Appendix 2

Author's review of his research achievements and publications

1. Name and surname

Dariusz Jakubas

2. Possessed diplomas, scientific / artistic degrees - with the name, place and year of receiving

M. Sc. – University of Gdańsk, Faculty of Biology, Geography and Oceanology, field of study: biology, specialty: environmental biology, 1998.

Ph. D. – University of Gdańsk, Faculty of Biology, Geography and Oceanology, field of study: biology, specialty: vertebrate ecology, 2003.

3. Information on previous employment in scientific / artistic institutions

University of Gdańsk, Faculty of Biology, Department of Vertebrate Ecology and Zoology

2002-2003 - assistant lecturer

2003-the present moment – assistant professor

4. Indication of achievement resulting from Article16 Paragraph 2 of the Act of 14 March 2003 on Academic Degrees and Title and on Degrees and Title in the Field of Art:

The achievement was to investigate a **response of planktivorous little auks (*Alle alle*) to variable oceanographic and climatic conditions in the Arctic**. It was documented as subject-specific paper series [1-7]. Coauthors' statements are contained in the Appendix 5.

a) (author / authors, title / titles of publications, year of publication, publisher name),

[1] JAKUBAS D., Wojczulanis-Jakubas K., Walkusz W., 2007. Response of Dovekie to Changes in food Availability. Waterbirds 30: 421-428 [IF 2007: 0,497]. I estimate my contribution to this paper (developing the concept of the study, collecting food samples, collecting data on feeding frequency, performing majority of analyses, writing the manuscript) as 60%.

[2] Moe B., Stempniewicz L., JAKUBAS D., Angelier F., Chastel O., Dinessen F., Gabrielsen G.W., Hanssen F., Karnovsky N.J., Rønning B., Welcker J., Wojczulanis-Jakubas K., Bech C., 2009. Climate change and phenological responses of two seabird species breeding in the high-Arctic. Marine Ecology Progress Series 393: 235–246 [IF 2009: 2,519]. I estimate my contribution to this paper (collecting data on the little auk breeding phenology in Hornsund in 2003, 2004, 2005 and 2006, collecting data on the ground temperature in the little auk colony in Hornsund in 2006, preparing data for Fig. 5, editing and commenting on the manuscript at all stages) as 25%.

[3] Wojczulanis-Jakubas K., JAKUBAS D., Karnovsky N.J., Walkusz W., 2010. Foraging strategy of little auks under divergent conditions on feeding grounds. Polar Research 29: 22-29 [IF 2010: 1,444]. I estimate my contribution to this paper (collecting food samples in 2004 and 2006, collecting data on feeding frequency and foraging trip duration in 2004 and 2006, discussing the concept of the study, editing and commenting on the manuscript at all stages) as 40%.

[4] Kwasniewski S., Gluchowska M., JAKUBAS D., Wojczulanis-Jakubas K., Walkusz W., Karnovsky N., Blachowiak-Samolyk K., Cisek M., Stempniewicz L. 2010. The impact of different hydrographic conditions and zooplankton communities on provisioning Little Auks along the West coast of Spitsbergen. Progress in Oceanography 87: 72-82 [IF 2010: 3,269]. I estimate my contribution to this paper (collecting food samples in Magdalenefjorden, collecting data on feeding frequency and foraging trip duration in Magdalenefjorden, analysing ornithological data and preparing relevant text, tables and figures, discussing the concept of the study, editing and commenting on the manuscript at all stages) as 25%.

[5] JAKUBAS D., Wojczulanis-Jakubas K., 2011. Subcolony variation in phenology and breeding parameters in little auk *Alle alle*. Polar Biology, 34: 31-39 [IF 2010: 1,445]. I estimate my contribution to this paper (developing the concept of the study, collection of data on phenology, breeding success and chick growth rate, performing statistical analyses, writing the manuscript) as 60%.

[6] JAKUBAS D., Głuchowska M., Wojczulanis-Jakubas K, Karnovsky N.J., Keslinka L., Kidawa D., Walkusz W., Boehnke R., Cisek M., Kwaśniewski S., Stempniewicz L., 2011.

Foraging effort does not influence body condition and stress level in little auks. Marine Ecology Progress Series 432: 277–290 [IF 2010: 2,483]. I estimate my contribution to this paper (developing the concept of the study, collecting of food samples in Magdalenefjorden, collecting of blood samples in Magdalenefjorden, collecting of data on feeding frequency and foraging trip duration in Magdalenefjorden, performing majority of analyses, writing the manuscript) as 60%.

[7] JAKUBAS D., Iliszko L., Wojczulanis-Jakubas K., Stempniewicz L. 2012. Foraging by little auks in the distant marginal sea ice zone during the chick-rearing period. Polar Biology 35: 73–81 [IF 2010: 1,445]. I estimate my contribution to this paper (developing the concept of the study, field work: searching for little auks nests, loggers attachment, loading data from the loggers, statistical analyses, writing the manuscript) as 60%.

b) description of the scientific aim of the study and results obtained with description of their potential application

The papers consisting of subject-specific paper series describe response of the little auk (dovekie) (*Alle alle*) to variable oceanographic and climatic conditions in the Arctic. This species is a colonial seabird breeding exclusively in the High Arctic (islands and archipelagos in the northern polar zone: Greenland, Spitsbergen, Franz Josef Land, Novaya Zemlya, Severnaya Zemlya). This is the most numerous alcid in the Atlantic Ocean and probably one of the most numerous seabirds of the world (>37 million breeding pairs). Little auk, foraging in the sea (planktivorous) and breeding in the land, transports marine-derived organic matter from sea to land (poor in nutrients and organic salts in the Arctic) and as such is considered as a keystone species in the Arctic ecosystem. Therefore, any changes in availability of the little auk's food resources could have profound consequences for the structure and functioning of both marine and terrestrial Arctic ecosystems. To cover their extremely high energetic demands, little auks prefer as food energy-rich zooplankton associated with the cold Arctic water masses (in the western coast of Spitsbergen this is a copepod *Calanus glacialis*, bigger and richer in energy compared to its counterpart *Calanus finmarchicus,* associated with warmer Atlantic water masses).

Changes in oceanographic and climatic conditions currently observed in the Arctic include among others higher inflow and participation of warmer Atlantic waters in the area of

western coasts of Spitsbergen. Such a situation may force little auks to forage on suboptimal prey species associated with this type of water masses, alternatively to extend the range of their foraging flights. In this context little auks diet composition and parental efforts may serve as indicators of changes in the Arctic marine ecosystems.

The aim of the paper series was to investigate response of little auks to variable oceanographic and climatic conditions in the Arctic. The studies were conducted in two largest breeding aggregations of the little auk on Spitsbergen [breeding colonies in the fjords Hornsund (south-west Spitsbergen) and Magdalenefjorden (north-west Spitsbergen)]. The studies were focused on investigating differences in feeding and breeding ecology between seasons and areas characterized by various oceanographic and climatic conditions. Results of those studies may be crucial for creating reliable scenarios of complex animal response to climate change in the Arctic.

Studies presenting inter-seasonal differences in feeding and breeding ecology were performed in the colony at Hornsund [papers 1-3].

In the first study [1], differences in the little auk chick diet composition between ’warm’ (2003 with considerable participation of Atlantic-origin warm water masses in the foraging grounds) and ’cold’ season (2004, with considerable participation of Arctic-origin cold water masses transporting sea-ice into the foraging grounds) were presented. Qualitative and quantitative analyses of food delivered for chicks revealed that wet mass and energy content of food loads were lower in ’warm’ season compared to ’cold’ one. Due to more frequent feedings in the ’warm’ season, daily energetic values of food loads were similar in both studied seasons. This paper showed for the first time the possibility of compensation for worse trophic conditions in ’warm’ season by more frequent feedings indicating ecological-behavioral plasticity of little auks.

The paper [2], among others, presents changes in the breeding phenology of little auks. For the first time, long-time series (1963–2008) was analyzed in relation to climate change. Data were collected in the little auk breeding colony at Hornsund. On Spitsbergen, spring air temperatures increased over the studied 18-years period, with temperature becoming 0.9°C warmer per decade. During the same period little auks showed a trend for earlier breeding (median hatch date became 4.5 days earlier over the study period). Spring air temperature (April-May) was the best predictor of little auk breeding phenology among all analyzed parameters [North Atlantic Oscillation index (NAO), air temperature, sea surface temperature and sea ice concentration]. The higher air temperature in spring, the earlier little auks

commenced breeding. This effect was associated with earlier snow melting and thus earlier unblocked access to nest chambers situated in the rock debris.

In the paper [3], the hypothesis that bimodal foraging strategy (alternating a long trip with several consecutive short trips) adopted by the little auks during the chick-rearing period is a response to a disadvantageous food conditions in the foraging areas, was tested for the first time. In this study, distributions of foraging trips length of birds breeding in Hornsund were compared between 'cold' (2004, foraging conditions for little auks were favorable: cold Arctic waters, rich in profitable high-energy food, were dominant in the feeding grounds; higher proportion of prey items associated with cold water masses in the chick diet) and 'warm' seasons (2006, great influx of warm Atlantic water in the feeding area, inducing poor foraging conditions; lower proportion of prey items associated with cold water masses in the chick diet). Analyses revealed that in both seasons little auks performed the bimodal foraging strategy, with similar ratio of short to long foraging trips. It indicates that this strategy is obligatory, regardless of trophic conditions in the foraging areas.

Papers [4, 6, 7] report differences in breeding and feeding ecology between little auks breeding in two colonies with foraging grounds characterized by different oceanographic conditions. Cold Arctic water masses with prey items energetically profitable for little auks dominated in the foraging areas near Hornsund. Warmer Atlantic water masses with suboptimal prey composition dominated in the foraging areas of birds breeding in Magdalenefjorden.

The paper [4] shows differences in parental efforts of little auks in various conditions of food availability. Meals delivered to chicks in Hornsund had higher numbers of prey items, biomass and energy content compared to the colony in Magdalenefjorden. Little auks from Hornsund fed the chicks less frequently and performed foraging trips of shorter duration than in Magdalenefjorden. Those differences were probably a consequence of lower relative abundance of the little auks' preferred prey (*C. glacialis*) on the foraging grounds adjacent to Magdalenefjorden. Searching for the preferred food items among abundant but less favored *C. finmarchicus*, may require more time and energy-demanding foraging behavior. As a consequence, foraging effort of the little auk parents from Magdalenefjorden was higher, and feeding efficiency lower compared to Hornsund.

The paper [6] presents, for the first time in natural conditions, influence of environmental and food conditions on the little auks body condition and stress level. In this study, oceanographic conditions and zooplankton composition in feeding areas, chick diet composition, frequency and duration of foraging trips, size-adjusted body mass (considered as

an index of condition) and stress level (the ratio of the heterophils and lymphocytes considered as reliable indicator of stress level in birds) of adults and chicks were compared between the colonies at Hornsund and Magdalenefjorden. In the studied season, diet composition, biomass and energy content of food loads delivered to the chick were similar in both colonies, though species diversity of prey items was higher in Magdalenefjorden. The frequency of feeds was similar in both colonies. Parent little auks in Magdalenefjorden, however, performed longer foraging trips than in Hornsund. Longer foraging trips suggest traveling longer distances to find abundant prey and/or spending more time foraging close to the colony but in suboptimal foraging areas. Despite increased parental efforts in Magdalenefjorden, size-adjusted body mass and stress levels of adults and chicks were similar in both colonies. The novel finding here is that little auks are able to adapt to the suboptimal environmental conditions without visible signs of stress. Moreover, results of this study suggests that little auks breeding and foraging in northwest coast of Spitsbergen did not reach a threshold requiring prioritization of self-maintenance over chick provisioning.

Paper [7] for the first time in the literature investigates range of foraging flights and exact location of foraging areas of little auks using a novel approach - miniature GPS and temperature loggers. Results confirm conjectures from earlier studies that little auks, despite the high cost of foraging (the time and energy expended on feeding combined with the high cost of diving and flapping flight), are able to reach remote foraging areas during the breeding period. The studied individuals from the colony at Magdalenefjorden were able to reach and forage (as indicated by the results of papers [4] and [6]) in marginal sea-ice zone, at least 100 km from the breeding colony. Since food conditions near the studied colony are usually suboptimal [see papers [4] and [6]), little auks breeding there may be forced, at least partially, to exploit more distant feeding areas to supplement their diet with energy-rich items.

Paper [5] presents for the first time in the little auk (and as one of a few in colonial seabirds) responses to different climatic parameters at the micro-scale – at the subcolony level. The study was conducted in Magdalenefjorden in three subcolonies differing in their microtopographic and microclimatic features, what was expressed in different aspect, inclination and length of snow cover persistence in spring. Timing of chick hatching differed significantly among subcolonies, and that was related to the different duration of snow persistence in spring. Little auks start to breed as soon as the snow cover melts sufficiently to allow them occupation of nest chambers. The earliest hatching was recorded in the subcolony located on steep slopes at low altitude in the vicinity of the fjord, which favours early ice and snow melting in spring. Hatching success also differed significantly among subcolonies,

which could also have been associated with the microclimatic features of the subcolonies. Hatching success was the lowest in the subcolony where birds started to breed, while patchy snow was still persisting, thus water from the melting snow could have flooded some of the nests. Alternatively, the low hatchability could have been caused by a higher frequency of less experienced breeders (e.g., first-time breeders) among the individuals nesting in this subcolony.

5. Description of other scientific-research achievements

The period before and during Ph.D. studies

After finishing the 6th Grammar School in Gdynia in 1993 and passing the entrance examination, I started university studies at the Faculty of Biology, Geography and Oceanography at the University of Gdańsk. I defended my M.Sc. thesis entitled “Chosen aspects of the breeding biology of the grey heron *Ardea cinerea* in the colony at Kąty Rybackie in 1996-1997” supervised by prof. Lech Stempniewicz receiving M.Sc. in Biology degree in 1998. I graduated with very good results. In my M.Sc. thesis I analyzed frequency and daily rhythm of incubation shifts, chick feedings, brood size and breeding success in the biggest colony of grey herons in Poland – at Kąty Rybackie.

After graduation, in 1998-2002 I was a Ph.D. student of Doctoral Studies of Environmental Biology and Oceanology of the University of Gdańsk. I collected the data for my Ph.D. dissertation entitled "Factors affecting the reproduction ecology of the grey heron *Ardea cinerea* L. - a comparison of four breeding colonies in northern Poland", supervised by professor L. Stempniewicz, in four heronries (mainly in three of them: in Mosty, Kąty Rybackie and Kiersity) in 1999-2002. Conducting this research was possible thanks to funds acquired from the University of Gdańsk (G8), and later from the Committee for Scientific Research (G2). The main results obtained during my Ph.D. studies are listed below:

- Timing of breeding differed among the studied colonies. Those heronries had different location (Mosty and Kąty Rybackie - coastal, Kiersity - inland) and microclimate. Accessibility of foraging grounds (lack of ice cover) in the spring was an important factor influencing commencement of breeding. Dates of colony occupation, egg laying and chick hatching were correlated with the dates of the last ice cover occurrence in the feeding areas [P20].
- Breeding success differed among the colonies. It increased with their size and was the highest in the biggest heronry at Kąty Rybackie. The number of chick feedings was the most important

factor affecting the breeding success. At Kąty Rybackie and Kiersity, chick mortality rate declined with the increase in number of chick feedings. High breeding success was recorded in the colonies with close situated foraging grounds (Mosty and Kąty Rybackie). Siblicide was an important cause of chick mortality in those colonies (wider discussion in the next subsection). Other factors, such as predation, human disturbance, weather conditions and experience of the parent birds seemed to have marginal influence on the breeding success in the studied colonies [P3].

- Siblicide was an important cause of chick mortality in two of the three compared colonies and occurred in 25% of the studied nests [P1]. This phenomenon was not recorded in the colony at Mosty, probably due to abundance of highly available, energy-rich food – the round goby *Neogobius melanostomus* [P2]. Additionally, attempts of inter-brood kleptoparasitism (food theft) from chicks by foreign nestlings were the rarest observed in the colony at Mosty [P14].
- Successful introduction of the round goby and its rapid expansion in the Gulf of Puck (the Baltic Sea) affected herons breeding at Mosty by changes in their diet composition and increase in the colony size. Analysis of regurgitated food revealed that the round goby made up 95% in abundance and 99% in biomass of the grey heron diet. An increase in the number of nests took place during the period when increase in biomass of caught round gobies in research fishing was observed. Before this species arrived in the area, the heronry size was stable and much smaller than during the studied period [P2, P4, P25].
- Herons breeding in the mixed colony with the cormorant *Phalacrocorax carbo* at Kąty Rybackie, apart from exploiting traditional foraging areas, feed also in the colony on fish regurgitated by cormorants. Observations revealed that herons exploited this extra food source throughout the whole breeding season with the intensity during the period of nest leaving by fledglings. Reserve food source available in the colony could be responsible for high breeding success of the herons in this heronry [P6].

Post-doctoral research activities

In October 2002, I was employed as an assistant lecturer in Department of Ecology and Vertebrate Zoology, the University of Gdansk, and a year later, after defending my Ph.D. thesis, as an assistant professor. Since my research interests include the ecology of colonial birds, I agreed to a proposal to take part in an expedition to Spitsbergen to study breeding ecology of the little auk, made by the head of the department, prof. Lech Stempniewicz, the doyen of Polish research of this species.

To investigate foraging and breeding ecology of little auks in the Arctic, together with the research team from my parent department I devoted nine research seasons. This was possible thanks to funds acquired by the members of the team and me [grants from the University of Gdansk (G9, G10), Ministry of Science and Higher Education (G3, G4, G5, G6), and the Polish-Norwegian funds (G1)]. The studies were conducted in cooperation with the Institute of Oceanology, Polish Academy of Sciences and researchers from foreign research institutions in Norway, USA and France. Elaborated scientific material collected during expeditions is included in the subject-specific paper series [1-7] listed in the point 4a.

The results of research activity in the Arctic were also described in other publications. They concern among others: the usefulness of biometric features to identify the sex of little auks ([P8] for the first time discriminant function based on biometric measurements was proposed for sex identification], biometric differentiation of the little auk world population ([P19], for the first time biometrics of little auks was compared among areas situated along the whole range area of occurrence], the intersexual differences in parental efforts [P15], body condition and haematological parameters ([P9] for the first time leukocyte profile was studied in this species], brood paternity and copulatory behavior [P10, P13], geographic and seasonal variability in the isotopic niche of little auks [P19], the glaucous gull *Larus hyperboreus* predation on the little auk [P5] and [P18], fungi prevalence and concordance in cloacae of pair members of little auks [P22], case of two-egg clutch incubation in the little auk [P17], changes in avifauna of the Hornsund area [P12], as well as herbivore faeces deposition under the colonies of piscivorous and planktivorous seabirds [P11].

Outside the mainstream of my scientific interest I also investigated migration of passerines. The studies were conducted based on the field station of the parental department located in the reserve "Lake Druzno" near Elbląg (north Poland). Reedbeds, an ideal breeding grounds and stop-over site for passerines during their autumn migration, was the main habitat where the studies were conducted. The most important result of those studies was to demonstrate for the first time the phenomenon of autumn protogyny in immature reed warblers *Acrocephalus scirpaceus* [P16], i.e. earlier migration of females compared to males. In the sedge warbler *Acrocephalus schoenobaenus*, the second species investigated in this study, such a phenomenon was not recorded. That inter-species difference may be explained in the context of different migration strategy, and behavior of these species at the stop-over sites as well as on the wintering grounds (reed warbler feeding on limited resources are territorial; sedge warblers foraging on the abundant food resources are, in contrast, not territorial). Thus, the reed warbler females may benefit from the earlier onset of autumn

migration by limiting competition with heavier males. Next papers concern variation of the reed bunting *Emberiza schoeniclus* body condition and hematological parameters in relation to sex, age and season ([P24], for the first time hematological parameters were studied in this species), and the biometric features useful for sex determination in sedge warblers ([P23] for the first time discriminant function based on biometric measurements was proposed for sex identification of immature sedge warblers). All these studies were funded by the University of Gdańsk [G11].

Gdańsk, 03.01.2012 Dariusz Jakubas