Second Quarterly Nugget for 2012/13

South African Institute for Aquatic Biodiversity

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1 Description of Research Work

The suborder Notothenioidei includes several families of fishes that evolved in and inhabit the Southern Ocean. To be able to survive in the ice-laden waters around Antarctica and its associated islands these fishes developed a number of adaptations, including a group of organic molecules called antifreeze glycoproteins or AFGPs. These AFGPs help depress the freezing point of blood serum and other body fluids below that of the seawater thus preventing the freezing of these fishes. Over time several species have become widespread in the Southern Ocean and inhabited the waters around sub-Antarctic islands, including the South African Prince Edward Islands (PEI) in the south Indian Ocean.

The Prince Edward Islands are young islands, not older than one million years, and with a temperature range of 3-8°C their water is ice-free. Fishes inhabiting the waters surrounding these islands are living close to or at the limit of their metabolic systems. Because of this, they would be expected to have inactive AFGP genes, or even lose them altogether and evolve into different species. In addition, having the AFGPs where they are not needed makes the sub-Antarctic populations vulnerable to predation and to environmental change such as global warming.

Past morphological studies divided populations from ice-laden waters and ice-free waters into sub-species or even species. However, Gon & Klages (1988) and DeWitt et al. (1990) found no justification for these actions and Gon et al. (1994) showed that *Notothenia coriiceps* at Marion Island most likely has AFGPs in its blood.

The objective of the current project, a PhD study by Ms Tshoanelo Moloi funded by the South African National Antarctic Programme (SANAP), is to determine the taxonomic status of the sub-Antarctic population using modern molecular genetics methods and investigating their AFGPs attributes. Tissue and blood serum samples were collected during the ICEFISH2004 cruise to the south Atlantic and three recent SANAP cruises to the PEI. Additional tissues were borrowed from collections in other countries.
2 Expected Impacts

The molecular genetic analysis of tissues of *Harpagifer georginaus* from the PEI and *Notothenia rossii* from the nearby Ob seamount suggested that there is no difference between the populations of the PEI area and the Scotia Arc islands of the south Atlantic. In *N. rossii* this was also supported by the presence of a full complement of AFGPs in its blood serum.

While there is no evidence of a resident population of this species in the PEI, its sister species, *N. coriiceps*, was once fairly abundant in the inshore waters of Marion Island and was on our list of study species. However, we were not able to catch a single specimen of *N. coriiceps* during our visits to Marion Island and, whilst this species is the most widespread of our study species, it seems to have disappeared from the PEI.

The apparent disappearance of this species could be a result of several factors, but the research singled out climate change as the most important one. Over the past 60 years seawater temperature at the PEI increased by at least 1.4°C, probably reducing the viability of young recruits and making the species more vulnerable to predation by a rapidly increasing fur seal population.

3 Research team

The Principle Investigator of the project is Mr Ofer Gon (left) of SAIAB who has done work on the systematics and biology of fishes of the PEI from 1984-1994. The collaborators in this project include Dr Monica Mwale, also from SAIAB, who is a molecular geneticist and Professor Chi-Hing Christina Cheng of the University of Illinois, USA, who is a world authority on the antifreeze biology of notothenioid fishes.

The research work is being done by Ms Tshoanelo Moloi (centre) who is a PhD student registered at Rhodes University, Grahamstown. Ms Moloi spent several months at the University of Illinois working on the AFGPs aspect of the project under the guidance of Professor Cheng (right).
4 Additional Information

Publications

Two papers, one on the AFGPs of *N. rossii*, and another on the disappearance of *N. coriiceps* from the PEI are currently being written. Other papers dealing with the other species of the project are in various stages of preparation.

Conference presentations

2. Gon, O., Mwale, M. & Moloi, T. 2012. Where have all the fish gone: could *Notothenia coriiceps* of the Prince Edward Islands be a victim of climate change? XXXII SCAR Open Science Conference, Portland, Oregon, USA.

Literature cited


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5 Approval

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