An experimental and observational study of the status and recovery of nocturnal seabirds at Amatignak and Little Sitkin Islands, Aleutian Islands, Alaska in 2008

by
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PRELIMINARY REPORT - NOT TO BE CITED OR DISTRIBUTED WITHOUT PERMISSION OF THE AUTHORS[3]

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Issue/Background:

Introduced predators have caused population declines and extirpations of colonial nesting seabirds on many formerly pristine islands. The Aleutians represent one of the largest oceanic island groups to which non-native mammalian predators were systematically or accidentally introduced during the 19th and 20th centuries, with devastating impacts on seabirds (Bailey 1993) - millions of seabirds nesting on more than 100 islands were wiped out. Nocturnal burrow- and crevice-nesting species such as storm-petrels, Ancient Murrelet (*Synthilboramphus antiquus*), Cassin's Auklet (*Ptychoramphus aleuticus*), and Whiskered Auklet (*Aethia pygmaea*) were most affected. To restore the former diversity of the Aleutians, non-native foxes have been removed from many islands, and plans for eradication of introduced Norway rats (*Rattus norvegicus*) are underway. Currently, the Aleutian Islands represent a patchwork of islands with and without predators eradicated (Ebbert 2000). The success of this restoration effort will ultimately be judged in part by the recovery of seabird populations and seabird recolonization of newly predator-free islands. Some key questions include: 1) What is the rate at which nocturnal seabirds are recolonizing predator-free islands?, 2) What factors determine the likelihood of natural recolonization and the rate thereof?, and 3) How might the process of recolonization and recovery be enhanced? The aims of our study focused on these questions. Growing evidence indicates that diurnally prospecting seabirds are responsive to visual and acoustic cues, and that these can be used to artificially establish new breeding colonies. There is less information about nocturnally active seabirds, but we hypothesized that nocturnal burrow-nesting seabird prospectors would place more importance on auditory and olfactory cues and will potentially use these signals when locating and assessing potential breeding sites. Our project aimed to test this idea and its application to restoration of nocturnal seabirds in the Aleutian Islands.

Objectives:

The objectives of the study were to 1) Test the importance of large and small-scale factors (habitat characteristics, temporal climatic conditions, within-island geographic factors, distance to source islands) determining prospecting behavior of nocturnal burrow-nesting Leach's and Fork-tailed (*Oceanodroma furcata*) Storm-petrels, Ancient Murrelets and Cassin's Auklets in the Aleutian islands, and 2) Quantify these species'

response to audio, visual, and olfactory cues as methods to enhance recolonization and recovery after the eradication of introduced predators. We hypothesized that prospectors favour settling amidst established colonies where conspecifics provide attraction, and we predicted that abandoned colonies can be recolonized when artificial cues are presented to prospectors. We conducted simultaneous research at two representative Aleutian islands (Amatignak and Little Sitkin) in which fox predators were recently removed; thus maximizing the chance that our findings would be robust and applicable across the island chain. Specifically we: 1) quantified the presence and frequency of prospecting by Leach's and Fork-tailed Storm-petrels, Ancient Murrelets and Cassin's Auklets at representative sites on each island, and 2) experimentally assessed whether call playback and artificial burrows enhanced prospecting behaviour. We also made detailed observations to assess the current status of seabirds and other birds at these recovering islands.

Methods

Study sites

Before fieldwork commenced we assessed the suitability of 48 Aleutian Islands for our study. For this preliminary list we considered all Aleutian Islands, but eliminated large islands (such as Attu, Kiska, Adak) because of the difficulty of accessing representative sites. From the short list of 48 we arrived at our selection of Amatignak (Delerof Islands) and Kasatochi (Rat Islands) based on the following criteria: availability of a suitable camp site and landing beach, foxes removed in last 20 years, absence of other introduced mammals, and presence of fresh water supply. Amatignak (3453 Ha) is an ancient, glacially eroded, densely vegetated island from which Arctic foxes were eradicated in 1991. Little Sitkin Island (6354 Ha) is a recent stratovolcano with little evidence of glacial erosion and sparse vegetation, from which Arctic foxes were eradicated in 2000. We expected to find more evidence of seabird recolonization on Amatignak (more time since eradication).

Automated acoustic monitoring

In order to automatically record nocturnal seabird vocalizations from representative sites, Songmeters (model SM-1, Wildlife Acoustics Inc.) were deployed at four locations

on both Little Sitkin and Amatignak Islands (Fig 1). Songmeters were mounted on 1 m high wooden posts and placed near the coast at < 100 m elevation near suitable nocturnal seabird breeding habitat (i.e., vegetated hillsides near the shoreline) as close as possible to the islands' geographic limits (i.e., north, south, east and west). These locations and dates were as follows: for Amatignak, north 51.29341°N 179.08994°W (June 24 – July 25), south 51.22952°N 179.09831°W (June 16 – July 29), east (camp) 51.26360°N 179.07399°W (June 17 – August 1), and west 51.262222°N 179.13419°W (June 15 – July 25), and for Little Sitkin, north (camp, Williwaw Cove; July 17 – July 31), south (just west of SSE Point; July 9 – August 1), west (between Sitkin and Double Points; July 1 – August 2), and south west (Williams Cove; July 18 – August 1) (all in datum WGS84). For control purposes we set a single (ninth) Songmeter in an area densely occupied by breeding Leach's and Fork-tailed Storm-petrels, Ancient Murrelets and Cassin's Auklets near North Bight on Buldir Island. Each Songmeter had two 16 GB memory cards installed, so at the recommended sample rate of 16kHz in the stereo record mode, the available 32 GB of memory could provide for 139 hours of recording time (46 nights at 3h/night). However, the predicted battery life of 100 h for high quality alkaline batteries restricted recording to about 32 nights at 3h/night. Therefore the following nightly schedule was programmed for automated recordings: commencing at 00:30 for 15 minutes, 01:00 for 15 minutes, 01:30 for 15 minutes, 02:00 for 15 minutes, 02:30 for 15 minutes, 03:00 for 15 minutes, 03:30 for 15 minutes, 04:00 for 15 minutes, 04:30 for 15 minutes, 05:00 for 15 minutes, 05:30 for 15 minutes, 06:00 for 15 minutes – for a total recording time per night of 3 h (180 minutes). Recording schedules were not adjusted for sunset time differences between islands or for seasonally changing sunset time – but the nightly schedule generously encompassed all times when nocturnal seabirds were likely to be vocalizing. Sound files were downloaded onto a laptop computer for subsequent analysis using automated call-recognition software (Songscope version 1.X, Wildlife Acoustics Inc.).

Ancient Murrelet playback attraction experiment

In order to experimentally measure the response of Ancient Murrelets to playback of representative conspecific vocalizations, we set up one study plot at each island (Amatignak 51.2557 °N 179.0663 °W Fig. 2, Little Sitkin, at the western end of Williwaw Cove, Fig. 3), with nightly monitoring. Study areas were selected for their resemblance

(vegetation and terrain) to Ancient Murrelet breeding areas on Buldir Island. One observer sitting in a tent (Amatignak) or in the open (Little Sitkin) listened each night and for each 15 minute interval between 01:00 and 04:00, recorded arrivals, departures, flybys, chirrup calls on and off the study site, number of birds call from 'burrows' (i.e, from the ground, concealed in vegetation or underground), and number of birds singing and number of songs performed (see Jones 1989). We also counted the number of flight calls (sometimes requiring estimation due to the large number of calls) and number of burrow callers for each of Leach's and Fork-tailed Storm-petrels. ILJ also counted number of Whiskered and Cassin's Auklet calls at Amatignak. Each study plot had two groups of 20 artificial burrows (total 40 per island) dug in before the monitoring commenced, with a separation of 20 m between the two burrow arrays. Each artificial burrow was a minimum of 30 cm long and 8 cm entrance diameter.

A **playback experiment** on these two study plots consisted of five nights of silent monitoring only (control) alternating with five nights of playback (stimulus) during 01:00 – 04:00 H, with three repetitions of control and playback at each site (Amatignak – control on June 22-26, July 2-6, and 12-16, and playback on June 27–July 1, and July 7-11 and 17-21; Little Sitkin – control on June 22-26, July 5-9, 16-20, and 26-30, and playback on June 30–July 4, and July 11-15 and 21-25). Listening, recording and playback continued irrespective of weather conditions. To assess the effect of playback of Ancient Murrelet vocalizations on behavior, we compared the frequencies of activities and vocalizations between playback and silent periods. Two forms of playback were presented simultaneously: 1) a selection of colony and burrow sounds including chirrup calls and songs recorded at Langara Island, British Columbia (sound files on an iPod Shuffle (Apple Computer Inc., set on repeat mode) was played over a TOA ER-2230 wireless megaphone, both iPod and megaphone set to 75% of maximum gain) located midway equidistant (20 m) from each burrow group and pointed out to sea (i.e., the two burrow groups and the megaphone forming an equilateral triangle 20 m on each side); and 2) the same selection of sounds was played on a second iPod connected two small speakers (NexxTech SXM/11), both iPod and speakers were set to 75% of maximum gain), these speakers placed on the ground in the middle of one of the two burrow arrays (chosen randomly) for the entire duration of the experiment.

Storm-petrel playback attraction experiments

In order to experimentally determine the response of Leach's and Fork-tailed storm-petrels to playbacks of their respective calls, an 8 m by 2 m mist net was set up on the beach in the valley near camp on Amatignak island, midway between the south and north faces of the valley high and on the cobble beach directly adjacent and parallel to the edge of inland *Elymus* grass. In order to investigate the relative attractiveness of different playback presentations, playback experiments were run for a total of 15 nights with a total of 5 treatments, a separate treatment being played on each night according to a randomized schedule. The treatments included a control with no sound playback, an arbitrary music sound control including 20 second intervals of John Mellencamp's 'Jack and Dianne' (Riva Records, 1982), Fork-tailed storm-petrel flight and burrow calls, Leach's storm-petrel flight and burrow calls, and finally storm-petrel colony sounds including a medley of flight and burrow calls from both species. The storm-petrel flight and burrow calls were recorded on both Egg and Buldir Island, were composed into medleys using the application Garage Band (Apple Computer, Inc.), uploaded to an iPod (Apple Computers Inc.), and were played using a TOA ER-2230 megaphone. Vocal response of the birds was evaluated by an observer who sat about 15 meters inland of the net counting calls and recording behaviours of storm-petrels and other attracted nocturnal seabirds. Behavioural response (i.e. circling) was evaluated by counting the number of storm-petrels caught in the net and marking their tails with quick-dry nail polish to account for recaptures. The recordings were played on their respective evenings from 1:30 a.m. until 4:30 a.m. with a 30-minutes-on, 30-minutes-off schedule. These interspersed 30 minute silence periods allowed the observer to get a more accurate account of long distance bird activity. The long and short distance reactions of storm-petrels, and any other seemingly attracted nocturnal seabirds, to conspecific and heterospecific playbacks were then analyzed.

To assess the possibility of auditory and/or olfactory cues as storm-petrel attractants to artificial burrows, a series of plots were used on Amatignak island. Three 4 by 4 meter plots made up of 14 artificial burrows (made of 40 cm long plastic tubing) placed in the ground were put in locations within the valley with suitable storm-petrel habitat and where high concentrations of storm-petrel flight calls were most often heard. Two plots were on the north face of the valley near camp in which the substrate was grassy tussocks composed of Rye grass *Elymus sp.* and Cow parsnip *Heracleum lanatum* (Plot 2: 51.26045˚N, 179.07993˚W, Plot 3: 51.26074˚N, 179.07878˚W). One plot was on the south

face of the valley near camp in which the substrate was poorly drained peat moss and Rye grass (Plot 1: 51.25761˚N, 179.07709˚W). All plots were at least 50 meters from one another and were at an elevation of about 15 meters. The experiment was run for a total of 24 nights with a total of 3 treatments. These treatments included a control (with no sound), playback (where recordings of storm-petrel colony noises were played), and playback and material (where recordings were played and storm-petrel nest material from Buldir island as well as paper towel rubbed with storm-petrels caught in the previous experiment were placed inside the artificial burrows). On each night at 01:20 h, toothpicks were placed at the front of the artificial burrows. On playback treatment nights storm-petrel colony recordings (the same medley used in the previous experiment, composed of calls recorded on Egg and Buldir island) were played over a TOA ER-2230 wireless megaphone from an ipod shuffle (Apple Computers Inc.) from 01:30 to 04:30 h. On playback and material treatment nights the paper towels (1/2 an 11 by 14 inch sheet rubbed with 3 Leach's storm-petrels, often including the birds' regurgitated orange stomach oil) was placed under a pile of nest material at the back of each burrow and colony recordings were played from 01:30 hto 04:30 h over the megaphone. The three treatments were performed on their respective nights according to a randomized schedule, starting with the first plot on night 1 the second plot on night 2 the third plot on night 3 back to the first plot on night 4 and so on. This schedule was determined to allow for at least 2 nights of inactivity on each plot to avoid residual effects of the treatments. An observer counted any nocturnal seabird activity within 30 meters of the plot from 01:30 h to 04:30 h. The toothpicks placed in the burrows were counted the following morning, making note of any knock-downs.

Finally, to test the feasibility of using the auditory and olfactory cues tested throughout the summer as stimulants for breeding activity in storm-petrels, these cues will be used with nest-boxes in a long-term experiment. Nine 12 by 12 by 6 inch nest boxes with a 14 inch long plastic tube entry were buried in grass tussocks on a 40 meter ridge on the northwest side of the valley at 51.26026˚N 179.08241˚W. Ten 12 by 12 by 6 inch nest boxes with a 14 inch long plastic tube entry were also buried in grass tussocks on Little Sitkin Island behind camp in Williwaw Cove. Inside the nest boxes, a small handful of storm-petrel nest material collected from Buldir Island was placed on top of a 5 by 3 inch piece of white cloth that was rubbed with storm-petrels also on Buldir Island. The rest of the bottom surface of the nest boxes was covered with grass and

moss collected from the hillside. Toothpicks were then placed within the plastic entry tube. On each night of the summer between June 22nd and August 7th (other than approximately 7 nights when equipment had to be repaired) from 12:30 to 5:00 in the morning, storm-petrel colony noises (same medley used in the previous experiment, composed of calls recorded on Egg and Buldir island) were played on Coby (make) speakers from an iPod shuffle (Apple Computers Inc.) on loop. Toothpicks were counted each night to make note of any knock-downs. These nest-boxes will be checked at the end of this season and subsequently next season for any sign of storm-petrel breeding activity.

Other observations

Amatignak: We made incidental observations of birds and marine mammals, operated an insect pitfall trapline, collected freshwater fish and plants.

Little Sitkin: We made incidental observations of birds and marine mammals and operated an insect pitfall trapline, malaise trap, and collected insects during hiking trips around the island.

Results

General observations

Little Sitkin and Amatignak Islands offered a splendid opportunity for comparative biological investigations of seabird colonization following eradication of introduced foxes. Ancient Murrelets were confirmed as breeding on both islands (more common on Amatignak). Leach's and Fork-tailed Storm-petrels were present nightly on both islands but no burrows were found.

Automated acoustic monitoring

Recordings were retrieved from the respective song meters, and approximately 470 hours of total recording time was obtained from Amatignak Island. At Little Sitkin approximately 258 hours of total recording time was obtained.

Analysis of the call frequency of various nocturnal seabirds in these recordings is underway in St. John's. Results of the analysis of these recordings using Songscope will be presented in detail elsewhere (e.g., PSG in Hakodate, February 2009).

Storm-petrel playback attraction experiments

Playback of Leach's and Fork-tailed storm-petrel calls seemed to elicit a significant response in both con- and hetero-specifics (Fig. 4). Fork-tailed storm-petrels did not show a strong vocal response to playbacks of their own calls, but were most definitely attracted to the recordings, as many birds were caught in the net on these playback nights versus control nights. Fork-tailed storm petrel response was more subtle, and this species was not attracted to any other treatment (i.e., they were only attracted to their own species' calls). Leach's storm-petrels on the other hand showed a relatively extreme response to playback. When recordings of their calls were played back about 25 times the number of birds would be caught in the net versus control nights and they would both circle and vocalize much more frequently. These birds also seemed to be attracted to Fork-tailed storm-petrel playbacks, more birds were caught in the net and heard vocalizing on these nights. Leach's storm-petrels also showed a very extreme response to colony noises, whether this response is more or less extreme than conspecific playbacks has yet to be determined. None of the birds were attracted to the music recordings of John Cougar Mellencamp, ruling out the possibility that birds are simply attracted to noise and headlamp light (either that, or the birds do not like the song 'Jack and Dianne').

Storm-petrels are definitely attracted to playbacks and nest-material odor, but did not seem to be entering the artificial burrows (Fig. 5). On playback/material nights birds were observed circling, vocalizing, landing on the plot, and occasionally making burrow calls from on or near the plot, yet more toothpicks were not knocked down on these nights versus control nights.

The results of the nest box experiment will not be clear until next season; however storm-petrels did not seem to be entering the nest boxes. There were few toothpick knock-downs at boxes throughout the summer on Amatignak and Little Sitkin. Further details of the results of this experiment will be presented in R. Buxton's thesis and publications.

Ancient Murrelet playback attraction experiment

Playback produced a spectacular response by Ancient Murrelets at both islands. At Amatignak, the frequency of arrivals increased by 3.16 times, departures by 2.51 times,

flyovers by 4.79 times, chirrup calls by 3.72 times, and number of songs performed by 5.23 times (Fig. 7). At Little Sitkin, the frequency of arrivals increased by 34.2 times, departures by 11.40 times, flyovers by 2.07 times, chirrup calls by 2.55 times, and number of songs performed by 9.83 times (Fig. 8). Further details of the results of this experiment will be presented in H. Major's thesis and publications.

Other observations

A summary of bird observations is presented in Appendix I and II. Many sea-lions and harbor seals were observed throughout the season on several parts of Amatignak island. In Ulva cove, close to camp, harbor seals were observed with two pups hauled out on the rocks to the south of the cove. Furthermore, several males were observed both day and night performing aggressive territorial displays such as tail slapping and biting. When the southern song meter was placed early in July many sea-lions were observed hauled out on Nitrof Point. This may be a possible sea-lion rookery, as over a dozen animals were seen. At Patterson Point on Little Sitkin one Harbour seal was commonly seen but up to 8 were seen at one time during late June. Occasionally 2-5 individuals were seen hauled out on rocks of Patterson Point.

Discussion

This report presents a summary of methodology and very preliminary analyses of results of the 2008 fieldwork. Initial observations indicate that Amatignak is in a more advanced stage of seabird recovery than Little Sitkin. For example, Glaucous-winged Gull nests were ubiquitous on Amatignak, but no nest was found on Little Sitkin. Ancient Murrelets appeared to be a more common breeder on Amatignak, based on the number of family groups heard departing. Ancient Murrelet breeding was concentrated in distinctive patches of tall vegetation near the shoreline, with breeding sites located in densely packed dead grasses (no earth burrows were found). Leach's and Fork-tailed Storm-petrels were heard every night at both islands but no evidence of nesting was found. At both islands, puffin spp. breeding appeared to be restricted to cliffs and offshore stacks.

Amatignak and Little Sitkin are at a crucial recovery stage. Whether numbers and diversity of nocturnal and other seabirds will recover to the point these islands resemble the community at Buldir is unknown. Our results indicate that the islands are recovering because seabirds that were certainly excluded by foxes are now breeding. Our playback experiments showed that it was possible to attract large numbers of the target species to suitable habitat, at least for night-time prospecting. Further progress of our experiments will show whether this extends to enhancement of breeding activity.

A clear picture of both the abundance and distribution of nocturnal seabirds will emerge once the sound recording analysis is complete. This report will be updated to reflect these results as soon as they are available.

Acknowledgements

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Parker, M.W., Kress, S.W., Golightly, R.T., Carter, H.C., Parsons, E.B., Schubel, S.E., Boyce, J.A., McChesney, G.J., and Wisely, S.M. 2007. Assessment of Social Attraction Techniques Used to Restore a Common Murre Colony in Central California. Waterbirds 30 (1): 17-28.

Figure captions

Figure 1 Amatignak (above) and Little Sitkin (below) depicted at the same scale (north up), showing locations of the Camp (black triangles), Playback/Monitoring Plot (black squares) and Song Meters (red dots). **[WHY DOES AMATIGNAK APPEAR LARGER IN AREA GIVEN THAT THE REFUGE'S AREA FIGURES INDICATE LITTLE SITKIN IS NEARLY 50% LARGER?]**

Figure 2 Two views of the Ancient Murrelet playback and monitoring plot at **Amatignak** Island: a) approximate area of coverage, view from across Ulva Cove; 2) study plot showing location of artificial burrows (top had ground playback, bottom no ground playback, megaphone was located at right side apex of red triangle.

Figure 3 Two views of the Ancient Murrelet playback and monitoring plot at **Little Sitkin Island**: a) approximate location of coverage, view looking west down Williwaw Cove; b) study plot showing location of artificial burrows (top two corners of triangle, burrow plots delineated in green), megaphone was placed at the vegetation edge at the base of red triangle.

Figure 4 Numbers of Storm-petrels caught in the mist-net in response to various playback stimulae in Ulva Cove on Amatignak island during 2008. 'Colony' playback means a mix of both species' calls. The net was opened 3 nights (from 1:30 a.m. – 4:30 a.m.) for each treatment, totaling 15 nights.

Figure 5 Number of birds that entered each artificial burrow (40 cm long plastic tubing dug into ground) based on number of toothpicks at the entry of each burrow that were knocked over.

Figure 7 Activity patterns at the Ancient Murrelet playback and monitoring plot at Amatignak Island (gray shaded section indicates playback presentations).

Figure 4 Activity patterns at the Ancient Murrelet playback and monitoring plot at Amatignak Island. (gray shaded section indicates playback presentations).

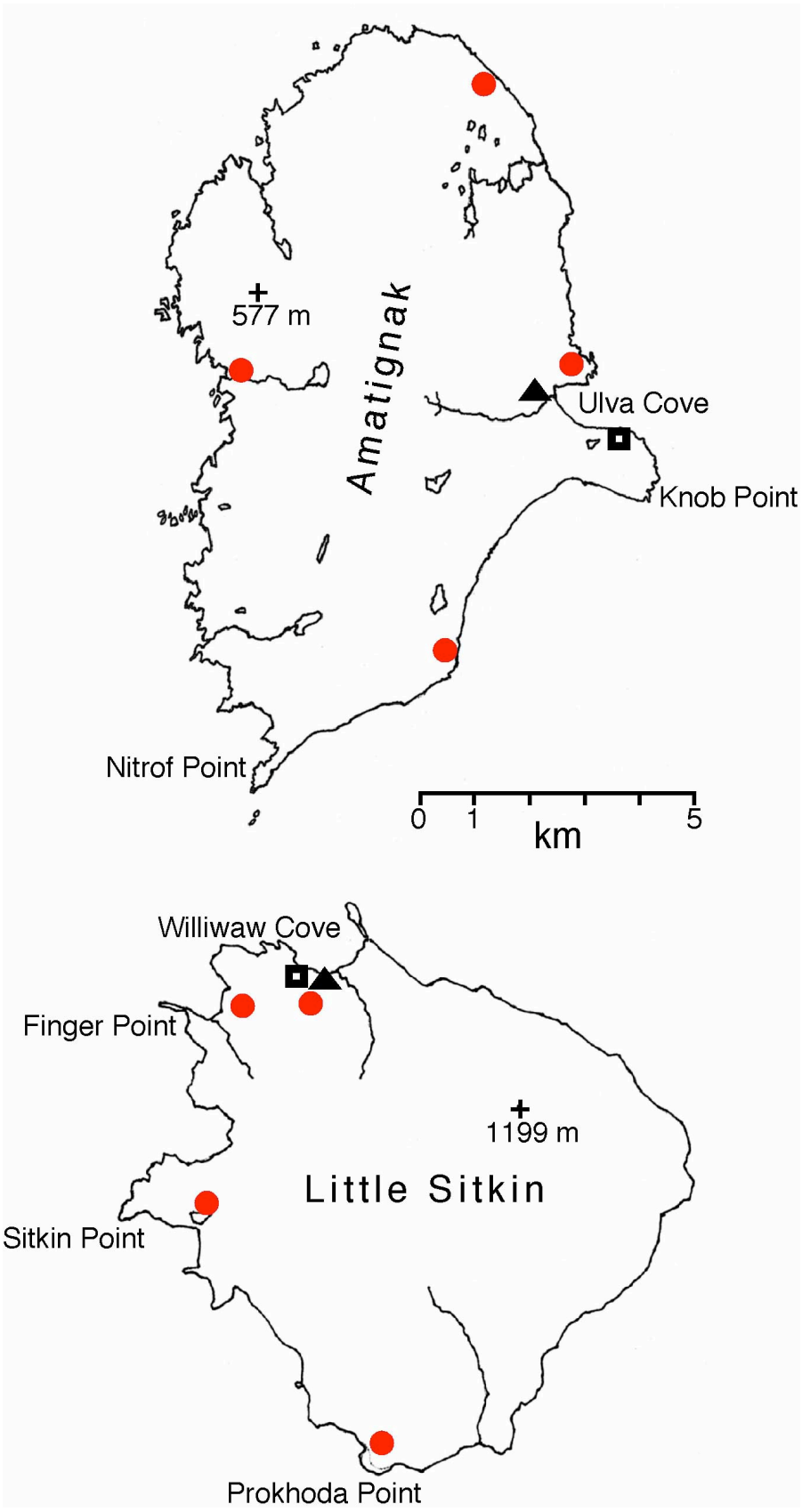
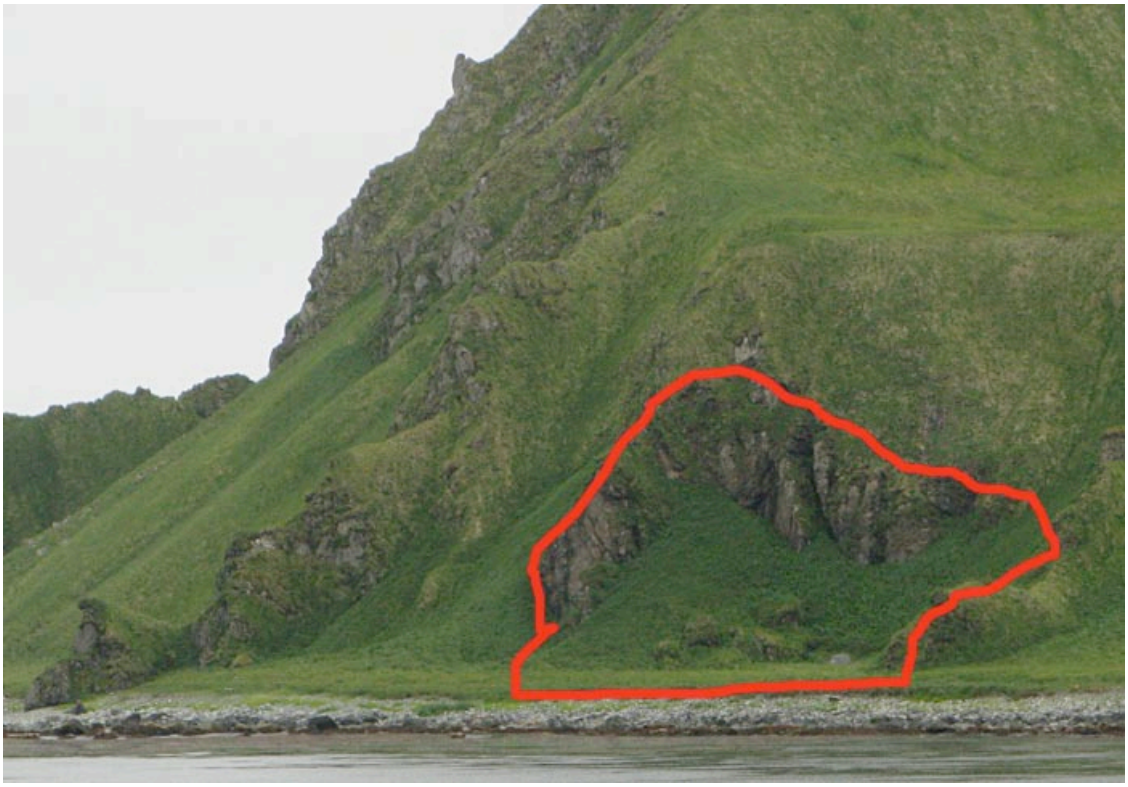
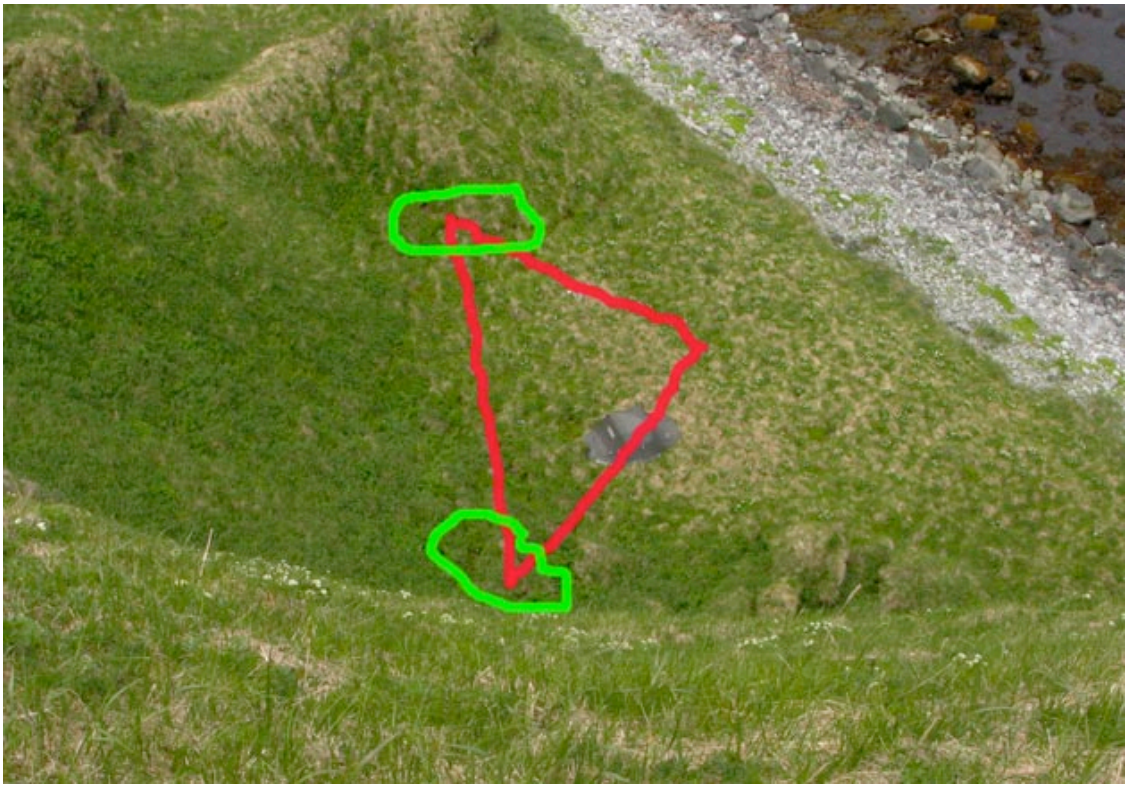

577 m
Amatignak
Ulva Cove
Knob Point
Nitrof Point
0 1 5
km
Williwaw Cove
Finger Point
1199 m
Little Sitkin
Sitkin Point
Prokhoda Point

Fig 1



a



b

Fig 2

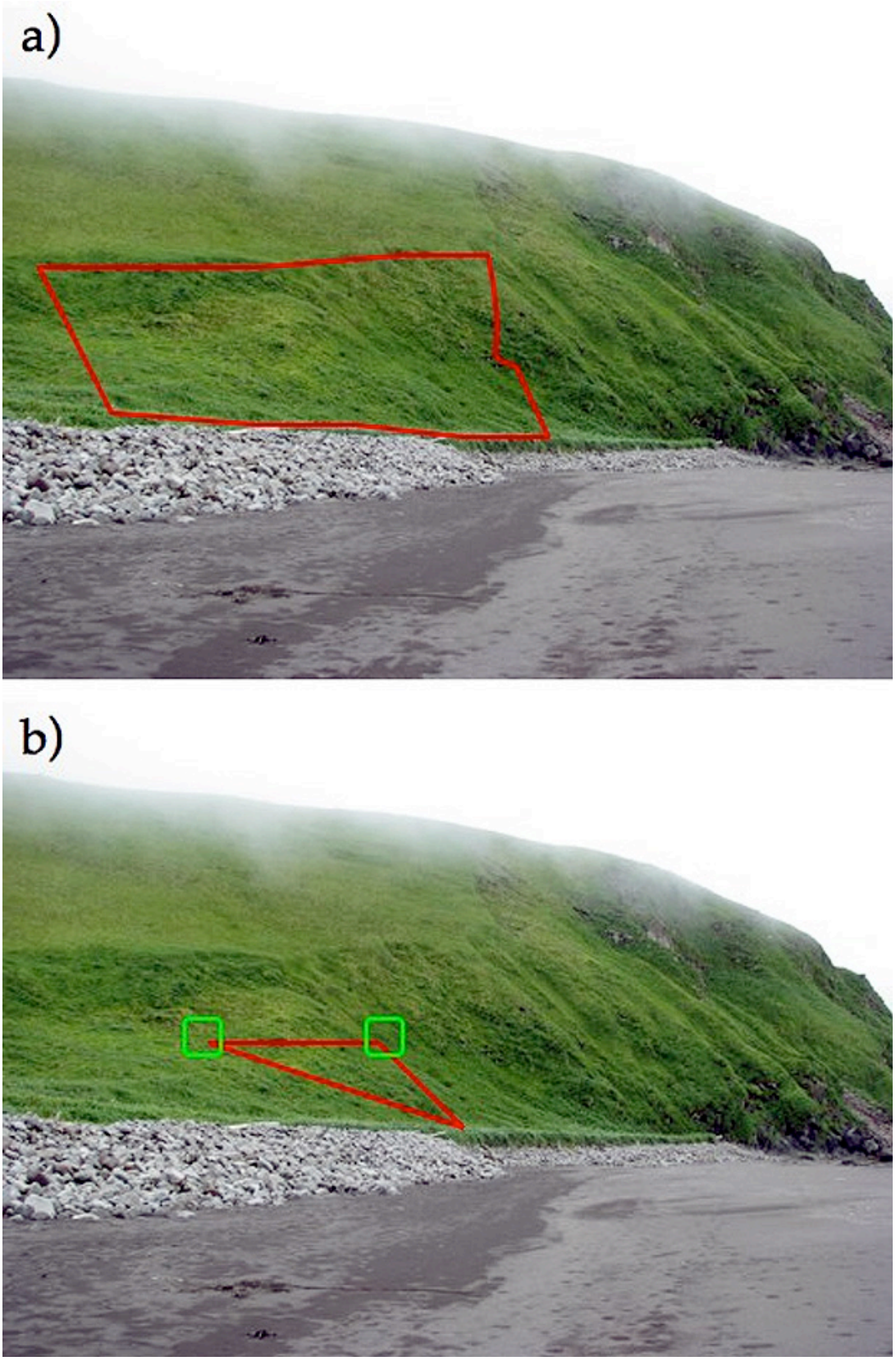


Fig 3

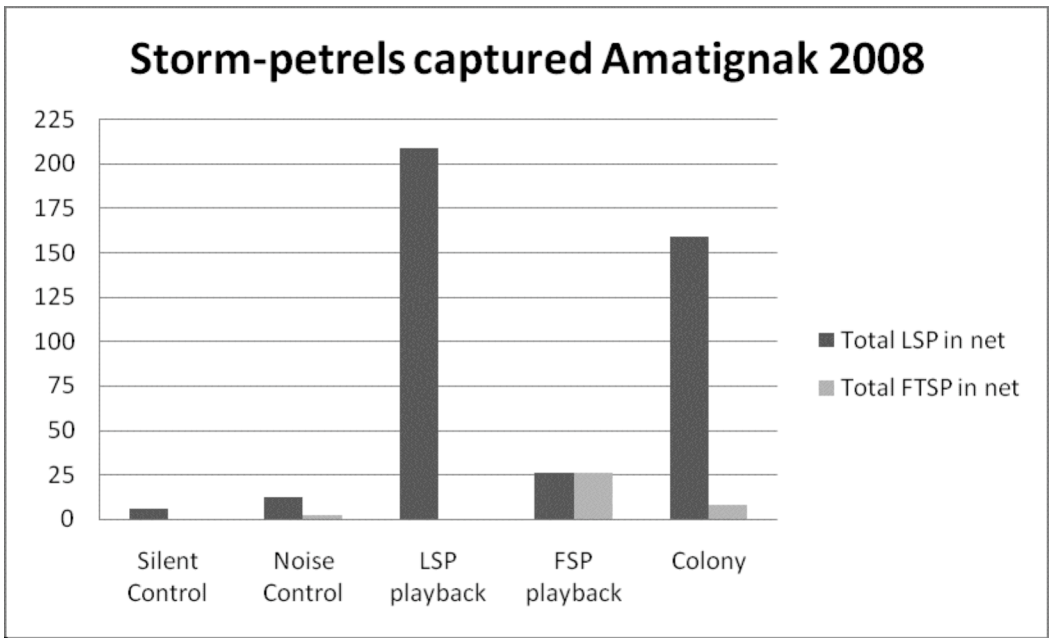

Storm-petrels captured Amatignak 2008
225
200
175
150
125
100
75
50
25
0
Silent Control
Noise Control
LSP playback
FSP playback
Colony
Total LSP in net
Total FTSP in net

Fig 4

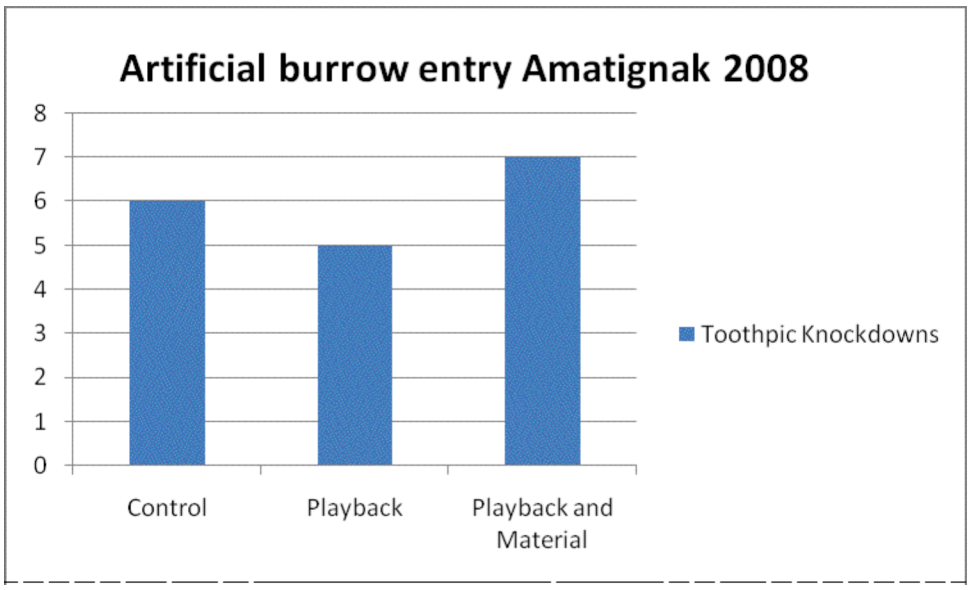

Artificial burrow entry Amatignak 2008
8
7
6
5
4
3
2
1
0
Control
Playback
Playback and Material
Toothpic Knockdowns

Fig 5

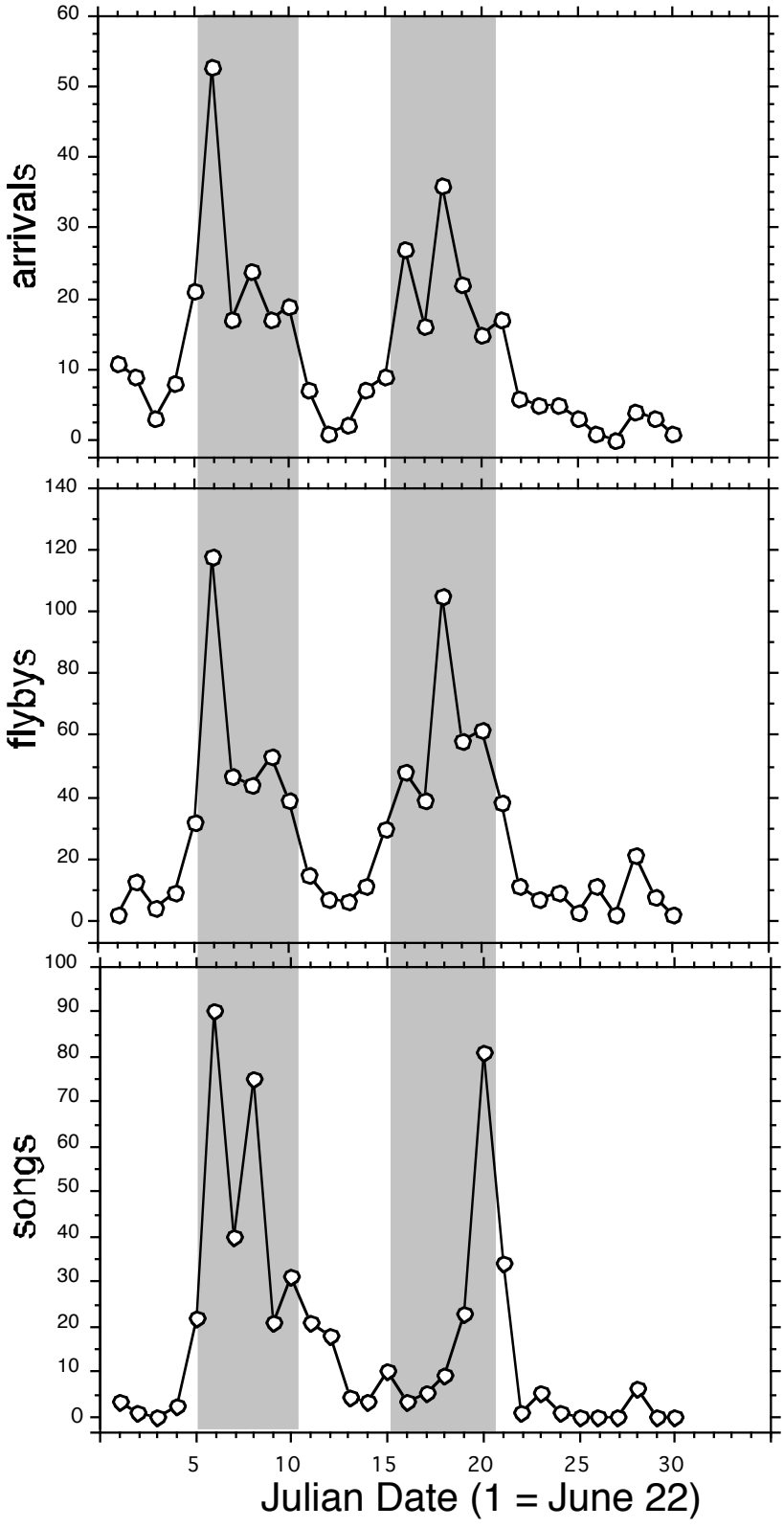


Fig 6

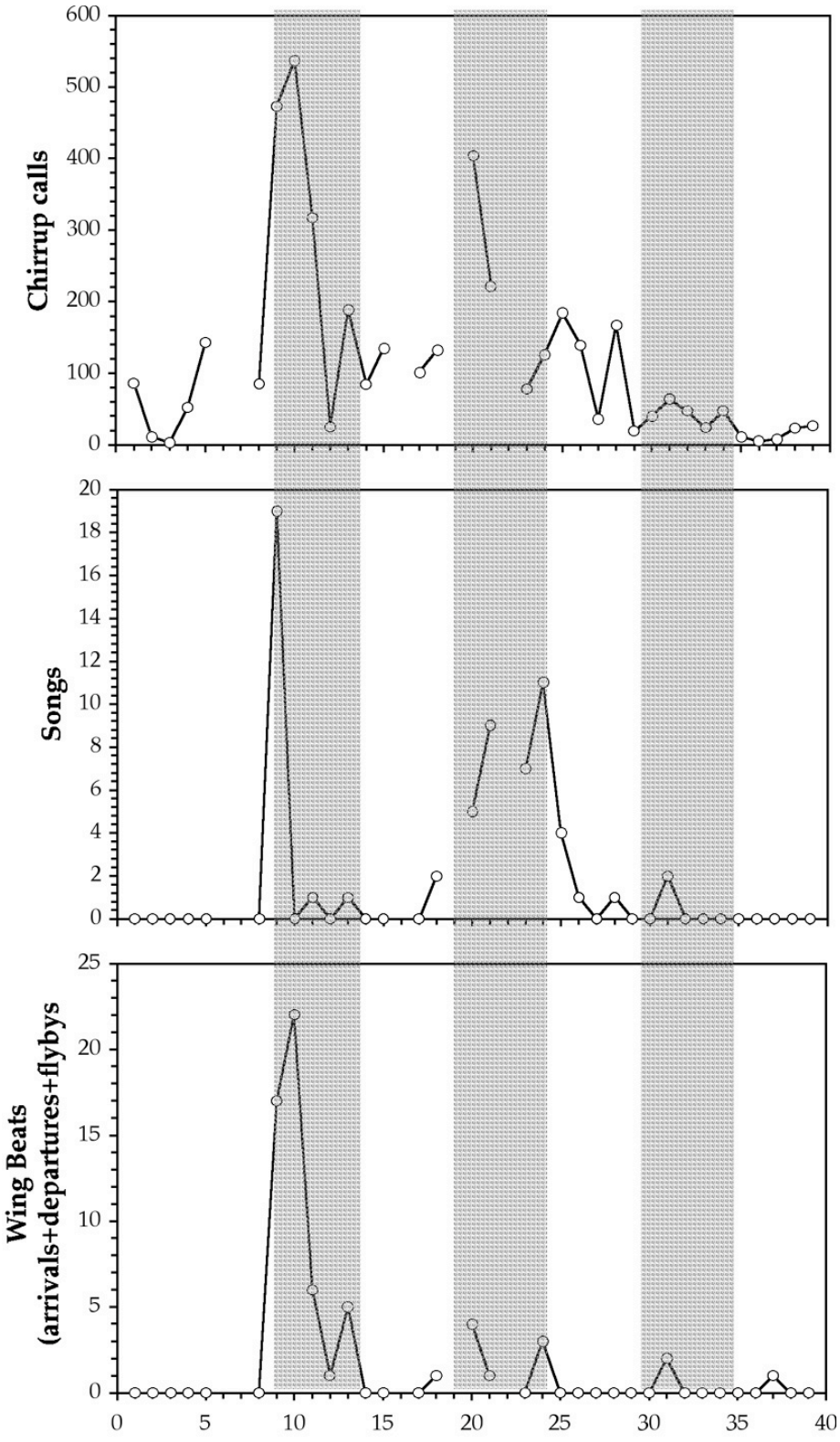

Chirrup calls
Songs
Wing Beats
(arrivals+departures+flybys
Julian Day (1= June 22)

Fig 7

Appendix 1 Annotated list of birds seen at Amatignak, June 10 – August 7, 2008

Red-throated Loon *Gavia stellata* One – to - two birds were regularly seen and heard calling in Ulva Cove through June and July. No evidence of nesting.

Fork-tailed Storm Petrel *Oceanodroma furcata* On some nights, birds were heard giving flight calls over the south-eastern and north-eastern sides of the valley near camp. Although no definitive evidence of nesting was obtained, the presence of birds burrow calling suggests that this species may breed in small numbers on Amatignak. A species likely to be recovering after the removal of foxes in 1991.

Leach's Storm Petrel *Oceanodroma leucorhoa* Birds were regularly heard calling (1000s of calls on some nights) while flying over land over study sites, camp, and the valley around camp. Although no definitive evidence of nesting was obtained, the presence of birds burrow calling suggests that this species may breed in small numbers on Amatignak. Based on the relative frequency of flight calls heard, this species may be about 10x more abundant than Fork-tailed Storm-petrel. A species likely to be recovering after the removal of foxes in 1991.

Pelagic Cormorant *Phalacrocorax pelagicus* Common, presumably breeds locally.

Red-faced Cormorant *Phalacrocorax urile* Common, presumably breeds locally.

Aleutian Cackling Goose *Branta hutchinsii leucoparia* Flocks flying by regularly in June, with a many droppings found in June during Songmeter deployment hikes, especially to the west side of the island. No birds were seen on the ground, but flocks regularly passed over Ulva Cove by day and night. Flocks were still present in mid-July.

Harlequin Duck *Histronicus histronicus* Uncommon near shore along the coast, usually in flocks of less than ten birds.

Greater Scaup *Aythia marila* Very rare, a total of ten female birds were observed on two lakes in a northern valley on July 16th. No evidence of breeding.

Common Eider *Somateria mollisima* Four birds (two males and two females) were observed close to shore in Ulva Cove, as if nesting, in mid June. Breeding was confirmed in mid-July when a female was observed in the cove with 6 ducklings.

Red-breasted Merganser *Mergus serrator* Very rare - four female birds were observed along with the Greater Scaup in the two lakes to the north of the island on July 16th. Two birds were in one lake and two in the other lake farther north. No evidence of breeding.

Black Oystercatcher ***Hematopus bachmanii*** Common breeder along all beaches and rocky shorelines that we visited. One nest near our Ulva Cove camp had its third egg laid about June 13, and hatching occurred during July 7-9. This breeding attempt failed, likely due to gull predation.

Rock Sandpiper ***Calidris ptilocnemis*** Rare breeder in meadows and vegetated alpine areas. Perhaps 50 pairs breed on the island.

Glaucous-winged Gull ***Larus glaucescens*** Common breeder along the coastline (beaches) and at inland lakes. ILJ estimates 500-1000 pairs at least breed on Amatignak – the dispersed distribution of nests making a count impossible. Presumably this species has recolonized Amatignak following the removal of foxes. Among 60 pellets examined, all had sea urchin present, 1 had limpet shells, 1 had fish remains, and none had bird remains. This suggests that gulls have not begun to exploit nocturnal seabirds at Amatignak (cf. Buldir).

Pigeon Guillemot ***Cepphus columba*** Rare near rocky headlands on the east side of the island. No evidence of breeding was observed, but it seems likely that a few pairs do breed on the island.

Ancient Murrelet *Synthliboramphus antiquus* Uncommon to rare breeder. Eleven family group departures were heard during nightly observations at ILJ's study plot in Ulva Cove. However, hundreds of birds likely came ashore in this area on some nights, indicating intense prospecting activity. This is a species likely to begin recovering from the removal of foxes.

Cassin's Auklet ***Ptychoramphus aleuticus*** Rare breeder. Small numbers of this bird were heard flight calling occasionally at night (especially in June). This species was detected on 9 of 30 nights of listening at ILJ's Ulva Cove study plot. A freshly hatched eggshell was found by RB under suitable cliff breeding habitat on June X. This is a species likely to begin recovering from the removal of foxes, although we found little evidence of a rapid return on Amatignak.

Parakeet Auklet *Cyclorhynchus psittacula* Probably an offshore visitor only. Not recorded on land. Might breed on cliffs on the rugged western coast of Amatignak, but we were not able to explore this area.

Crested Auklet *Aethia cristatella* Offshore visitor only. No suitable breeding habitat is present on Amatignak.

Least Auklet *Aethia pusilla* Offshore visitor only. No suitable breeding habitat is present on Amatignak.

Horned Puffin ***Fratercula corniculata*** Uncommon to rare along grassy seacliff-faces. A dozen birds were occasionally seen circling around cliffs near Ulva Cove. A species likely to be recovering from the removal of foxes.

Tufted Puffin ***Fratercula cirrhata*** Uncommon to rare along grassy seacliff-faces. A dozen birds were occasionally seen circling around cliffs and vegetated offshore stacks. Many birds were seen flying towards steep cliffs on the western side of the island. A species likely to be recovering from the removal of foxes.

Bald Eagle ***Haliaeetus leucocephalus*** Uncommon at Amatignak. We never saw more than two adults at a time. Two nests were observed - one with two large chicks in it on a sea stack just north of Ulva Cove, the second on the east coast about 1.5 km north of Knob Point.

Peregrine Falcon ***Falco peregrinus*** Uncommon breeder. Territorial pairs were observed at two locations.

Northern Raven *Corvus corax* Three birds (probably two adults and a fledgling) frequented the Ulva Cove area on a daily basis.

(Rock Ptarmigan *Lagopus mutus* Absent. No evidence of this species was detected anywhere on Amatignak Island in 2008.)

Winter Wren ***Troglodytes troglodytes*** Common along shoreline, in dense vegetation everywhere.

Lapland Longspur ***Calcarius lapponicus*** Common to abundant in meadows.

Snow Bunting ***Plectrophenax nivalis*** Uncommon in stony habitat on inland ridges and mountainsides, mostly above 300 m asl.

Aleutian Song Sparrow ***Melanospiza melodia*** Abundant in well-vegetated areas along shorelines, in well-vegetated areas up to 200 m asl.

Gray-crowned Rosy Finch ***Leucosticte arctoa*** Uncommon nearly everywhere on island.

Appendix 2 Annotated list of birds seen at Little Sitkin Island, June 9 – August 4, 2008

Red-throated Loon *Gavia stellata* One – to - two birds were regularly seen in Williwaw Cove. No evidence of nesting.

Fork-tailed Storm Petrel *Oceanodroma furcata*. Birds were regularly heard calling at western end of Williwaw cove where they are presumably nesting, although no definitive evidence of breeding was found. Occasionally birds were also heard calling and seen flying over our camp. A species likely to be recovering after the removal of foxes.

Leach's Storm Petrel *Oceanodroma leucorhoa* Birds were regularly heard calling while flying over land over our study sites and camp throughout the season. Presumably breeding on Little Sitkin but no definitive evidence was found. Based on the relative frequency of flight calls heard, this species is considerably less abundant than Fork-tailed Storm-petrel. A species likely to be recovering after the removal of foxes in the year 2000.

Cormorant spp. *Phalacrocorax pelagicus/urile* Common, presumably breeds locally along cliffs of NW Head.

Aleutian Cackling Goose *Branta hutchinsii leucoparia* Large flocks (>30 individuals) flying by regularly in June, with a many droppings found in June during hikes. Six birds were seen on the ground, presumably foraging on an inland plateau on the SW side of the island. Flocks were still present in mid-July. No evidence of breeding.

Green-winged Teal *Anas crecca* Commonly seen on small lake behind dunes and in stream beside camp in Williwaw Cove. Found female with five ducklings in small lake on June 15th and another four ducklings in stream in late June.

Harlequin Duck *Histronicus histronicus* One –to- two birds seen occasionally on water at Patterson Point.

Common Eider *Somateria mollisima* Four birds were observed flying close to shore at Patterson Point on June 30th. One –to –two birds occasionally seen flying over water in Williwaw Cove in June and July. No evidence of breeding.

Red-breasted Merganser *Mergus serrator* One –to –two birds were occasionally seen in water off Williwaw Cove during June and July. No evidence of breeding.

Sandhill Crane *Grus canadensis* Uncommon. Two individuals seen foraging on grassy slope near Sitkin Point on June 20th. Two were again seen on June 27th near ENE Point.

Black Oystercatcher *Hematopus bachmanii* Common breeder along all beaches and rocky shorelines that we visited. One nest near Patterson Point camp had two eggs in early June neither of which hatched. Between 7-10 individuals were regularly seen on beach in Williwaw Cove throughout June and July.

Rock Sandpiper *Calidris ptilocnemis* Abundant breeder in meadows and vegetated alpine areas. Two nests were found on June 15th with 3 and 4 eggs and one family group with at least one chick. Family groups including at least two chicks were encountered virtually every time we hiked over plateaus and alpine areas.

Parasitic Jaeger *Stercorarius parasiticus* Two individuals were observed on July 18th harassing an eagle near Sitkin Point. No evidence of breeding.

Glaucous-winged Gull *Larus glaucescens* Common along beaches and along cliffs at NW Head, but no evidence of breeding was observed. In excess of 25 adults were seen on beach at Williwaw Cove throughout June and July with numbers fluctuating drastically (ranging from ten to close to 100). Adults were also abundant along Finger Point and NW Head. Pellets found on beach were almost entirely composed of urchins, although some limpets were observed.

Common Murre *Uria aalge* One-to-two individuals seen occasionally on water in Williwaw Cove in mid-late July.

Pigeon Guillemot *Cepphus columba* Less than five birds were regularly seen in the water near Patterson Point. No evidence of breeding was observed.

Ancient Murrelet *Synthliboramphus antiquus* Uncommon to rare breeder. Two family group departures were heard during nightly observations at our study plot in western Williwaw Cove. The occurrence of breeding only 8 years after the removal of foxes is noteable. Moreever, hundreds of birds likely came ashore in this area on some nights, indicating intense prospecting activity. This is a species likely to begin recovering from the removal of foxes.

Cassin's Auklet *Ptychoramphus aleuticus* Rarely heard during nightly observations in same vicinity as Fork-tailed Storm Petrels. No evidence of breeding was observed.

Horned Puffin *Fratercula corniculata* Common breeder (presumably) in grassy cliffs along Patterson Point and NW Head, one individual seen departing grassy cliff at Sitkin Point on July 18th. A species likely to be recovering from the removal of foxes.

Tufted Puffin *Fratercula cirrhata* Common breeder (presumably) along grassy seacliff-faces at Patterson Point and NW Head. A species likely to be recovering from the removal of foxes.

Bald Eagle *Haliaeetus leucocephalus* Commonly seen in all locations visited at Little Sitkin.

Peregrine Falcon *Falco peregrinus* Commonly seen and heard around cliffs of NW Head and western Wiliwaw cove where it is presumably breeding.

Northern Raven *Corvus corax* Two birds commonly seen and heard near Finger Point and rarely encountered in Williwaw Cove (July 26th was the first time we

encountered one on the beach at Williwaw Cove). No evidence of breeding was observed.

Rock Ptarmigan ***Lagopus mutus*** Common breeder encountered regularly on plateaus and alpine areas. On July 16th we encountered a female with at least two chicks on plateau above NW Head. On July 18th on plateau near WNW Cove a defensive female was encountered and another female with at least 5 chicks was seen in valley between NW Head and western Williwaw Cove. One adult female and 5 fledglings were seen flying near Williwaw Cove on August 1st.

Winter Wren ***Troglodytes troglodytes*** Abundant along shoreline, in dense vegetation everywhere.

Lapland Longspur ***Calcarius lapponicus*** Abundant breeder. One nest with 5 small chicks was found on July 9th at SSE Point. Fledgling longspurs were abundant around camp beginning July 12th.

Snow Bunting ***Plectrophenax nivalis*** Common in stony habitat on inland ridges and mountainsides, mostly above 300 m asl. One nest with 3-4 eggs was found on June 27th and we began seeing juvenile birds along beaches in mid-July.

Aleutian Song Sparrow ***Melanospiza melodia*** Abundant in well-vegetated areas along shorelines, in well-vegetated areas up to 200 m asl. Fledgling Song Sparrows were extremely abundant along the beach of Williwaw Cove throughout mid-late July.

Gray-crowned Rosy Finch ***Leucosticte arctoa*** Regularly seen in vegetated areas, many large groups were seen in Williwaw Cove in late July and early August.