

1110 Sandbanks which are slightly covered by sea water all the time

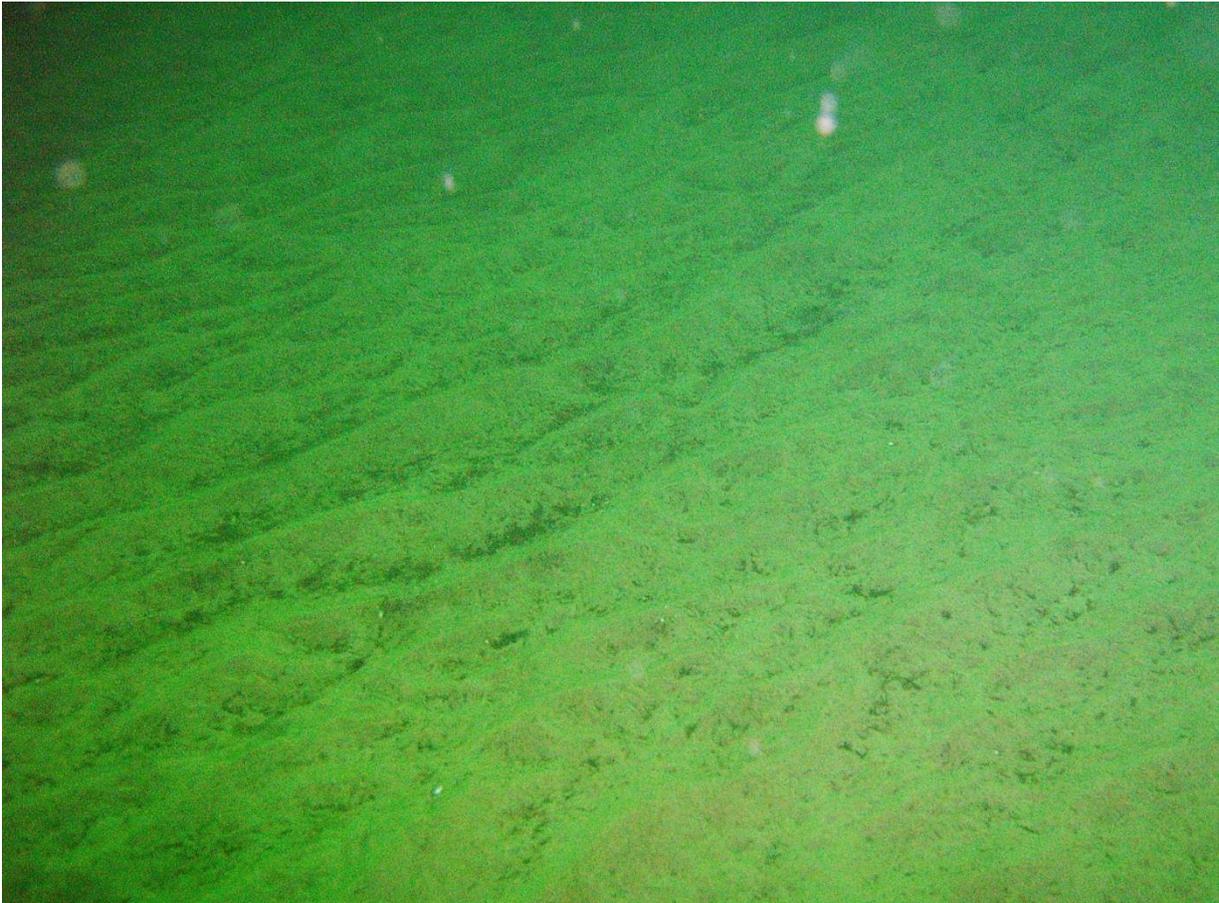


Photo 1. Sandy bottom at the Słupsk Bank (R. Opiota)

I. DESCRIPTION OF THE HABITAT

According to Warzocha (2004), the underwater sandbanks (1110) are defined as “sandy shoals situated in the sublittoral zone, permanently submerged in water”. They are elongated, curved or irregularly shaped shallows and usually surrounded by deeper water. Sublittoral sandbanks are mainly composed of sandy sediments but also of sediments with bigger (boulders, pebbles) or smaller (mud) grains. Shoals situated on hard bottom are considered as sandbanks only when fauna is typical of sands, not stony bottom that is underneath. Depth of 20 m is regarded as a borderline of habitat 1110 (Interpretation manual ... 2013). Usually, no phytobenthos species are found there, except algae growing on pebbles or on blue mussel aggregations which are occasionally present on the sandy bottom. Very typical of underwater sandbanks are invertebrates like *Bathyporeia pilosa*,

Pygospio elegans and *Cerastoderma glaucum* (Warzocha 2004), which are commonly found on sandy bottom in the sublittoral zone.

Habitat 1110 is characterized by a high degree of naturalness. Its location in shallow water and exposition to waves prevent organic matter deposition. Moreover, its location far away from sources of land-based pollution allows to maintain natural conditions for bottom fauna communities.

In the Polish marine areas the Odra Bank and the major part of the Słupsk Bank can be regarded as 1110 habitat (Warzocha 2004).

Odra (Odrzańska) Bank is a sandy shoal situated in the middle of the Pomeranian Bay and restricted to the depth of 10 m (site central point 14°25,195'E 54°19,118'N). Average depth of the Odra Bank is 7-8 m, while the shallowest part is 5 m. The width of the shoal, from western to eastern margin, is about 25 km, the length is approx. 35 km. The eastern part of the Odra Bank is situated in the Polish exclusive economic zone and comprises 19% of the whole sandbank. The Odra Bank is situated in two Natura 2000 areas: Refugium in the Pomeranian Bay (PLH990002) (comprises 25% of its area) and Pomeranian Bay (PLB990003) (Ławicki et al. 2012, SDF for PLH990002, SDF for PLB990003). It is composed of sandy sediments of diverse grain size. There are no records on macrophytes occurrence in the Odra Bank area. The benthic fauna is diverse, consisting of some 21 species, mainly amphipods *Bathyporeia pilosa*, bivalves *Mya arenaria*, *Cerastoderma glaucum*, *Macoma balthica*, snails *Hydrobia ulvae* and polychaetes *Pygospio elegans*, *Hediste diversicolor* (Zetler and Gosselck 2006, Ławicki et al. 2012, Opióła et al. 2016). Also fish like flatfish, herring, sprat and salmon are observed (Warzocha 2004).

Słupsk Bank is situated in the central part of the Polish marine areas, approximately 25 NM northward from Ustka and is limited by the depth of 20 m (Warzocha 2004), (site central point 16°42,068'E 54°56,344'N). This site includes 20% of the Słupsk Bank (PLC990001), which belongs to the Natura 2000 network (SDF for PLC990001). The Słupsk Bank is covered with compacted gravely-sandy sediment with aggregations of glacial erratic. Sandy bottom is devoid of macrophytes while more stony bottom area, known as "the Słupsk Bank boulder area", is overgrown with communities of macroalgae (habitat 1170 – reefs). Sandy bottom is inhabited by sparsely aggregations of *Mytilus trossulus* (Jakusik et al. 2013), *Cerastoderma glaucum*, *Pygospio elegans* and *Macoma balthica* (Kruk-Dowgiałło et al. 2011, Opióła et al. 2016).

II. METHODS

1. Assessment of the conservation status of the habitat as well as indices of specific structure and functions

The table (Table 1) presents the description of parameters and indicators for the assessment of the conservation status of the habitat (1110), while the table (Table 2) presents the valorisation of these parameters and indicators. The figure (Fig. 1) presents the method of aggregating of the indicators' components, indicators and parameters to assess the conservation status of this habitat.

Table 1. Description of parameters and indices with their components of the habitat 1110

Parameter/Indicator/Indicator components	Description of parameter, indicator or indicator components
Area	The area of the habitat in its natural borders at particular sites
Specific structure and functions	
Typical species of macrozoobenthos	Species particularly associated with the habitat: <i>Bathyporeia pilosa</i> , <i>Mya arenaria</i> , <i>Pygospio elegans</i> , <i>Cerastoderma glaucum</i> .
State of sediments	
TOC content [% s.m.]	The total organic carbon content in the bottom sediments of the Baltic Sea depends on the grain size, organic matter content and the dynamics of the bottom waters, and thus also on the dynamics of the sediments. The enrichment of bottom sediments with organic carbon intensifies biogeochemical processes, affects the thickness of sediments, oxygen conditions and, consequently, may cause changes in biocenoses.
Ntot content [% s.m.]	The main source of nitrogen in the sediments is organic matter. Nitrogen in organic compounds is usually the dominant form of this element. Seasonal changes in nitrogen content in the surface layer of Baltic sediments are associated with the primary production cycle. Growth is observed after spring and autumn phytoplankton blooms, when the load of fresh organic matter reaches the sediments from the water column (Forsberg 1991).
Ptot content [% s.m.]	In bottom sediments, significant amounts of phosphorus compounds may be deposited, however, these compounds under favourable conditions (e.g. as a result of the intensification of biochemical processes), may be released into the water column. The process enhances eutrophication causing high primary production, even in the period when the inflow of mineral compounds significantly decreased (Forsberg 1991). The phosphorus content in the surface layer of the Baltic sediments remains in close relation to their lithology.
redox potential [mV]	The redox potential is an important parameter regulating the biological processes in bottom sediments, and its value depends, among other things, on the oxygen concentration in the bottom layer, organic matter, nitrogen, iron and manganese compounds. The redox potential is a measure of the activity and quality of the oxidation and reduction reactions occurring in bottom sediments (Bohn, 1977, Pempkowiak, 1997), as well as the estimation of the intensity of these processes.
Conservation prospects	This is an expert forecast of the condition of the habitat for the next 10–15 years. It takes into account the current status of the population of typical species, the state of the habitat, the occurring processes and their intensity, as well as any identified impacts and anticipated threats that may affect the future condition of the habitat, as well as the effect of protective measures.

Table 2. Evaluation of status parameters and indices of specific structure and functions of the habitat 1110

Parameter/Indicator/ Indicator components	Assessment		
	FV favourable status	U1 unfavourable inadequate status	U2 unfavourable bad status
Area	The area of the habitat is not reduced and it is not anthropogenically fragmented	The area of the habitat shows a slow downward trend compared to earlier studies or literature information or it is anthropogenically fragmented	The habitat area has a fast downward trend compared to earlier studies or literature information or it is strongly anthropogenically fragmented
Specific structure and functions			
Typical species of macrozoobenthos	4 species from the list of the typical species occur	3 or 2 species from the list of the typical species occur	1 or no species from the list of the typical species occur
State of sediments			
TOC content	if the value is <2	if the value is in the range <2; 8>	if the value is >8
Ntot content	if the value is <0,25	if the value is in the range <0,25; 0,50>	if the value is >0,50
Ptot content	if the value is <0,10	if the value is in the range <0,10; 0,20>	if the value is >0,20
redox potential	if the value is >150	if the value is in the range <150; -100>	if the value is <-100*
Conservation prospects	Conservation prospects for the habitat are good or excellent, no significant impact of threatening factors predicted, survival of the habitat in the perspective of 10–15 is very probable	Conservation prospects are medium rated, threatening factor impact expected	Conservation prospects poor, observed strong influence of threatening factors, the survival of the habitat in the perspective of 10–15 years can not be guaranteed

* the U2 rating for 'redox' decreases by one grade the assessment resulting from the aggregation of the remaining components of the 'Sediments' status indicator

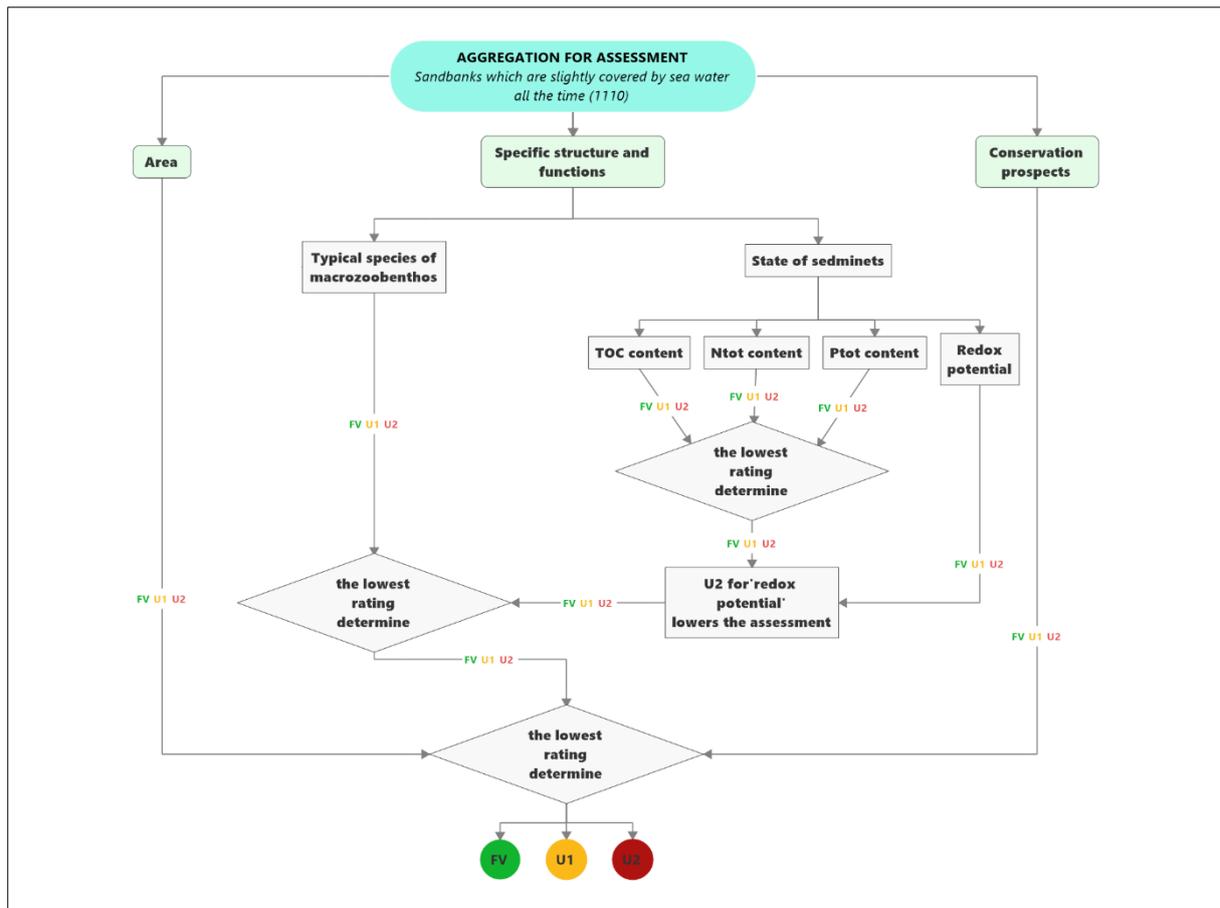


Fig. 1. Diagram of aggregation of indicators components, indicators and parameters to assess the state of protection of the habitat Sandbanks which are slightly covered by sea water all the time (1110)

2. Methodology of monitoring studies

2.1. Selection of monitoring locations

A monitoring site is understood as the area of the habitat within its natural boundaries, within which research stations are located, on which samples for research are collected.

The monitoring should cover both sites of the habitat 1110 known in Polish sea areas, Odrzana Bank and Słupsk Bank (Fig. 2). Samples from 5 stations, distributed evenly within the habitat, should be taken at each site.

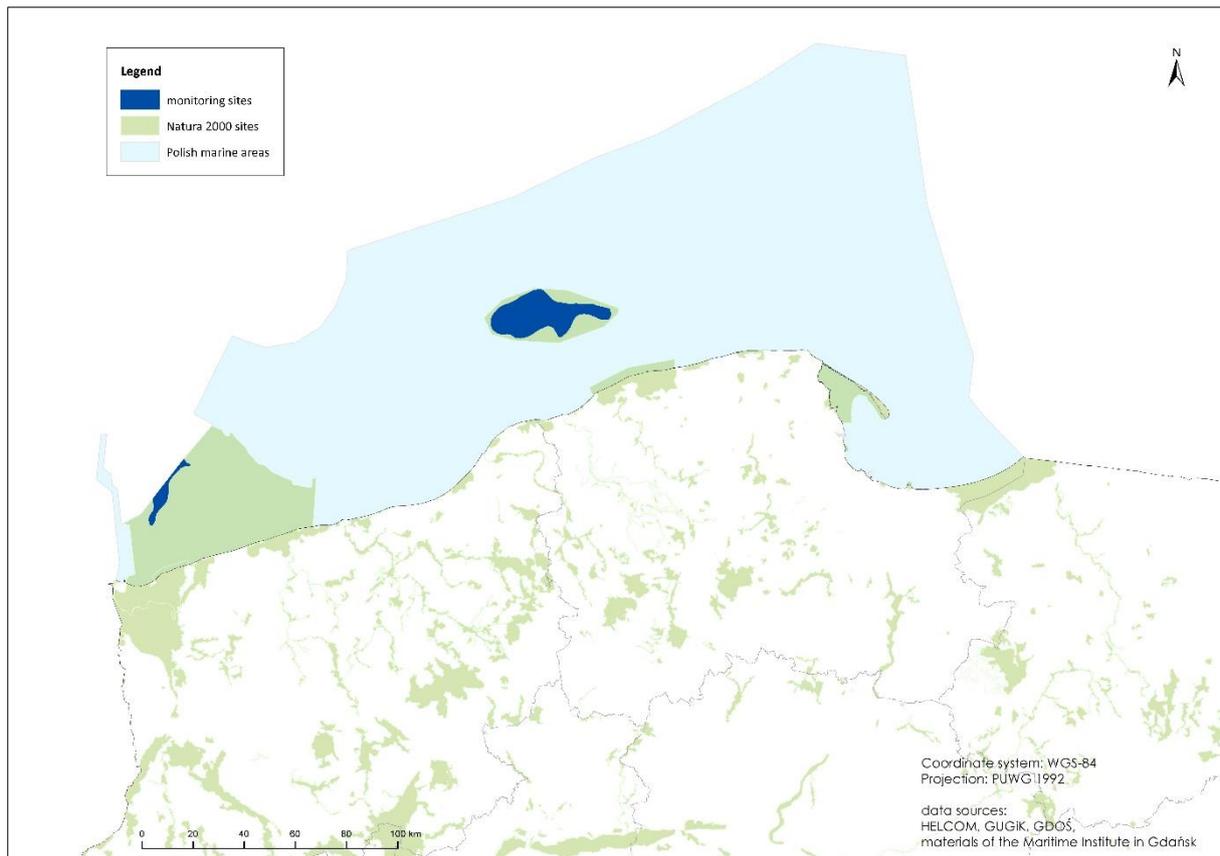


Fig. 2. Distribution of the sites for monitoring habitat in the Polish marine areas

2.2. Study methods

Typical species of macrozoobenthos

Sampling of macrozoobenthos is carried out in accordance with the methodology described in the Methodological Guide (...) (Osowiecki i Błęńska 2010). The methodology is based on the guidelines of the Helsinki Commission (Manual for Marine Monitoring in the COMBINE Program of HELCOM 2015).

A van Veen grab with catching area of 0.1 m² and a weight of about 60 kg (Photo 2) is used for sampling. Samples are rinsed on a sieve with a mesh size of 1 mm and preserved with a 4% formalin solution. At each station, three replicates are taken as separate samples for analysis.

The analysis of the samples should be carried out in accordance with the standards of the laboratory treatment of biological samples used in international monitoring of the Baltic Sea (HELCOM 1988). The taxonomic nomenclature of macrozoobenthos species should be adopted in accordance with the World Register of Marine Species WoRMS (www.marinespecies.org).



Photo 2. Van Veen grab

State of sediments

The sediment samples for physicochemical analyses should be collected by a van Veen grab in accordance with the PN-EN ISO 5667-19 standard. In the in-situ samples, the redox potential is measured using the potentiometric method according to PN-ISO 11271. The collected bottom sediments are placed in glass containers and cooled down. The determination of total nitrogen, total phosphorus and total organic carbon should be carried out according to appropriate methodologies or equivalent methods:

- total nitrogen - according to the modified Kjeldahl method with the addition of titanium dioxide as a catalyst according to PN-ISO 11261 standards,
- total phosphorus - by inductively spectrometry coupled plasma with ICP-OES after mineralization in Aqua Regia on the basis of own research procedures,
- total organic carbon - by infrared spectrometry according to PN-ISO 10694.

Sampling and all geochemical measurements and analyses should be performed by a laboratory which is accredited in the above-mentioned scope.

2.3. Time and frequency of studies

It is recommended to carry out the studies in spring (April-May), before breeding season of the fauna. During this studies, sediments samples should also be taken. The monitoring studies of the habitat should be conducted once every 5-6 years, optimally every three years.

2.4. Equipment used in studies

For field studies and laboratory analyses of the indicators: 'Typical macrozoobenthos species' and 'Sediment bottom status' one should use: a van Veen grab, 1 mm sieve, formalin, potentiometer with a redox electrode, microscope, distillation unit with steam distillation, burette, a microwave mineraliser, or a set for mineralization under reflux conduits, ICP-OES spectrometer, TOC analyzer.

2.5. Examples of field and laboratory forms

MACROZOOBENTHOS SAMPLING FORM
Name of the site: <i>Ławica Odrzana</i>
Institution: <i>Maritime Institute in Gdańsk</i>
Name of vessel: <i>IMOR</i>
Sampling gear/catching area: <i>van Veen; 0,1 m²</i>
Threats observed: <i>lack</i>

No	Station	Sample	Date	Time (UTC)	Sediment*	Remarks
1.	<i>1ŁO</i>	<i>1ŁO/1</i>	<i>2016-06-07</i>	<i>04:14</i>	<i>Sand</i>	-
2.	<i>1ŁO</i>	<i>1ŁO/2</i>	<i>2016-06-07</i>	<i>04:24</i>	<i>Sand</i>	-
3.	<i>1ŁO</i>	<i>1ŁO/3</i>	<i>2016-06-07</i>	<i>04:33</i>	<i>Sand</i>	-
4.	<i>2ŁO</i>	<i>2ŁO/1</i>	<i>2016-06-07</i>	<i>06:12</i>	<i>Sand</i>	-
5.	<i>2ŁO</i>	<i>2ŁO/2</i>	<i>2016-06-07</i>	<i>06:20</i>	<i>Sand</i>	-
6.	<i>2ŁO</i>	<i>2ŁO/3</i>	<i>2016-06-07</i>	<i>06:33</i>	<i>Sand</i>	-

*type of sediment: boulders >25 cm; pebbles 4-25 cm; gravel; sand; clay; silt ; blue mussel aggregations

Prepared by:	Verified by:	Approved by:
Date:	Date:	Date:
Signature – full name:	Signature – full name:	Signature – full name:

BOTTOM SEDIMENT SAMPLING FORM

Name of site: *Ławica Odrzana*

Institution: *Maritime Institute in Gdańsk*

Vessel: *IMOR*

Method of sampling (norm): *PN-EN ISO 5667-19*

Sampling gear / volume: *van Veen*

Scope of research: *redox, Ntot, Ptot, C org.*

Sample conservation: *cooling*

Threats observed: *lack*

No.	Station	Sample	Date	Time (UTC)	Sediment*	Depth [m]	Temp. of sediment [°C]	Redox [mV]	Remarks
1.	<i>1ŁO</i>	<i>1ŁO</i>	<i>2016-06-07</i>	<i>04:45</i>	<i>Sand</i>	<i>7,5</i>	<i>13,9</i>	<i>444,1</i>	
2.	<i>2ŁO</i>	<i>2ŁO</i>	<i>2016-06-07</i>	<i>06:38</i>	<i>Sand</i>	<i>7,0</i>	<i>14,7</i>	<i>152</i>	

* type of sediment: boulders >25 cm; pebbles 4-25 cm; gravel; sand; clay; silt ; blue mussel aggregations

Prepared by:	Verified by:	Approved by:
Date:	Date:	Date:
Signature – full name:	Signature – full name:	Signature – full name:

MACROZOOBENTHOS LABORATORY ANALYSIS FORM
Site: <i>Ławica Odrzana</i>
Institution: <i>Maritime Institute in Gdańsk</i>
Station: <i>1Ł0</i>
Sample: <i>1Ł0/1</i>
Date: <i>2016-06-07</i>
Sampling gear/catching area: <i>van Veen 0,1 m2</i>

No.	Taxon	Abundance	Biomass [g w. w.]*	Remarks
1	<i>Hediste diversicolor</i>	40	1,054	
2	<i>Pygospio elegans</i>	150	0,210	

[g w.w.] – grams of wet weight; accuracy 0,001 g

Prepared by:	Verified by:	Approved by:
Date:	Date:	Date:
Signature – full name:	Signature – full name:	Signature – full name:

SEDIMENT LABORATORY ANALYSIS FORM	
Site:	<i>Ławica Odrzana</i>
Institution:	<i>Instytut Morski w Gdańsku</i>
Station:	<i>1Ł0</i>
Sample:	<i>1Ł0</i>
Date of sampling:	<i>2016-06-07</i>
Date of delivery:	<i>2016-06-08</i>

No.	Analysis	Unit	Result*		Method	Remarks
			value	uncertainty		
1.	<i>TOC</i>	<i>% s.m.</i>	<i>0,027</i>	<i>0,003</i>	<i>wg normy PN-ISO 11261:2002, zmodyfikowana metoda Kjeldahla</i>	
2.	<i>Ptot</i>	<i>% s.m.</i>	<i>0,004</i>	<i>0,001</i>	<i>Metoda atomowej spektrometrii emisyjnej ze wzbudzeniem w plazmie indukcyjnie sprzężonej (ICP-OES) po roztworzeniu rozdrobnionych próbek wodą królewską. Procedura PB – 10 wydanie 7 z dnia 10.02.2016 r.</i>	
3.	<i>N tot</i>	<i>% s.m.</i>	<i>p. 0,02</i>		<i>Metoda spektrometrii w podczerwieni wg normy PN-ISO 10694:2002</i>	
4.	<i>...</i>					

Explanations for the table:

p. - below the limit of quantification

* the result was given with expanded uncertainty, the expansion factor $k = 2$; with 95% probability

Prepared by:	Verified by:	Approved by:
Date:	Date:	Date:
Signature – full name:	Signature – full name:	Signature – full name:

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