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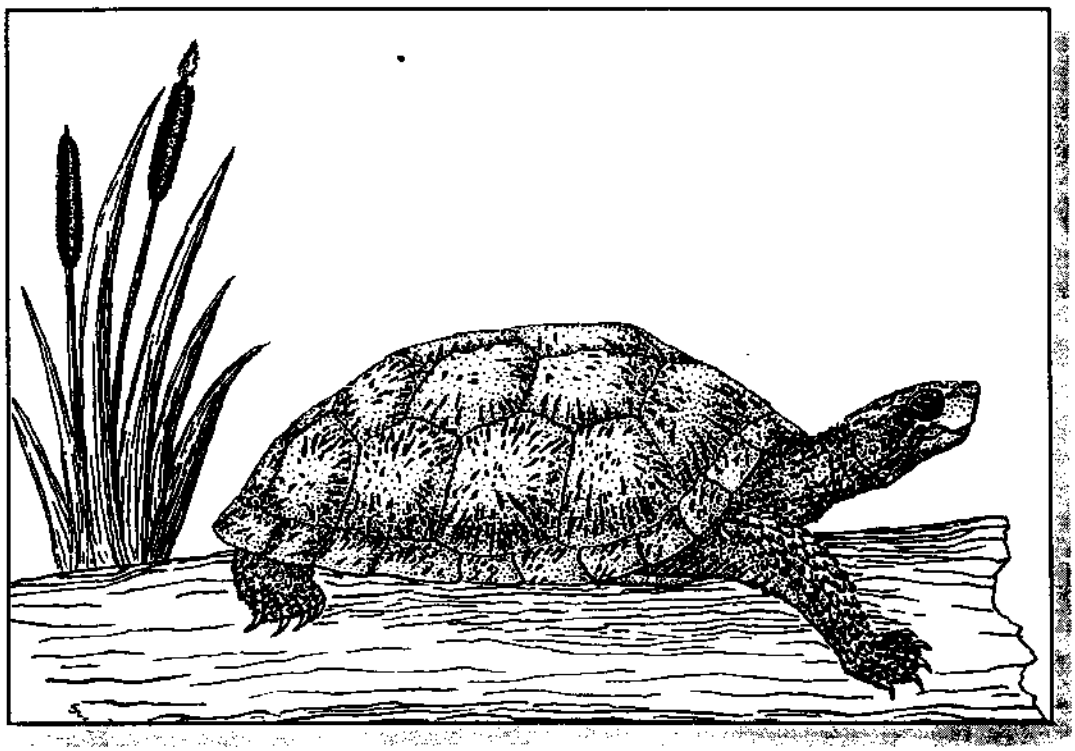
DEPARTMENT OF WILDLIFE

# Washington

July 1993



# STATUS OF THE WESTERN POND TURTLE *(Clemmys marmorata)* IN WASHINGTON

Washington
Department of Wildlife
Wildlife Management Division

The Washington Department of Wildlife maintains a list of endangered, threatened and sensitive species (Washington Administrative Codes 232-12-014 and 232-12-011, Appendix B). Species are evaluated for listing using a set of procedures developed by a group of citizens, interest groups, and state and federal agencies (Washington Administrative Code 232-12-297, Appendix B). The procedures were adopted by the Washington Wildlife Commission in 1990. They specify how species listing will be initiated, criteria for listing and delisting, public review, and recovery and management of listed species.

The first step in the process is to develop a preliminary species status report. The report includes a review of information relevant to the species' status in Washington including, but not limited to: historic, current, and future species population trends, natural history including ecological relationships, historic and current habitat trends, population demographics and their relationship to long term sustainability, and historic and current species management activities.

The procedures then provide for a 90-day public review opportunity for interested parties to submit new scientific data relevant to the status report and classification recommendation. During the 90-day review period, the Department holds one public meeting in each of its administrative regions. At the close of the review of the draft report, the Department completes a final status report and listing recommendation for presentation to the Washington Wildlife Commission. The final report, listing recommendation, and any State Environmental Policy Act findings are then released for public review 30 days prior to the Commission presentation.

This report is the Department of Wildlife's final Status Report and listing recommendation for the western pond turtle. The listing proposal will be presented to the Washington Wildlife Commission on August 14, 1993 at the Colville Community Center, Colville, Washington. Comments on the report and recommendation may be sent to: Endangered Species Program Manager, Washington Department of Wildlife, 600 Capitol Way N, Olympia, WA 98501-1091; or presented to the Wildlife Commission at its August 14 meeting.

This report should be cited as:

Washington Department of Wildlife. 1993. Status of the western pond turtle (*Clemmys marmorata*) in Washington. Unpubl. Rep. Wash. Dept. Wildl., Olympia.

# Status of the

# Western Pond Turtle (*Clemmys marmorata*)

# in Washington

July 1993

Washington Department of Wildlife
600 Capitol Way N
Olympia, WA 98501-1091

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## ACKNOWLEDGMENTS

This status report was compiled by Scott A. Richardson and has been drawn primarily from a Department of Wildlife contract report prepared by Dan C. Holland (1991c). It was improved after reviews by Dan Holland, Kate Slavens, and Kelly McAllister. The cover illustration was drawn by Siobhan Sullivan. The Department appreciates the interest shown and information provided by individuals who attended the public meetings or wrote letters concerning the status report and listing proposal.

# EXECUTIVE SUMMARY

The western pond turtle (*Clemmys marmorata*) is state-listed as a threatened species by the Washington Wildlife Commission. A proposal to list the species as threatened or endangered under the Endangered Species Act is under review by the U.S. Fish and Wildlife Service.

This species is a highly aquatic turtle that occurs in streams, ponds, lakes, and permanent and ephemeral wetlands. Western pond turtles spend much of their lives in water, but require terrestrial habitats for nesting, overwintering, and dispersal. Although generally wary they may be seen basking on emergent or floating vegetation, logs, rocks, and occasionally mud or sand banks. The diet of this species consists primarily of small invertebrates, carrion, and plant material. In Washington, the species overwinters in upland habitats adjacent to water bodies or in mud bottoms of lakes or ponds. Nesting occurs from May to August in hard soils with scant vegetative cover up to 200 m from the watercourse. These turtles are long-lived, with an estimated lifespan of 50 to 70 years. They require more than 10 years to attain sexual maturity.

The western pond turtle range extends from Washington south through Oregon to Baja California. The historic range in Washington included disjunct populations in the Columbia River Gorge and the Puget Sound region. Western pond turtles have essentially been extirpated in Puget Sound and have undergone significant declines from historic levels in the rest of their Washington range. Presently, viable populations are restricted to two isolated sites in Skamania and Klickitat counties. Intensive 1992 surveys found 69 western pond turtles in the state (3 in Puget Sound and 66 in the Columbia Gorge).

Habitat loss and alteration are the primary causes of the decline in western pond turtle numbers. Wetlands have been filled for residential and industrial development, particularly in the Puget Sound region. Water diversion projects and construction of dams have reduced available habitat and have isolated populations. Exotic predators such as bullfrogs and some large fish, which have been introduced to lakes and ponds, exact a toll on hatchling and young turtles. Human disturbance can keep females from crossing over land to lay eggs, or can cause turtles to reduce the amount of time spent in maintenance behaviors such as basking. Loss of lakeside vegetation to grazing and trampling can make habitat less suitable for hatchlings and juveniles.

An unknown disease killed at least 36 turtles in Klickitat County in 1990, highlighting the precarious condition of the state's population. A captive breeding program has been established to build a population of turtles for future release into suitable Washington habitat. A headstart program was used to enhance the survival of hatchling turtles from wild nests. Predator control and habitat enhancement has occurred at some occupied sites. The Department of Wildlife has acquired land supporting one of the two most important populations in the state, and is in the process of acquiring the other.

The western pond turtle has been extirpated from a significant portion of its range in Washington. Viable populations remain only in a few restricted areas in the Columbia Gorge. The population is estimated to number fewer than 100 individuals and has recently declined from already low numbers. The species is highly vulnerable to extirpation in Washington in the foreseeable future by natural or human-caused factors.

It is recommended that the western pond turtle be reclassified from threatened to endangered in Washington.

## TAXONOMY

The western pond turtle (*Clemmys marmorata*) has been known variously as the Pacific pond turtle, western mud turtle, Pacific mud turtle, and Pacific fresh-water turtle. It is a member of the order Testudines and the family Emydidae.

The type specimens of the western pond turtle were collected during the U.S. Exploring Expedition in 1841 in the vicinity of Puget Sound, and were described by Baird and Girard (1852) as *Emys marmorata*. The first use of the combination *Clemmys marmorata* was by Strauch (1862). Seeliger (1945) divided the species into two subspecies: the northwestern pond turtle (*Clemmys marmorata marmorata*) and the southwestern pond turtle (*Clemmys marmorata pallida*). The northwestern subspecies is found from the Sacramento Valley, California northward to Puget Sound. The southwestern subspecies is found from the vicinity of Monterey, California southward to Baja California Norte. The area of the San Joaquin Valley, California is considered a zone of intergradation.

Seeliger's description of the two subspecies is based upon examination of 158 specimens from throughout the range of the species (Washington and Nevada excluded). Holland (1992) examined 5,137 specimens and distinguished three morphologically distinct forms. One form is restricted to the Columbia River Gorge, while Puge Sound animals are most similar to turtles from the Willamette drainage.

## DESCRIPTION

The western pond turtle is a moderate-sized emydid. Maximum size varies geographically, with the largest animals reaching 210 mm (8.2 in). Large animals may exceed 1 kg (2.2 lb) in mass. In a series of 45 adults from Klickitat County the mean weight of males was 554 g (1.2 lb) and the mean weight of non-gravid females was 504 g (1.1 lb) (D. Holland, unpubl. data). Non-gravid females of a given carapace length are usually significantly heavier than males (Holland 1985a). Hatchlings are 25-31 mm (1.0-1.22 in) in length and weigh from 3-7 g (0.11-0.25 oz) (D. Holland and F. Slavens, unpubl. data).

The color of this species varies geographically and with age. In general, animals in the northern part of the range are darker in overall coloration. The ground color of the carapace is generally dark brown or black, but may be reddish in a small percentage of the females in a given population. In some extremely old males the melanin in the carapace appears to disappear in a patchy manner, producing a piebald or mottled appearance. The carapace may be unmarked, or may possess a series of fine black radii or lines extending outward from the growth center of each shield. These lines may be darker than the ground color of the carapace and often surround small yellow-gold flecks. The plastron is generally cream to yellow in color, with varying degrees of black or brown mottling.

Head and neck coloration varies ontogenetically, sexually, and geographically. Small animals and females tend to have a varying number of dark flecks or rosette-like markings (often referred to as a "paisley print") on the head, sides of the neck, and throat. Females tend to retain these markings throughout life, whereas males usually become progressively darker on the head and sides of the neck, while the throat becomes white or cream-yellow. Hatchlings are generally dark brown-olive in color, with prominent mottling on the head and neck.

Western pond turtles are sexually dimorphic (Appendix A). In general, females have smaller heads, less heavily-angled snouts, relatively higher and rounder carapaces, longer, thinner tails and no plastral concavity.

## DISTRIBUTION

### North America

The western pond turtle historically ranged from the vicinity of Puget Sound in Washington south to the Sierra San Pedro Martirs in Baja California Norte (Fig. 1). Most populations are found west of the Sierra-Cascade crest. At least three populations are found in outlying areas, although two of these may be the result of introductions.

### Washington

Western pond turtles occur in two areas in Washington: along the Columbia River from the vicinity of Vancouver, Clark County to an area near Lyle, Klickitat County; and in a restricted area near Puget Sound (Fig. 2 and 3). The gap of approximately 130 km (81 mi) which separates the two populations is the largest known disjunction in the range of this species. The Puget Sound population represents the only truly allopatric group within this species.

There are 19 western pond turtle specimens from Washington in museum collections (Table 1). Sixteen are from the Puget Sound area, two are from near Lyle, Klickitat County, and one is from Vancouver, Clark County.

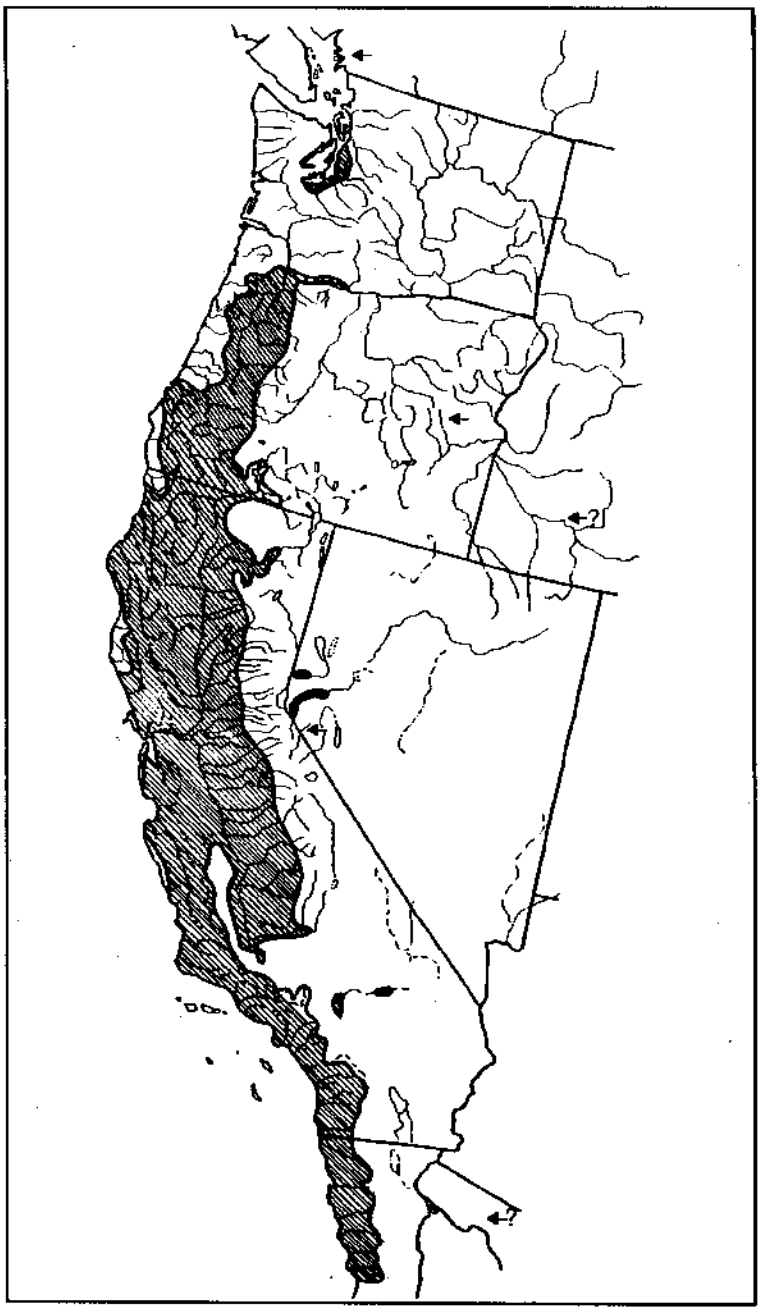

Figure 1. Range of the western pond turtle (Holland 1991b, adapted from Seeliger 1945). Arrows indicate introduced animals or populations. Arrows with question marks indicate records with probable erroneous locality information.

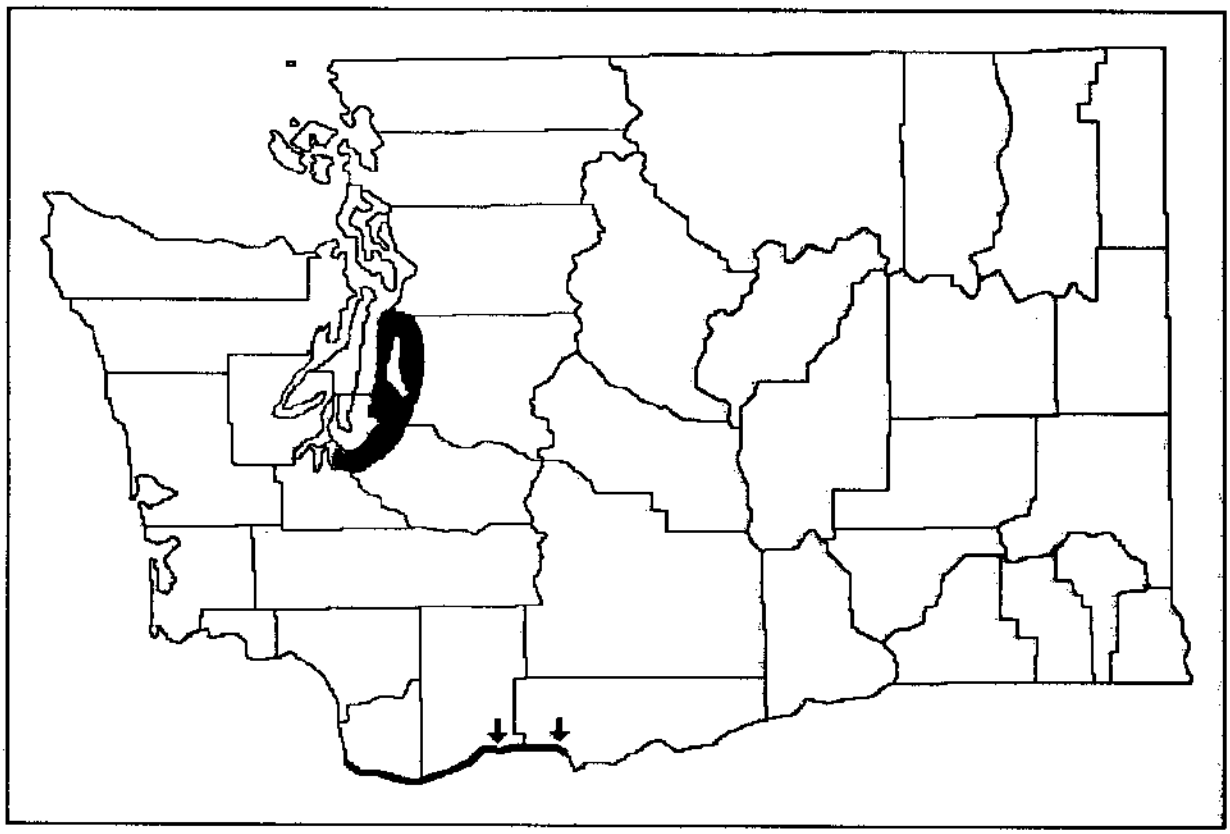

Figure 2. Range of the western pond turtle in Washington (adapted from Holland 1991c). Hypothesized historic range is shown with heavy lines. Present-day populations are indicated by arrows.

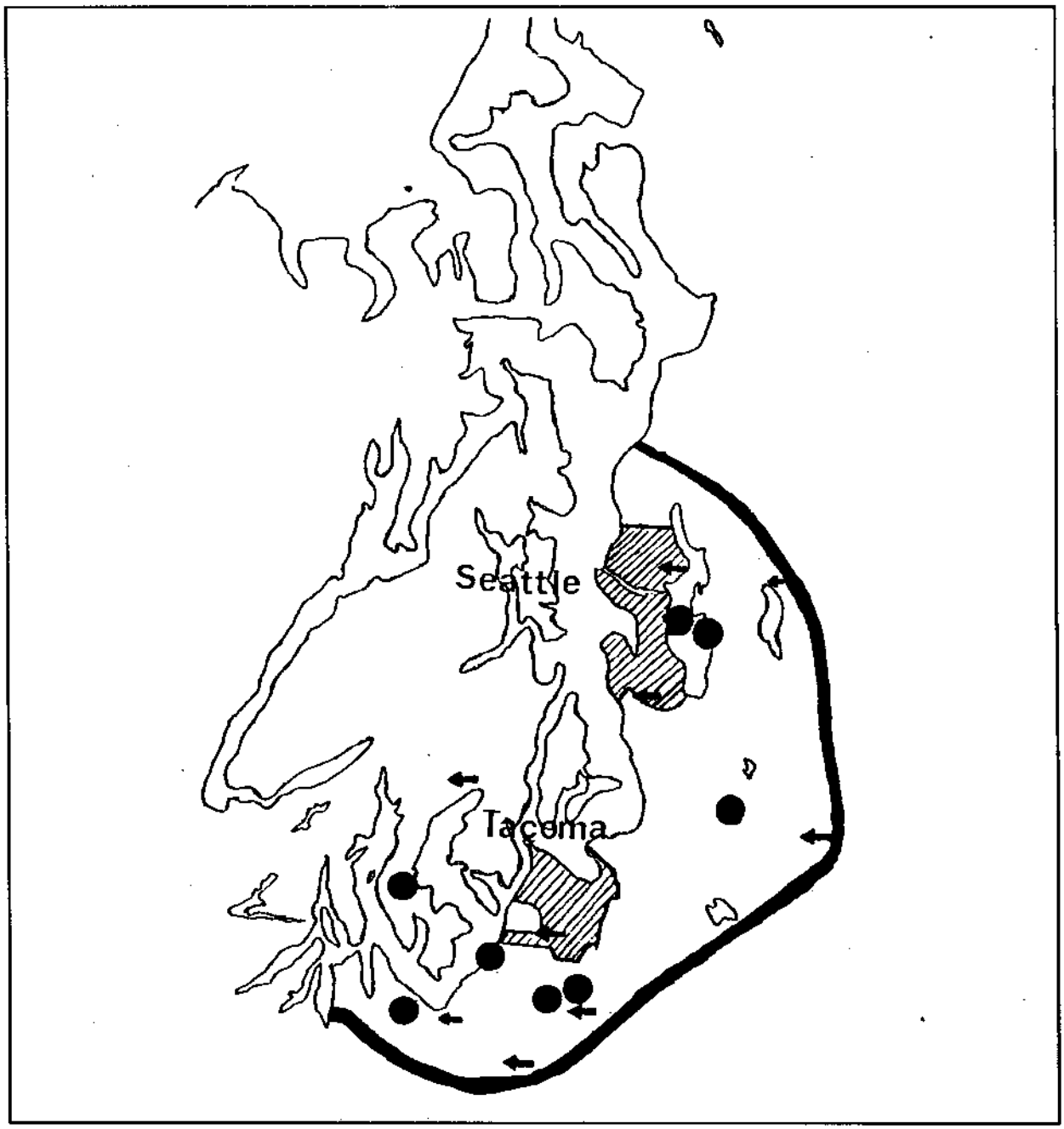


Figure 3. Hypothesized historical distribution of the western pond turtle in the area of Puget Sound, shown by heavy line (from Holland 1991c). Also shown are approximate locations of museum specimens (dots) and recent sight records (arrows).

Table 1. Western pond turtle specimens collected in Washington. Information assembled from Milner (1986) and Holland (1991b).

| Locality | County | Date | Collector | Comments | Specimen[a] |
|---|---|---|---|---|---|
| Steilacoom, Puget Sound | | 1841 | U.S. Exploring | Holotype | USNM 007700 |
| Puget Sound | | 1841 | Expedition | Cotype | USNM 008800 |
| Puget Sound | | 1841 | " | Cotype | USNM 00759400 |
| Puget Sound | | 1841 | " | Cotype | USNM 00759500 |
| Puget Sound | | 1841 | " | Cotype | USNM 00759600 |
| Puget Sound | | 1841 | " | Cotype | USNM 00131830 |
| Fort Steilacoom | | 1853-1860 | J. G. Cooper | Gravid female | MCZ 42200 |
| Lk Washington, Tacoma | Pierce | Apr 1891 | | | ANSP 3986 |
| 1.4 km SE of Mooring Mast Lake | Pierce | 23 May 1937 | J. R. Slater | Imm. female | PSM 3020 |
| Meridian Lake | King | 20 Jun 1948 | W. Hagerman | | PSM 4992 |
| Long Lake | Thurston | 10 May 1950 | J. R. Slater | | PSM 6300 (3621) |
| Sportsman's Lake | Pierce | 12 Oct 1951 | H. Myhrman | | PSM 4971 |
| Meydenbauer Bay, Lake Washington | King | 9 Aug 1952 | M. Johnson | | PSM 8189 |
| Bay Lake | Pierce | 23 Mar 1956 | Anon. | | CRCM 57-244 |
| San Juan Island | Island | 26 Aug 1960 | J. Berger | Transported? | UI 48370 |
| Lake Washington | King | 1963 | Anon. | | UWBM 20332 |
| Salmon Creek, Vancouver Lake | Clark | 1963 | E. Nelson | Found dead | CCC |
| 5.6 km W of Lyle | Klickitat | | | | AMNH 84331 |
| 5.6 km W of Lyle | Klickitat | | | | PSM 8233 |

[a] Holdings as follows: American Museum of Natural History, New York (AMNH); Academy of Natural Sciences, Philadelphia (ANSP); Clark Community College (no museum), Vancouver, Washington (CCC); Charles R. Conner Museum, Washington State University, Pullman (CRCM); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (MCZ); James R. Slater Museum of Natural History, University of Puget Sound, Tacoma, Washington (PSM); University of Illinois, Urbana-Champaign (UI); National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM); Thomas Burke Memorial Washington State Museum, University of Washington, Seattle (UWBM).

# NATURAL HISTORY

## Behavioral Characteristics

*General.* The western pond turtle is a wary species with a well-developed sense of sight and a moderate sense of hearing (Holland 1985a). The initiation of escape behavior varies with the individual and circumstances, but often occurs when a perceived threat is 100 m (330 ft) distant or more. If not disturbed, this species spends a considerable amount of time engaged in thermoregulatory behavior. In the spring, early summer, and autumn most turtle activity is diurnal. In some areas during the summer the species may be primarily crepuscular, and

in some areas activity may persist throughout the year. Detailed information on behavioral characteristics can be found in Bury and Wolfheim (1973) and Holland (1985a).

*Overwintering*. Western pond turtles overwinter from mid-October or November to March or April. Overwintering may occur on land up to 500 m from the nearest watercourse, and turtles sometimes change sites during the season (Holland 1989; Slavens 1992a; D. Holland, pers. comm.).

*Foraging*. Western pond turtles locate food by sight or by smell, and spend considerable amounts of time engaged in apparent foraging activity. Under normal conditions feeding behavior is solitary. However, large numbers of animals may collect at a vertebrate carcass and aggressive interactions are common under these conditions (D. Holland, unpubl. data). Food must be swallowed in the water; the species is apparently incapable of swallowing in air. Animals normally forage along the bottom of watercourses they inhabit, searching carefully in submerged leaf litter and other detritus. They may also forage on items on the surface or feed in the water column under special circumstances (Holland 1985b). Nocturnal foraging has been observed during the summer months along the central California coast (Holland 1985a). The feeding range of western pond turtles is not known, but is assumed to coincide with individual home ranges.

## Diet

The western pond turtle is a dietary generalist. Holland (1989) lists known food items from most major groups of animals and a few plants. In general, western pond turtles prey heavily on aquatic invertebrates, such as the larvae of beetles, stoneflies, caddisflies, dragonflies and other insects. Bury (1986) notes that turtles in a stream environment in northern California may occasionally take small fish and frogs. Holland (1985a) found two vertebrate prey items in over 500 stomach flushings of animals from the central coast of California, but it is thought that these were scavenged.

Turtles may sometimes feed on carrion. Scavenging has been noted on the carcasses of various mammals, birds, reptiles, amphibians and bony fishes. Interestingly, although in many areas bullfrogs (*Rana catesbeiana*) co-occur with western pond turtles, there is no evidence that turtles feed on either larval or post-metamorphic bullfrogs, although they may feed on their carcasses (D. Holland, pers. comm.). The presence of toxins in the skin of these amphibians may act to deter their use as a food source by pond turtles.

Use of plants appears to be limited except in the case of post-partum females who may ingest large quantities of cattail or tule roots at certain seasons (Holland 1985a). In environments which apparently lack other prey items, turtles may eat large quantities of filamentous green algae as a food source (Holland 1989).

## Home Range

Bury (1972a) notes the following average home range sizes for animals in a stream environment in northern California: adult males 0.976 ha (2.41a), adult females 0.248 ha (0.61a), juveniles 0.363 ha (0.9a). Considerable overlap in home ranges of individuals of both sexes occurred in this area.

## Interspecific Relationships

The western pond turtle occurs sympatrically with the western painted turtle (*Chrysemys picta belli*) in Oregon and at least six localities in Washington (Nordby 1992; D. Holland, pers. comm.). There are no published accounts of interactions between these species, although they have been observed basking together at both localities. The two species may utilize the same prey base, but if competition occurs it has not been documented. Western pond turtles may also interact with other species of introduced turtles (D. Holland, pers. obs.) and other animal species. Aggressive interactions with two-striped garter snakes (*Thamnophis hammondi*) and several species of birds have been noted (Holland 1985a).

# HABITAT REQUIREMENTS

## General

The western pond turtle is found in a variety of aquatic habitats, both permanent and intermittent, from sea level to approximately 1,375 m (4,500 ft). All records for the northern part of the range (Willamette basin in Oregon north into Washington) are below 763 m (2,500 ft). The name western "pond" turtle is something of a misnomer, as ponds are relatively scarce throughout most of the range of this species. However, in many areas of Oregon and Washington the species is found in ponds and small lakes.

Historically, western pond turtles occurred in large numbers in the warm, shallow lakes and sloughs on the floor of the San Joaquin and Sacramento valleys of California. It is in the few remaining areas that approximate these habitat conditions that this species reaches very high densities; over 1,000 turtles/ha (405 turtles/ac) of water surface are known from several areas (D. Holland, unpubl. data). In at least one area a density of 3,700 turtles/ha (1,500 turtles/ac) occurred until recently (D. Holland, unpubl. data). There are several records of turtles occurring in the Klamath Lakes, Oregon and Clear Lake, California. Western pond turtles are usually rare or absent in reservoirs, impoundments, canals, or other bodies of water heavily altered by human activity.

Western pond turtles may be found in some of the larger rivers within their range (e.g., the Sacramento, the Klamath, the Willamette), but are often restricted to areas near the banks or adjacent backwater habitats where the current is relatively slow and abundant basking sites

and refugia exist. They may be found in slower moving streams where basking sites are available, but generally avoid heavily shaded areas. In many areas of California, intermittent streams may hold sizeable populations of this species. Turtles are also known to utilize ephemeral pools as habitat in some areas. The species appears to tolerate brackish water, often coexisting with brackish-water fish species such as sculpins (*Leptocottus armatus* and *Cottus* sp.) along the California coast.

## Substrate and Vegetation

Habitats chosen by western pond turtles may exhibit a variety of substrates including solid rock, boulders, cobbles, gravel, sand, mud, decaying vegetation, and combinations of these.

In many areas turtles may be found in rocky streams with little or no emergent vegetation. In other areas they may occur in slow-moving streams or backwaters with abundant emergent vegetation such as cattails (*Typha* sp.) or tules (*Scirpus* sp.). In certain coastal streams they may occur in areas with no emergent vegetation but abundant submerged vegetation, most typically ditch grass (*Ruppia maritima*). In the northern parts of the range, pond lilies (*Nuphar* sp.) or arrow weed (*Sagittaria* sp.) are often the dominant aquatic macrophytes. In certain disturbed habitats the only aquatic vegetation present may be large mats of filamentous green algae. Dense growths of woody vegetation along the edges of the watercourse which shade potential basking sites may make some otherwise suitable habitats unsuitable for prolonged use by western pond turtles.

## Basking Sites

Western pond turtles spend a considerable amount of time engaged in thermoregulatory behavior and much of this is conducted by emergent basking. This activity has been noted in all months of the year in some areas, but generally increases in frequency through the spring, peaks in early to mid-June, then declines until September, when another peak is reached. Turtles may also seek thermally-suitable microhabitats in the water to engage in an activity known as aquatic basking (Holland 1985a). This behavior may vary microgeographically as well as seasonally. In general, aquatic basking peaks in early to mid-July in most areas and declines by early September. In these situations turtles may typically be found concealed in or under masses of floating vegetation or algae, or in shallow water relatively close to shore.

Turtles may utilize a variety of sites for emergent basking, such as rocks, sand, mud, downed logs, submerged branches of nearshore vegetation, and emergent or submerged aquatic vegetation. Turtles are also known to bask on the carcasses of large mammals, and will utilize human-produced detritus such as planks, barrels, abandoned autos, and other items. In some areas thermally preferable basking sites may be limited and competition for these sites may occur if population densities are high (D. Holland, unpubl. data).

## Refugia

When engaging in escape behavior, turtles swim rapidly toward the bottom of the watercourse and hide under or in nearby refugia. These refugia may consist of rocks of varying size, submerged logs or branches, submerged vegetation, or holes or undercut areas along the bank. In some cases animals may attempt to burrow into the substrate. Occasionally turtles have been observed to hide in thick vegetation or holes out of the water at the edge of the watercourse. If turtles are surprised in shallow water with no nearby refugia, they may remain motionless. In many cases turtles surprised while engaging in aquatic basking in mats of vegetation in shallow water simply withdraw the head and limbs and remain motionless. The presence of suitable refugia within a watercourse may affect the microdistribution of animals in that particular area; turtles are rarely found more than a few meters from a refugium of some sort.

## Water Conditions

Turtles have been observed active in water temperatures as low as 3°C (37°F) and as high as 38°C (100°F). In general, turtles avoid prolonged exposure to water above 35°C (95°F). Visibility through water in areas inhabited by turtles may range from less than 15 cm (6 in) to more than 10 m (33 ft). The lower end of this spectrum may vary significantly by season.

## Uplands

Western pond turtles use upland areas adjacent to water bodies for overland dispersal, to nest, to overwinter, and to aestivate. Other overland movements may be spring and fall migrations to and from upland overwintering sites, or may be in response to wetlands or drainages drying out, or other reasons not presently understood (Holland 1991b). Most western pond turtles are somewhat sedentary, although they are sometimes known to travel several hundred meters in just a few days (Bury 1972a).

Telemetry studies of eight turtles in Washington during 1991-92 documented turtles leaving the water for short periods of time during late summer and fall to burrow under leaf litter and grasses (Slavens 1992a). One turtle came out on land and up onto a hillside adjacent to the lake on 11 August 1991 was still at the same location in February 1992. All of the other turtles which left the lake did so for short periods of time, returning to the water and then back to land again (Slavens 1992a). Two turtles made upland trips at least four times each and returned to the same land area each time (Slavens 1992a). It is possible that the temperature of the water may have become too warm as the locations of the turtles were found to be considerably cooler (Slavens 1992a).

The monitored turtles began overwintering during the first week of November in 1991. One turtle was moving great distances for two additional weeks before settling at one site. Only one monitored turtle overwintered in the water (Slavens 1992a).

## POPULATION DYNAMICS

### Reproduction

Relatively little is known about reproductive habits of western pond turtles. Possible courtship behavior has been described by Holland (1988). Mating has been observed in nature between March and November, and in captivity during August and September. Age and size at the development of secondary sexual characteristics varies geographically (D. Holland, unpubl. data), but these are generally evident in both sexes by the time an animal reaches 110 mm (4.3 in) carapace length. The time required for males to achieve sexual maturity is not known, but is thought to be at least 10-12 years in Washington. In a sample of 10 gravid females from the Lyle, Washington population the smallest animal was 143 mm (5.63 in) carapace length, or approximately 14-17 years of age. However, females as small as 111 mm (4.3 in), with an approximate age of 7-10 years, have been observed carrying eggs in southern California.

When preparing to lay eggs, females typically leave the water in late afternoon or early evening and travel a considerable distance. Nests are usually located on south or southwest facing slopes in moderately hard soil. In Washington distances of up to 187 m (614 ft) are known (Holland 1991a), while in California distances of up to 400 m (1,300 ft) away from and 92 m (300 ft) above the watercourse have been recorded (Storer 1930). Females moisten the soil around the nest by evacuation of the bladder prior to excavation of the nest chamber. Excavation may require several hours to complete and the female commonly remains on or near the nest site overnight.

It appears that the majority of mature females in a given population are gravid at any given time. Actual oviposition may occur yearly or in alternate years and a few instances of double-clutching (two clutches in one season) are known (D. Holland, pers. comm.). Females have been observed with large oviductal eggs in February, and with shelled eggs in May to August. Eggs are deposited from late April through August in California, although all six known cases of oviposition in Washington occurred in June. Clutch size ranges from 1 to 13 eggs and is positively correlated with body size. Mean clutch size in a sample of 31 females from California was 4.87 eggs and in sample of nine females from Washington was 6.44 (range 5-10) (Holland 1991a). In one instance in Washington, a monitored female deposited five eggs in one nest and a single egg in another (Holland 1991a).

Eggs average 34 mm (1.34 in) in length, 21 mm (0.83 in) in diameter, and 8-10 g (0.28-0.35 oz) in weight. In a sample of six nests in Washington in 1990, incubation time varied from 95 to 104 days (Holland 1991a). Incubation time in captivity is 73-80 days (Feldman 1982). Hatchlings from Washington average 5-7 g (0.18-0.25 oz) in weight and 27-31 mm (1.1-1.2 in) in carapace length (F. Slavens, unpubl. data). In some areas hatchlings may overwinter in the nest (D. Holland, unpubl. data).

## Mortality

*General.* Preliminary analyses by D. Holland (unpubl. data) suggest mortality is very high in the younger (less than 6-8 years) age classes. It is likely that under undisturbed conditions only 10-15% of the animals that hatch in a given year survive until the end of the first year. Survival from the first to second and second to third year is similarly low, but increases slightly by the fourth and fifth years. Survivorship apparently continues to increase until the attainment of sexual maturity. Exact rates of turnover in the adult population are not known, but probably average 3-5% per year in undisturbed populations (D. Holland, unpubl. data). The maximum age achieved by animals in the wild is not known, but is at least 42 years (D. Holland and R. Bury, unpubl. data). The estimated maximum lifespan based upon an extrapolation from known adult growth rates is 50-70 years (D. Holland, unpubl. data), an estimate which approximates that of the ecologically similar *Emydoidea blandingi* in Michigan (J. Congdon, pers. comm. to D. Holland).

*Predation.* Published accounts of predation on western pond turtles are limited. Moyle (1973) notes that bullfrogs prey on western pond turtles. Bears (*Ursus americanus*) and coyotes (*Canis latrans*) completely eliminated a southern California population when drying of a stream forced overland movement by the turtles (S. Sweet, pers. comm. to D. Holland). Raccoons (*Procyon lotor*) preyed on two adults from the Klickitat County population in 1991-92. In 1992, 97 of 106 western pond turtle nests in Oregon were predated, presumably by raccoons or skunks (Holland 1993). Mortality due to trampling by cattle is also known (Holland 1985a).

Predation by man may take the form of wanton shooting, capture by hook and line fishing or entanglement in nets, collection for the pet trade (Bury 1982; D. Holland, pers. obs.) or collection for food (M. P. Hayes and S. Sweet, pers. comm. to D. Holland).

Holland (1989) lists four additional known predators: gray fox (*Urocyon cinereoargenteus*), river otter (*Lutra canadensis*), mink (*Mustela vison*), and largemouth bass (*Micropterus salmoides*). Suspected predators include bobcat (*Lynx rufus*), beaver (*Castor canadensis*), nutria (*Myocastor coypu*), great blue heron (*Ardea herodias*), black-crowned night heron (*Nycticorax nycticorax*), golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), red-shouldered hawk (*Buteo lineatus*), giant garter snake (*Thamnophis gigas*), two-striped garter snake, California red-legged frog (*Rana aurora draytoni*), rainbow trout (*Oncorhynchus mykiss*) and channel catfish (*Ictalurus punctatus*).

*Drought.* The prolonged drought in California has apparently resulted in significant declines (up to 85%) in some populations and the outright elimination of others (D. Holland, unpubl. data). Drought may function as a direct mortality factor by elimination of the habitat required by turtles for survival, or by elimination of the prey base required by turtles.

Without adequate body fat reserves produced by late-season feeding, turtles may be unable to survive the stress of overwintering.

*Parasites.* The effect of parasites on western pond turtle populations is unknown. The only known ectoparasites are leeches (*Placobodella* sp.) found on specimens from northern California and central Oregon (Holland 1991b). Endoparasites include nematodes (Bury 1986) and lungworms (Holland 1991b).

*Disease.* A syndrome similar to upper respiratory disease caused damage to the Klickitat County population in 1990. The causal agent is not known with certainty, but may have been a virus or mycoplasm. Western pond turtles essentially have evolved in isolation from most other turtle species for most of their history. Therefore exotic species may introduce pathogenic agents to which western pond turtles have never been exposed, and thus have had no chance to evolve any level of resistance. If this is the case, the introduction of exotic species [e.g. red-eared slider (*Trachemys scripta elegans*)] may have catastrophic consequences for western pond turtle populations.

*Contaminants.* The effect of biocontaminants on western pond turtles is not well understood; a single reference exists in this respect (Bury 1972b). However, given the long lifespan of turtles and their position as a tertiary consumer in the food chair, they may act as bio-accumulators of certain contaminants such as PCBs and heavy metals, a situation known to occur in other turtle species [(e.g. common snapping turtle (*Chelydra serpentina*)].

A 6,000-gallon spill of diesel fuel in an Oregon creek affected several dozen turtles in January 1993, resulting in several serious pathological symptoms. Thirty turtles were recovered and given intensive medical care and prolonged treatment; 29 survived at least 5 months (D. Holland, pers. comm., June 1993).

## POPULATION STATUS

### Past

*General.* Fossils assigned to this species are known from Pleistocene strata in the vicinity of White Bluffs in south-central Washington (Brattstrom and Sturn 1959), indicating that western pond turtles once had a wider range than present. The historic distribution along the Columbia River is not well known. It is likely that populations were patchily distributed in suitable habitat to at least the vicinity of Lyle and possibly further east. Construction of dams along the river and alteration of historic patterns of water flow may have eliminated many of these habitats within the last 50 years.

No exact historic data are available on the size or dynamics of populations in the Columbia River Gorge or around Puget Sound. Cooper (1860) noted that turtles were "common in

freshwater ponds and rivers west of the Cascades," a point questioned by Storer (1937), who stated that if this was the case, "specimens should be forthcoming." The scarcity of specimens may be explained in several ways: 1) the wary nature of the species precluded extensive collection; 2) the species was uncommon or present in low numbers due to various limiting factors at the terminus of its range; and/or 3) a dramatic reduction in the size of population(s) in this area occurred prior to the initiation of extensive collecting efforts that began with the activities of J. Slater in the 1930's.

*Puget Sound.* Areas surrounding Puget Sound probably was incapable of supporting western pond turtles prior to approximately 10-11,000 years ago due to extensive glaciation. D. Holland (pers. comm.) suspects turtles in this area arrived about 9-10,000 years ago through the Puget Trough from the Willamette drainage, and suggests a pyroclastic event from Mount Rainier about 4,700 years ago cut off the dispersal corridor, isolating the Puget Sound population.

The Puget Sound population was apparently large enough to support commercial collecting activities for the restaurant trade during the late 1800's (M. Jennings, pers. comm. to D. Holland). Examination of some historic localities in the Puget Sound area in 1990 revealed that commercial collection could easily have eliminated or severely reduced populations in certain habitats. It is also probable that habitat alteration may have played a significant role in this localized decline. Given these premises, the statement in Milner (1986) that in the opinion of local naturalists "the western pond turtle was probably never very numerous in northwestern Washington" is probably contextually correct, as by the 1930's populations were probably severely reduced from levels present 50-100 years earlier. Additional evidence exists for a parallel situation in certain areas of California (D. Holland, unpubl. data).

The 15 specimens from the Puget Sound area represent a minimum of six localities in three counties (Table 1, Fig. 2). Locality information for the type series is vague, but locations for the seven animals collected between 1937 and 1963 are fairly specific. The turtle collected on San Juan Island in 1960, is suspected to have been brought to the island.

Milner (1986) summarized sight records for Puget Sound locations after conversing with a number of biologists and naturalists. In King County, turtles had been seen during the 1950's at each end of Sammamish Slough. Meydenbauer Bay near Bellevue supported turtles in the 1960's. In Seattle, individuals were reported near Northgate, in West Seattle, and at Haller Lake during the 1960's and 1970's.

In Pierce County, the marshes in the northeast corner of Fort Lewis supported western pond turtles. Spanaway and Halvorson marshes, and Muck, Sequalitchew, American, Lewis, Spanaway, and Chambers lakes all had resident turtles. Most sightings occurred in the 1930's through the 1960's. The south Tacoma swamp and McChord Air Field near Mooring Mast Lake both supported turtles, but these wetlands were filled. Another turtle site, the

headwaters of Murray Creek, was used in the 1940's but was altered and channelized later. Turtles observed at several other Pierce County sites have not been identified to species (Milner 1986).

In Thurston County, western pond turtle eggs were collected from a site north of Olympia and adults were observed in Lacey during the 1940's and at Patterson Lake in 1969. In Kitsap County one was found near Kitsap Lake in the early 1980's (Milner 1986).

Extensive surveys of 56 wetlands by Milner (1986) failed to reveal the presence of any western pond turtles in the Puget Sound area, and it was concluded that the species had effectively been extirpated in the region.

Surveys or incidental sightings in 1991-92 revealed a few isolated individuals in the Puget Sound region. A turtle seen at Leschi Park in Seattle may have been a western pond (D. Boersma, pers. comm. to K. McAllister). Four western pond turtles were captured at isolated sites near Tacoma (1987), Port Orchard (1991), Fife (1992), and Ravensdale (1992). The status of turtles collected in this area have to be regarded with caution, as their origin may be uncertain.

*Columbia Gorge.* At the beginning of 1990, the Klickitat County population was estimated to number between 60 and 80 animals (D. Holland, unpubl. data), indicating little or no recruitment had occurred since 1985 when monitoring of the population began (Zimmerman 1986). Lack of recruitment also is indicated by measurements of carapace lengths from this population (Holland 1991a). The age composition of the Klickitat County population is moderately adult-biased (Fig. 4).

In early to mid-1990, the Klickitat County population was decimated by an unknown pathogen. At least 36 animals are known to have died. To curb the spread of the disease and to treat sick animals, 32 adult and subadult animals were removed from the ponds and treated at the Woodland Park Zoo (WPZ). Fourteen of these survived and were returned to the wild in 1991. Based on spring 1991 surveys, at least 40 turtles were observed to have survived the 1990 disease outbreak at the lake/pond complex (Slavens 1992a). The population was increased by 23 hatchlings which were removed from the wild, head-started in captivity, and released back to the lake/pond complex in 1991-92.

The Skamania County population was surveyed in July 1990 and 12 western pond turtles were observed (D. Holland, unpubl. data). Fewer than 10 individuals were counted during surveys in the summer of 1991 (Wash. Dept. Wildl., unpubl. data), but given the amount of available habitat, this area may hold a potentially viable population.

A few additional sightings and specimens are known from other Columbia River Gorge areas. Single turtles have been seen on a log in the Columbia River at the north shore of Reed Island in 1978, on a road near Dallesport in 1990 (male), and in a duck pond at a

ranch approximately 18 km (11 mi) east of the Lyle population site in 1990 (female). Two specimens collected near Lyle come from the approximate location of a small stream draining into the Columbia River, about 2.2 km (1.4 mi) west of the present-day Klickitat County lake/pond locality. This stream and another stream approximately 1.6 km (1 mi) further west were checked in July 1990. The habitat appeared marginal in both cases and no turtles were observed (D. Holland, pers. obs.).

There are reports of two animals from the vicinity of Vancouver Lake, near Vancouver, Clark County. D. Blackburn (pers. comm. to D. Holland) was shown the shell of an animal found dead in 1989 in this area and one specimen exists in the collection of Clark Community College.

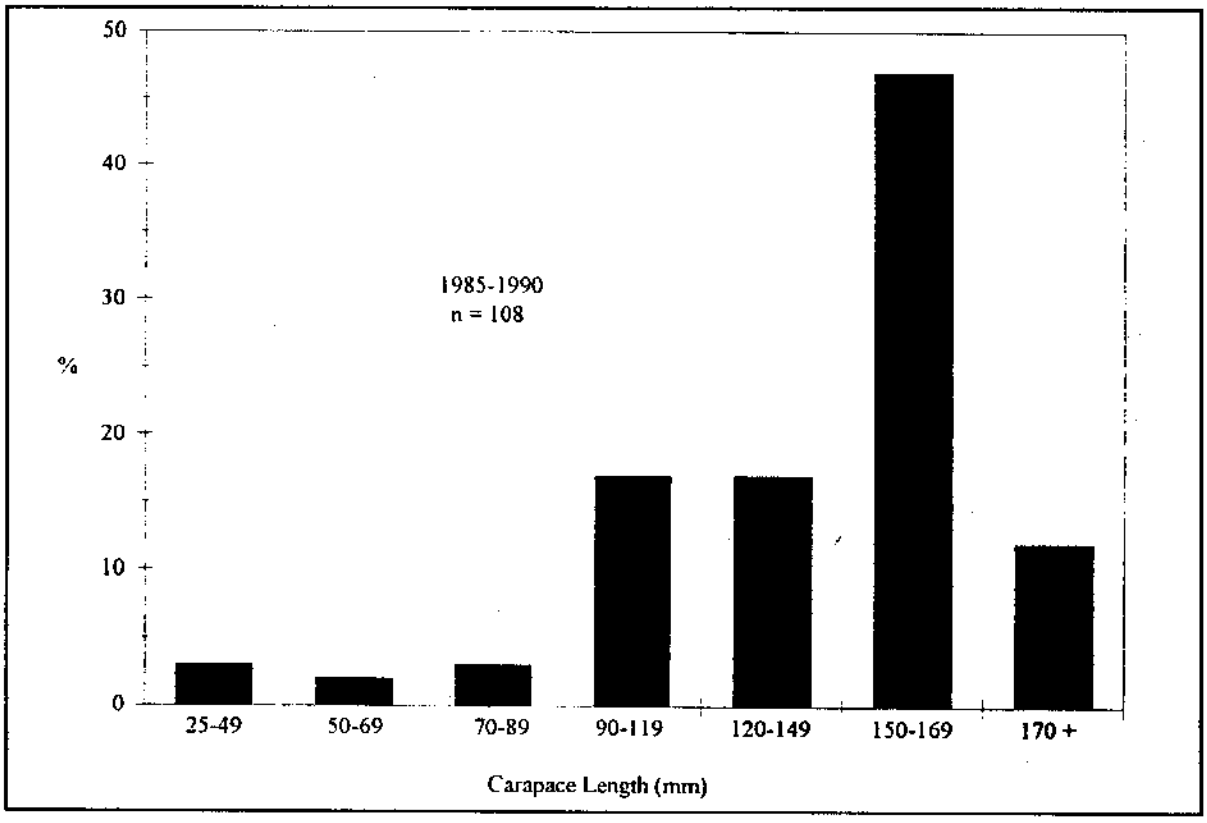


Figure 4. Size/age class composition of the western pond turtle population in Klickitat County (based on Holland 1991b:Table 3).

## Present

In 1992, 69 turtles at 15 sites were found in the combined Puget Sound/Columbia Gorge surveys (Nordby 1992). During the surveys, 450 painted turtles were seen, with all but eight of them in the Columbia Gorge. Of the 15 sites supporting western pond turtles, six contained painted turtles and one held a red-eared slider. In only two of these sites was the number of western pond turtles greater than the number of other species.

Twenty-eight wetlands in King, Pierce, Kitsap, Thurston, and Mason counties were surveyed in 1992 (Table 2). Single turtles were observed in King, Kitsap, and Thurston counties (Nordby 1992). None were recorded at any of 23 additional wetlands on Fort Lewis (Stringer 1992). It is concluded that the species has been effectively extirpated from the Puget Sound region.

There are only two major population sites in the Columbia River Gorge (Fig. 2). Surveys conducted in Skamania, Klickitat, and Clark counties in 1992 (Table 2) found 66 western pond turtles at 12 wetlands (Nordby 1992). The majority of all individuals counted (96%) were in the previously known sites in Klickitat and Skamania counties. Slavens (1992b, pers. comm.) estimated 12 to 22 turtles at the Klickitat County lake site and counted 40 at the nearby pond site. Juveniles were encountered at only four s tes. New confirmation of western pond turtle presence occurred at seven sites in Skamania County.

During 1993, one adult male western pond turtle was found in Lewis County (Wash. Dept. Wildl., unpubl. data), and another adult male was documented east of Dallesport, Klickitat County (D. Anderson, pers. comm.).

Table 2. Results of 1992 western pond turtle surveys in Washington (compiled from Nordby 1992).

| County | Sites surveyed | Sites with pond turtles | Adult pond turtles | Juvenile pond turtles | Painted turtles | Red-eared Sliders |
|---|---|---|---|---|---|---|
| Skamania | 39 | 10 | 23 | 2 | 288 | |
| Klickitat | 6 | 2 | 33 | 8 | 4 | |
| Clark | 15 | 0 | | | 150 | |
| King | 14 | 1 | 1 | | 5 | 5 |
| Pierce | 7 | 0 | | | | 7 |
| Kitsap | 5 | 1 | 1 | | 3 | |
| Thurston | 1 | 1 | 1 | | | |
| Mason | 1 | 0 | | | | |
| Totals | 88 | 15 | 59 | 10 | 450 | 12 |

## Future

The population of turtles in the Skamania county wetlands is probably very small and the presence of bullfrogs may adversely affect its potential viability. It is obvious that these areas and possibly other sites supported viable populations of western pond turtles within the recent past. Based upon experience with other populations in similar habitats (D. Holland, unpubl. data), it appears that the amount and quality of habitat at these sites is capable of supporting far larger populations of turtles than currently exist or recently existed. Prediction of actual carrying capacity for each site is fraught with potential problems and should not be considered rigorous without a more detailed knowledge of the dynamics of each population. However, it seems reasonable that the Klickitat County lake/pond complex could or did support a population of at least 120-150 turtles. Based upon preliminary estimates of life history parameters (D. Holland, unpubl. data), it appears that a minimum viable population for this general area would probably be at least 60-90 animals.

Given the limited amount of available habitat and limited size of this population, coupled with the presence of bullfrogs, natural mortality in this population may already exceed recruitment. If this is the case, the population may effectively be extirpated in Washington within the next few years. Due to the long lifespan of this species, individual turtles may persist in an area for many years after a population has become reproductively unsustainable. However, with intensive management, successful captive breeding and head-starting efforts, it may be possible to increase the wild population numbers and distribution in the future.

# HABITAT STATUS

## Past

A number of factors have contributed to the decline in adequate habitat for western pond turtles. Wetland reclamation and development eliminated much habitat during the past century, and diversion of water for irrigation and other purposes also eliminated or altered turtle habitat. Grazing or trampling of emergent vegetation may have modified aquatic and riparian habitats to the extent that they became less suitable for hatchlings and juveniles (Holland 1991b). The construction of dams and creation of reservoirs has also had adverse impacts on western pond turtles including: altering water flow in drainages; elimination of habitat in the direct vicinity of dams and reservoirs; creation of habitat suitable for the spread of exotic species which have deleterious effects on western pond turtles; fragmentation of populations; interruption of movement patterns; and creation of barriers to normal dispersal (Holland 1991b).

Negative effects of habitat alteration are not limited to watercourses. Since turtles may make extensive overland movements for egg deposition, dispersal, and overwintering, altering

upland habitats within 0.4 km (0.25 mi) of watercourses may also have adversely affect turtle populations.

## Present

The known area occupied by viable populations of western pond turtles in the state of Washington totals slightly over 2.4 $km^2$ (1.5 $mi^2$). One population is restricted to four ponds in Skamania County and the other occurs in a series of five ponds and a lake in Klickitat County. The Klickitat County sites have been or are being purchased by the Department of Wildlife. The Skamania County sites are primarily in private and U.S. Forest Service ownership and most are within the Columbia River Gorge National Scenic Area. The populations are separated by a road-distance of about 27 km (17 mi).

*Klickitat County*. The Klickitat County lake site can be characterized as moderately disturbed. The lake was slightly modified within the last 20-30 years to increase its size and water storage capacity. The area surrounding the lake was historically used for grazing, which has been limited in recent years. The area immediately surrounding the lake shows some signs of prolonged human use in the form of a small abandoned pumphouse, vehicle trackways, and footpaths. A road located about 5 m (16 ft) above and 10-15 m (35-50 ft) east of the eastern shore of the lake allows a direct view of the lake and potential access. Traffic on this road was observed to average 2-3 vehicles per hour during late May to early June 1990, and shooting in the general vicinity of turtles was observed at least once in this period. This type of activity has been previously noted by the landowner. To a limited extent, turtles appear to be somewhat acclimated to the presence of traffic on this road. The effects of long-term exposure to low levels of disturbance of this type are not known, but may be significant.

The lake was stocked with largemouth bass, bluegill (*Lepomis macrochirus*), and brown bullhead (*Ictalurus nebulosus*) within the last 10-15 years. The presence of fish encouraged recreational use of the lake by local fishermen, which was permitted by the landowner until summer 1990. Recreational fishing may have had a significant impact on the viability of the turtle population through incidental capture and/or interruption of normal basking activities. Control efforts in 1991 removed 193 kg (425 lb) of fish, including bass, bullheads, pumpkinseeds, and bluegills (Slavens 1992a).

Large numbers of bullfrogs also occur at this site and may in part be responsible for the lack of recruitment in this population. In a 5-month period in 1991, 205 bullfrogs and 161 tadpoles were removed from the lake. Despite those efforts, many frogs and tadpoles remained in the lake at the end of the season (Slavens 1992a). Emergent vegetation in the lake is limited to areas where water depth does not normally exceed 70-90 cm (28-35 in), and the turbidity of the water is normally high. Basking sites for turtles in the form of downed logs or snags were very limited at this location before artificial basking rafts were installed in 1991-92.

Immediately south of the lake site are five ponds which hold the majority of the turtles in this area. This area, like the lake site, is located in a mixed oak/pine/grassland habitat, with Oregon white oak (*Quercus garryana*) and ponderosa pine (*Pinus ponderosa*) dominant. Bullfrogs exist in all ponds on this site and brown bullheads are present in the two largest ponds described below. While the area around the lake site lacks surface rock formations, numerous piles of basalt are present throughout the pond site. Of the five ponds that hold turtles on this site, one is artificial (permanent) and four are natural (two permanent formed by natural basaltic sinkholes, and two ephemeral). Although no movement of turtles between the pond complex and the lake has been noted during studies at this area, it is highly probable that turtles historically moved freely within this system and may continue to do so to a lesser extent. These two areas are considered an ecological unit.

The artificial pond was created by excavation in the mid-1970's. It is relatively shallow, with a depth in most areas of about 1-1.4 m (3-5 ft), and is currently heavily grown with native and exotic water lilies. There is a small patch of emergent vegetation in the form of cattails on the north shore and the pond is surrounded by a fringe of willows (*Salix* sp.) and oaks. Some structures, abandoned agricultural implements, and detritus are located immediately northeast of the pond. One of these structures is utilized during the haying season. The area immediately around the pond can be characterized as lightly disturbed.

The four natural ponds are located a few hundred meters south of the artificial pond, and three of them occur along the base of a minor basalt bench. This area was historically used for seasonal cattle grazing, but this practice was discontinued within the last few years. The two westernmost ponds are permanent but the smaller eastern pond is ephemeral, and has been observed to dry by July. All of these ponds are utilized by turtles. The eastern pond is less than 1 m (3 ft) deep, covers about 150-180 $m^2$ (500-600 $ft^2$) and has abundant emergent vegetation in the form of rushes and sedges, as well as seasonal growths of aquatic angiosperms (*Ranunculus* sp.). This pond is bordered on the west by an elevated irrigation pipe and a horse trail is present about 20 m (66 ft) south of the south shore. This area can be categorized as lightly disturbed.

The middle and western ponds are considerably larger, at 0.25-0.32 ha (0.6-0.8 ac) and 0.4 ha (1 ac), respectively, and deeper, at about 2.5 m (8.2 ft). They support abundant growths of pond lilies and arrow weed. Small patches of cattails exist on the south and west shore of the western pond. Basking sites in the form of downed logs are present in both ponds, but are proportionately more abundant in the western pond. The area around both ponds can be characterized as lightly disturbed to undisturbed.

On the basalt bench above these three ponds, and about 100 m (330 ft) north-northwest of the western pond, is an ephemeral pond that is seasonally utilized by turtles. It is < 1 m (3 ft) deep, covers more than 1,500 $m^2$ (5,000 $ft^2$), and has abundant emergent vegetation. This pond has been observed to dry by July.

*Skamania County.* The Skamania County population exists in an extensive wetland complex of a number of ponds, which can be characterized as lightly to moderately disturbed. Nearly all contain bullfrogs. At least two of the ponds are artificial and in areas used for cattle grazing. The ponds are relatively small, between 2,000 and 3,000 $m^2$ (6,500-10,000 $ft^2$), with mud substrates, abundant submerged vegetation, limited emergent vegetation and relatively few basking sites. They can be characterized as moderately disturbed.

Approximately 0.4 km (0.25 mi) west are two additional ponds. One covers less than 500 $m^2$ (1,650 $ft^2$), is at least 4 m (13 ft) deep, and apparently holds water on a year-round basis. The area is periodically grazed by cattle and can be characterized as moderately disturbed. Approximately 150 m (500 ft) north of this pond is another pond that was first noted to hold western pond turtles in 1990. This pond is about 2500-3000 $m^2$ (8,000-10,000 $ft^2$) in area and holds both painted turtles and pond turtles. The status of this pond is uncertain, as it may represent a natural pond that has been enlarged by diking. The grassland around the pond appears to be moderately grazed and there is little or no emergent vegetation on the periphery. Basking sites in the form of downed logs are abundant. This area can be characterized as moderately disturbed.

*Puget Sound.* Dramatic habitat alterations have occurred in wetlands throughout the Puget Sound region. Milner (1986) reported that several historic western pond turtle sites have been developed in the past 25 to 35 years, and that other areas have experienced dredging, channelization, filling, bulkheading, draining, and emplacement of fixed structures.

Many of the wetlands at Fort Lewis have a history of human alterations such as drainage, farming, and re-flooding. Stringer (1992) found that many wetlands have few or no natural basking sites and most marshes have banks congested with tall grass and cattails. Most wetlands also have populations of bullfrogs and/or introduced game fish. American and Sequalitchew lakes are used heavily for recreation and are close to residential areas. Still, Bury (1992) believed several waterways on the reservation have fair to excellent habitat conditions for western pond turtles.

# CONSERVATION STATUS

## Legal Status

In Washington, the western pond turtle is classified under WAC 232-12-011 as a threatened species, a subcategory of protected wildlife. It may not be collected, harassed, held in captivity (live or dead), or sold.

The western pond turtle is currently a Category 2 candidate for listing under the Endangered Species Act. A petition to list the species as threatened or endangered has been received by the U.S. Fish and Wildlife Service, but a decision whether listing is warranted is pending.

The western pond turtle is considered a sensitive species by the Oregon Department of Fish and Wildlife, and a species of special concern by the California Department of Fish and Game. In these states and Nevada, western pond turtles may not be taken without a scientific collecting permit.

In Baja California Norte, Mexico the southwestern pond turtle *C. m. pallida* is protected by Fauna Silvestre and may not be taken without a scientific collecting permit.

## Management Activities

The Washington Department of Wildlife is actively engaged in management and recovery efforts for the western pond turtle. The Department's objectives for the western pond turtle population in Washington are to protect existing wild populations and their habitat, survey for potential habitats and undiscovered populations, and increase numbers and distribution of turtles. Some of these activities are being coordinated with the Woodland Park Zoo and the Center for Wildlife Conservation.

*Critical Habitat Acquisition.* The site in Klickitat County that contains the greatest number of western pond turtles remaining in the state was purchased by the Department in 1992. The nearby lake site, which is part of the ecological complex is in the process of being acquired. A management plan for the two sites will be developed to assure long-term protection. State and federal agencies will continue to explore opportunities to purchase additional sites.

*Habitat Enhancement.* Artificial basking rafts have been placed at a number of sites to improve opportunities for thermoregulatory behavior. During 1991 and 1992, 45 rafts were distributed at 31 sites in five counties (Nordby 1992). In 1992, 24 rafts were placed in 22 lakes and marshes at Fort Lewis (Stringer 1992). Use of the wooden-plank rafts by western pond turtles in Klickitat County appears to be good.

*Predator Removal.* Slavens (1992a) reported on efforts to remove aquatic predators from the lake and ponds supporting the Klickitat County turtle population. Bullfrog control efforts were initiated under permit by the Department in the summer of 1990. In 5 months, 205 bullfrogs and 161 tadpoles were removed from the lake, but many frogs and tadpoles remained at the end of the season. Gigging at night, catching by hand, and using a fishing pole were very effective, and a pellet gun was also employed. In 1991, 193 kg (425 lb) of fish (bass, bullheads, pumpkinseeds, and bluegills) were gill-netted and removed from the lake.

*Surveys.* In 1991, 128 wetlands in southwestern Washington were surveyed for western pond turtles (Wash. Dept. Wildl., unpubl. data). The following year, 88 sites in eight counties were surveyed by a corps of biologists and 30 volunteers using a standardized survey protocol (Nordby 1992). The discovery of eight new sites with western pond turtles present

is an encouraging result of this relatively inexpensive management technique. Development of a standardized protocol, observer training, and repetition of surveys have helped to assure the collection of quality data.

*Captive Breeding Program.* In 1991 the Department of Wildlife, the Woodland Park Zoo, and the Center for Wildlife Conservation initiated a captive breeding program for western pond turtles. In 1992, a female found near Port Orchard and placed in the captive breeding population, produced 11 eggs in captivity. Four hatched and will be head-started in captivity. Currently, there are nine adult turtles in the captive breeding project. The objective of the program is to produce about 40 hatchlings per year for eventual release into suitable habitat in the state.

*Head Start Program.* The Woodland Park Zoo, Center for Wildlife Conservation, and Department of Wildlife conducted a joint project in 1991 to enhance survival of hatchling turtles. Western pond turtle nests that were located during Holland's 1990 research (Holland 1991a) were protected with exclosures and monitored in September for emerging hatchlings. As the turtles emerged from the nest, they were brought into captivity to be raised in a head-start program. The objective of the program is to raise the turtles to a size where they can escape predation by bullfrogs. In captivity they can attain a 2-year old size in a single year. Of 28 hatchlings brought into captivity, 23 survived. In 1991, 1[illegible] were released back to the wild and in 1992 the remaining nine were released. Several of them were observed during 1992 and early 1993 (K. Slavens, pers. comm.). The juveniles have been seen basking alone, with other released turtles, and with wild juveniles and adults. The head-start technique will be employed for additional hatchlings when nests can be located in the wild or when hatchlings are produced from captive breeding.

# FACTORS AFFECTING CONTINUED EXISTENCE

## Adequacy of Existing Regulatory Mechanisms

The primary mechanism for protection of the western pond turtle in Washington is its status as a state-threatened species. The Columbia Gorge National Scenic Area Management Plan has placed a number of identified pond turtle habitats in categories which will protect them from development and alteration. There are limited regulatory mechanisms for protecting habitat for this species through the Washington Forest Protection Act, which is administered by the Department of Natural Resources.

## Present and Threatened Habitat Loss

The population of western pond turtles in the Puget Sound region has already been extirpated as a result of significant habitat loss in combination with other factors. Alteration, degradation and loss of habitat is expected to continue in this region as a result of increases

in human population and concomitant development. In the Columbia Gorge area, habitat known to support populations is being acquired and protected while efforts are underway to acquire additional sites. The ability to increase numbers and distribution of western pond turtles in the future will depend, in part, on the extent to which suitable habitat can be found and protected and/or restored.

## Human Disturbance

The western pond turtle appears to be relatively sensitive to the effects of human disturbance. There do not appear to be any viable populations in areas where human population densities are moderate to high, such as in heavily developed lake areas, or along major rivers, even where seemingly suitable habitat persists.

The possible reasons for this are numerous. This species is known to nest only up to 0.4 km (0.25 mi) away from water (Storer 1930). Alteration or destruction of adjacent habitats may eliminate nesting areas; increase the rate of predation on nesting females, nests, or hatchlings; and/or expose hatchlings to lethal post-hatching conditions. If there is a high degree of nest-site philopatry as is known in some similar species (J. Congdon, pers. comm. to D. Holland), incompatible land uses may exacerbate potential problems with the viability of a population.

Although this species may to some extent become acclimated to low levels of human disturbance (D. Holland, pers. obs.), individual variation in behavioral responses may influence dynamics of populations. Low levels of disturbance may affect the frequency and duration of basking or foraging behavior, which may be particularly important for gravid females. Egg development rate may be closely tied to a physiological window of a critical minimum number of days at or above a certain temperature. Lack of access to this window, either by interruption of basking or by other activities, may lead to a delay in the maturation of eggs and time of their deposition. This in turn may lead to a decrease in the time available for offspring to develop, hatch, and find suitable microhabitat and food to increase the probability of overwinter survival.

Familiarization with humans and continuous low levels of disturbance may decrease the natural wariness of this species and make it more susceptible to acts of vandalism such as wanton shooting. Additionally, there may be significant effects of human commensals on western pond turtle populations. Cattle trample and eat the microhabitat required by hatchlings along watercourses and may crush nests. Dogs may mutilate nesting females (D. Holland, pers. obs.). Raccoons are major predators on turtles and turtle eggs (Christiansen and Gallaway 1984, Slavens 1992b). Predation on nests is known to increase near ecological edges (Temple 1987), such as those created by human activities.

Activities of anglers may influence western pond turtle behavior or cause direct mortality. Boat traffic poses the threat of disturbance with associated pressures on resident turtles, and animals can be hooked or netted, which may lead to death.

Extensive overland movements by western pond turtles increase their vulnerability to predation and other mortality sources. Alteration of aquatic habitats, by water diversion projects or similar situations, may impose considerable hardship on moving turtles and result in higher than normal levels of mortality. Vehicular traffic on roads which traverse western pond turtle habitat may result in significant mortality to turtles moving over land.

The western pond turtle has a long life span, a relatively low reproductive rate, relatively high subadult mortality, and low recruitment. The combination of these factors makes this species especially sensitive to certain types of disturbance, particularly factors that affect recruitment. Even relatively minor changes in the pattern or level of recruitment may have major effects on the potential viability of a population, but due to the long life span of this species changes of this nature may not be superficially obvious. As previously noted, turtles may persist in an area for extended periods even after the population is no longer reproductively viable.

### Interspecific Relationships

As significant predators on hatchling and juvenile western pond turtles, exotic species such as bullfrogs and bass may alter recruitment patterns and reduce survivorship. Holland (1991b) compared several turtle sites shared with bullfrogs to several others where bullfrogs were not present, and showed higher proportions of young turtles where the alien predator was not a factor.

Sunfish compete directly and indirectly for invertebrate prey, and carp alter habitat when feeding on submerged and emergent vegetation.

## CONCLUSIONS AND RECOMMENDATION

The number of western pond turtles in Washington is critically low, the historic population has been extirpated from a significant portion of the range, and the current population has a very restricted range and is highly vulnerable to natural and catastrophic events. At the present time, Klickitat and Skamania counties support the only populations which can be considered viable.

Without extensive, immediate, and continuing human intervention, it is highly probable that this species will totally disappear from Washington within 10 to 15 years. Maintenance of extant populations will probably require long-term recovery efforts directed at habitat

protection and restoration, a long-term predator control program to eliminate bullfrogs and exotic fishes, captive breeding and reintroduction, and head-start programs for hatchlings.

This species is in danger of extirpation from Washington in the foreseeable future. It is therefore recommended that the western pond turtle be reclassified from threatened to endangered status.

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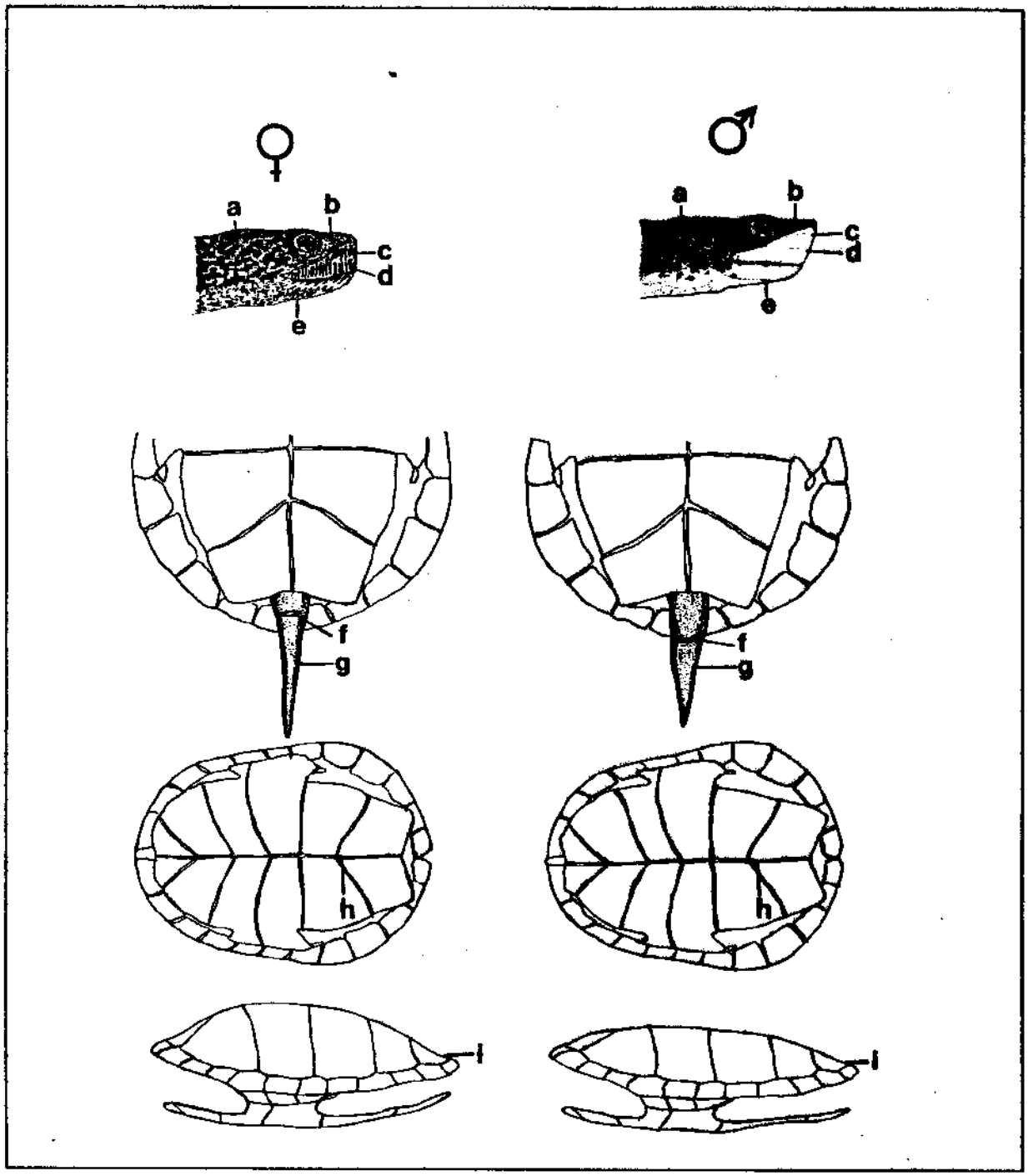
Appendix A. Key to sexually dimorphic characters in the western pond turtle (from Holland 1991b). Character letters refer to illustrations on the following page.

| Character | Female | Male |
|---|---|---|
| a. neck | lateral and dorsal surfaces of head and neck usually mottled or ocellate in pattern | lateral and dorsal surfaces of head and neck often uniformly colored, especially in older animals |
| b. nose | distance from anterior edge of orbit to edge of snout relatively small | distance from anterior edge of orbit to edge of snout relatively large |
| c. snout | angle usually vertical or nearly vertical | angle usually about 10-15° from vertical |
| d. maxilla | often with fine dark vertical lines or "mustache" | lightly marked or unmarked, especially in older animals |
| e. throat | often flecked with numerous small dark markings | usually lightly marked or unmarked, especially in older animals |
| f. vent | cloaca usually at or anterior to posterior edge of carapace | cloaca usually posterior to posterior edge of carapace |
| g. tail | usually relatively long and thin | usually relatively short and thick |
| h. plastron | area of femoral-anal seam junction usually flat or slightly convex | area of femoral-anal seam junction usually slightly concave |
| i. shell | relatively high/deep in relation to length of carapace, rounded in vicinity of costals 3-4 | relatively low/shallow in relation to length of carapace, often not rounded in vicinity of costals 3-4 |

Note: These characteristics are intended as a general guide and will not consistently apply to all turtles of this species. Appearance of secondary sexual characteristics usually occurs by the time an animal reaches approximately 120 mm carapace length. However, in populations in the southern part of the range and in small streams in montane areas, characteristics may become apparent at 100-110 mm carapace length.

Appendix A (cont'd). Key to sexually dimorphic characters in the western pond turtle (from Holland 1991b).



# Appendix B

## Washington Administrative Codes

## 232-12-297, 232-12-011, 232-12-014

**WAC 232-12-297 Endangered, threatened, and sensitive wildlife species classification.**

PURPOSE

1.1 The purpose of this rule is to identify and classify native wildlife species that have need of protection and/or management to ensure their survival as free-ranging populations in Washington and to define the process by which listing, management, recovery, and delisting of a species can be achieved. These rules are established to ensure that consistent procedures and criteria are followed when classifying wildlife as endangered, or the protected wildlife subcategories threatened or sensitive.

DEFINITIONS

For purposes of this rule, the following definitions apply:

2.1 "Classify" and all derivatives means to list or delist wildlife species to or from endangered, or to or from the protected wildlife subcategories threatened or sensitive.

2.2 "List" and all derivatives means to change the classification status of a wildlife species to endangered, threatened, or sensitive.

2.3 "Delist" and its derivatives means to change the classification of endangered, threatened, or sensitive species to a classification other than endangered, threatened, or sensitive.

2.4 "Endangered" means any wildlife species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state.

2.5 "Threatened" means any wildlife species native to the state of Washington that is likely to become an endangered species within the foreseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats.

2.6 "Sensitive" means any wildlife species native to the state of Washington that is vulnerable or declining and is likely to become endangered or threatened in a significant portion of its range within the state without cooperative management or removal of threats.

2.7 "Species" means any group of animals classified as a species or subspecies as commonly accepted by the scientific community.

2.8 "Native" means any wildlife species naturally occurring in Washington for purposes of breeding, resting, or foraging, excluding introduced species not found historically in this state.

2.9 "Significant portion of its range" means that portion of a species' range likely to be essential to the long term survival of the population in Washington.

LISTING CRITERIA

3.1 The commission shall list a wildlife species as endangered, threatened, or sensitive solely on the basis of the biological status of the species being considered, based on the preponderance of scientific data available, except as noted in section 3.4.

3.2 If a species is listed as endangered or threatened under the federal Endangered Species Act, the agency will recommend to the commission that it be listed as endangered or threatened as specified in section 9.1. If listed, the agency will proceed with development of a recovery plan pursuant to section 11.1.

3.3 Species may be listed as endangered, threatened, or sensitive only when populations are in danger of failing, declining, or are vulnerable, due to factors including but not restricted to limited numbers, disease, predation, exploitation, or habitat loss or change, pursuant to section 7.1.

3.4 Where a species of the class Insecta, based on substantial evidence, is determined to present an unreasonable risk to public health, the commission may make the determination that the species need not be listed as endangered, threatened, or sensitive.

DELISTING CRITERIA

4.1 The commission shall delist a wildlife species from endangered, threatened, or sensitive solely on the basis of the biological status of the species being

considered, based on the preponderance of scientific data available.

4.2 A species may be delisted from endangered, threatened, or sensitive only when populations are no longer in danger of failing, declining, are no longer vulnerable, pursuant to section 3.3, or meet recovery plan goals, and when it no longer meets the definitions in sections 2.4, 2.5, or 2.6.

INITIATION OF LISTING PROCESS

5.1 Any one of the following events may initiate the listing process.

5.1.1 The agency determines that a species population may be in danger of failing, declining, or vulnerable, pursuant to section 3.3.

5.1.2 A petition is received at the agency from an interested person. The petition should be addressed to the director. It should set forth specific evidence and scientific data which shows that the species may be failing, declining, or vulnerable, pursuant to section 3.3. Within 60 days, the agency shall either deny the petition, stating the reasons, or initiate the classification process.

5.1.3 An emergency, as defined by the Administrative Procedure Act, chapter 34.05 RCW. The listing of any species previously classified under emergency rule shall be governed by the provisions of this section.

5.1.4 The commission requests the agency review a species of concern.

5.2 Upon initiation of the listing process the agency shall publish a public notice in the Washington Register, and notify those parties who have expressed their interest to the department, announcing the initiation of the classification process and calling for scientific information relevant to the species status report under consideration pursuant to section 7.1.

INITIATION OF DELISTING PROCESS

6.1 Any one of the following events may initiate the delisting process:

6.1.1 The agency determines that a species population may no longer be in danger of failing, declining, or vulnerable, pursuant to section 3.3.

6.1.2 The agency receives a petition from an interested person. The petition should be addressed to the director. It should set forth specific evidence and scientific data which shows that the species may no longer be failing, declining, or vulnerable, pursuant to section 3.3. Within 60 days, the agency shall either deny the petition, stating the reasons, or initiate the delisting process.

6.1.3 The commission requests the agency review a species of concern.

6.2 Upon initiation of the delisting process the agency shall publish a public notice in the Washington Register, and notify those parties who have expressed their interest to the department, announcing the initiation of the delisting process and calling for scientific information relevant to the species status report under consideration pursuant to section 7.1.

SPECIES STATUS REVIEW AND AGENCY RECOMMENDATIONS

7.1 Except in an emergency under 5.1.3 above, prior to making a classification recommendation to the commission, the Agency shall prepare a preliminary species status report. The report will include a review of information relevant to the species' status in Washington and address factors affecting its status, including those given under section 3.3. The status report shall be reviewed by the public and scientific community. The status report will include, but not be limited to an analysis of:

7.1.1 Historic, current, and future species population trends

7.1.2 Natural history, including ecological relationships (e.g. food habits, home range, habitat selection patterns).

7.1.3 Historic and current habitat trends.

7.1.4 Population demographics (e.g. survival and mortality rates, reproductive success) and their relationship to long term sustainability.

7.1.5 Historic and current species management activities.

7.2 Except in an emergency under 5.1.3 above, the agency shall prepare recommendations for species classification, based upon scientific data contained in the status report. Documents shall be prepared to determine the environmental consequences of adopting the recommendations pursuant to requirements of the State Environmental Policy Act (SEPA).

7.3 For the purpose of delisting, the status report will include a review of recovery plan goals.

PUBLIC REVIEW

8.1 Except in an emergency under 5.1.3 above, prior to making a recommendation to the commission, the agency shall provide an opportunity for interested parties to submit new scientific data relevant to the status report, classification recommendation, and any SEPA findings.

8.1.1 The agency shall allow at least 90 days for public comment.

8.1.2 The agency will hold at least one public meeting in each of its administrative regions during the public review period.

FINAL RECOMMENDATIONS AND COMMISSION ACTION

9.1 After the close of the public comment period, the agency shall complete a final status report and classification recommendation. SEPA documents will be prepared, as necessary, for the final agency recommendation for classification. The classification recommendation will be presented to the commission for action. The final species status report, agency classification recommendation, and SEPA documents will be made available to the public at least 30 days prior to the commission meeting.

9.2 Notice of the proposed commission action will be published at least 30 days prior to the commission meeting.

PERIODIC SPECIES STATUS REVIEW

10.1 The agency shall conduct a review of each endangered, threatened, or sensitive wildlife species at least every five years after the date of its listing. This review shall include an update of the species status report to determine whether the status of the species warrants its current listing status or deserves reclassification.

10.1.1 The agency shall notify any parties who have expressed their interest to the department of the periodic status review. This notice shall occur at least one year prior to end of the five year period required by section 10.1.

10.2 The status of all delisted species shall be reviewed at least once, five years following the date of delisting.

10.3 The department shall evaluate the necessity of changing the classification of the species being reviewed. The agency shall report its findings to the commission at a commission meeting. The agency shall notify the public of its findings at least 30 days prior to presenting the findings to the commission.

10.3.1 If the agency determines that new information suggests that classification of a species should be changed from its present state, the agency shall initiate classification procedures provided for in these rules starting with section 5.1.

10.3.2 If the agency determines that conditions have not changed significantly and that the classification of the species should remain unchanged, the agency shall recommend to the commission that the species being reviewed shall retain its present classification status.

10.4 Nothing in these rules shall be construed to automatically delist a species without formal commission action.

RECOVERY AND MANAGEMENT OF LISTED SPECIES

11.1 The agency shall write a recovery plan for species listed as endangered or threatened. The agency will write a management plan for species listed as sensitive. Recovery and management plans shall address the listing criteria described in sections 3.1 and 3.3, and shall include, but are not limited to:

11.1.1 Target population objectives

11.1.2 Criteria for reclassification

11.1.3 An implementation plan for reaching population objectives which will promote cooperative management and be sensitive to landowner needs and property rights. The plan will specify resources needed from and impacts to the Department, other agencies (including federal, state, and local), tribes, landowners, and other interest groups. The plan shall consider various approaches to meeting recovery objectives including, but not limited to regulation, mitigation, acquisition, incentive, and compensation mechanisms.

11.1.4 Public education needs

11.1.5 A species monitoring plan, which requires periodic review to allow the incorporation of new information into the status report.

11.2 Preparation of recovery and management plans will be initiated by the agency within one year after the date of listing.

11.2.1 Recovery and management plans for species listed prior to 1990 or during the five years following the adoption of these rules shall be completed within 5 years after the date of listing or adoption of these rules, whichever comes later. Development of recovery plans for endangered species will receive higher priority than threatened or sensitive species.

11.2.2 Recovery and management plans for species listed after five years following the adoption of these rules shall be completed within three years after the date of listing.

11.2.3 The agency will publish a notice in the Washington Register and notify any parties who have expressed interest to the department interested parties of the initiation of recovery plan development.

11.2.4 If the deadlines defined in sections 11.2.1 and 11.2.2 are not met the department shall notify the public and report the reasons for missing the deadline and the strategy for completing the plan at a

commission meeting. The intent of this section is to recognize current department personnel resources are limiting and that development of recovery plans for some of the species may require significant involvement by interests outside of the department, and therefore take longer to complete.

11.3 The agency shall provide an opportunity for interested public to comment on the recovery plan and any SEPA documents.

CLASSIFICATION PROCEDURES REVIEW

12.1 The agency and an ad hoc public group with members representing a broad spectrum of interests, shall meet as needed to accomplish the following:

12.1.1 Monitor the progress of the development of recovery and management plans and status reviews, highlight problems, and make recommendations to the department and other interested parties to improve the effectiveness of these processes.

12.1.2 Review these classification procedures six years after the adoption of these rules and report its findings to the commission.

AUTHORITY

13.1 The commission has the authority to classify wildlife as endangered under RCW 77.12.020. Species classified as endangered are listed under WAC 232-12-014, as amended.

13.2 Threatened and sensitive species shall be classified as subcategories of protected wildlife. The commission has the authority to classify wildlife as protected under RCW 77.12.020. Species classified as protected are listed under WAC 232-12-011, as amended.

[Statutory Authority: RCW 77.12.020. 90-11-066 (Order 442), § 232-12-297, filed 5/15/90, effective 6/15/90.]

**WAC 232-12-011 Wildlife classified as protected shall not be hunted or fished.** Protected wildlife are designated into three subcategories: Threatened, sensitive, and other.

(1) Threatened species are any wildlife species native to the state of Washington that are likely to become endangered within the foreseeable future throughout a significant portion of their range within the state without cooperative management or removal of threats.

Protected wildlife designated as threatened include ferruginous hawk, *Buteoregalis*; bald eagle, *Haliaeetus leucocephalus*; western pond turtle, *Clemmys marmorata*; green sea turtle, *Cheloniia mydas*; loggerhead sea turtle, *Caretta caretta*; Oregon silverspot butterfly, *Speyeria zerene hippolyta*; pygmy rabbit, *Brachylagus idahoensis*.

(2) Sensitive species are any wildlife species native to the state of Washington that are vulnerable or declining and are likely to become endangered or threatened in a significant portion of their range within the state without cooperative management or removal of threats.

(3) Other protected wildlife.

Other protected wildlife include all birds not classified as game birds, predatory birds, or endangered species[,] or designated as threatened species or sensitive species; and fur seal, *Callorhinus ursinus*; fisher, *Martes pennanti*; wolverine, *Gulo luscus*; western gray squirrel, *Sciurus griseus*; Douglas squirrel, *Tamiasciurus douglasii*; red squirrel, *Tamiasciurus hudsonicus*; flying squirrel, *Glaucomys sabrinus*; golden-mantled ground squirrel, *Callospermophilus saturatus*; chipmunks, *Eutamias*; cony or pika, *Ochotona princeps*; hoary marmot, *Marmota caligata* and *olympus*; all wild turtles not otherwise classified as endangered species, or designated as threatened species or sensitive species; mammals of the order *Cetacea*, including whales, porpoises, and mammals of the suborder *Pinnipedia* not otherwise classified as endangered species, or designated as threatened species or sensitive species. This section shall not apply to hair seals and sea lions which are threatening to damage or are damaging commercial fishing gear being utilized in a lawful manner or when said mammals are damaging or threatening to damage commercial fish being lawfully taken with commercial gear.

[Statutory Authority: RCW 77.12.020. 90-11-065 (Order 441), § 232-12-011, filed 5/15/90, effective 6/15/90. Statutory Authority: RCW 77.12.040. 89-11-061 (Order 392), § 232-12-011, filed 5/18/89; 82-19-026 (Order 192), § 232-12-011, filed 9/9/82; 81-22-002 (Order 174), § 232-12-011, filed 10/22/81; 81-12-029 (Order 165), § 232-12-011, filed 6/1/81.]

**Reviser's note:** RCW 34.05.395 requires the use of underlining and deletion marks to indicate amendments to existing rules, and deems ineffectual changes not filed by the agency in this manner. The bracketed material in the above section does not appear to conform to the statutory requirement.

**WAC 232-12-014 Wildlife classified as endangered species.** Endangered species include: Columbian white-tailed deer, *Odocoileus virginianus leucurus*; Mountain caribou, *Rangifer tarandus*; Blue whale, *Balaenoptera musculus*; Bowhead whale, *Balaena mysticetus*; Finback whale, *Balaenoptera physalus*; Gray whale, *Eschrichtius gibbosus*; Humpback whale, *Megaptera novaeangliae*; Right whale, *Balaena glacialis*; Sei whale, *Balaenoptera borealis*; Sperm whale, *Physeter catodon*; Wolf, *Canis lupus*; Peregrine falcon, *Falco peregrinus*; Aleutian Canada goose, *Branta canadensis luecopareia*; Brown pelican, *Pelecanus occidentalis*; Leatherback sea turtle, *Dermochelys coriacea*; Grizzly bear, *Ursus arctos horribilis*; Sea Otter, *Enhydra lutris*; White pelican, *Pelecanus erythrorhynchos*; Sandhill crane, *Grus canadensis*; Snowy plover, *Charadrius alexandrinus*; Upland sandpiper, *Bartramia longicauda*; Northern spotted owl, *Strix occidentalis*.

[Statutory Authority: RCW 77.12.020(6). 88-05-032 (Order 305), § 232-12-014, filed 2/12/88. Statutory Authority: RCW 77.12.040. 82-19-026 (Order 192), § 232-12-014, filed 9/9/82; 81-22-002 (Order 174), § 232-12-014, filed 10/22/81; 81-12-029 (Order 165), § 232-12-014, filed 6/1/81.]