

Marine Habitat Use of Thick-billed Murres

2015 Field Season Report

Project Overview

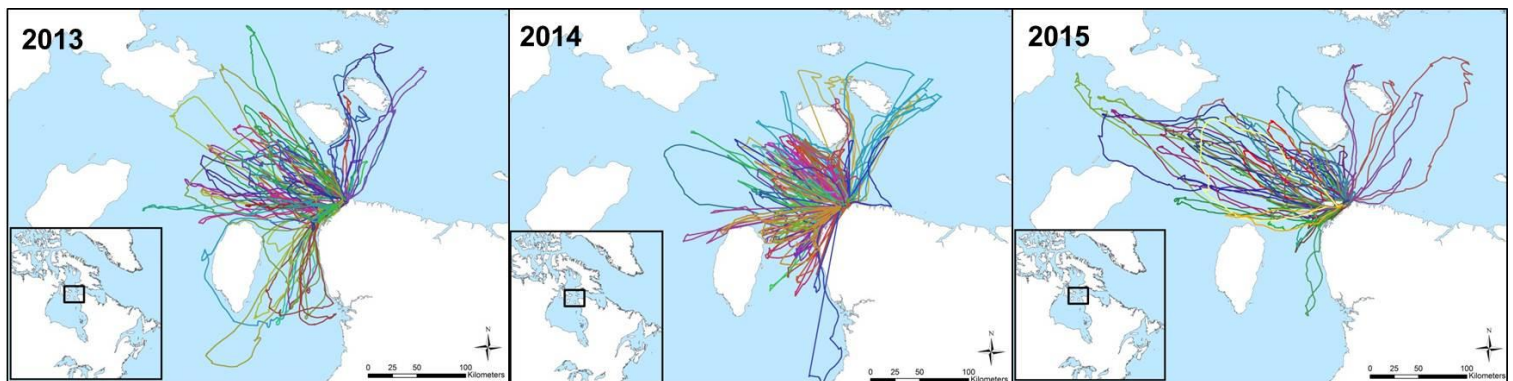
Recent increases in resource development activities are projected to increase shipping traffic in Canada's eastern arctic marine regions. However, there is not enough information to properly assess potential ecological impacts of year-round shipping lanes on marine wildlife. Our goal is to determine the distribution and abundance patterns of Thick-billed Murres, in an effort to identify key marine habitats. At the Digges Island colony, we are investigating whether birds breeding at a variety of specific locations within the colony utilize different marine habitat areas, and whether this changes between breeding stages (incubating eggs vs feeding chicks). In association with this research, we are examining how variation in foraging behaviour might influence physiology and reproductive success of individuals. This work will establish a baseline of marine habitat use from which potential future impacts of resource development to marine birds may be assessed. It will also help to provide the information necessary to develop efficient monitoring protocols for Canada's northern Thick-billed Murre colonies.



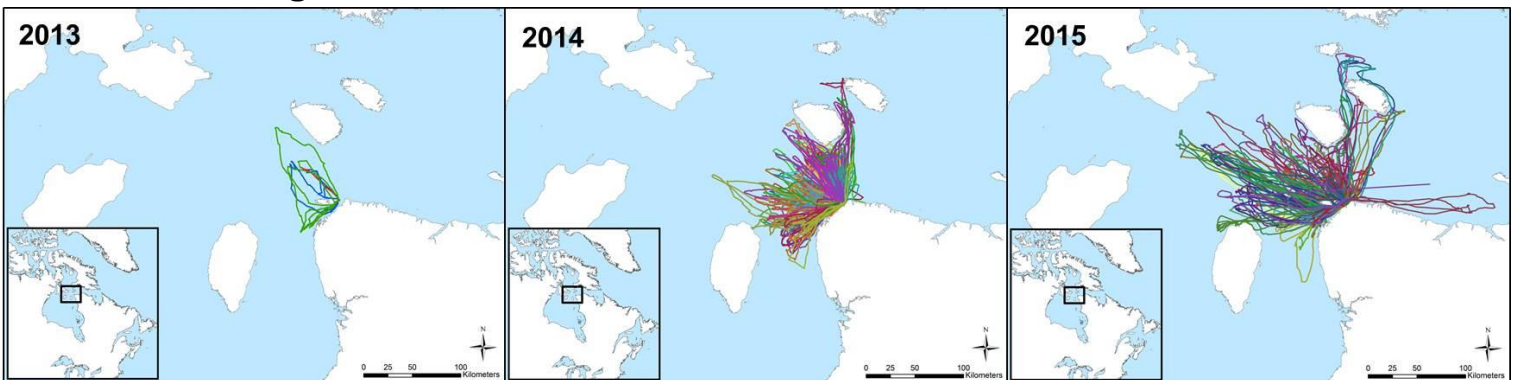
Interannual and seasonal variation in marine habitat use

We initiated GPS deployments on Thick-Billed Murres in 2012 and have since discovered variation in habitat use between years. The project is also investigating whether there are differences in the duration and distance of foraging trips between breeding stages (incubation vs. chick-rearing).

Incubation



Chick-Rearing



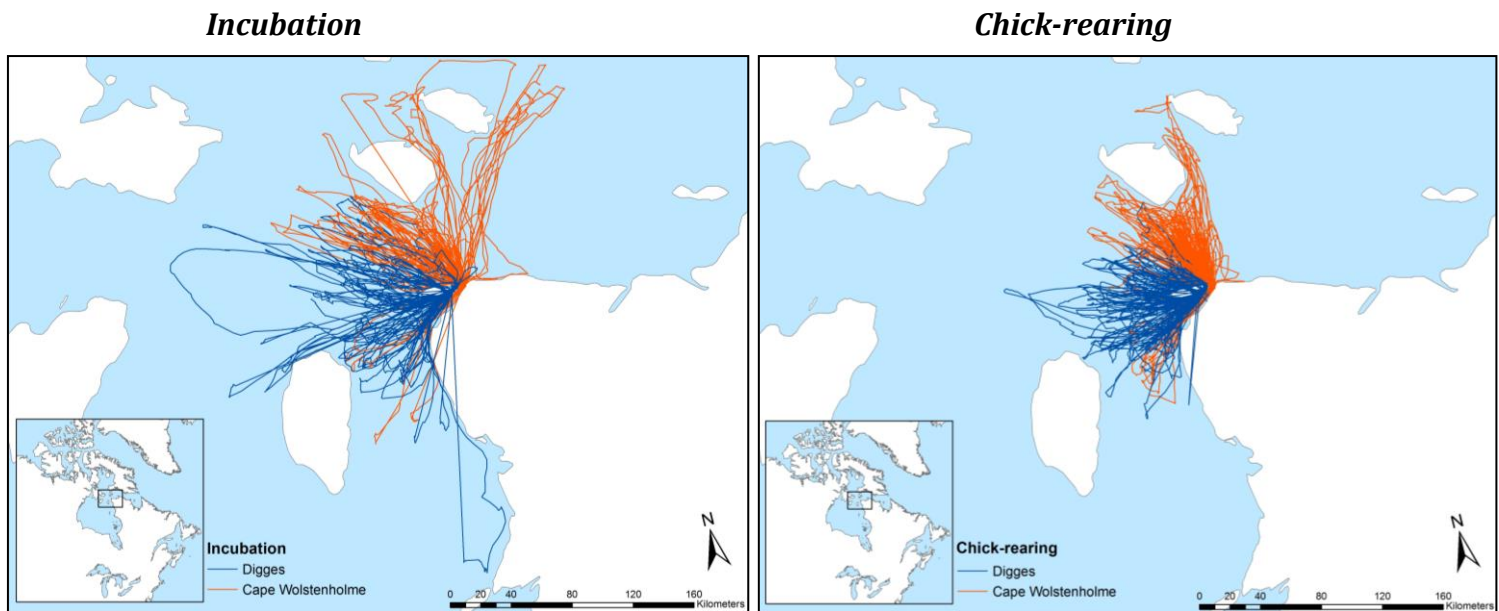
GPS Tracks of Thick-billed Murres during incubation and chick rearing in Digges Sound 2013-2015. Note: only 3 individuals were tracked during chick rearing in 2013.

Murres tracked from the Digges Island and Cape Wolstenhome sub-colonies utilized a larger marine habitat area early in the breeding season when they were incubating eggs than they did when they were feeding chicks. This is likely because the energetic and time demands while incubating an egg are much different than when an adult must also collect food to provision a chick. To examine interannual differences in marine habitat use analyses are currently underway to determine whether factors such as sea-ice and weather conditions may influence the duration and distance of foraging trips.

Spatial partitioning of marine habitat areas within and among breeding colonies

- Travis White (PhD, Carleton University)

Previous tracking work provided some evidence for spatial partitioning of marine resources between thick-billed murre breeding colonies. In Digges Sound, there are two sub-colonies (Cape Wolstenhome, and Digges Island) that make up the larger Digges Sound Colony. We tested for evidence of spatial partitioning by deploying GPS units on murrees from both sub-colonies during both the incubation and chick-rearing periods.



GPS tracks of Thick-billed Murres nesting on Digges Island (blue) and Cape Wolstenhome (orange).

Murres from Cape Wolstenhome tended to use the marine area North and East of Digges Island while Murres from Digges Island tended to spend more time in the area South and West of the Island. Our data also suggest that some partitioning of marine resources exists between murres nesting *within* different regions on the Digges Island colony itself. These results have very important implications for monitoring marine habitat use and emergency response planning because they suggest that the location of nesting influences the marine habitat used while foraging away from the colony.

Physiological mechanisms linking foraging behaviour with reproduction

-Graham Sorenson (MSc. University of Windsor)

To investigate mechanisms driving variation in movement behaviour between individuals, the team also measured energetic physiological traits. A small blood sample was collected from each individual before and after GPS units were deployed in order to assess their physiological state before and after foraging trips. By combining the GPS and physiological data, it will be possible to assess foraging effort in relation to physiological traits such as hormone levels. By comparing physiological data between colonies and across years it will be possible to determine the flexibility of individuals and populations in their response to environmental challenges such as changing ice dynamics and food availability.



Small blood samples taken from Thick-billed Murres at Digges Island, 2015.

Quantifying diving behavior and foraging energetics

-Thomas Lazarus (PhD. McGill University)

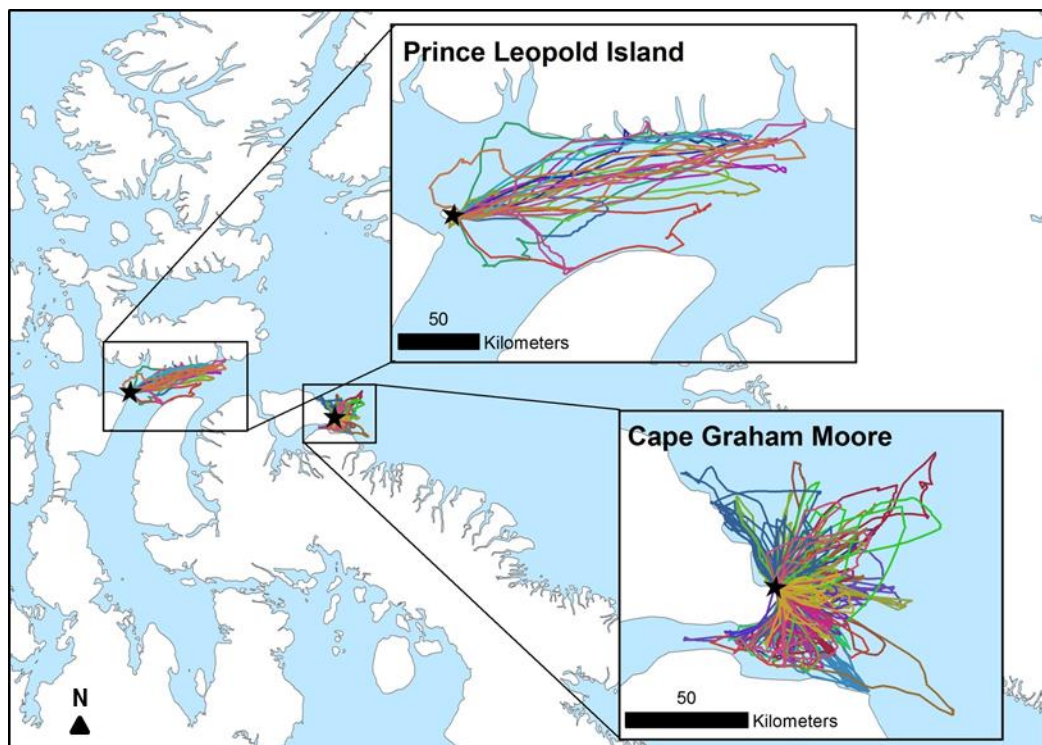
Through the repeated tracking of individuals it has been confirmed that there is significant variability in both the length and duration of foraging trips made by the same individuals. In addition to understanding which marine habitats are used, we are also interested to know how the habitat is being used. With the use of additional technologies such as time depth recorders and accelerometers, it is now possible to quantify foraging effort at different marine locations. By combining this data with physiological data, we plan to investigate the energetic profitability of different foraging behaviours, and how this may change within a summer and between years.



Thick-billed Murre with a time-depth recorder on it's left leg.

Patterns of Marine Habitat Use at Multiple Colonies

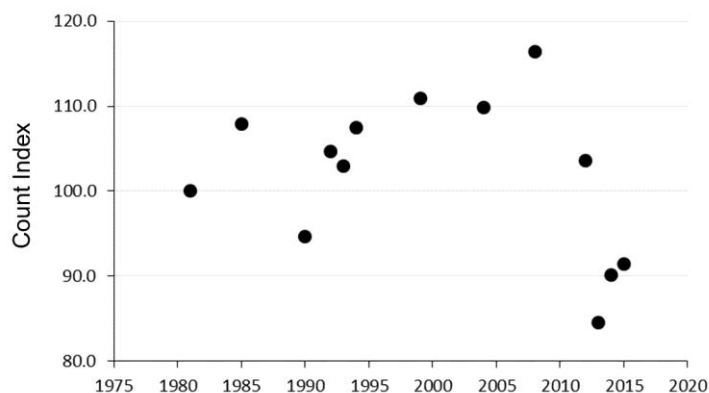
In addition to ongoing work in Digges Sound it is also useful to examine marine habitat use of Thick-billed Murres at other colonies. Tracking data collecting in 2014 indicated that murres from the smaller breeding colonies at Cape Graham Moore and Prince Leopold Island did not travel as far during foraging trips, likely because of reduced competition for prey resources near the colony as compared to the larger colonies in Digges Sound. Colonies may also be exposed to different interaction levels with proposed marine shipping. In 2014 we tracked a subset of individuals from the Cape Graham Moore Colony in response to the northern shipping route of Baffinland Iron Mine's *Mary River Project*. Our work at Digges Island suggests interannual differences in marine habitat use, and in 2016 we plan to return to Cape Graham Moore to launch a more detailed investigation of seasonal marine habitat use in Pond Inlet and around Bylot Island. This will provide an important baseline from which to compare patterns of marine habitat use by murres moving forward.



GPS Tracks of Thick-billed Murres at Prince Leopold Island and Cape Graham Moore 2014.

Long Term Population Monitoring

Environment Canada has led monitoring of Thick-billed Murre populations in Hudson Strait since the early 1950's and has regularly monitored the colonies since the early 1980's, led by Tony Gaston. In 2015, we continued this work by completing daily counts of the numbers of birds present at selected standardized study plots on Digges Island. Counts of Thick-billed Murres continued to be markedly lower than the long term average and suggest a decline since 2010. This is a similar pattern to the nearby colony on Coats Island suggesting that similar factors may be influencing the two colonies, and there is now also evidence of decline in low arctic colonies over the past 4 years.



Thick-Billed Murre count indices at Digges Island.
Count index is displayed as a percentage of the counts in baseline years (Digges: 1980-82).



Thick-Billed Murre eggs collected at Digges Island for ongoing contaminant analyses.

Monitoring Northern Contaminants

Since 1991, Environment Canada has been monitoring levels and effects of contaminants such as PCB's, organochlorine pesticides, and trace elements including mercury in the arctic environment. This work, led by Dr. Birgit Braune, has found that mercury concentrations in Thick-billed Murre eggs sampled in 2012-2014 did not change significantly from levels measured in 1993 but remained lower than levels measured in murre eggs from a high Arctic colony. By contrast, concentrations of some of the organochlorines, such as DDT and PCBs, decreased between 1993 and 2012-2014. As part of this ongoing research program, the team collected 15 eggs from the Thick-billed Murre breeding colony on Digges Island in 2015. These eggs will be chemically analyzed and the results will contribute to ongoing monitoring of the levels, trends, and effects of contaminants in Arctic-breeding seabirds and their eggs.

Research Partners and Financial Support

Our research at Digges Island was a combined effort of many people and organisations. Dr. Grant Gilchrist (Environment Canada) leads the project together with Dr. Oliver Love (University of Windsor) and Dr. Kyle Elliot (McGill University). The project coordinator in 2015 was Mike Janssen (Environment Canada).

The research at Digges Island is logistically complicated and labour intensive, requiring a mixed crew of climbers, students, biologists and local guides. Jimmy Audlaluk, Phillipe Audlaluk and Moses Audlaluk provided critical logistical support and boat transportation while advising on GPS deployment locations. Kerry Woo, Will Black and Bruen Black provided climbing expertise and Thomas Lazarus and Graham Sorensen (both graduate students) added technical and scientific skillsets to the team.

Research in Canada's north is expensive and funding for this work is necessarily provided by a network of partnerships that includes but is not limited to: Environment Canada Wildlife Research Division, Environment Canada Ecotoxicology and Wildlife Health Division, the Canadian Wildlife Service, Baffinland Iron Mines Corporation, the PEW Charitable Trusts, Mitacs, Polar Knowledge Canada, ArcticNet, Ocean's North, Nunavut General Monitoring Plan, University of Windsor, McGill University, Northern Scientific Training Program, Northern Contaminants Program and NSERC.



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