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Do North American Migratory Barren-Ground Caribou Subpopulations Cycle?

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APPENDIX S1
SUBPOPULATION RANGE ATTRIBUTE METADATA

Normalized difference vegetation index (NDVI), net primary production (NPP), and mean land surface temperature (LST) were obtained for each subpopulation range using Google Earth Engine (GEE) The scripts identified (below) are examples. Each script was slightly modified to select the specified attribute on a subpopulation by subpopulation basis.

Subpopulation ranges were identified and georeferenced based on the COSEWIC (2016) map of barren-ground caribou designateable units. The ranges used in conjunction with the GEE script were archived in KML and KMZ file formats under the file name "Google Earth Engine–Barren-ground Caribou Subpopulation Range Files." The NDVI, NPP, and LST metadata obtained from GEE were organized by subpopulation and archived under the file name "Barren-ground Caribou Subpopulation LST, NPP and NDVI meta-data.xlsx." Both the range files and metadata file are available upon request to the corresponding author.

Normalized Difference Vegetation Index (NDVI): NDVI data was obtained from the USGS Landsat 7 TOA Reflectance (Orthorectified) image collection.

```
//Import Barrenland Herd KML ranges
var range = ee.FeatureCollection(‹ft:1Eugplvi9_n2CCoXJyPb5feDmenjGx0egXFJwhEbn›);
Map.addLayer(range);

//Function for collection of images minimizing cloud cover
var rgb_vis = {min: 0, max: 0.3, bands:[‹B4›, ‹B3›, ‹B2›]};
function addNDVI(image) {
var ndvi = image.normalizedDifference([‹B4›,›B3›]);
return image.addBands(ndvi);
}
var filtered = L7.filterDate(‹2000-01-01›, ‹2017-12-31›)
.filterBounds(ROI);
var with_ndvi = filtered.map(addNDVI);
Map.addLayer(filtered.median(), rgb_vis, ‹RGB›);
Map.addLayer(with_ndvi.median(), {bands: ‹nd›, min: 0, max: 1}, ‹NDVI›);

//Print time series chart
print(Chart.image.series(with_ndvi.select(‹nd›), ROI));
```

NPP data were obtained from the MOD17A3.055: Terra Net Primary Production Yearly Global 1km image collection.

```
//Import Barrenland Herd KML ranges
var range = ee.FeatureCollection(‹ft:1Eugplvi9_n2CCoXJyPb5feDmenjGx0egXFJwhEbn›);
Map.addLayer(range);

// Extract NPP band
var NPP = MODIS.select(‹Npp›);
```

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```
//Clip image to polygon geometry
var NPP_roi = MODIS.map(function(image) { return image.clip(WA_Total); });
Map.addLayer(NPP_roi);

//Print NPP time-series
print(Chart.image.series(NPP_roi.select(‹Npp›), WA_Total));
```

LST data were obtained from the MOD11A2.006 Terra Land Surface Temperature and Emissivity 8-Day Global 1km image collection.

```
//Import Barren-ground caribou KML Herd Ranges
var range = ee.FeatureCollection(‹ft:1Eugplvi9_n2CCoXJyPb5feDmenjGx0egXFJwhEbn›);
Map.addLayer(range);

//Import LST and convert from Kelvin to Celcius
var modisLSTday = ee.ImageCollection(‹MODIS/006/MOD11A2›).select(‹LST_Day_1km›);
var modLSTday = modisLSTday.map(function(img) {
return img.multiply(0.02).subtract(273.15).copyProperties(img,[‹system:time_start›,›system:time_end›]);
});

//Clip LST to barren-ground polygons
var LST_roi = modLSTday.map(function(image) { return image.clip(WA_Total); });
Map.addLayer(LST_roi);

//Chart LST Time-series
var time_series = Chart.image.series(LST_roi, WA_Total, ee.Reducer.mean(), 1000, ‹system:time_start›);
print(time_series);
```

APPENDIX S2
SUBPOPULATION SINE FUNCTION FITS AND SUBPOPULATION SURVEY ESTIMATES

Sine functions were fit to the available subpopulation estimates for nine subpopulations that were classified as sine-cyclic: George River, Leaf River, Qamanirjuaq, Bathurst, Bluenose-East, Bluenose-West, Cape Bathurst, Porcupine, and Western Arctic. Graphical representation, period lengths, amplitude values, correlation coefficients, and significance of the fits are provided below.

Population abundance and demographic data estimates for the Qamanirjuaq, Bathurst, and George River subpopulations in addition to the abundance estimates for the Leaf River, Bluenose-East, Bluenose-West, Cape Bathurst, Porcupine, Central Arctic, Teshekpuk Lake, and Western Arctic subpopulations are archived under the file name "Barren-ground Caribou Subpopulation estimates + Sine Function Fits.xlsx" and is available upon request to the corresponding author.

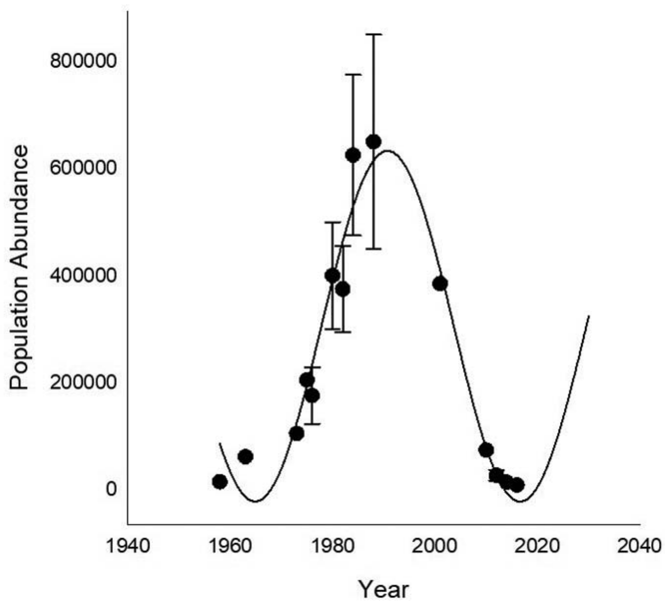

FIG. S1. The George River subpopulation time series abundance estimates approximate a sine wave (r = 0.973, $p < 0.001$) with a period of 51 years (SE = 2.3) and an amplitude of 327 432 (SE = 19 936.6).

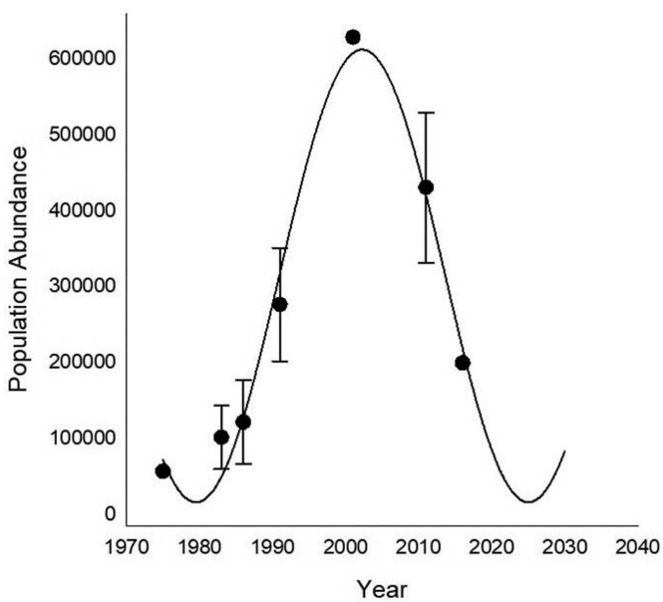

FIG. S2. The Leaf River subpopulation time series abundance estimates approximate a sine wave (r = 0.988, $p < 0.001$) with a period of 45 years (SE = 2.0) and an amplitude of 298 168 (SE = 19 954).

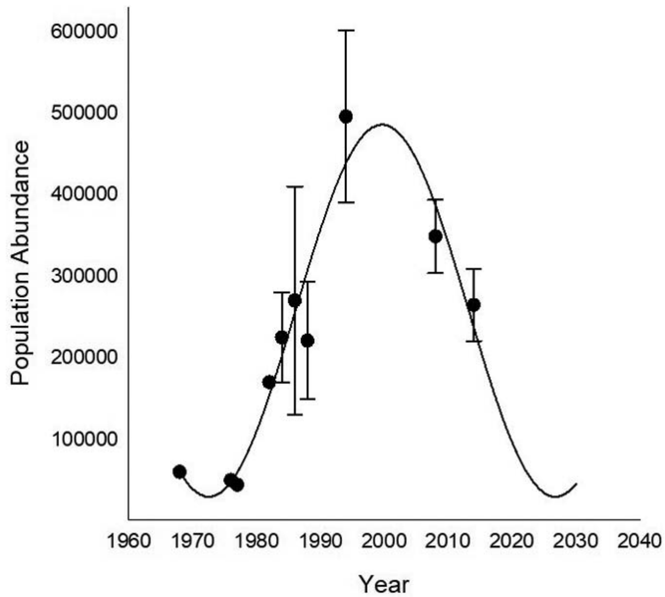

FIG. S3. The Qamanirjuaq subpopulation time series abundance estimates approximate a sine wave (r = 0.960, $p < 0.001$) with a period of 54 years (SE = 4.1) and an amplitude of 228 198 (SE = 23 735).

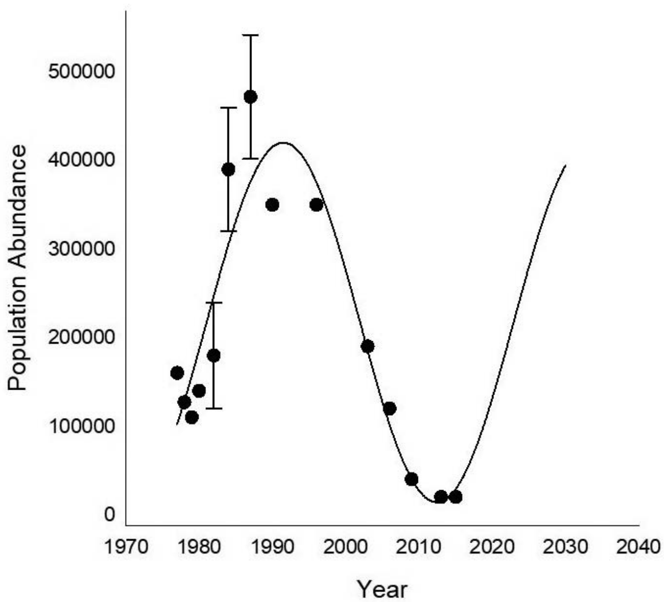

FIG. S4. The Bathurst subpopulation time series estimates approximate a sine wave (r = 0.935, $p < 0.001$) with a period of 42 years (SE = 3.4) and an amplitude of 203 154 (SE = 23 147).

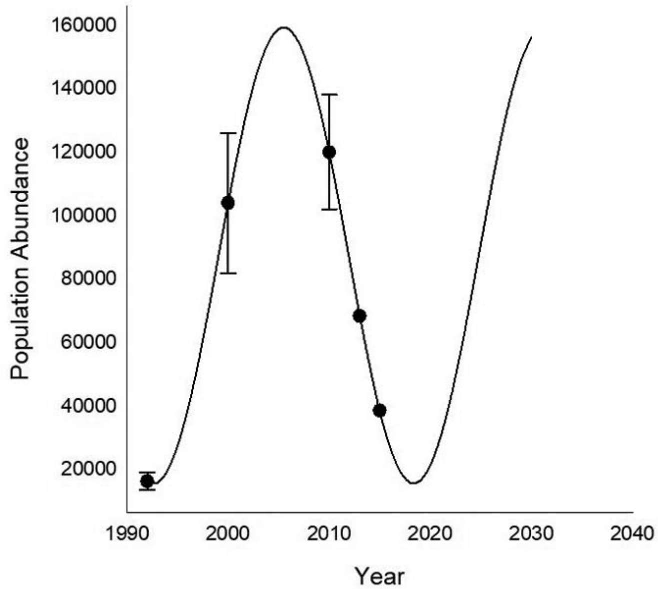

FIG. S5. The Bluenose-East subpopulation time series abundance estimates approximate a sine wave (r = 0.999, $p < 0.001$) with a period of 26 years (SE = 0.10) and an amplitude of 71 893 (SE = 425).

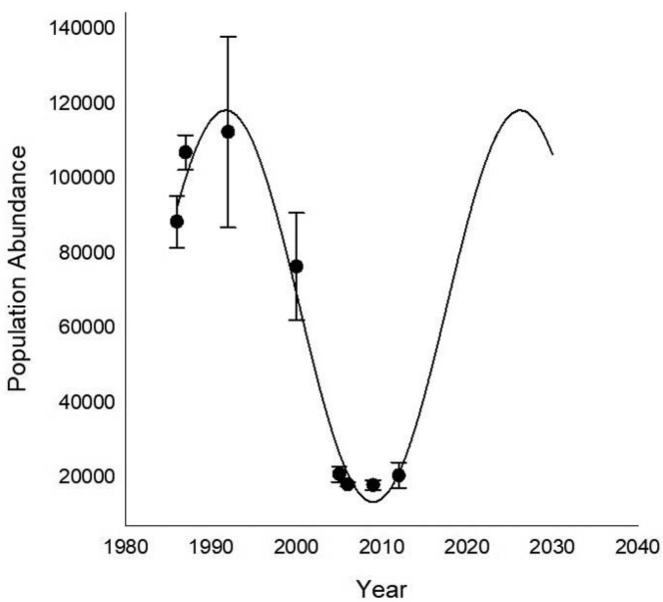

FIG. S6. The Bluenose-West subpopulation time series subpopulation abundance estimates approximate a sine wave (r = 0.987, $p < 0.001$) with a period of 35 years (SE = 2.0) and an amplitude of 52 408 (SE = 3144).

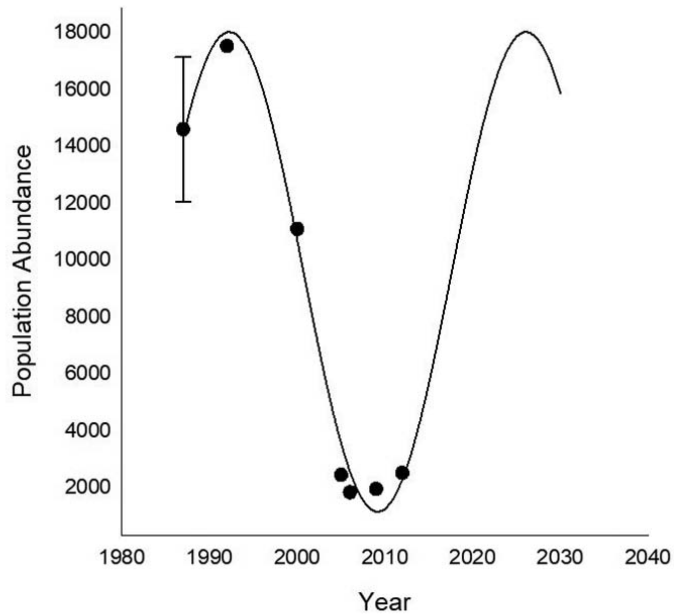

FIG. S7. The Cape Bathurst subpopulation time series abundance estimates approximate a sine wave (r = 0.994, $p < 0.001$) with a period of 33 years (SE = 1.5) and an amplitude of 8445 (SE = 385)

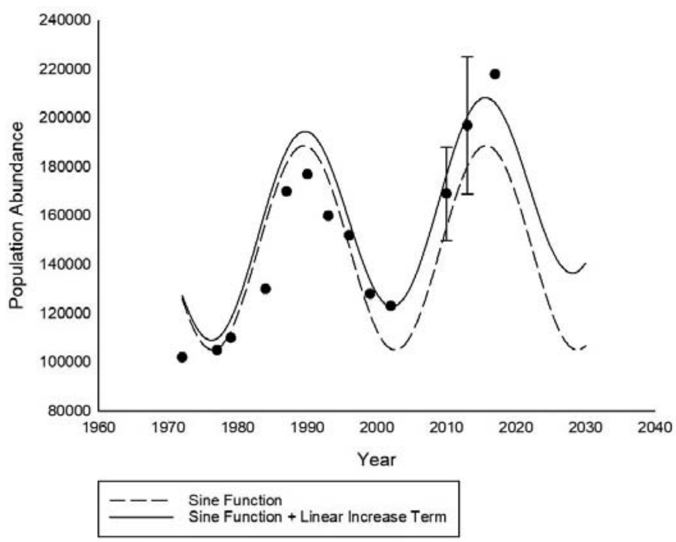

FIG. S8. The Porcupine subpopulation time series abundance estimates approximate a sine wave (r = 0.877, $p < 0.001$). The sine function with the additional linear increase term, improved the fit (r = 0.946, $p < 0.001$) to approximate a sine wave with a period of 26 years (SE = 1.5) and an amplitude of 48 338 (SE = 4875).

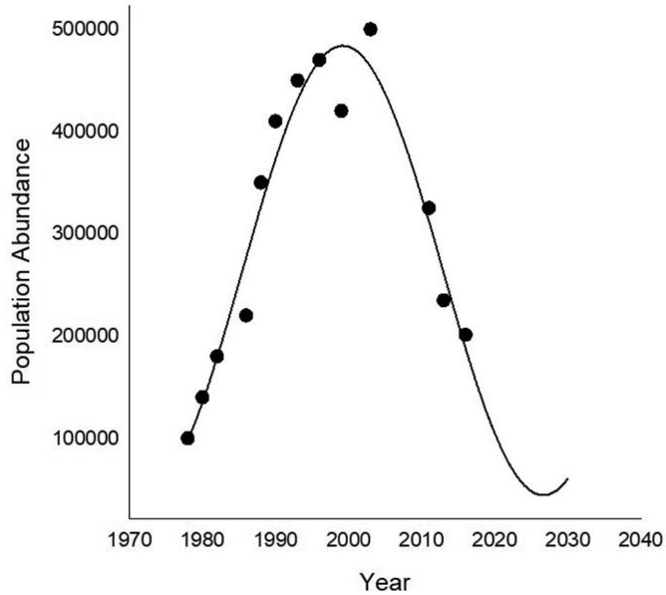

FIG. S9. The Western Arctic subpopulation time series subpopulation abundance estimates approximate a sine wave (r = 0.986, $p < 0.01$) with a period of 55 years (SE = 11.1) and an amplitude of 219 830 (SE = 60 273).