U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Falcipennis canadensis isleibi*

COMMON NAME: Prince of Wales spruce grouse

LEAD REGION: 7

INFORMATION CURRENT AS OF: 9/23/2010

STATUS/ACTION
_Initial 12-month Petition Finding:
___ not warranted
___ warranted
___ warranted but precluded (also complete (c) and (d) in section on petitioned candidate species- why action is precluded)
X Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status
_ New candidate
_Continuing candidate
_ Non-petitioned
_Petitioned - Date petition received: _____
_ 90-day positive - FR date:
_ 12-month warranted but precluded - FR date:
_Is the petition requesting a reclassification of a listed species?
_Listing priority change
Former LP:___
New LP: ___
Latest Date species became a Candidate: _____
_ Candidate removal: Former LP: ___
_ A - Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
_ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
_ F - Range is no longer a U.S. territory.
_ I - Insufficient information exists on biological vulnerability and threats to support listing.
_ M -Taxon mistakenly included in past notice of review.
_ N -Taxon may not meet the Act's definition of "species."
_ X -Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Bird; Phasianidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE:
Region 7: Alaska.

CURRENT STATES/COUNTRIES/TERRITORIES/COUNTRIES OF OCCURRENCE:
Region 7: Alaska.

LAND OWNERSHIP: We estimated land ownership by category within the assumed range of the Prince of Wales (POW) spruce grouse (*Falcipennis canadensis isleibi*) using the Alaska General Land Status map (AGLS 2008). The POW spruce grouse habitat is located on approximately 75 percent (%) federal (8075 square kilometers (km^2); 3118 square miles (mi^2)), 16% native (1767 km^2; 682 mi^2), 5 % private (479 km^2; 185 mi^2), 4 % state (411 km^2; 159 mi^2), and <1% native and state combined (27 km^2; 10 mi^2) lands. All of the federal lands are within the Tongass National Forest and are managed by the U.S. Forest Service (USFS) under the Tongass Land Management Plan (TLMP; USDA Forest Service 2008). Spruce grouse breeding and wintering habitats are similar; therefore estimated land ownership is likely similar year-round (Boag and Schroeder 1992).

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BIOLOGICAL INFORMATION:

Species Description

The spruce grouse (*Falcipennis canadensis*) is a medium-sized gamebird found primarily in northern coniferous forests (Boag and Schroeder 1992). It is a small, compact grouse measuring 41 centimeters (cm; 16 inches (in)) in length with a short neck and tail (Boag and Schroeder 1992). Male spruce grouse have distinctively-patterned tails, red marks above the eye, white spots on the breast, and black necks. Female spruce grouse are mottled brown with both rufous and gray color phases; they have dark black and white barring on their belly and breast, small red coloration above their eyes, and brown tails (Boag and Schroeder 1992).

The POW spruce grouse is a recently-described subspecies most similar in morphology to the Franklin's grouse (*F. c. franklinii*; Dickerman and Gustafson 1996, Barry and Tallmon 2010; Fig. 1). Generally, POW spruce grouse have longer tails and shorter wings than Franklin's grouse (Table 1). Both the Franklin's subspecies and the POW spruce grouse lack a chestnut band at the tip of the tail, characteristic of the taiga subspecies (*F. c. canadensis*); the taiga subspecies, in turn, lacks white marks on the tail coverts (Fig. 1). Male POW spruce grouse are darker olive colored, with less grey on the dorsum and flanks than Franklin's, and the white marks on the coverts of the upper tail are much narrower than the Franklin's (Fig. 1).

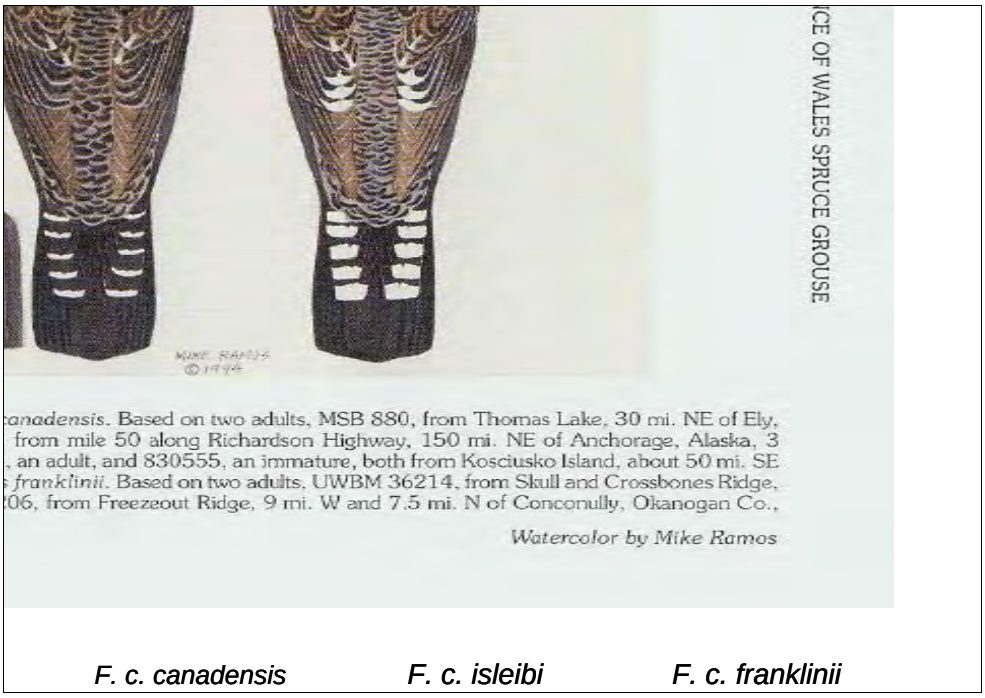

Fig. 1. Plumage variation in three subspecies of spruce grouse: taiga (*F. c. canadensis*), POW (*F. c. isleibi)*, and Franklin's *(F. c. franklinii*; Dickerman and Gustafson 1996).

Table 1. Mean wing chord and tail lengths (millimeter (mm); (in)) and associated standard deviations (±SD) of POW spruce grouse and Franklin's grouse, and sample size (n).

Subspecies and source	Male		Female	
	Wing chord mm(in)±SD	Tail mm(in)±SD	Wing chord mm(in)±SD	Tail mm(in)±SD
POW spruce grouse				
Dickerman and Gustafson (1996)				
adults	169 mm (6.7 in), n=1	127±1.0 mm (5.0±0.04 in), n=2		
immature	169 mm (6.7 in), n=1	116±2.1 mm (4.6±0.08 in), n=2	171 mm (6.7 in), n=1	
age unknown			169±1 mm (6.7±0.04 in), n=3	102±5.0 mm (4.0±0.20 in), n=2
Russell (1999)				
adults	178 mm (7.0 in), n=1		180±7.2 mm (7.1±0.28 in), n=5	
immature	172 mm (6.8 in), n=1		171 mm (6.7 in), n=1	
Franklin's grouse				
Boag and Schroeder (1992)				
adults	184±3.1 mm (7.2±0.12 in), n=11	113±3.6 mm (4.4±0.14 in), n=11	180±4.4 mm (7.1±0.17 in), n=8	95±2.3 mm (3.8±0.09 in), n=8
immature	180±4.1 mm (7.1±0.16 in), n=4	102±1.6 mm (4.0±0.06 in), n=4	168±6.6 mm (6.6±0.26 in), n=5	89±4.5 mm (3.5±0.18 in), n=5

Taxonomy

Spruce range throughout northern North America, with two widely recognized subspecies: the taiga subspecies in the north and the Franklin's grouse in the montane forests of the cordilleras (extensive chain of mountains or mountain ranges) in the south-west portion of its range (Boag and Schroeder 1992). These two subspecies have a range of morphological intergradations in British Columbia (Dickerman and Gustafson 1996). In addition to the taiga and Franklin's subspecies, Dickerson and Gustafson (1996) described a third subspecies of spruce grouse based on morphology that is endemic to several islands in southern Southeast Alaska. The authors compared spruce grouse specimens from the POW Island complex (i.e., POW Island and several smaller, adjacent islands) to spruce grouse from mainland North America; although the sample size was small (n=7), Dickerman and Gustafson (1996) concluded that grouse from POW Island were morphologically distinct from the mainland specimens and proposed a third subspecies, POW spruce grouse (*F. c. isleibi*).

To corroborate findings by Dickerson and Gustafson (1996), Barry and Tallmon (2010) used mitochondrial DNA (mtDNA) and nuclear markers to classify the POW spruce grouse as a separate subspecies. Barry and Tallmon (2010) collected tissue from spruce grouse in central Alaska (taiga subspecies: n=9), Southeast Alaska (POW spruce grouse: on POW n=20, and on Zarembo Island n=11), and British Columbia (taiga subspecies: n=9; Franklin's grouse: n=14). The mtDNA sequences and nuclear microsatellite alleles showed consistent patterns of divergence for POW spruce grouse populations; populations on POW and Zarembo Islands shared a unique haplotype, and island (POW spruce grouse) and mainland (Franklin's and taiga grouse) populations had the highest level of divergence from one another, with island populations showing lower genetic variation (Fig. 2). Furthermore, POW spruce grouse from POW Island had high levels of allele frequency divergence from those on Zarembo Island; despite the small sample size from Zarembo Island, results suggest that these two populations in Southeast Alaska may be reproductively isolated from each other or could be in the near future (Fig 2). Further analysis is needed to verify if spruce grouse on POW and Zarembo Islands are indeed separate populations, as well as to determine if there is population divergence among the other islands on which POW spruce grouse are known or expected to occur.

The POW spruce grouse is not currently recognized by the American Ornithologists' Union (AOU) because the last edition of the AOU checklist to include subspecies was published in 1957 (AOU 1957). However, results from Barry and Tallmon (2010) were published in *The Auk*, the quarterly journal of the AOU. Based on morphological characteristics (Dickerman and Gustafson 1996) and genetic differentiation (Barry and Tallmon 2010), we consider the POW spruce grouse a subspecies in this document. Until more information is available, we assume that all spruce grouse located on the islands in southern Southeast Alaska are from one population of POW spruce grouse.

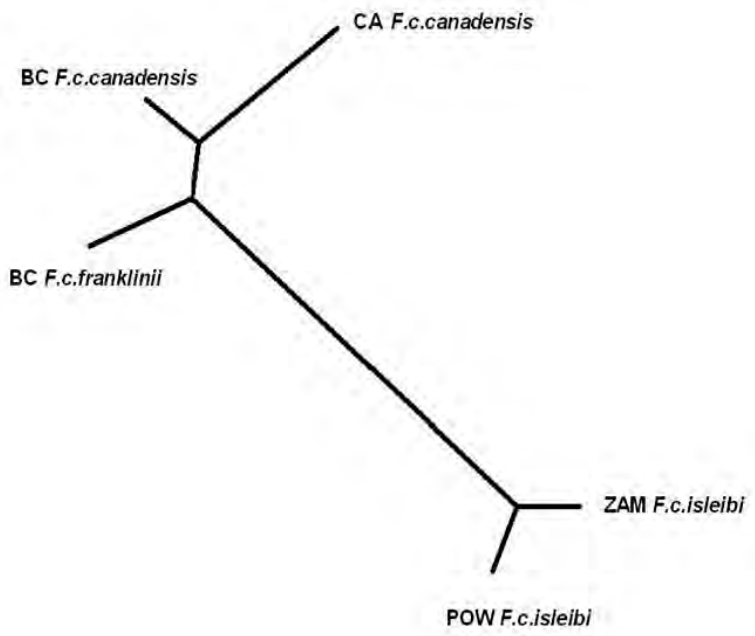

Fig. 2. POW spruce grouse (POW and ZAM) are genetically distinct from other subspecies, as shown by this phylogenetic tree based on mitochondrial DNA sequences from five populations of spruce grouse. The length of tree branches indicates genetic relatedness between populations; the longer the branch, the less related the two populations are based on mitochondrial DNA. Labels denote where specimens were collected (BC = British Columbia, CA = central Alaska, POW = Prince of Wales, ZAM = Zarembo) and their morphological subspecies designation (*F. c. canadensis* = taiga subspecies, *F. c. franklinii* = Franklin's grouse, *F. c. isleibi* = POW spruce grouse). This figure was reproduced from Barry and Tallmon (2010) with permission.

Habitat/Life History

Across most of their range, spruce grouse use northern, conifer-dominated forests that vary in elevation from sea level to 3,600 meters (m) (11811 feet (ft)), and are closely linked to fire disturbance (Boag and Schroeder 1992, Storch 2007). They are generally associated with dense forests with a developed middle story, including branches or smaller trees or shrubs that are 2-8 m (6.6-26.2 ft) tall (Storch 2007). Spruce grouse appear to select microhabitats that contain horizontal diversity within coniferous forests to meet specific biological needs (Storch 2007); horizontal diversity, or interspersion, refers to the intermixing of units of different habitat types (Giles 1978). They are primarily arboreal in the winter and terrestrial in the summer (Boag and Schroeder 1992).

POW spruce grouse are the only population of spruce grouse known to inhabit islands or the temperate rainforest, which has no history of fire disturbance (Russell 1999), yet there are substantial gaps in our knowledge of POW spruce grouse habitat relationships. This is primarily a result of the difficulty in studying this subspecies, because of both their low densities, and the ruggedness and dense vegetation within their habitat (Russell 1999, Williamson et al. 2008, Nelson 2010). However, two important, but short-term, studies on this species collected habitat and life history information on northern POW Island (Russell 1999, Nelson 2010); we consider results to be applicable to all islands on which they occur.

POW spruce grouse is a habitat generalist, using a variety of habitat types, including old-growth, second-growth, and mixed conifer (i.e., scrub) forests and muskegs (wetland bog) (Russell 1999). Russell (1999) reported that they select habitat at fine scales of about 2 hectares (ha) (5 acres (ac)), primarily occupying high-volume old-growth and scrub forests and avoiding clearcuts; second-growth forests were used in proportion to their availability. During the breeding season, females occupy open forest stands with relatively low tree density, medium canopy cover, and a dense shrub layer where food and cover are available (Russell 1999, Williamson et al. 2008). Brood rearing female POW spruce grouse used scrub forest habitat more often than other habitat types, perhaps because invertebrate abundance was higher in scrub habitat (Russell 1999). In contrast, males inhabit a more complex matrix of open and closed forests during the breeding season, using stands with little mid-story, but relatively high tree density and canopy cover interrupted by forest openings (Russell 1999, Williamson et al. 2008). These forest openings are likely linked to their "wing-clap" display: an aggressive, territorial advertisement characteristic of both POW spruce grouse and Franklin's grouse (MacDonald 1968, Russell 1999). This display involves flying from trees with tail feathers fully spread, pausing slightly in midair, and then bringing the backs of the wings together to create a loud clapping sound. Franklin's grouse then make another loud clap before landing on the ground, whereas the few POW spruce grouse that have been observed performing the display have made a second clap before landing in another tree, and have not displayed in open areas (MacDonald 1968, Russell 1999). Despite their differences in habitat use, male and female POW spruce grouse appear to favor open-canopy, scrub forests during the breeding season, perhaps due to the combination of available food, cover, and courtship display sites (Russell 1999).

Spruce grouse are primarily herbivores, although they will consume insects in snow-free months (Boag and Schroeder 1992). Fungi and animal matter appear to be important in the diet of juvenile spruce grouse, and short-needled pine and spruce needles are apparently the only diet

for spruce grouse in the winter in other parts of their range (Boag and Schroeder 1992, Storch 2007). POW spruce grouse eat Sitka spruce (*Picea sitchensis*) needles and buds, western hemlock (*Tsuga heterophylla*) needles, and *Vaccinium* species (e.g., blueberries; Russell 1999). Juvenile POW spruce grouse were observed eating Sitka spruce and western hemlock needles at 8 weeks of age; adults were observed foraging in the mid-crown, roughly 20-30 m (66-98 ft) above ground in Sitka spruce trees (Russell 1999).

Male and female spruce grouse appear to be capable of breeding the year after hatching, and this is presumably also true for POW spruce grouse (Boag and Schroeder 1992). Hatching success ranges from 29 to 81% among subspecies and locations of spruce grouse; there is no estimate of POW spruce grouse hatching success (Boag and Schroeder 1992). Average clutch size of POW spruce grouse is 5.6, similar to other subspecies of spruce grouse (range = 4.8-5.6; Boag and Schroeder 1992, Russell 1999). Based on limited data, POW spruce grouse begin egg-laying in late April, continue nesting activities until 1 July, and attend to chicks until early October (Russell 1999, Nelson 2010). Russell (1999) documented nest abandonment following long incubation times (2 of 6 nests), presumably due to failure of eggs to hatch, but did not report nest predation.

The lifespan of POW spruce grouse is unknown, but is probably similar to that of Franklin's grouse, documented as 13 years (Boag and Schroeder 1992). There is a wide range of variability in annual survivorship (22-75%) among spruce grouse subspecies and locations (Boag and Schroeder 1992). Russell (1999) and Nelson (2010) estimated annual survival of radio-marked POW spruce grouse to be 39% and 45%, respectively (Table 2). Probable causes of mortality were similar across both studies, with predation, road strike, and hunter harvest constituting the majority of mortalities (Table 2). As with any study on marked animals, there are potential effects of capture and handling, or tag-related effects on survivorship. Known and probable predators include Queen Charlotte goshawk (*Accipiter gentilis laingi*), American marten (*Martes americana*), ermine (*Mustela erminea*), Alexander Archipelago wolf (*Canus lupus ligoni*), barred owl (*Strix varia*), bald eagle (*Haliaeetus leucocephalus*), and other birds of prey that occur within the range of the POW spruce grouse. Nelson (2010) documented significant differences in survivorship of breeding (8%) and non-breeding birds (72%); non-breeding birds were 10 times more likely to survive a year than breeding birds. Non-breeding birds had the highest survival in the winter and spring, whereas breeding birds had similar survival rates year round (Nelson 2010). Nelson (2010) found no effect between unharvested and harvested habitats on the short-term survival of radio-marked POW spruce grouse. This study defined "harvested" habitat to be forests of all ages post harvest, and "unharvested" habitat to be all other forest types, including high-volume old-growth, low-volume scrub forest, and muskeg (Nelson 2010).

Table 2. Annual survivorship and mortality of radio-marked POW spruce grouse as estimated by two field studies, Prince of Wales Island.

	Field Studies	
	Russell (1999)	Nelson (2010)
Total no. radio-marked birds (no. juveniles)	19 (3)	38 (1)
Estimated annual survival	45%	39%
Probable cause of mortality (juveniles)		
Predation	4 (1)	3
Road strike	2 (1)	2
Hunter harvest	2 (1)	3
Researcher-caused	1	0
Natural causes	0	1
Unknown	0	3

Spruce grouse are poor long-distance flyers and are generally sedentary, with some limited migratory movement between summer and winter habitats (Boag and Schroeder 1992, Williamson et al. 2008). The breeding and wintering habitats for spruce grouse are similar; however, grouse tend to move from more open forest stands to denser forest stands when there is snow (Boag and Schroeder 1992). Some Franklin's grouse have migrated up to 11.0 km (6.8 mi) between winter and summer habitats, but the majority (75%) remained sedentary; females were more likely to migrate than males, and migrated farther than males (Schroeder 1985). The taiga subspecies from interior Alaska migrated short distances, averaging 0.9 km (0.6 mi; range: 0.2-8.0 km (0.1-5.0 mi)); females, again, migrated farther than males (Boag and Schroeder 1992). There is no information on adult dispersal of POW spruce grouse.

Post-fledging dispersal patterns of POW spruce grouse are limited in scope as the three juveniles studied were siblings; average dispersal distance of these birds was 1.8 km (1.1 mi; Russell 1999). Nelson (2010) noted that juvenile POW spruce grouse dispersed up to 1.6 km (1.0 mi) in a day. Spruce grouse prefer to walk rather than fly when moving, and POW spruce grouse rarely were observed crossing clearcuts, even if it resulted in a longer route (Boag and Schroeder 1992, Russell 1999). Clearcuts may be avoided because the thick logging debris often present could inhibit walking, and thus be a barrier to dispersal (Russell 1999). Therefore, POW spruce grouse may use roads to move from one watershed to another. Nelson (2010) never observed dispersal events above 300 m (984 ft) in elevation. Western hemlock and Sitka spruce forests occur below 600 m (1969 ft) in elevation in Southeast Alaska, and treeline (between subalpine and alpine) on north central POW is between 457-610 m (1500-2000 ft; Alaback 1982, P. Krosse, personal communication), suggesting that dispersal occurs well-below treeline.

Historical and Current Range/Distribution

Spruce grouse in North America span from Alaska to Labrador, and occupy most of Canada, as well as New England and northern states in the western United States. The first published

description of spruce grouse in the Alexander Archipelago was the collection of a female and five eggs by Osgood (1905); he described discovering a potentially new species of grouse on POW Island, which he later determined to be a Franklin's grouse. Besides brief mentions by Swarth (1911) and Gabrielson and Lincoln (1959), there was very little additional information about spruce grouse in this region until Dickerman and Gustafson (1996) reported its morphological distinction and proposed it to be a distinct subspecies.

There are records of POW spruce grouse on 11 islands in Southeast Alaska: Dall, Grindall, Heceta, Kosciusko, Mitkof, Prince of Wales, San Fernando, Suemez, Tuxekan, Warren, and Zarembo Islands (Fig. 3, Table 3; Osgood 1905, Gabrielson and Lincoln 1959, Dickerman and Gustafson 1996, Russell 1999, Rabe 2006, Williamson et al. 2008). It is possible that POW spruce grouse are present on other nearby islands but have not been detected, as this species is extremely cryptic, most of those islands are rarely visited, and surveys for this species have not been conducted outside of POW Island. Spruce grouse are notably absent from the Queen Charlotte Islands, and from most of the mainland to the east (Boag and Schroeder 1992). Because of the sparce historical records and the lack of a complete survey for this species, there is no evidence to suggest that the recent historical distribution is much different than the current distribution.

Table 3. Specimens of POW spruce grouse collected in Southeast Alaska and stored at the University of Alaska Museum of the North (UAM), Fairbanks, Alaska.

UAM ID #	Date collected	Location	Age/sex	Sex
4282	9/15/1982	POW Island	-	-
6387	6/9/1993	Heceta Island	adult	female
6386	6/12/1993	POW Island	adult	male
7715	6/6/1995	POW Island	juvenile	-
7714	6/6/1995	POW Island	juvenile	-
6908	6/11/1995	POW Island	juvenile	-
6748	11/1/1995	POW Island	-	-
6985	7/20/1996	Zarembo Island	-	-
6986	7/20/1996	Zarembo Island	-	-
7278	4/22/1997	POW Island	adult	male
9005	10/1997	POW Island	juvenile	-
8500	1997	POW Island	juvenile	male
8597	1997	POW Island	adult	female
13512	6/28/2001	POW Island	adult	male
24687	4/5/2007	POW Island	adult	female

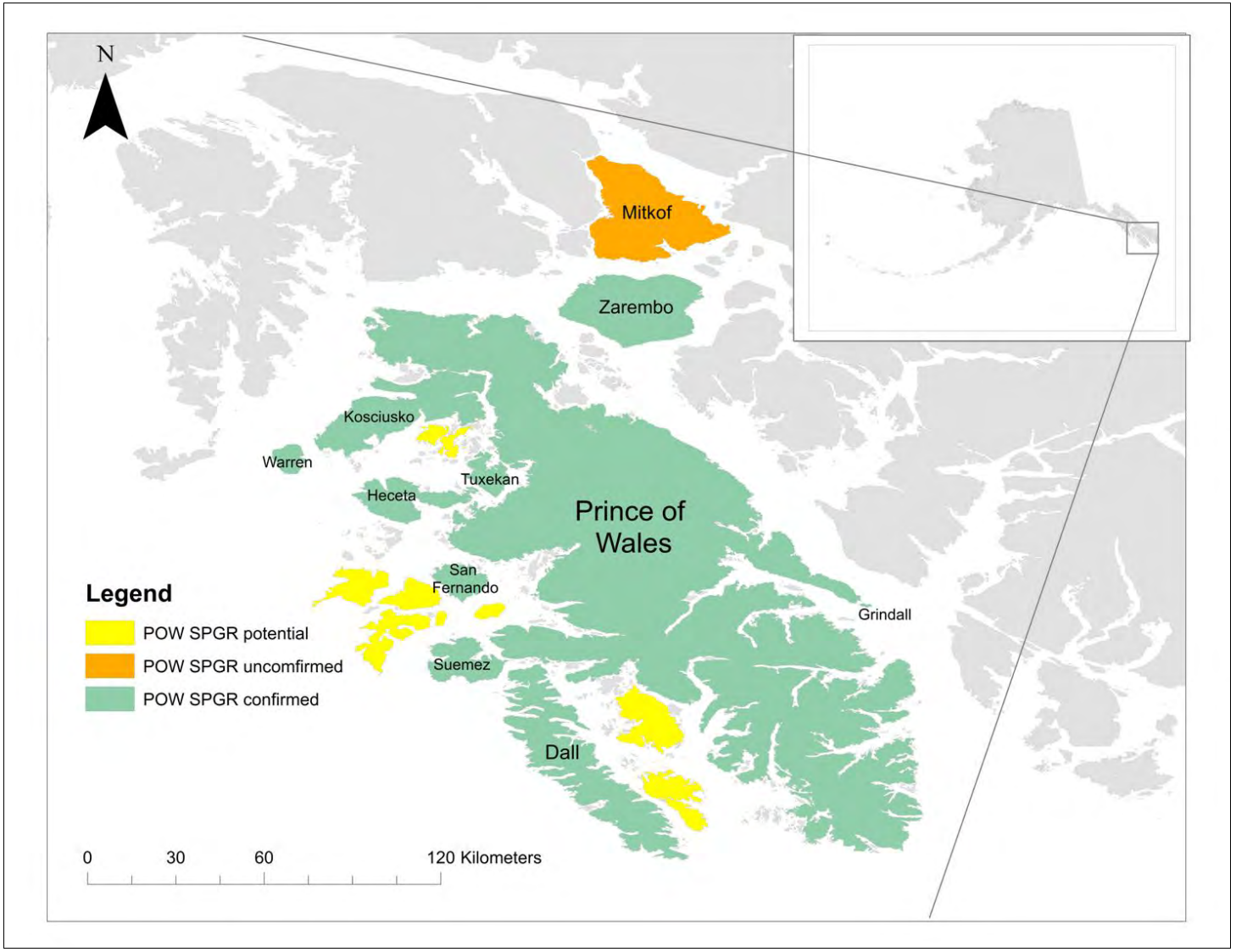

Fig. 3. Distribution of Prince of Wales (POW) spruce grouse (SPGR) in southern Southeast Alaska based on museum specimens and documented sightings.

POW spruce grouse are rarely detected on region-wide surveys for birds. Since surveys began on Zarembo Island in 1993, the roadside North American Breeding Bird Survey (BBS) has produced four records (in 1994 (n=2), 2002 (n=1), 2005 (n=1), and 2008 (n=1)), and one record near Beaver Creek, POW Island, in 1977 (Sauer et al. 2008). There are three other BBS routes on POW Island that are routinely surveyed, yet spruce grouse have never been observed on those routes (Sauer et al. 2008). The Christmas Bird Count (CBC), which has been conducted in 23 years since 1981 on POW Island, reported only one spruce grouse within the range of this distinct subspecies: in Thorne Bay, in 1989 (National Audubon Society 2002).

Spruce grouse are rare on the mainland of Southeast Alaska, where their taxonomic status is unknown but they are presumably not POW spruce grouse. POW spruce grouse are poor long-distance fliers, and POW Island is separated from the mainland by over 6 km. This relatively long distance, coupled with the history of glaciation in Southeast Alaska, suggests that spruce grouse on islands and the mainland of Southeast Alaska have been separated for over 10,000 years (Dickerman and Gustafson 1996, Nowacki et al. 2001). During the CBC, which has been conducted nationwide since 1901, two spruce grouse were observed in Skagway in 2005 and one in Haines in 1981 (National Audubon Society 2002). There are six records of spruce grouse on the mainland, including Haines and British Columbia (specimens #39738, 39739, 39740, 39741 42003, 42013; University of Alaska Museum of the North, Fairbanks, Alaska). Johnson et al. (2008) conducted bird surveys on 11 mainland rivers in Southeast Alaska and noted spruce grouse (two females with broods) on only the Chilkat River near Haines.

The range of spruce grouse overlaps broadly with other grouse, although their distributions tend to be parapatric (adjacent, narrowly overlapping) rather than sympatric (broadly overlapping) (Boag and Schroeder 1992). Sooty grouse (*Dendragapus fuliginosus*) are not found on POW Island and many islands to the west, although they are present in other parts of Southeast Alaska (Gabrielson and Lincoln 1959, Smith et al. 2001). There is no evidence of sooty grouse and spruce grouse overlapping on the same island in Southeast Alaska (Swarth 1911, Rabe 2006).

Spruce grouse are considered rare (common terminology for the abundance of birds is: common, uncommon, rare, casual or accidental, not known to occur) in all seasons in Southeast Alaska (Armstrong 2008). A comparison of home ranges between POW spruce grouse and spruce grouse in other parts of their range suggests that: (1) POW spruce grouse occupy larger home ranges than mainland spruce grouse; 211 ha (521 ac) versus 24 ha (59 ac), respectively, and (2) POW spruce grouse generally exist in lower breeding season densities; 2.5 birds/100 ha (247 ac) versus 0-83 birds/100 ha (247 ac), respectively (Boag and Schroeder 1992, Russell 1999, Williamson et al. 2008). Estimates of home range size and density are likely biased low, largely due to difficulties in observing POW spruce grouse in the dense vegetation in the forests of Southeast Alaska (Russell 1999).

Population Estimates/Status

Despite considerable effort, a reliable survey method for estimating population size and trend of POW spruce grouse does not exist. Russell (1999) and Nelson (2010) attempted to develop and test survey methodology on north POW Island, but the low encounter rates and cryptic behavior of this subspecies, coupled with the difficult terrain and dense vegetation within its range

prevented the estimation of abundance, occupancy, or other population-level metrics. Driving surveys, particularly on logging roads during rain-free periods in September and October, were the most productive method, but resulted in only 1 bird sighted per 1,130 km (702 mi) driven ±232 km (144 mi; standard error; Nelson 2010). Detection probabilities of POW spruce grouse estimated using an occupancy modeling framework were very low; surveyors using dogs to assist in locating a known bird in a 0.25 x 0.25 km (0.2 mi) grid resulted in a 25% detection rate, and surveyors alone detected birds 29% of the time (Nelson 2010). Despite the difficulties, there are two population estimates of POW spruce grouse; however, both were derived based on numerous assumptions of unknown reliability and should be interpreted with caution.

Using data collected as part of a habitat relationship study, Russell (1999) calculated the hectares of habitat on POW Island that was "available" to POW spruce grouse using habitat use information from radio-marked birds, and then divided the "available" habitat by the average home-range size of radio-marked POW spruce grouse, adjusting for the potential overlap of grouse within home-ranges. Russell (1999) proposed a population estimate of 10,500 POW spruce grouse on POW Island, and divided that by the available habitat to estimate a breeding season density of 2.5 birds/100 ha (247 ac) within potentially occupied habitat. These estimates should be considered with caution because they were based on few samples and the accuracy of the estimates is unknown (i.e., no associated variance was reported). Further, Russell (1999) estimated home-ranges of radio-marked POW spruce grouse by primarily relocating birds with triangulation (little visual confirmation) and used these estimates to quantify the degree of overlap in home-ranges. Most of Nelson's (2010) relocations of radio-marked grouse were visually confirmed, and other grouse were associated with the marked birds occasionally, suggesting that there may be more overlap in grouse ranges than assumed by Russell (1999).

Williamson et al. (2008) calculated rough estimates of spruce grouse populations based on potentially occupied habitat, predicted density, and estimated habitat patch occupancy of spruce grouse. These estimates are calculated using a simplified model, and are intended to be used only as baselines for future work (Williamson et al. 2008). They estimated the population of spruce grouse in the United States and Canada to range from 5,003,487 to 16,553,287; the population within Bird Conservation Region (BCR) 5, which extends from the Kenai Peninsula to California, is estimated to be around 8,300 (Williamson et al. 2008). Within BCR 5, spruce grouse only occur in Southeast and south-central Alaska and therefore, we assume that the population size of POW spruce grouse is smaller than 8,300 birds. There are two issues with this estimate that necessitate caution: (1) the forest inventories (different from ones used by Russell (1999)) that were used to calculate potentially occupied habitat were incomplete for Alaska, thereby underestimating the available habitat for grouse (Williamson et al. 2008), and (2) the authors used the POW spruce grouse density estimate proposed by Russell (1999), which is of unknown accuracy.

Although there is no reliable estimate of POW spruce grouse population size, island biogeography theory suggests that island populations exist in lower densities than similar areas on mainland, and more isolated islands will have smaller populations; therefore, the population of POW spruce grouse is assumed to be low (MacArthur and Wilson 1967). The POW spruce grouse was designated in the ADFG's Comprehensive Wildlife Conservation Strategy as a landbird species closely associated with mature forests and sensitive to forest management

(ADFG 2006). Primary reasons for the classification were extreme vulnerability to threats, including forest management, because of its small population and restricted range (ADFG 2006). This subspecies has not been ranked globally or within the state of Alaska by NatureServe (ADFG 2006). The POW spruce grouse is listed under Audubon Alaska's WatchList, which highlights declining or vulnerable bird populations that warrant research, and potentially protection (Stenhouse and Senner 2005). Audubon Alaska's WatchList identifies the relative abundance, breeding distribution, and threats during the breeding and nonbreeding season of POW spruce grouse as a concern, and describes it as a small and restricted population (Stenhouse and Senner 2005). The International Union for the Conservation of Nature Red Book lists spruce grouse as "lower risk;" however, POW spruce grouse, specifically, are not listed (Storch 2007).

THREATS:

The threats analysis examines the five factors currently affecting the POW spruce grouse, or that are likely to affect the species within the foreseeable future. Foreseeable future is evaluated for each threat. Section 4 of the Act (16 U.S.C. 1533) and implementing regulations (50 CFR part 424) set forth procedures for adding species to, removing species from, or reclassifying species on the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, a species may be determined to be endangered or threatened based on any of the following five factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;
(B) Overutilization for commercial, recreational, scientific, or educational purposes;
(C) Disease or predation;
(D) The inadequacy of existing regulatory mechanisms; or
(E) Other natural or manmade factors affecting its continued existence.

In considering what factors might constitute threats, we must look beyond the mere exposure of the species to the factor to determine whether the species responds to the factor in a way that causes actual impacts to the species. If there is exposure to a factor, but no response, or only a positive response, that factor is not a threat. If there is exposure and the species responds negatively, the factor may be a threat and we then attempt to determine the significance of the threat. If the threat is significant, it may drive or contribute to the risk of extinction of the species such that the species warrants listing as threatened or endangered as those terms are defined by the Act. This does not necessarily require empirical proof of a threat. The combination of exposure and some corroborating evidence of how the species is likely impacted could suffice. The mere identification of factors that could impact a species negatively is not sufficient to compel a finding that listing is appropriate; we require evidence that these factors are operative threats that act on the species to the point that the species meets the definition of threatened or endangered under the Act. Threats from the five factors are discussed below.

To evaluate threats we must also define what our foreseeable future for those threats is. Foreseeable future encompasses the foreseeability of threats and the foreseeability of the impact of those threats on the species. Foreseeable future extends only so far as we can depend on data to formulate a reliable prediction. We may not rely on assumption, speculation, or preconception.

Lack of information population data in the case of POW spruce grouse inhibits our ability to see how threats will affect the species into the future. We do not know what the population number is, if it has increased or decreased in the past, or if it will increase or decrease in the future. What we do know is that TLMP, which guides management activities for a majority of the species' habitat, will not be revised for the next 15 years. As explained below, within this time frame, land management activities are expected to create favorable habitat for the species. We also anticipate that within this time frame a method for population survey and monitoring will be developed and implemented, and that population trends can subsequently be documented, allowing us to evaluate if any of the potential threats identified in the five factor analysis truly are threats.

Because the lack of data greatly reduces our ability to see into the future, we have selected a foreseeable future of 15 years for all threats. We have selected this short time span primarily because land management practices within this time frame should stay stable and favorable, it provides enough time for survey methods to be developed and implemented, it will allow us to develop and implement conservation actions with our partners, and it will allow us sufficient time to determine if any threats are having a negative impact on the population.

A. <u>The present or threatened destruction, modification, or curtailment of its habitat or range.</u> Within Southeast Alaska, timber harvest has occurred disproportionately in the range of the POW spruce grouse. On POW Island, in particular, there has been extensive and intensive, broad-scale clearcutting, fragmenting the island into a patchwork of uniform-aged, forest stands less than 50 years old and a widespread road system. Between 1954 and 2005, approximately 20% of the total land area and 25% of the original productive old-growth on POW and surrounding islands was logged (Brinkman et al. 2009). The majority (32%) of old-growth was taken from northern POW Island compared to a smaller portion (10%) taken from southern POW Island (Albert and Schoen 2007). Although this geographic distinction is not biologically meaningful to the POW spruce grouse, logging did not occur uniformly across the island and therefore, any impacts from logging would be more prevalent in the northern part of the island. Similar logging practices have occurred on surrounding islands where POW spruce grouse are known or expected to occur (productive old-growth logged: 20% on the Dall Island complex, 13% on the Outside Islands (Kosciusko, Warren, Heceta, Tuxekan, San Fernando, and Suemez Islands), and 16% on Etolin and Zarembo Islands; Fig. 3; Albert and Schoen 2007).

Although past timber harvest on POW and surrounding islands was extensive, the USFS, the primary land manager in the region, recently shifted their land management practices from broad-scale timber harvest to forest restoration, second-growth management, and smaller-scale logging (USDA Forest Service 2008). Within the TLMP, the foundation for protecting fish and wildlife habitats on the Tongass National Forest is the implementation of the Conservation Strategy; the framework of the strategy consists of a series of old-growth reserves of differing sizes and a set of management standards and guidelines aimed at providing connectivity within the reserve system (USDA Forest Service 2008). Some of the remaining intact, old-growth forests within the POW spruce grouse distribution are protected from future development in old-growth reserves: 14% on northern POW Island, 42% on southern POW Island, 43% on the Dall Island complex, and 42% on the Outside Islands (Albert and Schoen 2007). There are also wildlife management guidelines for specific species (e.g., Queen Charlotte goshawk) and the

POW spruce grouse likely benefits from the implementation of these forest guidelines that are intended to sustain old-growth associated species and resources and preclude the need for listing additional species under the Endangered Species Act (USDA Forest Service 2008). The TLMP is not expected to need revision for approximately the next 15 years.

Despite extensive logging within the range of the POW spruce grouse, it is difficult to assess effects of the modified landscape on grouse populations for several reasons. First, pre-timber harvest data on the POW spruce grouse do not exist. Consequently, there is not a baseline with which to compare current population size or trend. Second, POW spruce grouse is a habitat generalist, using a variety of habitats, including old-growth, second-growth, and mixed conifer (i.e., scrub) forests and muskegs. This species does not appear to depend on productive old-growth forests, the target of logging operations, for survival or reproduction, but instead selects a variety of microhabitats within coniferous forests that contain horizontal diversity (Russell 1999). Third, the relationship between clearcut logging and POW spruce grouse abundance, survival, and reproduction likely changes with vegetation succession. For example, POW spruce grouse avoid young (<5 years) clearcuts presumably because large amounts of debris inhibit movement, increased exposure to predators, and lack of food, but as the understory vegetation peaks after 15-25 years, grouse probably benefit from increased berry production and cover for chicks (Russell 1999, Alaback 1982). This advantageous period for grouse is then followed by forest conditions that are unfavorable such as canopy closure, high stem densities, and little understory vegetation due to reduced light; these conditions can persist up to 150 years after clearcut logging (Wallmo and Schoen 1980, Alaback 1982, Russell 1999). The USFS is currently developing a second-growth management plan for POW Island that includes thinning and gapping of forests less than 50 years old; these silvicultural practices will likely encourage structural and horizontal diversity beneficial to grouse (Russell 1999). Past timber harvest on POW and surrounding islands has most likely had some level of effect on POW grouse populations, but data do not exist to quantify the past, present, or future effect, or the direction of the effect (positive or negative) with any certainty.

Roads are generally associated with negative effects on the biological integrity of terrestrial ecosystems, including direct mortality from vehicle strikes and increased human contact such as hunting (Trombulak and Frissell 2000). There are at least 4,000 km (2,485 mi) of roads on POW and the surrounding islands to the west, which are within the range of POW spruce grouse (Brinkman et al. 2009; Fig. 3). Approximately 2,900 km (1,802 mi) of those roads are open to the public, and 2,300 km (1,429 mi) are managed by the USFS (Brinkman et al. 2009); these totals do not include Zarembo Island, another roaded island within the range of the POW spruce grouse. POW Island (6,675 km^2 (2,577 mi^2)) contains approximately 2,604 km (1,618 mi) of open roads averaging 4.3 m (14 ft) in width (R. Kubitza, personal communication); after extrapolation, the total area of open roads on POW Island is at least 11.2 km^2 (4.3 mi^2). Although the amount of land actually disturbed by roads is relatively small (less than 0.2% of the island area), public road access creates opportunities for POW spruce grouse to be struck by vehicles and facilitates hunter access. POW spruce grouse found along road systems are the most vulnerable to harvest, whereas birds in unroaded areas have little chance of being harvested (Rabe 2009). During two field studies (with limited sample size), 42-44% of the mortalities of radio-marked POW spruce grouse were road-related as either road strike or hunter harvest (Table 2; Russell 1999, Nelson 2010). POW spruce grouse have been observed gritting and feeding

along roads, and hens with broods probably use roads to aid in dispersal (Nelson 2010). Road strike accounted for 17-22% of the mortalities of radio-marked birds; these values are comparable to hunter harvest (Table 2; Russell 1999, Nelson 2010). In 2009, the USFS received economic stimulus funds through the American Recovery and Reinvestment Act for road maintenance and decommissioning and intends to close approximately 1,500 km (932 mi) of roads on POW and surrounding islands (approximately 38-40% of the existing roads; Brinkman et al. 2009, Nelson 2010). These road closures will benefit POW spruce grouse.

To conclude, although extensive and intensive timber harvest has occurred within the range of the POW spruce grouse, this species uses a variety of habitats, selecting for horizontal diversity on the landscape. We lack sufficient data on population size prior to and after timber harvest and therefore, are unable to estimate population trend in relation to harvest statistics; regardless, the relationship between POW spruce grouse and timber harvest is complex with populations likely fluctuating with plant succession. Furthermore, we do not anticipate the continuation of broad-scale clearcutting, as has occurred in the past; in fact, forest management on POW Island and surrounding islands has transitioned away from timber harvest and toward forest restoration and second-growth management. We therefore conclude, based on the best scientific information available, that the present or threatened destruction, modification, or curtailment of POW spruce grouse habitat or range is not a significant threat to the species now or in the foreseeable future.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
Spruce grouse are cryptic and freeze to avoid predation; once spotted, spruce grouse are easily killed by hunters, making this species susceptible to overharvest especially near roads and human populations (Gabrielson and Lincoln 1959, Storch 2007, Williamson et al. 2008). Although based on limited sample size, recreational hunters were responsible for 25-33% of the mortalities of radio-collared POW spruce grouse, but these values may be biased high because all of these birds were initially captured on or near roads (Table 2; Russell 1999, Nelson 2010). However, a complex matrix of roads intersects much of northern POW, Heceta, western Kosciusko, Tuxekan, and Zarembo Islands and therefore, the hunter-caused mortality observed in these studies is likely representative of hunting effects in other areas with similar road networks, assuming that hunter effort is constant. There are no consistent, ongoing programs monitoring the harvest of POW spruce grouse by hunters (Rabe 2009). Therefore, there are insufficient data to estimate the proportion of the population being taken by hunters.

ADFG implemented a short-term wing collection program and hunter survey to understand the abundance and distribution of spruce grouse and bird hunters in Southeast Alaska (Rabe 2009). Seventy-eight hunters participated in the program, submitting 240 unique samples between 2006 and 2008. Only 24 of those samples were spruce grouse (the remainder were sooty grouse) collected from Zarembo, POW, and San Fernando Islands (Rabe 2009). ADFG estimated there to be 4,400 grouse and ptarmigan hunters in Southeast Alaska; 70% of the respondents identified themselves as “dedicated” and 30% were “opportunistic” hunters (estimates specific to the POW spruce grouse range were not reported; Rabe 2009). Peak hunting periods are April-May and September-October (Rabe 2009). In total, Rabe (2009) estimated an annual harvest of 6,600 sooty and spruce grouse in Southeast Alaska in 2003; extrapolations from the wing collection program result in 660 POW spruce grouse taken by hunters in 2003 (Rabe 2009). Because we lack a reliable population estimate, we are unable to evaluate whether hunting mortality could be

leading to overutilization of the POW spruce grouse, but Rabe (2009) reported that the annual harvest of POW spruce grouse is small and localized. ADFG regulates the recreational take of the POW spruce grouse by setting daily bag limits; the Alaska Board of Game considers regulation changes on a region-based schedule with each region of Alaska being discussed on a two-year cycle.

There is no commercial harvest of POW spruce grouse, and we are not aware of any collection for educational purposes. The capture and radio-marking of POW spruce grouse has occurred for two research projects (Russell 1999, Nelson 2010). One POW spruce grouse died, apparently due to stress from researcher handling (Russell 1999); however, further studies did not have any capture-related injuries (Table 2; Nelson 2010).

Overutilization for commercial, scientific, and educational purposes does not occur. Recreational harvest of POW spruce grouse does occur but it is regulated and we have no evidence that the current level of take is leading to a population decline. Therefore, based on the best scientific information available, we conclude that overharvest from commercial, scientific, recreational, or education purposes is not a threat to POW spruce grouse now or in the foreseeable future.

C. Disease or predation.

Although many parasites have been reported in spruce grouse, none appear to be significant factors in mortality (Boag and Schroeder 1992). There have been no studies on disease in POW spruce grouse, and based on studies of other species of spruce grouse, we conclude that disease in not a threat to the population.

Predation is a major source of mortality of spruce grouse across their range (Boag and Schroeder 1992). Avian and mammalian predators were the cause of death for 25-44% of radio-marked spruce grouse on POW Island (Table 2; Russell 1999, Nelson 2010); these predation rates are similar to those reported for spruce grouse in other parts of North America (Boag and Schroeder 1992). POW spruce grouse may have been reduced in population size by the introduction of marten (MacDonald and Cook 2007) and the expansion of barred owls, which are known to hunt diurnally (Kissling and Lewis 2009), to POW and nearby islands. Although marten and barred owls are generalist predators, consuming a variety of prey including small mammals, fish, birds, and berries, both species prey primarily on small mammals throughout the year (Mazur and James 2000, Flynn et al. 2004). The risk of predation is greater in open areas that do not provide cover, such as young (<5 years) second-growth forests or muskegs, where POW spruce grouse may be more visible to predators (Russell 1999). In other parts of North America, predation was the primary cause of mortality of spruce grouse immediately following logging; reduced survival thereby decreased density by 60% (Turcotte et al. 2000). POW spruce grouse were the most frequent prey delivered to nests by Queen Charlotte goshawks on POW Island (18% of the diet of goshawk nestlings) and were abundant in the diet throughout the nesting season, with the highest proportion taken in early July (Lewis et al. 2006). Lewis et al. (2006) concluded that POW spruce grouse were an important part of the Queen Charlotte goshawk diet and speculated that this was especially true in the winter when migratory birds are no longer available.

To conclude, there is no evidence that predation rates of POW spruce grouse are high compared to other parts of the spruce grouse range in North America. The range expansion (barred owl) and introduction (marten) of predators to POW Island may have affected spruce grouse locally, but we lack information on population size and trend of POW spruce grouse to evaluate whether changes in the predator community have had a population-level effect on spruce grouse. Spruce grouse coexist with these predators in other parts of their range, and likely have evolved strategies to protect them from these predators. Although timber harvest initially reduced forest cover, increasing exposure of POW spruce grouse to predators, regeneration within those stands has begun, and based on the TLMP we do not anticipate significant harvest of remaining old-growth forest stands in the near future, but instead expect land managers to harvest mature, second-growth stands, which will maintain protective cover.

Newly introduced predators on islands can have a marked effect on susceptible populations. However, no effect has been detected for POW spruce grouse. This may be because they evolved with these predators on the mainland and have retained strategies that protect them from predation. We have no evidence that disease or predation is negatively affecting POW spruce grouse. Consequently, based on the best scientific information available, we conclude that predation is not a threat to POW spruce grouse now or in the foreseeable future.

D. The inadequacy of existing regulatory mechanisms.

POW spruce grouse on USFS land are protected through the implementation of the National Environmental Policy Act (NEPA), as well as the TLMP (USDA Forest Service 2008, USEPA 2010). NEPA was established for the protection, maintenance, and enhancement of the environment; the NEPA process involves the evaluation of the environmental effects of a federal undertaking, including any alternatives (USEPA 2010). All federal agencies are required to conduct the NEPA process when implementing major federal actions significantly affecting the environment. The findings of the process must be incorporated into the agency's decision making process (USEPA 2010). Because approximately 75% of the POW spruce grouse range occurs on USFS land, the majority of its habitat is covered through NEPA analysis.

A final Environmental Impact Statement (part of the NEPA process) was written to evaluate the TLMP. The TLMP operates under the regulation and guidelines of the National Forest Management Act, and guides all natural resource management activities, as well as establishing standards and guidelines for the forest (USDA Forest Service 2008). The TLMP guidelines include coordinating and collaborating with state and federal agencies on wildlife habitat planning, as well as conducting wildlife habitat improvement, and maintenance (USDA Forest Service 2008). Within the TLMP, the foundation for protecting fish and wildlife habitats on the Tongass National Forest is the implementation of the Conservation Strategy; the framework of the strategy consists of a series of old-growth reserves of differing sizes and a set of management standards and guidelines aimed at providing connectivity within the reserve system (USDA Forest Service 2008). Because the goal of the Conservation Strategy is to maintain habitat characteristics that most likely will be favorable to POW spruce grouse, we assume that implementation of the TLMP will maintain suitable habitat for the species.

Because POW spruce grouse do not migrate across international boundaries, they are not protected by the Migratory Bird Treaty Act.

ADFG hunting regulations on POW Island and surrounding islands allow the take of five grouse per day per hunter and a limit of ten grouse in possession, with an open season from August 1 to May 15 (ADFG 2010b). ADFG regulates the recreational take of the POW spruce grouse by setting daily bag limits; the Alaska Board of Game considers regulation changes on a region-based schedule with each region of Alaska being discussed on a two-year cycle. Therefore, ADFG can change the regulations for POW spruce grouse if, and when, it is determined that recreational harvest is having a detrimental effect on the population.

Because we do not have population abundance or trend information for this subspecies, it is unknown if the current harvest regulations are adequately protecting the POW spruce grouse. The efficacy of these regulations should be revisited after additional research is completed, and conservation agreements are put into place (as discussed below). We cannot link a population decline to a lack of regulatory mechanism; consequently, we conclude that lack of regulatory mechanisms is not a threat to POW spruce grouse now or in the foreseeable future.

E. Other natural or manmade factors affecting its continued existence.

Populations of POW spruce grouse are relatively small in size and only inhabit islands; these characteristics increase extinction risk of this unique subspecies. Small populations of endemic species on islands are particularly susceptible to extinction and extirpation due to their vulnerability to habitat loss and fragmentation, the introduction of exotic species, and over exploitation (Thomas et al. 2004, Cook et al. 2006). Island populations of endemic species in Southeast Alaska have lower genetic variability compared to populations on the continental mainland, decreasing their likelihood to adapt to environmental changes and increasing their risk of stochastic extinction (Frankham et al. 2002, Cook et al. 2006). However, this species has persisted through habitat modification and timber harvest, which was much higher during the 1970s-1990s, when the human population on POW Island was greater due to logging operations and timber harvest was at its peak.

Storch (2007) reported that the greatest challenges to grouse worldwide are climactic changes that degrade habitat and reduce survival or reproductive success. For example, the timing of both lekking and hatching of black grouse (*Tetrao tetrix*) in the United Kingdom has changed in response to insect availability, which is critical to early life survival of young (Visser and Both 2005). Over the next 100 years, Southeast Alaska is predicted to experience increased summer and winter temperatures and rain (as opposed to snow), causing a cascade of biological and ecological effects (Haufler et al. 2010). Since 1971, temperature in Juneau has increased by 1.97 degrees Centigrade (C; 3.54 degrees Fahrenheit (F)) compared to the statewide increase of 1.49 degrees C (2.69 degrees F; Haufler et al. 2010). Predicted impacts to Southeast Alaska include an increased growing season, rise in sea levels, and greater storm intensities; forests will expand into alpine areas and dried wetlands, insect outbreaks will increase, and invasive species are expected to encroach (Haufler et al. 2010). Evapotranspiration ratios are expected to change as a result of increased growing seasons, which could affect the timing of snowfall, peak runoff, and the amounts and occurrence of snow cover (Haufler et al. 2010). In addition, warmer temperatures may increase evapotranspiration rates, causing drier conditions, which could lead to fires, and the potential for spruce beetle (*Dendroctonus rufipennis*) invasions (Haufler et al. 2010).

It is difficult to anticipate effects of climate change on the POW spruce grouse, specifically, but their apparently small population size and limited ability to disperse may make them more vulnerable to rapid or immediate changes in habitat, food sources, insects, or predators. However, some predicted changes, such as forests expanding into alpine areas (Haufler et al. 2010), would probably benefit POW spruce grouse by increasing cover, winter food availability, and possibly dispersal corridors, thereby facilitating genetic exchange of grouse among watersheds. Other predicted changes within their range that may occur rapidly, such as pathogen or insect irruptions, may have demographic and ecological impacts to populations of POW spruce grouse (Williamson et al. 2008). We anticipate that changes in habitat, food sources, insect outbreaks, and invasive species as a result of climate change may occur, but the timing and magnitude of change are unknown. POW spruce grouse is a habitat generalist and, since the 1970s, this species has persisted through significant and immediate habitat modification as a result of timber removal and harvest by humans. It has therefore demonstrated adaptability and plasticity to a changing environment which we believe will also enable the species to adapt to a changing climate. In addition, changes in land management practices (e.g., second-growth management) on POW Island should benefit this species, mitigating potential negative effects of climate change.

Although island species are generally more vulnerable to extinction, POW spruce grouse has demonstrated resiliency in the face of habitat modification, most likely because it is a habitat generalist, utilizing a variety of habitats. Based on the best scientific information available, we conclude that neither climate change nor other natural or manmade factors threaten the POW spruce grouse now or in the foreseeable future.

Conclusion

Despite their endemic status on an isolated group of islands where logging, road building, and subsequent fragmentation have occurred, there is a general lack of information about POW spruce grouse, including their distribution, population size, trends, and habitat requirements. In the absence of these data and without making unsupported assumptions, we cannot conclude that POW spruce grouse populations have been negatively impacted by previous timber harvest and subsequent fragmentation of the landscape, primarily because this species is a habitat generalist, using a variety of habitats. Planned changes in land management on POW Island, including second-growth management and decommissioning of logging roads, are currently being implemented by the USFS and should benefit this species. In addition, we have had positive discussions with ADFG regarding changes in hunting regulations for the POW spruce grouse; we will continue to work closely with ADFG to propose changes to the regulations that will benefit and reduce risk to this endemic subspecies. We currently have no information that clearly links any threat to a decline in population number. We acknowledge that there are several gaps in our knowledge that need to be filled, in particular, developing an effective population sampling protocol and instituting systematic sampling so population number and trends can be determined. It will be important to revisit the status of this species again.

We find that the threats are not of sufficient imminence, intensity, or magnitude to indicate that the POW spruce grouse is in danger of extinction (endangered) or likely to become endangered within the foreseeable future (threatened), throughout all or a significant portion of its range.

Therefore, we conclude that POW spruce grouse should not be listed as threatened or endangered.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED:

There are no known conservation agreements.

RECOMMENDED CONSERVATION MEASURES:

Proactive conservation measures can be taken in an attempt to protect this species and ensure its persistence into the future. The implementation of these conservation and management needs will require the support of Federal and State agencies, private landowners and corporations, as well as universities and non-governmental organizations.

Research:
Barry and Tallmon (2010) verified the POW spruce grouse subspecies using genetic techniques, but the observed high levels of allele frequency divergence between populations on POW and Zarembo Islands needs to be further explored. If island populations of spruce grouse in Southeast Alaska are indeed reproductively isolated, the implications for management and conservation would be substantial. We recommend collecting additional genetic samples from islands surrounding POW Island to determine the level of divergence within and among island populations.

The genetic distinctness (Barry and Tallmon 2010), in conjunction with the assumed limited distribution of this subspecies, emphasizes the importance of monitoring both its population size and threats (Rabe 2009). We recommend development, testing, and implementation of an effective population monitoring protocol to determine population size, trend, distribution, and density of POW spruce grouse. This task has been attempted previously, but a reasonable and sound protocol has not been produced to date (Russell 1999, Rabe 2009, Nelson 2010). Adequate time, resources, and expertise will be critical in the success of this task. This information will help identify important areas and habitats for conservation, as well as monitor potential changes associated with climate change.

Given the extensive and intensive, broad-scale timber harvest that has occurred on POW Island, we recommend evaluating the efficacy of second-growth timber management strategies (e.g., thinning, gapping) on populations of grouse by monitoring before and after changes using experimental design. This information will aid in future management actions and will assist in evaluating the potential effects from previous timber harvest, especially clearcutting.

Management:
Road-related effects to POW spruce grouse merit attention. We suggest decommissioning old logging roads, as is already planned, in areas of high grouse use (Brinkman et al. 2009). We recommend developing and implementing a road management plan for POW Island that considers key dispersal times (September and October, April and May) of the POW spruce grouse.

POW spruce grouse appear to rely on horizontal diversity and select a variety of habitats (Russell 1999). We recommend identifying and protecting corridors of contiguous habitat that contain key features, including connectivity of high-volume old-growth forest and scrub forest, maintaining horizontal diversity, and creating small clearings and horizontal diversity on previously harvested forests (Russell 1999, ADFG 2006, Storch 2007).

We recommend quantifying the level of POW spruce grouse harvest. We recommend requiring hunters to report where they are hunting (island, watershed, road, off-road), number of birds taken, and submitting samples for continued genetic work and verification of identification. This information would be helpful in evaluating and justifying changes to management guidelines (e.g., bag limits, season) and, if necessary, closure of critical POW grouse habitat to hunters. We recommend shortening the hunting season and reducing the bag limit to allow hens with broods to disperse with fewer risks. Specifically, we suggest delaying the start of hunting season until after 15 October, and shortening the season to end in early April. Given the presumably small population, restricted distribution, and the apparent low annual survival of breeding birds, the POW spruce grouse would benefit from more strict hunting regulations and season. This is particularly true in the fall (September-October) when broods are still together and are frequently encountered on roads.

Collaboration:
The collaboration of stakeholders will be crucial in creating a conservation solution for the POW spruce grouse. To date, interest and collaboration with key partners has been outstanding and we believe many gains in conservation of POW spruce grouse could be accomplished by fostering those partnerships. We propose meeting with stakeholders in early 2011 to begin drafting a collaborative conservation agreement, and conducting follow up meetings as needed.

DESCRIPTION OF MONITORING:

None of the broad-scale bird monitoring efforts on POW Island and surrounding islands adequately monitors population size or trend of POW spruce grouse. The Alaska Landbird Monitoring Survey (ALMS), BBS, and CBC were not designed to monitor this species and, in fact, POW spruce grouse are rarely recorded during any of these surveys despite sufficient spatial coverage (National Audubon Society 2002, Sauer et al. 2008). An effective population monitoring protocol specific to this species needs to be developed and implemented.

COORDINATION WITH STATES:

The ADFG nominated the POW spruce grouse to be a landbird priority species in their Comprehensive Wildlife Conservation Strategy (ADFG 2006). This strategy recommends several conservation priorities and goals for the subspecies. The ADFG has used Section 6 funding to address high priority needs related to the POW spruce grouse. Biologists and managers from State (ADFG) and Federal agencies (USFWS, USFS) have met formally on two occasions (March 2004, September 2009) in Thorne Bay to coordinate and prioritize information needs and to discuss management and conservation opportunities.

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APPROVAL/CONCURRENCE:

Approved: _____ 9/29/2010
ACT Regional Director, Fish and Wildlife Service Date

Concur: _____ _____
Director, Fish and Wildlife Service Date

Do not concur: _____ _____
Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review:
Conducted by: