

REVIEW by Dr. Donald Reid
(Wildlife Conservation Society Canada)

OF

“Linking geomorphological processes and wildlife micro-habitat selection: nesting birds select refuges generated by permafrost degradation in the Arctic.”

Authors: Madeleine-Zoé Corbeil-Robitaille, Éliane Duchesne, Daniel Fortier, Christophe Kinnard, Joël Bêty

Summary Comments

This is a very interesting and valuable, field-based, study of an influential process in Arctic ecology – the degradation of polygonal terrain and associated shifts in availability and use of islets as predation refuges. It is certainly worthy of publication.

Overall, my suggestions for changes have to do with (a) relating this study more completely to both the broader Arctic context and the full degradational continuum for Arctic water bodies which can include talik drainage of lakes and ponds, (b) more careful use of technical terms on some points, (c) providing a bit more detail on some processes to illustrate some key points (the biologically-trained readership would benefit from more detail on the geomorphological and hydrological processes), and (d) minor improvements to the English.

Comments regarding content and interpretation

96 Are these measures of active layer depth just referring to upland tundra without standing water? If so, then that is worth mentioning. Are there any data on active layer depth under water bodies? What happens to the water in these ponds in winter (does it always completely freeze to the bottom)?

101 What does “essentially” mean? A better description in English could be found to indicate frequency of nesting on islets as compared to nesting on “mainland” (“the great majority”?)

110 It would be useful to provide the size (square kilometres) of the “study area”, and the total number of individual water bodies, so that readers can understand the density of islets and ponds in this ecosystem, for comparison to other Arctic ecosystems.

Table 1 (i) In line 3, reference is made to “glacial drift”. Glacial drift is defined as a set of materials left behind by glaciers and their meltwater; it is not a process as such. So the “boulders” are not deposited “by” drift, but “as a component of” drift. (ii) In line 5, “exposition” is not a very appropriate word in English for this process (it generally refers to abstract ideas); “exposure” is used to refer to physical processes that “reveal” something new and would be a better term to use.

Table 2 Please explain (in the caption) why some of the parameters are displayed in bold font in the right-hand panel.

Figure 4 The Caption text includes: “The islets used by nesting birds are shown using dark filled circles.” This seems insufficient to fully explain these circles: (a) mention that there is an interpretive legend (bottom right) would be useful); (b) Is each number in the legend equal to the total number of islets used by nesting birds of each species?; (c) there are four sizes of circle, each with a unique whole integer value in the legend (categorical summary): how are numbers of islets in between these integer values to be inferred (are the four values just maximums higher than the next lowest category)?

285 I don't think this sentence is technically correct, nor intended. Cryoturbation and frost-cracking primarily affect the *ground surface* (and in winter) not the *surface of the permafrost*. The surface of the permafrost is at the base of the active layer, and varies from year to year depending on how deeply the thaw penetrates the ground and how much meltwater pools at the base of the active layer.

287 Mention is made of “permafrost polygons”. Yes, the polygonal patterns are related to permafrost presence, but the polygons themselves are not comprised of permafrost (except for the ice wedge parts), so using permafrost as an adjective here seems inappropriate. The sentence would be correct if “Permafrost” is dropped from the beginning, and the text explains that the repeated annual freezing and thawing of water is supported over many years by the inability of that water, in the active layer, to drain away because of the underlying permafrost.

325 The last sentence of this paragraph talks about potential processes leading to change in ponds and islets. I think this needs more complete discussion. (A) It seems to me (based on your information and other literature) that the process of degradation of polygonal terrain to form thermokarst ponds is already well underway; this already defines the distribution and size of ponds to some extent so is not just a future outcome. In addition, what do the authors know about any efforts to quantify this historical pattern based on sequences of satellite images? If this has not been done, then it seems like a useful exercise to attempt, and worth mention in this discussion. (B) Mention is made of “positive feedback” but it is unclear how this would work. Please explain. For example, does this have to do with rising temperature of the water, or increasing wind fetch on bigger ponds? The first is an amplification of the existing direct effect, and the second might be considered a positive feedback depending on how frequent and certain the coalescence of ponds is over time. Wind deserves discussion because it is a dominant feature of Arctic weather, and could affect islet longevity and turnover through the erosive power of waves. (C) Earlier in the paragraph “hydrological flux” is mentioned, without explanation as to specific process. Are there demonstrated trends in snowfall in this region that are affecting the amount of surface water after melt? This possibility needs discussion, because of immediate within-year effects on islet availability. In fact, the amount of surface water is probably the dominant factor, in conjunction with air temperature, driving degradational processes and suitability of islets for nesting.

337 The sentence starting “The lowlands,...” would benefit from more discussion to place it both in the larger Arctic context and in the complete degradational continuum. This study is in the High Arctic. Degradational effects are occurring in this study area, so how does that relate to other Arctic regions, especially the Low Arctic? For example, there is a further step in the degradational continuum wherein ponds/lakes disappear, because of draining through a talik in the underlying permafrost which itself has degraded deeply. This is well documented in subarctic areas. I presume you have no evidence of this yet from Bylot Island, but what is the risk of it occurring (i.e. how deep is the permafrost underlying the study area)? Do you know of any evidence of draining of thermokarst lakes in the Low Arctic (e.g., Chen et al. 2022 Sci Tot Env, <https://doi.org/10.1016/j.scitotenv.2021.150828>.)?

339 The text suggests “Additional research”. Please suggest some specifics. For example, can sequences of remotely-sensed imagery provide inference about these processes and their possible trends, and also the fate of islets themselves? What about forward-looking monitoring, field-based and/or with remote sensing?

Editorial Points

37 The sentence is incomplete: “...diversity of biological ? ”

55 The reference to Caro 2005 is incorrectly written; there is no need for first name (Caro, 2005)

62 The sentence is incomplete: “...surrounding dryer ? ”

95 I think the valleys are created by the rivers, so “...valleys with glacial rivers...” would be better

96 The parentheses before the word “active” need to be closed after “(Fortier et al. 2006)”

97 The second use of the word “wetlands” should be “wetland”

286 “reliefs” should be “relief”

311 “drifts” would better be “drift”

317 Title of section 4.4. “refuges sensitivity” needs to change (in terms of suitable English). This section is mostly about the *longevity of islets, or susceptibility of islets to change*.

334 The word “together” is unnecessary and redundant.