SNOW GOOSE ABUNDANCE

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PURPOSE

As with any species, a measure of abundance is key to understanding its interactions with other species and its impact on ecosystem functioning. This protocol was developed specifically for Snow Geese (GSNO and LSNO) but could be applied to other colonial nesting species (e.g. Ross' Goose; ROGO) if necessary. Abundance of these species is most easily determined during the nesting period. We distinguish two measures of abundance, relative density and absolute abundance, and we provide a different procedure for each. The former is reckoned as the number of nests per unit area while the latter is the integration of relative densities over the extent of the nesting colony or over some landscape region being inventoried for more dispersed nesters. This protocol was adapted from previous protocols in use on Bylot Island (NU) and La Pérouse Bay (MB).

TIME PERIOD

On Bylot Island, the best period to conduct snow goose nest searches is from 10 to 25 June. Dates may need to be adjusted slightly at other sites depending on the latitude.

PROCEDURE 1 – RELATIVE DENSITY

Snow geese typically nest in colonies of several thousand pairs. Finding these colonies is usually relatively easy given the high density of birds and their large size. The basic principle is to thoroughly search a number of plots of fixed size distributed throughout the colony and to record all nests in those plots. The first half of incubation is usually the best time to do that. However, as nests found here are also used to determine reproductive success (see other protocol), some nests must be found during the laying period. In this case, a second visit may be required during incubation to be sure that late nests are included in the density estimate. The number and size of plots may vary depending of the density of geese. Usually, the aim is to search for 300 to 400 nests. The procedure used on Bylot Island differs slightly from the one used at La Pérouse and we present both here.

Bylot Island

There are two types of plots.

Central Colony Plot (C). One large plot is monitored every year in the center of the colony. The goal is to survey about 200 nests in this area. The size of the area is adjusted every year depending of the reproductive effort of the geese, which may vary considerably in the High Arctic. We usually start with a core area of ca 45 ha but if nests density is too low, we enlarge the area. This is the first area searched for nests, thus most nests are found during the laying period. As we want to have a measure of density, all nests found during following visits must be recorded and positioned with a GPS. These nests are also used to determine the annual mean laying dates and thus we ensure that both nests initiated early or late are included in the sample. During nest visits, avoid excessive disturbance of nests because it could result in nest destruction by predators. For example, avoid visiting the same sector in consecutive days (space

the visits in one sector by 2 to 3 days). It is preferable to work in groups instead of being spread out over a large portion of the colony. By focusing our activities in one sector, we minimise disturbances.

Random Plots (P). The objective is to find at least 100 goose nests in plots randomly distributed within the nesting colony. Random plots are 1 ha (100 × 100 m) and their total number is influenced by nest density. Two major types of nesting habitats occur on Bylot Island, wetland and mesic tundra, each with different densities. The plots are usually stratified according to these two habitats, with an equal number of nests in each. Every year, the coordinates of a specific corner (ex: North corner) are randomly drawn from a 100 × 100 m grid map covering the whole colony. Plots are set up in the field during the first half of incubation, in the same order they were drawn. On the first visit, plot corners are marked using pre-numbered wooden stakes (ex: P015 for random plot #15). Plots are searched and all nests found inside plots (including empty, predated and abandoned nests) are positioned with a GPS. If the plots are visited during the laying period, they should be revisited during incubation to ensure that all nests were found. It is important to note if no nests are found in a particular plot, and to distinguish cases when plots are inaccessible (e.g. due to river flooding) from those that were visited but no nests were found.

It is possible that a random plot will be located in the *Central Colony Plot*. It is important to record nests already marked in this particular plot and to indicate that these nests ALSO belong to a random plot. Nests also marked as part of the *Central Colony Plot* are also considered in the total nests count for the random plots.

When Snowy Owls are nesting, goose nests tend to cluster around owl's nests. In such year, the random plots may be adjusted to account for a peculiar distribution of nests. For example, if many owls are nesting, their nest should be systematically searched and positions, and goose nest searches may be concentrated around the owls' nests.

La Pérouse Bay

Over the years, we have selected sections (areas) of the colony that are representative of nesting density over the entire nesting colony or region. Once selected, an area continues to be monitored even if nesting density declines precipitously (say in association with habitat degradation). At La Pérouse Bay, the areas reflect different habitat types and correspond to colony expansion. Three of the areas have now been monitored for 12 years and two, corresponding to recent expansion, have only been monitored for 2 years. In each area, 5 sites have been selected that again are representative of the area being surveyed. Care was taken to avoid just the highest or just the lowest density portions. The sites are marked with a metal pole (T-bar), driven into the substrate. Nests associated with the site are counted in a 50m circle around the center pole by 3 individuals – one at the center to support the pole and 50m rope, the second at 25 m and the third at 50m (0.785 ha). The outer two individuals count both active and failed nests between themselves and the next inner person as the perimeter of the circle is walked. Totals for both active and failed nests are tallied for the five sites in an area and entered into an Excel spreadsheet.

We monitor La Pérouse Bay for annual expansion and when a new nesting area is found, new sampling sites are erected.

PROCEDURE 2 – ABSOLUTE ABUNDANCE

The most rigorous method to determine the absolute abundance (i.e. total size of a colony) is to conduct aerial surveys with a helicopter but it is extremely expensive and thus cannot be done on an annual basis. At La Pérouse, this is usually done every 10 years and the procedure used there is described below. On Bylot Island, the Canadian Wildlife Service uses a different approach as they conduct a total inventory of geese on the island every 5 years during the molting period when birds are rearing their young (see Reed

and Chagnon 1987, Reed et al. 1992, 2002 for methods). A reasonable estimate of absolute abundance can nonetheless be obtained using a hybrid approach that is far less expensive. Both approaches are described below.

The Hybrid Approach

If the areas and sites used to determine relative nesting abundance are representative of nesting in the colony, then they can be combined with a determination of the extent of the colony to generate an estimate of overall abundance. At La Pérouse, the estimates of relative density taken from the circular site counts were found to correspond well to the mean densities estimated from the helicopter transects in common areas. The colony extent, estimated from the last complete helicopter survey annually or a reconnaissance flight run around the colony limits, can be adjusted annually based on ground observations. When relative density is available by habitat (as on Bylot Island), the total abundance can be calculated separately for each habitat, assuming that the area of each habitat in the colony is known.

Aerial Survey (La Pérouse Bay)

Flight lines were established and flown in a Bell 206B Jet Ranger using an on-board GPS to navigate from start to stop points. The start points are evenly spaced along the coast and the stop points are defined when no more nesting Snow Geese are encountered for at least 0.5 km (or more if potentially good nesting habitat is observed farther along the flight line). Two observers in the rear of the helicopter record the occurrences of nests between 10 and 50 metres from the flight line on their respective sides of the aircraft while a third observer records the nests 10 metres to either side of the flight line through the chin bubble. (The helicopter marking and calibration method for the 100-m wide transect line is found in Ross et al. 2006). Total numbers of nests are recorded for each 0.5-km section of the transect line and these data are translated into density contours. The total nesting abundance for the colony is obtained by integrating these density contours over the defined limits of the nesting colony. The latter are obtained by plotting the nesting limits obtained during the transect flights. Initial estimates are simply made using average densities and total area occupied by nesting Snow Geese. The area occupied is determined from points on the flight transect lines where nesting starts and stops (more details are found in Ross et al. 2004).

MATERIAL (PROCEDURE-1)

- Painted wooden staked, already numbered
- Map of the sector and field book
- Binoculars
- GPS
- 50-m rope marked at 25 m (La Pérouse only)

LITERATURE CITED

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