

Influence of forage fish availability on the risk of gull predation and kleptoparasitism on Atlantic Puffins (*Fratercula arctica*)



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Background photo © Emily Runnells

Background

Migratory forage fish affect interactions among seabird species while aggregated within foraging ranges of colonies

Capelin (*Mallotus villosus*)

- Keystone forage fish species in the Northeast Atlantic
- Migrates annually from offshore regions to spawn in coastal Newfoundland
- Acts as pulsed resource when migrates inshore
- Decreased biomass since population collapse in 1991¹



Fig. 1 Beach capelin spawning.

Study Species

Herring Gull (*Larus argentatus*, HERG) and Great Black-backed Gull (*Larus marinus*, GBBG)

- Surface-feeders
- Known kleptoparasites^{2,3}
- Dietary generalists:
 - Spawning capelin
 - Seabird eggs and chicks, and adults of smaller species⁴

GBBG are larger, more aggressive than HERG

Atlantic Puffin (*Fratercula arctica*, ATPU):

- Wing-propelled pursuit divers
- Carry 'bill loads' of fish back to young⁵
- Lay one egg per year, breeding in multi-species colonies with gulls in coastal Newfoundland



Fig. 2 Herring Gull (left), Great Black-backed Gull (middle), and Atlantic Puffin (right).

Objective, Hypothesis & Prediction

Investigate changes in gull predation and kleptoparasitism on Atlantic Puffins under varying capelin availability throughout the breeding season

Hypothesis: The inshore availability of spawning capelin influences the risk of gull predation and kleptoparasitism on ATPU

Prediction: Gull-based predation risk on ATPU will decrease and kleptoparasitism risk will increase following inshore arrival of capelin

Study Site & Methods

Northeast Newfoundland coast, Eastern Canada
– **James Island** ATPU colony (17,000 breeding pairs⁶)

July-August 2021 (Fig. 4)

- Annually persistent capelin spawning sites monitored for spawning activity
- ATPU burrows monitored for timing of hatching

Focal observations: 90 min per day, randomly selected gulls, recorded location and all behaviours (see Fig. 7) for up to 10 min each

Carcass surveys: every 2-4 days, followed a standard route on the island (Fig. 5), counting each ATPU carcass within 20 m of the transect line

- Marked carcasses to differentiate new and previously encountered carcasses during each survey

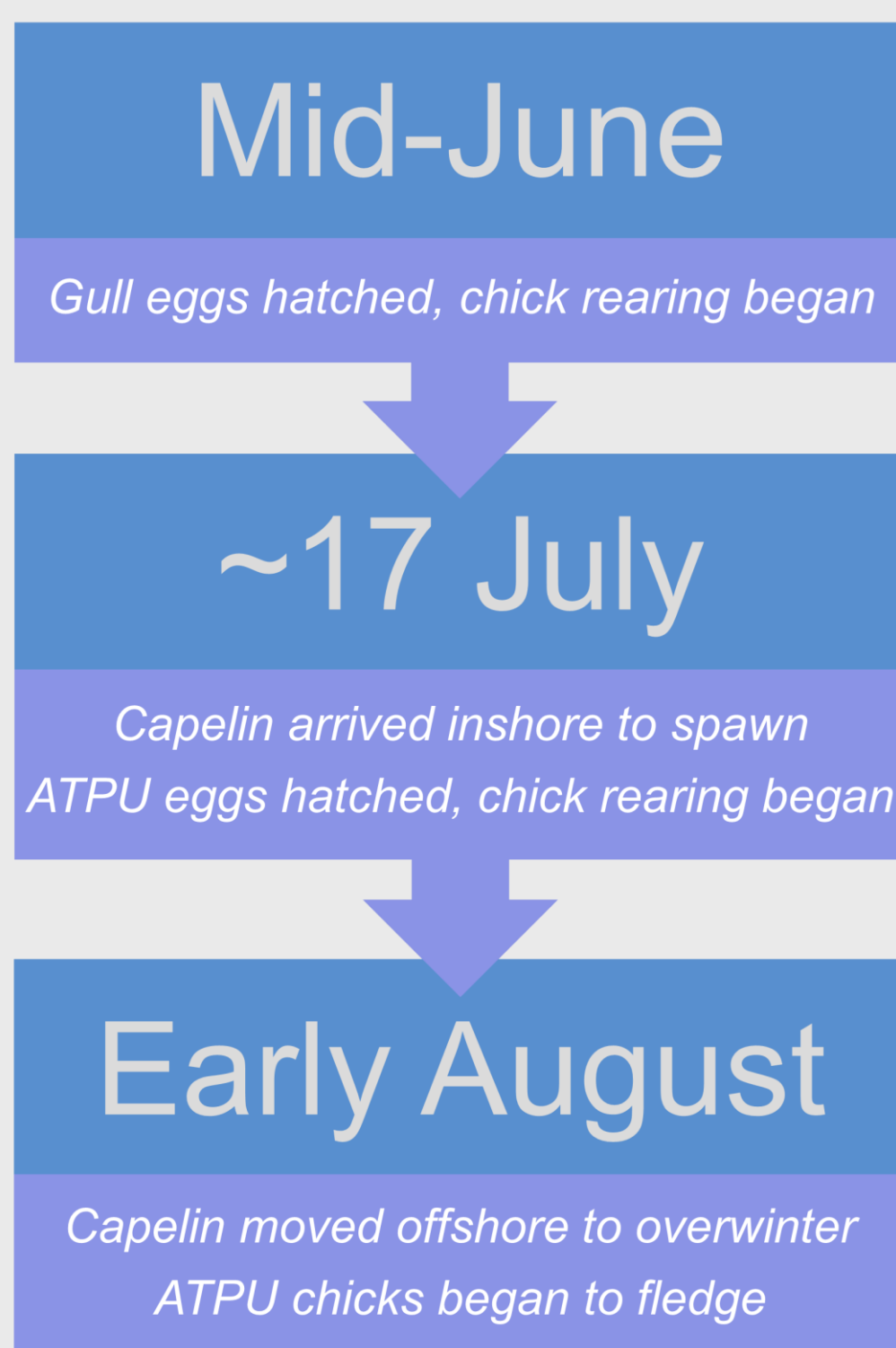


Fig. 4 Summer 2021 timeline of events.

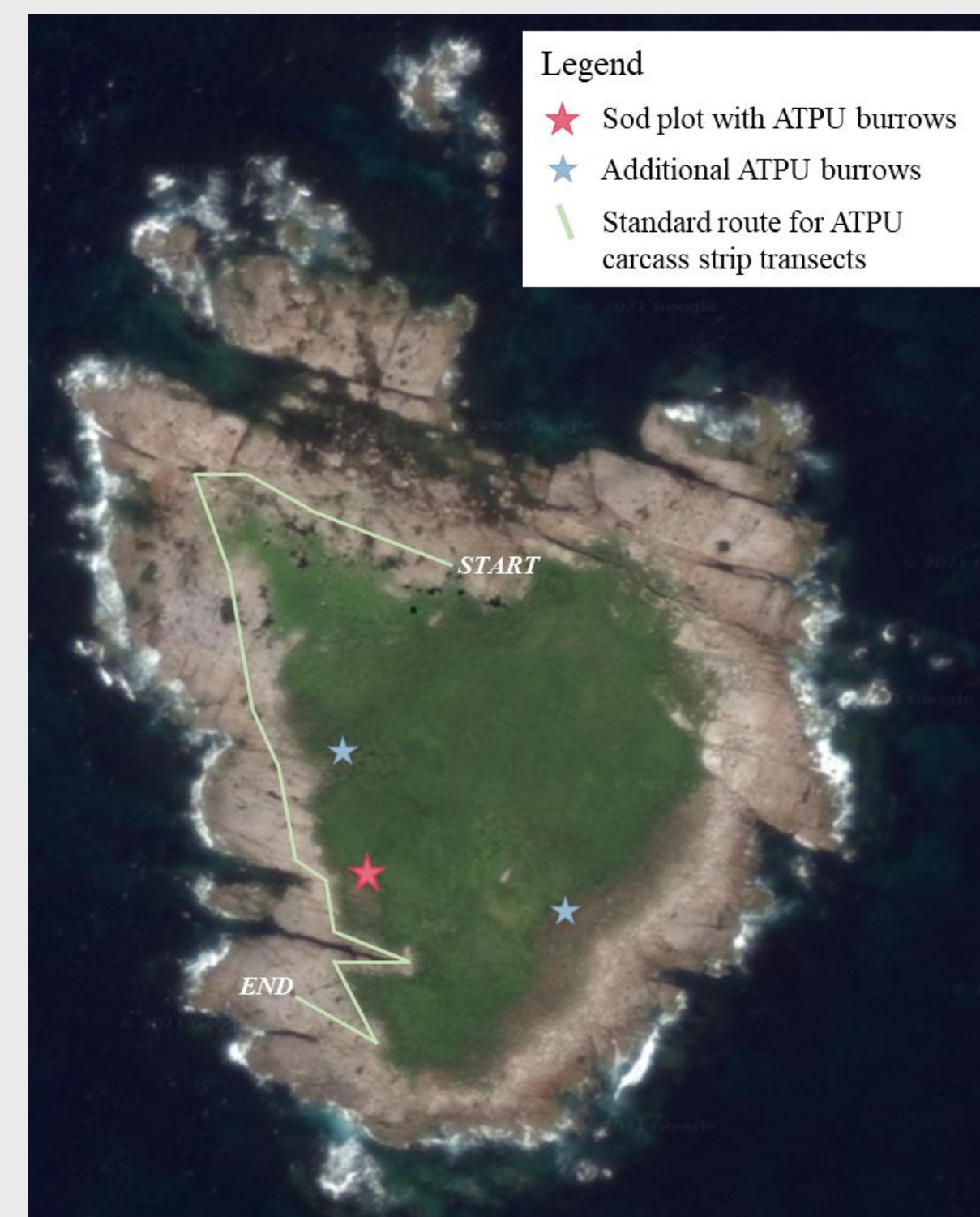


Fig. 5 Map of James Island and ATPU carcass survey route.

Results

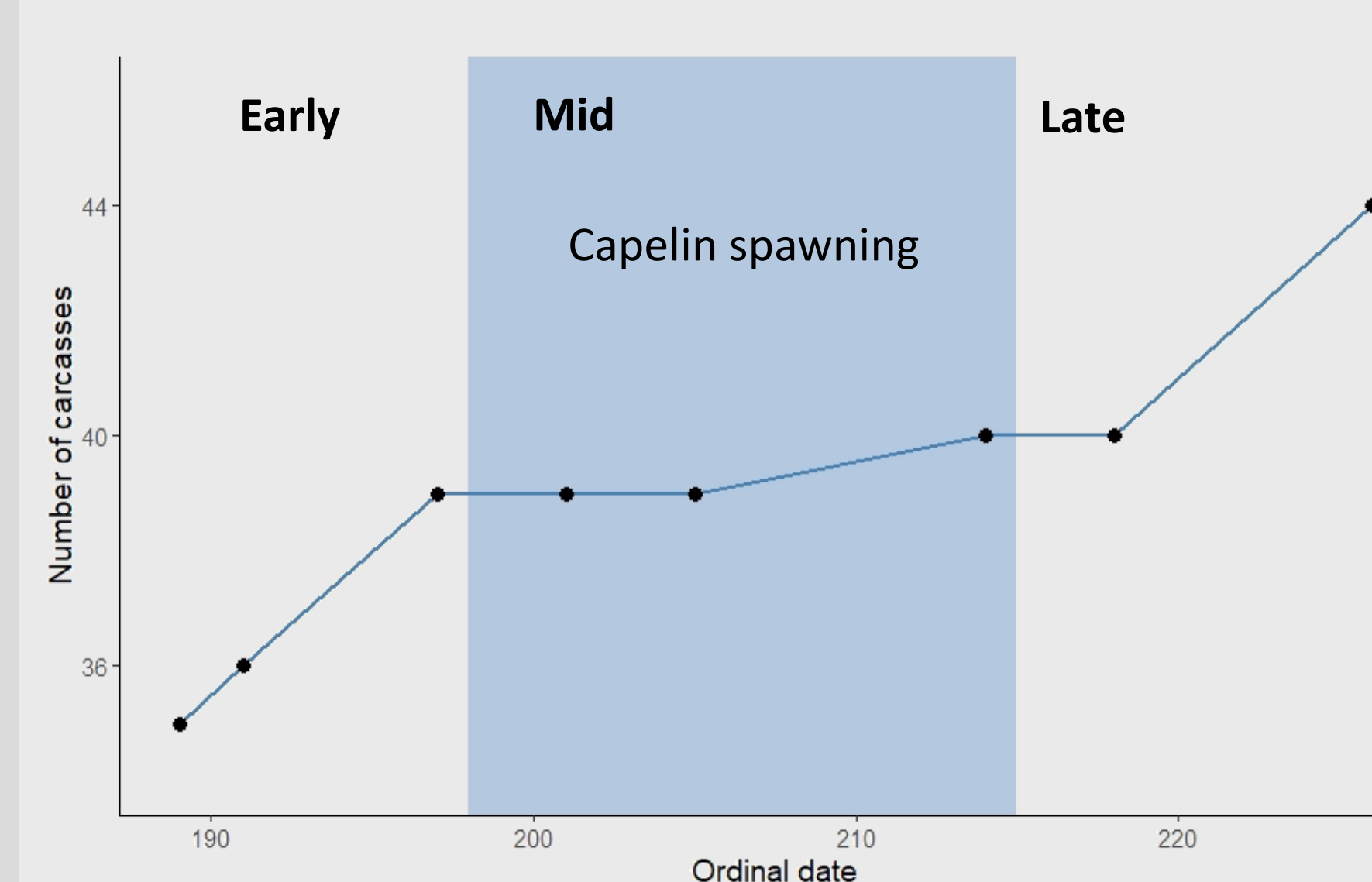


Fig. 6 Cumulative number of ATPU carcasses encountered throughout the breeding season along a standard transect.

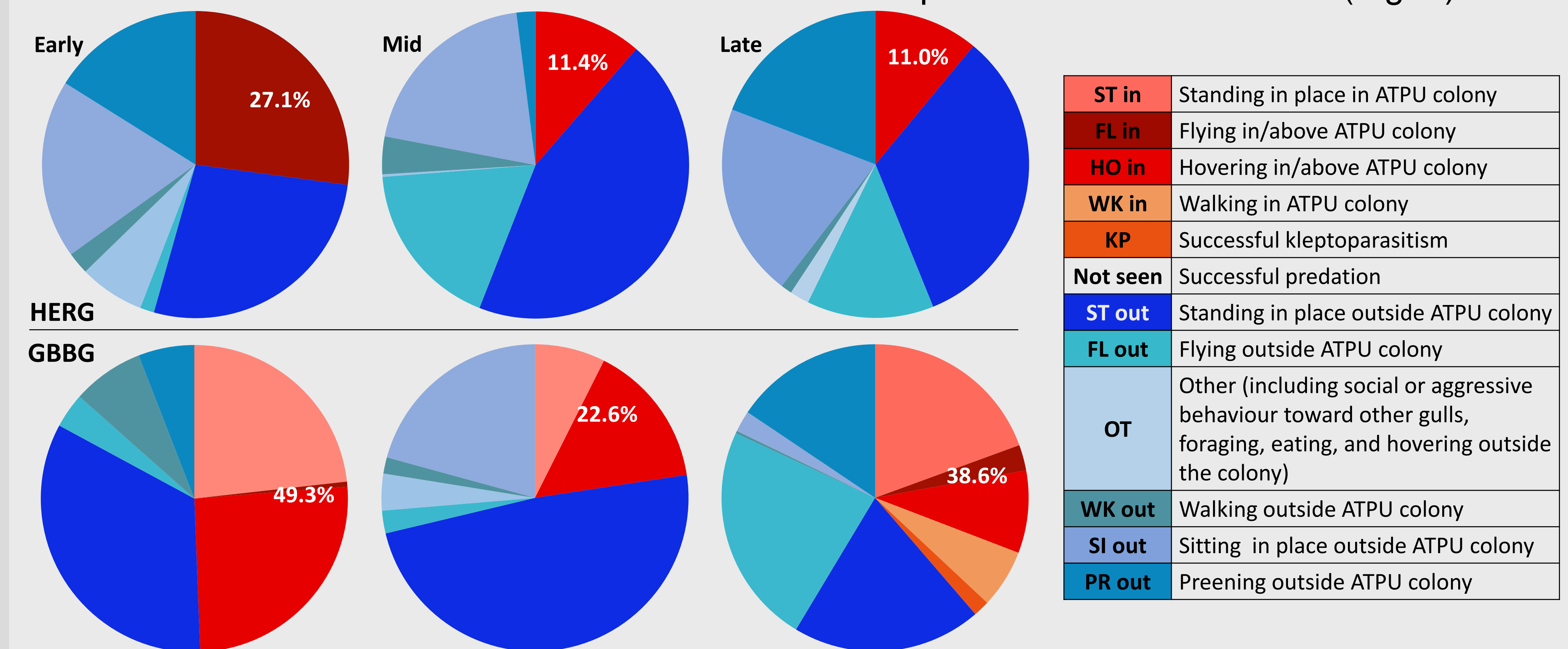


Fig. 7 Proportion of time by behaviour observed in focal follows of 5 HERG and 5 GBBG in the early (incubation), mid (chick-rearing, capelin spawning), and late (fledging beginning, post-capelin spawn) ATPU breeding season, with aggressive behaviours (red, total percentage of time indicated) occurring in the ATPU colony and non-aggressive behaviours (blue) outside the colony.

ST in	Standing in place in ATPU colony
FL in	Flying in/above ATPU colony
HO in	Hovering in/above ATPU colony
WK in	Walking in ATPU colony
KP	Successful kleptoparasitism
Not seen	Successful predation
ST out	Standing in place outside ATPU colony
FL out	Flying outside ATPU colony
OT	Other (including social or aggressive behaviour toward other gulls, foraging, eating, and hovering outside the colony)
WK out	Walking outside ATPU colony
SI out	Sitting in place outside ATPU colony
PR out	Preening outside ATPU colony

Conclusion

Continued decline in capelin biomass following the early 1990s population collapse¹ has meant decreased prey availability

- Our findings suggest that lower capelin availability may result in increased predation risk on ATPU by gulls
- Shifting gull predation could impact ATPU populations, reproductive success

Our findings can be used to inform appropriate fisheries and gull management strategies on the Newfoundland coast to protect this globally threatened species

References

1. Buren A et al., 2019. Mar Ecol Prog Ser. 616:155-170
2. Thompson D, 1986. Anim. Behav. 34: 1189-1205
3. Busniuk K et al., 2020. Anim. Behav. 166: 273-279
4. Maynard L & Davoren G, 2020. Mar Ornithol. 48: 103-109
5. Lowther P et al., 2020. Cornell Lab of Ornithology, USA
6. Jenkins E et al., 2018. Canadian Wildlife Services Technical Report, Environment and Climate Change Canada



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