

Global Conservation Status of Turtles and Tortoises (Order Testudines)

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ABSTRACT. – We present a review and analysis of the conservation status and International Union for Conservation of Nature (IUCN) threat categories of all 360 currently recognized species of

extant and recently extinct turtles and tortoises (Order Testudines). Our analysis is based on the 2018 IUCN Red List status of 251 listed species, augmented by provisional Red List assessments by the IUCN Tortoise and Freshwater Turtle Specialist Group (TFTSG) of 109 currently unlisted species of tortoises and freshwater turtles, as well as re-assessments of several outdated IUCN Red List assessments. Of all recognized species of turtles and tortoises, this combined analysis indicates that 20.0% are Critically Endangered (CR), 35.3% are Critically Endangered or Endangered (CR+EN), and 51.9% are Threatened (CR+EN+Vulnerable). Adjusting for the potential threat levels of Data Deficient (DD) species indicates that 56.3% of all data-sufficient species are Threatened. We calculated percentages of imperiled species and modified Average Threat Levels (ATL; ranging from Least Concern = 1 to Extinct = 8) for various taxonomic and geographic groupings. Proportionally more species in the subfamily Geoemydinae (Asian members of the family Geoemydidae) are imperiled (74.2% CR+EN, 79.0% Threatened, 3.89 ATL) compared to other taxonomic groupings, but the families Podocnemididae, Testudinidae, and Trionychidae and the superfamily Chelonioidae (marine turtles of the families Cheloniidae and Dermochelyidae) also have high percentages of imperiled species and ATLs (42.9–50.0% CR+EN, 73.8–100.0% Threatened, 3.44–4.06 ATL). The subfamily Rhinoclemmydinae (Neotropical turtles of the family Geoemydidae) and the families Kinosternidae and Pelomedusidae have the lowest percentages of imperiled species and ATLs (0%–7.4% CR+EN, 7.4%–13.3% Threatened, 1.65–1.87 ATL). Turtles from Asia have the highest percentages of imperiled species (75.0% CR+EN, 83.0% Threatened, 3.98 ATL), significantly higher than predicted based on the regional species richness, due to much higher levels of exploitation in that geographic region. The family Testudinidae has the highest ATL (4.06) of all Testudines due to the extinction of several species of giant tortoises from Indian and Pacific Ocean islands since 1500 CE. The family Testudinidae also has an ATL higher than all other larger polytypic families (≥ 5 species) of Reptilia or Amphibia. The order Testudines is, on average, more imperiled than all other larger orders (≥ 20 species) of Reptilia, Amphibia, Mammalia, or Aves, but has percentages of CR+EN and Threatened species and an ATL (2.96) similar to those of Primates and Caudata (salamanders).

KEY WORDS. – IUCN Red List; chelonians; imperiled; endangered; threatened; Average Threat Level; Asia; Geoemydinae; Testudinidae; Reptilia; extinction

The International Union for Conservation of Nature (IUCN) Red List of Threatened Species™ (www.iucnredlist.org) is the global standard for threat assessments and determination of conservation status of all species of animals and plants on Earth. Assessments of threats, extinction risk, and conservation status of all tortoises and freshwater turtles are officially provided to the IUCN Red List by the IUCN Tortoise and Freshwater Turtle Specialist Group (TFTSG; www.iucn-tftsg.org), which has produced status assessments for unevaluated and re-evaluated taxa on a continuous basis since 1982. Documenting the overall conservation status and percentage of threatened species of tortoises and freshwater turtles is important to understanding how seriously these taxa are threatened with extinction, how they compare with other imperiled taxa, and how threat levels for individual species and groups change through time. The global turtle conservation community needs these assessments to conduct analyses of the current conservation status of all turtles, but especially species with rapidly changing status levels, to help guide both prescriptive and reactive conservation policies and strategies for time-sensitive implementation of effective conservation efforts. Due to lengthy production times between draft assessments by the TFTSG via regional workshops and their eventual

publication as official IUCN Red List accounts, many of these TFTSG provisional status assessments have languished for years and have not yet appeared on the IUCN Red List; nearly one third of all turtle and tortoise species are not yet included on the current IUCN Red List. To make these provisional TFTSG assessments available in a more timely fashion, the Turtle Taxonomy Working Group (a committee of the TFTSG) has published brief, updated conservation status assessments based on these drafts (Turtle Taxonomy Working Group [TTWG] 2010, 2011, 2012, 2014, 2017). Previous provisional TFTSG Red List assessments have also been published as recommendations ahead of formal IUCN Red List publication (TFTSG 1989; TFTSG and Asian Turtle Trade Working Group [ATTWG] 2000; Horne et al. 2012).

To further assess and more effectively summarize the current conservation status of all turtles and tortoises in a single, comprehensive analysis, we provide here a combined review of the current official 2018 IUCN Red List (including published marine turtle assessments as determined by the IUCN Marine Turtle Specialist Group) and a review and analysis of the most current TFTSG Provisional Red List assessments of the conservation status of all previously unevaluated or re-evaluated tortoise and freshwater turtle species. This augmented TFTSG Red

List 2018 is the first assessment to consider the global conservation status of all species in the Order Testudines, at present generally recognized to include about 360 species (TTWG 2017; TTWG, unpubl. data, 2018). This review and analysis has been undertaken by the TFTSG (its current and former Chairs, Red List Coordinators, Executive and Steering Committees, Regional Vice-Chairs, and other key contributors); it is based on a series of regional, TFTSG-led IUCN Red Listing workshops and subsequent reviews involving members of the TFTSG and other specialists.

METHODS AND RESULTS

Our overarching goal was to summarize the best available science to inform policy and strategic conservation action. We used the most current taxonomy (TTWG 2017; TTWG, unpubl. data, 2018) to create species richness lists for turtles in a variety of geographic regions of the world and calculated percentages of imperiled species and Average Threat Levels (ATL; see definition and methodology below) for these and various taxonomic groupings. We compared these analyses with those of other threatened vertebrate groups (all other Reptilia and all Amphibia, Mammalia, and Aves). The limitations of these analyses are the limitations of the taxonomy and are the same for any use of species richness. As noted by Kiester (2013, p. 707), “As a practical matter, calculating species richness depends on the taxonomy available and hence on the taxonomic philosophy of the practitioners for a given taxon.” We believe that the taxonomic philosophies used in these different vertebrate groups are sufficiently similar to make valid comparisons.

There were 356 species of modern (post-1500 CE) turtles and tortoises (Order Testudines) recognized in the most recent global checklist (TTWG 2017). Four new species of freshwater turtles have been described or elevated from subspecies since then: *Kinosternon vogti*, *Sternotherus intermedius*, *Sternotherus peltifer*, and *Trachemys medemi* (Vargas-Ramírez et al. 2017; López-Luna et al. 2018; Scott et al. 2018), bringing the total to 360 (TTWG, unpubl. data, 2018). Of these, 7 are marine turtles, leaving 353 tortoise and freshwater turtle species.

The current official IUCN Red List (version 2018.1) formally includes only 251 of the 360 recognized turtle and tortoise species (plus 8 separate subspecies and 24 regional subpopulations), using a slightly outdated taxonomy from the one presented in TTWG (2017) and used in this review. Of the 251 species listed, 8 are assessed as Extinct (EX) (including *Pelusios seychellensis*, considered a subspecies by TTWG [2014, 2017] and herein), 1 Extinct in the Wild (EW), 1 Critically Endangered (Possibly Extinct) (CR(PE)), 42 Critically Endangered (CR), 44 Endangered (EN), 66 Vulnerable (VU), 32 Near Threatened (NT), 1 Lower Risk/Conservation Dependent (LR/cd; an outdated threat category being phased out by

IUCN), 45 Least Concern (LC), and 11 Data Deficient (DD) (see Table 1).

By IUCN Red List protocol, Threatened species are defined as the combination of all those in the three status categories of CR, EN, and VU. Therefore, as of the published 2018 IUCN Red List, 153 species (61.0% of the included species) are officially regarded by the IUCN as Threatened, with 87 species (34.7%) considered CR+EN and 43 species (17.1%) considered CR. If one excludes the 11 DD species, then 63.8% of the remaining 240 data-sufficient species included are considered Threatened. Unfortunately, because only 251 of all 360 recognized species of turtles and tortoises are currently included on the 2018 IUCN Red List, these numbers are not as accurate as they need to be and, while representative, they only apply to about two thirds of the world’s turtle fauna and are therefore imprecise. By including the additional 109 TFTSG Provisional Red List assessments with these official assessments, we arrive at more precise estimates of the global conservation status of all turtles and tortoises.

Of the total of 360 species, 109 (30.3%) are not yet included on the official IUCN Red List. Nevertheless, all these unlisted (Not Evaluated) species have already been evaluated by the TFTSG. Status assessments of all tortoises and freshwater turtles are being accomplished on an ongoing basis through specialist consultations and regional IUCN Turtle Red Listing workshops organized and led by the TFTSG. These workshops consistently assess previously unevaluated species and re-assess outdated previously evaluated species. Since 1999, the TFTSG has held IUCN Red Listing workshops in and for species in Asia three times, India twice, Australia and New Guinea twice, South America twice, and Mexico, United States, Sub-Saharan Africa, Madagascar, the Galápagos Islands, and the Mediterranean region once each. Most of these TFTSG assessments have been finalized and published on the IUCN Red List while many others remain provisional and were recorded in TTWG (2017).

The third Asian IUCN Red Listing workshop, held by the TFTSG in Singapore in 2018, considered new and updated evaluations for nearly 100 Asian and New Guinean taxa, and additional Australian and Chinese taxa are currently in the process of being re-assessed. Further, a recent supplementary session was held in the United States for any remaining DD or Not Evaluated species. More than 50 of these new assessments have progressed to a state where their categorization could be added to this report. However, many remain in early review and are not yet recorded here; for these species we use the provisional TFTSG assessments from earlier workshops in Australia and Asia (Horne et al. 2012; TTWG 2017).

As such, all turtles and tortoises (Order Testudines) have now been assessed using the IUCN Red List categories and criteria. Although not yet officially published on the IUCN Red List, we can use these TFTSG Provisional Red List assessments to update and

Table 1. Actual numbers of listed species and percentages of number of species listed and of all turtle and tortoise species recognized for several previous IUCN Red Lists (1982–2011), the current IUCN Red List (version 2018.1), as well as the current TFTSG Red List 2018. Data for IUCN from Groombridge (1982), Baillie and Groombridge (1996), and data downloads from the IUCN Red List website (www.iucnredlist.org) in 2004–2018. IUCN conservation status threat categories: EX = Extinct; EW = Extinct in the Wild; CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; NE = Not Evaluated; NL = Not Listed. Threatened species = CR+EN+VU species. The total number of species recognized at the time of each dated listing extrapolated from Pritchard (1979), Iverson (1992a), Fritz and Havaš (2007), and Turtle Taxonomy Working Group (2011, 2017).

	EX	EW	CR	EN	VU	NT	LC	DD	(CR+EN)	Threatened (CR+EN+VU)	EX+EW+ CR+EN+VU	No. data- sufficient	No. species listed	NE/NL	No. of species recognized	No. of subsp. listed
Actual numbers																
IUCN Red List 1982 ^a	0	0	3	8	10	9	—	24	11	21	21	30	54	183	237	5
IUCN Red List 1996	6	0	10	28	58	48	[53] ^b	23	38	96	102	150	173	102	275	13
IUCN Red List 2004	7	1	25	46	57	42	14	13	71	128	136	192	205	107	312	16
IUCN Red List 2007	7	1	26	46	60	43	19	10	72	132	140	202	212	107	319	16
IUCN Red List 2011	6	1	32	44	58	37	39	11	76	134	141	217	228	102	330	19
IUCN Red List 2018	8	1	43	44	66	33	45	11	87	153	162	240	251	109	360	8
TFTSG Red List 2018	7	0	72	55	60	40	98	28	127	187	194	332	360	0	360	21
Percent of listed species																
IUCN Red List 1982 ^a	0.0	0.0	5.6	14.8	18.5	16.7	—	44.4	20.4	38.9	38.9	55.6	—	338.9	—	—
IUCN Red List 1996	3.5	0.0	5.8	16.2	33.5	27.7	[30.6] ^b	13.3	22.0	55.5	59.0	86.7	—	59.0	59.0	—
IUCN Red List 2004	3.4	0.5	12.2	22.4	27.8	20.5	6.8	6.3	34.6	62.4	66.3	93.7	—	52.2	52.2	—
IUCN Red List 2007	3.3	0.5	12.3	21.7	28.3	20.3	9.0	4.7	34.0	62.3	66.0	95.3	—	50.5	50.5	—
IUCN Red List 2011	2.6	0.4	14.0	19.3	25.4	16.2	17.1	4.8	33.3	58.8	61.8	95.2	—	44.7	44.7	—
IUCN Red List 2018	3.2	0.4	17.1	17.5	26.3	13.1	17.9	4.4	34.7	61.0	64.5	95.6	—	43.4	43.4	—
TFTSG Red List 2018	1.9	0.0	20.0	15.6	16.1	11.4	26.9	8.1	35.6	51.7	53.6	91.9	—	0.0	0.0	—
Percent of all recognized species																
IUCN Red List 1982 ^a	0.0	0.0	1.3	3.4	4.2	3.8	—	10.1	4.6	8.9	8.9	12.7	22.8	77.2	—	—
IUCN Red List 1996	2.2	0.0	3.6	10.2	21.1	17.5	[19.3] ^b	8.4	13.8	34.9	37.1	54.5	62.9	37.1	37.1	—
IUCN Red List 2004	2.2	0.3	8.0	14.7	18.3	13.5	4.5	4.2	22.8	41.0	43.6	61.5	65.7	34.3	34.3	—
IUCN Red List 2007	2.2	0.3	8.2	14.4	18.8	13.5	6.0	3.1	22.6	41.4	43.9	63.3	66.5	33.5	33.5	—
IUCN Red List 2011	1.8	0.3	9.7	13.3	17.6	11.2	11.8	3.3	23.0	40.6	42.7	65.8	69.1	30.9	30.9	—
IUCN Red List 2018	2.2	0.3	11.9	12.2	18.3	9.2	12.5	3.1	24.2	42.5	45.0	66.7	69.7	30.3	30.3	—
TFTSG Red List 2018	1.9	0.0	20.0	15.6	16.1	11.4	26.9	8.1	35.6	51.7	53.6	91.9	100.0	0.0	0.0	—

^a Outdated 1982 categories converted to current categories as follows: E (Endangered) = CR+EN; V (Vulnerable) = VU; R (Rare) = NT; I (Indeterminate) + K (Insufficiently Known) = DD.

^b Species assessed as LC in 1996 were not formally included on the Red List.

better determine the overall global conservation status of turtles and tortoises.

This updated and augmented TFTSG Red List 2018 (Table 1; Appendix 1) encompasses all 360 currently recognized species of turtles and tortoises. Of these, 332 are data-sufficient and categorized as follows: 7 EX, 1 CR(PE), 71 CR, 55 EN, 60 VU, 40 NT, and 98 LC. A total of 187 species are officially categorized as Threatened (CR+EN+VU), and an additional 28 species lack sufficient data to categorize their status and are DD.

We adjusted the percentages of Threatened species to potentially account for those DD species that may also be Threatened. We followed the calculation method of determining percentage of data-sufficient Threatened species utilized by Hoffmann et al. (2010) and Böhm et al. (2013) whereby the number of Threatened species (187) is divided by the number of data-sufficient species (332; i.e., the total number of recognized species [360] minus those that are DD [28]). This adjustment assumes that DD species may have the same approximate percentage of Threatened species as of data-sufficient species.

About 20 separate subspecies of turtles have also been assessed and listed by IUCN and the TFTSG (Appendix 2) but are not further analyzed here other than to note that some are CR and Possibly Extinct in the Wild (PEW). There is increased conservation value in also assessing all subspecies of turtles for the Red List; there are currently 121 additional turtle and tortoise subspecies recognized, for a total of 481 turtle and tortoise taxa (TTWG 2017; TTWG, unpubl. data, 2018). We recommend that status evaluations of all recognized taxa be undertaken.

Average Threat Levels (ATL). — Expanding on similar previous quantitative analyses of regional threat levels for turtles and tortoises developed by Stuart and Thorbjarnarson (2003) and Rhodin (2006), we expanded and modified the ranking system of Rhodin (2006) to calculate global ATL for polytypic taxonomic groupings (e.g., classes, orders, superfamilies, families, or subfamilies) or broad geographic groupings, and we used these ATL values for comparisons among turtles and tortoises and with other vertebrate groups.

We assigned numerical threat levels per individual species in each selected grouping, with LC = 1, NT = 2, VU = 3, EN = 4, CR = 5, EW = 6, CR(PE) = 7, and EX = 8. DD species were assigned a value of 2.5 based on the potential predicted average threat level after evaluation (see Hoffmann et al. 2010). We then summed all species values per selected grouping and calculated the ATL for each group (where ATL equals the total summed threat value per grouping divided by the total number of species per grouping).

Patterns and Comparative Analyses

This TFTSG Red List 2018 has 187 species of turtles and tortoises (51.9%) that are Threatened, with 127

(35.3%) CR+EN, 72 (20.0%) CR, and 56.2% of 332 data-sufficient species Threatened. When analyzing these figures as percentages of only those species officially included on the IUCN Red Lists (Table 1; Fig. 1), it is apparent that the figures of 61.0% or 63.8% Threatened species as reflected on the 2018 IUCN listing are high estimates. In fact, based on our TFTSG assessments, 51.7% of all recognized turtles and tortoises, or 56.2% of all data-sufficient species, are currently assessed as Threatened and 58.3% are Threatened or already EX.

While still among the highest percentages of any of the larger vertebrate groups, these figures are not quite as high as indicated on the official IUCN Red List. The reason for these apparently lower percentages of Threatened species is that, of the species previously not included on the IUCN Red List, a lower percentage have now been provisionally assessed by the TFTSG as Threatened and many are DD or LC. However, when we calculate these figures as percentages of all turtle species recognized at the time of the assessments (Table 1; Fig. 2), they are now markedly higher than in previously published IUCN Red Lists, and we see that the percentages of both CR+EN and Threatened turtles and tortoises have actually increased over the years.

Comparison of Taxonomic Groupings. — We compared the percentages of Threatened and CR+EN species for selected turtle and tortoise groupings (superfamilies, families, or subfamilies) (Fig. 3). We compared all polytypic families of turtles and tortoises with 2 exceptions. One, we split the family Geoemydidae into its 2 component subfamilies because of their marked geographic separation and analyzed each separately: the Geoemydinae (Asian and Eurasian freshwater and semiterrestrial turtles) and the Rhinoclemmydinae (Neotropical freshwater and semiterrestrial turtles). Two, we included all marine turtles of the families Cheloniidae and Dermochelyidae in their inclusive superfamily Chelonioidea.

We found that, among these groupings, the subfamily Geoemydinae (62 Asian and Eurasian species) currently has the overall highest percentages of imperiled species, with 74.2% CR+EN and 79.0% Threatened. Only the much-smaller family Podocnemididae (South American and Madagascan river turtles, 8 species) has a higher proportion of Threatened species (100.0%), and the superfamily Chelonioidea (marine turtles, 7 species) also has more Threatened species (85.7%), but each of these families have lower percentages of CR+EN species than do the Geoemydinae. The subfamily Rhinoclemmydinae (9 Neotropical species) and the families Kinosternidae (Neotropical mud turtles, 30 species) and Pelomedusidae (African side-necked turtles, 27 species) have the lowest percentages of Threatened species. The 4 evolutionarily distinct and monotypic freshwater turtle families and subfamilies (Dermatemydidae, Platysternidae, Carettochelyidae, and Pseudemydurinae) are all highly imperiled with a single CR or EN species each: *Dermatemys mawii*,

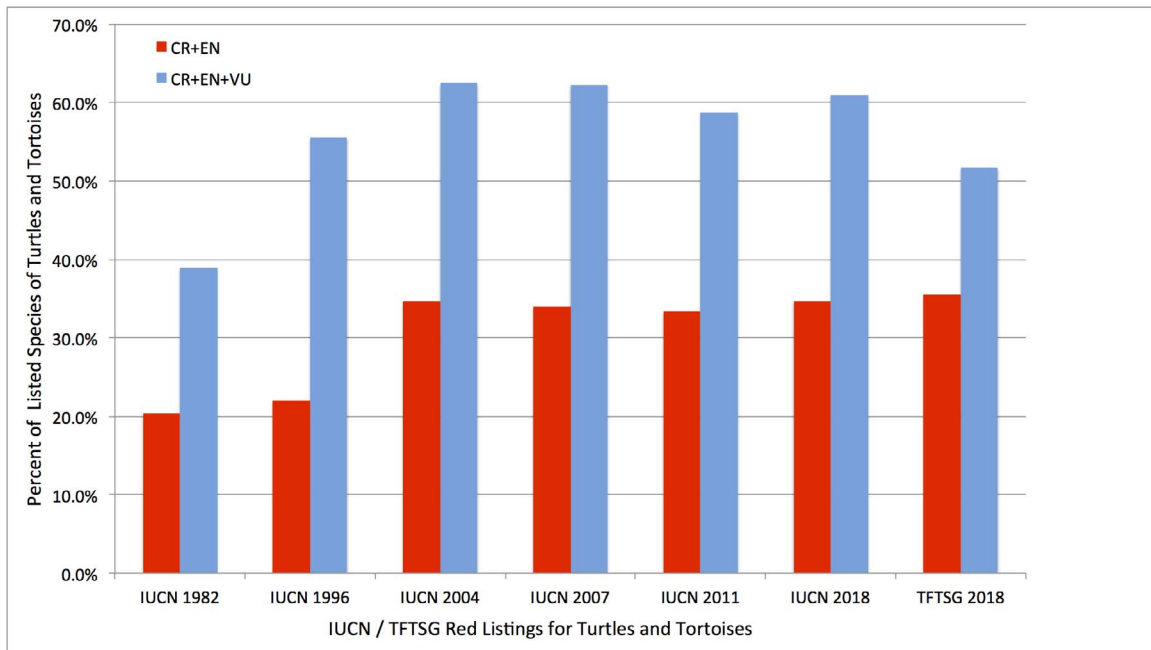


Figure 1. Critically Endangered and Endangered (CR+EN) and Threatened (CR+EN+VU) species of turtles and tortoises as a percentage of the total number of IUCN- or TFTSG-listed species at the time, as published by IUCN Red Lists 1982–2018 and on this TFTSG Red List 2018. Data sources as in Table 1. (Color version is available online.)

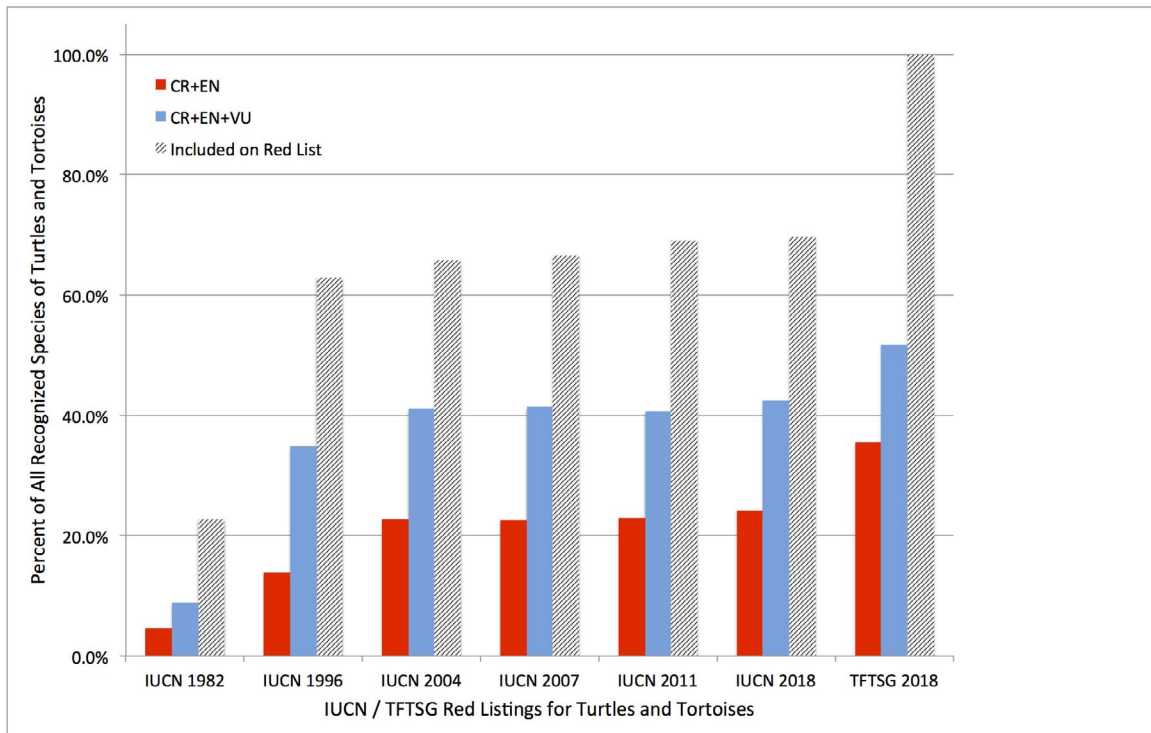


Figure 2. Critically Endangered and Endangered (CR+EN), Threatened (CR+EN+VU), and Listed species of turtles and tortoises as percentages of the total number of recognized species at the time, as published on IUCN Red Lists 1982–2018 and on this TFTSG Red List 2018. Data sources as in Table 1. (Color version is available online.)

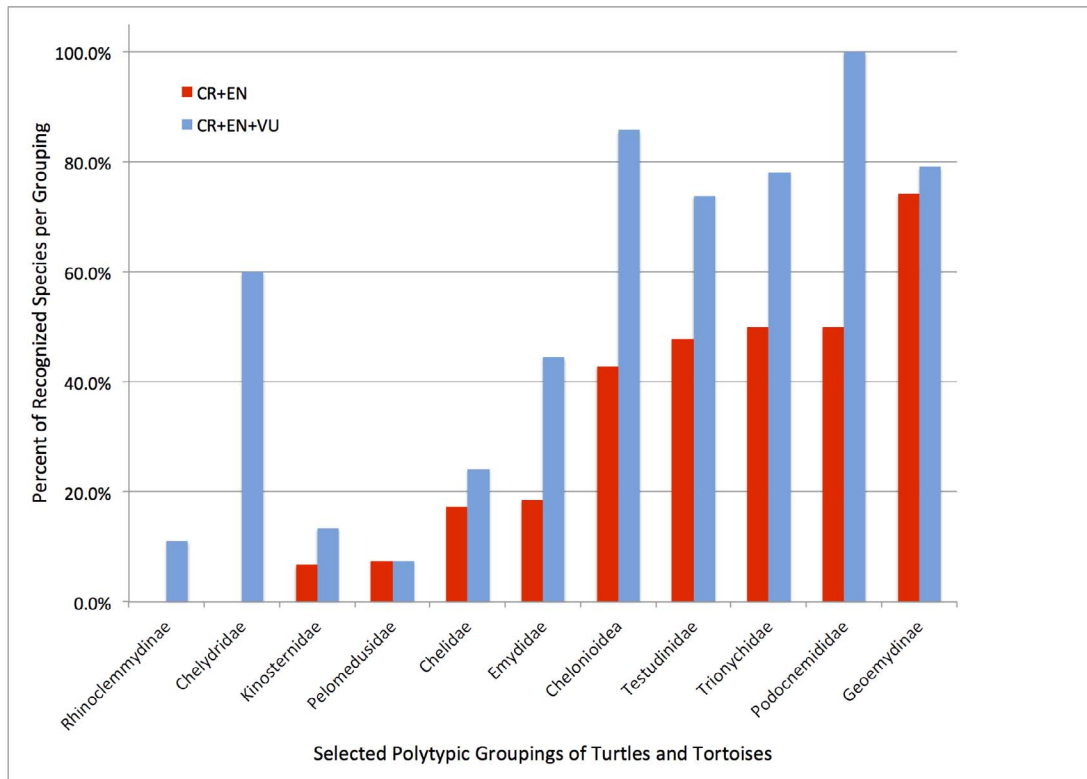


Figure 3. Composition of TFTSG Red List 2018 showing Critically Endangered and Endangered (CR+EN) and Threatened (CR+EN+VU) turtle and tortoise species per selected polytypic group (superfamily, family, or subfamily) as a percentage of the total number of recognized species in each defined group. (Color version is available online.)

Platysternon megacephalum, *Carettochelys insculpta*, and *Pseudemydura umbrina*. The distinct monotypic marine turtle family Dermochelyidae has a single VU species: *Dermochelys coriacea*.

There was a highly significant positive correlation between the species richness and number of Threatened species per selected taxonomic grouping (superfamily, family, or subfamily) (Pearson's $r = 0.895$, $r^2 = 0.802$, $p < 0.0001$). However, after accounting for the relative species richness in each grouping in calculating the expected frequencies, there was a significant difference among groups in terms of frequency of expected vs. observed Threatened species ($\chi^2 = 25.89$, $df = 13$, $p < 0.01$), with the Testudinidae, Geoemydinae, and Trionychidae having more Threatened species than expected and Chelidae, Pelomedusidae, and Kinosternidae having fewer Threatened species than expected (Fig. 4).

If we calculate the percentage of Threatened or Extinct species, then the family Testudinidae (tortoises, 65 species), with 7 species of insular giant tortoises already having gone extinct during modern times, increases from 73.8% Threatened to 84.6% Threatened or Extinct species.

The Testudinidae, with its many large and easily collected terrestrial tortoises, has been highly exploited and consumed by humans for about as long as humanity has existed on the planet (Turtle Extinctions Working Group [TEWG] 2015). Many continental and insular

species of giant tortoises went extinct during the Quaternary (Pleistocene and Holocene) during the global spread of prehuman hominids and humans out of Africa into first Asia and Eurasia, then the Australasian archipelago and Australia, and eventually to North America, Central America, the Caribbean archipelago, and South America (TEWG 2015). When the numbers of fossil tortoises that went extinct during the Quaternary are combined with the modern (living and extinct) species of tortoises, of the more than 120 species of tortoises that have existed since the beginning of the Pleistocene nearly 60% have already gone extinct, presumably primarily through human overexploitation (TEWG 2015). The other large-bodied terrestrial turtles, the giant horned turtles of the extinct family Meiolaniidae with 7 species (also often insular), all went extinct during the Pleistocene and Holocene, apparently due at least partly to human exploitation (TEWG 2015; Hawkins et al. 2016).

We calculated ATL values for all selected taxonomic groupings of turtles and tortoises (Fig. 5). The entire Order Testudines, with 360 total species, has a calculated ATL of 2.96. We found that five (Testudinidae, Geoemydinae, Podocnemididae, Cheloniodea, and Trionychidae) currently have much-higher threat levels (ATL = 3.44–4.06) than the other families and subfamilies, with the Kinosternidae, Pelomedusidae, and Rhinoclemmydinae having the lowest ATLs (1.65–1.87).

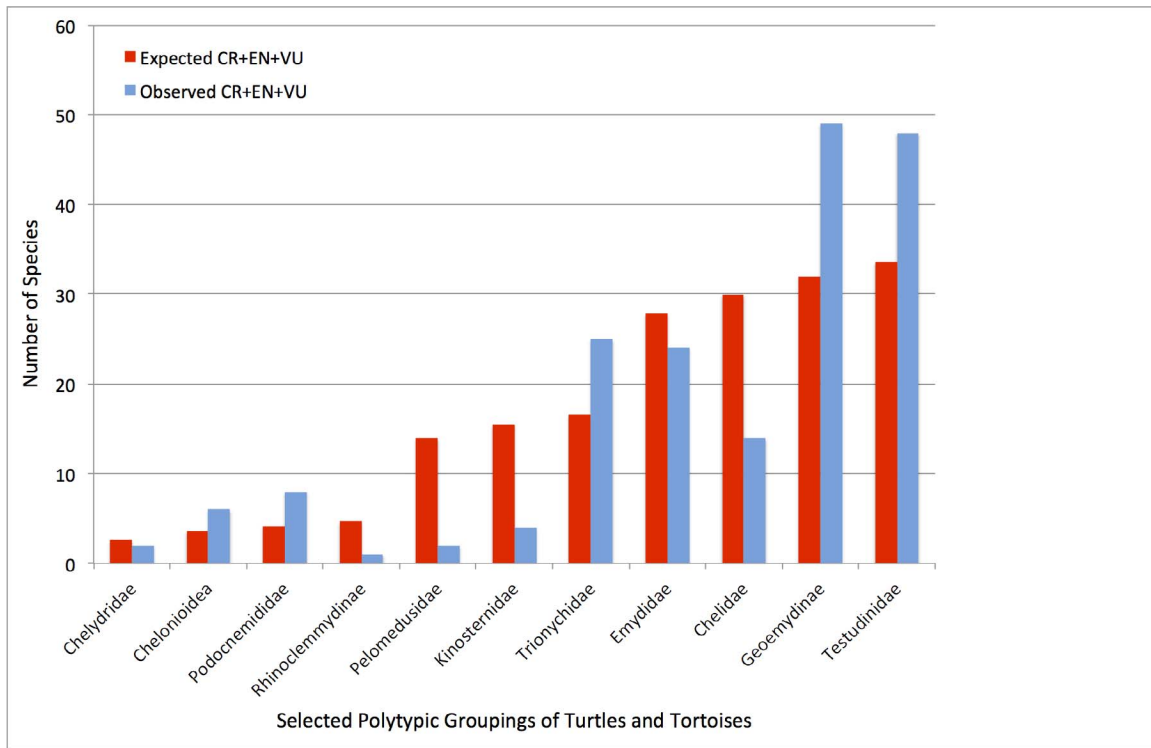


Figure 4. Composition of TFTSG Red List 2018 showing expected vs. observed number of Threatened (CR+EN+VU) turtle and tortoise species per selected polytypic grouping (superfamily, family, or subfamily) as related to species richness in each grouping. The observed and expected frequencies differed significantly, with species of Testudinidae, Geoemydinae, and Trionychidae at higher risk than in other groupings. (Color version is available online.)

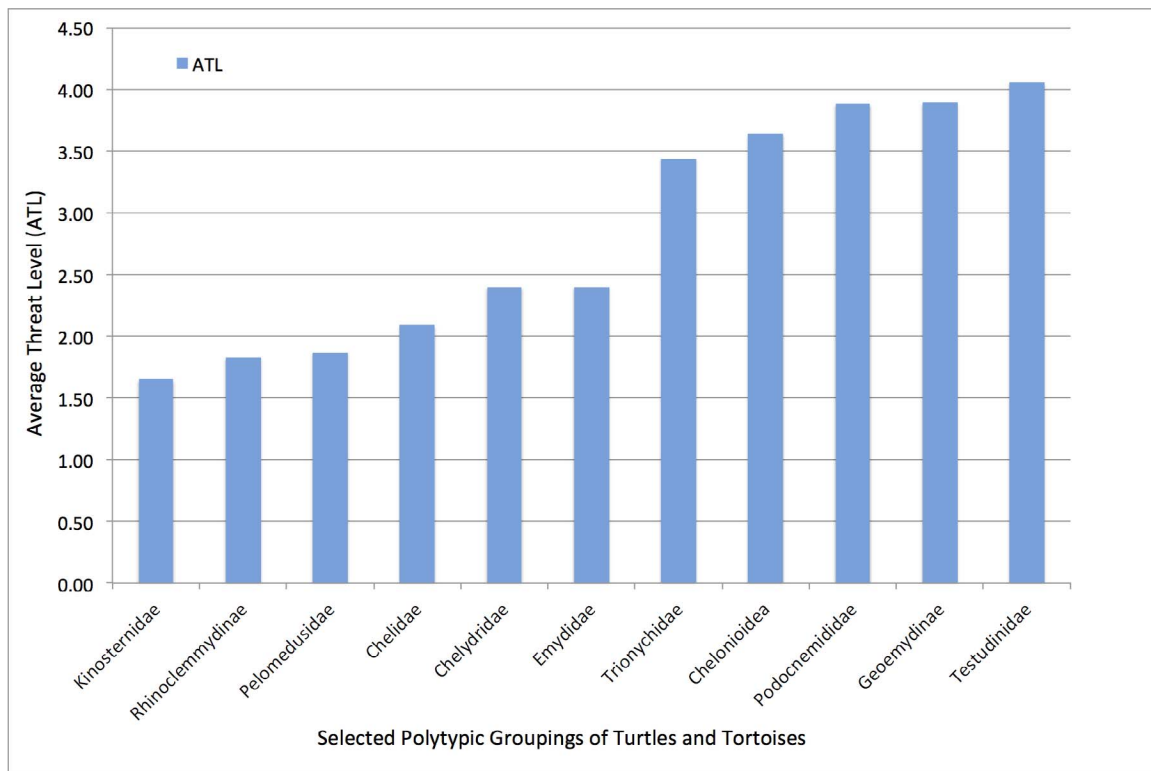


Figure 5. Composition of TFTSG Red List 2018 showing calculated Average Threat Level (ATL; see text for calculation methodology) per selected polytypic group (superfamily, family, or subfamily) of turtles and tortoises. The entire order Testudines has an ATL of 2.96. (Color version is available online.)

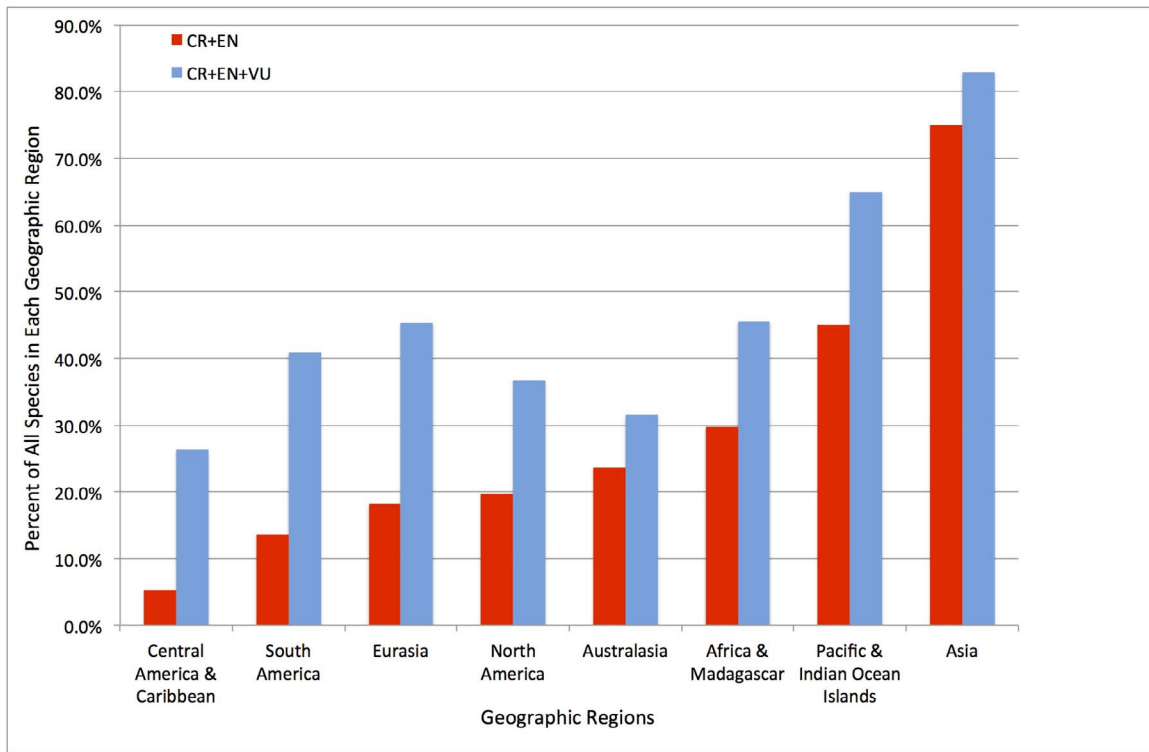


Figure 6. Composition of TFTSG Red List 2018 showing Critically Endangered and Endangered (CR+EN) and Threatened (CR+EN+VU) freshwater turtle and tortoise species per geographic region as a percentage of the total number of recognized species in each region. Regional delineations defined in Appendix 1. (Color version is available online.)

Comparison of Geographic Regions. — When comparing the percentages of Threatened and CR+EN species of turtles and tortoises by geographic region (Fig. 6; definitions of geographic regional delineations in Appendix 1), we found that Asia (88 species) has the overall highest proportions with 75.0% CR+EN and 83.0% Threatened. Only the much-smaller regional grouping, Pacific and Indian Ocean Islands (20 giant tortoise species of which 7 are already Extinct), has a similar but lower percentage of Threatened species (65.0%). However, if we examine the percentage of Threatened or Extinct species, then the Pacific and Indian Ocean Islands group of giant tortoises increases to 100%.

Analysis of the ATLS for these geographic regions (Fig. 7) revealed that the Pacific and Indian Ocean Islands, with their many recently EX tortoise species, have the highest ATL level (5.60). However, Asia also has a quite high ATL (3.98), with the other regions having much lower ATLS, although the Africa and Madagascar grouping has a slightly higher ATL (2.69) than the others.

There was a highly significant positive correlation between species richness and number of Threatened species per geographic region (Pearson's $r = 0.886$, $r^2 = 0.786$, $p < 0.01$). To highlight whether the turtles of any specific geographic region are more threatened than those from other geographic regions, we considered the relative species richness in each region. We then calculated the expected numbers of imperiled species per geographic region given the total species richness of that region, and

compared the observed vs. expected frequencies of imperiled species per geographic region by a chi-square test. The result of this analysis for CR+EN species, using the total number of species per geographic region, was that the observed and expected frequencies differed significantly ($\chi^2 = 26.32$, $df = 7$, $p < 0.001$), with only Asian species being more at risk than in the other geographic regions (Fig. 8). For Threatened species, the chi-square was not significant ($\chi^2 = 13.15$, $df = 7$, $p = 0.068$), indicating that the geographic pattern of Threatened species was consistent with the species richness of that region.

We also calculated the expected frequency of EX, CR, or EN species by geographic region. The EX species were found only in the Pacific and Indian Ocean Islands, and this pattern was highly nonrandom ($\chi^2 = 49$, $df = 7$, $p < 0.0001$). For CR species, there was a significant difference among geographic regions ($\chi^2 = 18.62$, $df = 7$, $p < 0.01$), with Asia having a significantly higher-than-expected frequency of CR species and Australasia and North America having significantly lower-than-expected frequencies. All other geographic regions had expected frequencies of CR species consistent with their overall richness. For EN species, there was no significant difference among geographic regions ($\chi^2 = 8.93$, $df = 7$, $p = 0.258$).

Comparison with Other Vertebrates. — We calculated the percentage of data-sufficient Threatened species for several other selected vertebrate groups included on the

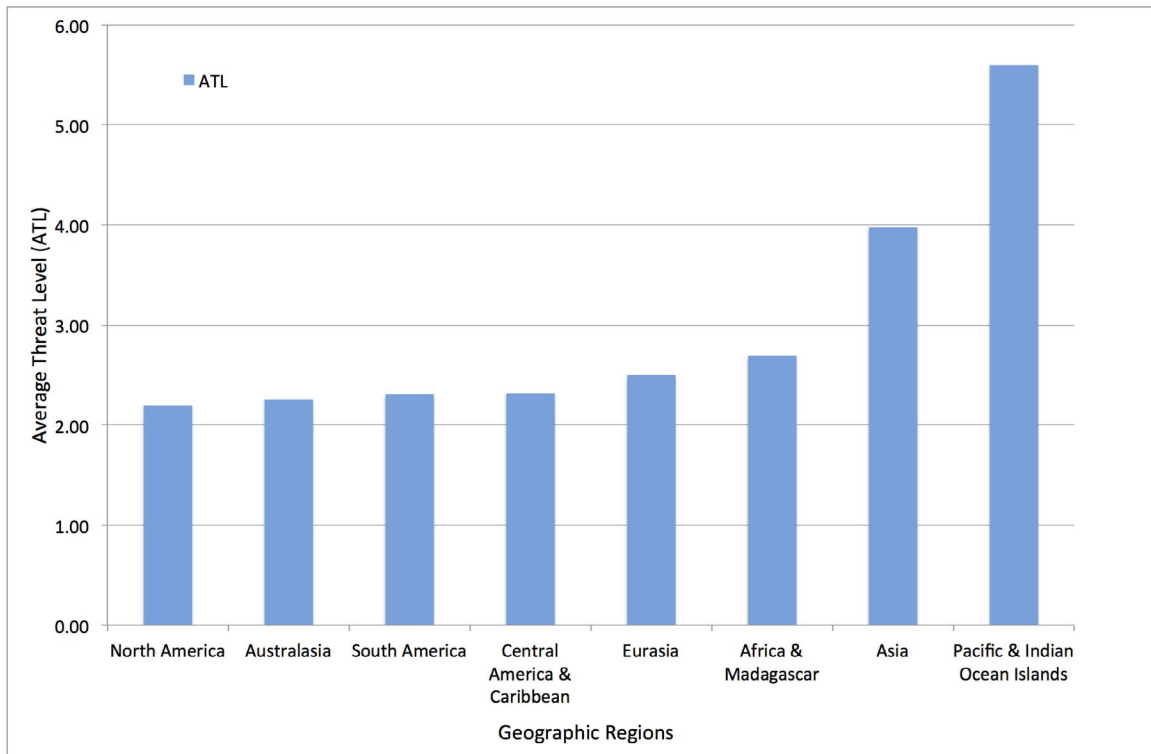


Figure 7. Composition of TFTSG Red List 2018 showing calculated Average Threat Level (see text for calculation methodology) per selected geographic region of turtles and tortoises. Regional delineations defined in Appendix 1. (Color version is available online.)

current IUCN Red List (version 2018.1): Squamata, Crocodylia, Amphibia, Mammalia, Aves, and Primates (Fig. 9). The percentages of Threatened species in most of these other groups were lower than for turtles and

tortoises, with only Primates (64.3%) having a higher percentage of Threatened species than the Testudines (56.2%) but with Caudata (salamanders, 55.4%) very close behind. Turtles and tortoises, with anywhere from about

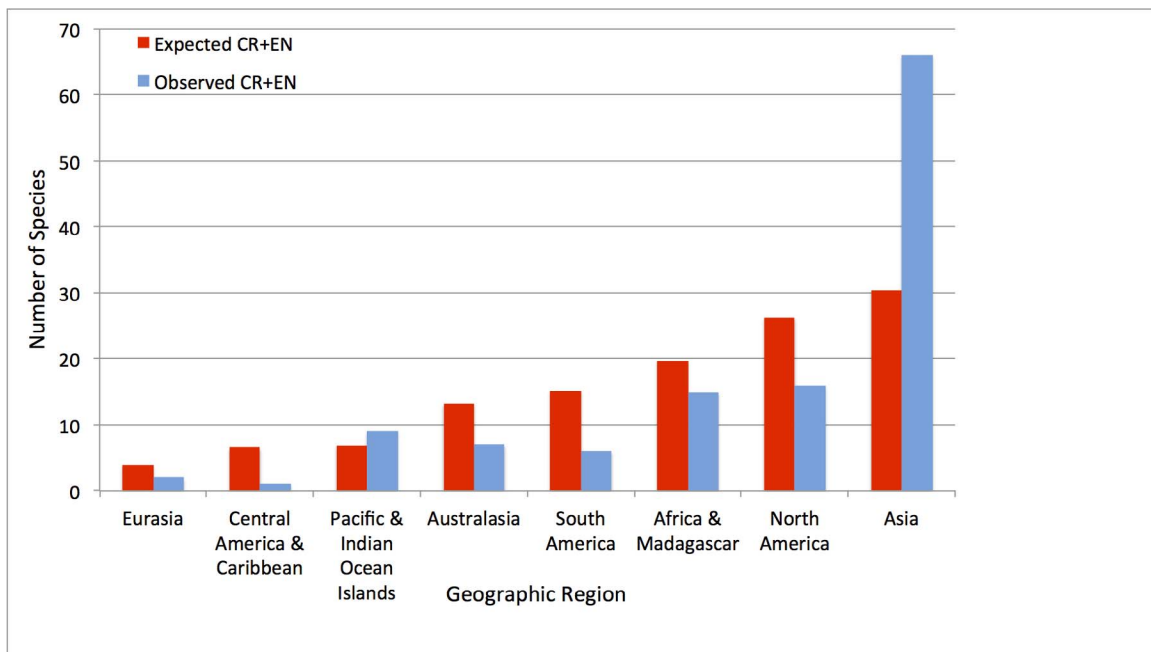


Figure 8. Composition of TFTSG Red List 2018 showing expected vs. observed number of Critically Endangered and Endangered (CR+EN) turtle and tortoise species per selected geographic region as related to species richness in each region. The observed and expected frequencies differed significantly, with Asian species being at higher risk than in other geographic regions. Regional delineations defined in Appendix 1. (Color version is available online.)

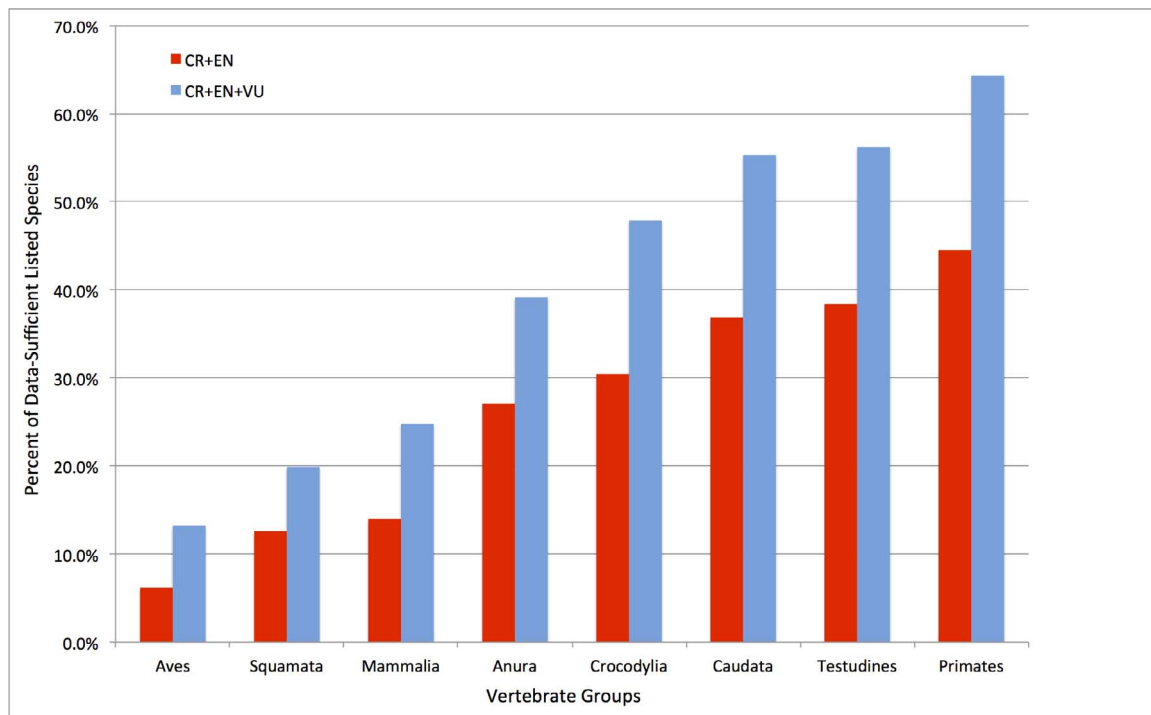


Figure 9. Critically Endangered and Endangered (CR+EN) and Threatened (CR+EN+VU) species in various selected classes and orders of vertebrates as a percentage of the number of data-sufficient listed species in each group, as published by IUCN Red List 2018.1, and for Testudines as of TFTSG Red List 2018. (Color version is available online.)

51%–56% of all their modern species Threatened and nearly 60% Threatened or Extinct, are one of the most imperiled of any of the larger groups of vertebrates.

We also compared the ATLs of turtles and tortoises from our fully assessed TFTSG Red List to the ATLs of other selected vertebrate groups (Fig. 10; Tables 2 and 3) that we calculated from the current IUCN Red List. Because these other vertebrate groups have also been fully assessed, we considered the analyses to be comparable. This indicated that the ATL of Testudines is similar to that of Primates, but very slightly higher, and that the other groups are all lower.

We then calculated and ranked the ATLs of all other polytypic (≥ 5 species) orders of the classes Reptilia, Amphibia, Mammalia, and Aves. All other large and moderate-sized orders (44 with ≥ 20 species) have lower ATLs than do the Testudines (Table 2), even the 2 orders of Amphibia, although the Caudata (salamanders) come close to Primates and Testudines in their threat levels.

We also compared and ranked the ATLs of all polytypic families (≥ 5 species) of Reptilia and Amphibia. The Testudinidae (tortoises) have the highest ranked ATL of all 114 families, with the top 4 ranked families and 5 of the top 10 also being Testudines (Table 3).

DISCUSSION

Corroborating our comparisons and analyses, turtles and tortoises are among the most imperiled vertebrates on the planet, and Asia is at the epicenter of the global turtle

extinction crisis that has recently and rapidly developed as a result of the unsustainable trade that began as the Asian Turtle Crisis (Behler 1997; Altherr and Freyer 2000; van Dijk et al. 2000; Rhodin 2000, 2001, 2002; Cheung and Dudgeon 2006; Zhou and Jiang 2008; Horne et al. 2012). Huge numbers of turtles, initially of Chinese and Asian species and then spreading regionally, have been collected and traded in the East Asian meat consumption trade, and their shells and bone are also used for traditional Chinese medicines (van Dijk et al. 2000; Chen et al. 2009). Live animals of all sizes, especially of rare and/or attractive species, have been poached and illegally marketed to the high-end international pet trade, primarily in China, but also to other Asian countries (e.g., Thailand, Malaysia, Japan, and Indonesia) as well as to Europe and the United States (van Dijk et al. 2000; Cheung and Dudgeon 2006; Nijman and Shepherd 2007, 2015; Zhou and Jiang 2008; Gong et al. 2009; TFTSG 2010a, 2010b; Stengel et al. 2011; Turtle Conservation Coalition [TCC] 2011, 2018; Horne et al. 2012; Auliya et al. 2016; Luiselli et al. 2016; Morgan and Chng 2017; Sigouin et al. 2017; Sung and Fong 2018). From this focal origin in East Asia, an unsustainable turtle trade has gradually spread and expanded, first regionally and then globally, as wild turtle populations have been sequentially exploited, with many rendered commercially and ecologically extinct (van Dijk et al. 2000; Rhodin 2000, 2001, 2002; Krishnakumar et al. 2009; TFTSG 2010a, 2010b; Eisemberg et al. 2011; TCC 2011, 2018; Horne et al. 2012; Castellano et al. 2013;

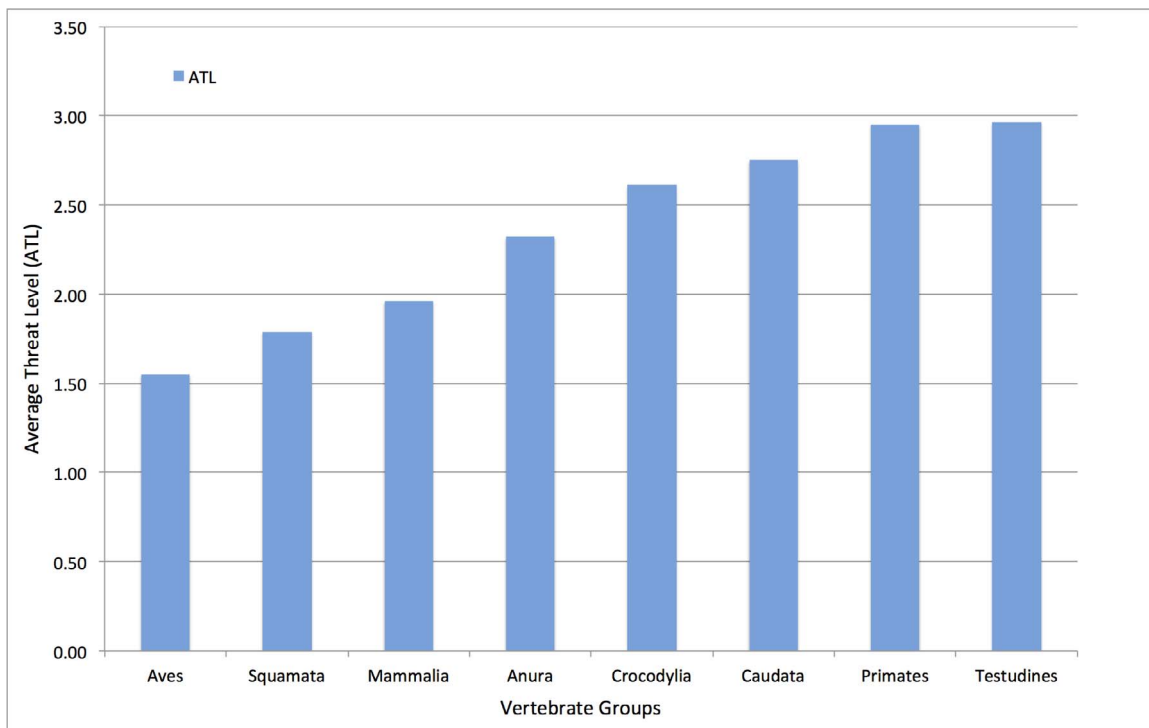


Figure 10. Average Threat Level (ATL; see text for calculation methodology) per selected class or order of listed vertebrates as of IUCN Red List 2018.1 and TFTSG Red List 2018. See Table 2 for ranked listing of ATLs for all large polytypic orders (≥ 100 species) of Reptilia, Amphibia, Mammalia, and Aves. (Color version is available online.)

Table 2. Top 25 ranked Average Threat Levels (ATL; see text for calculation methodology) of the largest 26 orders ($n \geq 100$ species) of Reptilia, Amphibia, Mammalia, and Aves. The next largest 18 orders ($n \geq 20$ species) also all have ATLs lower than Testudines. Taxonomy of orders and calculations from IUCN Red List (version 2018.1) and TFTSG Red List 2018.

Order	Class	<i>n</i>	ATL
Testudines	Reptilia	360	2.96
Primates	Mammalia	440	2.95
Caudata	Amphibia	566	2.75
Gruiformes	Aves	192	2.65
Diprotodontia	Mammalia	147	2.53
Procellariiformes	Aves	142	2.52
Cetartiodactyla	Mammalia	335	2.48
Anura	Amphibia	5936	2.32
Psittaciformes	Aves	415	2.14
Columbiformes	Aves	367	1.94
Carnivora	Mammalia	295	1.94
Eulipotyphla	Mammalia	469	1.88
Anseriformes	Aves	176	1.82
Galliformes	Aves	308	1.81
Rodentia	Mammalia	2285	1.80
Squamata	Reptilia	6393	1.79
Accipitriformes	Aves	251	1.77
Chiroptera	Mammalia	1241	1.74
Strigiformes	Aves	241	1.73
Charadriiformes	Aves	384	1.63
Coraciiformes	Aves	188	1.45
Passeriformes	Aves	6648	1.42
Caprimulgiformes	Aves	596	1.38
Cuculiformes	Aves	151	1.32
Piciformes	Aves	485	1.29

Table 3. Top 25 ranked Average Threat Levels (ATL; see text for calculation methodology) of 114 polytypic families ($n \geq 5$ species) of Reptilia and Amphibia. Taxonomy of families and calculations from IUCN Red List (version 2018.1) and TFTSG Red List 2018. The turtle family Geoemydidae was treated as 2 separate subfamilies (Geoemydinae and Rhinoclemmydinae).

Family	Class	Order	<i>n</i>	ATL
Testudinidae	Reptilia	Testudines	65	4.06
Geoemydinae	Reptilia	Testudines	62	3.89
Podocnemididae	Reptilia	Testudines	8	3.88
Cheloniidae	Reptilia	Testudines	6	3.75
Iguanidae	Reptilia	Squamata	36	3.63
Telmatobiidae	Amphibia	Anura	60	3.59
Eleutherodactylidae	Amphibia	Anura	193	3.56
Trionychidae	Reptilia	Testudines	32	3.44
Ranixalidae	Amphibia	Anura	10	3.20
Calyptocephalellidae	Amphibia	Anura	5	3.20
Nyctibatrachidae	Amphibia	Anura	16	3.13
Alsodidae	Amphibia	Anura	27	3.00
Crocodylidae	Reptilia	Crocodylia	14	3.00
Micrixalidae	Amphibia	Anura	11	2.95
Plethodontidae	Amphibia	Caudata	380	2.89
Petropedetidae	Amphibia	Anura	9	2.89
Rhacophoridae	Amphibia	Anura	328	2.84
Conrauidae	Amphibia	Anura	6	2.83
Aromobatidae	Amphibia	Anura	100	2.82
Hynobiidae	Amphibia	Caudata	50	2.80
Brevicipitidae	Amphibia	Anura	33	2.77
Bufoidea	Amphibia	Anura	546	2.68
Craugastoridae	Amphibia	Anura	704	2.64
Xenosauridae	Reptilia	Squamata	6	2.58
Ambystomatidae	Amphibia	Caudata	36	2.53

Luiselli et al. 2013; Mali et al. 2014; Colteaux and Johnson 2017).

In addition to this severe past and ongoing overexploitation and trade, global turtle and tortoise populations have also been further impacted and reduced by numerous other contributing threats. These include increasing habitat loss, fragmentation and degradation, deforestation and agricultural expansion, urbanization and road mortality, nest and hatchling depredation by subsidized predators, environmental pollution, invasive species, and global climate change causing habitat alteration (desertification and sea level rise) and potentially affecting reproductive potential (through temperature-dependent sex determination), as well as increased incidence of infectious disease (Swingland and Klemens 1989; Gibbons et al. 2000; Moll and Moll 2004; Steen and Gibbs 2004; Rizkalla and Swihart 2006; Browne and Hecnar 2007; Rhodin et al. 2008–2018; TCC 2011, 2018; Quesnelle et al. 2013; Agha et al. 2018; Bowne et al. 2018; Fagundes et al. 2018; Hamilton et al. 2018; Spencer et al. 2018; Thompson et al. 2018a, 2018b). As a result of all these impacts and the resultant decreasing populations, the important ecological roles that turtles and tortoises normally fulfill in their habitats and ecosystems have suffered dramatically (Lovich et al. 2018).

The global extent and severity of the turtle extinction crisis can be visualized through a series of maps showing the richness of species currently categorized as CR, CR+EN, or Threatened (CR+EN+VU) and of all recognized species (Fig. 11). The geographic hotspots for species assessed as CR (Fig. 11A) are in Southeastern China, Southeast Asia, and Northern India. The geographic hotspots for species assessed as CR+EN (Fig. 11B) are in Southeastern China, Southeast Asia and Indonesia, and Northern India and Pakistan. Several species in the Amazon region of South America as well as Africa are also impacted in addition to some in North America, especially in the Northeastern United States. For species assessed as Threatened (Fig. 11C), the same hotspots apply but are more pronounced and spread across larger geographic areas. Additional emerging hotspots of Threatened species include the Southeastern United States, West and Central Africa, Central and Southern India, and Southern New Guinea. For comparison, the species richness distribution for all freshwater turtles and tortoises is shown in Fig. 11D. Additionally, Iverson (1992b), Buhlmann et al. (2009), Mittermeier et al. (2015), Ennen et al. (2017), Roll et al. (2017), and TTWG (2017) have also provided similar maps and analyses of turtle distribution patterns, global turtle hotspots, and priority areas of conservation concern.

As part of the process of determining the threatened status of the world's tortoises and freshwater turtles, the TCC (2011, 2018) has compiled 2 consensus listings of the Top 25+ most endangered turtles in the world, which included the top 50–65 most imperiled species in each of those years. Continuing to evaluate further changes in turtle species status and reflecting those in Top 25+ compilations, as well as the IUCN Red List and TFTSG

Red List, will be vitally important for ongoing and future conservation efforts for these highly imperiled species. This will be important in terms of both documenting potential improved status for those species that are benefitting from conservation efforts and evaluating increasing threats and deteriorating survival prospects for other species that need heightened attention.

Responding to the increasingly imperiled status of tortoises and freshwater turtles worldwide has been the focus of the TFTSG and other organizations over the last 3 decades, with several action plans and reviews having been generated (TFTSG 1989; van Dijk et al. 2000; TCF 2002; TCC 2011; Horne et al. 2012; TCC 2018). The regular use and analysis of both the official IUCN Red List and the augmented TFTSG Red List in developing action plans, while continuing the important work of finalizing publication of these TFTSG Provisional Red List assessments, will provide the global turtle conservation community with an improved and more timely overview of the conservation status of all tortoises and freshwater turtles. Further, continuing to calculate and monitor changes in the ATLS of various taxonomic and geographic groupings of turtles and tortoises can help measure improvement or deterioration of conservation status and provide a metric for the need and/or effectiveness of conservation efforts. This will help guide emerging conservation policy and strategic action and allow for more time-sensitive implementation of critically needed conservation and research efforts for this highly imperiled group of charismatic vertebrates.

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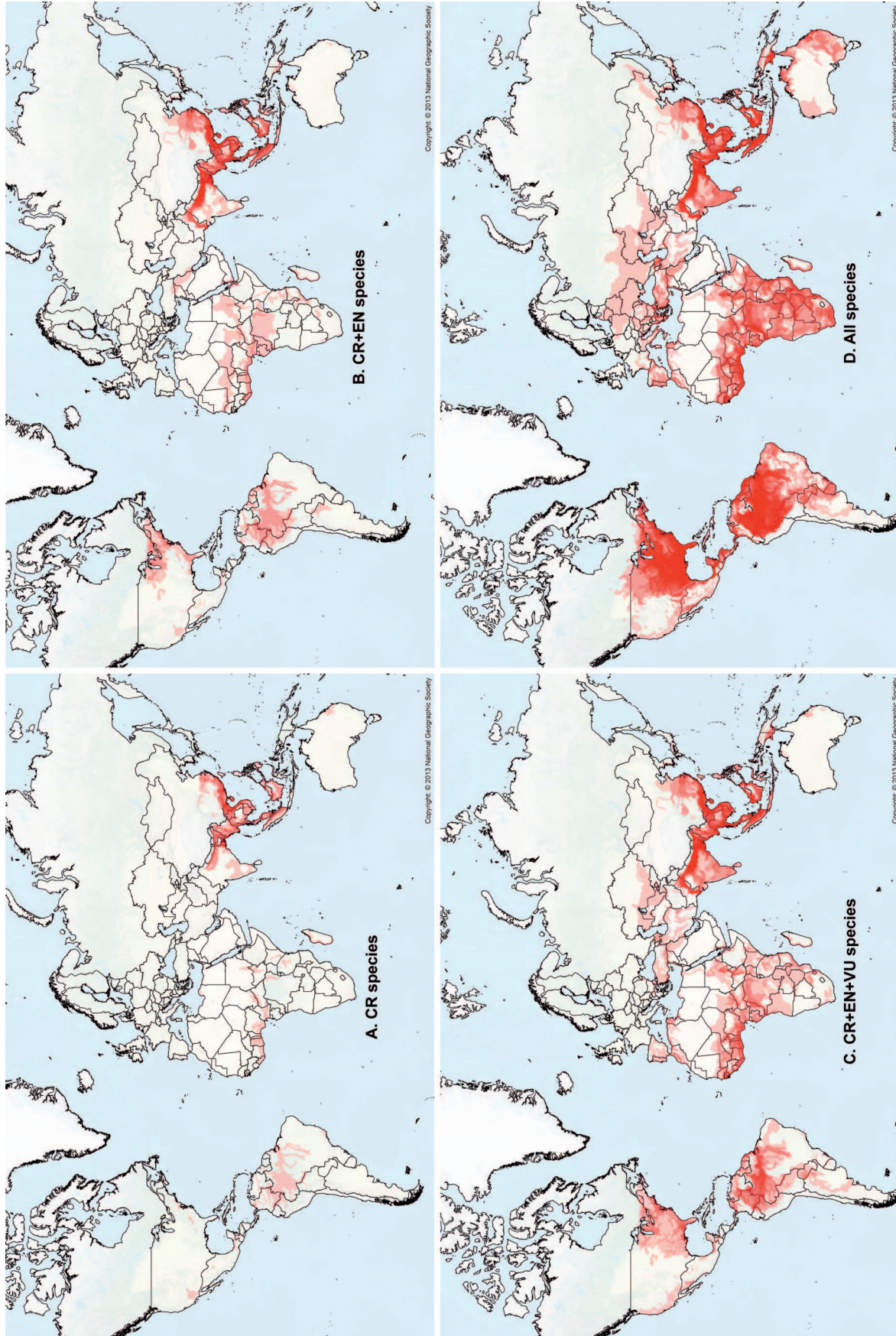


Figure 11. Global species richness maps for all tortoises and freshwater turtles as of TFTSG Red List 2018. Composite maps of distribution shapefiles, each species shown in red at 80% transparency and stacked, with the lightest red color = 1 species, and increasing up to the darkest red color for up to about 15–20 species. A. Species assessed as Critically Endangered (CR = 70). B. Species assessed as Critically Endangered and Endangered (CR+EN = 125). C. Species assessed as Threatened (CR+EN+VU = 186). D. All 353 currently recognized species of tortoises and freshwater turtles (adapted from Turtle Taxonomy Working Group [TTWG] 2017 and TTWG, unpubl. data, 2018).

Fauna and Flora [CITES]), national (e.g., USFWS), and sub-national (provincial or state) wildlife management and conservation agencies and regulating bodies in many countries that devote time and resources to the conservation of species under their regulatory mandate and control; this includes conducting conservation research and management and regulating the domestic and international use and trade in these species. The TFTSG is most grateful to all of them, as they play a vital role in supporting the efforts of the entire turtle conservation community to help preserve turtles and prevent their extinction. We also thank Jeffrey Seminoff and Peter Lindeman for their helpful reviews. Required disclaimer for US Government employees (coauthors Berry and Lovich): any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the US Government.

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Appendix 1. Listing of conservation status of all 360 currently recognized turtle and tortoise species (Order Testudines: tortoises, freshwater turtles, and marine turtles), including primary geographic occurrence, IUCN Red List status (and year published), TFTSG Provisional Red List status (and most recent year assessed), and current updated TFTSG Red List 2018 global status. Taxonomy as per Turtle Taxonomy Working Group (TTWG 2017 and TTWG unpubl. data, 2018). Red List categories: EX = Extinct; EW = Extinct in the Wild; CR = Critically Endangered; EN = Endangered; VU = Vulnerable; (Threatened = CR+EN+VU); NT = Near Threatened; LC = Least Concern; LR/CD = Lower Risk/Conservation Dependent (now = NT); DD = Data Deficient; NE = Not Evaluated; NL = Not Listed; (PE) = Possibly Extinct; (PEW) = Possibly Extinct in the Wild. Geographic regions: AF = Africa (excluding the Mediterranean region of northern Africa but including the southernmost tip of the Arabian Peninsula); AS = Asia (includes Pakistan through China, Korea, and Japan and through Malaysia to Indonesia but excluding Timor, Roti, and Indonesian Papua); AU = Australasia (Australia and New Guinea, including Timor, Roti, and Indonesian Papua); CA = Central America (from the Isthmus of Tehuantepec in Mexico to Panama, including San Andrés); CB = Caribbean Islands (except Trinidad and San Andrés); EA = Eurasia (includes the Mediterranean region of northern Africa through the Middle East to Afghanistan and including Russia and the former Soviet Republics of Central Asia); IO = Indian Ocean Islands (Mascarenes and Seychelles); MG = Madagascar; NA = North America (includes Mexico to the Isthmus of Tehuantepec); OC = Oceanic (marine turtles); PO = Pacific Ocean Islands (Galápagos); SA = South America (includes Trinidad but not the Galápagos). * = TFTSG provisional assessments submitted and in press on the IUCN Red List.

Classification	Common name	Geographic region	IUCN Red List		TFTSG Provisional		Global Status
			Status	Year published	Status	Year assessed	
Cryptodira							
Chelydridae							
<i>Chelydra acutirostris</i>	South American Snapping Turtle	SA	NE	2007	NT	2018	NT
<i>Chelydra rossignoni</i>	Central American Snapping Turtle	CA	VU	2012			VU
<i>Chelydra serpentina</i>	North American Snapping Turtle	NA	LC				LC
<i>Macrochelys suwanniensis</i>	Suwannee Alligator Snapping Turtle	NA	NE	1996	VU	2018	VU
<i>Macrochelys temminckii</i>	Western Alligator Snapping Turtle	NA	VU		VU	2011	VU
Cheloniodea							
Cheloniidae							
Caretinae							
<i>Caretta caretta</i>	Loggerhead	OC	VU	2015			VU
<i>Eretmochelys imbricata</i>	Hawksbill	OC	CR	2008			CR
<i>Lepidochelys kempii</i>	Kemp's Ridley	OC	CR	1996			CR
<i>Lepidochelys olivacea</i>	Olive Ridley	OC	VU	2008			VU
Cheloniinae							
<i>Chelonia mydas</i>	Green Turtle	OC	EN	2004			EN
<i>Natator depressus</i>	Flatback	OC	DD	1996			DD
Derموchelyidae							
<i>Derموchelys coriacea</i>	Leatherback	OC	VU	2013			VU
Kinosternoidea							
Derموatemydidae							
<i>Derموatemys mawii</i>	Central American River Turtle	CA	CR	2006			CR
Kinosterninae							
<i>Kinosternon abaxillare</i>	Central Chiapas Mud Turtle	CA	NE	1996	DD	2018	DD
<i>Kinosternon acutum</i>	Tabasco Mud Turtle	CA	NT	2007			NT
<i>Kinosternon alamosae</i>	Alamos Mud Turtle	NA	DD	1996	LC	2018	LC
<i>Kinosternon angustipons</i>	Narrow-bridged Mud Turtle	CA	VU				VU
<i>Kinosternon bauri</i>	Striped Mud Turtle	NA	LC	2011			LC
<i>Kinosternon chimalhuaca</i>	Jalisco Mud Turtle	NA	LC	2007			LC
<i>Kinosternon creaseri</i>	Creaser's Mud Turtle	CA	LC	2007			LC
<i>Kinosternon dunnii</i>	Dunn's Mud Turtle	SA	VU	1996	VU	2011	VU
<i>Kinosternon durangoense</i>	Durango Mud Turtle	NA	DD	2007	LC	2018	LC
<i>Kinosternon flavescens</i>	Yellow Mud Turtle	NA	DD	2011			DD
<i>Kinosternon herrerai</i>	Herrera's Mud Turtle	NA	NT	2007			NT

Appendix 1. Continued.

Classification	Common name	Geographic region	IUCN Red List		TFTSG Provisional		Global Status
			Status	Year published	Status	Year assessed	
<i>Kinosternon hirtipes</i>	Rough-footed Mud Turtle	NA	LC	2007			LC
<i>Kinosternon integrum</i>	Mexican Mud Turtle	NA	LC	2007			LC
<i>Kinosternon leucostomum</i>	White-lipped Mud Turtle	CA	NE			LC	2011
<i>Kinosternon oxacae</i>	Oaxaca Mud Turtle	NA	DD	2007		LC	2018
<i>Kinosternon scorioides</i>	Scorpion Mud Turtle	SA	NE			LC	2011
<i>Kinosternon sonoriense</i>	Sonora Mud Turtle	NA	NT	2011			NT
<i>Kinosternon steindachneri</i>	Florida Mud Turtle	NA	NE			LC	2011
<i>Kinosternon stejnegeri</i> ^a	Arizona Mud Turtle	NA	LC	2007			LC
<i>Kinosternon subrubrum</i>	Eastern Mud Turtle	NA	LC	2011			LC
<i>Kinosternon vogti</i>	Vallarta Mud Turtle	NA	NE			CR	2018
<i>Sternotherus carinatus</i>	Razor-backed Musk Turtle	NA	LC	2011			CR
<i>Sternotherus depressus</i>	Flattened Musk Turtle	NA	CR	2011			CR
<i>Sternotherus intermedius</i>	Intermediate Musk Turtle	NA	NE			LC	2018
<i>Sternotherus minor</i>	Loggerhead Musk Turtle	NA	LC	2011			LC
<i>Sternotherus odoratus</i>	Common Musk Turtle	NA	LC	2011			LC
<i>Sternotherus peltifer</i>	Stripe-necked Musk Turtle	NA	NE			LC	2011
Sturotypinae							
<i>Claudius angustatus</i>	Narrow-bridged Musk Turtle	CA	NT	1996			NT
<i>Sturotypus salvinii</i>	Pacific Coast Giant Musk Turtle	CA	NT	1996			NT
<i>Sturotypus triporcatus</i>	Northern Giant Musk Turtle	CA	NT	1996			NT
Testudinoidea							
Emyridae							
Deirochelyinae							
<i>Chrysemys dorsalis</i>	Southern Painted Turtle	NA	NE			LC	2011
<i>Chrysemys picta</i>	Painted Turtle	NA	LC				LC
<i>Deirochelys reticularia</i>	Chicken Turtle	NA	NE	2011			LC
<i>Graptemys barbouri</i>	Barbour's Map Turtle	NA	VU	2011		NT	VU
<i>Graptemys caglei</i>	Cagle's Map Turtle	NA	EN	2011			EN
<i>Graptemys ernsti</i>	Escambia Map Turtle	NA	NT	2011			NT
<i>Graptemys flavimaculata</i>	Yellow-blotched Map Turtle	NA	VU	2011			VU
<i>Graptemys geographica</i>	Northern Map Turtle	NA	LC	2011			LC
<i>Graptemys gibbonsi</i>	Pascagoula Map Turtle	NA	EN	2011			EN
<i>Graptemys nigrinoda</i>	Black-knobbed Map Turtle	NA	LC	2011			LC
<i>Graptemys oculifera</i>	Ringed Map Turtle	NA	VU	2011			VU
<i>Graptemys ouachitensis</i>	Ouachita Map Turtle	NA	LC	2011			LC
<i>Graptemys pearlensis</i>	Pearl River Map Turtle	NA	EN	2011			EN
<i>Graptemys pseudogeographica</i>	False Map Turtle	NA	LC	2011			LC
<i>Graptemys pulchra</i>	Alabama Map Turtle	NA	LC	2011			LC
<i>Graptemys sabinensis</i>	Sabine Map Turtle	NA	NT	2011			NT
<i>Graptemys versa</i>	Texas Map Turtle	NA	NE			LC	2011
<i>Malaclemys terrapin</i>	Diamondback Terrapin	NA	LC	2011			LC
<i>Pseudemys alabamensis</i>	Alabama Red-bellied Cooter	NA	NT	2011		VU	2018
<i>Pseudemys concinna</i>	River Cooter	NA	EN	1996		EN	2011
<i>Pseudemys floridana</i>	Coastal Plain Cooter	NA	LC	2011			LC
<i>Pseudemys forzungi</i>	Rio Grande Cooter	NA	LC	2011			LC

Appendix 1. Continued.

Classification	Common name	Geographic region	IUCN Red List		TFTSG Provisional		Global Status
			Status	Year published	Status	Year assessed	
<i>Pseudemys nelsoni</i>	Florida Red-bellied Cooter	NA	LC	2011			LC
<i>Pseudemys peninsularis</i>	Peninsula Cooter	NA	LC	2011			LC
<i>Pseudemys rubriventris</i>	Northern Red-bellied Cooter	NA	NT	2011			NT
<i>Pseudemys texana</i>	Texas Cooter	NA	LC	2011			LC
<i>Trachemys adiutrix</i>	Maranhao Slider	SA	EN	1996		NT	NT
<i>Trachemys callirostris</i>	Colombian Slider	SA	NE		2011	VU	VU
<i>Trachemys decorata</i>	Hispaniolan Slider	CB	VU	1996			VU
<i>Trachemys decussata</i>	Cuban Slider	CB	NE		1996	LC	LC
<i>Trachemys dorbigni</i>	D'Orbigny's Slider	SA	NE		2011	LC	LC
<i>Trachemys gaigeae</i>	Big Bend Slider	NA	VU				VU
<i>Trachemys grayi</i>	Western Meso-American Slider	CA	NE		2018	DD	DD
<i>Trachemys medemi</i>	Atrato Slider	SA	NE		2017	VU	VU
<i>Trachemys nebulosa</i>	Baja California Slider	NA	NE		2018	DD	DD
<i>Trachemys ornata</i>	Ornate Slider	NA	VU	2007			VU
<i>Trachemys scripta</i>	Pond Slider	NA	LC	2011			LC
<i>Trachemys stejnegeri</i>	Central Antillean Slider	CB	NT	1996		NT	NT
<i>Trachemys taylora</i>	Cuatro Cienegas Slider	NA	EN	2007			EN
<i>Trachemys terrapen</i>	Jamaican Slider	CB	VU	1996			VU
<i>Trachemys venusta</i>	Eastern Meso-American Slider	CA	NE		2018	DD	DD
<i>Trachemys yaquia</i>	Yaqui Slider	NA	VU	2007			VU
Emydoidea							
<i>Actinemys marmorata</i>	Northern Pacific Pond Turtle	NA	VU	1996		VU	VU
<i>Actinemys pallida</i>	Southern Pacific Pond Turtle	NA	VU	1996		VU	VU
<i>Clemmys guttata</i>	Spotted Turtle	NA	EN	2011			EN
<i>Emydoidea blandingii</i>	Blanding's Turtle	NA	EN	2011			EN
<i>Emys orbicularis</i>	European Pond Turtle	EA	NT	1996			NT
<i>Emys trinacris</i>	Sicilian Pond Turtle	EA	DD	2009			DD
<i>Glyptemys insculpta</i>	Wood Turtle	NA	EN	2011			EN
<i>Glyptemys mhlenbergii</i>	Bog Turtle	NA	CR	2011			CR
<i>Terrapene carolina</i>	Common Box Turtle	NA	VU	2011			VU
<i>Terrapene coahuila</i>	Coahuilan Box Turtle	NA	EN	2007			EN
<i>Terrapene nelsoni</i>	Spotted Box Turtle	NA	DD	1996		DD	DD
<i>Terrapene ornata</i>	Ornate Box Turtle	NA	NT	2011			NT
Platysternidae							
<i>Platysternon megacephalum</i>	Big-headed Turtle	AS	EN	2000		CR	CR
Geoemydidae							
Geoemydinae							
<i>Batagur affinis</i>	Southern River Terrapin	AS	CR	2016		CR	CR
<i>Batagur baska</i>	Northern River Terrapin	AS	CR	2000		CR	CR
<i>Batagur borneoensis</i>	Painted Terrapin	AS	CR	2000		CR	CR
<i>Batagur dhongoka</i>	Three-striped Roofed Turtle	AS	EN	2000		CR	CR
<i>Batagur kachuga</i>	Red-crowned Roofed Turtle	AS	CR	2000		CR	CR
<i>Batagur trivittata</i>	Burmese Roofed Turtle	AS	EN	2000		CR	CR
<i>Cuora amboinensis</i>	Southeast Asian Box Turtle	AS	VU	2000		EN	EN
<i>Cuora aurocapitata</i>	Yellow-headed Box Turtle	AS	CR	2000		CR	CR
<i>Cuora bourreti</i>	Bourret's Box Turtle	AS	CR	2016		CR	CR

Appendix 1. Continued.

Classification	Common name	Geographic region	IUCN Red List		TFTSG Provisional		Global Status
			Status	Year published	Status	Year assessed	
<i>Cuora cyclomata</i>	Vietnamese Three-striped Box Turtle	AS	CR	2000	CR	2016	CR
<i>Cuora flavomarginata</i>	Yellow-margined Box Turtle	AS	EN	2000	CR	2011	CR
<i>Cuora galbinifrons</i>	Indochinese Box Turtle	AS	CR	2016			CR
<i>Cuora mccordi</i>	McCord's Box Turtle	AS	CR	2000	CR	2011	CR
<i>Cuora mouhotii</i>	Keeled Box Turtle	AS	EN	2000	CR	2011	CR
<i>Cuora pani</i>	Pan's Box Turtle	AS	CR	2000	CR	2011	CR
<i>Cuora picturata</i>	Southern Vietnam Box Turtle	AS	CR	2016	CR	2018	CR
<i>Cuora trifasciata</i>	Chinese Three-striped Box Turtle	AS	CR	2000	CR	2011	CR
<i>Cuora yunnanensis</i>	Yunnan Box Turtle	AS	CR	2010			CR
<i>Cuora zhoui</i>	Zhou's Box Turtle	AS	CR	2000	CR	2011	CR
<i>Cyclenys atripons</i>	Western Black-bridged Leaf Turtle	AS	NE		EN	2018	EN
<i>Cyclenys dentata</i>	Asian Leaf Turtle	AS	NT	2000	NT	2018	NT
<i>Cyclenys enigmatica</i>	Enigmatic Leaf Turtle	AS	NE		DD	2018	DD
<i>Cyclenys fusca</i>	Myanmar Brown Leaf Turtle	AS	NE		LC	2018	LC
<i>Cyclenys gemeli</i>	Assam Leaf Turtle	AS	NE		NT	2018	NT
<i>Cyclenys oldhamii</i>	Southeast Asian Leaf Turtle	AS	NE		EN	2018	EN
<i>Cyclenys pulchristriata</i>	Eastern Black-bridged Leaf Turtle	AS	NE		EN	2018	EN
<i>Geoclemys hamiltonii</i>	Spotted Pond Turtle	AS	VU	2000	EN	2018	EN
<i>Geoemyda japonica</i>	Ryukyu Black-breasted Leaf Turtle	AS	EN	2000	EN		EN
<i>Geoemyda spengleri</i>	Black-breasted Leaf Turtle	AS	EN	2000	EN	2011	EN
<i>Hardella thurjii</i>	Crowned River Turtle	AS	VU	2000	EN	2018	EN
<i>Heosemys annandalii</i>	Yellow-headed Temple Turtle	AS	EN	2000	CR	2018	CR
<i>Heosemys depressa</i>	Arakan Forest Turtle	AS	CR	2000	CR	2011	CR
<i>Heosemys grandis</i>	Giant Asian Pond Turtle	AS	VU	2000	EN	2011	EN
<i>Heosemys spinosa</i>	Spiny Turtle	AS	EN	2000	EN	2011	EN
<i>Leucocephalon yuwonoi</i>	Sulawesi Forest Turtle	AS	CR	2000	CR	2011	CR
<i>Malayemys khoratensis</i>	Khorat Snail-eating Turtle	AS	NE		LC	2018	LC
<i>Malayemys macrocephala</i>	Malayan Snail-eating Turtle	AS	NE		LC	2018	LC
<i>Malayemys subtrijuga</i>	Mekong Snail-eating Turtle	AS	VU	2000	NT	2018	NT
<i>Mauremys annamensis</i>	Vietnamese Pond Turtle	AS	CR	2000	CR	2018	CR
<i>Mauremys caspica</i>	Caspian Turtle	EA	NE		LC	2011	LC
<i>Mauremys japonica</i>	Japanese Pond Turtle	AS	NT	2000			NT
<i>Mauremys leprosa</i>	Mediterranean Pond Turtle	EA	NE		VU	2011	VU
<i>Mauremys mutica</i>	Yellow Pond Turtle	AS	EN	2000	CR	2011	CR
<i>Mauremys nigricans</i>	Chinese Red-necked Turtle	AS	EN	2000	CR	2011	CR
<i>Mauremys reevesii</i>	Reeves' Turtle	AS	EN	2011			EN
<i>Mauremys rivulata</i>	Western Caspian Turtle	EA	NE		LC	2011	LC
<i>Mauremys sinensis</i>	Chinese Stripe-necked Turtle	AS	EN	2000	EN	2011	EN
<i>Melanochelys tricarinata</i>	Tricarinata Hill Turtle	AS	VU	2000	CR	2018	CR
<i>Melanochelys trijuga</i>	Indian Black Turtle	AS	NT	2000	LC	2018	LC
<i>Morenia ocellata</i>	Burmese Eyed Turtle	AS	VU	2000	EN	2018	EN
<i>Morenia petersi</i>	Indian Eyed Turtle	AS	VU	2000	EN	2018	EN
<i>Notochelys platynota</i>	Malayan Flat-shelled Turtle	AS	VU	2000	VU	2018	VU
<i>Oritia borneensis</i>	Malaysian Giant Turtle	AS	EN	2000	CR	2018	CR
<i>Pangshura smithii</i>	Brown Roofed Turtle	AS	NT	2000	NT	2018	NT

Appendix 1. Continued.

Classification	Common name	Geographic region	IUCN Red List		TFTSG Provisional		Global Status
			Status	Year published	Status	Year assessed	
<i>Pangshura sylhetensis</i>	Assam Roofed Turtle	AS	EN	2000	EN	2018	EN
<i>Pangshura tecta</i>	Indian Roofed Turtle	AS	LC	2000	VU	2018	VU
<i>Pangshura tenioria</i>	Indian Tent Turtle	AS	LC	2000	LC	2018	LC
<i>Sacalia bealei</i>	Beale's Eyed Turtle	AS	EN	2000	CR	2011	CR
<i>Sacalia quadriocellata</i>	Four-eyed Turtle	AS	EN	2000	EN	2011	EN
<i>Siebenrockiella crassicolis</i>	Black Marsh Turtle	AS	VU	2000	EN	2011	EN
<i>Siebenrockiella leytenis</i>	Palawan Forest Turtle	AS	CR	2000	CR	2018	CR
<i>Vijayachelys silvatica</i>	Cochin Forest Cane Turtle	AS	EN	2000	EN	2018	EN
Rhinoclemmydinae							
<i>Rhinoclemmys annulata</i>	Brown Wood Turtle	CA	NT	1996	DD	2018	DD
<i>Rhinoclemmys areolata</i>	Furrowed Wood Turtle	CA	NT	2007	NT		NT
<i>Rhinoclemmys diademata</i>	Maracaibo Wood Turtle	SA	NE		VU	2011	VU
<i>Rhinoclemmys funerea</i>	Black Wood Turtle	CA	NT	1996			NT
<i>Rhinoclemmys melanosterna</i>	Colombian Wood Turtle	SA	NE		LC	2011	LC
<i>Rhinoclemmys nasuta</i>	Large-nosed Wood Turtle	SA	NT	1996	NT	2010	NT
<i>Rhinoclemmys pulcherrima</i>	Painted Wood Turtle	NA	NE		LC	1996	LC
<i>Rhinoclemmys punctularia</i>	Spot-legged Turtle	SA	NE		LC	2011	LC
<i>Rhinoclemmys rubida</i>	Mexican Spotted Wood Turtle	NA	NT	2007			NT
Testudinidae							
<i>Albarrachelys gigantea</i> ^b	Aldabra Giant Tortoise	IO	VU	1996			VU
<i>Asrochelys radiata</i>	Radiated Tortoise	MG	CR	2008			CR
<i>Asrochelys yniphora</i>	Ploughshare Tortoise	MG	CR	2008			CR
<i>Centrochelys sulcata</i>	African Spurred Tortoise	AF	VU	1996		2013	EN
<i>Chelonoidis carbonarius</i>	Red-footed Tortoise	SA	NE		VU	2011	VU
<i>Chelonoidis chilensis</i>	Chaco Tortoise	SA	VU	1996			VU
<i>Chelonoidis denticulatus</i>	Yellow-footed Tortoise	SA	VU	1996			NT
<i>Chelonoidis abingdonii</i>	Pinta Giant Tortoise	PO	EX	2016			EX
<i>Chelonoidis chathamensis</i>	Volcán Wolf Giant Tortoise	PO	VU	2017			VU
<i>Chelonoidis darwini</i>	San Cristóbal Giant Tortoise	PO	EN	2017			EN
<i>Chelonoidis donfaustoi</i>	Santiago Giant Tortoise	PO	CR	2016			CR
<i>Chelonoidis duncanensis</i>	Eastern Santa Cruz Giant Tortoise	PO	CR	2017			CR
<i>Chelonoidis guntheri</i> *	Pinzón Giant Tortoise	PO	VU	2017			VU
<i>Chelonoidis hoodensis</i>	Sierra Negra Giant Tortoise	PO	EN	1996		2017	CR
<i>Chelonoidis microphyes</i> *	Española Giant Tortoise	PO	CR	2017			CR
<i>Chelonoidis niger</i>	Volcán Darwin Giant Tortoise	PO	VU	1996			VU
<i>Chelonoidis plantasticus</i>	Floreana Giant Tortoise	PO	EX	2017			EX
<i>Chelonoidis porteri</i>	Femadina Giant Tortoise	PO	CR(PE)	2017			CR(PE)
<i>Chelonoidis vandenburghi</i> *	Western Santa Cruz Giant Tortoise	PO	CR	2017			CR
<i>Chelonoidis vicina</i> *	Volcán Alcedo Giant Tortoise	PO	VU	1996			VU
<i>Chersina angulata</i> *	Cerro Azul Giant Tortoise	PO	EN	1996			EN
<i>Chersobius boulengeri</i> *	Angulate Tortoise	AF	LC	2017			LC
<i>Chersobius signatus</i> *	Karoo Dwarf Tortoise	AF	NT	2017			EN
<i>Chersobius solus</i>	Speckled Tortoise	AF	VU	2017			EN
<i>Cylindraspis indica</i>	Nama Tortoise	AF	VU	1996			EN
	Reunion Giant Tortoise	IO	EX	1996			EX

Appendix 1. Continued.

Classification	Common name	Geographic region	IUCN Red List		TFTSG Provisional		Global Status
			Status	Year published	Status	Year assessed	
<i>Cylindraspis inepta</i>	Mauritius Giant Domed Tortoise	IO	EX	1996			EX
<i>Cylindraspis peltales</i>	Rodrigues Domed Tortoise	IO	EX	1996			EX
<i>Cylindraspis triserrata</i>	Mauritius Giant Flat-shelled Tortoise	IO	EX	1996			EX
<i>Cylindraspis vosmaeri</i>	Rodrigues Giant Saddleback Tortoise	IO	EX	1996			EX
<i>Geochelone elegans</i>	Indian Star Tortoise	AS	VU	2016	VU	2018	VU
<i>Geochelone platynota</i>	Burmese Star Tortoise	AS	CR	2000	CR	2018	CR
<i>Gopherus agassizii</i>	Mojave Desert Tortoise	NA	VU	1996	CR	2011	CR
<i>Gopherus berlandieri</i>	Texas Tortoise	NA	NE		NT	2011	NT
<i>Gopherus evgoodei</i> *	Goode's Thoms scrub Tortoise	NA	NE		VU	2018	VU
<i>Gopherus flavomarginatus</i> *	Bolson Tortoise	NA	VU	2007	CR	2017	CR
<i>Gopherus moroikawai</i>	Sonoran Desert Tortoise	NA	NE		VU	2011	VU
<i>Gopherus polyphemus</i>	Gopher Tortoise	NA	VU	1996	EN	2011	EN
<i>Homopus areolatus</i> *	Parrot-beaked Tortoise	AF	LC	2017	LC	2017	LC
<i>Homopus femoralis</i> *	Greater Dwarf Tortoise	AF	LC	2017	LC	2017	LC
<i>Indotestudo elongata</i>	Elongated Tortoise	AS	EN	2000	CR	2018	CR
<i>Indotestudo forstenii</i>	Forsten's Tortoise	AS	EN	2000	EN	2018	EN
<i>Indotestudo travancorica</i>	Travancore Tortoise	AS	VU	2000	EN	2011	EN
<i>Kinixys belliana</i>	Bell's Hinge-back Tortoise	AF	NE		VU	2013	VU
<i>Kinixys erosa</i>	Forest Hinge-back Tortoise	AF	DD	1996	EN	2013	EN
<i>Kinixys homeana</i>	Home's Hinge-back Tortoise	AF	VU	2006	CR	2013	CR
<i>Kinixys lobatiana</i> *	Lobatse Hinge-back Tortoise	AF	LC	2017	VU	2017	VU
<i>Kinixys natalensis</i> *	Natal Hinge-back Tortoise	AF	NT	1996	VU	2017	VU
<i>Kinixys nogueyi</i>	Western Hinge-back Tortoise	AF	NE		VU	2013	VU
<i>Kinixys spekii</i>	Speke's Hinge-back Tortoise	AF	NE		VU	2013	VU
<i>Kinixys zombensis</i>	Southeastern Hinge-back Tortoise	AF	NE		VU	2013	VU
<i>Malacochersus tornieri</i> *	Pancake Tortoise	AF	VU	1996	CR	2013	CR
<i>Manouria emys</i>	Asian Giant Tortoise	AS	EN	2000	CR	2018	CR
<i>Manouria impressa</i>	Impressed Tortoise	AS	VU	2000	EN	2011	EN
<i>Psammobates geometricus</i> *	Geometric Tortoise	AF	CR	2015	CR	2017	CR
<i>Psammobates oculifer</i>	Serrated Tent Tortoise	AF	NE		LC	2013	LC
<i>Psammobates tentorius</i> *	Tent Tortoise	AF	LC	2017	NT	2017	NT
<i>Pyxis arachnoides</i>	Spider Tortoise	MG	CR	2008	CR		CR
<i>Pyxis planicauda</i>	Flat-tailed Tortoise	MG	CR	2008	CR		CR
<i>Stigmocheilus pardalis</i>	Leopard Tortoise	AF	LC	2015	LC		LC
<i>Testudo (Testudo) graeca</i>	Spur-thighed Tortoise	EA	VU	1996	VU		VU
<i>Testudo (Testudo) kleinmanni</i>	Egyptian Tortoise	EA	CR	2003	CR		CR
<i>Testudo (Testudo) marginata</i>	Marginated Tortoise	EA	LC	2004	LC		LC
<i>Testudo (Agrionemys) horsfieldii</i>	Central Asian Tortoise	EA	VU	1996	VU		VU
<i>Testudo (Chersine) hermanni</i>	Hermann's Tortoise	EA	NT	2004	NT		NT
Trionychidae							
Carettochelyidae							
<i>Carettochelys insculpta</i> *	Pig-Nosed Turtle	AU	VU	2000	EN	2017	EN
Trionychidae							
Cyclanorbinae							
<i>Cyclanorbis elegans</i>	Nubian Flapshell Turtle	AF	CR	2016	CR		CR

Appendix 1. Continued.

Classification	Common name	Geographic region	IUCN Red List		TFTSG Provisional		Global Status
			Status	Year published	Status	Year assessed	
<i>Cyclanorbis senegalensis</i>	Senegal Flapshell Turtle	AF	VU	2016			VU
<i>Cycloderma aubryi</i>	Aubry's Flapshell Turtle	AF	VU	2017			VU
<i>Cycloderma frenatum</i>	Zambezi Flapshell Turtle	AF	EN	2016			EN
<i>Lissemys ceylonensis</i>	Sri Lankan Flapshell Turtle	AS	NE			VU	VU
<i>Lissemys punctata</i>	Indian Flapshell Turtle	AS	LC	2000		VU	VU
<i>Lissemys scutata</i>	Burmese Flapshell Turtle	AS	DD	2000		LC	LC
Trionychinae							
<i>Amyda cartilaginea</i>	Malayan Softshell Turtle	AS	VU	2000		VU	VU
<i>Amyda ornata</i>	Southeast Asian Softshell Turtle	AS	VU	2000		VU	VU
<i>Apalone ferox</i>	Florida Softshell Turtle	NA	LC	2010			LC
<i>Apalone mutica</i>	Smooth Softshell Turtle	NA	LC	2010			LC
<i>Apalone spinifera</i>	Spiny Softshell Turtle	NA	LC	2010			LC
<i>Chitra chitra</i>	Asian Narrow-headed Softshell Turtle	AS	CR	2000		CR	CR
<i>Chitra indica</i>	Indian Narrow-headed Softshell Turtle	AS	EN	2000		EN	EN
<i>Chitra vandijki</i>	Burmese Narrow-headed Softshell Turtle	AS	NE	2000		CR	CR
<i>Dogania subplana</i>	Malayan Softshell Turtle	AS	LC	2000		LC	LC
<i>Nilssonia formosa</i>	Burmese Peacock Softshell Turtle	AS	EN	2000		CR	CR
<i>Nilssonia gangetica</i>	Indian Softshell Turtle	AS	VU	2000		EN	EN
<i>Nilssonia hurum</i>	Indian Peacock Softshell Turtle	AS	VU	2000		EN	EN
<i>Nilssonia leithii</i>	Leith's Softshell Turtle	AS	VU	2000		CR	CR
<i>Nilssonia nigricans</i>	Black Softshell Turtle	AS	EW	2002		CR	CR
<i>Palea steindachneri</i>	Wattle-necked Softshell Turtle	AS	EN	2000		EN	EN
<i>Pelochelys bibroni</i>	New Guinea Giant Softshell Turtle	AS	VU	2000		VU	VU
<i>Pelochelys cantorii</i>	Asian Giant Softshell Turtle	AU	VU	2000		CR	CR
<i>Pelochelys signifera</i> *	Northern New Guinea Softshell Turtle	AS	EN	2000		CR	CR
<i>Pelodiscus asenaria</i>	Hunan Softshell Turtle	AU	NE	2000		VU	VU
<i>Pelodiscus parviformis</i>	Northern Chinese Softshell Turtle	AS	NE	2000		DD	DD
<i>Pelodiscus maackii</i>	Vietnamese Softshell Turtle	AS	NE	2000		DD	DD
<i>Pelodiscus sinensis</i>	Chinese Softshell Turtle	AS	NE	2000		CR	CR
<i>Rafetus euphraticus</i>	Euphrates Softshell Turtle	EA	VU	2000		EN	EN
<i>Rafetus swinhoei</i>	Red River Giant Softshell Turtle	EA	EN	2017		EN	EN
<i>Trionyx triunguis</i>	African Softshell Turtle	AS	CR	2000		CR	CR
Pleurodira		AF	VU	2017			VU
Chelidae							
Chelinae							
<i>Acanthochelys macrocephala</i> *	Pantanal Swamp Turtle	SA	NT	1996		NT	NT
<i>Acanthochelys pallidipectoris</i>	Chaco Side-necked Turtle	SA	EN	2016			EN
<i>Acanthochelys radiolata</i>	Brazilian Radiolated Swamp Turtle	SA	NT	1996		LC	LC
<i>Acanthochelys spixii</i>	Black Spiny-necked Turtle	SA	NT	1996		NT	NT
<i>Chelus fimbriata</i>	Matamata Turtle	SA	NE	2011		LC	LC
<i>Mesoclemmys dahli</i>	Dahl's Toad-headed Turtle	SA	CR	1996		CR	CR
<i>Mesoclemmys gibba</i>	Gibba Turtle	SA	NE			LC	LC
<i>Mesoclemmys heliostemma</i>	Yellow-crowned Toad-headed Turtle	SA	NE			DD	DD
<i>Mesoclemmys hoguei</i>	Hoge's Side-necked Turtle	SA	CR	2016		DD	DD
<i>Mesoclemmys nasuta</i>	Guyanan Toad-headed Turtle	SA	NE			DD	DD

Appendix 1. Continued.

Classification	Common name	Geographic region	IUCN Red List		TFTSG Provisional		Global Status
			Status	Year published	Status	Year assessed	
<i>Mesoclemmys perplexa</i>	Cerrado Side-necked Turtle	SA	NE		LC	2018	LC
<i>Mesoclemmys raniceps</i>	Amazon Toad-headed Turtle	SA	NE		LC	2018	LC
<i>Mesoclemmys tuberculata</i>	Tuberculate Toad-headed Turtle	SA	NE		LC	2018	LC
<i>Mesoclemmys vanderhaegei</i>	Vanderhaege's Toad-headed Turtle	SA	NT	1996	NT	2018	NT
<i>Mesoclemmys zuliae</i>	Zulia Toad-headed Turtle	SA	VU	1996	VU	2011	VU
<i>Phrynops Geoffroanus</i>	Geoffroy's Side-necked Turtle	SA	NE		LC	2011	LC
<i>Phrynops hilarii</i>	Saint-Hilaire's Side-necked Turtle	SA	NE		LC	2011	LC
<i>Phrynops tuberosus</i>	Guianan Shield Side-necked Turtle	SA	NE		LC	2011	LC
<i>Phrynops williamsi</i> *	Williams' Side-necked Turtle	SA	NE		VU	2018	VU
<i>Platemys platycephala</i>	Twist-necked Turtle	SA	NE		LC	2011	LC
<i>Rhinemys rufipes</i>	Red Side-necked Turtle	SA	NT	1996	LC	2011	LC
<i>Hydromedusinae</i>							
<i>Hydromedusa maximiliani</i>	Brazilian Snake-necked Turtle	SA	VU	1996	NT	2011	NT
<i>Hydromedusa tectifera</i>	South American Snake-necked Turtle	SA	NE		LC	2011	LC
<i>Cheloniinae</i>							
<i>Chelodina (Chelodina) canni</i>	Canni's Snake-necked Turtle	AU	NE		NT	2009	NT
<i>Chelodina (Chelodina) gunaleni</i>	Gunalen's Snake-necked Turtle	AU	NE		DD	2009	DD
<i>Chelodina (Chelodina) longicollis</i>	Eastern Snake-necked Turtle	AU	NE		LC	2009	LC
<i>Chelodina (Chelodina) mccordi</i> *	Roti Snake-necked Turtle	AU	CR	2000	CR	2018	CR
<i>Chelodina (Chelodina) novaeguineae</i>	New Guinea Snake-necked Turtle	AU	NE		LC	2009	LC
<i>Chelodina (Chelodina) pritchardi</i>	Pritchard's Snake-necked Turtle	AU	EN	2000	EN	2009	EN
<i>Chelodina (Chelodina) reimanni</i>	Reimann's Snake-necked Turtle	AU	NT	2000	DD	2009	DD
<i>Chelodina (Chelodina) steindachneri</i>	Steindachner's Snake-necked Turtle	AU	NE		LC	2009	LC
<i>Chelodina (Macrochelodina) burrungandjii</i>	Arnhem Snake-necked Turtle	AU	NE		LC	2009	LC
<i>Chelodina (Macrochelodina) expansa</i>	Broad-shelled Snake-necked Turtle	AU	NE		NT	2009	NT
<i>Chelodina (Macrochelodina) kuchlingi</i> ^c	Kuchling's Snake-necked Turtle	AU	NE		DD	2018	DD
<i>Chelodina (Macrochelodina) oblonga</i>	Northern Snake-necked Turtle	AU	NE		LC	2018	LC
<i>Chelodina (Macrochelodina) parkeri</i>	Parker's Snake-necked Turtle	AU	VU	2000	NT	2018	NT
<i>Chelodina (Macrochelodina) walloyarrina</i> ^c	Kimberley Snake-necked Turtle	AU	NE		LC	2018	LC
<i>Chelodina (Macrochelodina) colliei</i>	Southwestern Snake-necked Turtle	AU	NT	1996	NT	2009	NT
<i>Eelseya (Eelseya) branderhorsti</i>	White-bellied Snapping Turtle	AU	VU	2000	VU	2009	VU
<i>Eelseya (Eelseya) dentata</i>	Northern Snapping Turtle	AU	NE		LC	2009	LC
<i>Eelseya (Eelseya) flaviventralis</i>	Yellow-bellied Snapping Turtle	AU	NE		LC	2018	LC
<i>Eelseya (Hanwarachelys) novaeguineae</i>	Western New Guinea Stream Turtle	AU	LC	2000	LC	2015	LC
<i>Eelseya (Hanwarachelys) rhodini</i>	Southern New Guinea Stream Turtle	AU	NE		LC	2015	LC
<i>Eelseya (Hanwarachelys) schultzei</i>	Northern New Guinea Stream Turtle	AU	NE		LC	2015	LC
<i>Eelseya (Pelcomastes) albagula</i>	White-throated Snapping Turtle	AU	NE		EN	2018	EN
<i>Eelseya (Pelcomastes) irwini</i>	Irwin's Snapping Turtle	AU	NE		NT	2018	NT
<i>Eelseya (Pelcomastes) lavarackorum</i>	Riverleigh Snapping Turtle	AU	NE		DD	2018	DD
<i>Elusor macrurus</i>	Mary River Turtle	AU	EN	1996	CR	2018	CR
<i>Emydura macquarii</i>	Eastern Short-necked Turtle	AU	NE		LC	2009	LC
<i>Emydura subglobosa</i>	Red-bellied Short-necked Turtle	AU	LC	2000	LC	2009	LC
<i>Emydura tanybaraga</i>	Northern Yellow-faced Turtle	AU	NE		LC	2018	LC
<i>Emydura victoratae</i>	Northern Red-faced Turtle	AU	NE		LC	2009	LC
<i>Myuchelys bellii</i>	Bell's Sawshelled Turtle	AU	EN	1996	VU	2018	VU

Appendix 1. Continued.

Classification	Common name	Geographic region	IUCN Red List		TFTSG Provisional		Global Status
			Status	Year published	Status	Year assessed	
<i>Mychelmys georgesi</i>	Bellenger River Sawshelled Turtle	AU	DD	1996	CR	2015	CR
<i>Mychelmys latisternum</i>	Sawshelled Turtle	AU	NE		LC	2011	LC
<i>Mychelmys purvisi</i>	Manning River Sawshelled Turtle	AU	DD	1996	NT	2011	NT
<i>Rheodytes leukops</i>	Fitzroy River Turtle	AU	VU	1996	EN	2018	EN
<i>Pseudemidurinae</i>							
<i>Pseudemidura umbrina</i>	Western Swamp Turtle	AU	CR	1996	CR	2011	CR
<i>Pelomedusidae</i>							
<i>Pelomedusa barbata</i>	Arabian Helmeted Turtle	AF	NE		EN	2016	EN
<i>Pelomedusa galeata*</i>	South African Helmeted Turtle	AF	NE		LC	2017	LC
<i>Pelomedusa gehafte</i>	Eritrean Helmeted Turtle	AF	NE		DD	2018	DD
<i>Pelomedusa kobe</i>	Tanzanian Helmeted Turtle	AF	NE		DD	2018	DD
<i>Pelomedusa neumanni</i>	Neumann's Helmeted Turtle	AF	NE		DD	2018	DD
<i>Pelomedusa olivacea</i>	Sahelian Helmeted Turtle	AF	NE		DD	2018	DD
<i>Pelomedusa schweinfurthi</i>	Schweinfurth's Helmeted Turtle	AF	NE		DD	2018	DD
<i>Pelomedusa somalica</i>	Somalian Helmeted Turtle	AF	NE		DD	2018	DD
<i>Pelomedusa subrufa</i>	Helmeted Turtle	AF	NE		DD	2018	DD
<i>Pelomedusa variabilis</i>	West African Helmeted Turtle	AF	NE		DD	2018	DD
<i>Pelusios adansoni</i>	Adanson's Mud Turtle	AF	NE		LC	2013	LC
<i>Pelusios bechuanicus</i>	Okavango Mud Turtle	AF	NE	1996	LC	2013	LC
<i>Pelusios broadleyi</i>	Turkana Mud Turtle	AF	VU		EN	2013	EN
<i>Pelusios carinatus</i>	African Keel Mud Turtle	AF	NE		LC	2013	LC
<i>Pelusios castaneus</i>	African Mud Turtle	AF	NE		LC	2013	LC
<i>Pelusios castanoides</i>	Yellow-bellied Mud Turtle	AF	NE		LC	2013	LC
<i>Pelusios chapini</i>	Central African Mud Turtle	AF	NE		LC	2013	LC
<i>Pelusios cupulatta</i>	Ivory Coast Mud Turtle	AF	NE		LC	2013	LC
<i>Pelusios gabonensis</i>	African Forest Turtle	AF	NE		LC	2013	LC
<i>Pelusios marani</i>	Gabon Mud Turtle	AF	NE		DD	2018	DD
<i>Pelusios nanus</i>	African Dwarf Mud Turtle	AF	NE		DD	2018	DD
<i>Pelusios niger</i>	West African Black Mud Turtle	AF	NE		NT	2018	NT
<i>Pelusios rhodesianus</i>	Variable Mud Turtle	AF	NE		LC	2013	LC
<i>Pelusios sinuatus</i>	Serrated Hinged Terrapin	AF	NE		LC	2013	LC
<i>Pelusios subniger</i>	East African Black Mud Turtle	AF	NE		LC	2013	LC
<i>Pelusios upembae</i>	Upemba Mud Turtle	AF	DD	1996	DD	2018	DD
<i>Pelusios williamsi</i>	Williams' Mud Turtle	AF	NE		LC	2013	LC
<i>Podocnemididae</i>							
<i>Erymnochelys madagascariensis</i>	Madagascan Big-headed Turtle	MG	CR	2008	CR		CR
<i>Peltocephalus dumerilianus</i>	Big-headed Sideneck Turtle	SA	VU	1996	VU	2011	VU
<i>Podocnemis erythrocephala</i>	Red-headed Amazon River Turtle	SA	VU	1996	VU	2011	VU
<i>Podocnemis expansa</i>	Giant South American River Turtle	SA	LR/CD	1996	CR	2011	CR
<i>Podocnemis lewyana</i>	Magdalena River Turtle	SA	CR	2016	CR		CR
<i>Podocnemis sextuberculata</i>	Six-tubercled Amazon River Turtle	SA	VU	1996	VU	2011	VU
<i>Podocnemis unifilis</i>	Yellow-spotted River Turtle	SA	VU	1996	EN	2011	EN
<i>Podocnemis vogli</i>	Savanna Sideneck Turtle	SA	NE		VU	2011	VU

^a Listed as *Kinosternon arizonense* by IUCN (see TTWG 2017, Annotation 17:13).^b Listed as *Geochelone gigantea* by IUCN.^c *Chelodina (Macrochelodina) kuchlingi* and *C. (M.) walloyarrina* are not presently accepted as valid species by the Taxonomic Committee of the Australian Society of Herpetologists, but TTWG (2017, Annotation 17:94) has accepted them provisionally.

Appendix 2. Listing of conservation status of 21 currently recognized subspecies of turtles and tortoises (Order Testudines) and 3 synonymized taxa still listed by IUCN, including geographic occurrence, IUCN Red List status (year published), TFTSG Provisional Red List status (year assessed), and current updated TFTSG Red List 2018 global status. Geographic regions and Red List categories as in Appendix 1. * = TFTSG provisional assessments currently in press on the IUCN Red List.

Classification	Common name	Geographic region	IUCN Red List		TFTSG provisional		Global status
			Status	Year published	Status	Year assessed	
Cryptodira							
Kinosternoidea							
Kinosternidae							
Kinosterninae							
<i>Kinosternon hirtipes hirtipes</i>	Valley of Mexico Mud Turtle	NA			CR	2018	CR
<i>Kinosternon hirtipes chapalaense</i>	Lake Chapala Mud Turtle	NA			CR	2018	CR
<i>Kinosternon hirtipes magdalaense</i>	San Juanico Mud Turtle	NA			CR	2018	CR
<i>Kinosternon hirtipes megacephalum</i>	Viesca Mud Turtle	NA	EX	2007	EX	2018	EX
<i>Kinosternon hirtipes murrayi</i>	Mexican Plateau Mud Turtle	NA			LC	2018	LC
<i>Kinosternon hirtipes tarascense</i>	Pátzcuaro Mud Turtle	NA			CR	2018	CR
<i>Kinosternon scorpoides albogulare</i>	White-throated Mud Turtle	CA			LC	2011	LC
<i>Kinosternon sonoriense longifemorale</i>	Sonoyta Mud Turtle	NA	CR	2017	LC		CR
Testudinoidea							
Emyridae							
Emydininae							
<i>Terrapene carolina mexicana</i>	Mexican Box Turtle	NA	LC	2011	LC		LC
<i>Terrapene carolina yucatanana</i>	Yucatan Box Turtle	CA	VU	2011	VU		VU
Testudinidae							
<i>Psammobates tentorius tentorius*</i>	Southern Tent Tortoise	AF			LC	2017	LC
<i>Psammobates tentorius trimenti*</i>	Western Tent Tortoise	AF			EN	2017	EN
<i>Psammobates tentorius verroxii*</i>	Northern Tent Tortoise	AF			LC	2017	LC
<i>Testudo (Testudo) graeca nikolskii^{a,b}</i>	Krasnodar Spur-thighed Tortoise	EA	CR	1996	CR		CR
<i>Testudo (Chersine) hermanni hermanni</i>	Western Hermann's Tortoise	EA	EN	1996	EN		EN
Trionychoidea							
Trionychidae							
<i>Apalone spinifera atra</i>	Black Spiny Softshell Turtle	NA	CR	2016	CR		CR
Pleurodira							
Chelidae							
Chelodinae							
<i>Chelodina (Chelodina) mccordi mccordi*</i>	Western Roti Snake-necked Turtle	AU			CR(PEW)	2018	CR(PEW)
<i>Chelodina (Chelodina) mccordi roteensis*</i>	Eastern Roti Snake-necked Turtle	AU			CR(PEW)	2018	CR(PEW)
<i>Chelodina (Chelodina) mccordi timorensis*</i>	Timor-Leste Snake-necked Turtle	AU			CR	2018	CR
<i>Chelodina (Macrochelodina) oblonga siebenrocki^{b,c}</i>	Siebenrock's Snake-necked Turtle	AU	NT	2000	NT		NT
<i>Emydura macquarii signata^{b,d}</i>	Brisbane River Turtle	AU	LC	1996	LC		LC
Pelomedusidae							
<i>Pelusios castaneus seychellensis^e</i>	Seychelles Mud Turtle	IO	EX	2003	EX		EX
<i>Pelusios castanoides intergularis</i>	Seychelles Yellow-bellied Mud Turtle	IO	CR	2003	CR		CR
<i>Pelusios subniger parietalis</i>	Seychelles Black Mud Turtle	IO	CR	2003	CR		CR

^a Currently considered a synonym of *Testudo (Testudo) graeca iberica*, not a separate subspecies (see Turtle Taxonomy Working Group [TTWG] 2017, Annotation 14:35).

^b Not currently recognized by TTWG (2017) as separate distinct subspecies; therefore without recognized separate conservation status.

^c Listed by IUCN as *Chelodina rugosa siebenrocki*; currently considered a synonym of *Chelodina (Macrochelodina) oblonga*, not a separate subspecies (see TTWG 2017, Annotation 07:91).

^d Currently considered a synonym of *Emydura macquarii macquarii*, not a separate subspecies (see TTWG 2017, Annotation 10:42).

^e Listed as *Pelusios seychellensis* by IUCN, but currently considered a questionable subspecies (see TTWG 2017, Annotation 17:103).