BioOne RESEARCH EVOLVED

Examining Patterns in Nocturnal Seabird Activity and Recovery Across the

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

e A k 130(2):331–341, 2013
© e American Ornithologists' Union, 2013.
Printed in USA.

E AMI I G A E I C AL EABI D AC I I A D EC E AC HE E E ALE IA I LA D , ALA KA, I G A MA ED AC IC EC DI G

RACHEL T. BUXTON,[1,4] HEATHER L. MAJOR,[2] IAN L. JONES,[1] AND JEFFREY C. WILLIAMS[3]

[1]*Depar men of Biolog , Memorial Uni er i of Ne ndland, S . John' , Ne ndland A1B 3X9, Canada;*
[2]*Cen re for Wildlife Ecolog , Depar men of Biological Science , Simon Fra er Uni er i , 8888 Uni er i Dri e, B rnab , Bri i h Col mbia V5A 1S6, Canada; and*
[3]*Ala ka Mari ime NWR, 95 S erling High , S i e 1, Homer, Ala ka 99603, USA*

A .—Populations of nocturnal burrow-nesting seabirds are notoriously di cult to measure because of their cryptic behavior at remote breeding sites. However, there is an urgent need to identify factors that influence recovery of these populations, because of the increasing number of introduced-predator eradication projects whose ultimate goal is to facilitate seabird and, thus, ecosystem recovery. We asked whether the relative status of nocturnal burrow-nesting seabirds across the Aleutian Islands, Alaska—inferred from levels of vocal activity collected with automated acoustic recording devices—can be explained in terms of ecological factors such as time since eradication, island size, and distance to source population. We deployed a total of acoustic recorders on six islands during – . Overall nocturnal call activity (mean number of calls night⁻ ± SE) was high (±) where predators were never introduced, low (. ± .) where introduced rats were present, and intermediate (±) where introduced predators have been eradicated. Using an information-theoretic approach, we found support for multiple factors as an explanation for the call activity of Leach's Storm-Petrels (*Oceanodroma le corhoa*), Fork-tailed Storm-Petrels (*O. f rca a*), and Ancient Murrelets (*S n hliboramph an iq*). Specifically, we conclude that although recovery of nocturnal burrow-nesting seabird populations in the Aleutians is not straightforward, the presence of nearby "predator refugia" may maximize the probability of seabird recovery and can be used when prioritizing islands for eradication programs. *Recei ed J l , accep ed Febr ar .*

Key words: acoustic monitoring, introduced predators, island restoration, nocturnal seabirds, population recovery.

Examen des tendances de l'activité nocturne et du rétablissement des oiseaux de mer sur les îles Aléoutiennes de l'Ouest, en Alaska, à l'aide d'enregistrements acoustiques automatisés

Oceanodroma le corhoa , *O. f rca a* et *S n hliboramph an iq* . Plus spécifiquement, nous concluons que malgré que le rétablissement des populations d'oiseaux de mer nocturnes nichant dans des terriers sur les îles Aléoutiennes ne soit pas simple, la présence de refuges contre les prédateurs à proximité peut maximiser la probabilité de rétablissement des oiseaux de mer et être utilisée lors de l'identification des îles prioritaires pour les programmes d'éradication.

, Jones et al. , Naugler and Smith , Seneviratne et al.).

Aco ic recorder .—We used digital automated acoustic recorders called “song meters” (Wildlife Acoustics, model SM),

was run for each species' flight call, with island as a categorical explanatory variable, site as a random variable, a log link, and Laplace approximation. Because of low incidence across islands and sites, Cassin's Auklet flight calls and other call types of all species (mate-attracting calls, territorial calls, etc.) were excluded from further analysis.

To assess whether ecological factors related to the eradication of introduced predators could explain call activity on di erent islands, we considered *a priori* candidate negative-binomial GLMMs (Table S). Models were corrected for zero inflation and had log links and Laplace approximations. Negative-binomial GLMMs, including a categorical random factor (site nested within island), were used to control for unaccounted variation between sites and islands and overdispersion. Each model was composed of biologically relevant combinations of variables in three separate analyses (calls night⁻

Mate-attracting calls and territorial calls were also numerous (Fig.), and Leach's Storm-Petrel chicks' begging calls were recorded at the western site, where flight-call activity was greatest.

Fork-tailed Storm-Petrel and Ancient Murrelet flight-call activity was about × higher at Kasatochi (foxes removed in) than at Amatignak and did not di er with activity levels at Buldir (Tables S –S). Mate-attracting calls were also numerous, but no chick calls were recorded. Leach's Storm-Petrel call activity did not di er between Kasatochi and Kiska (overlapping e ect sizes;

Table S). Conversely to this positive relationship between call activity and years since eradication, call activity did not di er between Nizki–Alaid (foxes removed in) and Kiska (Fig.).

Variable a ec ing call ra e .—For all three species considered, we found that vocal activity was a ected by explanatory variables related to recovery after predator eradication. e best-supported model from our candidate set explaining the mean rate of Leach's Storm-Petrel call activity after the eradication of introduced predators was the global model. is model received × more support than the second best-supported model (Table). Parameter estimates and standard errors bounded zero for the terms "island size," "wind speed," "Fork-tailed Storm-Petrel flight calls," and "Ancient Murrelet chirrup calls," indicating weak e ects. Leach's Storm-Petrel call activity was highest with increasing years since predator eradication, at sites with refugia (except talus refugia, which corresponded to decreased call activity), and when the moon phase was closest to the new moon (Table).

e best-supported model from our candidate set explaining Fork-tailed Storm-Petrel call activity included the following variables: years since eradication, island size, refugia, and distance to the nearest source. is model received . × more support

TABLE 3. S A (*w*) (*w*E) (SE P 0( )( )3(9)-16(7( )-5

than the second best-supported model (Table). Parameter estimates and standard errors bounded zero for the terms “years since eradication” and “island size,” indicating weak e ects. Fork-tailed