Voices of Glacier Bay

Building a Library of Sound

Final Report
Glacier Bay National Park
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The Voices of Glacier Bay project was a collaborative effort between the National Park Service at Glacier Bay, the Alaska Coastal Rainforest Center at the University of Alaska, Juneau, and the Macaulay Library of Natural Sounds at Cornell University in Ithaca, New York. Recordings were made by Richard Nelson and Hank Lentfer. After two years of recording and editing, the Voices of Glacier Bay project has produced a diverse library of natural sounds including ninety species of birds, twelve mammals, as well as buzzing bugs, bubbling bergs, and zipping zippers. In addition to species-focused recordings, dozens of soundscape level tracks were made throughout the Bay, from the clamor of the ice-front to the peace of the spruce forest. The whoosh of whale breath and chatter of a Pacific wren have already found their way into the programs of interpretive rangers. The value of the library, for both interpreters and researchers, will only grow with time.

METHODOLOGY

The Voices of Glacier Bay project had two main objectives. The first was focused on producing recordings that could be used to enhance the visitor experience. Prior to any field work, we met multiple times with staff from the Park's Interpretive Division. We left these meetings with a detailed "wish list" of sounds and a growing number of ideas of how these sounds might later be used in slide presentations, on the Park's website, and displays set up both on cruise ships and the Bartlett Cove visitor center. With this objective in mind, we focused on capturing clean, 5-star recording of the iconic parks sounds (whale, dawn chorus, willow ptarmingan, wolf, ocean and forest soundscapes). We also gathered sounds of people experiencing the park (paddle strokes, footsteps on the beach, tent zipper).

The second objective focused on the long-term value of the library for the growing field of acoustic ecology. With this in mind, we captured soundscapes from the various habitats found along the length of the bay from the peri-glacial environment in the upper arms to the young spruce forest near the Bay's mouth. Analogous to establishing photo points, these recordings now serve as a baseline for monitoring acoustic change over time.

While a single, 5-star recording of a hermit thrush might meet the needs of the interpretive staff, we captured the song of dozens of hermit thrush (and many other species) throughout the park. These multiple, single-species tracks may prove useful to the scientists researching either temporal or spatial variation in bird song. While care was always taken to create the cleanest recordings possible, we recorded in acoustically messy locations (alongside streams for example) in order to create a library of sounds from a variety of places within the Park.

Equipment:

The majority of recordings were made with a 21.5 inch Telinga parabolic dish housing a Sennheiser MKH 20 omni-directional microphone (see photo). Stereo recordings were made with M/S pair of microphones (Sennheiser MKH 20/30) housed in a Sennheiser MZW20-1 zeppelin. A Sound Devices pre-amp was occasional deployed with the M/S pair.

Hank Lentfer recording with parabolic dish.

All recordings were made with a Marantz PMD II 661 digital recorder. Both recordists carried identical parabolics and recorders. A single M/S set up was shared between the two recordists (see photo). Equipment specifics were documented for each recorded track.

All recordings, whether mono or stereo, were captured at PCM-24 (check Macaulay guidelines for better description of file resolution) and a sample rate of 48k. All recordings were saved as .wav files.

M/S pair of stereo mics with the zeppelin wind screen.

Metadata:

The following information was collected for each individual recording. Metadata was spoken and captured on the back end of each recording. Later, back in the studio, the metadata was transcribed from the audio format and typed into an Excel Spreadsheet.

FileName: A unique name for each audio file was created using the following convention:

L060213_006.wav where the beginning letter is the first letter of the recordist's last name following by the date the track was made, followed by the track number and file type. In the above example the recording was made by Hank **L**entfer on June 06, 2013. It was the sixth recording of the day.

RecordType: This identifies whether the track is of a bird, marine fauna, terrestrial fauna, anthropogenic, or glacier.

Species: This identifies the primary species in a recording. When doing landscape level recordings, the species entry reads "Soundscape". The common names for birds follows the naming convention of the American Ornithologists Union (AOU).

BGS: Up to four background species were identified following the AOU convention.

PlaceNames: Standardized place names were assigned to each track down to the "cove" or "bay" level. For example, Adams Inlet or Beartrack Cove. (see appendix I for list of places names)

Habitat: The forty-six habitats described in the Land Classes and Plant Associations of Glacier Bay National Park and Preserve (Natural Resources Technical Reports NPS/GLBA/NRTR-2008/093) were consolidated into twenty-two habitat types. (See appendix II).

Distance: Distance to focal species was recorded using the following increments: 0-10m, 10-100m, 100-500m, 500m+, unknown. Often, when an animal was heard but not seen, it was difficult or impossible to estimate distance. In these cases the distance is left blank.

Comments: Additional natural history observations

Song: Only relevant for bird recordings.

Call: Only relevant for bird recordings. Indicates alarm calls and other non-song vocalizations.

Lat/Long: Recorded in decimal degrees in WGS84.

Date: Recorded in MM/DD/YYYY format

Time: Recorded at time audio ends. 24 hour format.

Temp: Recorded in Fahrenheit using inexpensive zipper pull thermometers.

WindSpeed: Estimated in MPH in the following increments: calm, light, 5-15, 15+.

SkyCover: Clear 0%, Mostly Clear 5-25%, Partly Cloudly 25-50%, Mostly Cloudy 50 - > 100%, Overcast – 100%

Precipitation: none, drizzle, rain, snow, hail.

Photo: A photo depicting habitat type is associated with each terrestrial-based recording. We did not take habitat photos for marine based recordings (humpback whales or marbled murrelet). Naming convention of the photos mirrors the audio file name. For example, audio track L060213_001.wav will be associated with photo L060213_001.jpeg.

Rating: A five star rating will be used. Five star tracks will have great resonance, no distracting back-ground noise, and a powerful, evocative feel. A one star track will have the focal species at a distant with many competing noises. A one star track will only be kept if the species in question is unique and rare. A three star track will be adequately clear with some competing sounds.

Equipment: The microphone, recorder, parabolic, pre-amp, and filters used for each recording will be documented.

Recordist: Initials for each recordists will be documented: RN for Richard Nelson and HL for Hank Lentfer.

Field Technique:

Greg Budney, curator of sound at the Macaulay Library of Natural Sounds, came to Glacier Bay and gave Richard and Hank a customized course in field recording. Greg provided insightful tips about reducing handling noise, finding natural amphitheaters, and other insights into creating great recordings.

Richard Nelson with recording gear strapped to the deck of a kayak.

Trips into the bay were made with a 23' motorized skiff with camping gear and two kayaks on board. A typical recording day began between 3 and 4 am. Not only is this an active for birds and other animals, it also tends to be a calmer time of day and boat and plane traffic is less. Given the early start times, we pitched our camp each night in the place we wanted to record in the morning.

Although we had an interest in gathering multiple recordings of the same species, we took care to not get multiple recordings of the same individual. When starting a recording session from the same place, each recordist would head in a different direction to make sure to not capture the same individual.

On glass-calm days we were able to record from either the skiff or the kayak. However, even one to two inch waves slapping the hull would make clean recordings impossible. As a result,

the majority of recordings were made while on foot. Although some hikes were made along glacial margins and up hillsides in the upper bay, the vast majority of recordings were made along or near the shoreline.

In both 2013 and 2014, during the spring breeding season (May and June) we focused our efforts on song birds. The itinerary of each trip was set based on what species we had yet to record and where we were most likely to find them. Once the bird song began to taper in late June-early July, we expanded our focus to things like glaciers, fish and terrestrial mammals.

Hank Lentfer recorded birds on an outwash plain.

Studio Time:

Data entry was done back at the studio by listening to each track and transcribing the metadata from audio format to the Excel Spreadsheet. Audio data remains embedded in the original recordings. Excessive handling noise was deleted from some tracks but otherwise the field recordings were preserved in their unaltered, unfiltered form.

In addition to cataloguing the raw files, we selected portions of the best and most unusually recordings to create a series of “selected clips”. Similar to cropping and adjusting the color balance on a photograph, we picked the cleanest portion of a recording and filtered or cut out background noise. All editing was done using Adobe Audition. The selected clips are organized by species or recording type (physical sounds, anthropogenic sounds, soundscapes). The selected clips were named to reflect the target sound; however, the name of the parent track was retained within the name of the selected clip. For example, the track N061013_001 is a 10 minute recording of humpback whales. From within that long recording we selected 45 seconds of good marbled murrelet vocalization. The selected clip was renamed: Marbled murrelet Glacier Bay N061013_001.

RESULTS

We made the most of the unusually dry, calm weather throughout the summer of 2013 and recorded a total of 57 days. In contrast to the ideal conditions in 2013, the summer of 2014 set records for the amount of rain. Subsequently, we recorded only 33 days in 2014.

Combining recordings from both seasons and both recordists results in 634 individual tracks representing 90 bird species and 14 mammals. See appendix III for a complete list of recorded species. In addition to the raw tracks we cleaned and edited 184 selected clips.

Digital copies of all sounds (along with the database) was delivered to Chris Gabriele at Glacier Bay National Park, Greg Budney at Cornell University, and Allison xx and Alaska Coastal Rainforest Center, University of Alaska (see appendix V for a complete list of sounds sent to Cornell University).

In addition to the recordings, we gave five public presentations, participated in trainings of Park interpretive staff in the spring of 2013 and 2014, and created a series of audio post on the website of Orion magazine. Two presentations were done in Gustavus. The first was given by Greg Budney from Cornell University at the beginning of the project in May of 2013. The second Gustavus presentation was done by Richard and Hank after the first field season. We did two presentation (winter 2013 and again winter 2014) in Sitka as part of the University's Natural History Lecture Series. In September of 2014 we did a presentation as part of the Evening at Egan Lecture series sponsored by the UAS in Juneau. This presentation was filmed and televised.

While each presentation had a slightly different focus the overall emphasis was on the transformative power of deep listening and the importance of Alaska's parklands in the preservation of soundscapes.

CHALLENGES, REFLECTIONS, AND NEXT STEPS

The sunny, warm spring of 2013 came on the heels of a winter with an unusually deep alpine snow pack. As a result, streams, waterfalls and rivers throughout the park were gushing with melt water. In concept, the murmuring of a stream seems like the ideal background noise for a recording of a thrush or warbler. In reality, the babble of a nearby creek combines with the roar of a distant waterfall to burden a recording with distracting white noise. For example, in mid-June we spent a day recording in Wachusett Inlet. At every point along the steep-walled fjord the soundscape was dominated by the sound of running water. As a result, are best recordings came from regions of the Bay with flatter terrain like Skidmore Inlet and the Klotz Hills. Fortunately for a Bartlett Cove/Gustavus based project, the quietest region of the entire park is the Gustavus Forelands.

In addition to running water, combusting carbon is the background noise most troubling to any sound recordist. The early hours, from 3 am to 7 am, remain largely free of motorized noise. About the time most campers are crawling from the tent and boiling the coffee water, boat

captains are pulling anchor and warming their engines. Ironically, the loudest boat in the Park in both the summer of 2013 and 2014 was the Baranof Wind. One June morning, we were recording on North Marble Island. The day was clear and calm and we'd had been working for 2-3 hours when the Baranof Wind rounded Lester Point. The throb of her engine traveled up bay well in advance of the ship and we had to put the microphones away and quit working. We ate breakfast and listened to the boat cruise past South Marble and then head for the camper drop-off at Mount Wright. Not until the ship tucked into Tidal Inlet did the Bay become quiet enough to record again. But the silence was short lived and we shut the recorders off while the day-boat poked along beneath the cliffs of Gloomy Knob. We share these details to illustrate how a single vessel affects the soundscape of the entire Bay. From North Marble we had to stop recording from 7:30 to nearly 11:00. Given that this boat is run by the concessionaire, there is also an opportunity for the National Park Service to Glacier Bay is improve the soundscape by requiring or encouraging a quieter vessel.

The second loudest (above water) boat in the Park is the Serac. Interestingly, this boat is louder at idling speeds than at cruising speeds. It seems this boat often leaves the dock well in advance of a transfer and idles her way to the rendezvous point. This results is more noise being pumped into the lower bay for a longer period of time than making quicker trips.
Glacier Bay is also under the flight path of Juneau-Anchorage jet traffic. Flight seeing trips on sunny days often flood the upper bay with high decibel noise. These flights, combined with private boats the cruise-ship traffic, make recording during the day extremely challenging. Without the predictable quiet of the early morning and late evenings, we would have captured only a fracture of the clean recordings that we did.

Two people, with two microphones in a handful of days can only hear and record so much. With more days to record, we would venture farther from the shoreline, gathering sounds from forested slopes and alpine summits. We'd venture across ice fields and records the avanlaches rumbling down high mountain slopes. We'd bundle up and listen to the sounds of the upper in the still cold days of mid-winter. But, despite all there is left to record, the Voices of Glacier Bay project has created a library of sounds unlike any other National Park in the country. This cutting edge library should be highlighted as a means to encourage other parks to undertake similar projects. A five minute video describing the project and show casing a few of the most captivating sounds would be an effective way to build excitement about the project within other park units.

Despite the whine and thrum of combusting carbon, Glacier Bay remains an acoustically rich and relatively quiet place. After a life of breathing city smog, it takes a lungful of crisp clean air to remind our bodies of an alternative way of being. Likewise, in the din of a cityscape in takes the subtle and diverse voices in a place like Glacier Bay to cleanse our sense of hearing. Unfortunately, the majority of Park visitors are rendered deaf by the rumble of the ship beneath their feet. While there is no real substitute for falling asleep with the sounds of the place pouring through the thin tent walls, the library of sounds tucked into the hard drives at Park Headquarters holds the potential of a rich acoustical experience for all Park visitors. It's all up to the imagination and creativity of the interpretive rangers.

Already park rangers are integrating sounds into their public presentations. It could be that, in a few years, it will be the rare program not embellished with the howl of a wolf and whooshing breath of a whale. But the presentations are just the beginning. Imagine the ships P.A. system playing a shifting soundscape reflective of the land within sight but beyond hearing of the ship. Imagine acoustical umbrellas suspended above each table in the lodge dining hall and a menu of sounds tucked alongside the beer and wine menu. Imagine the imaginable. Then make it so. Give the gift of sound.

A clear highlight in two years of recording was the morning a wolf laid down in the rye-grass just beyond the bow of the kayak, lifted her snout to the sky and cut loose with a long mournful series of notes. That voice, rich in longing, filled with content purpose, inseparable from the land from which it arises, once, not that long ago, rang throughout the northern hemisphere of this planet. Howls rang in China, across Siberia, and echoed throughout central Europe. Packs sang across North America from Nova Scotia to Nome and down into Central America. And, like lights being snuffed, the song of the wolf has winked out around the globe. The beauty of that voice, so vibrant and vital here in Glacier Bay, is made all the more precious by the thousands of valleys, shores, and hillsides around the world diminished by its absence.

It has been an honor, a privilege, and a deep amount of joy-filled fun to have spent the last two years listening so keenly to the voices of Glacier Bay, to work in a place where mornings can and do unexpectedly fill with wolf song. The full complement of voices that filled the minds and imaginations of the Tlingit people living in Glacier Bay prior to the last ice advance are still buzzing and singing and bellowing today. Although the bird and bears now live beneath the high whine of cruising jets and alongside the daily throb of passing boats, the ancestral soundscape still dominates the alder-shrouded hillsides and ice-choked inlets of the park. Waking at 3 am, day after day, it became increasingly clear there is no such thing as solitude anywhere in the Park. At every camp, in whatever cove, we awoke to share morning with dozen of birds, a barking seal, a whistling murrelet, lapping waves, bristling breezes. There are thousands tumbling on up into the millions of neighbors where ever you care to pitch your tent in this Park. All we have to do is open our ears to enjoy the splendid sounds of their company.

Appendix I

Place Names
Voices of Glacier Bay

Adams Inlet	Glacier Bay	Sealers Island
Ancon Rock	Goose Cove	Sebree Cove
Bartlett Cove	Grand Pacific Glacier	Sebree Island
Bartlett Lake	Grand Plateau Glacier	Secret Bay
Bartlett River	Hugh Miller Inlet	Shag Cove
Beardslee Entrance	Hunter Cove	Sita Reef
Beardslee Islands	Hutchins Bay	Sitakaday Narrows
Beartrack Cove	Jaw Point	South Marble Island
Beartrack River	Johns Hopkins Inlet	South Sandy Cove
Berg Bay	Johnson Cove	Spider Island
Berg Lake	Lagoon Island	Spokane Cove
Blue Mouse Cove	Leland Islands	Strawberry Island
Boulder Island	Lester Island	Tarr Inlet
Caroline Point	Link Island	Tidal Inlet
Caroline Shoal	Marble Mountain	Tlingit Peak
Casement Glacier	Margerie Glacier	Tyndall Cove
Composite Island	McBride Glacier	Park Service Headquarters
Crillon Inlet	McBride Inlet	Van Horn Ridge
Drake Island	McConnell Ridge	Vankahini River
Dundas Bay	Muir Glacier	Venisa Point
Dundas River	Muir Inlet	Vivid Lake
Eider Island	Muir Point	Wachusett Inlet
Excursion River	North Marble Island	Westdahl Point
Fairweather Glacier	North Sandy Cove	Whidbey Passage
Fairweather Range	Nunatak Cove	White Thunder Ridge
Fall Creek	Point Carolus	Willoughby Island
Fingers Bay	Point Gustavus	Wolf Creek
Flapjack Island	Portage Creek	Wolf Point
Fourmile Creek	Ptarmigan Creek	York Creek
Francis Island	Puffin Island	Young Island
Gable Mountain	Queen Inlet	
Garforth Island	Reid Glacier	
Gateway Knob	Reid Inlet	
Geikie Glacier	Rendu Inlet	
Geikie Inlet	Riggs Glacier	
Geikie Rock	Ripple Cove	
George Point	Rush Point	
Gilbert Inlet	Russell Island	
Gilbert Peninsula	Sandy Cove	

Gilman Glacier	Sawmill Bay	
Girdled Glacier	Scidmore Bay	

Appendix II

Consolidation of Habitat Types

On right are the habitat types defined within Land Classes and Plant Associations of Glacier Bay National Park and Preserve (Natural Resources Technical Reports NPS/GLBA/NRTR-2008/093). On left are the categories used in the Voices of Glacier Bay Project.

Closed Sitka Spruce Forest Closed Hemlock Forest Closed Sitka Spruce - Hemlock Forest	**Closed Coniferous**
Open Sitka Spruce Forest Open Hemlock Forest Open Hemlock - Sitka Spruce Forest Sitka Spruce Woodland	**Open Coniferous**
Open Sitka Spruce - Black Cottonwood Forest Sitka Spruce - Black Cottonwood Woodland Open Black Cottonwood Forest	**Open Cottonwood**
Closed Black Cottonwood Forest Closed Sitka Spruce - Black Cottonwood Forest Black Cottonwood Woodland	**Closed Cottonwood**
Closed Tall Alder Shrub Closed Tall Willow Shrub Closed Tall Alder - Willow Shrub Closed Low Shrub	**Closed Shrub**
Open Low Willow Shrub Open Low Willow Shrub - Mesic Herbaceous Mosaic Open Low Shrub Open Tall Alder - Willow Shrub Open Tall Willow Shrub	**Open Shrub**
Open Low Shrub Peatland Hemlock-Spruce Woodland Peatlan Shore-pine woodland Peatland	**Peatland**
Dryas Dwarf Shrub Ericaceous Dwarf Shrub Dwarf Shrub – Herbaceous	**Dwarf Shrub**
Elymus	**Rye Grass**
Mesic Herbaceous Mesic Herbaceous Coastal Wet Herbaceous	**Herbaceous**
Halophytic Herbaceous Wet Meadow	**Salt Marsh**
Aquatic Herbaceous Pond Lake	**Pond/Lake**
Rock - Bare Ground	**Bare**
Bryophyte	**Moss/Lichen**
Estuarine	**Estuary**
Riverine	**River**
Marine	**Marine**
Snow and Ice	**Snow/Ice**
Human Disturbance	**Human**
Intertidal	**Intertidal**
Sky	**Sky**
Hemlock Dwarf Tree Scrub	**Subalp forest**

Appendix III

Recorded Bird Species
Voices of Glacier Bay

GEESE, SWANS, AND DUCKS	Black Oystercatcher	Steller's Jay
Greater White-fronted Goose	Spotted Sandpiper	Black-billed Magpie
Emperor Goose	Greater Yellowlegs	Northwestern Crow
Brant	Whimbrel	Common Raven
Canada Goose	Western Sandpiper	**SWALLOWS**
Trumpeter Swan	Dunlin	Tree Swallow
American Wigeon	Wilson's Snipe	Bank Swallow
Mallard	Red-necked Phalarope	Barn Swallow
Northern Pintail	**GULLS, TERNS**	**CHICKADEES, NUTHATCHES,CREEPERS**
Green-winged Teal	Black-legged Kittiwake	Chestnut-backed Chickadee
Harlequin Duck	Bonaparte's Gull	Red-breasted Nuthatch
Surf Scoter	Mew Gull	**WRENS, DIPPERS, KINGLETS**
White-winged Scoter	Glaucous-winged Gull	Pacific Wren
Long-tailed Duck	Caspian Tern	Golden-crowned Kinglet
Bufflehead	Arctic Tern	Ruby-crowned Kinglet
Barrow's Goldeneye	**JAEGERS**	**THRUSHES, MOCKINGBIRDS**
Common Merganser	Parasitic Jaeger	Gray-cheeked Thrush
GROUSE, PTARMIGAN	**ALCIDS**	Swainson's Thrush
Willow Ptarmigan	Pigeon Guillemot	Hermit Thrush
Sooty Grouse	Marbled Murrelet	American Robin
LOONS, GREBES	**Kittlitz's Murrelet**	Varied Thrush
Red-throated Loon	**PIGEONS, DOVES**	**STARLINGS WAGTAILS, PIPITS**
Common Loon	Eurasian Collared-Dove	American Pipit
Horned Grebe	**OWLS**	WAXWINGS
Red-necked Grebe	Northern Pygmy-Owl	**LONGSPURS, BUNTINGS, WARBLERS**
ALBATROSSES, SHEARWATERS, FULMARS, AND PETRELS	Barred Owl	Tennessee Warbler
CORMORANTS	Northern Saw-whet Owl	Orange-crowned Warbler
Pelagic Cormorant	**NIGHTHAWKS, SWIFTS**	Yellow Warbler
HERONS, BITTERNS	**HUMMINGBIRDS**	Yellow-rumped Warbler
Great Blue Heron	Rufous Hummingbird	Townsend's Warbler
HAWKS, EAGLES	**KINGFISHERS**	Wilson's Warbler
Bald Eagle	Belted Kingfisher	**SPARROWS**
Sharp-shinned Hawk	**WOODPECKERS**	Savannah Sparrow
Red-tailed Hawk	Red-breasted Sapsucker	Fox Sparrow
Merlin	**FLYCATCHERS**	
RAILS, CRANES	Alder Flycatcher	

Sandhill Crane	Pacific-slope Flycatcher	
SHOREBIRDS	**SHRIKES**	

Appendix IV

Recorded Mammals and Invertebrates
Voices of Glacier Bay

Terrestrial Mammals	**Marine Mammals**	**Invertebrates**
Brown Bear	Humpback Whale	Horse Fly
Mountain Goat	Orca	Mosquito
Coyote	Steller Sealion	Beach Flies
Wolf	Harbor Porpoise	Barnacles
Red squirrel	Harbor Seal	
Long-tailed vole	Sea Otter	
River otter		
Moose		