Northern Pacific Rattlesnake (*Crotalus viridis oreganus*)

Conservation Status—The northern Pacific rattlesnake is one of two western rattlesnake (*Crotalus viridis*) subspecies occurring in Oregon. Populations of the northern Pacific rattlesnake in the Willamette Valley are not designated as Sensitive by ISSSSP but are designated as Oregon Conservation Strategy species (ODFW 2006). The subspecies has no federal special status. Willamette Valley populations of *C. v. oreganus* are believed to be threatened by the loss of grassland habitat and a long history of persecution by humans (ODFW 2006).

Systematics & Distribution— The phylogenetic relationships of the western rattlesnake are currently being reconsidered by taxonomists. Up to nine subspecies of *C. viridis* have been previously recognized (Klauber 1996), but recent mitochondrial DNA studies have found evidence of only five divergent populations organized within two major clades that are divided geographically by the Rocky Mountains (Pook et al. 2000, Ashton and de Queiroz 2001). Ashton and de Queiroz (2001) recommend abandoning the traditional classification of subspecies within *C. viridis* and propose recognizing the two major clades as separate species: *C. viridis* to include *C. v. viridis* and *C. v. nuntius*; the remainder of the previously recognized subspecies (including *C. v. oreganus*) as *C. oreganus*. Although the arguments for revising the taxonomy of *C. viridis* by Pook et al. (2000) and Ashton and de Queiroz (2001) are compelling, we have retained the previous subspecies classification and use northern Pacific rattlesnake (*C. v. oreganus*) in this account to remain consistent with the nomenclature currently accepted by the Oregon Department of Fish and Wildlife (ODFW).

The northern Pacific rattlesnake occurs in two disjunct geographic ranges: the southern range that includes the Klamath Mountains physiographic province in northwest California and the major interior valleys of western Oregon (i.e. Rogue, Umpqua, and Willamette Basins); the northern range encompasses the Blue Mountains and the sagebrush-steppe of the Columbia Basin in Washington and British Columbia (St. John 2002). The northern Pacific rattlesnake is distributed along a greater elevational range than any other *Crotalus* subspecies: from sea-level to 6,900 ft in Oregon (Klauber 1996).
A second subspecies, *C. v. lutosus* (Great Basin rattlesnake) is distributed throughout much of the Great Basin physiographic province in Oregon, Nevada, and California (St. John 2002). The northern Pacific rattlesnake and Great Basin rattlesnake would both be recognized as the same species (i.e., western rattlesnake) according to taxonomic revisions recommended by Ashton and de Queiroz (2001).

In the Willamette Valley, there is evidence from anecdotal accounts and museum specimens that the northern Pacific rattlesnake once occurred in every county of the province, and was even a nuisance to quarry workers on the banks of the Columbia River (Klauber 1996). However, the species probably has never been widely distributed in the region because of the scarcity of

exposed bedrock for over-wintering habitat across most of the valley floor. The subspecies likely was more common in the southern portion of the Willamette Valley (Gordon 1939, St. John 1987). Steep foothills and isolated buttes may have supported localized populations in the northern Valley.

Today, the subspecies has been extirpated from most of the Valley. An extensive survey of amphibians and reptiles in the Willamette Valley conducted in 1984 and 1986-87 detected northern Pacific rattlesnakes at only 6 localities: near Mehama (Marion County); near Lebanon and Brownsville (Linn County); and in the Coburg Hills and near Eugene (Lane County; St. John 1987). The only localities that have confirmed continued presence of the subspecies since 2000 are near Mehama (A. St. John, pers. comm.), Eola Hills (Polk County; anonymous landowner, pers. comm.), and 6 locations in Lane County (B. Wolfer, pers. comm.; A. St. John, pers. comm.). Several *C. v. oreganus* have been captured or killed near Wren (Benton County) since 2007 (K. Harding, pers. comm.), but multiple individuals of *C. v. lutosus* have also been discovered contemporaneously, suggesting a deliberate or accidental release of both subspecies at the locality.

Ecology—The northern Pacific rattlesnake is adapted to a broader range of environments than any other subspecies of *C. viridis*. The subspecies can tolerate conditions at 11,000 ft above sea level in the Sierra Nevada Range, to the coastal redwood belt of northern California, as well as ponderosa pine forests in British Columbia (Klauber 1996). In the Willamette Valley, northern Pacific rattlesnakes are most closely associated with oak woodlands, mixed oak-madrone woodlands, and open stands of Douglas-fir and hardwoods on dry sites (St. John 1987). Rocky slopes, especially with south or west aspects, appear to be a crucial habitat element across the entire geographic range of the subspecies (Klauber 1996).

Seasonal activity radiates from the hibernacula, to which rattlesnakes display strong fidelity (Klauber 1996, Macartney 1985). Hibernacula usually are located in south- or southwest-facing talus slopes or where bedrock is exposed and fissured, permitting rattlesnakes to access underground chambers (Diller and Wallace 1984, Macartney 1985). Most known hibernacula in the Willamette Valley have been in exposed ledges of basalt or sedimentary rock (St. John 1987). In northern California, the subspecies may overwinter in mammal burrows (Fitch 1949). Dozens of rattlesnakes may aggregate in hibernacula and other species of snakes may use the same site (Klauber 1996, Diller and Wallace 2002). In northern Idaho, northern Pacific rattlesnakes typically retreat to hibernacula in mid-October (Wallace and Diller 2001).

Wallace and Diller (2001) reported that the median date at which northern Pacific rattlesnakes emerge from hibernation in Idaho was April 1. In Madera County, CA, rattlesnakes usually emerge in March (Fitch 1949). Upon emergence, rattlesnakes may remain in pairs or aggregations near the hibernaculum for a short period (Fitch 1949). Rattlesnakes then migrate to summer foraging areas following similar movement paths each year (Macartney 1985). Other *Crotalus* species have also been observed using the same travel corridors over multiple years (Neill 1948). In British Columbia, the median maximum distance that northern Pacific rattlesnakes were observed from their hibernaculum was 1.2 km (range 0.29-3.0 km; n=10; Bertram et al. 2001). Foraging habitat may be similar to the rocky slopes that characterize overwintering site, but rattlesnakes may also use meadows, pasturelands, or riparian areas on valley floors (Fitch 1949, Klauber 1996). Rattlesnakes are relatively sedentary within their summer ranges, making

occasional, circuitous movements between burrow systems of mammalian prey (Fitch 1949). In Northern California, the average home range was estimated to be 12.2 ha (30 ac) for adult males and 6.5 ha (16 ac) for adult females (Fitch 1949).

Females typically reach sexual maturity during their 4th year in northern Idaho (Diller and Wallace 2002). Females breed biennially in California and northern Idaho (Fitch 1949, Diller and Wallace 2002) and on a triennial cycle in British Columbia (Macartney and Gregory 1988). Mating activity demonstrates a bi-modal, seasonal pattern with peaks occurring soon after emergence from hibernacula in the spring and again in late fall before rattlesnakes move into dens (Diller and Wallace 2002). Young are born live (Fitch 1949). The maximum longevity of northern Pacific rattlesnakes was estimated to be more than 20 years (Fitch 1949).

The diet of adult northern Pacific rattlesnakes is largely composed of rodents; rabbits, birds, and lizards form a minor portion of their diet (Fitch 1939, Macartney 1989). Rodent populations often display regular cycles of abundance, thereby affecting prey availability for rattlesnakes. Diller and Wallace (2002) reported that the reproductive condition of female rattlesnakes was positively related to prey abundance during the previous year.

In California, red-tailed hawks (*Buteo jamaicensis*), great horned owls (*Bubo virginianus*), and coyotes (*Canis latrans*) are reported to be the most significant predators of juvenile rattlesnakes (Fitch 1939). Predation is not believed to be a significant source of mortality among adults (Fitch 1939; Diller and Wallace 2002).

Habitat Management/Restoration—Habitat loss to urban development, agriculture, and rock quarry operations are reported to be among the most widespread and severe threats to the persistence of northern Pacific rattlesnake populations (ODFW 2006, SIRART 2008). However, because of the discomfort most people have about living near rattlesnakes, recruiting volunteer landowners to undertake habitat improvements or other conservation actions to benefit the species will certainly be difficult. Nevertheless, during our research review we became aware of three private landowners in the Willamette Valley that are indeed deliberately leaving rattlesnakes undisturbed on their property.

Given the rarity of the northern Pacific rattlesnake in the Willamette Valley and its purported limited capability to make long-distance movements, habitat restoration projects further than perhaps a kilometer from active hibernacula are unlikely to be colonized for years and will have little effect on improving local population viability in the short term. Educating landowners that live within the home range of known populations as to the objective risks posed by rattlesnakes, as well as measures to minimize human-rattlesnake interactions, is likely to be more useful than habitat restoration projects in unoccupied areas.

Translocation of individuals to habitat strongholds has been used as a conservation strategy for a number of species-at-risk in the Pacific Northwest, including the Columbia basin pygmy rabbit, western pond turtle, and Fender's blue butterfly (Campbell et al. 2006). Short-distance translocation of western rattlesnakes has been investigated and is reportedly effective for maintaining small populations when appropriate habitat is provided and conflict areas are carefully managed (Brown et al. 2009). To our knowledge, translocation has not been proposed to

conserve the northern Pacific rattlesnake in the Willamette Valley, but the approach would seem to merit study given the serious declines of rattlesnake populations in the region.

Non-Habitat Limiting Factors— Persecution by humans has been the greatest threat to the northern Pacific rattlesnake and other *C. viridis* populations since European settlement. Individuals were systematically hunted and killed during annual "rattlesnake round-ups" that were held in many communities and hibernacula have been routinely destroyed by landowners on whose property they were located (Klauber 1996).

Rattlesnakes can be attracted to warm road surfaces to thermoregulate and road-related mortality is reported to be among the most serious threats to rattlesnake populations (SIRART 2008). It is also suspected that mechanized farming practices (e.g, tilling, crop harvesting) may also cause significant mortality (SIRART 2008).

The presence of large herds of livestock may also have had a deleterious effect on rattlesnake populations during the early settlement of the Willamette Valley. There is anecdotal, but widespread evidence that western rattlesnakes emigrate from intensively grazed areas, although it is unclear whether rattlesnakes are responding to vegetation changes, livestock activity, or both (Klauber 1996). During the late-nineteenth century, livestock numbers in the Willamette Valley increased dramatically. For example, it is estimated that there were 90,000 sheep and more than 30,000 hogs in Polk and Marion Counties by 1900 (Blok 1973). Livestock herds were largely unconfined on the landscape during the settlement period and hogs had a particularly severe impact on native habitats and wildlife (Boag 1992).

Repeated handling of rattlesnakes during the course of scientific studies may cause significant loss of mass in individuals (Fitch 1949) and was hypothesized to cause a serious decline in survival during a long-term population study conducted in Idaho (Diller and Wallace 2002).

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