Abstract

Harbor seals (Phoca vitulina) are a wide-ranging pinniped, occupying diverse habitats across the majority of coastlines in the northern Pacific and Atlantic oceans. One of the most remote places they inhabit is the northeastern Gulf of Alaska, a 500-km stretch of exposed coastline with sparse human settlements and few embayments. Of these, Icy Bay (IB: ice field apx. 75 km²), has tidewater glaciers that provide floating ice, supporting the largest aggregation of this species in the world (>11,000 seals). A nearby, much less abundant, glacial haul-out (Disenchantment Bay [DB: apx. 70 km²]; 2,000 seals) allows for a comparison of life history traits of the two populations and their ice habitat, to help explain the difference in use. We hypothesize that better habitat quality at IB promotes higher pup survival and ultimately population size. Using aerial-photographs from 49 surveys over two years at the two sites, we mapped and measured the lengths of about 30,000 seals, including about 10,000 pups, and characterized their ice habitat. We found peaks in ice coverage corresponding to the early pupping period (mid-May) followed by a seasonal decline; IB consistently had twice the ice coverage, and ice bergs used by seals were twice the size of those in DB. Growth rates of pups were similar, but pupping phenology was advanced at IB by 7–13 days compared to DB. Larger mothers tended to pup earlier; those at IB left pups unattended (an indication of weaning) later compared to DB. Our findings suggest that IB supports more seals due to more reliable ice conditions for hauling out. Over time, this may have led to better condition and higher productivity of females, earlier-breeding, longer lactation, and higher pup survival. Differential recruitment, immigration, and other effects stemming from disturbance could also favor IB, given that DB has ~100 annual cruise ship visits during pupping.

Differences in timing of pupping may help explain differences in seal abundance between sites

- Higher habitat quality (haulout, prey, predation) 
  - Better female condition 
  - Earlier parturition

Phenology could be a useful tool for illuminating differences between populations across space and time.

Hypotheses

- Higher quality habitat (foraging and/or haulout) at Icy Bay enhances female condition which in turn leads to earlier parturition, longer lactation, bigger pups, higher pup survival and ultimately a larger population.
- Better habitat would also directly benefit pups through more efficient nursing and energy conservation.

How’d we get the data?

Field Methods

- DHC Beaver flew transects 200m apart at 100 feet at 100 knots.
- A GPS-linked, digital SLR camera, mounted in belly port, captured images of 80m x 120m ground coverage at 4cm/pixel resolution every 2 sec.

Analytical Methods

- Images were projected and scaled in a GIS, and seals’ body lengths and the largest dimension of the ice were estimated by superimposing polylines.

Pups and yearlings close to the size threshold were inspected visually for differences. In pelage color: gray seals were deemed pups, brown seals, yearlings.

What do the data say?

- Pups were discriminated using a sample of known pups (suckling; N = 1,099). Classification with length data on known yearlings (N=48) classification was improved by modeling pup growth.

Pup growth

- Pup size and growth were not different between sites.

Take home points

- More favorable ice conditions at Icy Bay could lead to better energy conservation and survival of all age classes but especially pups that are most vulnerable to heat loss.
- Overall advantages of the ice habitat at Icy Bay could over decades result in significant differences in population size compared to less advantageous sites.
- Measuring phenology as a tool for population monitoring merits further testing, especially in populations believed to be declining.
- Human influence in glacial fjords, especially vessel tourism, may compound impacts on populations already challenged by climate-driven habitat degradation.

Future data needs......

- Empirical data on female and pup condition, possibly using a proxy for girth from vertical imagery.
- Phenology data on shore and how foraging gears prior to parturition and possibly during nursing to learn about possible differences in foraging habitat.

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Photos by: John Jansen and Dave Withrow

A Glacial Perspective

Looking back 900 years, studies of glacial dynamics present a different picture of these habitats, revealing a complex interplay between glacial movement (advancing or retreating) and the amount of ice available by seals. Historically, there were periods when either or both bays were not suitable for hauling out on ice, and other periods when – unlike today – Disenchantment and Yakutat bays formed a much larger seal haulout, with likely much larger ice cover and many times more seals than currently at Icy Bay.