

RAPTOR AND SEABIRD REPRODUCTIVE SUCCESS

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PURPOSE

Annual reproductive success sets the stage for an individual's contribution to the gene pool and is one of the determinants of population growth (or decline). It is governed by a depreciative process that starts with an initial investment of eggs and ends (from a northern perspective) with the fledging of young and their movement south during migration. The depreciation involves a cascade of interactions with the habitat (e.g. quantity and quality of forage), competitors, predators and parasites. In many areas, predation is the leading cause of nesting failure in birds, and thus nesting success is a major component of predator-prey interactions. The components of reproductive success that are of interest here are:

Laying date: date that the first egg is laid in a nest

Hatching date: date at which the first egg hatched in a nest

Fledging date: date at which the first chick left a nest

Clutch size: total number of eggs laid in a nest

Nesting success: proportion of initiated nests where at least one chick hatch

Hatching success: proportion of eggs still present in the nest at hatch that produce chicks

Fledging success: proportion of hatched chicks that fledge

TIME PERIOD

Monitoring period for raptor and seabird nests usually extends throughout most of the summer. Raptors tend to nest earlier than seabirds and most of them should have initiated nesting by the end of May or early June. Fledging should occur from mid July to early August. Seabirds tend to start nesting in early or mid June and fledging should occur in late July or early August. Dates used here are for Bylot Island and may need to be adjusted at other sites depending on the latitude.

PROCEDURE

All raptor and seabird species (including ravens and sandhill cranes; this is implicit hereafter whenever referring to those groups) described in the abundance protocols are of interest. However, those most likely to be encountered are:

- Snowy Owl (SNOW)
- Rough-legged Hawk (RLHA)
- Peregrine Falcon (PEFA)
- Gyrfalcon (GYFA)
- Long-tailed Jaeger (LTJA)
- Parasitic Jaeger (PAJA)
- Pomarine Jaeger (POJA)
- Glaucous Gull (GLGU)

Reproductive success is usually determined on ALL raptor/seabird nests found, whether these nests were found during systematic searches (see protocols on abundance) or opportunistically. Ideally, nests should be found as early as possible during the laying period.

Keep in mind that search and inspection of **raptor** nests should be made with great care. First, be very careful when walking on steep hills or along cliffs and do not take any undue risk that could result in a fall. Second, raptors often attack people when approaching their nests and their claws can cause severe injuries. Always be alert when checking those nests, especially when you bend over nests or when you are in unstable position (e.g. along cliffs). For aggressive raptors (e.g. owl), it is recommended to wear a hard hat and to bring a long pole. Drive the pole in the ground close to the nest. This will prevent the bird from hitting you when you are bent over the nest. For **gulls** nesting on islands, waders or a small inflatable boat may be necessary to access nests. Always bring a long pole with you when you paddle to an island nest. Drive the pole in the ground and attach your boat to it (this will prevent it of being blown away, and you of being stranded!).

Each time a nest is found, proceed in the following manner:

- 1) Record the nest position in a GPS (use the alphacode of the species followed by a number; see above or in the protocols on abundance).
- 2) Most raptor and gull nests should not require adding a marker nearby because they should be easy to relocate with the GPS coordinate. This may not be so for jaeger nests that tend to be very secretive. If needed, put a pre-numbered wooden stake 10 to 15 feet north of the nest for these species. Put the wooden stake on an elevated place, with its larger side towards the direction you would normally come from. This will facilitate finding the stake from a certain distance.
- 3) With a permanent marker, write a different number (1, 2, 3, ...) on both tips of each egg. Number the eggs from the dirtiest one (no 1) to the cleanest one, if possible. If the nest already contains marked eggs, **continue the sequence of numbers**. If several nests are close to each other, mark the nest number on the large tip of each egg as well to minimize confusion during next visits.
- 4) In the field book, write down the following information:
 - Number of eggs or young
 - The stage of the nest (see table in appendix for nest stage codes)
 - Signs of predation (see table in appendix for codes)
 - The numbers on the eggs already present (if the nest was found before your visit), the number given to the new eggs (circle these numbers) and the number on the broken eggs (put an X on these numbers).

It is important to note this information during each visit.
 - If the nest contains chicks, take notes on their development stage (e.g. size, locomotor ability, eyes opened or not, amount of down/feather and color, etc) in order to be able to determine the approximate age of the young. If young differ, indicate information for the least and the most advanced chicks.
 - All other appropriate information, like the presence of a white egg (no dirt at all), the female on the nest (or nearby), and chicks found outside the nest (how far?) should also be noted.
 - If you are convinced that chicks are hidden near the nest (e.g. because of attacks by the parents; see below) but you cannot find them, note the information.

During nest visits, avoid excessive disturbance of the nests because it could result in nest destruction by predators or abandonment by parents. Ideally, nest should be visited a minimum of 5 times (laying period, beginning of incubation, hatching period, mid chick rearing period and near fledging), and if possible at weekly intervals. In sites where marking with tarsal bands is taking place, always check for the presence of bands on parents attending nests. Whenever a marked individual is present, try to read the band number (or color codes depending upon the species).

Every time a nest is revisited, **repeat steps # 3 and 5 mentioned above**. Do not forget to write down the number on the eggs (REALLY important). Be careful to distinguish a predated nest from one that hatched successfully and where chicks have left. When a nest at the egg stage is found empty during a revisit and you are unsure if this is due to predation or an early fledging, try to look for **shell membranes** or the remains of predated eggs. The presence of soft shell membranes is a reliable indicator that the nest has hatched with success. However, large pieces of hard shell with simply a hole in them are indicative of predation because those are not found in nests where young hatched successfully (chicks trample the hard shells into fine pieces).

For some species, you have to be especially careful to ascertain fledging success because the young may leave the nest early after hatching and hide in the vegetation, sometimes up to 100m from the nest. Depending of the species, this can happen fairly quickly after hatch (e.g. ~ 1 week in jaegers), or later during growth (e.g., in owls young leave gradually the nest starting with the oldest one first around 3 weeks of age). When a nest that had previously young is empty (or some young are missing, especially in owls), search around the nest for hiding chicks. Alarm call of parents around an empty nest is a sure sign that the young fledged successfully but are hiding somewhere. Even if you fail to find the young, record the nest as successful fledging and add remarks.

Since females of most of these species lay their eggs at intervals of about 2 days (occasionally longer) and start to incubate immediately after the first one is laid, eggs do not hatch all at the same time. Thus, it is possible that the hatching date of the first egg (which defined the hatch date of the nest) will be missed. Therefore, whenever nests contain both eggs AND chicks during a visit, it is important to note the developmental stage of each chick to be able to approximate the hatching date.

MATERIAL

- Small permanent marker
- Binoculars
- Field book
- GPS
- Protection material for raptor nests (hard hat, long pole)
- Inflatable raft with a paddle, life vest and a long pole for gull nests

DATA MANAGEMENT

Data should be transcribed to data sheets back at the field camp. Each nest visit is transcribed on a different line. Data from these visits will be used to estimate nest parameters such as the egg laying date and clutch size. Formulas used for these calculations are available with the data sheets.

If visits occur during the laying period it is useful to **estimate** the **hatching date** on the data sheets by adding the specific incubation period to the date at which the first egg was laid. Indicate this date in parenthesis on the data sheet. It will serve as a guide to plan future nest visits during the hatching period.

When you enter the information on data sheets, verify if the number of eggs in the nest increased. If it is the case and if the egg laying date and clutch size was already estimated (i.e. we thought that laying was complete when the nest was first found), the egg laying date should be re-calculated, assuming that during the first visit, the nest was still in the laying period. However, do not recalculate if you suspect parasitism during the incubation.

NEST STAGE variable

Codes	Definition
0	Female killed or nest destroyed by an observer
1	Cold eggs (may contain one warm egg) but the nest is still active
2	Warm eggs
3	Eggs that just started hatching (strong knocks or small crack)
4	Eggs at the end of hatching (hole-pip)
5	Chicks in the nest (may still contain eggs)
6	Empty nest, fledged with success
7	Empty nest, fledged with success but some eggs or dead chicks remaining (indicate how many)
8	Completely predated or abandoned nest (cold eggs found after the beginning of incubation, all chicks dead without evidence of any fledging)
9	Unknown

PREDATION variable

Codes	Definition
0	No predation
1	Missing or broken eggs since the last visit
2	Complete predation (ALL eggs broken or missing)