

Drifting fast or walking slow

The project supported by Sysselemanden Miljøvernfond

Expedition Prins Karl Forlandet in the framework of Svalbard Intertidal Project (SIP), Institute of Oceanology PAN. Financial support from Svalbard Miljøvernfond (grant nr 16/01633-4) and grant from the Ministry of Science and Higher Education in Poland. Project was registered under Research on Svalbard RIS nr 3423. Program web page:

<https://www.iopan.pl/projects/SIP/index.html>

1. Resultat av prosjektet

Specific goal of this trip was to find how the Prins Karl Forlandet is colonised with the two contrasting species of *Gammarus*. If the west (Atlantic coast) is colonised with cold water species *G. setosus*, it means that its boreal counterpart *G. oceanicus* crawls slowly along the coast of West Spitsbergen, and was not able to colonise the outer Island coast yet. If the opposite is true, it is likely, that *Gammarus oceanicus* is supplied from the Norway and West European mainland with the sea currents (e.g. riding on the litter drifting along).

Sampling has been performed from one hour before to one hour after the lowest tide (regular, M2 semidiurnal moon tides, of 1.6 m average amplitude).

At each sampling station submerged rocks were selected (skjerra) with visible vegetation cover. Name of the station, geographic position (GPS), date and hour were noted. Notes on litter, wildlife, and algae deposits were taken. Temperature and salinity of the tidal pools were measured with the electronic field reader.

Next, series of photos were taken - general view of the shore, and 5 to 10 close-up photos of individual coast fragments. Each close up was taken from the 50 cm distance, and presents approximately 60 x 60 cm, for the assessment of the scale 20 cm long leatherman tool was placed on the rock.

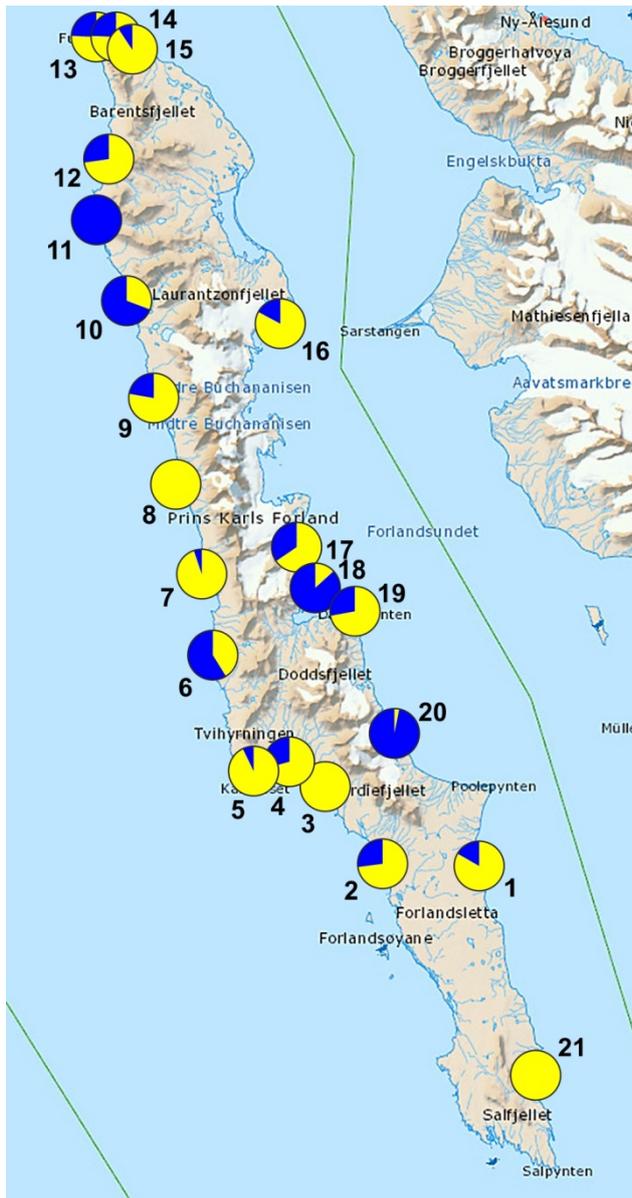
1. Macroorganisms - hard substrate - three vegetated rock fragments of 20 x 20 cm were scraped down to the bare stone, all squares situated within 1m from each other. All the organisms, algae, soft sediment removed was placed to the large 1 dm³ bottle unsorted and fixed with 5% formalyne solution.
2. Macroorganisms - soft substrate - six sediment squares were cut (15 x 15cm and 5 x cm depth), placed unsorted into 1 dm³ plastic jars and fixed with 10% formalyne solution.
3. Macroorganisms - free moving - from the neighbouring area - tidal pools, holes among rocks etc., all conspicuous organisms were collected with the hand pushing net of 0.5 mm mesh size. Additionally 30-40 gammarid amphipods were collected from below the flat, loose rocks in the study site.
4. Meiofauna - from soft sediment (also fine gravel and coarse sand) three replicates of surface (upper 5cm) sediment were collected with the use of 10 cm² plastic tube.

Additionally to the organisms survey, we also noted the plastic debris, the macro plastic collection – methods were:

We focused on plastic debris, ignoring glass, metal and natural debris (wood and algae). The largest plastic debris (large fragments of fishing trawl over 100 kg) were all noted along the route. The plastic items were inspected for the presence of encrusting organisms along the entire 100-km route.

Easily visible (above 1 cm) plastic items were counted on transects from the low water mark, along three plots 10 m per 10m at each sampling station. Such wide transects were chosen, as some debris was observed above the high water mark, wind-blown to the lower coastal plain. Plastic items were collected, weighted in categories.

Fig. 1 Summary of the data on the distribution of local, arctic species - *Gammarus setosus* (blue) and newcomer, boreal species *Gammarus oceanicus* (yellow) from the collection 2016-2018 – for details see



ESTIMATION OF MACROPLASTIC LITTER ALONG 100km of the
WEST COAST
OF PRINS KARL FORLANDET, summer 2017

	estimated	estimated	estimated weight
category	ind.weight in kg	number of items	kg
buoys	0.5	10000	5000
ropes	1	1000	1000
packing stripes	0.1	100	10
thick foil sheets	2	1000	2000
large plastic boxes	5	1000	5000
small containers for liquids	0.01	1000	10
large containers for liquids	2	1000	2000
nets small fragments	1	100	100
nets large fragments (trawls)	500	6	3000
PET bottles	0.1	100	10
shoes	0.5	100	50
other (textiles, small items)	0.1	100	10

Main conclusions

1. Prins Karl Forlandet is colonised mainly with boreal *Gammarus oceanicus*, with few isolated locations where local, arctic *Gammarus setosus* prevails. As the arctic species is still present on the West coast of the island, exposed for the strongest Atlantic waters influence, it more likely, that the boreal species is colonising the island slowly, crawling from the outer part of Isfjorden. The genetic analyses are underway and will help to final answer.

2. Stranded specimens of blue shell (*Mytilus edulis*) were found along the entire west coast of Prins Karl Forlandet, with clear indication of birds consumption (eiders, glaucous gulls).
3. Macroplastic debris of various kind (fishing gear, plastic foil, containers, bags, cosmetics, shoes) is present in substantial amount from the water line to the nearby tundra.
4. Some of the litter (mainly large plastic containers) are carrying encrusting plants and animals not native to Svalbard (Cirripedia – 3 species, Bryozoa 2 species, blue shell and other two bivalves, gastropods eggs). As the „traditional” litter (wood and fishing gear) is not carrying encrusting organisms, the macroplastic becomes an new and fast vector of southern species dispersal.
5. Exceptional was the finding of the yellow rubber duck on the NW corner of the Island – the toy from the load of 29.000 others who were washed in central Pacific in 1992, and afterwards drifted around the globe – last one was found in Scotland in 2007.

Peer reviewed papers published from the project so far:

Węslawski J.M., Dragańska-Deja K., Legeżyńska J., Walczowski W., 2018 Range extension of a boreal amphipod *Gammarus oceanicus* in the warming Arctic", *Ecology and Evolution*, 8, ;8:7624–7632; DOI: 10.1002/ece3.4281

Weslawski JM., Kotwicki L. 2018 Macro-plastic, a new vector for boreal species dispersal on Svalbard *Polish Polar Research* 39, 165–174

In preparation is the paper:

Grabowski M. et al. Genetic diversity and phylogeny of *Gammarus* spp in Svalbard.

All data on the project outcome are available (and new are going to be posted) on the SIP program web page:

<https://www.iopan.pl/projects/SIP/index.html>

2. Egenvurdering av gjennomføringen av prosjektet

- all planned data were collected, analysed and presented for public use
- all planned funds were used according to the budget

3 Miljøeffekt/miljøgevinst av tiltaket/prosjektet, sluttvurdering.

Vitenskapelige organisasjoner skal også rapportere på relevansen resultatet i prosjektet har for miljøvernforvaltningen.

The project results show various way of colonisation Svalbard coasts by boreal species (new arrivals from Faroe- Shetland area, plastic debris as a vector of species transport and slow spread of locally established populations. All results are presented on open web page and are being published in

open access peer- reviewed scientific journals. General public was informed through the local Svalbardposten article, major Polish Newspaper Gazeta Wyborcza, public presentations during science festivals and web page promotion. The management relevance of the findings is the hypothesis that Northern Norway is a secondary source of organisms drifting to Svalbard, compared with West European area of Northern UK and North Sea – this implies important component of large plastic debris that transport grown up populations of southern species to the North.

contact:

Jan Marcin Weslawski, Institute of Oceanology Polish Academy of Sciences, Sopot 81-712,
street Powstanców Warszawy 55,

Email weslaw@iopan.gda.pl