

1170 Reefs

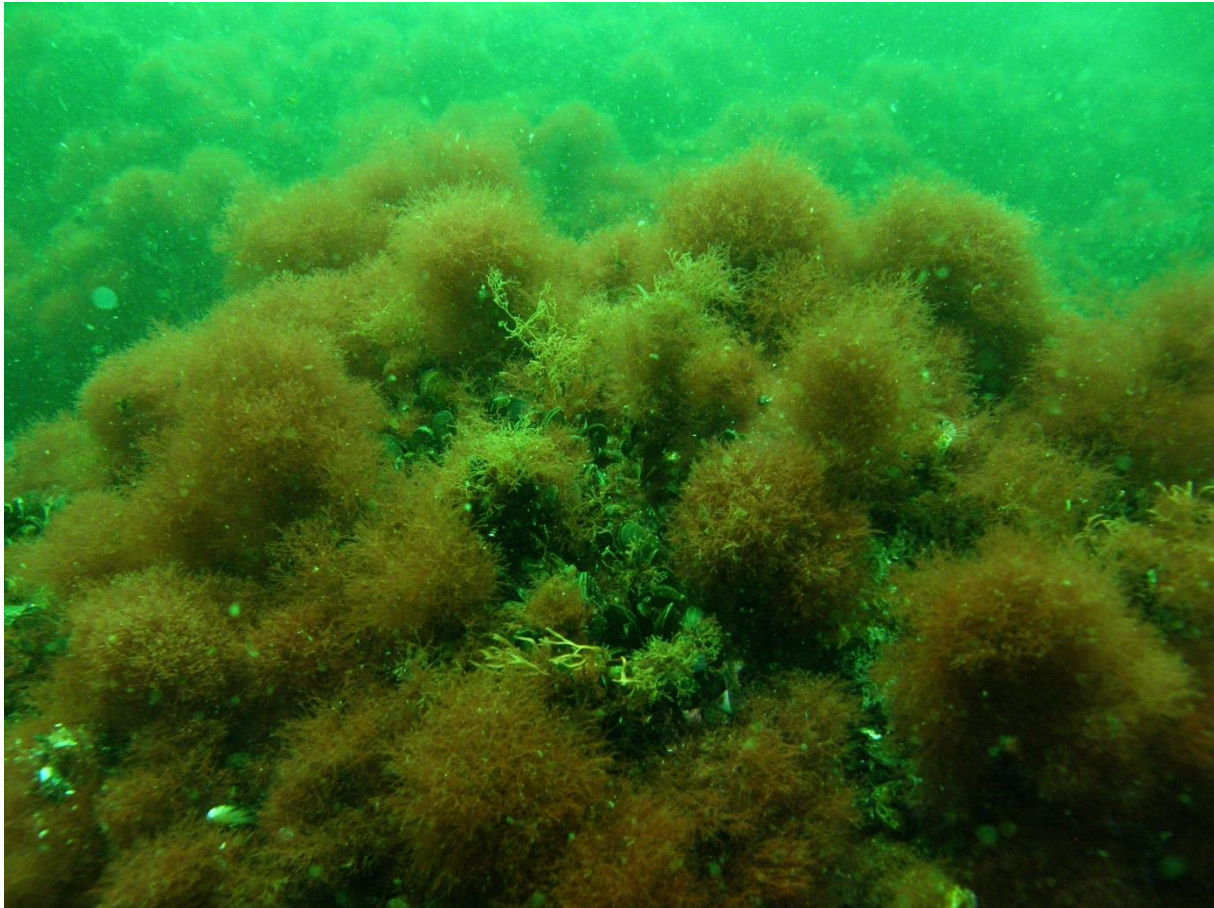


Photo. 1. Fouling community at the Słupsk Bank boulder area (photo. T. Krypczyk)

I. DESCRIPTION OF THE HABITAT

According to (Warzocha, 2004) the Reefs (1170) are defined as „underwater rocky substrate that arise from the sea floor, situated in sublittoral zone”. The habitat is characterized by high taxonomic diversity of flora and fauna that are distributed in zones depending on depth. In the Polish marine areas, reefs are not formed by rock but stones: pebbles and boulders located in the littoral zone (Interpretation manual 2013). Species typical of habitat 1170 are macroalgae, mainly red algae *Vertebrata fucoides* (formerly *Polysiphonia fucoides*) and protected species: *Furcellaria lumbricalis* and *Ceramium diaphanum* (Regulation of the Minister of Environment, 9 Oct 2014, on the protection of plant species, Journal of Laws 2014 pos. 1409) as well as benthic invertebrates e.g. *Mytilus trossulus* and *Gammarus* spp. (Andrulewicz et al. 2004, Warzocha 2004, Osowiecki and Kruk-Dowgiałło 2006a, Osowiecki and Żmudziński 2000, Kruk-Dowgiałło et al. 2009, Kruk-Dowgiałło et al. 2011, Opióła et al. 2016). So far, in the Polish marine areas only three sites belonging to habitat 1170 have been identified: Słupsk Bank – called “Słupsk Bank boulder area” (Andrulewicz et al. 2004, Warzocha 2004, SDF of PLC990001), coastal Rowy locality – called „ Rowy boulder area” (SDF of

PLH220023, Osowiecki and Kruk-Dowgiałło 2006a) and in the Gulf of Gdańsk, nearby the Orłowo Cliff – natural boulder area (SDF of PLH220105, Osowiecki and Żmudziński 2000) as well as artificial reefs made of natural stones, so-called underwater breakwaters which were built in 2006 in order to protect the shore (Kruk-Dowgiałło et al. 2009).

Słupsk Bank boulder area is situated in the north-western part of the Słupsk Bank, about 46 km northward from the coastal locality of Ustka. Its surface area reaches 111.3 km² and it covers 14% of the total area of Słupsk Bank Natura 2000 area (SDF of PLC990001), (Kruk-Dowgiałło et al. 2011). Bottom surface is diverse what makes the boulder area distinctive among all regions in the Southern Baltic. Characteristic morphological features are chains of hills composed mostly of rock blocks and boulders, resistant to erosion (Kruk-Dowgiałło et al. 2011). Hard substrate and relatively high water transparency create favourable conditions for the development of different types of benthic communities formed by habitat-forming species e.g. *Furcellaria lumbricalis*, *Ceramium diaphanum*, *Polysiphonia fucooides* and *Mytilus trossulus* (Andrzejewicz et al. 2004, Warzocha 2004, Kruk-Dowgiałło et al. 2011). In many parts of the Słupsk Bank boulder area, Species that are rare in the Polish marine waters can be observed, e.g. *Coccolithus truncatus*, *Desmarestia viridis*, *Rhodomela confervoides* as well as species rarely occurring in the Baltic Proper, e.g. *Delesseria sanguinea* (Kruk-Dowgiałło et al. 2011, State Environmental Monitoring (SEM) data). The Słupsk Bank boulder area has been a subject of scientific interests of marine biologists who used different research methods there (Demel and Mańkowski 1951, Demel and Mulicki 1954, Warzocha 1980, Okońtowicz 1991, Andrzejewicz et al. 2004, Opióła et al. 2016). The biggest area of this site (100 km²) was examined in 2007. Mapping method was applied, habitats at level 3 and 5 of EUNIS classification were identified and for the first time natural values of this site were assessed (Kruk-Dowgiałło et al. 2011). Since 2008 the monitoring of phytobenthos has been carried out within the State Environmental Monitoring programme.

Rowy boulder area is situated in the middle coastal zone approx. 1.5 km northward from Rowy locality. Rowy boulder area is situated in the vicinity of the Słowiński National Park and it is protected under the Natura 2000 network within PLH220023 Ostoja Słowińska (SDF of PLH220023). The site is formed by the abrasion platform with numerous stones and fields of boulders forming compacted abrasive pavement. Some of the boulders reach a diameter up to 4 m and extend above the bottom up to 2 m. Taxonomically diverse and highly abundant benthic communities with domination of macroalgae develop vastly on the stony bottom there. Mainly red algae such as *Vertebrata fucooides* and *Furcellaria lumbricalis* occur, occasionally species rare in the Polish marine areas such as brown algae *Sphacelaria cirrosa* and protected red algae *Ceramium tenuicorne* can be observed (Osowiecki and Kruk-Dowgiałło 2006a, Kruk-Dowgiałło et al. 2008, Brzeska 2009, Opióła et al. 2016, SEM data). Compared to other areas in the coastal zone of the Polish part of the Baltic Sea, macrozoobenthos in the Rowy boulder area should be considered as extremely rich in terms of taxonomic diversity and abundance. Occurrence of 23 species and unidentified individuals of Oligochaeta, Nemertea and insect larvae were observed (Osowiecki and Kruk-Dowgiałło 2006a, Opióła et al. 2016).

Rowy boulder area was identified in 1996 during field studies aiming at valuation of marine protected areas (Kruk-Dowgiałło 2000). Further studies was designed to evaluate its biological diversity. Then, for the first time in the Polish marine areas, habitat mapping method was used. It based on the combined results of hydroacoustic (bathymetric and sonar maps) and biological research (Osowiecki and Kruk-Dowgiałło 2006a, 2006b, 2007). Since 2010, the monitoring of phytobenthos has been carried out in this area, within the State Environmental Monitoring programme.

Reefs in the Gulf of Gdańsk are located in the coastal zone nearby the Orłowo Cliff. As a result of high waves activity, the erosion is observed not only on the cliff but also on the coastal strip of the

seabed. It is an extremely dynamic and diverse area, where on the sandy bottom numerous pebbles and boulders, and even outcrops of lignite occur (Osowiecki and Żmudziński 2000). The area nearby the Orłowo Cliff is protected within Natura 2000 network as Orłowo cliffs and reefs PLH220105 (SDF of PLH220105). According to the SDF of PLH220105 the habitat covers 78.29 ha. Natural reefs formed as the result of cliff erosion are situated at the depth of 1-8 m. Reefs are overgrown with macroalgae, mainly green algae *Ulva* and *Cladophora* genera down to the depth of 2 m, in deeper zone with red algae *Vertebrata fucoides*. Hard substrate in some places is overgrown with brown algae *Protohalopteris radicans* – rare in the Polish marine waters and by protected species of red algae *Furcellaria lumbricalis* (Kruk-Dowgiałło et al. 2009, Opióła et al. 2016, SEM data). Zoobenthos communities of hard bottom (blue mussels, barnacles, bryozoans) are accompanied by numerous small crustaceans (Osowiecki and Żmudziński 2000, Kruk-Dowgiałło et al. 2009, Opióła et al. 2016).

In the vicinity of natural reefs, three underwater breakwaters were built (each approx. 70 m long). They are made of natural stones and form a compact spatial structure located at depth of 3 m. The breakwaters cover an area of 0.39 ha (Kruk-Dowgiałło et al. 2009). According to the Habitats Directive EU, underwater breakwaters can be regarded as artificial reefs (Interpretation manual 2013), where developed macroalgae communities prevent eutrophication, serve as a source of oxygen, food for herbivores and constitute a substrate for spawning and shelter for fish. Monitoring studies carried out on the breakwaters surface in 2007-2009 (Brzeska et al. 2009) showed that developed communities of flora and fauna found there are similar to those on natural reefs.

The outstanding natural values of reefs near Orłowo Cliff were noticed in 1992, when zoobenthos research started (Opióła 1994) and continued in 1996 and 1997, but additionally included phytobenthos (Osowiecki and Żmudziński 2000). Proposal to cover the site with reserve protection together with detailed description of borders and natural values of the area was sent to the Ministry of Environment in 1998 (Czeczotka et al. 1998, Osowiecki and Żmudziński 2000). Since 2000, the monitoring of phytobenthos has been carried out within the State Environmental Monitoring programme.

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 a description of parameters and indices to assess the conservation status of the Reefs (1170) while the table (Table 2) presents the valorisation of these parameters and indicators. The figure (Fig. 1) presents the method of aggregating values of indicators and parameters to assess the conservation status of this habitat

Table 1. Description of parameters and indices with their components of the habitat Reefs (1170)

Parameter/Indicator	Description of parameter or indicator
Area	The area of the habitat in its natural borders at particular sites
Specific structure and functions	
Typical macroalgae taxa	Index based on occurrence of typical taxa: <i>Furcellaria lumbricalis</i> , <i>Ceramium</i> spp., <i>Vertebrata fucoides</i> .
Typical fouling and phytophilous macrozoobenthos taxa	Index based on occurrence of typical taxa: <i>Amphibalanus improvisus</i> , <i>Einhornia crustulenta</i> , <i>Mytilus trossulus</i> , <i>Gammarus</i> spp.

Parameter/Indicator	Description of parameter or indicator
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. Valorisation of parameters and indices of the Reefs (1170)

Parameter/Indicator	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 macroalgae taxa	3 taxa from the list of the typical taxa occur	2 taxa from the list of the typical taxa occur	1 or none taxa from the list of the taxa species occur
Typical fouling and phytophilous macrozoobenthos taxa	4 taxa from the list of the typical taxa occur	3 or 2 taxa from the list of the typical taxa occur	1 or no taxa from the list of the typical taxa occur
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

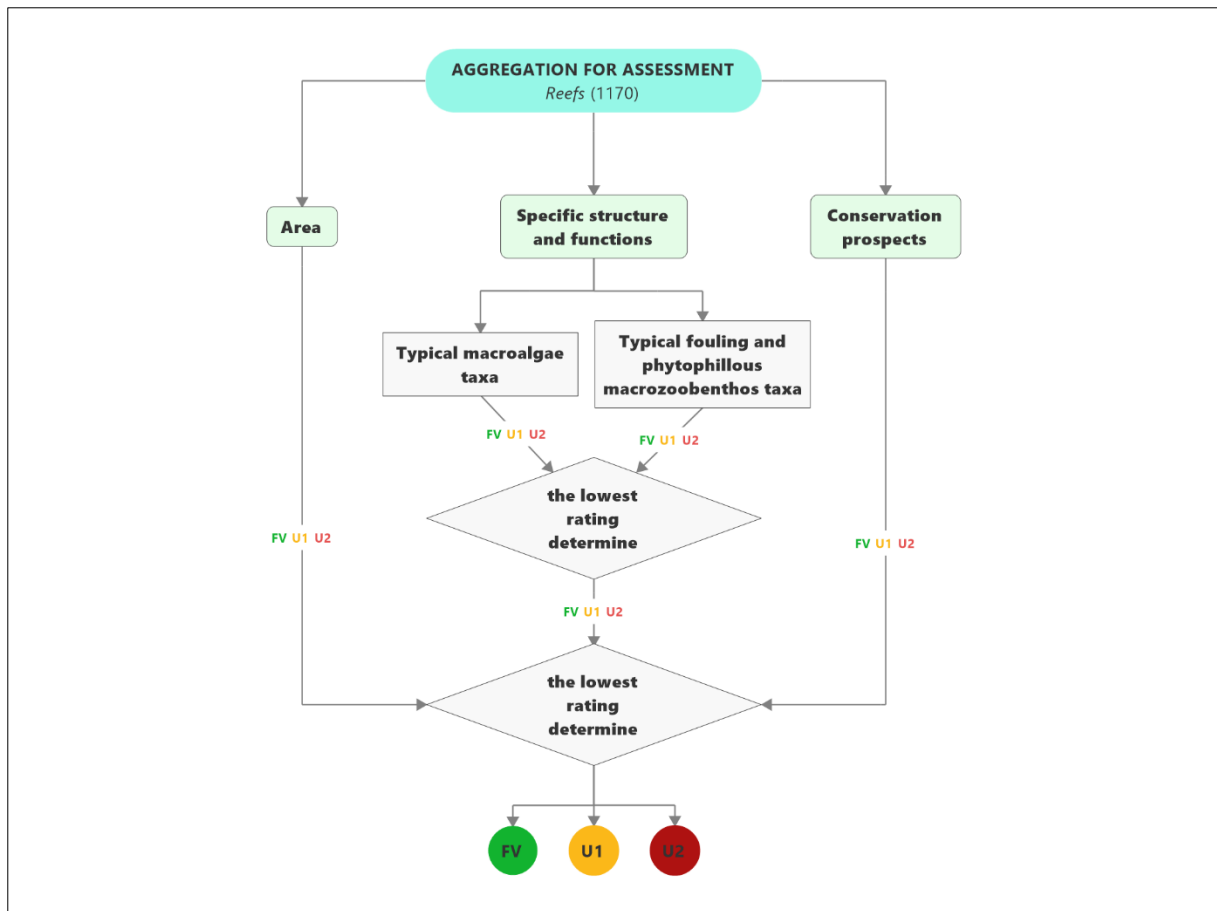


Fig. 1. Scheme of aggregation of indicators and parameters to assess the conservation status of the Reefs (1170)

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.

Due to the unique nature of the habitat and a small number of sites, all known sites in the Polish marine areas should be monitored, i.e.: Głazowisko Ławica Słupskiej, Głazowisko Rowy, Rafa Orłowo (Fig. 2).

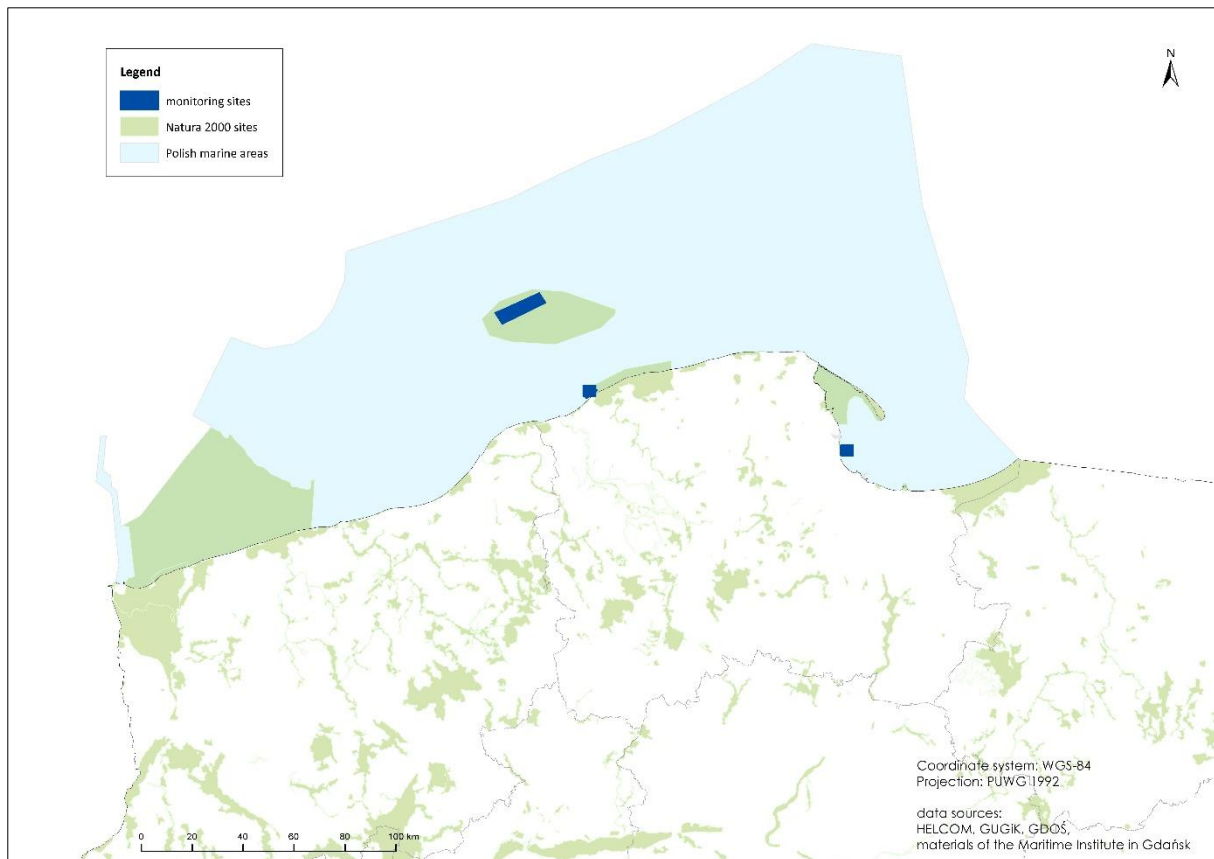


Fig. 2. Sites for monitoring the habitat Reefs (1170)

2.2. Study methods

Typical macroalgae taxa

Occurrence of typical macroalgae taxa should be assessed on the basis of field studies and data obtained from other sources.

Macrophyte samples should be collected by a diver at five stations within the following sites: Głazowisko Ławicy Słupskiej and Głazowisko Rowy in June. Five samples should be collected at each station, among them: four quantitative samples using the DAK frame (Andrulewicz et al 2004) and one qualitative sample of macroscopically different taxa. During the collection of samples, the film or photographic documentation should be made and the transparency should be measured with the Secchi disc.

Macrophyte samples should be subjected to laboratory analysis in terms of taxonomic composition in accordance with the methodological guide for macrophyte research (Kruk-Dowgiąłło et al. 2010). The names of identified taxa should be provided in accordance with the current nomenclature of the World Registry of Marine Species (WORMS).

In the case of Rafa Orłowo, the results of research carried out as part of the HELCOM COMBINE (SEM) monitoring should be used. Samples should be collected in a way that enables assessment based on both indicators, i.e. 'Typical Macroalgae Taxa' and 'Typical fouling and Phytoplankton Taxa'.

Typical fouling and phytophilous macrozoobenthos taxa

Occurrence of typical fouling and phytophilous macrozoobenthos taxa should be assessed on the basis of field studies and data obtained from other sources..

Samples of fouling and phytophilous fauna should be obtained by selecting animal organisms from quantitative samples collected for studies of typical macroalgae taxa.

Samples of fouling and phytophilous fauna should be subjected to laboratory analysis in terms of taxonomic composition in accordance with the methodological guide for macrozoobenthos research (Osowiecki and Błęńska 2010). The names of identified taxa should be provided in accordance with the current nomenclature of the World Registry of Marine Species (WORMS).

The assessment should also take into account the results of the monitoring of the fouling and phytophilous fauna performed within the HELCOM COMBINE monitoring at the KO profile. These data should be obtained from the database of the Chief Inspectorate for Environmental Protection.

2.3. Time and frequency of studies

Sampling should be done in June. The data for the assessment from the KO profile should correspond to the month and the year in which the samples were collected at the Głazowisko Ławica Słupska and Głazowisko Rowy. The sampling should be performed every 3 years.

2.4. Equipment used in studies

For field studies of the indicators: 'Typical macroalgae taxa' and 'Typical fouling and phytophilous macrozoobenthos taxa' the following equipment is recommended: DAK frame (Andrulewicz et al. 2004), spatula, mesh bags, plastic bags with string closure, Secchi disc, tweezers, diving equipment and a boat, enabling diving works equipped with a navigation system. The samples should be kept in the refrigerator (up to 12h from collection) or in the freezer (over 12h from collection).

2.5. Examples of field and laboratory forms

MACROALGAE AND FOULING AND PHYTOPHILLOUS FAUNA FIELD FORM

Name of a site: *Ławica Słupska*

Institution: *Maritime institute in Gdańsk*

Name of a vessel: *IMOR*

Equipment/Sampling area: *DAK/ 0,04m²*

Observed threats of the habitat: -

No.	Symbol of the station	Symbol of the sample	+/-	Date of the sampling	Time (UTC)	Vegetation coverage (attached) [%]*	Vegetation coverage (unattached) [%]*	Total vegetation coverage [%]*	Sediment [%]**	Secchi disk [m]	Depth [m]	Remarks
1.	LS3	1	+	2017-06-04	09:05	80	0	80	100 boulders	7	8,5	-
		2	+									
		3	+									
		4	-									
		JAK	+									
2.	LS4	1	+	2017-06-04	11:15	100	0	100	100 boulders	6,5	9	-
		2	+									
		3	+									
		4	+									
		JAK	+									

* rounded to 5%, coverage estimated at the station

** type of sediment on the station: boulder, stones, sand, gravel, silt, mussel aggregation, other; with vegetation coverage rounded to 5%

Compiled by:	Checked by:	Approved by:
Date:	Date:	Date:
Signature – full name:	Signature – full name:	Signature – full name:

LABORATORY ANALYSIS FORM FOR MACROPHYTES	
Name of a site: <i>Ławica Słupska</i>	
Institution: <i>Instytut Morski w Gdańsku</i>	
Symbol of a station: <i>LS3</i>	
Symbol of a sample: <i>LS3/1</i>	
Date: <i>2017-06-04</i>	
Equipment/Sampling area: <i>DAK/ 0,04m²</i>	

No.	Taxon	Drying period		Biomass [g d.w.* / sample]	Remarks
		Date from	Date to		
1.	<i>Ceramium sp.</i>	2017-06-12	2017-06-25	0,0003	-
2.	<i>Vertebrata fucoides</i>	2017-06-12	2017-06-25	0,0145	-
3.	<i>Delesseria sanguinea</i>	2017-06-12	2017-06-25	0,0033	<i>herbarium</i>
4.	<i>Coccotylus truncatus</i>	2017-06-12	2017-06-25	0,0087	-

*[g d.w.] – dry weight with accuracy to 0,0001 g

Compiled by:	Checked by:	Approved by:
Date:	Date:	Date:
Signature – full name:	Signature – full name:	Signature – full name:

LABORATORY ANALYSIS FORM FOR FOULING AND PHYTOPHILLOUS FAUNA
Name of a site: <i>Ławica Słupska</i>
Institution: <i>Instytut Morski w Gdańsku</i>
Symbol of a station: <i>LS3</i>
Symbol of a sample (repetition): <i>LS3/1</i>
Date: <i>2017-06-04</i>
Equipment/Sampling area: <i>DAK/0,04m²</i>

No.	Taxon	Abundance	Biomass [g w.w.]*	Remarks
1.	<i>Gonothyraea loveni</i>	-	+	<i>qualitatively</i>
2.	<i>Amphibalanus improvisus</i>	-	+	<i>qualitatively</i>
3.	<i>Idotea balthica</i>	5	0,0029	
4.	<i>Gammarus sp</i>	37	0,035	
5.	<i>Mytilus trossulus</i>	3226	39,962	

*[g w.w.] – grams of wet weight with accuracy to 0,001 g

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Date:	Date:	Date:
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