Coordination, conflict, and neglect in biparental storm-petrel incubation

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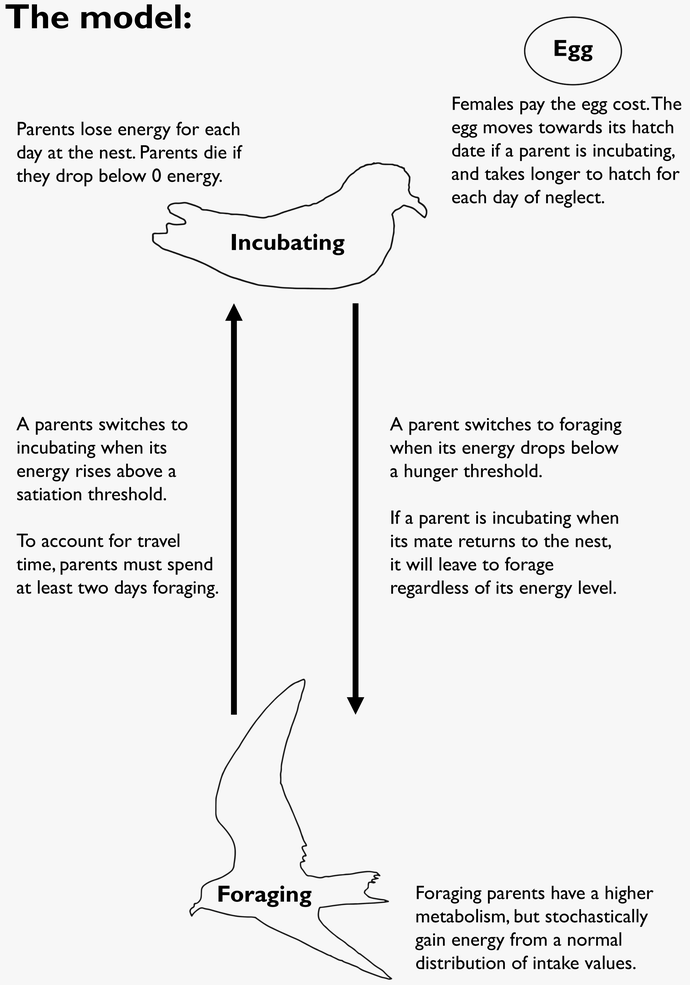
The question:

Leach's Storm-Petrels (*Oceanodroma leucorhoa*) travel hundreds of kilometers away from their nests to forage. How do two storm-petrel parents coordinate incubation care while maintaining their own condition?

The model:



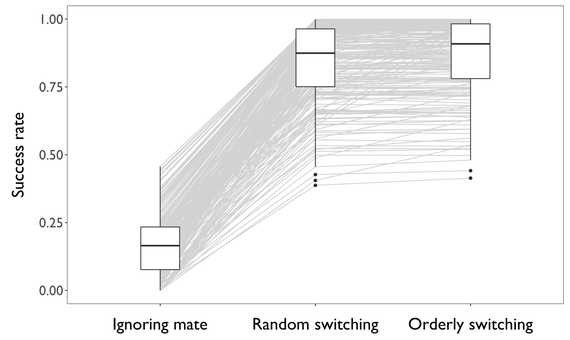
Behavioral strategy: a combination of hunger and satiation thresholds. Each strategy is replicated across 10,000 breeding seasons for a pair of parents with identical strategies.

Success rate: a season is successful if: (A) The egg hatches within a time limit, (B) the egg remains below a threshold for consecutive neglect, and (C) neither parent dies. Rate is calculated across strategy replicates.

Environmental condition: the mean for the normal distribution of foraging intake values. Default = 160 kJ/day.

For empirical parameters, model code, and acknowledgements see:
ltaylor2.github.io/LHSP

1. Leaving to forage when your mate arrives is critical for incubation success. Orderly switching is only important for a few strategies.

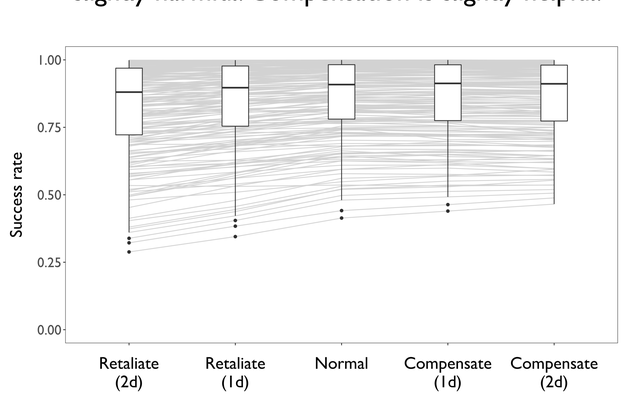


Gray lines are strategies.

"Random switching" means a random mates leaves to forage if mates overlap at the nest.

"Orderly switching," the default, means the previously-incubating mate leaves to forage if mates overlap at the nest.

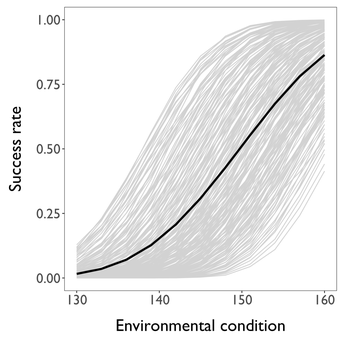
2. More complicated social responses cause only minor changes to success. Retaliation is slightly harmful. Compensation is slightly helpful.



Retaliation means staying to forage for one (or two) additional days if your mate did not relieve your incubation duties.

Compensation means staying to incubate for one (or two) additional days if your mate did not relieve your last incubation duties.

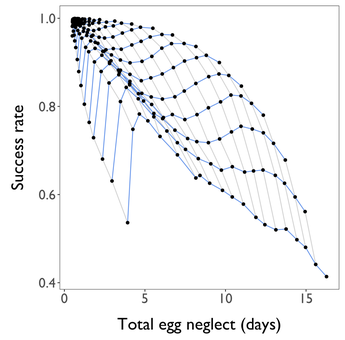
3. Environmental condition is a major driver of incubation success. Intermediate environments exacerbate the difference between good and bad strategies.



Gray lines are strategies.

Black line shows arithmetic mean.

4. Strategies with the similar success rates have different total egg neglect rates. The optimal strategy will depend on how neglect influences chick survival and development.

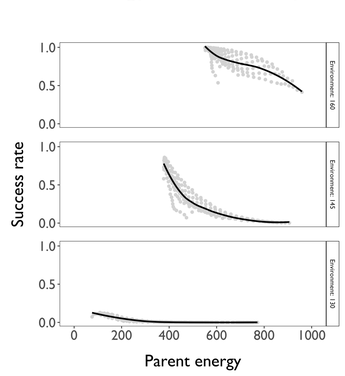


Points are strategies.

Gray lines group hunger thresholds.

Blue lines group satiation thresholds.

5. Strategies fix a tradeoff between parent energy and incubation success. The optimal strategy will depend on the link between energy and mortality risk.

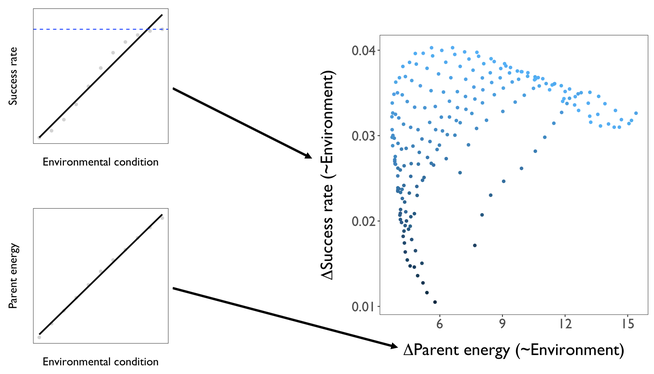


Points are strategies.

Lines are fit with LOESS.

Parent energy is the approximate geometric mean energy level (kJ) throughout the season for females.

6. Strategies have different sensitivities to environmental change for both success rate and parent energy. The optimal strategy for current and lifetime success will depend on the probability of different conditions.



Points are strategies.

Colors show the success rate of the strategy in the best environment (lighter blue = higher success rate).

X-axis: the slope of the linear regression of geometric mean parent energy as a function of environment.

Y-axis: the slope of the linear regression of success rate as a function of environment.