

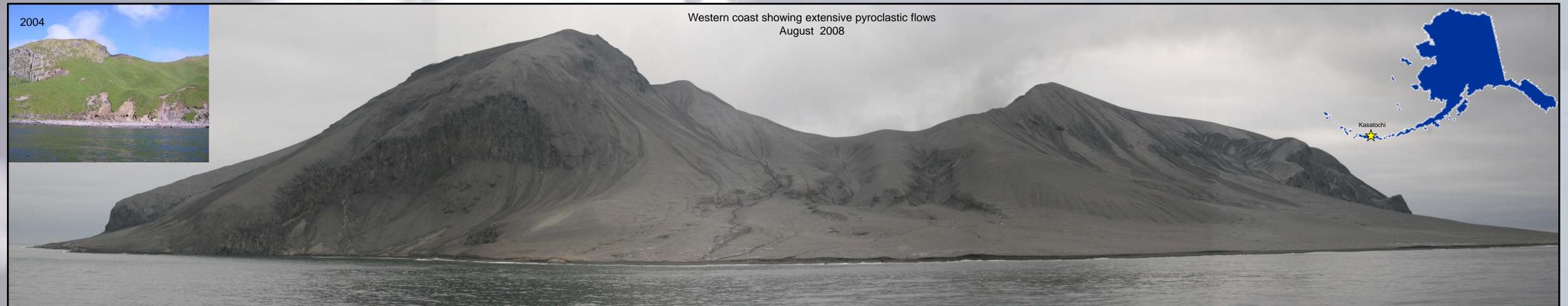
ASHES TO ASHES: DESTRUCTION AND SUBSEQUENT RESPONSE OF A SEABIRD COLONY AFTER VOLCANIC ERUPTION

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INTRODUCTION

In August 2009, a catastrophic eruption of Kasatochi Island covered the entire surface of this central Aleutian Islands volcano under tens of meters of ash and pyroclastic flow material. Prior to the eruption the island supported hundreds of thousands of breeding seabirds including auklets, storm-petrels, and gulls. Kasatochi was one of nine annual seabird monitoring sites on Alaska Maritime National Wildlife, therefore a substantial dataset on the biota of the island existed prior to the eruption. Here we present information obtained during brief visits to Kasatochi during summer 2009 to document the status of seabirds the first breeding season after the eruption.



METHODS

Pre-eruption breeding status and abundance of seabirds was based on 13 summers of observations. In summer 2009 we documented post-eruption conditions with:

- Land based surveys 12-15 June and 10-12 August
- A nearshore marine circumnavigation on 13 June
- Marine transects in the vicinity of Kasatochi 16-21 July
- Audio recordings with song meters running June-August at former auklet and storm-petrel colonies

RESULTS

- Timing of the eruption (daytime and later in the breeding season) affected mortality
 - Many adults probably survived the eruption
 - Few adults still incubating in August
 - Nocturnal species away foraging
 - Chick mortality depended on species' phenology
 - Chicks already fledged by early August survived (all ancient murrelets, whiskered auklets, and 60-85% other auklets)
 - Chicks still in nests perished (all storm-petrels, gulls, cormorants, and puffins, most guillemots, and 15-40% least, crested, and parakeet auklets)
- Almost all breeding habitat was destroyed or rendered unavailable by eruption debris
- Many birds returned to former colony sites in 2009 but had nowhere to breed e.g. auklets socialized at former colony sites but breeding crevices were buried so birds laid eggs on ash surface and in water

Table 1. Effects of the eruption on formerly-breeding seabirds at Kasatochi Island.

Species	Population Estimates		Direct Mortality (%)		Habitat Loss	
	Pre-eruption ^a	Post-eruption ^b	Adult	Chick ^c	Breeding	Foraging
Returned in 2009, attempted to breed but unsuccessful						
Leach's/fork-tailed storm-petrels	1500-2000	present	0	100	y	n
Glaucous-winged gull	300-400	200-250	some	most	some	some
Least auklet	100,000-250,000	100,000-250,000	0	15	y	n
Crested auklet	100,000-200,000	100,000-200,000	0	40	y	n
Parakeet auklet	1000-2000	1000-2000	0	40	y	n
Whiskered auklet	100-200	present	0	0	y	n
Ancient murrelet	25-50	present	0	0	y	n
Returned in 2009, did not attempt to breed						
Red-faced/pelagic cormorants	up to 140	6	0	100	y	some
Common/thick-billed murres	30-40	35	0	0	y	n
Pigeon guillemot	100-200	100-200	0	most	y	some
Horned/tufted puffins	500-1000	85	some	100	y	n

^aPre-eruption estimates are based on counts, annotated lists, and observations collected during USFWS annual monitoring from 1996-2008.

^bPost-eruption estimates are based on combined surveys in 2009.

^cEstimates of chick mortality are based on the percent of chicks still remaining in nests at the time of eruption.



DISCUSSION

The eruption of Kasatochi volcano affected all species of breeding seabirds either directly (mortality of chicks and adults for some species) or indirectly (loss of habitat). Future recovery will depend on the rate of re-exposure of former, or creation of new, breeding habitat through erosion of the coastline and covering ash mantle. Within the volcanically active Aleutian Islands ecosystem, this event is typical of the disturbance that biota in the region have experienced for millennia and provides a valuable opportunity to study the natural recovery of an island ecosystem following such complete devastation. The refuge is participating in a long-term multi-disciplinary study to document the recovery of Kasatochi's bird, mammal, invertebrate, nearshore, and vegetative communities along with changes to the soil and the island's geomorphology.