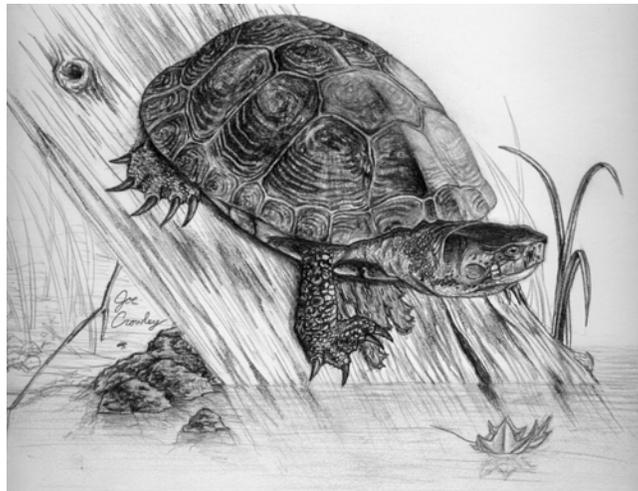


COSEWIC Assessment and Status Report

on the

Pacific Pond Turtle *Clemmys marmorata*

in Canada



EXTIRPATED
2002

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE IN
CANADA



COSEPAC
COMITÉ SUR LA SITUATION DES
ESPÈCES EN PÉRIL
AU CANADA

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COSEWIC Assessment Summary

Assessment Summary – May 2002

Common name

Pacific pond turtle

Scientific name

Clemmys marmorata

Status

Extirpated

Reason for designation

This species was found occasionally in southern BC up to 1959. This species is at risk throughout its range and has disappeared from the northern parts of its range, in BC and most of Washington, Oregon and northern California. As it has not been recorded in BC since 1959, it can be considered to be extirpated from Canada.

Occurrence

British Columbia

Status history

Designated Extirpated in May 2002. Assessment based on a new status report.



COSEWIC Executive Summary

Pacific Pond Turtle *Clemmys marmorata*

Species information

The Pacific pond turtle (*Clemmys marmorata*) is one of four species in the genus *Clemmys*, Family Emydidae. This species is further subdivided into a northern and southern subspecies: *C.m. marmorata*, the northern Pacific pond turtle, and *C.m. pallida*, the southern Pacific pond turtle. The carapace is olive, dark brown or black with varying degrees of mottling and 9-18 cm in length in adults. The plastron is yellowish with dark blotches, and skin colour is grey. Juvenile turtles differ from adults by having a keeled carapace and a relatively longer tail. (See section on Species Information for a note on potential changes in taxonomy.)

Distribution

The historical distribution of *Clemmys marmorata* ranged along the west coast of North America from southern British Columbia to Baja California and inland to Nevada. Currently, the main distribution of this species is in coastal California and Baja California with isolated inland populations found in Washington, Oregon, Nevada and the Mojave River in California. There have been no records of the Pacific pond turtle in Canada since 1959.

Habitat

C. marmorata is primarily riparian, found in slow-moving streams, large rivers, sloughs and occasionally brackish water. It is found in rocky habitats as well as those with muddy bottoms and prefers areas with emergent vegetation. This species experiences seasonal drought in portions of its range and can apparently survive by migrating to existing pools and estivating in the mud. Nest sites are in dry, open areas and this turtle will overwinter in both woodland areas and under water.

Biology

This species reaches maturity at approximately 8-10 years or at a carapace length of 13.5-14 cm. Eggs are laid between May and August, and those clutches laid later in the season may overwinter as hatchlings or experience embryonic diapause until favourable conditions are met the following spring. The Pacific pond turtle will eat a

wide variety of food items from plant to animal to carrion. Maximum age estimates vary considerably, but this turtle can certainly live over 20 years in the wild.

Population sizes and trends

The Pacific pond turtle was possibly common in the ponds and lakes of southern British Columbia and Vancouver Island in the mid-1800s, but no sightings have been recorded in Canada since 1959. After an intensive 10-year recovery project, the populations in Washington state now total a mere 450-500 individuals. Oregon populations have decreased to less than 10% of their original numbers and are estimated at 2,000 individuals. There are no population estimates for this species in California or Baja California, and it has been suggested that it no longer exists in Nevada.

Limiting factors and threats

This species was subject to unrelenting commercial harvesting for food in the late 19th and early 20th centuries, which caused a significant decline in overall population numbers. Since that time, habitat has been and continues to be modified or lost as agricultural and urban development increases in North America. Recruitment in the Washington state populations is significantly limited by heavy predation on juveniles by the introduced American bullfrog (native to eastern North America) and raccoons.

Special significance of the species

Clemmys marmorata is the only species of its genus found in western North America (Ernst et al. 1994). All four *Clemmys* species (the wood turtle, *Clemmys insculpta*; bog turtle, *Clemmys muhlenbergii*; and spotted turtle, *Clemmys guttata*) are at some risk of extinction in Canada and the United States.

Existing protection or other status designations

C. marmorata is on the International Union for the Conservation of Nature Red List as a Vulnerable species (IUCN website). It is also a Special Concern species in the United States under the Endangered Species Act (USFWS website). This species is listed as Threatened in Washington, Sensitive in Oregon and of Special Concern in California. It may be Extirpated in Nevada, and is on the British Columbia Red List as an Extirpated species.



COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild species, subspecies, varieties, and nationally significant populations that are considered to be at risk in Canada. Designations are made on all native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fish, lepidopterans, molluscs, vascular plants, lichens, and mosses.

COSEWIC MEMBERSHIP

COSEWIC comprises representatives from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership), three nonjurisdictional members and the co-chairs of the species specialist groups. The committee meets to consider status reports on candidate species.

DEFINITIONS

Species	Any indigenous species, subspecies, variety, or geographically defined population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list.



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COSEWIC Status Report

on the

Pacific Pond Turtle

Clemmys marmorata

in Canada

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2002

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SPECIES INFORMATION

Name and classification

The Pacific pond turtle (*Clemmys marmorata*) is one of four species in the genus *Clemmys*, Family Emydidae (Crother et al. 2000). *Clemmys* species are known collectively as the American pond turtles as they are restricted to North America (ibid.), and all are at some risk of extinction in Canada and the United States (R. Brooks, pers. comm.).

Clemmys marmorata has been subdivided into a northern and southern subspecies: *C.m. marmorata*, the northern Pacific pond turtle, and *C.m. pallida*, the southern Pacific pond turtle (Crother et al. 2000). These subspecies intergrade in the San Francisco Bay area (Carr 1952). Recent genetic analysis has shown that the northern inland populations are genetically distinct from one another, whereas northern coastal populations are not (Gray 1995). Southern populations also remain genetically similar. Based on differences in cytochrome b, Gray (1995) determined that Oregon (and presumably more northerly) populations are fairly recent invaders from northern California, and that Baja California populations may be distinct enough to be a separate species.

[Author's note: Recent genetic work by Bickham et al. (1996) and Burke et al. (1996) has shown that the *Clemmys* genus may be paraphyletic, thus necessitating a new generic arrangement. *C. marmorata* may be more closely related to *Emydoidea blandingii* and *Emys orbicularis* than *C. insculpta* and *C. muhlenbergii* (a sister clade) or *C. guttata* (a monospecific clade) (Ernst 2002; Crother et al. 2000).]

Description

The Pacific pond turtle is a medium-sized species with a carapace length of 9-18 cm (Holland 1985). The carapace is smooth and keelless with a pattern of spots or lines radiating out from the centres of the scutes (Ernst et al. 1994). Carapace ground colour varies from olive to nearly black, sometimes with a mottling pattern (Carr 1952). The plastron is hingeless, and pale yellow with irregular dark blotches along the hind edges of the scutes (Ernst et al. 1994). Skin colour is gray with pale yellow on the neck, chin, forelimbs and tail (ibid.)

There is no significant size difference between males and females; however, males have a concave plastron and a slightly lower carapace height (Carr 1952). Ernst et al. (1994) state that females show more shell patterning than males, although Carr (1952) states the opposite. The male's cloacal vent is posterior to the margin of the carapace; the female's is ventral to the margin (Ernst et al. 1994). Juvenile Pacific pond turtles differ from adults by having a keeled carapace and a relatively longer tail (Carr 1952).

DISTRIBUTION

North American range

Historically, the Pacific pond turtle was distributed along the west coast of North America from southern British Columbia to the Baja Peninsula (Bury 1970a; Carr 1952; Figure 1). The majority of the turtle's distribution is now restricted to coastal California and the Baja Peninsula, with small isolated inland populations in Washington, Oregon, along the Mojave River in California, and possibly Nevada, although the population is now thought to be extirpated (Ernst et al. 1994; Lovich and Meyer In Press; Figure 2). *Clemmys marmorata* remains have been found in Pleistocene era deposits, such as Lake Manix and the La Brea Tar Pits in California (Ernst et al. 1994).

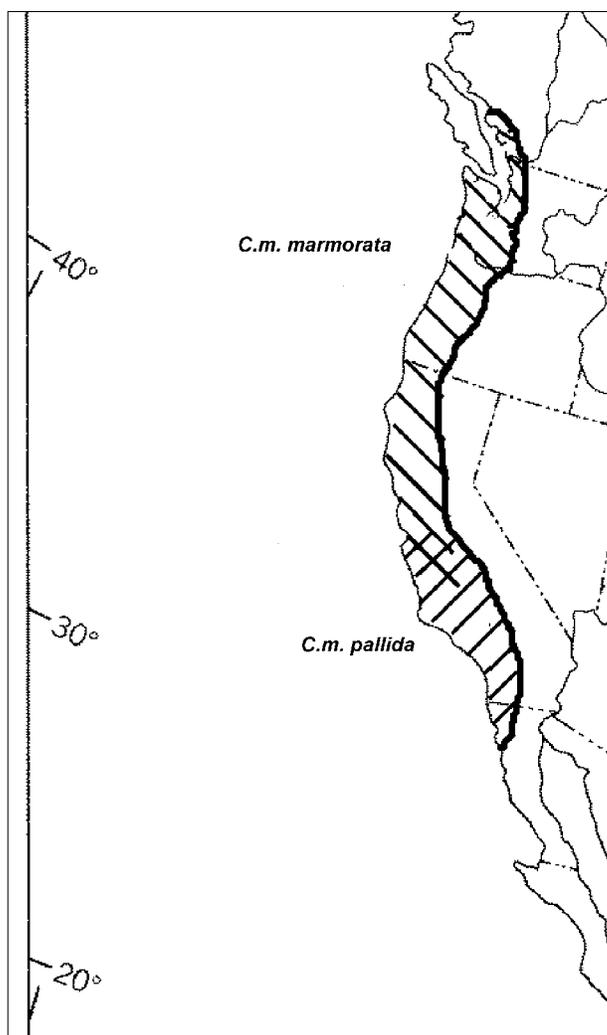


Figure 1. Historic range of *Clemmys marmorata* in North America (after Carr 1952).

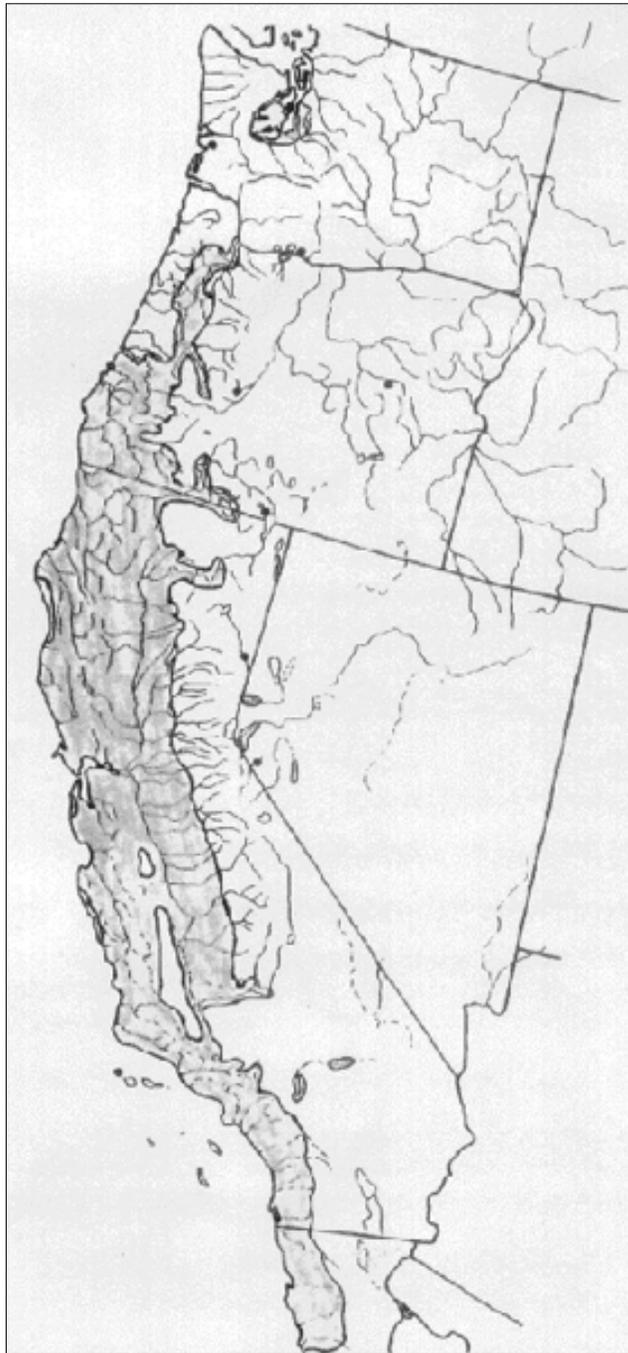


Figure 2. Current range of *Clemmys marmorata* in North America (by D. Holland, published in USACE website).

There are three validated records of the Pacific pond turtle in the Vancouver area of British Columbia from 1933, 1936 and 1959 (Bury 1970a; Cook 1984). Before 1950, there were also unverified sightings of this turtle on Vancouver Island (Bury 1970a). While there is some debate over the number and validity of the records of this turtle in Canada (Carr 1952; Ernst et al. 1994; Cook 1984), there is no biogeographic basis for this turtle's range not to have extended into Canada (B. Bury pers. comm.). First, the climate in southwestern British Columbia is favourable for *Clemmys marmorata*, particularly areas having hot and dry summers and oak-woodland habitat. The Canadian populations may have been established when a warming period in the Pleistocene opened up a "banana belt" from the Puget Sound trough to the east side of Vancouver Island (B. Bury pers. comm.). Second, the Pacific pond turtle was common in the Puget Sound area (which extends almost to the Canadian border) even into the 1960s (B. Bury pers. comm.).

HABITAT

Habitat requirements

Pacific pond turtles are most often found in streams, large rivers, slow-moving sloughs and quiet waters (Bury 1986b), although they occur in a wide variety of habitats including ponds, vernal pools, marshes, ephemeral creeks, reservoirs, agricultural ditches, sewage treatment ponds, canals and estuaries (Reese and Welsh 1997; IEP interim report). These turtles can tolerate saltwater for short periods of time, and commonly occur in brackish water (D. Holland pers. comm. to IEP). Habitats are often strewn with rocks or gravel (Bury 1986b), but contain some aquatic vegetation and sites for basking (Ernst et al. 1994).

Pacific pond turtles require deep pools with large woody debris to provide refugia from predators (Reese and Welsh 1998a). They are frequently associated with vegetated banks that may also provide protection from predators while allowing adequate exposure to sunlight for thermoregulation (ibid.). Along the Trinity River in California, Reese and Welsh (1998a) found that in sections of the river with lower water temperatures, turtles are more commonly associated with basking objects (rocks and logs) and baskable bank than sections of the river with warmer water temperatures. This suggests that in British Columbia, where water temperatures are lower than in California, suitable basking areas would be critical for Pacific pond turtles to maintain optimal body temperature.

Use of terrestrial habitat by Pacific pond turtles in northern California has been well documented by Reese and Welsh (1997). Movements on land are most common in summer and winter, with the summer peak corresponding to females seeking nest sites and the winter peak corresponding to both sexes seeking hibernacula. Female turtles spend time on land during every month of the year, whereas males do not use terrestrial habitat during July and August. Preliminary data from Lovich and Meyer (In Press) show frequent small movements of Pacific pond turtles between adjacent ponds and

wetlands in the Mojave watershed, California. All of the radiotagged turtles in Reese and Welsh's 1997 terrestrial habitat study overwintered in mixed, deciduous, and coniferous woodlands.

Trends

No studies have examined the extent of suitable habitat for the Pacific pond turtle in British Columbia. In the United States, damming and other water diversionary methods have created unsuitable habitat for turtles by increasing water velocity, decreasing water temperature, removing bank vegetation and creating barriers to terrestrial habitat (Reese and Welsh 1998a). In the Willamette Valley, seven dams control the waterway where a significant portion of the Oregon pond turtle population remains. Extensive loss of wetland habitat has occurred in California where less than 10% remains unchanged by agricultural development (Lovich and Meyer In Press). Habitat modification and destruction continue to limit the distribution of Pacific pond turtles in the United States (ibid.).

Protection/ownership

The Washington Department of Wildlife purchased 165 acres of land surrounding the turtle ponds in Klickitat County, Washington, for the Western Pond Turtle Project and is continuing to negotiate for ownership of the land surrounding turtle ponds in Skamania County (WPTP website). These are the only two sites in the state of Washington where the Pacific pond turtle remains. There is no formal protection of the Willamette Valley in Oregon; however, the population of Pacific pond turtles is continually monitored by the United States Army Corps of Engineers and the Oregon Department of Fish and Wildlife (USACE website).

BIOLOGY

As the Pacific pond turtle has been so infrequently recorded in British Columbia, and not at all since 1959, there are no studies on its biology in Canada.

Reproduction

Very little information is currently available on the life history of the Pacific pond turtle. There are inconsistencies in the literature regarding age of maturity, time of copulation and time of nesting. These may be related to environmental differences, particularly temperature, throughout the turtle's range; however, some of the major discrepancies are from populations within Washington state. The Pacific pond turtle reaches maturity at approximately 8 to 10 years, or at a carapace length of 135 to 140 mm (Ernst et al. 1994). Information specific to the Washington population states that age of maturity is reached by females at 10-15 years and at 8-12 years by males (WPTP website). Copulation has been observed in the field in April, May, June and late August (Ernst et al. 1994; IEP interim report). Nesting occurs from late May to early

June in the Mojave River population (Lovich and Meyer In Press), from mid-June to mid-July in the Trinity River population (Reese and Welsh 1997), and from May to August in the Washington state populations (IEP interim report; WPTP website).

Prior to nesting, females in the Trinity River population made multiple trips (ranging from 2-11) onto land during which they burrowed into leaf litter for up to three days at a time (Reese and Welsh 1997). This may allow the females to increase their body temperature to optimize preovipositional development of the embryo as land temperatures are greater than water temperatures in spring (*ibid.*), or to assess the environment for favourable oviposition sites. Females dig flask-shaped nests in open, upland sites with a southern exposure (Ernst et al. 1994; Reese and Welsh 1997). Clutch size ranges from 2-11 and there is some evidence that multiple clutches may be laid in the same year (Ernst et al. 1994).

Hatchlings in the Trinity River population did not emerge from nests until the following spring (Reese and Welsh 1997). It is unknown whether the hatchlings overwintered in the nest cavity or if the embryonic development was suspended until just before emergence in March. The incubation time for turtles in Washington state ranged from 90-130 days (WPTP website). Hatchling sex is determined by incubation temperature (M. Ewert, pers. comm.).

Growth and survivorship

Hatchling Pacific pond turtles have a carapace length between 25 and 29 mm and reach 27.8-33.9 mm by the beginning of their second season (Ernst et al. 1994). The maximum carapace length for this species is recorded as 18 cm in Carr (1952) and 21 cm in the IEP database (IEP interim report), with an average carapace length of 15 cm (Carr 1952). The longest-lived turtle in captivity lived over 12 years (Ernst et al. 1994); however, maximum age attained in the wild is unknown and estimates vary from 20+ years (*ibid.*) to 30-40 years (IEP interim report) to 50 years (WPTP website).

A demographic study of the Trinity River population indicated that the age-structure of this population is skewed towards adults. Overall, only 25% of the total captures were juveniles, and significantly fewer juveniles than adults were recaptured throughout the study (Reese and Welsh 1998b). It is possible that juveniles have a lower capture probability; however, the low rate of recapture may also be due to lower survival probability. Despite high adult survivorship, naturally low nest survivorship in Pacific pond turtles makes high juvenile survivorship crucial for a population to maintain long-term stability (Reese and Welsh 1998b; Congdon et al. 1993).

Feeding habits

The Pacific pond turtle is an opportunistic forager and scavenger. In the wild it has been observed feeding on various plants, algae, crustaceans, adult and larval insects, fish, frogs, snakes, and duck and mouse carrion, and in captivity it will eat anything from dog food to earthworms to romaine lettuce (Ernst et al. 1994). Males consume larger

prey and more animal matter than females, who eat more algae. Juveniles eat smaller food items, and more of them, than adults (Bury 1986a).

Behaviour

Pacific pond turtles generally forage at sunrise (0530-0800h), but may forage throughout the day in the summer months (Ernst et al. 1994). They will move upstream and downstream to different pools in early morning and evening in search of suitable feeding and basking opportunities (ibid.). The majority of basking takes place between 0900 and 1000h (Bury 1972). Basking Pacific pond turtles aggressively defend their place in the basking site if it becomes crowded. They will ram and push, threaten with an open-mouth gesture and occasionally bite one another (Bury 1986b). Adult turtles will sometimes use the open-mouth gesture to threaten juveniles already occupying good basking sites, and may even push the smaller turtle off its perch (Ernst et al. 1994).

Hibernation

Hibernation takes place both on land and in the water (Ernst et al. 1994; Reese and Welsh 1997). Of the 12 radio-equipped turtles monitored by Reese and Welsh (1997), 10 chose hibernation sites in woodlands (hardwood, coniferous and mixed) and two overwintered in lentic bodies of water. All turtles moved onto land in September, but changed locations as many as four times before early December when they selected their final sites. Emergence began in February and was completed in June (Reese and Welsh 1997). In the Willamette Valley, the earliest occurrence of the Pacific pond turtle was 28 February and the latest was 19 November (Evenden 1948 in Ernst et al. 1994). This species will also estivate during summer drought periods by burrowing into the muddy bottoms of streams or pools (Bury 1986b; Ernst et al. 1994).

POPULATION SIZES AND TRENDS

The number of Pacific pond turtles along the west coast of North America has dropped dramatically since the late 19th century when this species was “almost constantly for sale in the markets of San Francisco” (True 1884 cited in Carr 1952). The Canadian population of *Clemmys marmorata* has been extirpated for nearly 50 years and the entire species has become rare or extirpated in the northern- and southernmost parts of its range. After surveys were conducted in Washington state between 1985 and 1990, it was confirmed that the species was no longer present in Puget Sound (where it had been formerly abundant) and that the only two remaining populations were in the Columbia Gorge (Washington Dept. of Wildlife 1991). The number of turtles remaining in these populations totaled 150-200 individuals, which was further reduced when a respiratory disease killed approximately 25% of the turtles in 1990 (WDW 1993). Through captive-breeding, protection of nests in the wild and predator control by the Western Pond Turtle Project, the number of turtles has increased to 450-500 individuals (K. Slavens, unpub. data).

The current Oregon population is thought to have decreased to less than 10% of its historical size (or approx. 2,000 individuals) (Woodland Park Zoo website). The greatest decline has occurred in the Willamette Valley where damming is extensive. The Willamette Valley Project, conducted by the United States Army Corps of Engineers and the Oregon Department of Fish and Wildlife, is currently monitoring and managing the population. Between 22 and 28 Pacific pond turtle nests have been located by USACE each year since 1992 (USACE unpubl. data).

There are no current population estimates for the Pacific pond turtle in California, Nevada or Baja California; however, this species has decreased and continues to decrease in abundance as 90% of this state's wetland habitat has been eliminated due to agricultural development (Lovich and Meyer In Press). This turtle remains locally abundant in some parts of northern California, however. In one watershed in the early 1970s, the abundance of *Clemmys marmorata* was estimated at 215 turtles per hectare of water and in one instance 50 turtles were found in one deep pool of a stream (Bury 1986b). The only population information from Nevada suggests that isolated populations from the Truckee and Carson Rivers may have become extirpated (Buskirk 1991 cited in Ernst et al. 1994). There are also no population estimates available for Baja California.

In the first survey of reptiles and amphibians of British Columbia, Lord (1866), naturalist of the British Boundary Commission, recorded under *Actinemys marmorata* "I have seen them in nearly every lake and pond east and west of the Cascades. They are also common on Vancouver Island." (Cook, unpubl.). His description of this turtle, "The general colour is olive, with darker markings, the under-portion being a brilliant yellow", does not provide enough detail to confidently identify the species as *Clemmys marmorata*. F. Cook (pers. comm.) states that this description could possibly apply to the western painted turtle (*Chrysemys picta bellii*), the only other freshwater turtle in the area. However, *C. p. bellii* has a large dark pattern or blotch on its plastron, bright red in the marginals, bright yellow lines on the head and neck, and no dark markings on the carapace (Ernst et al. 1994; Carr 1952; Cook 1984), none of which fit with Lord's description. Indeed, Lord's description of *A. marmorata* is virtually identical to that given for *C. marmorata* in modern descriptions (Carr 1952; Ernst et al. 1994). No specimens of *C. marmorata* (or *A. marmorata*) from the Boundary Survey were deposited in the British Museum, although Lord did misidentify one juvenile *C. p. bellii* collected from Vancouver Island as *A. marmorata*, a mistake that was noted by Storer (1937; F. Cook pers. comm.). Juvenile *C. marmorata* have a dark plastral figure similar to *C. p. bellii* that is lost as the turtle matures (Carr 1952). It seems that, as *C. marmorata* and *C. p. bellii* were the only two species of freshwater turtle in southern British Columbia during the mid-1800s, and as the turtle Lord described as having a brilliant yellow plastron could not have been *C. p. bellii*, *C. marmorata* must have been formerly common in southern British Columbia and even Vancouver Island. However, the lack of specimens of *C. marmorata* in museum collections of Lord's samples raises serious questions regarding his claims. As these 2 turtle species are quite distinct, then if *C. marmorata* was not on Vancouver Island, Lord was either extremely careless, or incompetent or dishonest. Unfortunately, there is no clear answer to this conundrum.

LIMITING FACTORS AND THREATS

From historic accounts of the Pacific pond turtle, it appears that the major cause of population decline was extensive commercial harvesting of these turtles for food. In 1879, Lockington wrote that the turtle had become scarce in the San Francisco area, despite being formerly abundant, because of high commercial demand (cited in Carr 1952). Another author (True 1884 in Carr 1952) noted that the turtle was “still almost constantly for sale in the markets of San Francisco” in the 1880s, with prices increasing to \$3 - \$6 per dozen turtles in the 1920s (Storer and Carl 1944 in Carr 1952). Even before European settlement in western North America, the Pacific pond turtle was harvested for food by the natives of California (Ernst et al. 1994).

More recently, habitat modification and destruction have caused a significant decrease in the Pacific pond turtle’s distribution along the west coast of North America. More than 90% of wetland habitat has been eliminated from California due to agricultural development (Lovich and Meyer In Press). Extensive damming, agricultural development and urban sprawl are cited as the causes of pond turtle decline in Oregon and, specifically, the Willamette Valley (USACE website). Damming alters flow rates and water temperature in the river and floods shoreline habitat, while development near waterways eliminates crucial terrestrial nesting and overwintering sites. These factors also fragment the turtle populations and habitat, and create impassable barriers between important habitat components (Reese and Welsh 1998a,b). Turtles have also been frequently seen crossing roads in agricultural areas of California (Reese and Welsh 1997), which puts them at risk of substantial road mortality.

Finally, in Washington state, disease and predation on juveniles by exotic species have severely limited recruitment in the two remaining populations. The large American bullfrog, an eastern North American native, was introduced to the west coast and has become one of the major predators of juvenile Pacific pond turtle (Cook 1984; WPTP website). As mentioned in the section on growth and survivorship, long-lived species with low fecundity and low nest survivorship must compensate by having high juvenile survivorship in order to maintain a stable population (Reese and Welsh 1998b; Congdon et al. 1993). This is particularly crucial in a small population trying to recover from increased mortality by stochastic events, such as the 1990 outbreak of respiratory disease in the Washington populations. That outbreak killed approximately 25% of 150-200 total Pacific pond turtles in the Columbia Gorge, and out of 40 sick turtles that were treated by the Woodland Park Zoo in Seattle, only 13 survived (WPTP website).

Turtles at the northern end of their range often show differences in life history traits that limit population growth rates (Litzgus and Brooks 1998). Lower overall temperatures, and particularly a shorter summer, lead to delayed sexual maturity, reduce the number of clutches a female can produce in a year and prevent many eggs from hatching. While all examples of limiting factors and threats are from American populations of the Pacific pond turtle, the pressures from harvesting, habitat modification, road mortality and predation by bullfrog can all be expected to have had an impact on the British Columbia population of the pond turtle. As the northern

populations of this species were probably smaller and less able to rebound from population decline, these threats and limiting factors must have been at least partly responsible for the extirpation of this species from Canada.

SPECIAL SIGNIFICANCE OF THE SPECIES

Clemmys marmorata is the only species of its genus found in western North America (Ernst et al. 1994). All four *Clemmys* species (the wood turtle, *Clemmys insculpta*; bog turtle, *Clemmys muhlenbergii*; and spotted turtle, *Clemmys guttata*) are at some risk of extinction in Canada and the United States.

EXISTING PROTECTION OR OTHER STATUS

C. marmorata is on the International Union for the Conservation of Nature Red List as a Vulnerable species (IUCN website). It is also a Special Concern species in the United States under the Endangered Species Act (USFWS website). This species is listed as Threatened in Washington, Sensitive in Oregon of Special Concern in California (Reese and Welsh 1997), and is on the British Columbia Red List as an Extirpated species (D. Fraser pers. comm.).

SUMMARY OF STATUS REPORT

The range of the Pacific pond turtle once stretched along the entire west coast of North America from Baja California to southern British Columbia. Populations were historically reduced by unrelenting commercial harvesting, and distribution has since dramatically declined due to extensive habitat loss. Agricultural and urban expansion, coupled with damming, continue to modify, fragment, and destroy habitat. Vehicle-related mortality and disease are decreasing adult survivorship, while predation on juveniles by raccoons and introduced bullfrogs is almost completely preventing recruitment. At the northern end of its range, this species is even more vulnerable to harvesting and predation because its delayed maturity and lower nesting success make it very slow to recover from severe population declines.

The Pacific pond turtle is at risk throughout its range and has not been recorded in British Columbia since 1959. Considering that the climate in southern British Columbia and Vancouver Island provided suitable habitat for this species, that mid-nineteenth century records describe *Clemmys marmorata* as being found in that area, that the species was once common in Washington right up to the Canadian border, and that the species has undergone a rapid and widespread decline in the 20th century from the northern part of its range (B.C., Washington, Oregon), there is little doubt that this species is native to Canada. Therefore, we propose a status of **Extirpated** for *Clemmys marmorata* in Canada.

TECHNICAL SUMMARY

Clemmys marmorata

Pacific pond turtle

Previously found in British Columbia

Tortue de l'Ouest

Extent and Area information	
• extent of occurrence (EO)(km ²)	0km ²
• specify trend (decline, stable, increasing, unknown)	N/A
• are there extreme fluctuations in EO (> 1 order of magnitude)?	No
• area of occupancy (AO) (km ²)	0km ²
• specify trend (decline, stable, increasing, unknown)	N/A
• are there extreme fluctuations in AO (> 1 order magnitude)?	No
• number of extant locations	0
• specify trend in # locations (decline, stable, increasing, unknown)	N/A
• are there extreme fluctuations in # locations (>1 order of magnitude)?	No
• habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat	Declining
Population information	
• generation time (average age of parents in the population) (indicate years, months, days, etc.)	>10yrs
• number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)	0
• total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals	N/A
• if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)	--
• are there extreme fluctuations in number of mature individuals (> 1 order of magnitude)?	--
• is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)?	Yes
• list each population and the number of mature individuals in each	--
• specify trend in number of populations (decline, stable, increasing, unknown)	--
• are there extreme fluctuations in number of populations (>1 order of magnitude)?	No
Threats (actual or imminent threats to populations or habitats)	
<ul style="list-style-type: none"> - habitat loss and alteration - population fragmentation - little or no recruitment - predation on young (by raccoon and introduced bullfrog) - commercial harvesting 	

Rescue Effect (immigration from an outside source)	
• <i>does species exist elsewhere (in Canada or outside)?</i>	In USA
• <i>status of the outside population(s)?</i>	At risk
• <i>is immigration known or possible?</i>	Unknown, possible
• <i>would immigrants be adapted to survive here?</i>	Unknown
• <i>is there sufficient habitat for immigrants here?</i>	No
Quantitative Analysis	--

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