedliska.gios.gov.pl/index.php/projekty-raportow-do-komisji-europejskiej-za-lata-2007-2012](http://siedliska.gios.gov.pl/index.php/projekty-raportow-do-komisji-europejskiej-za-lata-2007-2012).
- [17] [www 2. http://eunis.eea.europa.eu/habitats/10008](http://eunis.eea.europa.eu/habitats/10008).
- [18] [www 3. http://jncc.defra.gov.uk/ProtectedSites/SACselection/habitat.asp?FeatureIntCode=H1160](http://jncc.defra.gov.uk/ProtectedSites/SACselection/habitat.asp?FeatureIntCode=H1160).
- [19] [www 4. https://www.bfn.de/fileadmin/MDb/documents/themen/natura2000/marin_11.pdf](https://www.bfn.de/fileadmin/MDb/documents/themen/natura2000/marin_11.pdf)

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