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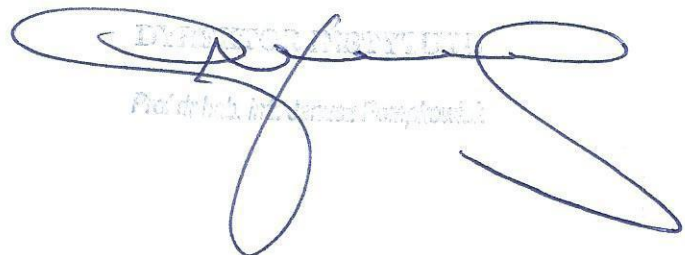
Sopot, 25.02.2016

Narodowe Centrum Badań i Rozwoju  
ul. Nowogrodzka 47 A,  
00-695 Warszawa

dot.: projektu realizowanego w ramach programu „Polsko – Norweska Współpraca Badawcza” pt.: „Glaciers as Arctic Ecosystem Refugia” (GLAERE) - ID 199377, kierownik: Prof. dr hab. Jan Marcin Węślawski.

Instytut Oceanologii Polskiej Akademii Nauk w Sopocie przesyła w załączeniu raport merytoryczny za rok 2015 z ww. projektu.

Z poważaniem,

  
Prof. dr hab. Jan Marcin Węślawski

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**PERIODIC REPORT**  
**of project implementation**  
**Polish-Norwegian Research Programme**

<b>Report number</b>	2			
<b>Reporting period</b>	from	2014.02.01	to	2014.12.31

<b>A. PROJECT INFORMATION</b>				
<b>Number of project contract</b>	POL-NOR/199377/91/2014		<b>Acronym</b>	GLAERE
<b>Duration of project</b>	from	2014.02.01	to	2017.01.31
<b>Project title</b>	<i>Glaciers as Arctic Ecosystem Refugia</i>			
<b>Key words</b>	Arctic, glaciers, top trophic levels, climate change			

<b>B. ENTITIES</b>			
<b>Status in project</b>	<b>Name of entity</b>	<b>Short name</b> (according to project contract)	<b>Type of entity</b>
<b>Project Promoter</b>	Institute of Oceanology PAS	IOPAS	Research institution
<b>Project Partner 1</b>	University of Gdansk	UG	University
<b>Project Partner 2</b>	National Marine Fisheries Research Institute	MIR-PIB	Research institution
<b>Project Partner 3</b>	Norwegian Polar Institute	NPI	Research institution
<b>Project Partner 4</b>	University Centre in Svalbard	UNIS	University

<b>B1. Principal Investigator</b>	
<b>First and last name, academic degree/title</b>	Prof. dr hab. Jan Marcin Węśławski
<b>Place of employment</b>	Institute of Oceanology PAS
<b>Telephone number, e-mail</b>	(58) 7311784, weslaw@IOPAS.gda.pl,



### C. INFORMATION ON THE IMPLEMENTATION PROGRESS IN THE REPORTING PERIOD

<b>C1. Work Package title and number</b>	<b>1. Management, Dissemination, Synthesis and Data base</b>			
<b>Start date</b>	planned	2014.02.01	actual	2014.02.01
<b>End date</b>	planned	2017.01.31	actual	In progress
<b>Cost of WP (PLN)</b>	planned	374 281,00	actual ( <i>value at the end of the reporting period</i> )	139 686,29
<b>Implementing entities</b>	IOPAS, NPI			

**An overview of the progress of work towards the objectives of the project, including achievements, milestones and deliverables specified in the project contract**

*No more than 3 A4 pages for each WP implemented in the reporting period: a description of the results achieved during the reporting period, activities carried out during this period and an explanation of the use of resources.*

**IOPAS:** Coordination in the GLAERE project included two major components: (i) monitoring of scientific progress of the project, and (ii) its financial and administration supervision (Task 1.4). The major GLAERE field and cruise campaigns were planned for summer 2015, and, therefore, scientific coordination included (i) maintaining communication between GLAERE researchers and partner institutions, (ii) joint planning for the field work, (iii) preparing, testing and configuration of scientific equipment, (iv) planning for joint sample analysis, and (v) gathering archival data for the GLAERE database (Task 1.3 and 1.4). In addition, according to the project proposal in M18 *Internal mid-term monitoring progress report* was prepared in order to assess if GLAERE is being implemented according to the plan. This document considered all deliverables and milestones (up to July 2015), and any existing or possible deviations (from the original work plan) and existing or possible delays. According to this assessment, the project is progressing as planned, no significant discrepancies were detected, hence no corrective actions are needed (Task 1.4).

Financial coordination is based on internal and external (to the National Centre of Research and Development) reporting. In February 2015, GLAERE periodic report for 2014 was prepared, and sent to the Polish-Norwegian Research Programme Operator. In March 2015, based on the project revision, the request for changes was prepared and sent to the Programme Operator (Task 1.4 and 1.5). GLAERE partner institutions submitted internal reports every three months to allow proper supervision of the use of the project financial resources (Task 1.5).

GLAERE information and dissemination strategy was implemented according to the *Detailed information and promotion plan* (D1.3; Task 1.2). The regular dissemination activities include the maintenance of the GLAERE web-page, and use of previously designed projects templated and programme logos (Task 1.2). In addition, the following actions were completed:

1. Preparation and publication of the popular science book for children 'One degree'. This book is prepared in Polish and English languages. The book is available in the digital form at IOPAS web-page (<http://www.IOPAS.gda.pl/projects/GLAERE/dissemination.html>). The printing copies can be obtained from IOPAS upon requests and are distributed free of charge during popular science events.
2. Preparation and release of the short movie prepared with children and for children. The movie title is: 'Vanishing Arctic'. The movie explains what happen to polar animals when the glaciers are melting. The movie is available at YouTube ([https://www.youtube.com/watch?v=8IF4Q\\_hhpqA](https://www.youtube.com/watch?v=8IF4Q_hhpqA)) and GLAERE web-page (<http://www.IOPAS.gda.pl/projects/GLAERE/dissemination.html>).
3. Presentation of project during the 8<sup>th</sup> Sopot Science Day (23<sup>rd</sup> May 2015). At the Polish-Norwegian



Projects' stand, GLAERE early-career researchers presented the project poster, involved visitors in simple demonstrations on glaciers and creation of the model of glaciers and associated wild life. They also distributed GLAERE popular science book entitled 'One degree'. During the Sopot Science Day, children were also invited to join the art classes during which they were able to draw, paint or sculpture organisms living close to the glaciers. On 16<sup>th</sup> of June 2016, an art exhibition took place where artworks from the Science Day were presented. The exhibition was joined with popular science talk on changing Arctic, release of short movie 'Vanishing Arctic', and distribution of 'One degree' books.

Three papers based on GLAERE results were published, and one more manuscript has been submitted for revision. In addition, the project was presented during 15 international and national conferences and workshops (see section D for details, Task 1.2).

**Explanation of the use of resources:** Expenses in this reporting period included: (i) salary costs related to project scientific coordination and dissemination activities, (ii) costs of materials needed for the popular science events (e.g., stationary, brushes, printing posters), (iii) costs related to movie production, (iv) costs of illustrations and printing costs of 'One degree' book, (iv) proofreading, and (v) travel costs to scientific events, where GLAERE concept, objectives and first results were presented.

**NPI:** This partner has not undertaken any actions in this reporting period.

<b>Milestones and deliverables</b>	<p><b>D1.4</b> Progress report on dissemination; report; (M12, delivered in M12)</p> <p><b>D1.9</b> Mid-term meeting report (M18, delayed)</p> <p><b>D1.5</b> Popular science book (M 24, delivered in M16)</p> <p><b>D1.10</b> Internal mid-term monitoring progress report, report; (M18, delivered in M18)</p> <p><b>M1.4</b> Specification (contents and authors) for the popular science book, report; (M 12, delivered in M12)</p> <p><b>M1.6</b> Mid-term meeting (M18, delayed)</p>
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**Description and justification of discrepancies and corrective actions**

*If during the reporting period there was a derogation from the contractual provisions (e.g. duration of WP), an explanation should be given: what type of derogation, reasons for the discrepancy, taken or planned corrective actions to determine impact on further implementation of the project and achievement of planned results of the project.*

Planned mid-term meeting was postponed due to the conflicting dates of field work of different research groups (M1.6; D1.9). The new date was set for 18-19th of May 2016, and during the meeting we plan to review obtained results and finish the logistics for the final phase of the field work in summer 2016.

The popular science book was planned to be released in M24. However, the work on the book has progressed faster than planned, and it was already published and presented to the public in May 2015. This faster release will allow us for longer distribution and information campaign for the book, and, therefore, we will be able to reach more persons and popular science events.

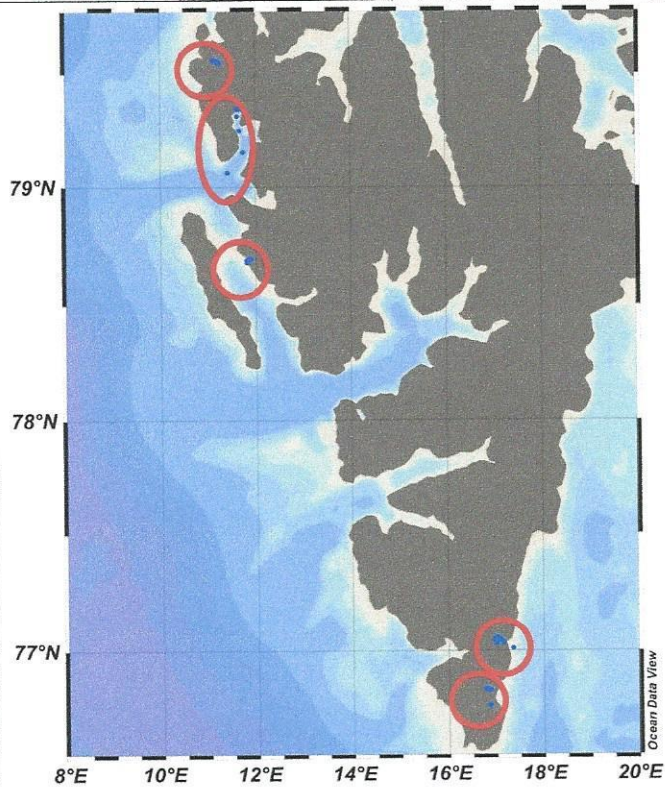
Apart from these two deviations, WP1 is being implemented according to the schedule, progress towards objectives, milestones and deliverables is satisfactory, and there are no contingency actions were assessed as needed. Differences between funds planned and spent are of operational character, and will be



compensated in the final reporting period for the GLAERE project.

<b>C1. Work Package title and number</b>	<b>2. Physical drivers</b>			
<b>Start date</b>	planned	2014.03.01	actual	2014.03.01
<b>End date</b>	planned	2016.11.30	actual	In progress
<b>Cost of WP (PLN)</b>	planned	469 320,99	actual ( <i>value at the end of the reporting period</i> )	243 207,47
<b>Implementing entities</b>	IOPAS, NPI			
<p><b>An overview of the progress of work towards the objectives of the project, including achievements, milestones and deliverables specified in the project contract</b></p> <p><i>No more than 3 A4 pages for each WP implemented in the reporting period: a description of the results achieved during the reporting period, activities carried out during this period and an explanation of the use of resources.</i></p>				
<p><b>IOPAS:</b> The physical environment in selected Svalbard fjords and glacial bays has been investigated during the period from January to December 2015. Various methods of measurements were introduced.</p> <p>Large amount of data were collected during the IOPAN research vessel R/V 'Oceania' summer cruise. These data (temperature, salinity, oxygen concentration) allow extending the time series from Hornsund and Kongsfjorden. Hydrographic conditions in the studied as well as water properties in the front of glaciers (Horn in Hornsund, Kongsvegen and Kongsbreen in Kongsfjorden) were investigated. Data were stored in the established database (T 2.1) and analysed. Time series of winter water volume and properties in the glacier bays Brepolen (Hornsund) and in the inner part of Kongsfjorden were analysed (Task 2.2). Measurements carried in summers 2014 and 2015 reveal warming of the water in these bays and very limited production of the winter water.</p> <p>Measurements conducted during the summer expedition to Hornsund provided the second source of data and contribute to Tasks 2.1, 2.2 and 2.4. Polish Polar Station in Hornsund served as the land base for this work and measurements were performed from the small boats. Hydrographic data were collected in the glacier bays Hansbukta, Burgerbukta and Brepollen. Special attention was devoted to the regions close to the glacier fronts where the intensive fresh water outflow, upwelling and eddies formation take place. Harsh weather and ice conditions in Hornsund during summer 2015 resulted in the limited amount of collected data, however even so, it is a valuable research material. Data were stored in the database and analyzed.</p> <p>CTD profiles collected during the cruise of sailing yacht S/Y 'Barlovento' established the third source of data, contributing to Tasks 2.1, 2.2 and 2.4. Waldemar Walczowski joined the yacht crew and made measurements during the trip along the eastern and western Svalbard shores. The bays Isbukta and Hamberg at the Spitsbergen eastern side were visited (Fig 1).</p>				





At the western side hydrographic measurements in Hornbeakbukta (in vicinity of the Polish Polar Station in Kaffioyra), Krossfjorden and Magdalenefjorden were performed. The unique data, especially from the eastern coast of Spitsbergen part, were acquired. During CTD casts the yacht approached closely the glaciers fronts, entering the unexplored regions, which were earlier occupied by glaciers and marked at maps as land (Fig 1). The new data from Hamberg Bay are particularly valuable, representing hydrographic conditions and water depths at front of the Hambergreen glacier. This glacier is a continuation of the Horn glacier in Brepollen, Hornsund. The latest measurements suggest that both glaciers occupy and close the sea straits. Fast melting of glaciers may cause opening of these straits over the time scale of 10-20 years.

The S/Y 'Barlovento' expedition proved that this kind of activity may give valuable and cost-efficient observational data.

Fig. 1. Region (red circles) of CTD casts (blue dots) performed from R/V 'Barlovento.'

**Explanation of the use of resources:** During the reporting period, GLAERE resources in WP2 were spent on salaries of personnel involved in the project, and to cover costs of field measurements from S/Y Barlovento in the Spitsbergen fjords. The costs of the scientific expedition included travel costs, accommodation, life insurance and protective clothing. Consumables included usable material for field measurement from small boats.

**NPI:** The main objective of our part of the work package is to model the meltwater contribution to the Kongsfjord fjord system in NW Svalbard, for the relevant time period covering the fjord observational record. Rain and surface melt runoff are the two sources of freshwater to the fjord system. Neither can be measured in situ on a basin scale; to estimate these parameters we must use models (Task 2.4).

Here we are using a distributed energy balance model coupled to a multi-layer snow model, which accounts for subsurface exchanges of energy and mass. This is particularly important for glacierized basins, such as in Kongsfjord, since there can be extensive refreezing of meltwater in the snow and firn of the glacier, leading to significantly delayed and reduced runoff.

The surface energy balance model is forced by meteorological parameters obtained from a regional climate model (RCM). Air temperature, humidity, cloud cover, air pressure and precipitation on a distributed grid are taken from the hydrostatic numerical weather prediction model HIRLAM (High Resolution Limited Area Model), which yields 3-hourly meteorological fields at an 11-km horizontal resolution. The RCM is forced at the boundaries by output from the ECMWF reanalysis dataset. To account for scale differences between the RCM and the complex topography of the domain, atmospheric forcing variables are downscaled onto the finer scale of the runoff model grid, using different approaches depending on the significance of topography on the distributions and the availability of observational data for calibration.



Calibration and validation of the melt model is the most crucial part of the modelling work. We calibrate the model using the NPI AWS (Automatic Weather Station) and glacier mass balance network, which covers several glaciers in the Kongsfjord drainage basin.

For our contribution to GLAERE, we maintained the AWS network, which provided the data needed for the modelling, completed the initial modelling runs, which concentrated on the two main tidewater glaciers for which we have calibration and validation data; these model runs have been published in a scientific paper (see below). We are now in the process of extending the model to the remaining glaciers in Kongsfjord (Task 2.4).

**Explanation of the use of resources:** WP2 resources were used to fund maintenance and acquisition of the AWS network on the glaciers Kongsvegen and Kronebreen/Holtedahlfonna. AWS data are needed for mass balance/runoff modelling. Modelling runs are funded by other sources. We have completed the initial modelling runs on these two main glaciers for which we have the calibration and validation data. The model runs have been published in a scientific paper, and runoff data are available for the period 1962-2012 for the scientific community. We are now in the process of extending the model to the remaining glaciers in Kongsfjord.

<b>Milestones and deliverables</b>	<b>M2.1</b> Archival material completed, database; (M12, delivered in M12)
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**Description and justification of discrepancies and corrective actions**

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WP2 is being implemented according to the schedule, progress towards objectives and deliverables is satisfactory, and no discrepancies or corrective actions are deemed necessary. Differences between funds planned and spent are of operational character and will be compensated in the final year of GLAERE implementation.



<b>C1. Work Package title and number</b>	<b>3. Remote sensing &amp; GIS</b>			
<b>Start date</b>	planned	2014.03.01	actual	2014.03.01
<b>End date</b>	planned	2016.09.30	actual	In progress
<b>Cost of WP (PLN)</b>	planned	356 480,40	actual ( <i>value at the end of the reporting period</i> )	214 758,07
<b>Implementing entities</b>	UG			
<p><b>An overview of the progress of work towards the objectives of the project, including achievements, milestones and deliverables specified in the project contract</b></p> <p><i>No more than 3 A4 pages for each WP implemented in the reporting period: a description of the results achieved during the reporting period, activities carried out during this period and an explanation of the use of resources.</i></p> <p><b>UG:</b> During the second year of the project there were three main areas of our activity. The first was connected with the finalization of Task 3.1 (Data base of tidal glacier fronts imagery on Svalbard) and realization of milestone M3.1 (Archival material completed) with deliverable D3.1 (Completion of archival data on tidal glacier fronts). The data base of archival data on tidal glacier fronts covering period 1999 – 2014 was delivered according to the milestone (M3.1). This data base contains special vector data structure which was created to store digitized glaciers fronts and was populated with 2249 records of glaciers and costal segments during 1999-2014 time period. These segments were created using on-screen digitizing method using the data base of 389 Landsat 8 satellite images of Svalbard acquired in 2013 and 2014. During the 2015 the database was updated with new data from 2015 and the new version of database of archival data on tidal glacier fronts was created. The second activity was connected with preparation and realization of Task 3.2 (Assessment of spatial extent of winter ice and turbid water plumes in summer) and Task 3.3 (Assessment of euphotic layer thickness in analysed areas) which have to resulted in a deliverable D3.2 (Completion of new field work data). The new field data were collected during expedition to Svalbard in July / August 2015. The measurements were taken in two fjords Hornsund (25 July – 1 August) and Kongsfjord (4 August – 9 August). All water measurements were taken from Zodiac C5 inflatable boat. The collected field work data will be delivered to data base (milestone M3.2) . During the expedition the following basic measurements were taken. CTD profiles were carried out using SD204 self-contained instrument manufactured by SAIV A/S that measures, calculates and records water salinity, temperature, pressure and turbidity. The turbidity were measured using backscatter sensor in FTU (Formazin Turbidity Units) units. The sensor was calibrated with particles of interest to measure suspended solids concentrations in mg l-1, density was calculated using standard salinity, temperature, presser formula. In Hornsund 36 profiles and in Kongsfiord 114 profiles were taken. Field measurements of SPM were obtained at various locations from discrete water sampling. In Hornsund 35 water samples and in Kongsfjord 73 water samples were taken. Secchi disk 20 cm in diameter was used to measure water transparency. In Hornsund 35 and in Kongsfjord 73 measurements were taken. The last area of our activity was connected with realization of Task 3.4 GIS visualization and model of animals distribution in glacial bays. In cooperation with WP 5 we modeled telemetry data to analyze bird movement. Two software tools for spatial analyses of telemetry data were created in this project.</p> <p><b>Explanation of the use of resources:</b> During the reporting period, GLAERE resources were spent on salaries of personnel involved in the project, and to fund field research on Spitsbergen. The costs of the scientific expedition included travel costs, accommodation, life insurance and specialist clothing.</p>				
<b>Milestones and deliverables</b>	D3.1 Completion of archival data on tidal glacier fronts, database; (M12, delivered in M12)			

	<b>M3.1</b> Archival material completed, acquisition of 389 Landsat 8 satellite images of Svalbard; (M12, delivered in M12)
<b>Description and justification of discrepancies and corrective actions</b> <i>If during the reporting period there was a derogation from the contractual provisions (e.g. duration of WP), an explanation should be given: what type of derogation, reasons for the discrepancy, taken or planned corrective actions to determine impact on further implementation of the project and achievement of planned results of the project.</i>	
This WP is being implemented as planned, progress towards objectives and deliverables is satisfactory, and there are no discrepancies so far.	



<b>C1. Work Package title and number</b>	<b>4. Marine mammals</b>			
<b>Start date</b>	planned	2014.03.01	actual	2014.03.01
<b>End date</b>	planned	2016.09.30	actual	In progress
<b>Cost of WP (PLN)</b>	planned	745 683,60	actual (value at the end of the reporting period)	526 503,30
<b>Implementing entities</b>	IOPAS, NPI			

**An overview of the progress of work towards the objectives of the project, including achievements, milestones and deliverables specified in the project contract**

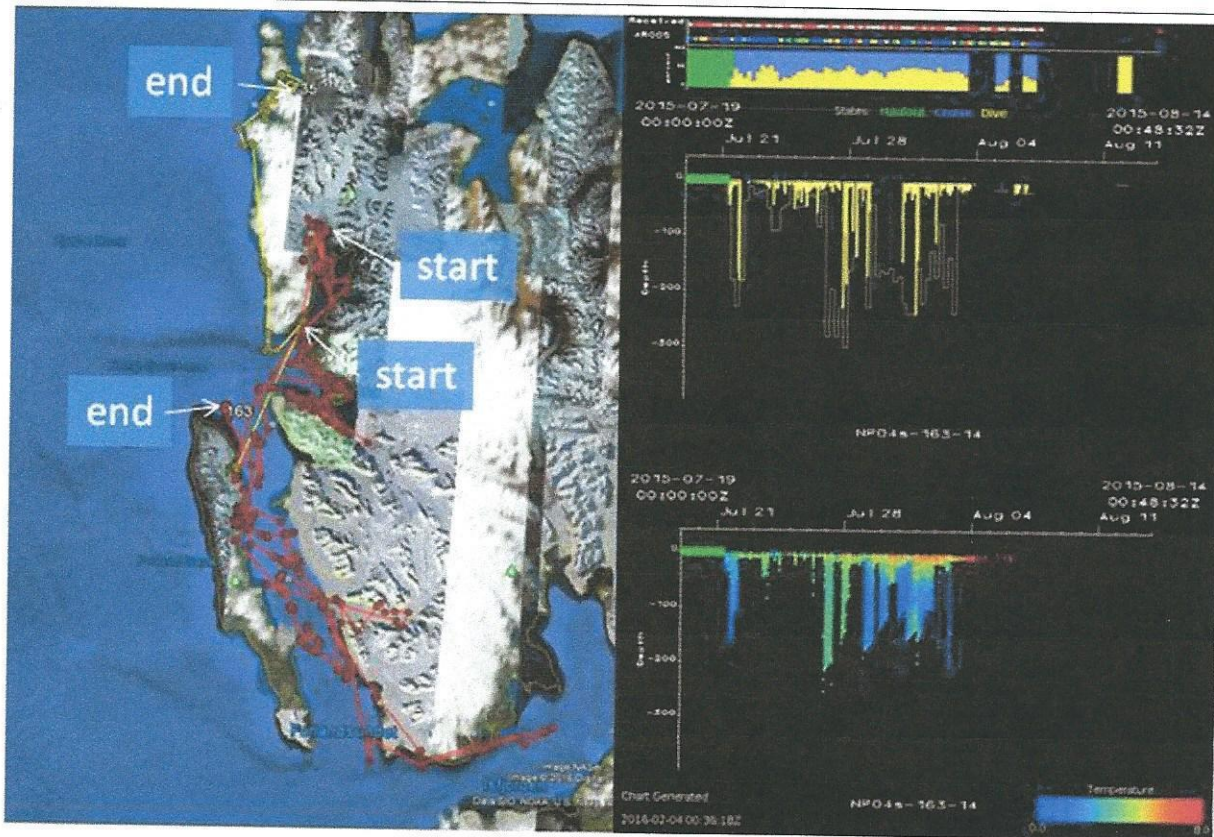
*No more than 3 A4 pages for each WP implemented in the reporting period: a description of the results achieved during the reporting period, activities carried out during this period and an explanation of the use of resources.*

**NPI:** Field work was carried out in July and August 2015 on the west side of Spitsbergen. Only two white whales were captured and instrumented both in the Krossfjorden area (see picture below):



The tags transmitted for a very short time (3 days and 21 days) and towards the last part of the fieldwork when we got to know this we decided not to try to catch more whales for instrumentation. The reason was that we used "old" tags that had been stored one year and we were uncertain as to what degree that had drained the batteries. The producers say it should not matter - but we will anyway order 10 fresh tags for the 2016 season. The tracks from the two whales from the 2015 season is shown below. Here are also some dive info (dives down to about 300m) and some temperature profiles collected (Task 4.2 and 4.3).





Good news is that the results from GLAERE has been used in an application for further research on "ICE Whales" that was supported by the Norwegian Research Council which implies that we will do two more field seasons with white whale tracking - the two latter years then financed by this new source. We have collected blood and blubber samples from 13 animals so far in GLAERE and these are currently to analyses for diet (Fatty acids and stable isotopes), general health assessment (blood screening) and for various pollutant studies (Task 4.2 and 4.3).

**Explanation of the use of resources:** Resources used from GLAERE has mainly been to pay for the boat and expenses with people in the field.

**IOPAS:** Automatic sonobuoy with a set of four omnidirectional hydrophones was deployed with sensors depth set to 20/22 metres. In addition to the set of the hydrophones, the buoy was equipped with an upward looking echosounder, a compass and inclinometer. The broadband hydrophones were horizontally aligned to detect direction of noise sources. The signals from the hydrophones were sampled at 30 kHz. All signals were recorded to memory cards during the entire period. Recording was accomplished in the 04-07.07.2015 and 25-29.07.2016 in two fjords Horsund (pos. Lat. 76° 59,595N, Lon. 16°24,042E) and in Kongsfjord (pos. Lat. 78° 53,103 N, Lon. 12°26,088 E) respectively (Task 4.2).

However, due to the high concentration of floating glacial ice, covering throughout all measurement period surface of both fjords, very high level of the noise was observed. More as 10 times recorded in previous season amplitude of the noise was observed. During the prevailing time of records the signal was saturated in the ADC unit. The gathered information after postprocessing is effective for detecting the direction of different dynamic events on the sea surface and on the ice cliffs, but mammals sound are not recognisable (T4.2 and 4.3).

**Explanation of the use of resources:** WP4 resources were used to cover the salary of scientists involved in



the project, travel cost to attend international conference, and to fund the summer field campaign. Costs of summer field campaign include travel costs to the Arctic and cost of consumables needed to perform research.

**Milestones and deliverables**

No milestones and no deliverables were planned for this reporting period

**Description and justification of discrepancies and corrective actions**

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WP4 is running according to the schedule with good progress towards deliverables and milestones. Differences between funds planned and spent are of operational character and will be compensated in the final year of GLAERE implementation.

<b>C1. Work Package title and number</b>	<b>5. Seabirds</b>			
<b>Start date</b>	planned	2014.03.01	actual	2014.03.01
<b>End date</b>	planned	2016.09.30	actual	In progress
<b>Cost of WP (PLN)</b>	planned	712 960,65	actual (value at the end of the reporting period)	339 998,38
<b>Implementing entities</b>	NPI, UG			

**An overview of the progress of work towards the objectives of the project, including achievements, milestones and deliverables specified in the project contract**

*No more than 3 A4 pages for each WP implemented in the reporting period: a description of the results achieved during the reporting period, activities carried out during this period and an explanation of the use of resources.*

**NPI:** In work package 5 we will assess in detail the importance of glacier fronts in Svalbard as foraging areas for seabirds, with emphasis on the black-legged kittiwake, which is the most numerous species utilizing glacier fronts as foraging habitats in Svalbard. The study areas are Kongsfjorden and Hornsund. As in 2014, fieldwork was conducted in Kongsfjorden from mid-June to the beginning of August 2015 (two persons).

Three cameras (Harbortronics Inc.) were deployed facing the Kronebreen glacier front to monitor bird activity and the attractiveness of the glacier front for seabirds (mostly black-legged kittiwakes, arctic terns and northern fulmars). Each camera took one picture/hour from June 16 to September 3, giving a total of ca. 6000 pictures. Two cameras were set up on the south side of the glacier (78°52'06.1" N / 12°29'14.7" E) and one on the north side (78°53'35.9" N / 12°32'35.5" E). On the south side, one camera had a wide-angle lens while the other had a telephoto lens in order to collect information at different scales. On the north side, the camera had a telephoto lens. All cameras aimed at what were assumed the major melt-water outlets from the glacier that released cold fresh water into the fjord. The images are analyzed, and data under preparation for publication (Task 5.1).

Regurgitated food from kittiwakes breeding at Ossian Sarsfjellet were collected for dietary studies. The samples have been worked up during fall 2015 (Task 5.2).

Black-legged kittiwakes were deployed with GPS loggers in the Ossian Sarsfjellet colony, north of the Kronebreen glacier. GPS loggers were deployed for up to one week on twenty-three adults caught on their nest during three periods; early (incubation), middle (hatching) and late (chick rearing; Task 5.3).

The study gave valuable data on kittiwake movements and their affinity to nearby glacier fronts. Movement and dietary data has been analyzed during fall and winter 2015-2016, and compared with similar data from 2014. Focus is now on writing up and submit a publication (Task 5.2 and Task 5.3).

**Explanation of the use of resources:** The funding spent in 2015 was used for covering field costs and personnel.

**UG:** The University of Gdańsk team from Department of Vertebrate Ecology & Zoology, University of Gdańsk (Michał Goc, Magdalena Hadwiczak, Lech Iliszko and Lech Stempniewicz), was working at Gnalberget, Hornsund between 10 July-01 August 2015 and realized following tasks:

1. foraging areas of kittiwakes *Rissa tridactyla* from Gnalberget colony (Task 5.3). As in 2014 we used miniature GPS loggers deployed on birds allowing us to collect series of GPS positions of foraging individuals. We have collected large amount of data showing that birds performed both, short foraging trips, visiting Hornsund area including glacial bays in Burgerbukta and Breepolen, and shelf areas around Sorkappland during the long-distance foraging trips. Individual birds flew as far as over 500 km during one



foraging trip. Data are being elaborated and preliminary results show much higher proportion of kittiwakes foraging in the fiord in 2015 comparing to 2014. This could be a consequence of different weather conditions and especially wind characteristics between the two study seasons.

2. samples of regurgitated food (n=25). They were sent to IO PAS for identification and laboratory analysis and preliminary results of their elaboration are now available.
3. sampling of zooplankton. We have collected 39 samples in the surface water layer in two zones adjacent to glacier front (c. 50 m and c. 250 m, respectively) in four glacier bays of the study area. They were sent to IO PAS for identification and laboratory analysis.
4. recording feeding frequency of parent kittiwakes using video recorder set in the colony during the whole study period (484 recorded hours).

Census of marine birds and mammals foraging in Burgerbukta (Task 5.1, 5.2, 5.3 and 5.4). Like in the previous season, total study transect amounting to 36 km was divided into 9 sectors differing as to coast and littoral type and sea icing. It also included four sections of glacier fronts. We performed 7 full surveys which revealed large numbers of seabirds foraging in the study area, including kittiwake, black guillemot and little auk, as well as ring seals and polar bears. King eider *Somateria spectabilis* was the new species noted in 2015. Much higher numbers of kittiwakes and even higher of little auks were observed foraging in Burgerbukta in 2015 comparing to 2014, perhaps due to worse weather conditions on the foraging grounds out of the fiord in 2015. We have also estimated rate of glacier retreating and area of fiord uncovered during last 15 years. Surface feeders, dominated by kittiwakes *Rissa tridactyla*, were much more abundant than benthic feeders (black guillemots *Cepphus 14ommon* and 14ommon eiders *Somateria mollissima*) and pursuit divers (little auks *Alle alle* and Brunnich's guillemots *Uria lomvia*). Coastal feeders exploiting first of all tidal glacier bays predominated largely pelagial feeders and all other groups foraging along remaining coastal sectors. Glacier bays characterized with much higher number of birds and mammals but with lower species diversity comparing to other parts of the study area. Analysis of census data has been completed and manuscript of paper is being prepared to submission.

**Explanation of the use of resources:** GLAERE resources were used to cover the remuneration of the personnel involved in the project, and to cover the cost of field campaign in the Arctic.

**Milestones and deliverables**

**D5.1** Completion of archival data on the use of glacial bays by seabirds. Survey data and tracking data (GLS and satellite) collected by IOPAS and NPI prior to this project, database; (M 12, delivered in M12)

**Description and justification of discrepancies and corrective actions**

*If during the reporting period there was a derogation from the contractual provisions (e.g. duration of WP), an explanation should be given: what type of derogation, reasons for the discrepancy, taken or planned corrective actions to determine impact on further implementation of the project and achievement of planned results of the project.*

This WP is being implemented as planned, progress towards objectives and deliverables is satisfactory, and there are no discrepancies so far. Differences between funds planned and used are of operational character and will be compensated in the final implementation year of the GLAERE project.



<b>C1. Work Package title and number</b>	<b>6. Fish</b>			
<b>Start date</b>	planned	2014.03.01	actual	2014.03.01
<b>End date</b>	planned	2016.11.30	actual	In progress
<b>Cost of WP (PLN)</b>	planned	694 357,77	actual (value at the end of the reporting period)	456 599,08
<b>Implementing entities</b>	<b>UNIS, IOPAS, MIR-PIB</b>			

**An overview of the progress of work towards the objectives of the project, including achievements, milestones and deliverables specified in the project contract**

*No more than 3 A4 pages for each WP implemented in the reporting period: a description of the results achieved during the reporting period, activities carried out during this period and an explanation of the use of resources.*

**IOPAN:** Survey design: The acoustic measurements for the GLAERE project were conducted in two West Spitsbergen fjords (Hornsund and Kongsfjorden) in summer season of 2015. Acoustic surveys were carried out in the inner part of fjords, in the glacier bays. 15 hours of acoustic records were collected in Hornsund (approximately 30 nmi of transects), while in Kongsfjorden measurements took 3 hours (6.5 nmi). Technical specifications of acoustic surveys limited the ship speed to 3 knots, however speed was further reduced to 1-2 knots when ice floes appeared in fjords (Task 6.2).

Acoustic data acquisition: Acoustic data were collected with a Simrad EK60 split-beam echosounder operating at frequencies of 70, 120 and 200 kHz. All three echosounders used a 256 ms pulse, with a power of 525, 200 and 120 W for 70, 120 and 200 kHz, respectively. The ping rate was set to 2 s<sup>-1</sup> and pulse transmission was synchronised for each transmitter. Pulse length allowed vertical resolution of 0.047 m. Set of three acoustical transducers was mounted on a frame attached to the broadside of the vessel, about 1 m below the sea surface. Acoustic signals were collected with dedicated Simrad ER60 software and stored digitally in the raw format as volume backscattering strength Sv for later analysis in Echoview and Matlab (Task 6.2).

Data processing: First concepts of raw acoustic data processing in Echoview software have been developed. Algorithms for noise correction and removing of spikes and flecks have been tested and preliminary studies of fish distribution have been carried on (Task 6.2).

**Explanation of the use of resources:** GLAERE funds were spent on salaries of researchers involved in WP6 execution, and to cover expenses related to field campaign in the Arctic.

**MIR-PIB:** The participation of MIR-PIB in WP-6 is related to the activities aimed at the description of the current state and understanding of climate-driven processes in fish populations in Arctic bays at two life phases, namely adult fish and early life stages (larval and juvenile). That includes both biological analysis of the fish occurring in bays (contribution to T6.2) and assessment of environmental controls responsible for fish species occurrences in glacial bays (contribution to T6.3).

Over the reporting period, MIR-PIB participated in analysis of adult fish samples collected in 2013 (predominantly polar cod). The obtained in 2014 biological characteristics of polar cod (length, weight, sex, gonads, etc.) has been extended by age analysis of 630 specimens. The age ranged from 0+ to 5 years with a domination of age class 2 (Task 6.2).

MIR-PIB employee participated in the r/v Oceania cruise in Svalbard in 2015. The ichthyoplankton samples were collected with use of Tacker Trawl – total of 25 taws at 13 stations. At each station, the tow was performed at two depths – in surface waters (up to 15-20 m) and in the deep water (up to 250 m). All the



collected early life stages of fish were identified to species (total of 13 species). The most numerous were polar cod larvae (77% of the collected specimens). Polar cod larvae are currently used in further examination including age estimation with use of the daily otolith microstructure analysis. Once the age of each individual is known, comparison of growth rates of larvae from different area as well as hatch dates back-calculation will be possible. Unfortunately, it is a laborious process because of the need of otolith preparation (Task 6.3).

In addition to the research on early life stages of Arctic fishes, MIR-PIB is participating in the preparation of research paper describing environmental conditions (especially food availability) effect on the fish species composition and distribution within Arctic fjords.

**Explanation of the use of resources:** Regarding finances, all the expenses were related to project activities planned for year 2015. That included participation in the organized by IO PAN cruise of r/v Oceania.

**UNIS:** UNIS completed the purchase and instrumentation of MOKAI - automated system for water sampling near the glacier cliffs. This instrument was finally deployed during January Hellmer Hansen cruise and tested in Isfjorden. The glacier survey in planned for August 2016.

**Explanation of the use of resources:** GLAERE resources were used to purchase the automated system for water sampling – MOKAI.

**Milestones and deliverables**

No milestones and no deliverables were planned for this reporting period

**Description and justification of discrepancies and corrective actions**

*If during the reporting period there was a derogation from the contractual provisions (e.g. duration of WP), an explanation should be given: what type of derogation, reasons for the discrepancy, taken or planned corrective actions to determine impact on further implementation of the project and achievement of planned results of the project.*

This WP is being implemented as planned, progress towards objectives and deliverables is satisfactory, and no discrepancies or corrective actions are deemed necessary. Differences between funds planned and spent are of operational character and will be compensated in the final year of GLAERE implementation.

<b>C1.Work Package title and number</b>	<b>7. Lower trophic levels</b>			
<b>Start date</b>	planned	2014.02.01	actual	2014.03.01
<b>End date</b>	planned	2017.01.31	actual	In progress
<b>Cost of WP (PLN)</b>	planned	607 825,44	actual (value at the end of the reporting period)	417 574,33
<b>Implementing entities</b>	IOPAS, MIR-PIB, UNIS			

**An overview of the progress of work towards the objectives of the project, including achievements, milestones and deliverables specified in the project contract**

No more than 3 A4 pages for each WP implemented in the reporting period: a description of the results achieved during the reporting period, activities carried out during this period and an explanation of the use of resources.

**IOPAS, MIR-PIB, UNIS:** The sampling campaign in 2015 was performed from board of r/v "Oceania". Two fjords: Hornsund and Kongsfjorden were revisited. In this season sampling was focused on collecting macrozooplankton with use of Tucker Trawls (horizontal trawls, below surface mixed zone). Also a set of photos was taken with use of underwater lander based photographic set. The sampling and photographing was conducted to provide materials for assessment of pelagic and benthic communities taxonomic composition, abundances and biomass (Task 7.2). All samples and stored photographic materials have been transported to the IO PAN laboratories.

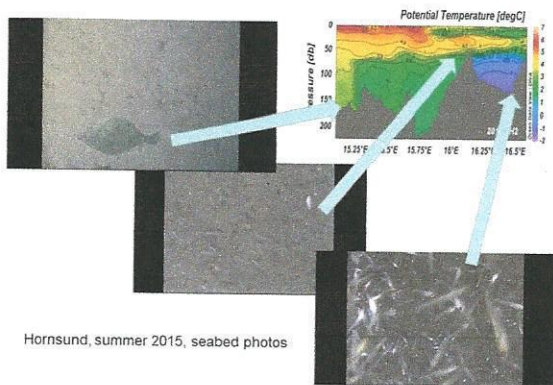


Fig. Examples of seabed photos taken at different localities in Kongsfjorden in 2015.

The materials collected in 2014 and 2015 have been analyzed in the laboratory in terms of taxonomic composition, species abundances, biomass and size distributions of dominant species (Task 7.1 and 7.2). These analyses are in progress. The first results of mesozooplankton materials indicated the inner bay stations in both fjords had highly abundant zooplankton assemblages, with *Pseudocalanus* spp., *Calanus glacialis* and *Bivalvia veligers* being numerically important taxa in Hornsund, while *Oithona similis*, *Pseudocalanus* spp and *C. glacialis* in Kongsfjorden. The bulk of mesozooplankton biomass in the glacial stations of west Spitsbergen fjords were represented mainly by *C. glacialis*. The first results of macroplankton analyses indicate different patterns of spatial variability depending on the fjord bathymetry characteristics. The high standing stocks of macrozooplankton (over 1000 g ww/1000m<sup>3</sup>) were noted in the glacial bay of the shallow, more Arctic waters influenced fjord (Hornsund), while in deeper, Atlantic water dominated fjord (Kongsfjorden) the highest biomass of macrozooplankton was noted in the deep, outer basins. Infaunal components of benthic communities in glacial bays were largely impoverished in terms of diversity and standing stocks (compared to central basins) while large quantities of epibenthic echinoderms were observed in near glacier areas.



The sets of benthic data based on materials collected in 2003-2014 have been compiled into a database. Part of the materials was analyzed, the previous identifications have been verified based on the archived materials. The database was prepared in Excell format. The database includes basic information on sampling stations (location, depth, sampling gear, sampling year), occurrence and densities of macrobenthic species and taxonomic affinities of the species (based on the taxonomy provided by WoRMS, Worlds Register of Marine Species, <http://www.marinespecies.org/>).

These data were analyzed with use of Species Distribution Modelling to explore the correlations between the species distributions and environmental factors, to verify if the species distribution is controlled by water temperature and point out potential refugia for Arctic benthos in the fjord (Task 7.3). Distribution data were compiled for species with at least 5 records of occurrence available for modelling. The environmental data included mean sediment grain size, distance from glaciers, depth, seabed slope, rugosity, mean bottom water temperature, temperature range, mean salinity, salinity range. The results confirmed the importance of bottom water temperature. The distribution of studied species (selected species of Mollusca and Crustacea) was clearly correlated with the specific water masses – colder or warmer. The results also indicated that the most inner basins of the Hornsund fjord may serve as the potential refugia for cold water arctic fauna, contrary to the outer and central basins of the fjord that create suitable habitats for fauna preferring warmer waters.

The materials collected in 2014 in order to characterize a food web structure in glacial bays (Task 7.4) were prepared for analyses and partly analyzed in terms of stable isotope and fatty acids composition. Stable isotope analysis (based on  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  signatures) provides time- and space- integrated insights into trophic relationships among organisms. Fatty acids add another dimension to the view of the trophic structure of the studied communities, especially valuable, when differences in  $\delta^{13}\text{C}$  between carbon sources are small. Combination of stable isotope and fatty acids analysis will provide a reliable and comprehensive approach to examining trophic interactions in the glacial bays.

69 samples of animal tissues were prepared for  $C_{\text{org}}$  and  $N_{\text{tot}}$  concentrations and their isotopic compositions as well as lipid analyses. Freeze-dried samples were homogenized and inorganic carbonate was removed with concentrated HCl. Analyses will be done with use of an Elemental Analyzer Flash EA 1112 Series combined with the Isotopic Ratio Mass Spectrometer IRMS Delta V (isotopes) and gas chromatography with a flame ionization detector (fatty acids).

**Explanation of the use of resources:** GLAERE resources were spent on salaries of personnel involved in the field work and laboratory analysis, and to fund sampling campaign. Sampling campaign costs included travel costs and consumables needed during the field work. Some reagents and other laboratory materials were purchased for sample processing.

<b>Milestones and deliverables</b>	<p><b>D7.1</b> Data base of archival data on glacial bays invertebrates occurrence, database; (M12, delivered in M12)</p> <p><b>M7.1</b> Field work completed; (M14, delayed)</p> <p><b>M7.2</b> Sample protocols delivered; (M17, delayed)</p>
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**Description and justification of discrepancies and corrective actions**  
*If during the reporting period there was a derogation from the contractual provisions (e.g. duration of WP), an explanation should be given: what type of derogation, reasons for the discrepancy, taken or planned corrective actions to determine impact on further implementation of the project and achievement of planned results of the project.*

The field work were planned to finish in summer 2015. However, it was decided to have another summer sampling/research campaign in 2016. This is because the purchase and equipping the MOKAI instrument (automated system for water sampling) with additional devices (e.g., depth sounder, CTD probe and acoustic

camera) took longer than expected. The instrument was deployed and tested last year, but the main glacier survey with it is planned for summer 2016. Therefore, M7.1 and consequently M7.2 were postponed till summer/early autumn 2016. This change does not have any negative influence on the project implementation – on the contrary it allows us to gather valuable data which would not be acquired in any other way. Apart from this change, WP7 is progressing as planned. Progress towards its objectives and deliverables is assessed as satisfactory, and there are no significant deviations from the contractual provisions. Differences between funds spent and planned are of operational character, and will be compensated during the final year of the project implementation.



## **C2. A publishable summary of the progress of work**

*A short summary for all WPs of the total work performed on the project during the reporting period. The information provided here may be published by NCBR on the website of the Programme or transferred to the Donors for publication.*

Project developed a full activity for the main field season in summer 2015, where two research vessels were involved (r/v OCEANIA and r/v Helmer Hansen). All research teams were busy in the field as well as in the working out the data collected in previous year. After a meeting in Tromso (November 2015 – during Workshop on Northern Fjords) we decided how to divide the field work in 2016 and what kind of logistics is going to be used. We also discussed the closer collaboration with other similar projects like Norwegian TIGRIF and German- Danish initiative on Greenland glaciers, as well as new project planned for the Polish Polar Center KNOW on glacial suspensions. ties, to mention:

**WP1:** Management and dissemination: web page and dissemination material was maintained and supplied with new events – the popular book for children was translated to English and printed, most notably the open competition for primary school was conducted with the focus on sea and glacial ice. The aim was to ask children to visualise the difference between the different kinds of ice. From over 20 participants three most effective were rewarded, and effects are visible on the web page. The project movie was launched on the web and you tube with English subtitles and has been presented on numerous occasions.

**WP2:** Physical drivers: The new CTD measurements were collected in summer from r/v OCEANIA and three yachts with volunteers visiting number of glacial localities to collect additional information for the project (water and sediment samples, CTD casts, Sechchi disc readings) – as a part of “citizen science initiative.

**WP3:** Remote sensing and GIS: the intensive field work was completed by the GIS team in Hornsund and Kongsfjorden, with new concept developed for the nature of glacial bay circulation – the idea of local upwelling was excluded. The two research papers were prepared for submission.

**WP4:** The tagging of white whales was continued as well as the studies on the ringed seals, yacht MERIDIAN was used again for the field work along Spitsbergen coast. Hydroacoustic study was continued in Hornsund and Kongsfjorden with large amount of new recordings completed from r/v OCEANIA.

**WP5:** Seabirds: the study on Kittiwake in Hornsund was continued with number of food samples.

**WP6:** Fish acoustical survey in the field 2015 was completed and data have been processed, that resulted in presentation on conference in Tromso and submission of research paper to Journal of Marine research.

**WP7:** Lower trophic levels: meso and macroplankton as well as nectobenthos were collected near the glacier fronts of four glaciers, near the glacier in as a reference in a 1km distance in 2015 – repeating the survey from previous year. Photo documentation of glacial seabed was supplemented with over 100 of new images, and results are stored in the georeferenced data base.



**C3. INDICATORS OF THE PROGRAMME**

No.	Indicator	Baseline value	Target value	Value reached from the beginning of the project implementation	Progress (%)	
	1	2	3	4	$5=(4/3)*100$	
1	Number of long term cooperation (new projects) resulting from the partnership	under preparation	0	0	0	n/a
		submitted	0	0	0	n/a
		funded	0	1	1	100%
2.	Number of international peer-reviewed publications	under preparation	0			
		submitted	0		1	
		published	0	11	4	36%
2a.	Subset: number of joint publications authored by project participants from both BS and DS	under preparation	0			
		submitted	0			
		published	0	5	1	20%
3.	Number of PhD students and Postdocs trained within the project	all	0	3	0	0%
		female	0	1	0	0%
4.	Number of researchers in leadership positions	all	0	7	7	100%
		female	0	2	2	100%
5.	Number of researchers and PhD students undertaking research and educational activities within the project	all	0	28	28	100%
		female	0	12	12	100%
6.	Number of work package leaders	all	0	7	7	100%
		female	0	2	2	100%



**C4. PROGRAMME OPERATOR'S INDICATORS**

No.	Indicator	Baseline value	Target value	Value reached in reporting period	Value reached from the beginning of the project implementation	Progress (%)
	1	2	3	4	5	$6=(5/3)*100$
1.	Number of master's theses based on results of research completed in frame of the project (including those prepared in cooperation with another research entity)	0	1	0	0	0%
2.	Number of PhD theses based on results of research completed in frame of the project (including those prepared in cooperation with another research entity)	0	2	0	0	0%
3.	Number of post-doctoral theses based on results of research completed in frame of the project (including those prepared in cooperation with another research entity)	0	0	0	0	n/a
4.	Number of professorships awarded during the project implementation	0	0	0	0	n/a
5.	Number of peer-reviewed papers presenting scientific findings obtained in frame of the project, published in reputable national journals	0	0	0	0	n/a
6.	Number of peer-reviewed papers presenting scientific findings obtained in frame of the project, published in reputable international journals	0	11	3	4	36%



7.	Number of solutions protected by industrial property law or planned to be covered by such protection	0	0	0	0	n/a
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#### D. DISSEMINATION AND PROMOTION

##### D1. PUBLICATIONS

No.	Title	Authors	Name of journal	IF	Date of submission for publication, year of publication	Language
1.	<i>From the worm's point of view. I: Environmental settings of benthic ecosystems in Arctic fjord (Hornsund, Spitsbergen)</i>	Drewnik, A., Węstawski, J.M., Włodarska-Kowalczyk, M., Łącka, M., Promińska, A., Zaborska, A., Gluchowska, M.	Polar Biology	1.586	2015 (published)	English
2.	<i>From the worm's point of view. II. Species Distribution Modelling of benthic macrofauna in the Hornsund fjord (Spitsbergen, Svalbard)</i>	Drewnik, A., Węstawski, J.M., Włodarska-Kowalczyk, M.	Oceanologia	1.000	December 2015 (submitted)	English
3.	<i>Modelling the long-term mass balance and firn evolution of glaciers around Kongsfjorden, Svalbard</i>	Van Pelt, W.J.J., Kohler, J.	Journal of Glaciology	3.240	2015 (published)	English
4.	<i>Dynamic perennial firn aquifer on an Arctic glacier</i>	Christianson, K., Kohler, J., Alley, R.B., Nuth, C., van Pelt, W.J.J.	Geophysical Research Letters	4.196	2015 (published)	English

##### D2. CONFERENCES AND SEMINARS

No.	Title of presented work	Authors	Date and place	Type (international/national)	Presentation / poster/other (specify)
1.	<i>The importance of tidewater glaciers for marine mammals and seabirds</i>	Strøm, H.	10-11/11/2015 Tromsø, Norway	FRAM Science Days 2015 (international)	Presentation



2.	<i>Fish and why non-fish fjords on Svalbard</i>	Węstawski, J.M., Szczucka J., Kwaśniewski, S., Głuchowska, M., Promińska A., Ormańczyk M., Deja K., Fey, D., Schmidt, B.	23-27/11/2015  Tromsø, Norway	International Workshop on Northern Fjords  (international)	Presentation
3.	<i>Meltwater contribution to Kongsfjord</i>	Kohler, J.	05/2015  Tromsø, Norway	KongHiro meeting  (national)	Presentation
4.	<i>Dynamic Perennial Firn Aquifer on a High Arctic glacier</i>	Kohler, J., Christianson, K., van Pelt, W. J. J.	2-5/06/2015 Ilulissat, Greenland	Ilulissat Climate Days  (international)	Presentation
5.	<i>Kongsfjord glaciology</i>	Kohler, J.	10/2015  Oslo, Norway	CalvingSeis meeting  (national)	Presentation
6.	<i>Modelling ground-ice events in arctic snowpack</i>	Kohler, J., van Pelt, W.J.J.	29-31/10/2015  Copenhagen Denmark	IGS-Nordic Branch meeting,  (international)	Presentation
7.	<i>A dynamic perennial firn aquifer</i>	Kohler, J., Christianson, K., van Pelt, W.J.J.	29-31/10/2015  Copenhagen Denmark	IGS-Nordic Branch meeting,  (international)	Poster
8.	<i>Detecting accumulation events and spatio-temporal distribution of snow in Kongsfjorden area</i>	Pramanik, A., van Pelt, W.J.J., Kohler, J.	29-31/10/2015  Copenhagen Denmark	IGS-Nordic Branch meeting,  (international)	Presentation
9.	<i>A dynamic perennial firn aquifer</i>	Kohler, J., Christianson, K., van Pelt, W.J.J.	14-18/12/2015  San Francisco, USA	2015 Fall Meeting, AGU  (international)	Poster
10.	<i>Ocean, sea ice and glaciers interaction in Svalbard area</i>	Walczowski, W., Błaszczuk, M., Wawrzyniak, T.	23-30/04/2015  Toyama, Japan	International ISAR-4/ICARP III Conference during ASSW2015  (international)	Presentation
11.	<i>Flexible foraging behaviour of a small zooplanktivorous seabird, the little auk <i>Alle alle</i>, in a changing Arctic</i>	Jakubas, D., Wojczulanis-Jakubas, K., Stempniewicz, L.	26-30/10/2015  Cape Town, South Africa	2nd World Seabird Conference  (international)	Presentation
12.	<i>Reproductive tug-of-war: males and females parental investments in the little auk</i>	Wojczulanis-Jakubas, K., Jakubas, D.	26-30/10/2015  Cape Town,	2nd World Seabird Conference  (international)	Presentation

			South Africa		
13.	<i>Micro-scale variation in little auks chicks diet composition in the northern West Spitsbergen</i>	Boehnke, R., Ostaszeweska, K., Jakubas, D., Wojczulanis-Jakubas, K., Blachowiak-Samolyk, K.	26-30/10/2015  Cape Town, South Africa	2nd World Seabird Conference  (international)	Presentation
14.	<i>The flexibility of chick begging behavior and parental care in an Arctic seabird, the little auk Alle alle</i>	Kidawa, D.	26-30/10/2015  Cape Town, South Africa	2nd World Seabird Conference  (international)	Presentation
15.	<i>IOPAS Arctic activity in 2015</i>	Walczowski W.	30.11-01.12/2015  Reykjavik, Iceland	ARCTIC ROOS 2015 Annual Meeting  (international)	Presentation

<b>D3. PATENTS/PATENT APPLICATIONS (title, number, date, Creator, Entitled to Patent)</b>
None

<b>D4. OTHER (not mentioned above e.g. promotional materials, training materials, educational materials, master thesis, PhD thesis, organization of workshops, conferences, etc.)</b>
<ol style="list-style-type: none"> <li>1. Preparation and publication of the popular science book for children entitled: 'One degree'. This book is prepared in Polish and English languages, and is available in the digital form at IOPAS web-page (<a href="http://www.IOPAS.gda.pl/projects/GLAERE/dissemination.html">http://www.IOPAS.gda.pl/projects/GLAERE/dissemination.html</a>).</li> <li>2. Preparation and release of the short movie prepared with children and for children. The movie title is: 'Vanishing Arctic'. The movie explains what happens to polar animals when the glaciers are melting. The movie is available at YouTube (<a href="https://www.youtube.com/watch?v=8IF4Q_hhpqA">https://www.youtube.com/watch?v=8IF4Q_hhpqA</a>) and GLAERE web-page (<a href="http://www.IOPAS.gda.pl/projects/GLAERE/dissemination.html">http://www.IOPAS.gda.pl/projects/GLAERE/dissemination.html</a>).</li> <li>3. Presentation of project during the 8<sup>th</sup> Sopot Science Day (23<sup>rd</sup> May 2015). The stand included demonstrations on glaciers, model of glacier and associated wild life, and art classes for children.</li> <li>4. Art exhibition (16<sup>th</sup> of June 2015) during which the artworks from the Sopot Science Day were presented. The exhibition was joined with popular science talk on the changing Arctic, release of short movie 'Vanishing Arctic', and distribution of 'One degree' books.</li> </ol>



**E. FINANCIAL SUMMARY**
**E1. COSTS INCURRED IN THE REPORTING PERIOD (PLN)**

	<i>Total costs</i>	<i>Requested funding</i>	<i>Beneficiary contribution</i>
<i>Project Promoter IOPAN</i>	523 710,85	523 710,85	0,00
<i>Project Partner 1 UG</i>	198 598,15	198 598,15	0,00
<i>Project Partner 2 MIR - PIB</i>	143 465,67	143 465,67	0,00
<i>Project Partner 3 NPI</i>	369 328,51	369 328,51	0,00
<i>Project Partner 4 UNIS</i>	252 752,54	252 752,54	0,00
<i>Total</i>	1 487 855,72	1 487 855,72	0,00

**E2. COSTS INCURRED CUMULATIVELY (PLN)<sup>1</sup>**

	<i>Total costs</i>	<i>Requested funding</i>	<i>Beneficiary contribution</i>
<i>Project Promoter IOPAN</i>	696 528,76	696 528,76	0,00
<i>Project Partner 1 UG</i>	455 406,14	455 406,14	0,00
<i>Project Partner 2 MIR - PIB</i>	152 790,24	152 790,24	0,00
<i>Project Partner 3 NPI</i>	673 456,08	673 456,08	0,00
<i>Project Partner 4 UNIS</i>	370 145,70	370 145,70	0,00
<i>Total</i>	2 338 326,90	2 338 326,90	0,00

<sup>1</sup> Cumulative value from all previous reports. In No. 1 Periodic Report values are equal to values in table E1.

***I certify that all information contained in this report are consistent with facts. I am aware of criminal liability arising from Art. 271 of the Penal Code, relating to certification of untruth as to the facts having legal significance.***

Person responsible for preparing the periodic report	<b>Name:</b>	Jan Marcin Węśławski
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	<b>Date, signature:</b>	25.02.16 

**Stamp of  
Project Promoter institution**



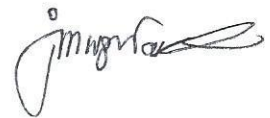
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**Signature and stamp of the authorized person  
to represent the Promoter Project**

**DIRECTOR**  
*Prof. Janusz Pempkowiak*



**Signature of Principal  
Investigator**





**APPENDIX no 1 – Interpretation of the indicators**

1	Number of long term cooperation (new projects) resulting from the partnership	Include all cases that are connected to research conducted in the project. New projects have to be implemented by at least one Polish and one Norwegian entity.
2.	Number of international peer-reviewed publications.	Include only internationally peer-reviewed publications. Publications have to directly refer to research conducted in the project.
2a.	Subset: number of joint publications authored by project participants from both BS and DS	Include only internationally peer-reviewed publications that are authored by researchers from at least one Polish and one Norwegian entity.
3.	Number of PhD students and Postdocs trained within the project.	For Norway: PhD fellows (SKO 1017) and Postdoctoral fellows (SKO 1352) who actually prepared their PhD thesis or postdoc works in the frame of research conducted in the project.  For Poland: PhD students and PhDs who prepared their PhD or habilitation thesis in the frame of research conducted in the project.
4.	Number of researchers in leadership positions	Include all researchers holding managerial positions in the project (Principal Investigators, WP leaders, task managers, etc.)
5.	Number of researchers and PhD students undertaking research and educational activities within the project	All PhD students and other researchers who contribute to and benefit from the project by gaining knowledge and expertise from research cooperation and research conducted in the project.
6.	Number of work package leaders	Include all WP leaders. If a person leads more than one WP, they should be counted only once.