



L.dz. IO/AB/RM/247/228/2015

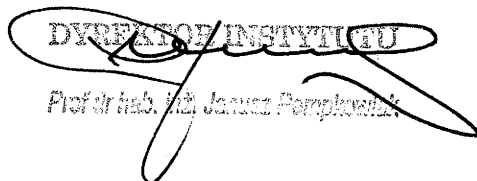
Sopot, 19.02.2015

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 Węsławski.

Instytut Oceanologii Polskiej Akademii Nauk w Sopocie przesyła w załączeniu raport merytoryczny za rok 2014 z ww. projektu.

Z poważaniem,


DIREKTOR INSTYTUTU
Prof. dr hab. inż. Janusz Permywański

Matylda

PERIODIC REPORT
of project implementation
Polish-Norwegian Research Programme

| | | | |
|-------------------------------|--|------------|----------------|
| Report number | 1 | | |
| Reporting period | from | 2014.02.01 | to 2014.12.31 |
| A. PROJECT INFORMATION | | | |
| Number of project contract | POL-NOR/199377/91/2014 | | Acronym GLAERE |
| Duration of project | from | 2014.02.01 | to 2017.01.31 |
| Project title | <i>Glaciers as Arctic Ecosystem Refugia</i> | | |
| Key words | Arctic, glaciers, top trophic levels, climate change | | |

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

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

¹ Choose one: research unit/institution, small /medium/ large enterprise, other

C. INFORMATION ON THE IMPLEMENTATION PROGRESS IN THE REPORTING PERIOD

| C1. Work Package title and number | 1. Management, Dissemination, Synthesis and Data base | | | |
|-----------------------------------|---|------------|---|-------------|
| Start date | planned | 2014.02.01 | actual | 2014.02.01 |
| End date | planned | 2017.01.31 | actual | In progress |
| Cost of WP (PLN) | planned | 374 281 | actual (value at the end of the reporting period) | 46 101,30 |
| Implementing entities | 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 of the GLAERE project included two major actions: monitoring of the scientific and of the financial aspects of the project (Task 1.4). Since main GLAERE campaign is planned for summer 2015, scientific coordination under this report included: (i) maintaining communication between GLAERE researchers, (ii) coordination of the literature studies, (iii) planning for the common field work in 2015, including selection of the sampling points, (iv) preparing, testing and configuration of the scientific equipment, and (v) developing specification for GLAERE data base. Structure of the data base optimized for acquisition, storage and exchange within GLAERE project was analysed and modelled. The data base design was implemented in compatibility with data and metadata standards promoted by SeaDataNet to increase visibility of GLAERE Database at European level. Space for data storage was allocated at IOPAS data servers. Data policy adopts good practices and policy standards recommended by IODE and ICES organizations (Task 1.4).

In order to ensure smooth start of the project, two KickOff meetings were organized. The first one was held in Senja in Norway in February 2014, the second one was organized in Sopot, Poland in March 2014. GLAERE Principal Investigator was present during both meetings in order to ensure proper information flow and research coordination. Minutes from both meetings were prepared (D1.8) and can be downloaded from GLAERE web-site (Task 1.4).

Financial coordination involves monitoring the way GLAERE funds are being spent. Every three months, each partner institution prepares and submits internal financial report (Task 1.5) to ensure proper supervision at the project level. *Quality and evaluation plan* (D1.7) was prepared to provide all partners with detailed information on requirements concerning scientific and financial reporting, budgetary issues, and possible changes in the project budget and project schedule (Task 1.4).

Detailed information and promotion plan (D1.3) was prepared to: (i) define dissemination target groups, (ii) plan appropriate actions and tools to be used respectively for identified target groups, (iii) identify GLAERE major dissemination events, (iv) set evaluation rules to measure effectiveness and efficiency of the dissemination and outreach activities, and (v) inform all partners on the stipulations of the Polish-Norwegian Research Programme concerning information and promotion. In addition, basic information and promotional materials were developed. These materials include the project logo, project stationary, template for deliverables and milestones, and information sticker to be placed on scientific equipment and on the doors of rooms and laboratories, where GLAERE scientists work. All these materials clearly indicate support received from the Polish-Norwegian Research Programme (Task 1.2).

In April 2014 GLAERE web-site was officially launched (D1.2). This web-site contains information on GLAERE

projects, its objectives and activities, photos and various dissemination materials. The web-site is hosted on the IOPAN server at <http://www.iopan.gda.pl/projects/GLAERE/index.html>, is available in Polish and in English, and will be regularly updated throughout the project duration.

Dissemination activities targeted at scientific community included publication of scientific review paper in a high rank journal of Marine Systems (see section D1 of this report for details) and four scientific presentations given during national and international conferences and meetings (Task 1.2).

Outreach activities, aimed at general public, included work on the popular science flash movie for school children and popular science book entitled "One degree makes a difference". Both the movie and the book will be available in the second half of 2015 (Task 1.2).

All four deliverables and three milestones foreseen for this report in WP1 were timely prepared, submitted to the GLAERE Principal Investigator and accepted. No deliverables and milestones were foreseen in other WPs (Task 1.4).

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 organizing coffee break during the KickOff meeting in Poland, (iii) purchase of computer and relevant software to be used during interactions with the general public, and (iv) travel costs to scientific events, where GLAERE concept and objectives were presented.

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

| | |
|------------------------------------|---|
| Milestones and deliverables | <p>D1.2 Website launch, working website, delivered (M3)</p> <p>D1.3 Detailed information and promotion plan, report, delivered (M6)</p> <p>D1.7 Quality and evaluation plan, report, delivered (M6)</p> <p>D1.8 KickOff meeting report, report, delivered (M2)</p> <p>M1.2 Specification of the website, definition of tabs for the website, delivered (M2)</p> <p>M1.3 Specification of the data base, report (M4)</p> <p>M1.5 KickOff Meeting, meeting, delivered (M2)</p> |
|------------------------------------|---|

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 significant deviations from the contractual provisions. However, there is a significant underspending both in IOPAS and NPI budgets. This underspending is of operational character, it will be compensated in the next reporting period, and has no influence on WP deliverables and outcomes. Costs related to GLAERE popular science movie and book for school children were originally planned for 2014. However, the majority of costs will only be chargeable in the beginning of 2015. In addition, some preliminary work on guidelines and recommendations for Arctic governance was planned for late 2014. Since the main GLAERE field campaign was postponed till summer 2015, it was decided to postpone these activities as well.

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|--|----------------------------|------------|---|-------------|
| C1. Work Package title and number | 2. Physical drivers | | | |
| Start date | planned | 2014.03.01 | actual | 2014.03.01 |
| End date | planned | 2016.11.30 | actual | In progress |
| Cost of WP (PLN) | planned | 469 321 | actual (value at the end of the reporting period) | 14 740,03 |
| Implementing entities | 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

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IOPAS: During the first year of GLAERE the archival hydrographic data from Horsund and Kongsfjorden have been collected and processed specifically for project's needs. Archival database includes temperature and salinity covering the period 2001-2013. Analysis of archival data has been done focused on circulation patterns in glacial bays and freshwater content. (Task 2.1).

To optimize field logistics the preparatory GLAERE field work in 2014 was combined with measurements under the other, more advanced project (AWAKE-2). Due to favorable ice conditions, hydrographic measurements from the small boat (field work based on the Polish Polar Station) started already in mid-April and were continued until mid-September, covering period from the beginning of glaciers ablation to its maximal discharge. Temperature, salinity and dissolved oxygen profiles were measured along two standard sections from Hornsbreen to Hoferypynten across the entire fjord width. Additionally CTD measurements were performed in all Hornsund glacial bays, at fronts of the Paierlbreen and Mühbacherbreen (Burgerbuchta), Storbreen, Hornbreen, Svalisbreen, Mandelejevreen (Brepolen) and Samarinbreen (Samarinvgagen) to investigate different regimes of glaciers discharge. Hydrographic measurements in Horsund were done using the Sea-Bird 19plus V2 CTD according to the following schedule: standard section H (H1-H7, once a week), standard section G (G1-G8, once a month), random points along forehead of Hansbreen (section NH, occasionally) and stations along Hornsund coastline, in front of main glaciers (different sections, once a season). (Task 2.1 and Task 2.2)

Additionally during the summer season the Acoustic Doppler Current Profiler (ADCP) was used to collect ocean currents measurements at selected sections along the glaciers fronts in Hornsund and across the fjord. ADCP observations revealed high temporal and spatial variability of currents in the glaciers vicinity with dominating tidal components. ADCP data also clearly showed the vertical structure of water column, in particular vertical distribution and concentrations of suspended particles. (Task 2.1 and Task 2.3)

In spring 2014 one chain of temperature loggers was deployed in the central part of Horsund at the depth of 120 m and in the summer two temperature strings were deployed: one in the Hansbukta at the depth of 69m and one (redeployed) in the central part of Hornsund. The IOPAS mooring located at the Horsund shelf at the depth of 90m for monitoring of the Atlantic water inflow into the fjord was recovered in 2014 after one-year long deployment but unfortunately the current meter AADI RDCP600 was tilted during deployment and current data are not reliable (CTD data are correct). The NPI mooring in Brepolen was also recovered and redeployed in summer 2014 and this data are available for GLAERE. (Task 2.1 and Task 2.2)

For the first time the multi-beam sonar NORBIT was used in 2014 for experimental and innovative measurements of the bottom and underwater part of the tidewater glaciers in Horsund. The first scans of underwater wall of tidewater glaciers, and glaciers foot were obtained and subglacial water outflows were registered. This technology is very promising and IOPAS is going to continue the multi-beam mapping of

glaciers' underwater walls in next years. In the context of GLAERE scientific questions, this method can be very useful to identify potential locations of underwater glacial discharge and resulting upwelling. (Task 2.1 and Task 2.3)

In addition to measurements from the small boat, the ship-borne measurements in Horsund and Kongsfjorden were done from RV Oceania with use of the towed CTD profiling system equipped with the Sea-Bird 19plus V2 CTD probe and the Rinko oxygen sensor. Hydrographic data were collected with high spatial resolution along four sections in Horsund and one section in Horsund Banken. Continuous ship-borne measurements of ocean currents with ADCP were also collected. The 2014 monitoring of hydrographic conditions in Kongsfjorden included 4 sections, measured in a similar way as in Horsund with the towed CTD system. (Task 2.1 and Task 2.2).

Explanation of the use of resources: Laptop to support work with archival hydrological data.

NPI: The main objective of this part of the work package is to model the meltwater contribution to the fjord system, in particular, to Kongsfjord in NW Svalbard, for the relevant time period covering the fjord observational record (Task 2.2 and Task 2.4).

There are two sources of freshwater to the fjord system: rain and surface melt runoff, neither of which can be observed in situ on the basin scale. To model melt and runoff at the basin scale, we use 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 those that ring Kongsfjord, since there can be extensive refreezing of meltwater in the snow and firn of the glacier, leading to significantly delayed and reduced runoff (Task 2.2 and Task 2.4).

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 driven 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 (Task 2.2 and Task 2.4).

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 (Task 2.2 and Task 2.4).

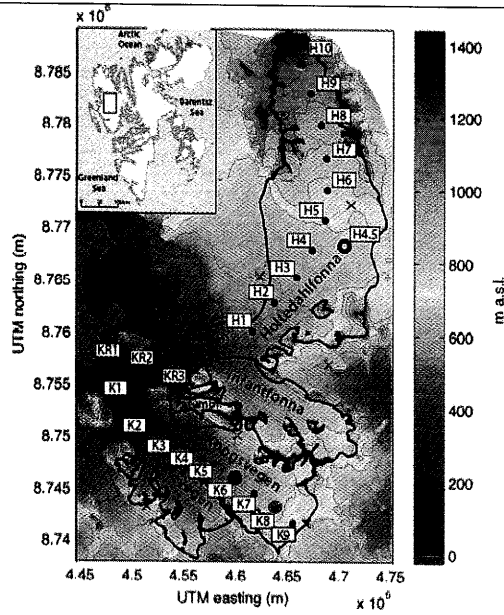


Figure 1. Surface-height map of the study area including outlines of the glaciers Sidorvegen, Kongsvegen, Infantformen, Fatumbeben and Høledahlifonna/Kroerbeben. The inset map shows the location of the glaciers in western Svalbard. Black dots mark the position of mass balance stake measurements; orange circles mark the positions of shallow core sites; blue circles mark the locations of AWS's. Red crosses mark the mid-points of the 11 × 11 km grid of the regional climate model, used to generate the down-scaled 100 × 100 m climate forcing for the coupled model (Section 3.3).

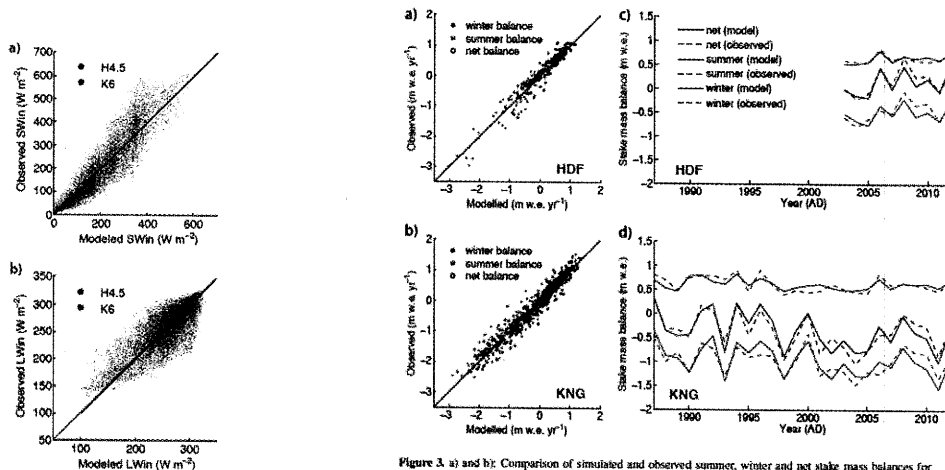


Figure 2. Comparison of simulated and observed 3-hourly incoming shortwave radiation (a) and incoming longwave radiation (b), observed with automatic weather stations at H4.5 and K6.

Figure 3. a) and b): Comparison of simulated and observed summer, winter and net stake mass balances for HDF (a) and KNG (b). c) and d): Time-series of simulated and observed stake-averaged summer, winter and net stake mass balance for HDF (c) and KNG (d).

Explanation of the use of resources: Funds are used to help offset the costs of running the AWS and mass balance stake networks.

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| 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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The preparatory field work in 2014 in Horsund and Kongsfjorden was done in combination with other ongoing projects to optimize the logistics and cost efficiency. Therefore a part WP2 funds in 2014 for personnel, fieldwork and consumables has been shifted to 2015 to support the costs of the GLAERE main field campaign.

| C1. Work Package title and number | 3. Remote sensing & GIS | | | |
|--|---|------------|---|-------------|
| Start date | planned | 2014.03.01 | actual | 2014.03.01 |
| End date | planned | 2016.09.30 | actual | In progress |
| Cost of WP (PLN) | planned | 356 480 | actual (value at the end of the reporting period) | 94 482,02 |
| Implementing entities | UG | | | |
| <p>An overview of the progress of work towards the objectives of the project, including achievements, milestones and deliverables specified in the project contract</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>During the first year of the project two main areas of activity concerned the Task 3.1 (Data base of tidal glacier fronts imagery on Svalbard) and preparation to realization of tasks 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 analyzed areas) were carried out.</p> <p>The main aim of Task 3.1 was to prepare a D3.1 deliverable framework for completion of archival data on tidal glacier fronts. The data base of 389 Landsat 8 satellite images of Svalbard acquired in 2013 and 2014 was created. This data base contains all images which may be useful for tidal fronts and watersheds analyses. The geobase contains also cloud masks for each image in the form of fishnet with spatial resolution of 20 km. Each cell contains 1 or 0 value which determines if the cell area is clouds and haze free. At present 25% of masks are completed. The most important product of Task 3.1 is the creating of archival data on tidal glacier fronts. The special vector data structure was created to store digitized glaciers fronts and populated with 2249 records of glaciers and costal segments during 2000-2010 time period. These segments were created using on-screen digitizing method. This vector data layer was also used to create polyline layer of Svalbard coastline and polygon layer of Svalbard with accuracy of about 30m for 2014. This two layers are ready to disseminate for other work packages.</p> <p>The preparation to realization of tasks Task3.2 and Task.3.3 contained several activities. As a main chosen method of determination of land source of water plumes was object based image analyses. For creating land cover map several tools in the form of ArcGIS Python toolboxes were created. Two toolboxes were created. The first toolbox Landsat8 is used for the preprocessing of downloaded and unzipped data in selected Area Of Interest. All spectral channels are pan-sharpened and atmospheric corrected radiance and reflectance as well as emissivity corrected land surface temperature is calculated. This toolbox contains also the tool for image segmentation which creates the vector layer of polygon objects. All tools in this toolbox works only with Landsat 8 imagery. The second toolbox Geobia supports the object based image analyses carried out in ArcGIS using layer of polygon objects. Tools of this toolbox are not limited to Landsat 8 imagery. The project of registration of winter ice was started. In the present stage it contains mainly the methodological issues and creating several maps of ice coverage in spring 2014.</p> <p>Explanation of the use of resources: Resources were mostly spent on salaries of people engaged on the project (for completing task Task 3.1 and preparation to realization of tasks Task 3.2 and Task 3.3). Additionally book ("Physics of Glaciers") and external disks were bought.</p> | | | | |
| 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.

Progress towards deliverables due in the next reporting period complies with the project work schedule. However, small differences between budget planned and budget spent occurred within the reporting period. In the budget of WP3 for the category 'Personnel', 'Consumables and supplies' and 'Other costs' less money was spent than planned. Unused funds will be used in the next financial years. These discrepancy have no impact on further implementation of the project.

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|--|--------------------------|------------|---|-------------|
| C1. Work Package title and number | 4. Marine mammals | | | |
| Start date | planned | 2014.03.01 | actual | 2014.03.01 |
| End date | planned | 2016.09.30 | actual | In progress |
| Cost of WP (PLN) | planned | 745 684 | actual (value at the end of the reporting period) | 220 908,48 |
| Implementing entities | 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: White whales were selected as the model species for the GLAERE fieldwork in 2014. This is because previous tagging had shown that these whales spend a lot of time foraging at tidal-glacier fronts. Tagging these whales will give us novel, updated data on space use at a time when the Arctic is rapidly changing, in addition to hydrographic data collected by the oceanographic sensors on the tags that is useful for both habitat and climate modelling.

During field work we used a sailboat as the base “ship” (see picture below) and operated out of this mobile platform on a daily basis using two zodiacs. When we catch white whales we basically use two different approaches (see pictures below); either we travel with the base boat and actively search for animals, and if we see some we jump in the zodiacs and set a net from the coast in front of them and try to herd a whale into it. The other approach is to set the net in a presumed good place and hope for whales to come by and herd an animal into the net when they are close enough (Task 4.1).

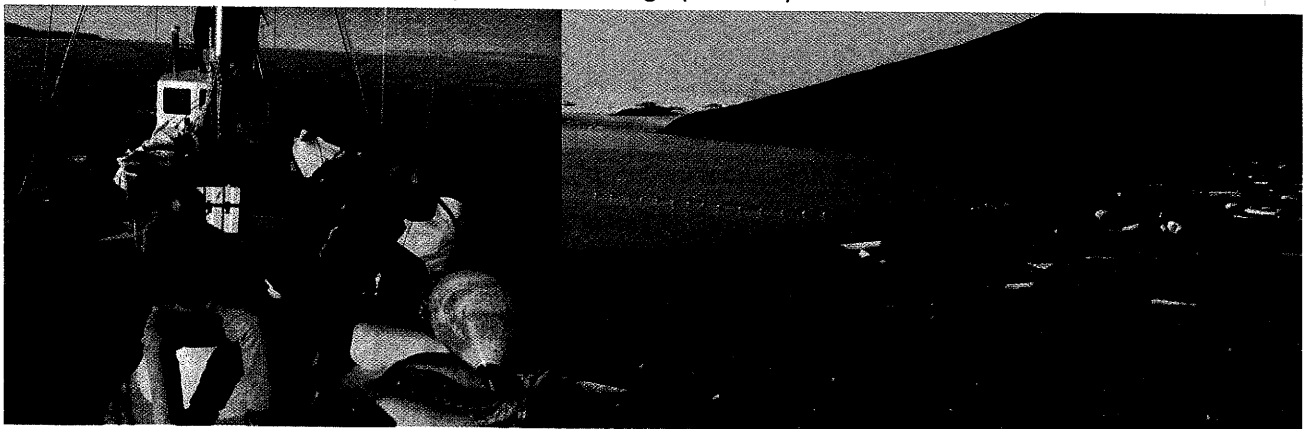


Figure 1: Fieldwork during summer of 2014

When a whale is caught it is disentangled from the net, a rope is attached to the tail which is anchored by a person up on shore, while a hoopnet is held over the head to ensure that the whale can breathe easily while we process it. The whale is measured (length and girth around the whale at the level of the foreflippers, which we use to estimate body mass) and then blood and blubber samples are collected for a whole suite of studies, including health assessment, various ecotoxicology projects and diet studies. Then we attach a satellite tag to the whale using surgical-nylon pins. These tags are custom made in co-operation with the Sea Mammal Research Unit, University of St Andrews, Scotland. They provide unique information on location, diving depth and duration as well as hydrographic data (temperature only on one tag type, and temperature and salinity on another). When the tag is on and the samples taken, the whale is released to swim freely and

collect data that is delivered to us via the ARGOS satellite system (Task 4.1).



Figures 2-4: Pictures of the process of attaching a satellite tag to a white whale during field work in Svalbard during the summer of 2014.

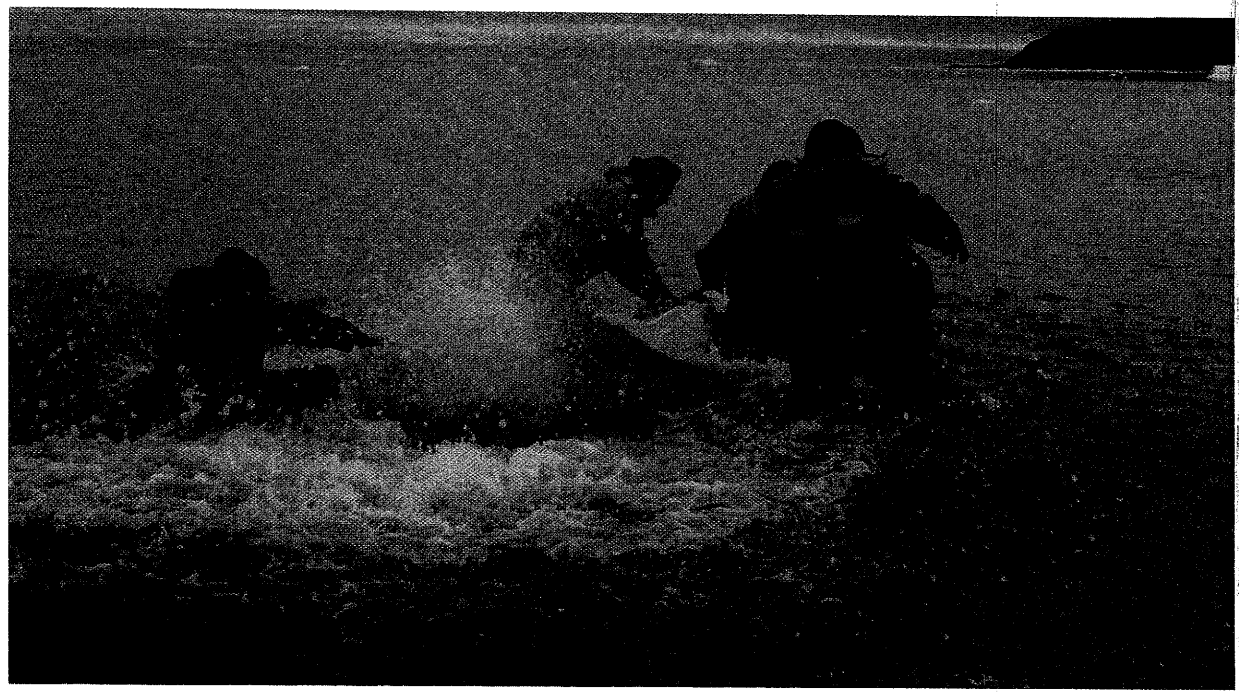


Figure 5: Always a lot of splashing when the whales are set free.

A total of 8 white whales were captured and instrumented during this fieldwork. Below is a map (Figure 6) showing the tracking results so far (end of Sept 2014) and as expected the whales generally travel very close to the shoreline. These data will not be filtered and analysed completely until after the 2015 field season when we hope to deploy some more tags. These tracking data will also be compared with tracking data from 1990ies in an attempt to see whether the movement patterns have changed as a result of changing hydrographic conditions especially on the westside of Svalbard during the last decade (Task 4.1).



Figure 6: White whales tracking results (September 2014)

Explanation of the use of resources: GLAERE funds in 2014 have been used for boat rental and purchase of satellite tags.

IOPAS: Although a fundamental field campaign in scope of GLAERE project is planned for the summer 2015, some pilot acoustic measurement of an ambient noise in the Hornsund Fjord were already performed during AREX'2014 expedition. The included three days records of the acoustic noise with four hydrophone buoy. They were preceded by specific preoperational works: establishing strategy and methods of data acquisition. A set of functions and procedures aimed at data postprocessing were developed in the MATLAB environment

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 the sampling campaign (travel costs and consumables needed during the field work).

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| Milestones and deliverables | No milestones and no deliverables were planned for this reporting period. |
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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.

Progress towards deliverables due in the next reporting period is according to the project schedule. However, differences between 'budget planned' and 'budget spent' occurred in 2014. The funds underspending is a result of a field work shift from 2014 to 2015. In the proposal, we planned one main GLAERE campaign in 2014. However, after discussions during KickOff meetings, it was decided that it would be better for the project to have the pilot campaign in 2014, and then the main field work in 2015. This change, and underspending of funds that followed, is, however, of an operational character, has no influence on the project goals and deliverables, and the underspending will be balanced in the next reporting period.

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|--|--------------------|------------|---|-------------|
| C1. Work Package title and number | 5. Seabirds | | | |
| Start date | planned | 2014.03.01 | actual | 2014.03.01 |
| End date | planned | 2016.09.30 | actual | In progress |
| Cost of WP (PLN) | planned | 712 960 | actual (value at the end of the reporting period) | 237 531,64 |
| Implementing entities | 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

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NPI: In work package 5 we will do a detailed assessment of the importance of glacier fronts in Svalbard as foraging areas for seabirds, with emphasis on the black-legged kittiwake, which are the most numerous species utilizing glacier fronts as foraging habitats in Svalbard. The study areas are Kongsfjorden and Hornsund. The main goals are:

- Assess the temporal (day/week/month) variation in the use of glacier fronts by kittiwakes and various other seabird species by use of time-lapse cameras deployed during the breeding season. This will be related to data collected in other work packages (i.e. melt water runoff) to see how distribution and abundance of seabirds are linked to the physical properties of the glacial front system.
- Assess the relative importance of the fronts as foraging areas for kittiwake during the breeding season, and the temporal and spatial variation in foraging patterns of the birds by deploying GPS-transmitters on breeding kittiwakes in colonies at different distances from glacier fronts.

The 2014-season was a pilot season for testing out the field techniques and set-ups.

Field work was conducted in Kongsfjorden from mid- June to end of July 2014. Three cameras (Harbortronics Inc.) were deployed facing the Kronebreen glacier front, in order to monitor bird activity, and the attractiveness of the glacier front on seabirds (mostly black-legged kittiwakes, arctic terns and northern fulmars). Each camera was shooting one image every hour from July, 17th to October 27, and gave a total of 5968 images (Task 5.1, 5.3 and 5.4).

Two cameras were set up on the southern side of the glacier (78°52'06.1" / 12°29'14.7") and one on the northern side (78°53'35.9" / 12°32'35.5"). On the southern side, one of the camera was setup using a wide angle, and the other with a long focal in order to collect information at different scales. On the northern side, the camera was setup with a long focal. All cameras were aiming at what was assumed as major outlets coming from the glacier, and releasing cold fresh water into the fjord. Image analyses started in January 2015, and are giving promising results (Task 5.1, 5.3 and 5.4).

15 kittiwakes were deployed with GPS logger (Ecotone) in the Ossian Sarsfjellet colony, north of the Kronebreen glacier. Performances and functionality of the Ecotone UR1A GPS loggers and its data recording base station were tested. GPS loggers were deployed on three different adults captured on their nest during the incubating period, on July, 13th. The loggers were left up to one week on the birds. In addition, a number of conventional GPS loggers (without wireless download and a base station) were deployed on 10 birds. The method used to tie up the loggers onto the birds tail feathers proved particularly efficient. Once equipped, none of the birds showed a behavior suggesting they were disturbed while flying. Some issues were faced regarding the functionality of the loggers. Some of them were resolved thanks to the fast replies of ECOTONE's technicians, while others including the ability of the solar panels to charge the battery (when the

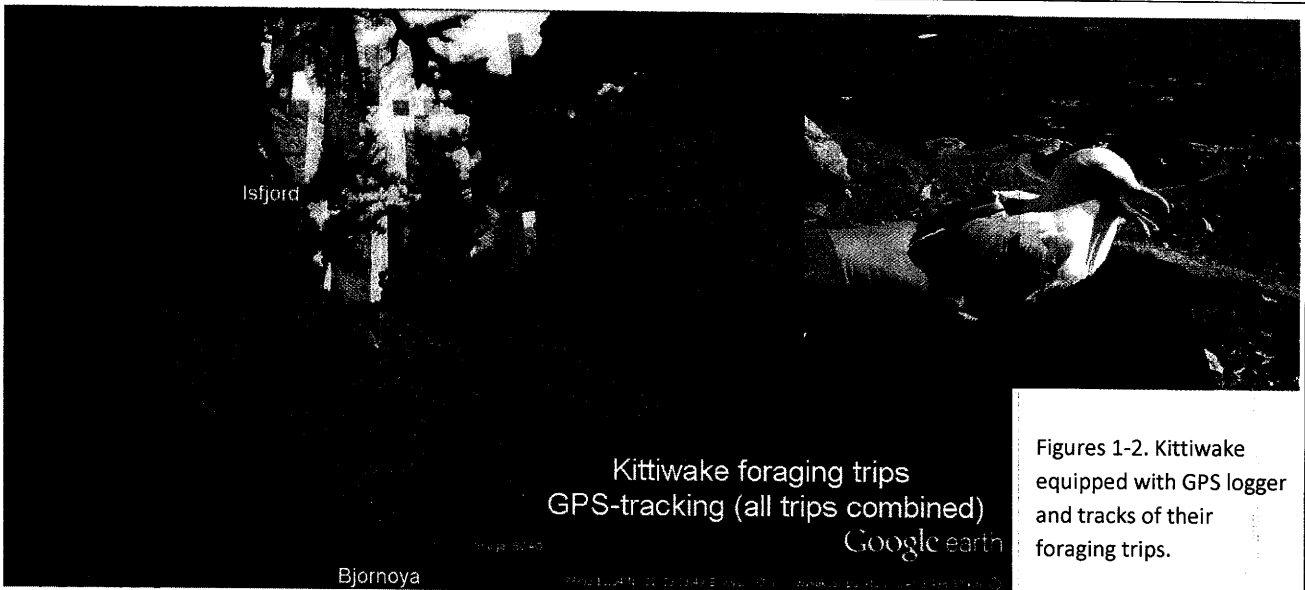
logger is attached to the tail and is covered by the wings while the adults doesn't fly) were still to be solved at the end of the summer. All in all the pilot study gave valuable data on kittiwake movements and their affinity to nearby glacier fronts, and will make a good basis for a more comprehensive deployment in 2015. The movement data will be analyzed during spring/summer 2015 (Task 5.1, 5.3 and 5.4).

Explanation of the use of resources: The funding spent in 2014 was mainly used for covering field costs and GPS-loggers, in addition to cost related to a travel to Ecotone (Poland) to be trained on using the Ecotone Base Station.

UG: The team from Department of Vertebrate Ecology & Zoology, University of Gdańsk, has been working at Gnalberget, Hornsund between 10 July-01 August 2014. Four tasks were realized:

- Foraging areas of kittiwakes *Rissa tridactyla* from Gnalberget colony (Task 5.3). 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 500km during one foraging trip (Fig. 1, 2).
- Collection of food samples delivered by parent kittiwakes to their nestlings (Task 5.2). We have collected samples (n=25) of regurgitated food. They were sent to IO PAS for identification and laboratory analysis and are being elaborated now.
- Census of marine birds and mammals foraging in Burgerbukta (Task 5.1-Task 5.4). Total counting route amounted to 36 km and was divided into 9 sectors differing as to sea icing, weather conditions and distance from glacier. It also included four sections of glacier fronts. We performed 10 full censuses which revealed numerous kittiwakes, black guillemots and ivory gulls foraging there, as well as ring seals, bearded seals, belugas and polar bears. We have also estimated intensity of glacier calving. In general, glacier bays of active Pajerlbreen and Muhlbacherbreen glaciers appeared the most attractive foraging grounds for seabirds (mainly kittiwakes and black guillemots) and marine mammals (seals and belugas) (Fig. 3, 4). Analysis of census data is underway and not completed yet.

Explanation of the use of resources: The financial resources planned for realization of the WP 5 - Seabirds were spent for activities related with field work performed in Hornsund (using of GPS loggers, food sampling, census of seabirds and mammals), laboratory work (elaboration of the collected samples), desktop work with census and GPS tracking data, as well as conceptual work on the specific WP tasks. Most of the used resources belong to the following cost categories: consumables & supplies, travel and personnel costs.



Figures 3-4. Bearded seal *Erignathus barbatus* wounded by polar bear rests on ice-floe in front of Pajerbreen.

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.

Progress towards deliverables due in the next reporting period is according to the project schedule. However, less funds were used when compared with GLARE proposal and contract. This underspending is a result of a field work shift from 2014 to 2015. We planned to organize one main GLAERE campaign in 2014. However, after discussions during KickOff meetings, it was decided that it would be better for the project to have the pilot campaign in 2014, and then the main field work in 2015. This change is of an operational character, has no influence on WP 5 goals and deliverables, and will be balanced in the next reporting period.

| | | | | |
|--|----------------------|------------|---|-------------|
| C1. Work Package title and number | 6. Fish | | | |
| Start date | planned | 2014.03.01 | actual | 2014.03.01 |
| End date | planned | 2016.11.30 | actual | In progress |
| Cost of WP (PLN) | planned | 694 358 | actual (value at the end of the reporting period) | 145 996,55 |
| Implementing entities | 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.

UNIS: Fish sampling for GLAERE was performed during the UNIS cruise on-board r/v Hellmer Hansen in September-October 2013. Despite being collected before GLAERE official start, these samples will be used for project analysis. Additional samples will be collected during the field work in 2015. These samples were shrimp trawl catches from the glacier's bays in Kongsfjorden. Frozen and preserved samples were transferred to IOPAS in summer 2014. Additional collection of fish was completed in 2014 from the epibenthic dredges, both from Hornsund and Kongsfjorden in the vicinity of glaciers (Task 6.1).

Explanation of the use of resources: An autonomous operated vehicle (AOV) was purchased. It will be used for samples collection at the glaciers front in 2015).

IOPAS: During the first year of project implementation, the main activities within WP6 were focused on (1) administrative works, (2) literature studies, (3) maintaining, configuring, testing and calibrating the scientific equipment, (4) planning the schedule for the field work and logistics of the summer campaign in the Arctic and (5) establishing further research activities (Task 6.2).

A fundamental field campaign in scope of GLAERE project is planned for the summer 2015, but some pilot acoustic measurement were already performed during AREG'2014 expedition. They were preceded by specific preparational works: establishing strategy and methods of data acquisition, development of sampling protocols and specification of sampling areas in the vicinity of glaciers in two West Spitsbergen fjords, Hornsund and Kongsfjorden. Additionally, on the basis of the archival data, the optimal configuration of the instruments for the incoming field work by use of the acoustic methods were designed. The multi-frequency acoustic measurements with echosounders SIMRAD EK 60 70/120/200 kHz for fish and Biosonics DTX 420 kHz for zooplankton were made in chosen glacial areas. AREG'2014 expedition has been summarized, review of the collected data records was made and preliminary data processing has started. It will be completed before the next experimental campaign starts (summer 2015; Task 6.2).

Work on the detailed schedule for further activities has been initialized in order to minimize risk of the unsuccessful operation (Task 6.2).

Explanation of the use of resources: GLAERE resources were spent on salaries of personnel involved in the WP 6 scientific activities.

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). Over the reporting period, MIR-PIB participated in the literature collection and overview as well as preparatory activities related to analysis of adult fish samples collected in 2013 (predominantly polar cod). The works involving typical ichthyologic

analysis and stomach extraction for further content examination will be carried out in 2015. All of the activities related to the investigation of the early life stages of Arctic fish are also scheduled for 2015 – no work in this area of interest has been done in the reporting period (Task 6.1).

Explanation of the use of resources: All expenses were related to purchase of materials that will be necessary during activities planned for 2015.

| | |
|------------------------------------|---|
| Milestones and deliverables | No milestones and no deliverables were planned for this reporting period. |
|------------------------------------|---|

| |
|---|
| Description and justification of discrepancies and corrective actions |
| <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> |

Similarly to WP2, WP5 and W6, less funds were used than planned. This is again a results of a change in summer field campaigns schedule. Instead of one field campaign in 2014, two will be organized: the pilot one took place in summer 2014. The main campaign will take place in summer 2015. This change was suggested during both GLAERE KickOff meetings. As explained before, this change is of an operational character, has no influence on WP 6 goals and deliverables, and unused funds will be spent in the next reporting period.

| C1. Work Package title and number | 7. Lower trophic levels | | | |
|--|-------------------------|------------|---|-------------|
| Start date | planned | 2014.02.01 | Actual | 2014.03.01 |
| End date | planned | 2017.01.31 | actual | In progress |
| Cost of WP (PLN) | planned | 607 825 | actual (value at the end of the reporting period) | 90 711,16 |
| Implementing entities | IOPAS, MIR, UNIS | | | |
| <p>An overview of the progress of work towards the objectives of the project, including achievements, milestones and deliverables specified in the project contract</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>IOPAS: The activities of GLAERE WP7 in 2014 started with planning and preparing the summer sampling campaigns. The sampling has been conducted from board of r/v Oceania. Two fjords off west Spitsbergen (Kongsfjorden and Hornsund) were visited. Four glacial bays were selected for sampling – Brepollen, off Hornbreen and Burgerbukta, off Paierlbreen (in Hornsund), and inner basin of Kongsfjorden – off Kronebreen and Kongsbreen (Fig. 1). The sampling was conducted to provide materials for assessment of pelagic and benthic communities taxonomic composition, abundances and biomass (Task 7.1) as well as for the description of the trophic structure of these communities, including the primary food sources and food supply (organic matter available to invertebrate consumers) (Tasks 7.3 and 7.4). At each localities the materials were collected at two stations located at the closest possible distance to the glacier front and 1000 m further away.</p> <p>The sampling for Task 7.1 covered various components of pelagic and benthic communities. Mesozooplankton was sampled with use of 500 µm WP2 net hauls (two vertical hauls from surface mixed layer and lower water layer (approx. 0 – 20m and 20- 80m depth), macrozooplankton with use of Tucker Trawl hauls (horizontal hauls , below surface mixed zone). Hyperbenthos and epifauna were sampled with use of two-net epibenthic sledge hauls and triangular dredge, while infauna with use of van Veen grabs. Baited traps were employed to collect scavenging fauna. Also a set of photos were taken with use of underwater lander based photographic set. This equipment was reconstructed by the GLAERE participants to work efficiently in the glacial bays environment. All samples have been transported to the IO PAS laboratories s and the analyses are in progress.</p> <p>The sampling for tasks 7.3 and 7.4 comprised collection of potential food sources (POM and SOM) and a wide set of invertebrate consumers. In order to characterize a food web baseline samples of pelagic POM were obtained by filtering sea water onto pre-combusted GF/F filters, while surface sediment samples (SOM) were collected with use of box-corer. The samples of 25 key species of both pelagic and benthic communities were collected in glacial bays in both fjords. Organisms caught with use of planktonic nets, dredges or Van Veen grab, were sorted by species on board, immediately after sampling to secure the freshness of the material and frozen until processing (at -80°C). The samples will be analyzed for stable isotope and fatty acids composition. Stable isotope analysis (based on δ15N and δ13C 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 δ13C between carbon sources are small. Because marine invertebrates are unable to synthesize some essential fatty acids (available in some organic sources) the profile of fatty acid composition in their tissues can also reveal the origin of the food source. Combination of stable isotope and fatty acids analysis will provide a reliable and comprehensive approach to examining trophic interactions in the glacial bays.</p> | | | | |

The assessment of composition and distribution patterns of pelagic and benthic organisms in glacial bays as compared to other fjordic basins (Task 7.1) will be performed based on the materials collected during the GLAERE cruises and the archived IOPAS data. IOPAS have considerable number of archived data from the fjords off west Spitsbergen, especially Kongsfjorden and Hornsund. Locations of sampling stations in Hornsund were plotted to visualize the coverage (Figure 2) and the building of the database has been initiated.

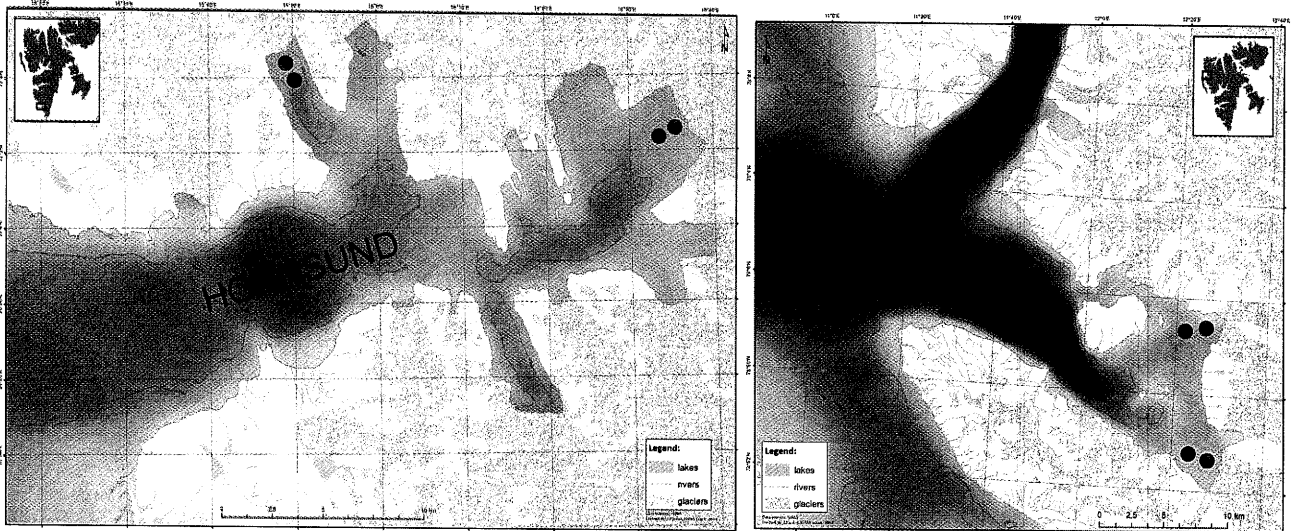


Figure 1. Sampling localities during the r/v Oceania summer GLAERE sampling campaign. (red and black dots indicate the sampling stations located at varying distances from the glacier front).

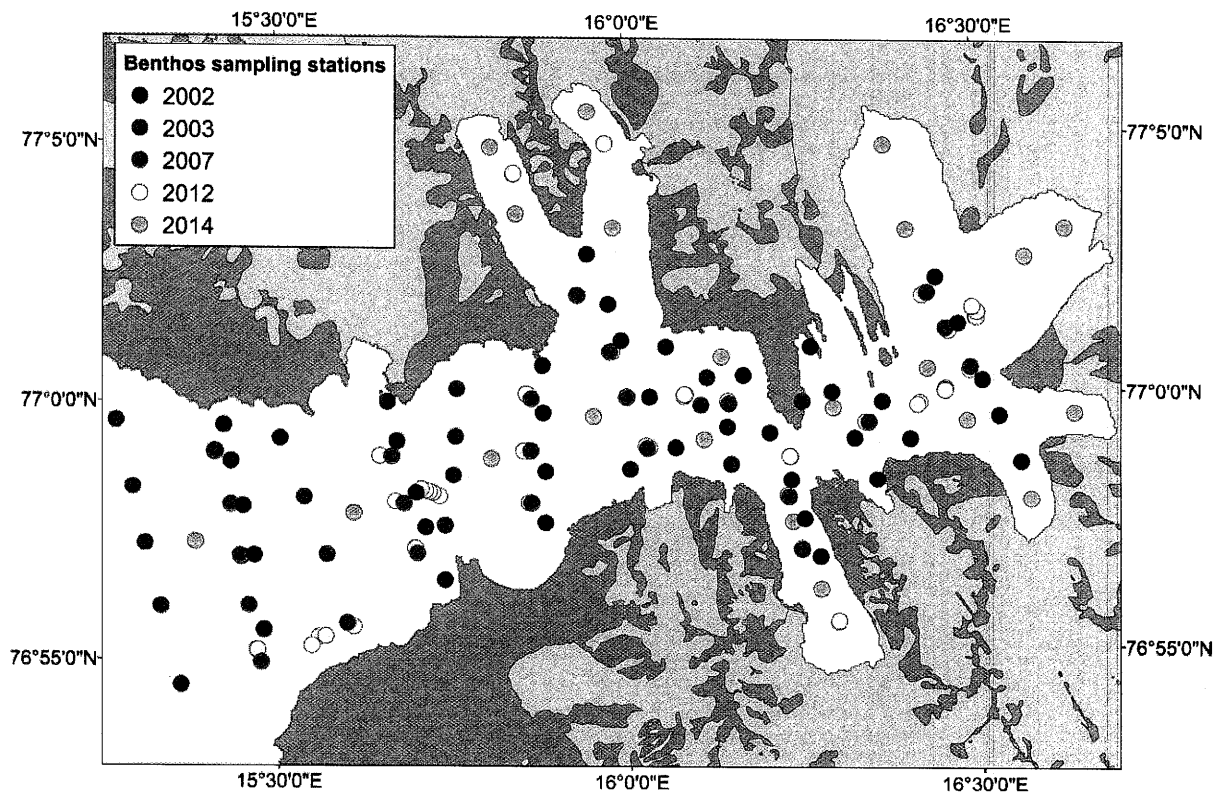


Figure 2. Coverage of benthic sampling stations in Hornsund in IO PAS archived datasets (data from 2002 to 2014 cruises).

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. In addition, underwater photography unit was purchased and tested. This equipment will be used in the main GLAERE campaign in 2015.

UNIS and MIR-PIB: no work has been undertaken by these institutions, what is according to the project schedule.

| | |
|------------------------------------|---|
| 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.

Similarly to other WPs, which include field work, there is an underspending in this WP budget. This underspending is again a result of a change in summer field campaign schedule. Instead of one field campaign in 2014, two will be organized: the pilot campaign took place in 2014, main field work are scheduled for summer 2015. As explained above, this change is of an operational character, has no influence on WP7 goals and deliverables. Unspent funds will be used in the next reporting period.

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 started after a Norwegian- Polish workshop held in Tromso in 2013, where a state of the art paper was produced and aims of future research was planned within Norwegian Research Fund. Three Polish and two Norwegian research and high education institutes formed the research team. The 2014 year was a start-up – pilot phase of the field work and research planning. The following work packages completed different activities, to mention:

WP1: Management and dissemination: web page and dissemination material was launched, and project was promoted in several international meetings. Popular scientific book about glaciers and associated fauna was prepared for print and an internet movie presenting the project was shot and is being edited.

WP2: Physical drivers: archival CTD casts data from several glacier fronts were collected in Hornsund and Kongsfjorden. The new CTD measurements were collected in spring and autumn in addition to standard summer surveys. ADCP and multibeam sonar together with mooring placed in glacier bay Brepollen completed new measurements. The glacial model of glacial runoff was tested and mass balance calculations were performed for the Kongsfjorden glaciers.

WP3: Remote sensing and GIS: the toolbox for sediment plume analysis was developed with special reference for Hornsund and Kongsfjorden. The data base of 389 Landsat images was completed for the analysis.

WP4: The tagging of eight white whales was done in summer 2014. The maps of the migration of whales were obtained and are being compared with previous tagging in this area. The preliminary hydroacoustic survey to detect sea mammals was performed in Hornsund, and obtained signals are being processed.

WP5: Seabirds: the special focus was given to Kittiwake, the bird that apparently most commonly feeding at glacier's cliffs. Radio tagging of fifteen birds in Hornsund was completed in 2014, while the Kittiwakes colonies in Kongsfjorden were controlled with the use of cameras. Food samples were collected from Hornsund colony and are being analysed.

WP6: Fish sampling was started with the UNIS cruise of Helmer Hansen with the shrimp trawl near the Kongsfjorden glaciers front in October 2013. Collected fish was transferred for ichthyological analyses in Sea Fisheries Institute and food studies in IOPAS. Additional collection of fish collected with epibenthic sledge was completed in summer 2014 and are being analysed. Hydroacoustic measurements were collected in 2014 and based on this preliminary material sampling in 2015 is going to be completed.

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. Photo documentation of glacial seabed was completed from the analysed glaciers. Organisms are sorted and identified as well as analysed for their biochemical composition. All this will help to restore the food web near the glacier front.

C3. INDICATORS OF THE PROGRAMME

| 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 research institutions cooperating in the Project | 0 | 5 | 5 | 5 | 100 |
| 2. | Number of researchers using the mobility component | 0 | 0 | 0 | 0 | n/a |
| 3. | Number of scientific publications | 0 | 11 | 1 | 1 | 9 |
| 4. | Number of small and medium-sized enterprises engaged in R&D and/or innovative activities | 0 | 0 | 0 | 0 | n/a |
| 5. | Number of patent applications | 0 | 0 | 0 | 0 | n/a |
| 6. | Number of female project managers | 0 | 0 | 0 | 0 | n/a |
| 7. | Number of degrees and titles awarded to female academic employees - beneficiaries of the Programme | 0 | 2 | 0 | 0 | 0 |

| 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 | 1 | 1 | 9 |
| 7. | Number of solutions protected by industrial property law or planned to be covered by such protection. | 0 | 0 | 0 | 0 | n/a |

D. DISSEMINATION AND PROMOTION

D1. PUBLICATIONS

| No. | Title | Authors | Name of journal | IF | Date of submission for publication, year of publication | Language |
|-----|--|---|---|-----------------|---|----------|
| 1. | The importance of tidewater glaciers for marine mammals and seabirds in Svalbard | C. Lydersen, P. Assmy, S-F. Petersen, J. Kohler, K.M. Kovacs, M. Reigstad, H. Steen, H. Strøm, A. Sundfjord, Ø. Varpe, W. Walczowski, J.M. Węśławski, M. Zajączkowski | Journal of Marine Systems, 129: 452-471 | 2.476 (in 2013) | 2014 | English |

D2. CONFERENCES AND SEMINARS

| No. | Title of presented work | Authors | Date and place | Type (international/national) | Presentation/poster/other (specify) |
|-----|--|---|--------------------------------|--|-------------------------------------|
| 1. | Glaciers as Arctic ecosystem refugia | C. Lydersen, P. Assmy, S-F. Petersen, J. Kohler, K.M. Kovacs, M. Reigstad, H. Steen, H. Strøm, A. Sundfjord, Ø. Varpe, W. Walczowski, J.M. Węśławski, M. Zajączkowski | 23-28.02.2014 Honolulu, USA | Ocean Sciences Meeting 2014 (international) | poster |
| 2. | Arctic fauna in glacier bays | C. Lydersen, P. Assmy, S-F. Petersen, J. Kohler, K.M. Kovacs, M. Reigstad, H. Steen, H. Strøm, A. Sundfjord, Ø. Varpe, W. Walczowski, J.M. Węśławski, M. Zajączkowski | 7-7.06.2014 Wroclaw, Poland | 35th Polar Symposium (international) | presentation |
| 3. | GLAERE: Glaciers as Arctic Ecosystem Refugia | J.M. Węśławski, J. Piwowarczyk | 23.04.2014, Warsaw, Poland | The Polish-Norwegian Research Programme Kick-off Conference | presentation |

| | | | | | |
|----|---------------------------------------|----------------|---------------------------|--|--------------|
| | | | | (national) | |
| 4. | Glaciers as Arctic ecosystems refugia | J.M. Węśławski | 7.11.2014, Poznań, Poland | <i>Seminars of the Biology Faculty of the Adam Mickiewicz University in Poznań</i> (national) | presentation |

D3. PATENTS/PATENTS APPLICATIONS (title, number, date, Creator, Entitled to Patent)

None.

D4. OTHER (not mentioned above e.g. promotional materials, training materials, educational materials, master thesis, PhD thesis, organization of workshops, conferences, etc.)

None.

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> | 172 817,90 | 172 817,90 | 0 |
| <i>Project Partner 1 UG</i> | 246 807,98 | 246 807,98 | 0 |
| <i>Project Partner 2 MIR - PIB</i> | 9 324,57 | 9 324,57 | 0 |
| <i>Project Partner 3 NPI</i> | 304 127,57 | 304 127,57 | 0 |
| <i>Project Partner 4 UNIS</i> | 117 393,16 | 117 393,16 | 0 |
| <i>Total</i> | 850 471,18 | 850 471,18 | 0 |

E2. COSTS INCURRED CUMULATIVELY (PLN)²

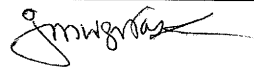
| | <i>Total costs</i> | <i>Requested funding</i> | <i>Beneficiary contribution</i> |
|------------------------------------|--------------------|--------------------------|---------------------------------|
| <i>Project Promoter IOPAN</i> | 172 817,90 | 172 817,90 | 0 |
| <i>Project Partner 1 UG</i> | 246 807,98 | 246 807,98 | 0 |
| <i>Project Partner 2 MIR - PIB</i> | 9 324,57 | 9 324,57 | 0 |
| <i>Project Partner 3 NPI</i> | 304 127,57 | 304 127,57 | 0 |
| <i>Project Partner 4 UNIS</i> | 117 393,16 | 117 393,16 | 0 |
| <i>Total</i> | 850 471,18 | 850 471,18 | 0 |

E3. INFORMATION ON DISTRIBUTION OF PREPARATORY COST REIMBURSEMENT AMONG PROJECT PARTNERS

The preparatory costs were divided equally between Polish and Norwegian partners, i.e., € 2,500 was granted to be divided between three Polish institutions, and € 2,500 between two Norwegian. Further division was based on the amount of work (and costs) each partner contributed to GLAERE proposal preparation. This division was agreed and accepted by all partners. As a result of these discussions, IOPAN (the project Promoter) received € 2,000, and UG € 500. MIR-PIB contribution was not major, and this institution received no share of the preparatory costs. NPI and UNIS received € 1,250 each.

² Cumulative value from all previous reports. In No. 1 Periodic Report values are equal to values in table E1.

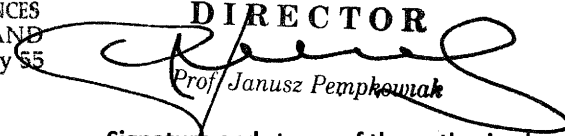
I certify that all information contained in this report are consistent with facts. I am aware of criminal liability arising from Art. 271 of the Penal Code, relating to certification of untruth as to the facts having legal significance.

| | | |
|--|-------------------------|---|
| Person responsible for preparing the periodic report | Name: | Jan Marcin Węśławski |
| | Phone number: | +48 58 73 11 784 |
| | e-mail: | weslaw@iopan.gda.pl |
| | Date, signature: | 19.02.2015  |

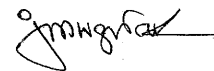


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DIRECTOR

Prof. Janusz Pemphorak

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



**Signature of Principal
Investigator**