

Effects of uneven sex-ratio to reproductive strategies, extra-pair paternity and demography in the Icelandic Purple Sandpiper (*Calidris maritima*) population

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1. Purpose of the visit

The purpose of the visit was to perform paternity analyses with microsatellite data on Icelandic Purple Sandpipers (134 individuals, 39 broods) to see the occurrence of extra-pair fertilizations (EPF's). EPF's of the Purple Sandpipers have previously been studied in Svalbard. In the Svalbard Purple Sandpiper population the sex-ratio is more or less even, the number of EPF's really low, only males brood the chicks, and there is no observable competition between the males. In the Icelandic population, however, the sex-ratio is biased towards males, chick attendance is biparental (although at a low rate), and competition between males occurs since the ratio of males compared to females is rather high (66 % males and 34 % females on migration after first winter; Gunnar Hallgrímsson, pers. comm.). Thus, the Icelandic population might have a different sort of breeding behavior – in the form of more EPF's – when compared to the Svalbard one.

This study adds to the knowledge of the evolution of sex-related characters in waders and birds in general. In addition, since in small populations EPF's are a way to increase the genetic variation and viability of offspring and to escape the negative effects of inbreeding, this work will also be applicable for conservation purposes in managing endangered wader species.

The main reason for the visit was to start collaboration between the Universities of Oulu and Iceland, and preliminarily lay the ground for a possible *post-doc* position in Reykjavik. *Post-doc* possibilities are still left open, but the research visit certainly started, hopefully a long-lasting, collaboration between the universities. I still have almost a year left of funding for my doctoral studies at my home university here in Oulu, which means we still have lots of time to plan the possible *post-doc* projects and apply for funding.

2. What was done

I started the laboratory work by preparing samples for the microsatellite work (mainly measuring concentrations and diluting DNA samples). I thought that the microsatellites would already have been amplified and I was to be there to analyze the data, but it turned out that there had been a delay in getting the PCR primers. Therefore I could not start the actual microsatellite work until during the second week of my stay. When the primers arrived, I quickly prepared the samples for the microsatellite run. The samples are being amplified at DeCode Genetics laboratory, situated next to the biology department of the University of Iceland in Reykjavik. When last week I asked from the population biology professor, Snæbjörn Pálsson (<https://notendur.hi.is/~snaebj/>), whether the data would be ready, he told me there were some technical issues at the DeCode, and when inquiring the issue today, I heard they are still running the samples. However, as soon as the data is ready, I will receive it and can perform the analyses here at the University of Oulu. During my PhD, I have been doing paternity analyses with waders, so I have no problem in finishing them without supervision.

Luckily we immediately came up with a plan B, so I could use my short time well. This new plan included learning a totally new skill for me: a new generation sequencing method (double digestion restriction-site associated DNA-sequencing, or shortly, ddRAD-seq), which can be used in studying not only EPF's but also for example genetic population structure, phylogeography and individual genetic variation. Hence, while waiting for the microsatellite primers to arrive, I prepared a genetic ddRAD library not only from the 134 Icelandic Purple Sandpipers, but also from a few samples from Svalbard and Canada, under supervision of a *post-doc* Kristen Westfall (http://www.researchgate.net/profile/Kristen_Westfall). The aim of the ddRAD-seq project is to look at genetic differences between different breeding populations (in addition to the EPF frequency in the Icelandic population). The samples are now waiting to be sequenced at the DeCode Genetics laboratory. Since this is a new method for me, I will need help in learning how to analyze the data. Thus, when the sequencing is ready, I will go back to Iceland in order to complete the started work.

Nowadays new generation sequencing methods are evolving rapidly and are becoming more and more common. I find learning this new technique extremely useful when considering future job possibilities – nearly all genetics related *post-doc* positions I have looked at require experience on the field. Therefore I am very happy with the outcome of my research visit.

3. Main results

Due to the delays and changes in the original plan (which was to do only paternity analyses), results are yet to be obtained. However, they are on their way. I should get the microsatellite data for analyzing during this year, possibly even this month, and the ddRAD-seq data should be ready in the beginning of 2015.

4. Future collaboration

EPF work

Since only the laboratory work is done and a preliminary draft of the EPF article written, future collaboration is certainly needed in order to get the data analyzed and the paper published. However, as said, I will get the data soon and can continue working with it, after which we can complete the manuscript and submit it.

ddRAD-seq work

The ddRAD-seq data will not only be used in the EPF work, but it will result in a second article (about genetic differences between different breeding populations). However, this is a subject which needs to be discussed more closely next year when the data is ready.

Due to the shortness of the research visit, I will make another trip to the University of Iceland in the beginning of 2015 to complete the ddRAD-seq analyses. A travel grant for the trip has already been granted, and preliminary time of the visit planned (on January, depending on when the genetic data is ready).

Other

In Southern Finland, in Jurmo birding station, there is a work group catching the Purple Sandpipers on their migration to the wintering grounds. We have preliminarily planned collaborating with the Jurmo group and have already discussed taking blood samples from the birds in order to find out their breeding origin and discover migration routes.

5. Resulting scientific articles

One article will be published on the EPF's of the Purple Sandpipers. We can use both the microsatellite and ddRAD-seq data for this work. Another paper with population genetic aspect will result from the ddRAD-seq data.

6. Other

I am extremely happy getting the funding which enabled me to visit a new country and university, to take part in not only one but two projects resulting in separate publications, and to learn a new skill which will definitely be useful for me in the future.