



Distribution of Invasive Red-eared Sliders, *Trachemys scripta* (Testudines: Emydidae) in the Wetlands of Gujarat State, India

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“Exotic,” “alien,” or “non-native” describes those species occurring outside their native or current ranges. When an exotic species becomes established (or “naturalized”), its population grows, and it has a deleterious impact on native ecosystems,

it is termed “invasive” (IUCN 2019). The effects and consequences of “invasive alien species” (IAS) were largely overlooked as a research subject until the General Assembly of the Scientific Committee on Problems of the Environment (SCOPE) began

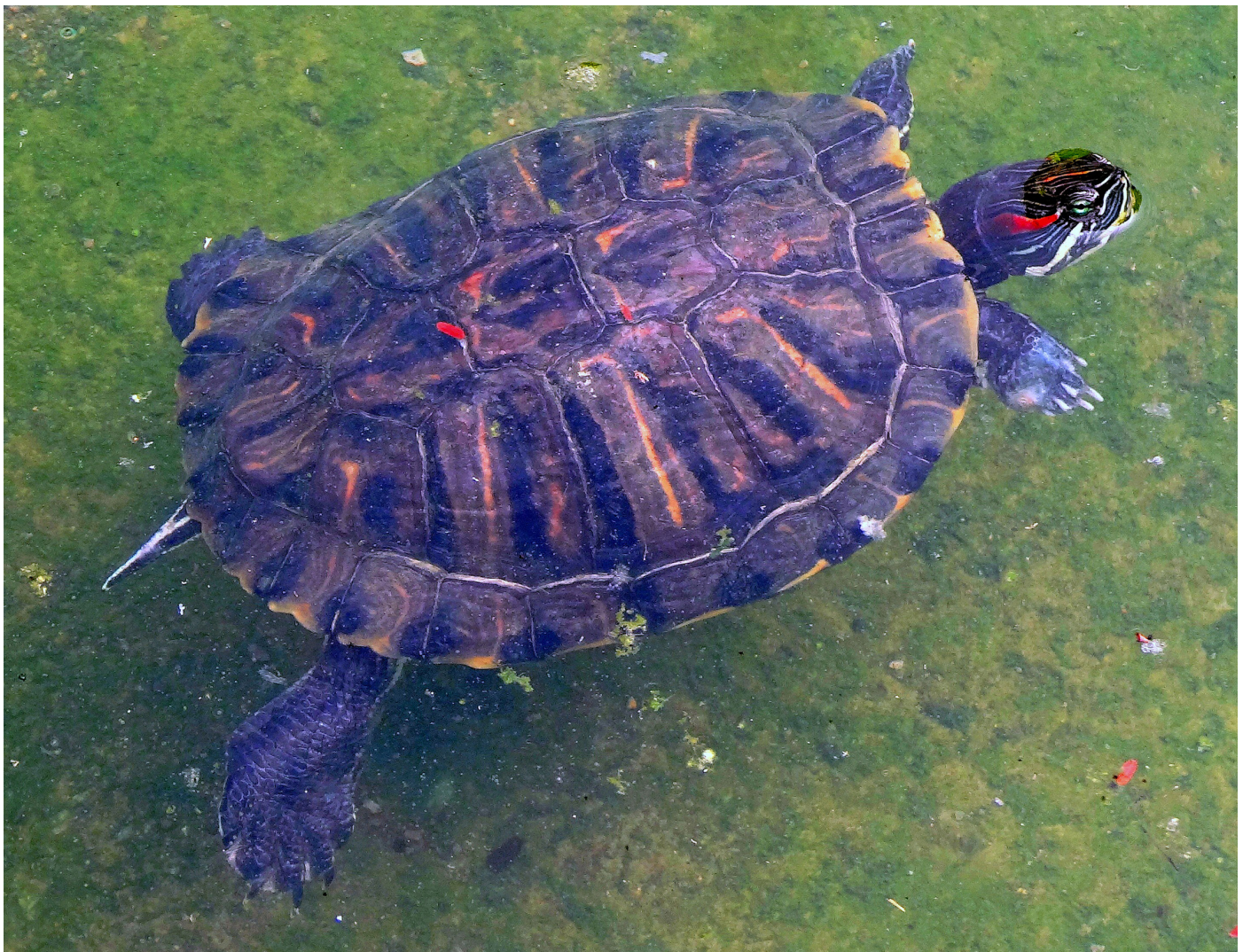


Fig. 1. The Red-eared Slider (*Trachemys scripta elegans*) is the most widely distributed invasive turtle species in the world. This individual is in captivity at the Sayang Bagi Zoo in Vadodara, Gujarat, India. Photograph by the author.

to address the ecology of biological invasions in 1982 (Drake et al. 1989), leading to the subject being properly discussed and addressed properly in India for the first time (Ramkrishnan 1991). Nevertheless, India currently has no exclusive legislation or any strong policies to deal with IAS (Pande and Arora 2014). Every year many exotics are imported into India — and one of the most popular is a turtle, the Red-eared Slider, *Trachemys scripta elegans* (Fig. 1; Ramsay et al. 2007).

Red-Eared Sliders represent one of three currently recognized subspecies of the Pond Slider (*T. scripta*; e.g., Ernst et al. 1994). The native range of *T. scripta* is the eastern United States (e.g., Ernst and Lovich 2009; Rhodin et al. 2009; Powell et al. 2016) but due to its popularity in the pet trade, *T. scripta elegans* is now the most widely introduced turtle species in the world (e.g., Ng et al. 2005; Ramsay et al. 2007) and is considered one of the world’s 100 worst invasive alien species (Lowe 2004). Populations are established on every continent except Antarctica (e.g., Lever 2003; Ramsay et al. 2007; Kraus 2009) and those naturalized populations have been reported from at

least 73 countries or overseas territories in Europe, Africa, Asia, Australia, the Americas, and Oceania (Lever 2003; Scalera 2006; Pupins 2007; Kraus 2009; Kikillus et al. 2010; van Dijk et al. 2011; Ficetola et al. 2012; Uetz et al. 2018).

A large number of *T. scripta elegans* are imported into India every year and these turtles have become established in wetlands throughout the nation — including those in Gujarat (Mujpura 2014; Vyas 2015). Because we do not know the nature and extent of any impact this exotic species could have on local fauna, we initiated a series of inquiries regarding this species and began the process of estimating the extent of its distribution in the state of Gujarat and its interactions with native turtles.

We directed inquiries about the species to animal dealers, hobbyists, NGOs, and forest officials of the Gujarat Forest Department and, in the course of herpetofaunal surveys from 2006 to 2016, we recorded 35 observations in bodies of water throughout five biogeographic zones and in 18 of the 33 districts of Gujarat (Fig. 2; Table 1). Bodies of water

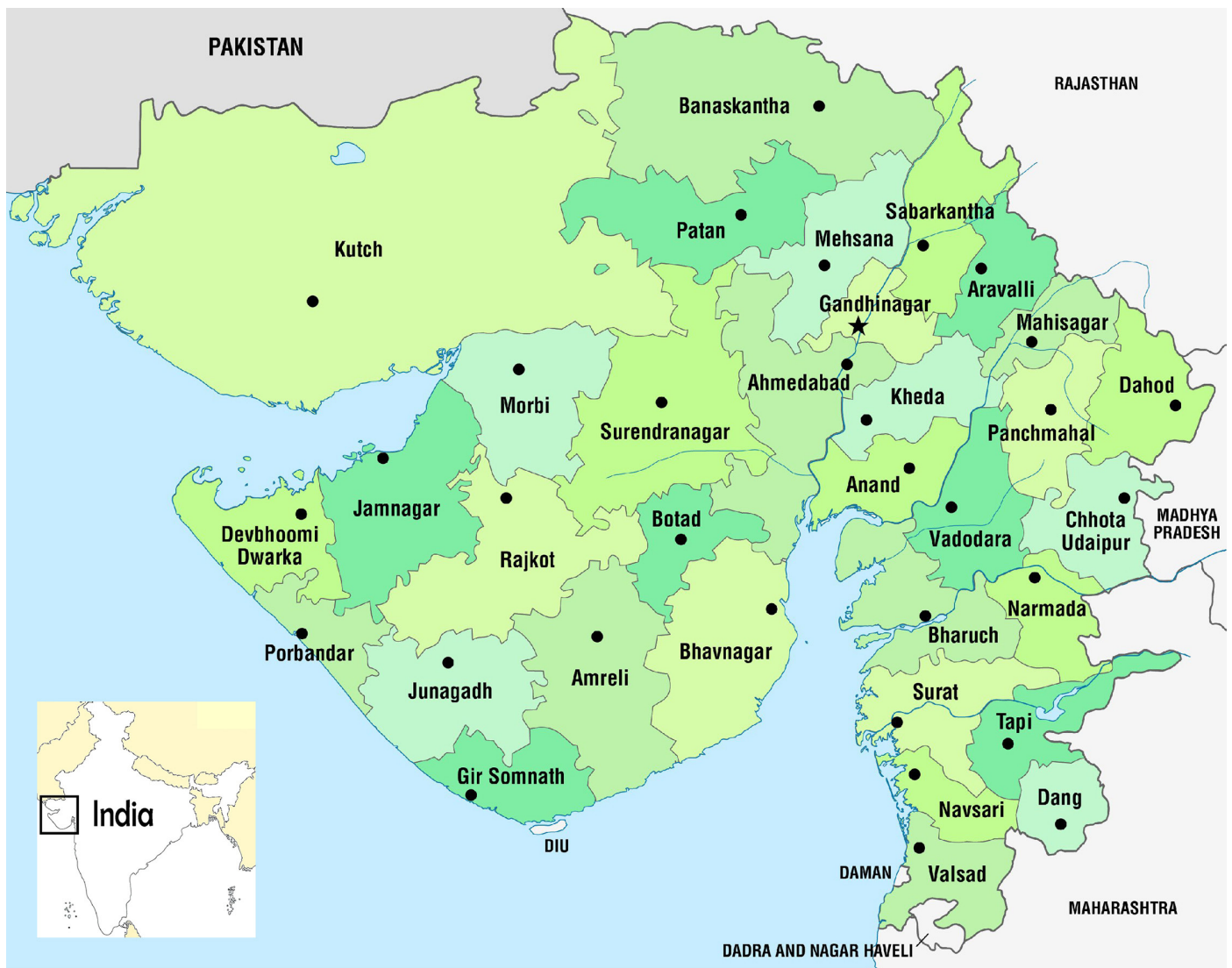


Fig. 2. Map of the state of Gujarat, India, with its administrative districts.

Table 1. Localities where Red-eared Sliders (*Trachemys scripta elegans*) occur in Gujarat, India, organized by biogeographic zones (all caps) and districts (bold). Habitats shared with native species are indicated as follows: LP = *Lissemys punctata*; NG = *Nilssonina gangetica*; PT = *Pangshura tecta*.

No.	Location	Native Turtle Species
SOUTH GUJARAT		
Valsad District		
1	Sukhi Talavadi, Valsad City 20°36'26.19"N; 72°56'20.27"E	LP
Tapi District		
2	Jal Vatika, Vyara Town 21°06'49.76"N; 73°23'29.90"E	LP
Navsari District		
3	Dudhiya Talav, Navsari City 20°56'51.18"N; 72°55'35.48"E	LP
Surat District		
4	Gopi Talav, Surat City 21°11'18.69"N; 72°49'46.36"E	LP, NG
5	Tapi River, Nr. Zoo, Surat City 21°14'02.90"N; 72°53'34.85"E	LP, NG
CENTRAL GUJARAT		
Bharuch District		
6	Ratan Talav, Bharuch City 21°41'53.69"N; 72°59'30.91"E	LP, NG
Vadodara District		
7	Vishwamitri River, New Akota Bridge, Vadodara City 22°17'52.43"N; 73°10'55.66"E	LP, NG
8	Sama Talav, Sama, Vadodara 22°20'31.98"N; 73°12'06.70"E	LP, NG
9	Lalbaug Talav, Lalbaug, Vadodara 22°17'02.19"N; 73°11'48.78"E	LP, NG
10	Gotri Talav, Vadodara City 22°18'51.95"N; 73°08'03.18"E	LP, NG
11	Harni, Vadodara City 22°20'18.91"N; 73°13'09.00"E	LP, NG
12	Chhani, Vadodara City 22°21'57.42"N; 73°10'11.63"E	LP, NG
13	Sur Sagar, Vadodara City 22°18'02.73"N; 73°12'13.17"E	LP, NG
14	Dabhoi Gam Talav, Dabhoi 22°08'09.77"N; 73°25'21.46"E	LP
Anand District		
15	Ambav Sim Talavadi, Ambav, Anand 22°25'10.04"N; 72°59'24.96"E	LP
Kheda District		
16	Kheta Talav, Nadiyad 22°41'27.74"N; 72°52'12.31"E	LP, NG, PT

17	Gomti Talav, Dakor 22°45'21.97"N; 73°08'47.55"E	LP, NG
18	Ram Sarovar, Nr. Vaso 22°39'03.40"N; 72°45'03.03"E	LP, NG
Dahod District		
19	Chhab Talav, Dahod 22°49'58.83"N; 74°14'57.88"E	LP
Ahmadabad District		
20	Chandola Lake, Ahmadabad 22°59'12.62"N; 72°35'16.08"E	LP, NG, PT
21	Vastrapur Lake 23°02'18.24"N; 72°31'43.89"E	LP
22	Pond, Serenity Library, Bhat 23°06'45.30"N; 72°37'25.26"E	LP
23	Sabarmati River, Nr. Narmada Canal 23°07'10.23"N; 72°39'04.21"E	LP, NG, PT
24	Sarkhej, Ahmadabad 22°58'47.41"N; 72°30'05.06"E	LP
25	Sanand Town 22°59'25.02"N; 72°22'55.68"E	LP, NG
Gandhinagar District		
26	Sabarmati, behind Indroda 23°11'39.76"N; 72°39'44.10"E	LP, NG, PT
NORTH GUJARAT		
Patan District		
27	Anand Sarovar 23°50'48.81"N; 72°07'44.21"E	LP
SAURASHTRA		
Jamnagar District		
28	Lakhota Lake, Jamnagar City 22°27'54.43"N; 70°04'05.48"E	LP
Bhavanagar District		
29	Krishna Kunj, Victoria Park, Bhavnagar 21°45'01.28"N; 72°07'34.55"E	LP
30	Moti Talav, New Port Road 21°46'29.97"N; 72°10'59.00"E	LP
Junagadh District		
31	Narshin Mehata Lake 21°31'07.47"N; 70°27'18.76"E	LP
Surendranagar District		
32	Dharam Talav 22°42'30.71"N; 71°40'06.70"E	LP, NG
Rajkot District		
33	Lalpari Lake 22°18'15.97"N; 70°50'36.05"E	LP
34	Randarda Lake 22°17'26.56"N; 70°50'32.82"E	LP
KUTCH		
Kutch District		
35	Hamisar Lake, Bhuj 23°15'07.04"N; 69°39'55.00"E	LP

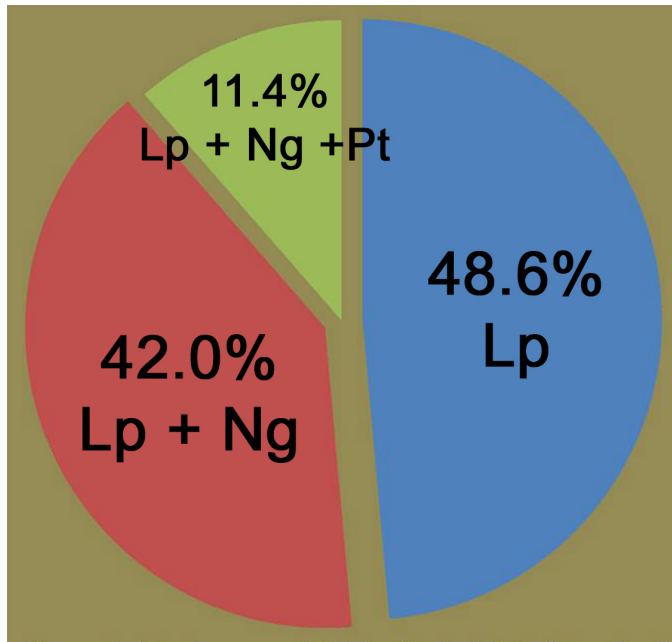


Fig. 3. A pie chart depicting the overlap in the ranges of the invasive Red-eared Slider (*Trachemys scripta elegans*) and three native species of turtles (Lp = *Lissemys punctata*; Ng = *Nilssonina gangetica*; Pt = *Pangshura tecta*) in the state of Gujarat, India.

included village ponds, lakes, and rivers (Tapti, Vishwamitri, Sabarmati). Earlier reports of this species included records from the Malan River, Bhavnagar District (Munjpara 2014) and Gomti tank at Dakor, Anand District (Vyas 2015).

These 35 water bodies are also natural habitats of one or more of three native species of turtles: Indian Roofed Turtle

(*Pangshura tecta*), Indian Soft-shelled Turtle (*Nilssonina gangetica*), and Indian Flap-shelled Turtle (*Lissemys punctata*). The native species sharing habitats with *T. scripta elegans* are indicated in Table 1. Although these species undoubtedly compete for spatial and trophic resources, the nature and extent of the impact of the sliders on the native turtle populations remains unknown and will require further research.

The extensive distribution in Gujarat likely is a consequence of the non-scientific and outdated approaches of inactive authorities who supposedly enforce wildlife laws and conservation practices and a moderately active trade in live animals (mainly for pets; e.g., Vyas 2015, 2017) catering to the many Indians who keep live turtles as pets at home, often in response to increasingly popular “feng-shui” and “vastu shastra” fads. As in Europe (e.g., Cadi and Joly 2004), pets escape or are released in nearby bodies of water without any consideration of the possible consequences. Also, the State Forest Department has been known to confiscate sizeable lots of illegally retained wild animals (including turtles) from individual pet owners, hobbyists, or pet-dealers and then release them into nearby habitats. No guidelines and protocols for the rescue and rehabilitation of confiscated or rescued animals exist. Sadly, in addition to an unwillingness to develop and adopt appropriate protocols, an absence of captive facilities for rescued or confiscated animals contributes to the problem.

Red-eared Sliders were not formally considered an IAS in India (e.g., Choudhury et al. 2000; Mandal 2011) until 2013 (Goenka 2013) and the Wildlife Institute of India, an autonomous institution under the Ministry of Environment



Fig. 4. A Red-eared Slider (*Trachemys scripta elegans*) from Fatehsagar lake, Udaipur City, Rajasthan, India. Photograph by S.K. Sharma.

Forest and Climate Change, has yet not addressed this species (e.g., Mathur et al. 2015) despite its documented presence in many Indian states. Published reports include those for Maharashtra (Goenka 2013; Kunju 2014; Telang 2016), temples ponds of Bangalore, Karnataka (Chetan 2013), Himayat Sagar of Hyderabad (Reddy 2016), Dhanas and Sukhna Lakes of Chandigarh (Singh 2015), Rajarhat, Kolkata, West Bengal (Bandyopadhyay 2015; Choudhuri et al. 2018), Fatehsagar Lake (Fig. 3), Udaipur, Rajasthan (S.K. Sharma, pers. comm., 15 December 2016), Goa (Jadav et al. 2018), and now Gujarat. Consequently, determining the severity of the impact of this invasive species on the native fauna and environment should be a high priority. In addition, the potential harm caused by Red-eared Sliders, certainly one of many mostly undocumented IAS, is but one example calling for urgent studies, relevant legislation and policies, and strict legal enforcement to minimize the damage of established IAS and to reduce the likelihood of additional invasions.

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