FEATURE ARTICLES

Field survey of Red-eared Sliders (*Trachemys scripta elegans*) in the Lower Fraser River Valley, British Columbia, in 2005

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Abstract

A survey of 29 wetlands in the lower Fraser River valley of British Columbia in 2005 suggests the introduced Red-eared Slider (*Trachemys scripta elegans*) is well established and more widely distributed than previously reported. History, habitat requirements, relative density, size distribution, and concerns about coexistence with the Western Painted Turtle (*Chrysemys picta bellii*) are discussed.

Introduction

The Red-eared Slider (*Trachemys scripta elegans* Weid) (Figure 1) has been the most popular turtle in the pet trade with more than 52 million individuals exported from the United States to foreign markets between 1989 and 1997 (Telecky 2001). Many of these went to Asia for food, but the species is common enough in pet stores to be nicknamed "dime store turtle". By 1960 more than 150 turtle farms were operating in the United States to meet the demand (Grijalva 2001). Sliders were charming; they also proved deadly. In 1975, the United States Food and Drug Administration banned the sale of sliders under "four inches" [10 cm] carapace length in the United States and Canada because they transmitted the disease salmonellosis (Ernst et al. 1994). Pet turtles were estimated to have caused 14% of reported human cases of salmonellosis in the early 1970s in the United States (Lamm et al. 1972). Salmonellosis is a serious disease of the digestive tract that infected several thousand children and caused a number of deaths attributed to handling pet turtles (Vosjoli 1992). Apparently, surviving sliders gradually lose some of their charm as pets, and many are released to the wild.

They are now established in at least 14 states outside their native range in the United States (including Hawaii) as well as numerous countries where they did not previously occur. Other countries with introduced feral slider populations include Australia, Bahrain, Canada, China, France, Germany, Guam, Japan, Israel, South Africa, South Korea, Taiwan and Thailand (Ernst et al. 1994). In short, they now inhabit six continents (they are native in North and South America) and are the most widely spread non-native turtle in Canada (Seburn and Seburn 2000).

Figure 1. Red-eared Slider basking at Jerry Sulina Park, Maple Ridge, BC. 29 July 2004 (R. Wayne Campbell). BC Photo 3260.

My purpose in this paper is to review the species' known distribution in British Columbia, summarize survey results of wetlands visited in the lower Fraser River valley of southwest mainland British Columbia, and provide reference information on the natural history of the Red-eared Slider for field naturalists and wildlife managers. The latter information, which includes detailed notes on identification, habitats, reproduction, growth and size, and physiology is available on the Biodiversity Centre for Wildlife Studies' website at www.wildlifebc.org.

Occurrence in British Columbia

The true distribution of the Red-eared Slider in British Columbia is unknown because the species is introduced and has not received attention from herpetologists. The Rainforest Reptile Refuge Society (2000), Ringuette (2004), Hamm (2005), and the Thompson Rivers University website (www.bcreptile.ca) show the species to be distributed in the Okanagan valley, from the United States border to

north of Kelowna, throughout the lower Fraser River valley, and on southern Vancouver Island in Beacon Hill Park. Given the species' well-established adaptability it seems possible it is more wide spread than currently documented.

Surveys in the Lower Fraser River Valley

Methods

Between 22 February and 7 September 2005 I surveyed 29 wetlands, mostly ponds and lakes, within easy driving range of my home in Surrey. Therefore this description of distribution is incomplete and relies on information I could obtain from elsewhere, rather than a comprehensive survey of the entire lower Fraser River valley. I was aware of some wetlands but others I found using 'google. map' to scan satellite photos within the study area. I also opportunistically surveyed ditches and slow rivers that flowed into ponds or lakes.

All surveys were conducted from shoreline (Figure 2). Sites were visited from one to seven times. Single visits occurred either when the habitat proved unsuitable or when I was able to obtain a decent survey of the site on the first visit.

I categorized the water bodies in three ways: habitat suitability, size of pond or lake, and accessibility. Based on literature from the Red-eared Sliders' native range I recognized three classes of habitat suitability: poor, moderate, and good. My rationale is similar to that of Morrealle and Gibbons (1986), but without quantitative measurements. I also did not encounter algal blooms so simply treated food and cover as one index, using density of emergent vegetation. A muddy bottom appears most important because it influences both reproduction and foraging. Emergent basking sites are likely least important, as I have observed many sliders basking on shorelines amongst *Typha latifolia* and other emergent plants. For these reasons, my classification of habitat suitability followed these classes:

- poor – gravel bottom regardless of basking sites, emergent vegetation was consistently low on gravel bottoms except where water lilies spread;
- moderate – muddy bottom, emergent vegetation sparse and emergent basking sites lacking; and
- good – muddy bottom, abundant vegetation and basking sites.

I recognized four pond or lake sizes based on the surface area of the water (islands were excluded):

1) < 0.25 ha (Figure 3),
2) 0.26 - 0.50 ha,
3) 0.51 - 1.00 ha, and
4) > 1.00 ha.

Figure 2. Corey G. Bunnell surveying Red-eared Sliders (circular image) at Alderwood Park, Surrey, BC. 2 September 2005 (Anthea Farr).

Figure 3. Most Red-eared Sliders were found in readily accessible ponds. This small pond (< 0.25 ha) in Alderwood Park, Surrey, BC, was adjacent to Earl Marriot School. It contained two sliders each time it was surveyed. 2 September 2005 (Corey G. Bunnell).

Accessibility to humans was grouped into three classes:

1) immediately adjacent to trail or path (Figure 4);
2) adjacent to roads (not paths) or screened by 20 m of vegetation from road or path; and
3) more than 20 m from road or path.

Figure 4. Ponds with emergent vegetation, muddy bottoms, and basking structures are preferred habitats in the lower Fraser River valley. Jerry Sulina Park in Maple Ridge, BC, is easily accessible from walking paths. 29 July 2004 (R. Wayne Campbell).

Habitat Requirements

Habitat requirements of the Red-eared Slider are broad and in its native range it coexists with other freshwater turtles (Conant 1975). Although it frequents diverse water bodies, it prefers quiet waters, about 1 to 2 m in depth (Cagle 1950). Sliders usually reach their greatest numbers in shallow water bodies with muddy bottoms and dense emergent vegetation (Ernst and Barbour 1972, Morrealle and Gibbons 1986, Storm and Leonard 1995). Mud figures prominently in nest construction and muddy bottoms also permit more emergent vegetation than do gravel bottoms. Although sliders are omnivorous, they eat mostly plant material as they grow older (Clark and Gibbons 1969). The Red-eared Slider also basks for hours each day during warm weather, so a third key element in their habitat is logs, rocks, or other emergent objects. When constructing their habitat suitability index, Morrealle and Gibbons (1986) also included cover as a key habitat element. They noted that highest densities of sliders occurred where algal blooms and aquatic macrophytes were abundant and formed dense mats on the surface. Dense surface vegetation provides cover from some predators and supports higher densities of invertebrates and aquatic vertebrates than does open water.

Relative Density

My earliest observation of a Red-eared Slider was 22 February on a sunny afternoon of 12 °C. Relative density of sliders in a water body was influenced by both access and habitat suitability (Table 1). I calculated relative density for each wetland size class by averaging the maximum count attained for all water bodies in that size class and dividing by the upper boundary of the class for all but the largest size class. I omitted the four largest lakes because shoreline surveys were inadequate for them, and used 2.0 as the approximate upper boundary of the remaining lakes > 1 ha. Size of the water body had little effect that could not be explained by access, habitat suitability or survey technique. Mean and range of turtle density (per ha water surface) for the four size classes were: < 0.25 ha (6.0; 0 - 32), 0.26 - 0.50 ha (16.0; 0 - 36); 0.51 - 1.00 ha (no turtles), > 1.00 ha (2.17; 0 - 4.5). Two points are apparent in Table 1. First, this habitat suitability index appeared to work well, as relative densities are ordered as expected. Second, accessibility had a far more profound effect. In the water bodies having good habitat suitability, the index of relative density declined from 11.2/ha with ready access to 0.0 when I had to move > 20 m off a trail or road.

Table 1. Approximate density of Red-eared Sliders (number/ha) by habitat suitability class and access class for 29 lakes and ponds in the lower Fraser River valley of British Columbia (nd = no data).

	Accessibility Class		
Habitat Suitability Class	**1**	**2**	**3**
Poor	0.0	nd	nd
Moderate	1.0	0.0	nd
Good	11.2	8.0	0.0

Turtle Size Distribution

When the entire carapace was visible, I estimated the carapace length in 5-cm classes through a spotting scope. Turtles were sometimes distant, so I only included observations where some well-known object also occurred in the field of view (e.g., width of *Typha latifolia* leaves). Given these restrictions I was able to obtain credible estimates of size for 72 sliders.

No turtles less than 10 cm (e.g., juvenile size classes) were observed and the large majority (74%) were > 15 cm (Figure 5). Given the size and growth rates of turtles in captivity and their natural habitat, these observations suggest that almost all turtles observed were adult and sexually mature.

The species is not well studied in British Columbia, nor the rest of Canada, but known to have established breeding populations elsewhere where it has been introduced – France, Germany, Israel, Japan, Ontario, South Africa, Spain and even the Mariana Islands (Cadi et al. 2004, De Roa and Roig 1997, Ernst et al. 1994). Immediately south, in Washington State, R. B. Bury (in Storm and Leonard 1995) reported juveniles and sub-adults. The smallest was 7.6 cm, which suggests that reproduction was occurring.

I searched for records of slider courtship, nesting, juvenile or hatchling turtles from Canada and found little. In Ontario, Red-eared Sliders that have been released into Grenadier Pond have established a local population that apparently competes directly with the natural turtle population (Dog Legislation Council of Canada 1998). Sanders et al. (2004) reported that Red-eared Slider numbers in Richmond Nature Park (British Columbia) have been growing steadily. In June 2002, several females were found attempting to lay eggs in southern portions of the park. In Beacon Hill Park, Victoria, B. Turner (pers. comm.) has seen the population of Red-eared Sliders (Figure 6) increase over the past decade and suggests they nest in flower beds but specific details are lacking. Breeding information still remains sparse for the province and I expect more focused surveys will find more records of breeding as there is suitable habitat hosting dense slider populations.

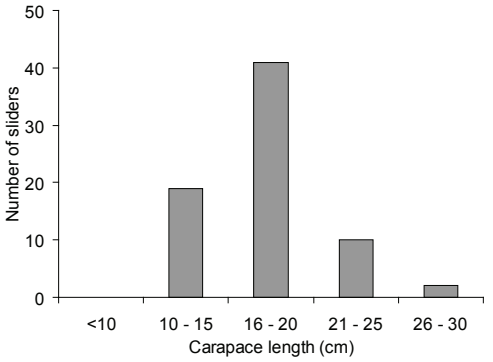

Figure 5. Size class (carapace length) distribution of 72 Red-eared Sliders from the lower Fraser River valley of British Columbia.

Figure 6. Over the past decade or so the population of Red-eared Sliders, and the number of ponds it occupies, have increased in Beacon Hill Park, Victoria, BC. 24 August 2005 (R. Wayne Campbell). BC Photo 3261.

Red-eared Sliders and Western Painted Turtles

I surveyed six sites where Western Painted Turtles (*Chrysemys picta bellii*) were previously reported, but found the species at only one site – Burnaby Lake. I did, however, find Red-eared Sliders at three of the six sites, including Burnaby Lake. It is this kind of relationship that has led to many anecdotal observations that sliders displace native turtles. In its review, the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) reported, "It is obvious that feral Red-eared Slider turtle populations are most likely to establish in areas intensively impacted by humans, which are precisely the areas where native turtle

communities have been most impacted. Declines of native turtle species in human-impacted landscapes have been widely documented throughout the world. It is convenient to blame observed declines in native species on the presence of a non-native species, but without a convincing causal link, this is not justified" (CITES 2003:13).

Since CITES statement in 2003, stronger evidence for a causal link has been accumulating. Cadi and Joly (2004) compared control and mixed groups of the European Pond Turtle (*Emys orbicularis*) and the introduced Red-eared Slider over three years in France. They found both weight loss and high mortality in *E. orbicularis* within the mixed groups and argued for stopping slider turtle introductions in all wetlands in Europe. The Western Painted Turtle has been observed at the pond in the Richmond Nature Centre in the past (Griffith 2000). However, Sanders et al. (2004) found none in 2002 and 2003; I found none in 2005. We both, however, found Red-eared Sliders. Sanders et al. (2004) noted attempted nest-building by sliders at the pond, indicating that the species is present and potentially capable of sharing pathogens with native turtles.

"...Red-eared Slider is now an established part of our provincial fauna, and despite mitigating factors, is likely to impact our sole remaining native turtle species."

If Red-eared Sliders are able to breed successfully in British Columbia, which appears physiologically possible, then it is likely that they may impact native Western Painted Turtles. Within the province, both turtles are largely limited to areas where human populations are relatively dense, and humans are the agents for slider introductions. CITES focused on turtles of subtropical and tropical regions, which frequently cohabit water bodies with other turtle species. The Western Painted Turtle may not be as well suited to cohabitation with non-native species as are more tropical turtles. This may explain the slider's apparent impact on the European Pond Turtle.

Conclusions

The Red-eared Slider occurs, and is widely distributed, in a variety of wetlands in the lower Fraser River valley of British Columbia but breeding status remains poorly documented. This introduced species may have been part of our environment much longer than appears in the literature. Although Gregory and Campbell (1984) did not report Red-eared Sliders in the province, they were for sale as pets in Vancouver at least in the 1960s and may have been released in lakes and ponds around settled areas. Because the species can be difficult to distinguish from Western Painted Turtles, observations of sliders could have been recorded as western painted turtles. In any event the Red-eared Slider is now part of the herptofauna of the province, and is continually replenished by abandoned pets. The Rainforest Reptile Refuge Society in Surrey currently hosts about 80 Red-eared Sliders abandoned by owners, and is accepting no more.

Although I found no hatchlings or juvenile turtles in my surveys (all turtles whose size could be assessed were at least 10 cm in carapace length; Figure 5), Sanders et al. (2004) reported attempted nest-building in Richmond Nature Park. Red-eared Sliders appear well adapted to environmental conditions in British Columbia. It likely is only a matter of time before the impact with native species is more clearly ascertained in the province. What may slow this impact is another introduced species - every pond in which I found sliders also contained Bullfrogs (*Rana catesbeiana*), which are large enough to consume hatchlings. Moreover, individuals 'setting sliders free' do so at their convenience, often releasing them in small ponds within easy access (Table 1). These ponds usually do not host Western Painted Turtles.

The Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) document on development of mid- and long-term conservation measures for tortoises and freshwater turtles, reports that "…the Red-eared Slider turtle has established feral populations throughout the world

through release or escape of pet animals, and these populations are seen with varying degrees of concern in many parts of the world, including France, Italy, California, South Africa, Israel, Taiwan, Thailand, Cambodia, Malaysia and Australia (e.g. Bouskila, 1986; Dupré, 1996; Ferri and di Cerbo, 1996; Chen and Lue, 1998)" (CITES 2003:12). In its review of potential impacts, CITES concluded, "It seems very unlikely that slider turtle populations would not be controlled by the ecological components that control native turtle populations" (CITES 2003:13). CITES noted that when the European Union prohibited the importation of the subspecies in 1997 because it was assumed to represent a potential threat to European native freshwater turtle species, the Union admitted that it was not aware of documented ecological damage. However, the CITES document focused primarily on turtle farming in southeast Asia to evaluate whether it merited further control, and may have been too optimistic in its rejection of concern.

Many workers and conservation biologists remain concerned about threats from these feral populations. Among the threats noted are: introduction of salmonellosis and other pathogens to native species, displacement of native species through predation of slider adults on native turtle hatchlings or some other means, displacement of native species other than turtles (Grijalva 2001, Sanders et al. 2004).

The introduced Red-eared Slider is now an established part of our provincial fauna, and despite mitigating factors, is likely to impact our sole remaining native turtle species. Breeding has not been confirmed but the species appears to inhabit an increasing number of permanent wetlands from Vancouver to Hope in the lower Fraser River valley of British Columbia.

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