



Occupancy and Productivity of Peregrine Falcons in Kenai Fords National Park

Monitoring Activities 2011

Natural Resource Data Series NPS/KEFJ/NRDS—2012/274



ON THE COVER

An occupied peregrine falcon nesting territory at Chiswell Island
Photograph by: KEFJ

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Abstract

In 2011, we conducted occupancy and productivity surveys for peregrine falcons in the Kenai Fjords National Park area as a part of a continued monitoring effort with the purpose of increasing our baseline knowledge of this species' life history within the park. We conducted two surveys in May onboard the *M/V Serac* (53 ft fiberglass live-aboard) to locate peregrine falcons and to determine territory status (occupancy). Peregrine falcon nesting success and productivity surveys were undertaken opportunistically in June and July during colonial seabird surveys. We surveyed 18 nesting territories in the Kenai Fjords study area in 2011, 10 of which were occupied by peregrine falcons. We confirmed the presence of chicks at three of the 10 occupied nest territories. Although more limited than 2010, 2011 survey efforts did reveal interannual variation in the breeding distribution and behavior of falcons in the study area. Factors that affect interannual site occupancy still need to be evaluated for this population. Presumably, factors influencing nesting propensity in this marine environment will differ from those affecting populations nesting in interior and northern Alaska. In 2012, we will continue to monitor historic and potential peregrine falcon nesting sites for occupancy and productivity. In addition, we will conduct a pilot study to determine contaminant levels and diet of falcons nesting in the Kenai Fjords.

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Introduction

Peale's peregrine falcons are a genetically and ecologically distinct subspecies of the peregrine falcon that are found in scattered populations along the Pacific Coast (White et al. 2002). Peale's peregrine falcons are a species of special concern in the U.S. and Canada due to very small population size (estimated at less than 1,000 individuals), restricted distribution, declining prey base, and lack of baseline data to assess conservation status (COWEWIC 2007). These marine-based peregrines are thought to be obligate predators of seabirds and therefore may be a good indicator of the health of local seabird populations because their nesting and productivity reflect local seabird abundance and distribution (Beebe 1960, Nelson 1990, Velarde 1993, White et al. 2002). Predation by coastal peregrine falcons has also been shown to have cascading direct and indirect effects on marine nearshore ecosystems and seabird abundance (Paine et al. 1990). These effects are particularly important in the management of threatened species such as Kittlitz's murrelets, a candidate for listing under the Endangered Species Act (2004). Peregrine falcons have been shown to specialize in predating *Brachyramphus* murrelet populations in British Columbia and Icy Bay, Alaska (Nelson and Myres 1976, M. Kissling, USFWS, pers. comm.).

Although populations of the once endangered American and Arctic races of the peregrine falcon have been well studied in Alaska, few studies have been published about the populations of coastal breeding peregrine falcons, and no long-term monitoring has occurred in Alaska. In 1985, the U.S. Fish and Wildlife Service (USFWS) conducted an inventory of peregrine falcons along the Kenai Fjords coast, and discovered a relatively dense population of Peale's peregrines (Janik and Schempf 1985). Additional surveys were conducted in the area in response to the Exxon Valdez Oil Spill (EVOS) in 1989 (Hughes and Sanger 1999). In 2010, KEFJ, in cooperation with AMNWR and ABR, Inc., conducted the first survey of peregrine falcons in the Kenai Fjords area since 1989. Results from this survey showed that the distribution of peregrine falcon territories was similar to that observed in 1989 and territories were in close proximity to seabird colonies, suggesting falcons in the area may have high nest-site fidelity and be dependent on seabird colonies as primary prey sources (Shook and Ritchie 2011).

In 2011, we conducted occupancy and productivity surveys for peregrine falcons in the Kenai Fjords area as a part of a continued monitoring effort with the purpose of increasing our baseline knowledge of this species' life history within the park.

Methods

Study Area

KEFJ is located along the southern coast of the Kenai Peninsula within the Gulf of Alaska Coast Ecoregion (Figure 1, Nowaki et al. 2001). The area is dominated by a cool, hypermaritime climate with minor seasonal temperature variation, seasonally persistent snow at sea level, and extended periods of precipitation. KEFJ includes deeply incised glacial fjords, tidewater glaciers, the Harding Icefield, and a portion of the Kenai Mountains (Chugach—St. Elias Mountain Ecoregion) that rise abruptly from the coast to >1,800 m asl. These slopes are characterized by grassy meadows and alder thickets, interspersed with dense temperate spruce-hemlock forests and granite cliff faces. More than 800 km of marine coastline is dominated by rocky headlands,

sheer cliffs, and sheltered bays. Numerous islets and larger islands including the Pye and Chiswell groups in the Alaska Maritime National Wildlife Refuge (AMNWR) increase the geographic and biological diversity of the area. Marine bird life is seasonally abundant in the fjords and offshore islands and there are more than 20 large, multi-species nesting colonies for seabirds, including Pelagic Cormorant (*Phalacrocorax pelagicus*), Black-legged Kittiwake (*Rissa tridactyla*), Common Murre (*Uria aalge*), Pigeon Guillemot (*Cepphus columbia*), Horned Puffin (*Fratercula corniculata*) and Tufted Puffin (*Fratercula cirrhata*) (Sowls et al. 1978). Surveys have documented close to 100,000 breeding seabirds at these colonies (Bailey 1977). There is an abundance of cliff habitat suitable for nesting peregrine falcons especially along the exposed outer coast and offshore islands (Janik and Schempf 1985). Other predatory birds frequenting these cliffs include Bald Eagles (*Haliaeetus leucocephalus*) and Common Ravens (*Corvus corax*).

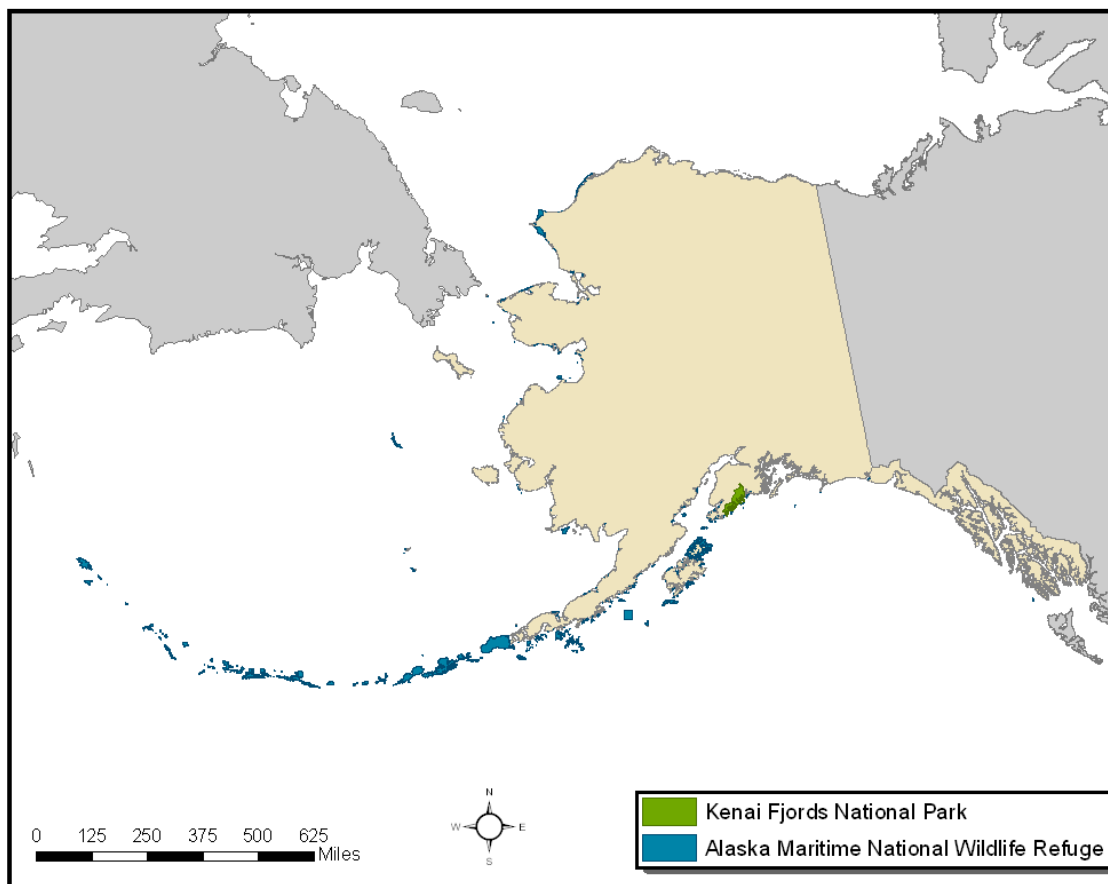


Figure 1. Location of Kenai Fjords National Park and the Alaska Maritime National Wildlife Refuge in Alaska.

The study area included cliff areas along the mainland coast of KEFJ from approximately Bear Glacier Point south and west to a point approximately 2 km south of Yalik Point (north of Nuka Island) and most islands of the AMNWR in the vicinity of this section of coastline (Figure 2). With limited time allocated for survey work in 2011, we focused survey effort on cliffs with a history of use by peregrine falcons (Figure 3, Janik and Schempf 1985, Hughes and Sanger 1999,

Shook and Ritchie 2011) and areas adjacent to seabird colonies that were being surveyed as part of a concurrent study. Islands not surveyed included Rabbit and Outer Islands in the Pye Island group to minimize potential disturbance to Steller's Sea Lions (*Eumetopias jubatus*) during surveys. Although some surveys extended northward into the outer bays and fjords, we conducted the majority of surveys at cliff areas directly influenced by the Gulf of Alaska.

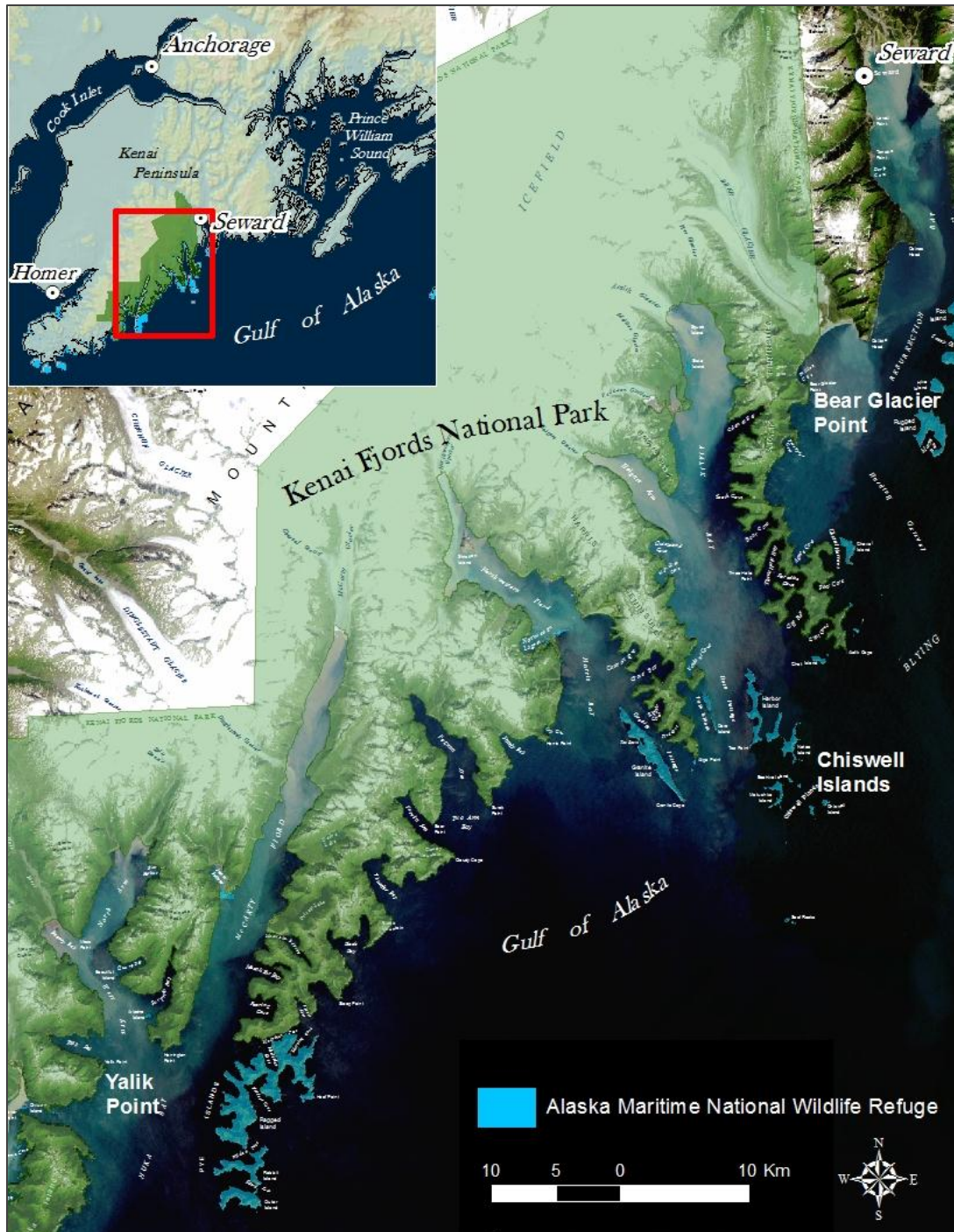


Figure 2. Map of the study area in Kenai Fjords National Park and the Alaska Maritime National Wildlife Refuge in Alaska.

Field Methods and Terminology

In 2011, survey protocols and terminology generally followed those used in 2010 (see Shook and Ritchie 2011). Standard protocol for both surveys included boating to known or suitable cliff habitat and, from a safe and reasonable distance to make observations (<100 m), searching cliffs for adult peregrine falcons, their sign (e.g., perches, guano, nest ledges, stick nests), or nestling or fledglings. Two, three or four observers searched cliffs during both survey periods. We used image stabilizing binoculars including 14 × 40 Nikon StabilEyes and 10 × 30 Canons. If adult or young were not detected during the initial scrutiny of cliff faces, we used a Foxpro3 Wildlife Caller to broadcast an ‘eechup’ call, which is used by adults during courtship and territorial encounters (Nelson 1990, Ratcliffe 1993). This call can elicit a response between members of a pair (e.g., returning calls, moving from one location to another) especially early in the incubation period (Shook and Ritchie 2011).

We conducted two surveys in May onboard the *M/V Serac* (53 ft fiberglass live-aboard) to locate peregrine falcons and to determine territory status (occupancy). The first occupancy survey occurred 2-6 May. The second occupancy survey was scheduled for 16-20 May, but was shortened to only two days due to bad weather. Unlike Shook and Ritchie’s (2011) intensive 7-day productivity survey, we undertook peregrine falcon nesting success and productivity surveys opportunistically in June and July during colonial seabird surveys. These surveys were conducted 13-17, 20-24, 27-29 June and 11-15, 18-22 and 25-29 July from either the *M/V Serac* or the 16 ft *Naiad 5.0, Auklet*.

General terminology for nest status (Table 1) closely followed the National Wildlife Federation’s Raptor Management Techniques Manual (Steenhof and Newton 2007), with some deviations. We included young less than ~28 days in the “successful territory” status. Productivity monitoring was done opportunistically in 2011, therefore some nestlings may have been <4 weeks old while others may have fledged.

Table 1. General terminology.

Term	Definition
1. Pair	Represents a territorial pair of peregrine falcons and could include observations of a pair or proof of a pair’s presence at nest cliff (e.g., eggs, young)
2. Nest	Structure made or the place used by birds for laying their eggs and sheltering their young
3. Alternate nest	An unoccupied nest site within the nesting territory of one pair of birds.
4. Nest cliff	A distinct cliff or bluff with at least one confirmed nesting attempt by peregrine falcons during the course of the study
5. Nesting territory	An area that contains, or historically contained, one or more nests within the home range of a single, territorial pair
6. Occupied territory	A nesting territory where a single or pair of adults showed territorial/defensive behavior at a specific cliff area (e.g., vocally ‘kekking’ at our presence, attacking other raptors)
7. Occupied nest	Proof of nesting was observed during surveys; i.e. an incubating adult, fresh eggs, fresh egg shells, or young.
8. Unoccupied	A nesting territory with a history of occupancy but with no observations of peregrine falcons recorded in 2011

Table 1. General terminology (continued).

Term	Definition
9. No nest	Observations of single birds or pairs, which did not occupy a cliff and where there was no history of nesting
10. Successful territory (nest or pair)	A nesting territory where at least one live nestling (regardless of age) was observed during the productivity survey
11. Productivity	The number of young (regardless of age); usually reported as the number of young produced (i.e., fledgling production) per territorial pair or per occupied territory in a particular year

We also defined the breeding status of each nesting territory using the terms defined in Table 2. We used these definitions from the Central Alaska Network Inventory and Monitoring Program's protocol for monitoring peregrine falcons (Ambrose et al. 2004) to further describe observed falcon behavior and maintain consistency with other monitoring efforts in Alaskan parks. However, we once again changed our definition of success by including young of any age, not just young that reached 4 weeks. We may revisit this definition later as protocols for monitoring become more established; however, at our current level of effort, we feel that important data would be lost by not reporting the presence of young in nests. Also as a result of our limited survey efforts in May, we decided to define nests as unoccupied if no activity was observed at the nesting territory during the entire summer, regardless of the amount of time spent at the site in May.

Table 2. Breeding status terminology.

Status	Definition
1. Unoccupied	A nesting territory where no birds showing an affinity for the territory during the breeding season was observed (≥ 4 hours spent at territory)
2. Unknown	A nesting territory where no bird showing an affinity for the territory during the breeding season was observed but investigators spent < 4 hours at the territory during the incubation period
3. Occupied -- non-breeding	A nesting territory where one or two birds showing affinity for the nesting territory during the breeding season were observed but no eggs were laid (requires confirmation that no eggs were laid)
4. Occupied -- breeding	An occupied nesting territory where eggs were laid (evidence includes young in nest, eggs or eggshells, or adults seen incubating) but where final breeding success was not determined
5. Occupied -- unsuccessful breeding	An occupied nesting territory where breeding was attempted but where no young were observed
6. Occupied -- successful breeding	An occupied nesting territory where one or more young were observed
7. Occupied -- breeding status unknown	An occupied nesting territory where breeding or non breeding could not be determined
8. Occupied -- breeding status unknown, no young fledged	An occupied nesting territory where breeding or non breeding could not be determined but it was certain no young fledged

Results

2011 Monitoring

We surveyed 18 nesting territories in the Kenai Fjords study area in 2011 (Figure 2, Table 3). For the purposes of this report, we designated nesting territories based on data collected during 2011 surveys, as well as data collected from previous survey efforts (Janik and Schempf 1985, Hughes and Sanger 1999, Shook and Ritchie 2011). Reviewing this information, we decided not to define Harbor-Natoa Island (KF018PEFA) and Chiswells (Beehive, KF019PEFA) listed in Shook and Ritchie (2011) as nesting territories. Peregrine falcons were not observed at these sites until 2010 surveys, and then falcons were observed moving through the areas, not occupying cliffs. We added one additional territory (Granite Island, S KF020PEFA) as a nesting territory based on falcon behavior observed in that area as well as sighting recorded in 1985 (Janik and Schempf 1985).

Table 3. Breeding status of known peregrine falcon territories along the Kenai Fjords coast in 2011.

Cliff ID	Cliff Location	Status
KF001PEFA	Granite Island, Taz Basin	Unoccupied
KF002PEFA	Harrington Point	Unoccupied
KF003PEFA	Yalik Point	Occupied
KF004PEFA	Wildcat Pass, Ragged Is	visited <4hr
KF005PEFA	Steep Point	Occupied
KF006PEFA	Ragged Island, Hoof Point	Unoccupied
KF007PEFA	Cloudy Cape	Unoccupied
KF008PEFA	Chiswell A Island	Occupied
KF009PEFA	Matushka Island (S)	Unoccupied
KF010PEFA	Harbor Island	Occupied
KF011PEFA	Harris Peninsula, Aligo Point	Unoccupied
KF012PEFA	Chat Island, Aialik Pen.	Successful
KF013PEFA	Aialik Cape (S)	Unoccupied
KF014PEFA	Aialik Cape (N)	Successful
KF015PEFA	Cheval Island	Occupied
KF016PEFA	Matushka Island	Occupied
KF017PEFA	Natoa Island	Successful
KF020PEFA	Granite Island, S	Occupied

Of the 18 nesting territories surveyed in 2011, 10 were occupied by peregrine falcons (Table 3). Of these, seven were occupied and three were unoccupied in 2010 (Table 4). Five nesting territories occupied in 2010 and two territories historically occupied were unoccupied in 2011 (Table 4). The two territories historically occupied (Aialik Cape (S) and Matushka Island (S)) were also not occupied in 2010 and their close proximity to occupied territories suggest these sites may no longer be occupied consistently.

Observations at territories occupied in 2010 and 2011 suggest that falcons used alternate nest cliffs at three sites (Steep Point, Aialik Cape (N), Cheval Island) and the same nest cliff at one site (Chat Island). We confirmed many nest locations by observing chicks or adult falcons delivering food. We were unable to confirm nest locations for other suspected nest ledges due to adult peregrine falcons evading detection.

We confirmed the presence of chicks at three (Natoa Island, Chat Island, Aialik Cape (N)) of the 10 occupied nest territories.

Discussion

In 2011, monitoring effort was limited by weather conditions and time constraints. Our results, therefore, do not provide a sufficient amount of data to fully evaluate the breeding status of peregrine falcons in the Kenai Fjords National Park area. While we were able to confirm the presence of chicks at only three nest territories, we suspect other territories could have successfully raised young that we didn't detect due to limited survey time in July.

Our efforts did reveal interannual variation in the breeding distribution and behavior of falcons in the study area. While peregrine falcons occupied historically used cliffs during the 2011 breeding season, it is clear that sites may not be occupied every year and alternate nest ledges are available and used. Factors that affect interannual site occupancy still need to be evaluated for this population. Presumably, factors influencing nesting propensity in this marine environment will differ from those affecting populations nesting in Interior and Northern Alaska.

In 2012, we will continue to monitor historic and potential peregrine falcon nesting sites for occupancy and productivity. In addition, we will conduct a pilot study to determine contaminant levels and diet of falcons nesting in the Kenai Fjords. This study, *Investigate Seabirds as Prey and Sources of Environmental Contaminants in Raptor Populations*, will provide us with a better understanding of the food-web dynamics that drive the upper trophic levels and bioaccumulation of contaminants in the marine environment.

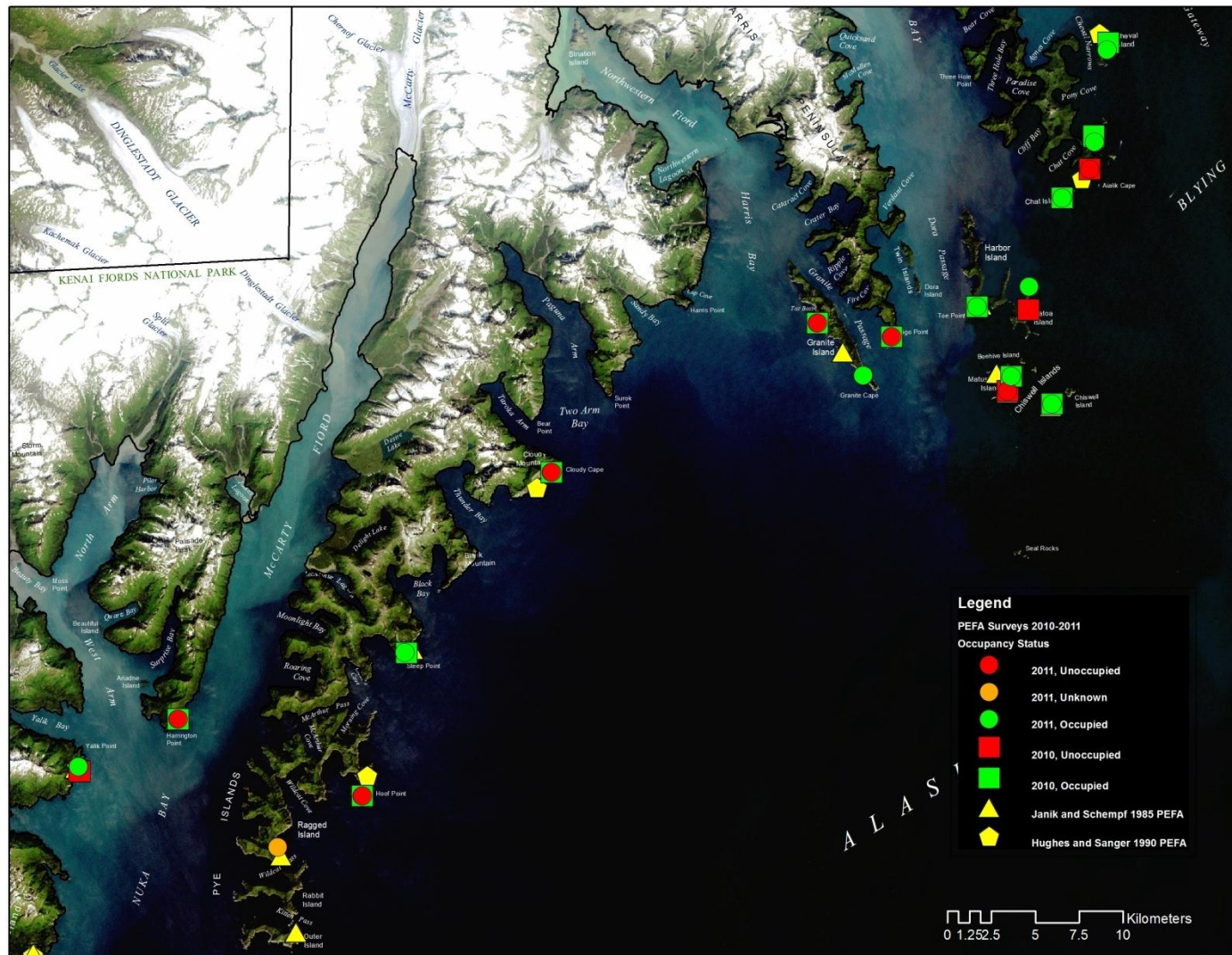


Figure 3. Location of current and historic nesting territories of peregrine falcons in the Kenai Fjords area.

Table 4. History of use of cliff locations by peregrine falcons, Kenai Fjords National Park study area, 1985 (Janik and Schempf 1985), 1990 (^a R. Ritchie unpubl. notes 1990, ^b Hughes and Sanger 1999), 2010 (Shook and Ritchie 2011), and 2011. In 2011, <4 hrs refers to sites at which observers spent less than 4 hours during occupancy surveys in May.

Cliff ID	General Area	1985	1990	2010 Occupancy	2010 Productivity	2010 Final Status	2011 Occupancy	2011 Productivity	2011 Final Status
KF001PEFA	Granite Island (N)	none	occupied, successful ^a	occupied	2(40+)	occupied, successful	unoccupied	0	unoccupied
KF020PEFA	Granite Island (S)	single	none	unoccupied	0	unoccupied	occupied	0	occupied
KF002PEFA	Harrington Point	none	pair ^a	occupied	0	occupied	unoccupied	0	unoccupied
KF003PEFA	Yalik Point	single	pair ^{a,b}	unoccupied	0	unoccupied	occupied	0	occupied
KF004PEFA	Wildcat Pass, Ragged Island	single	none	single	0	no nest	unknown (<4 hrs)	0	unknown
KF005PEFA	Steep Point	pair	none	unknown	2(33)	occupied, successful	occupied	unknown	occupied
KF006PEFA	Ragged Island (Hoof Point)	none	occupied, successful ^a	occupied	1(31)	occupied, successful	unknown (<4 hrs)	0	unoccupied
KF007PEFA	Cloudy Cape	none	pair	occupied	unknown	occupied, poss successful	unoccupied	0	unoccupied
KF008PEFA	Chiswell A Island	single	single ^a	occupied	0	occupied	occupied	0	occupied
KF009PEFA	Matushka Island (S)	single	pair ^{a, d}	single	0	unoccupied	unknown (<4 hrs)	0	unoccupied
KF010PEFA	Harbor Island	single	pair ^a	occupied	1(unk)	occupied, successful	occupied	0	occupied
KF011PEFA	Harris Peninsula (Aligo Pt)	none	pair ^a	occupied	0	occupied, failed	unoccupied	0	unoccupied
KF012PEFA	Chat Island, Aialik Peninsula	none	pair ^b	occupied	0	occupied	unknown (<4 hours)	≥1(unk)	occupied, successful

Table 4. History of use of cliff locations by peregrine falcons, Kenai Fjords National Park study area, 1985 (Janik and Schempf 1985), 1990 (a R. Ritchie unpubl. notes 1990, b Hughes and Sanger 1999), 2010 (Shook and Ritchie 2011), and 2011. In 2011, <4 hrs refers to sites at which observers spent less than 4 hours during occupancy surveys in May (continued).

Cliff ID	General Area	1985	1990	2010 Occupancy	2010 Productivity	2010 Final Status	2011 Occupancy	2011 Productivity	2011 Final Status
KF013PEFA	Aialik Cape (S)	single	pair ^b	unoccupied	0	unoccupied	unknown(<4 hours)	0	unoccupied
KF014PEFA	Aialik Peninsula (N)	single	none ^a	occupied	0	occupied	unknown	1(40)	occupied, successful
KF015PEFA	Cheval Island	none	pair ^b	occupied	2(34)	occupied, successful	occupied	unknown	occupied
KF016PEFA	Matushka Island	single	occupied, successful ^a	unknown	3(45)	occupied, successful	unknown (<4 hours)	unknown	occupied
KF017PEFA	Natoa Island	none	single ^a	no nest	0	no nest	unknown(<4 hours)	2(45)	occupied, successful
KF018PEFA	16-21 Island	none	none	not checked	0	no nest	unknown(<4 hours)	0	no nest
KF019PEFA	Beehive Island	none	none	unknown	0	no nest	unknown(<4 hours)	0	no nest
Total Occupied		10	12			12			10

Literature Cited

- Ambrose, S., N. Guldager, S. Daw, M. Beer. 2004. American peregrine falcon monitoring protocol for Yukon-Charley Rivers National Preserve. Central Alaska Network Inventory and Monitoring Program National Park Service, U.S. Department of the Interior.
- Bailey, E.P. 1977. Distribution and abundance of marine birds and mammals along the south side of the Kenai Peninsula, Alaska. *Murrelet* 58: 58–72.
- Beebe, F.L. 1960. The marine peregrines of the Northwest Pacific coast. *Condor* 62: 144–189.
- COWEWIC. 2007. COSEWIC Assessment and update status report on the peregrine falcon (*Falco peregrinus*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON, Canada.
- Hughes, J.H., and G.A. Sanger. 1999. Observations of Peale's peregrine falcons, *Falco peregrinus pealei*, on the Northern Gulf of Alaska Coast, Exxon Valdez Oil Spill State/Federal Natural Resource Damage Assessment Final Report (Bird Study Number 5). Unpublished report by Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage, AK. 11 pp.
- Janik, C.A., and P.F. Schempf. 1985. Peale's peregrine falcon (*Falco peregrinus pealei*) studies in Alaska, June 12–24, 1985. Unpublished administrative report by U.S. Fish and Wildlife Service, Raptor Management Studies, Juneau, Alaska. 10 pp + 2 appendices.
- Nelson, R.W., and M.T. Myres. 1976. Declines in populations of peregrine falcons and their seabird prey at Langara Island, British Columbia. *Condor* 78: 281–293.
- Nelson, R. W. 1990. Status of the peregrine falcon (*Falco peregrines pealei*) on Langara Island, Quenn Charlotte Island, British Columbia (Canada), 1968-1989. *Canadian Field-Naturalist* 104:193-199.
- Nowaki, G., P. Spencer, M. Fleming, T. Brock, and T. Jorgenson. 2001. Unified ecoregions of Alaska: 2001. U.S. Department of Interior, U. S. Geological Survey. Open File Report 02-297.
- Paine, R. T., J. T. Wootton, and P. D. Boersma. 1990. Direct and indirect effects of peregrine falcon predation on seabird abundance. *Auk* 107:1-9.
- Ratcliffe, D. 1993. *The Peregrine Falcon*. T. and A. D. Poyser, Second Edition, London. 454 pp.
- Shook, J. E., and R. J. Ritchie. 2011. Occupancy and productivity of peregrine falcons in Kenai Fjords National Park, Alaska, 2010. Report prepared for the National Park Service by ABR, Inc. – Environmental Research and Services, Fairbanks, AK.
- Sowls, A.L., S.A. Hatch, and C.J. Lensink. 1978. Catalog of Alaskan seabird colonies. U.S. Fish and Wildlife Service, FWS/OBS 78/78.

- Steenhof, K., and I. Newton. 2007. Assessing nesting success and productivity. Pages 181–192 *in* D.M. Bird and K. L. Bildstein (eds.). Raptor research and management techniques. Hancock House, Surrey, British Columbia; Blaine, WA.
- White, C.M., N.J. Clum, T.J. Cade, and W.G. Hunt. 2002. Peregrine falcon. *The Birds of North America*. No. 660: 1–48.
- Velarde, E. 1993. Predation of nesting larids by peregrine falcons at Rasa Island, Gulf of California, Mexico. *Condor* 95:706-708.