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Balancing the scales: Including under-represented herptile species in a One Health approach

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Abstract

The One Health High-Level Expert Panel's definition of One Health includes optimizing the health of people, animals (wild and domestic) and ecosystems. For many One Health practitioners, wildlife that can spread zoonoses are the focus, particularly if they can come in contact with people. However, ecosystem health is often best-indicated by less-encountered species, for instance, amphibians and reptiles. This review highlights how these taxa can benefit human health and well-being, including cultural significance, as well as their impact on plant, animal and environmental health. We highlight current challenges to the health of these species and the need to include them in the One Health Joint Action Plan. We conclude with a call to action for inclusion of amphibians and reptiles in a One Health approach.

Introduction

The Millennium Ecosystem Assessment, a United Nations report, discussed four categories of ecosystem services: provisioning, regulating, supporting and cultural services. The public may not understand that the benefits they obtain from ecosystems are not just due to the wildlife they see, but also the cryptic wildlife they may not notice, including reptiles and amphibians. Herpetofauna (amphibians and reptiles, also described as herps or herptile species) contribute to all of the ecosystem services (Valencia-Aguilar et al., 2013); yet few people recognize that human health and well-being is tied to the diversity and health of herptile species. The One Health High-Level Expert Panel (OHHLEP), assembled and endorsed by a quadripartite coalition consisting of the Food and Agriculture Organization (FAO), World Health Organization (WHO), World Organization for Animal Health (WOAH) and United Nations Environment Program (UNEP), defines One Health as “an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems” (One Health High-Level Expert Panel (OHHLEP) et al. 2022). Even when tackling complex problems using a One Health approach, multi-sectoral teams often focus on wildlife that are commonly encountered or observed by people (Cunningham et al., 2017), ignoring the multiple ways in which human health is tied to the less-encountered reptiles and amphibians. Healthy forests, wetlands and other ecosystems inhabited by herps benefit human health and well-being (e.g., source of clean air, clean water and food security). Amphibians are indicators of ecosystem health and serve as important sources of energy for food webs. For example, salamanders are the greatest sources of biomass or food for forest vertebrates in parts of North America (Semlitsch et al., 2014). So why is herptile health rarely integrated into a One Health approach? One of the key underlying principles of One Health is equity between sectors and disciplines. Following a “Herps and One Health” workshop at the 2022 inaugural Global Amphibian and Research Disease Conference, the participants delved deeper into the topic and completed this manuscript. Here we review some illustrative examples that provide evidence supporting the critical need to integrate herptile species health into an equitable One Health approach and highlight the contributions of herpetofauna to ecosystem, plant, animal and human health. We

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conclude with a call to action that highlights the integral role of herps in the Quadripartite One Health Joint Plan of Action.

Herps are indicators of ecosystem health

Reptiles and amphibians contribute to nutrient cycling, seed dispersal and pollination, pest control and energy conversion by ingesting plants and serving as food for predators (Hocking and Babbitt, 2014). Ectotherms, including reptiles and amphibians, are sensitive to environmental change and can serve as indicators of ecosystem health. As such, herps are critical to the United Nations Sustainable Development Goals #6 (clean water) and #15 (life on land) (2024). The 2022 SDG report highlighted that (1) over 85% of the world's wetlands have been lost over the last 300 years (SDG #6) and (2) ten million hectares of intact forest are lost to land-use change every year (SDG #15). Because herptile biodiversity and health are impacted by habitat degradation and loss, these species represent key bio-indicators of ecosystem health. For example, geographic herptile functional group analyses were used in South Korea to guide the identification of biodiversity hotspots and indicate ecosystem health (Jeon et al., 2023). Similarly, China (Li et al., 2017), the United States (Adams and Muths, 2019) and other countries monitor herptile biodiversity to assess ecosystem health.

Herps and plant health

Amphibians and reptiles contribute to overall plant health through seed dispersal and pollination and as predators of crop pests (Valencia-Aguilar et al., 2013; Hocking and Babbitt, 2014). Herps can serve as pollinators when they move from flower to flower, drinking nectar and inadvertently transporting pollen for example *Xenohyla truncata* (de-Oliveira-Nogueira et al., 2023). In another example, the dusky lizard (*Liolaemus belii*) has been shown to be an important seed disperser of a barberry species native to Chile (Celedón-Neghme et al., 2008). This is significant because berberine, a popular dietary supplement with medicinal benefits, comes from barberry plant species. As predators, 78% of the South American toad's (*Rhinella arenarum*) diet includes arthropods that damage crops, and it is reported that the loss of *R. arenarum* and other amphibians will decrease this biological pest control for soybean crops (Attademo et al., 2005).

Herps and animal health

An interdependency exists between herpetofauna and other wildlife in their ecosystems. Larval amphibians can occur in incredibly high densities in some ecosystems and are likely to have significant effects on ecosystem functions, including primary productivity, through changes in the food web (Seale, 1980). They can act as primary consumers, detritivores, predators and even cannibals, improving water quality of both wild and farm ponds and in turn affecting domestic and farm animal health (Gibbons et al., 2006). Reptiles can also impact farm animal health. For example, Caiman species can control aquatic snails that serve as intermediate hosts for the trematode *Fasciola hepatica*, which damages the liver of infected cattle and sheep (Valencia-Aguilar et al., 2013). Herps can also be impacted as a cascade effect; for example, declines in neotropical frogs and tadpoles can result in significant declines of frog-eating snake populations (Zipkin et al., 2020).

Herps and human health

One of the most common notions connecting herptile species and human health is the detrimental presence of poison in amphibians and reptiles. Venomous species inject toxin by bite (e.g., cobra) or sting, while humans handling poisonous species may ingest, inhale or absorb toxins (e.g., poison dart frog). Injection or ingestion of toxins may result in illness or death. Furthermore, while herptile species can be a food source for humans (e.g., frog legs), there is concern over their potential to carry multidrug-resistant strains of important human pathogens like *E. coli* and *Acinetobacter* spp. similar to other meats (Morrison and Rubin, 2020). The mechanisms of such antimicrobial resistance in wildlife species remain unclear but may be tied to persistence of antimicrobial residues in domestic animals and the environment (Vittecoq et al., 2016). Given the gravity of emerging antimicrobial resistance, further investigation into drug-resistant microbes and wild herpetofauna is warranted. Human health and well-being benefit from herptile species, including the development of cancer therapies, cardiovascular therapies and other treatments (Table 1; Bordon et al., 2020).

Cultural benefits of herptile species

Urbanized societies are becoming more disconnected from nature and wildlife, including amphibians and reptiles. Yet, the One Health approach reminds us that we are all linked, including the importance that herps play throughout various cultures. Ethnoherpetology documents the human connection to herptile species as represented in ancient culture vestiges and folklore, with some cultural traditions persisting to this day (Crump, 2024); in the earliest human civilizations, amphibians and reptiles were deities. Here, we detail the importance of some herpetological species across past and present cultures.

Turtles

Turtles play a prominent role in the creation story of several indigenous peoples and tribes across the Americas. The Iroquois, Ojibwe, Algonquin, Cree and others believe that North and Central America were formed on the back of a large turtle that Great Mother Aataentsic landed on after falling through a hole in the sky (Pearce, 2005). Contemporarily, turtles are also responsible for ecotourism booms to watch and participate in the conservation of sea turtle species during nesting on beaches (Jacobson and Lopez, 1994).

Snakes

Many traits that are associated with snakes have been likened to human traits - for example the sinuous coils of a snake's body are often related to human hair, becoming a symbol of richness, wealth and prosperity in 4th century Roman culture (Lazarou, 2018). In one Aboriginal dreaming story, the rainbow serpent is referred to as a creator and, like the rainbow, frequently associated with water and rainfall. The rainbow serpent is a widespread tradition in pre-colonial Australian societies, depicted in the rock art of the Waayni people from Northwestern Queensland (Taçon, 2008).

Even to this day, the rod or staff of the Greco-Roman god of healing and medicine, Asclepius, is used as a symbol of health care. Evidence suggests that the non-venomous European Aesculapian snake (*Zamenis longissimus*), which derives its name from this god, was allowed to roam freely in "healing temples" in ancient Greece

Table 1. Examples of connections between herptile species and human health

Herptile Class	Connections to Human Health	References
Amphibians	<i>Direct connections</i>	
	In the 1930s, <i>Xenopus laevis</i> were taken from the wild and used to develop a human pregnancy test. Captive rearing was then utilized to sustain a steady resource of these toads.	(Elkan, 1938)
	A toxin isolated from a dendrobatid frog (<i>Epipedobates tricolor</i>) shows promise as non-opiate pain killer and potentially derivatives used in treating Parkinson's disease and Alzheimer's.	(Salehi et al., 2018)
	Antimicrobial peptides (AMP) from anuran skin can inhibit infection of human immune deficiency virus (HIV).	(VanCompernelle et al., 2005)
	Skin secretions from <i>Phyllomedusa</i> frogs may be useful in treating drug-resistant infections.	(Azevedo Calderon et al., 2011)
	<i>Indirect connections benefits</i>	
	Amphibian collapse in Costa Rica and Panama is associated with increased incidence of the mosquito-borne human malaria.	(Springborn et al., 2022)
	Insights from amphibian regenerative capabilities are informing advances in regenerative medicine.	(Mahapatra et al., 2023)
Reptiles	<i>Direct connections benefits</i>	
	The venom of <i>Bothrops</i> snakes has important antimicrobial and pharmacological properties.	(Ciscotto et al., 2009)
	Venoms of <i>Heloderma</i> and various snake species are used in pharmaceutical drugs to treat things such as hypertension and Type 2 diabetes mellitus.	(Bordon et al., 2020)
	<i>Indirect connections benefits</i>	
	The immune system of western fence lizards (<i>Sceloporus occidentalis</i>) and southern alligator lizards (<i>Elgaria multicarinata</i>) kills the pathogenic agent of Lyme disease in infected, feeding ticks.	(Lane and Quistad, 1998)

and was even used for healing superficial skin lesions (Demetrioff, 2020). The association of snakes with wisdom is also propounded through many early cultures, including Hinduism, where the god Shiva, who typically wears a snake around his neck, represents wisdom (Stanley, 2008).

Frogs, toads and salamanders

Many neotropical societies view frogs as good-luck charms or signs of fertility, dating back thousands of years (Valencia-Aguilar et al., 2013). Amazonian indigenous tribes have used skin secretions of several Dendrobatid frogs to rub on their bodies to gain power or to experience pain and euphoria (Valencia-Aguilar et al., 2013). In addition, secretions can be used in making “curare,” a poison used

in hunting and medicine (Valencia-Aguilar et al., 2013). In Asia, frogs and toads are associated with wisdom and magic in Chinese and Japanese cultures (DeGraaff, 1991).

Herptile biodiversity loss

Since the global herptile crisis was first recognized in the 1980s amphibian and reptile populations have declined precipitously (Rollins-Smith, 2020; Luetdke et al., 2023). Currently, 21% of the assessed reptile species and 41% of amphibian species are at risk of extinction (‘IUCN Red List of Threatened Species’ 2024).

Impacts of anthropogenic environmental degradation and contamination on herps

Global ecosystem changes of the Anthropocene have impacted herptiles more profoundly than any other vertebrate taxa (Barnosky et al., 2011). For amphibians, especially, their shared terrestrial and aquatic life histories, permeable skin and adaptation to species-optimal thermal, precipitation and UV radiation conditions make them a good sentinel species for environmental health and “canaries in the coalmine” for environmental degradation (Hopkins, 2007). In many areas of the globe, amphibians have been among the first taxa to show population-wide responses to genotoxic and teratogenic environmental contaminants like pesticides, herbicides, agricultural runoff, sewage, and pharmaceutical and industrial effluent (Egea-Serrano et al., 2012). Population-wide health impacts of environmental contaminants in amphibians, like atrazine, have triggered re-evaluation of legally allowed levels of chemicals in wastewater and environmental effluent to protect environmental health as well as public health (Roy, 2002). These chemicals have the potential to induce genotoxic and teratogenic changes in exposed humans as well.

Land-use change driven by human influence on the environment is a major driver of global biodiversity loss (Isbell et al., 2017). For herpetofauna specifically, habitat loss and degradation are considered crucial drivers of species declines (Ford et al., 2020). These declines will have profound implications for other organisms and ecosystems.

Impacts of climate change on herp health

Climate change is associated with warming global temperatures, changing precipitation patterns, sea level rise and increased extreme weather events. These shifts in climate are altering the habitats that amphibians and reptiles reside in, and, as such, suitable environments for their survival may be shrinking (McMenamin et al., 2008; Luetdke et al., 2023). Climatic events have been linked to local population extinctions, the predicted dispersal of herpetofauna to areas outside of their normal ranges, and projections that more herptile species will be listed as endangered, threatened or vulnerable (Olson and Saenz, 2013; Luetdke et al., 2023). In Table 2, we review the potential impacts of climate change on herptile species.

Rises in ambient temperatures may influence reptile biodiversity, especially in species with temperature-dependent sex determination because rises in temperature may skew sex ratios to levels that cannot sustain populations (Valenzuela et al., 2019); this is especially the case for chelonian diversity (Ihlow et al., 2012). It has been suggested that larval development may be the most vulnerable amphibian life stage affected by climate shifts due to more regular droughts and the general rise in water temperature in

Table 2. Summary of potential and demonstrated impacts of climate change on Herptile Health

Climate Change Category	Type of Impact	Impacts on Herptile Health	Examples of References Addressing These Impacts
Average Warming	Global average increases in temperature across all seasons	- Increased energy budgets at increased temperatures -> tradeoffs with immune function - Sex ratio biases in TSD herps - Range shrinkage - Shifts in seasonal feeding, migration, breeding - Potential for increased heat-tolerant pathogen presence - Heat avoidance behavior may lead to increased host-pathogen interactions (e.g., certain fungi) - Reduction in species richness	(Lesbarrères et al., 2014) (Biber et al., 2023) (Rollins-Smith, 2017)
Severe Precipitation Events	Drought	- Hydric stress influences immune function (can increase it in some reptiles) - Lack of rain as seasonal cue - Increased aestivation times, potential increased energy budgets - Range shrinkage - Shrinkage or loss of some aquatic habitats - Increased competition and decreased resources lead to stress - Increased interactions between hosts and pathogens - Breeding grounds disappear - Aquatic larvae require rapid development/plasticity to survive	(Moss et al., 2022) (Sinai et al., 2022)
	Flooding	- Novel habitat connectivity for hosts and pathogens - Increased residence time of aquatic pathogens - Water avoidance behavior may increase multi-host interactions on “islands” - Potential for habitat alteration, range shrinkage	(Walls et al., 2013)
Severe Thermal Events	Heat Waves	- Thermal stress influencing immune function - Aggregation at thermal refugia-increased host interactivity - Mortality (genetic bottleneck, population loss) - Range shrinkage in deserts, mountain tops etc - Change in disease dynamics	(Song et al., 2022) (Rollins-Smith, 2017)
	Cold Fronts	- Potential for pathogen “flare-ups” while host metabolism is low - Aggregation at thermal refugia-increased host interactivity - Mortality (genetic bottleneck, population loss, some habitats may become inhospitable) - Breeding or development interruption	(Rollins-Smith, 2017)
Increased Storm Intensities	Habitat Alteration: Lightning: Fire Frequencies	- Range shrinkage or expansion: habitat structural change leads to changes in refugia, resources - pH changes in habitat influence host and pathogen	(Hossack and Pilliod, 2011)
	Habitat Alteration: Wind Damage: Canopy destruction	- Range shrinkage or expansion: habitat structural change leads to changes in refugia, resources - Potential for increased UV exposure with canopy loss-influence both pathogens and microbiome at forest floors	(Marroquín-Páramo et al., 2021)
	Habitat Alteration: Storm Surge: Saltwater Inundation	- Ecosystem change based on salt-tolerant species (host, pathogen, environment) - Hydric stress influencing immune function - Mass mortality events, range shrinkage, population extinction expected for amphibians	(Albecker and McCoy, 2017)

amphibian breeding habitats (Sinai et al., 2022). Climate change (i.e., high temperatures and increased drought in some regions) may be beneficial or harmful to herptile species in terms of changing pathogen dynamics, pathogen pollution by invasive species, water stress and trophic mismatch.

Pathogen dynamics

The herptile host-pathogen relationship is highly temperature-dependent and likely one of the most significant drivers determining infectious disease outcomes (Rohr et al., 2008). Higher temperatures, in both live animal exposure experiments and wild populations, are associated with increased disease occurrence and severity (Price et al., 2019). It has been hypothesized that increased drought will reduce the prevalence

of the amphibian skin-eating fungus, *Batrachochytrium dendrobatidis* (*Bd*), because the pathogen is dependent on freshwater for reproduction and survival (Fisher et al., 2009). Others argue that *Bd* is amplified by drought conditions (Pounds et al., 1999) because infection of the pelvic patch, important for rehydration, would make frogs more vulnerable during dry periods. For reptiles, seasonal climate variations that alter overwintering conditions and ambient air temperatures, likely play a crucial role in pathogen transmission and disease culmination, which has been suggested for snake fungal disease (Albecker and McCoy, 2017). In another reptile study, warmer temperatures resulted in overall higher ectoparasite infections in wild common lizard (*Zootoca vivipara*) females, though the lizard's color variety/morphotype varied the rate of infection (Wu et al., 2022). The degree to which climate alterations affect disease outcomes of individual pathogen-exposed

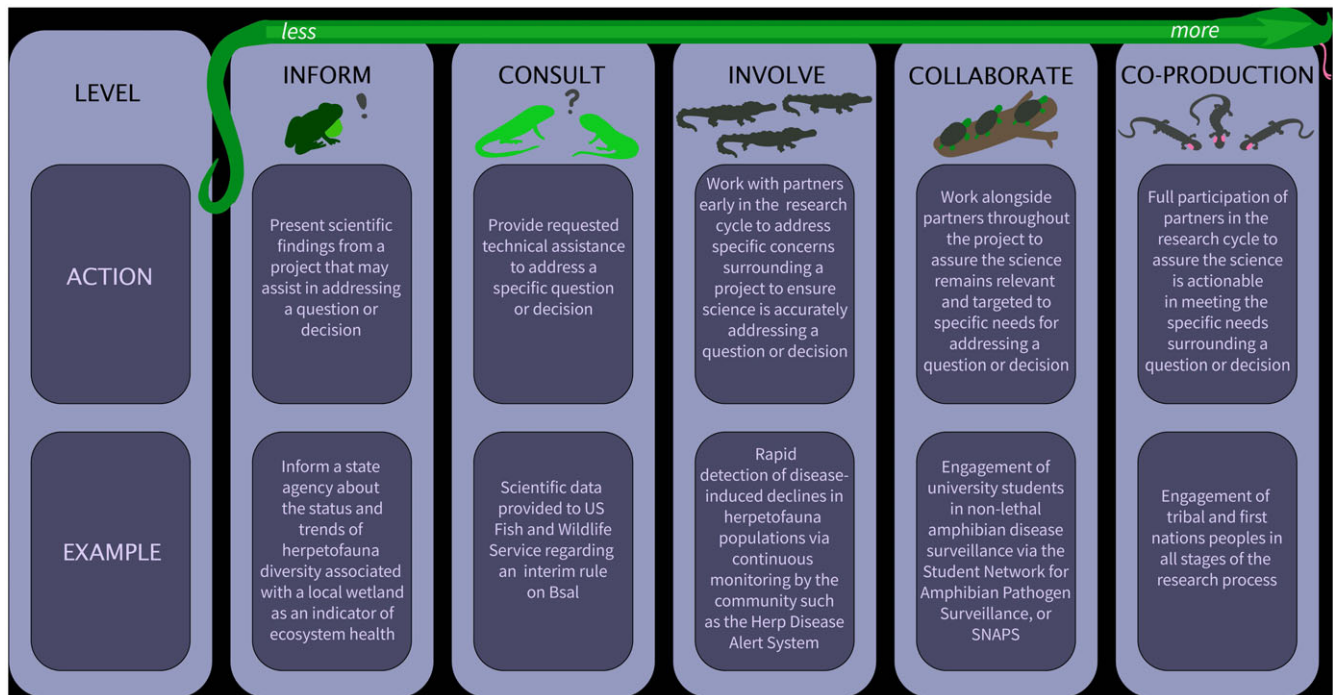


Figure 1. Examples of how Citizen Science can be incorporated into herpetile One Health approaches. Adapted from <https://www.usgs.gov/media/images/illustration-participatory-science-usgs-ecosystems-mission-area>.

amphibians and reptiles and how this translates to a landscape scale and/or population level, still needs to be further elucidated.

Hydric stress

While many reptiles are adapted to arid and mesic environments with limited water availability, hydric stress can influence thermoregulatory behavior (Ladyman and Bradshaw, 2003), influence sex ratios in offspring (Dupoué et al., 2019) and stagnate reproduction (Dezetter et al., 2021). These scenarios can often lead to reproductive failure and decreases in recruitment (Chandler et al., 2017). All amphibians rely on availability of freshwater or moisture for reproduction regardless of life history. Because most amphibians display a biphasic life history, eggs, tadpoles and metamorphs are particularly vulnerable to the direct effects of drought such as mortality from desiccation or dehydration (Li et al., 2013). Somewhat counterintuitively, reptiles under hydric stress show enhanced components of immune function (Brusch et al., 2020), which may be a result of adaptation to arid environments, or to counteract the reduced immune capacity of reptiles maintaining lower body temperatures when under hydric stress (Ladyman and Bradshaw, 2003). This phenomenon deserves further study to investigate how it may influence host–pathogen dynamics.

Trophic mismatches

Changes in phenology of herpetofauna food sources could result in trophic mismatches upon spring emergence (Kharouba et al., 2018), unless phenology shifts in herpetofauna are synchronous with shifts in their food sources. Conversely, winters are predicted to be shorter in some parts of the globe (Räisänen et al., 2004), which could be beneficial for reptiles and amphibians that hibernate, as long as food sources are available. Experimental work suggested that a shorter, warmer winter was beneficial for

survival and body mass changes during hibernation for common toads (*Bufo bufo*) (Üveges et al., 2016). Alternatively, climate change may result in prolonged estivation or behavioral refugia time which could lead to reduced foraging or breeding windows and ultimately population declines (Sinervo et al., 2010).

Herpetile diseases

For herpetofauna, negative effects on biodiversity are most notable when looking at declines caused by the global spread of emerging infectious diseases. One of the best cases exemplifying the disastrous results of species loss is frog population collapse due to *Bd* that led to declines in snake species, key amphibian predators (Zipkin and DiRenzo, 2022). In addition to over 500 amphibian species declines, at least ninety amphibian species are believed to have gone extinct because of this fungal panzootic (Scheele et al., 2019). In Panama, a comparison of pre- and post- *Bd* epizootic Neotropical snake species richness showed a 20% decline following a 75% decline in amphibian abundance (Zipkin et al., 2020). Increases in human malaria cases have been associated with the decline of amphibian mosquito predators (Springborn et al., 2022). Overall, reptile and amphibian declines can be attributed to two overarching mechanisms: mortality and decreased recruitment. Unregulated global trade has introduced deadly pathogens, like chytrid (*Bd* and *B. salamandrivorans*, *Bsal*) fungi, *Ophidiomyces ophiodiicola* (i.e., causative agent of snake fungal disease) and ranaviruses, to immunologically naive herpetile populations resulting in unchecked spread through native populations.

Inclusion of herps in the One Health Joint Plan of Action

The One Health Joint Plan of Action (OH JPA 2022–2026) developed by the Quadripartite Organizations (FAO, UNEP, WOA, WHO) – includes six action tracks with the last one

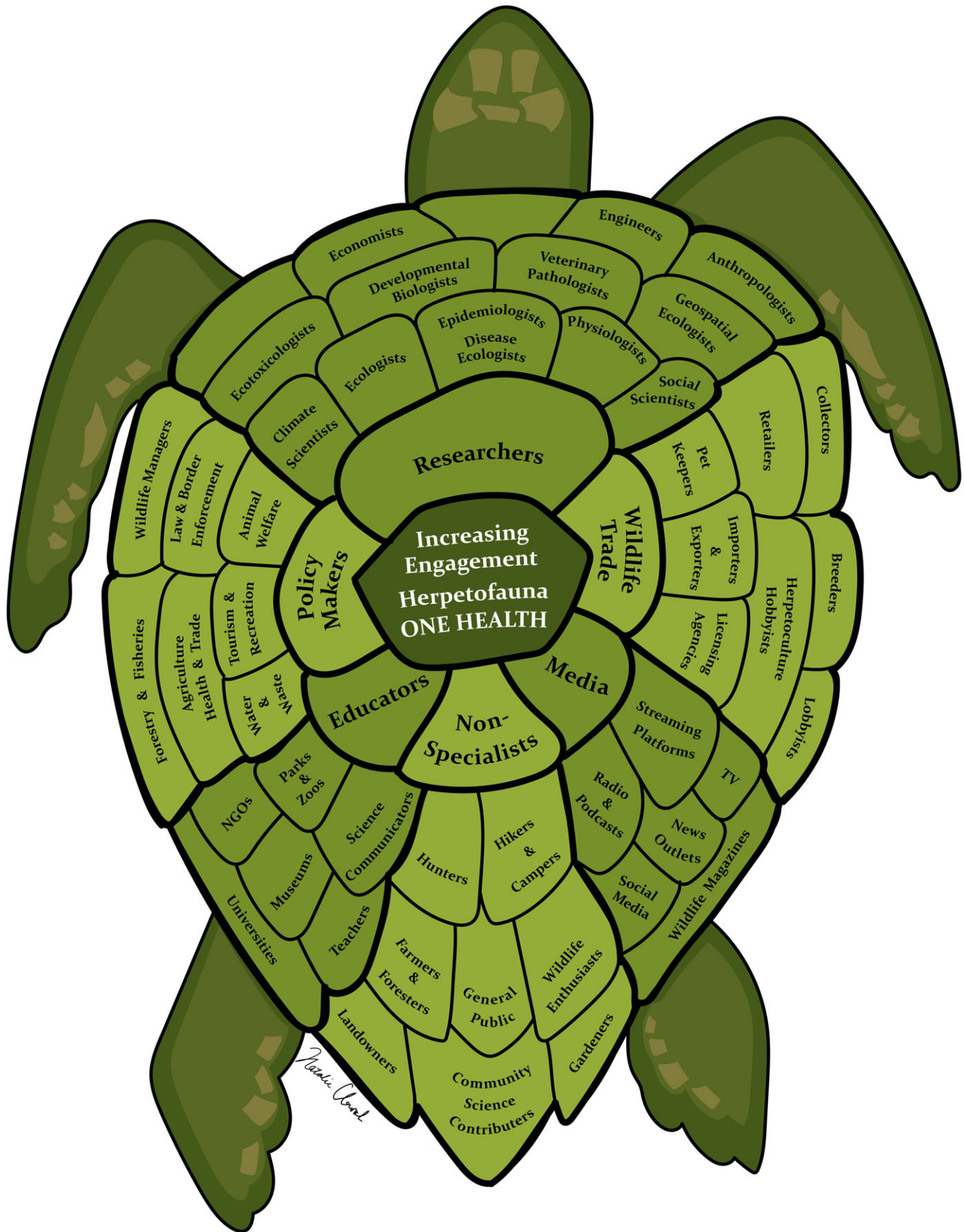


Figure 2. Visual schematic representing the diverse stakeholders that can contribute to a successful One Health approach for herpetofauna. Credit: Natalie Claunch.

focused on integrating the environment into One Health (*Protect and restore biodiversity, prevent the degradation of ecosystems and the wider environment to jointly support the health of people, animals, plants and ecosystems, underpinning sustainable development*). The biodiversity and health of herpetile species, aligned with ecosystem health, has direct and indirect consequences for plant, animal and human health. The health of these ectotherms, which are sensitive to environmental change, needs to be added to the mainstream One Health approach (see the OH JPA 2022-2026, Action 6.2).

Developing a holistic approach to manage emerging herp threats

To apply a true “One Health” approach, we must expand our thinking beyond pathogens/diseases of concern and include overall health and determinants of health for monitoring and conservation actions. For example, the approach taken by Wittrock et al. (2019) that considers a “Determinants of Health” model for caribou and sockeye salmon. This model, which has roots in public health, considers biotic, abiotic and social contributions that factor into health outcomes (Wittrock et al., 2019). Can we foresee something similar for amphibians and reptiles, to broaden our approach to managing health with a holistic, systems-based approach? How do we accomplish this with limited resources dedicated to herpetofauna? Are there existing systems already in place that can be utilized? The following are a few selected examples that might be included in One Health approaches.

Engaging participatory science into herp monitoring programs

OH JPA Activity 6.3.8 - Engage with citizen science on data collection for monitoring the health of the environment to inform action.

It is widely accepted that in an environment where professional resources for species monitoring are increasingly scarce, community scientists are of greater importance. Despite concerns about the robustness of data collected in this way and the biosecurity practices employed, participatory science is making a significant contribution in many regions (Schmeller et al., 2009). Perhaps, increasing the engagement of the public may prove useful, raising awareness of the plight of herpetofauna and giving the public a role in herpetofauna health and conservation, ultimately elevating the popularity status of herpetofauna despite their cryptic nature (e.g., see Figure 1).

Engaging the IUCN for protecting and restoring biodiversity of herpetofauna

Currently, the International Union for Conservation of Nature (IUCN) is composed of a number of working groups, including the Amphibian Specialist Group (ASG), the Snake Specialist Group (SSG), the Tortoise and Freshwater Turtle Specialist group (TFTSG), Marine Turtle Specialist Group (MTSG) and the Crocodile Specialist Group (CSG) where government officials, researchers and workers across sectors at the local, national, regional and global levels review threats and implement conservation action plans. These include developing shared databases and surveillance across different sectors and identifying new solutions that address the root causes and links between risk factors and impacts to biodiversity. Using the WHO model, the ASG and SSG could implement a One Health approach to integrate

research along the amphibian, reptile, human, animal, plant and environmental health interface. This integrated framework would identify and promote multi-sectoral approaches to reduce health threats, including the transformations required to prevent and mitigate the impact of current and future health challenges at regional, country and global levels (Cunningham et al., 2017). Such an approach could be combined with task forces already in place (e.g., Bsal Task Force, <https://www.salamanderfungus.org/>; <https://sosanfibs.org/>) to make recommendations for research on emerging disease threats and develop long-term global plans of action to avert outbreaks. The panel could additionally have a role in investigating the impact of human activity on the environment and wildlife habitats, and how this drives disease threats.

CALL TO ACTION: Integrating herps into a One Health approach

Integrating herps into the One Health approach would potentially have multiple beneficial impacts on public health and well-being. Herein, we implore a call to action for those using a One Health approach to integrate reptiles and amphibians, indicators of ecosystem health, into their decision-making. The One Health approach requires interdisciplinary collaboration to promote a sustainable future for humans, animals, plants and their shared ecosystems (One Health High-Level Expert Panel (OHHLEP) et al. 2022) and is being implemented in the One Health Joint Plan of Action. Unfortunately, we often limit our view of One Health to a few closely related disciplines and neglect the broader scope of factors that may be equally significant. A One Health team must engage representatives and stakeholders across multiple sectors to coordinate and collaborate for an effective, holistic response (Figure 2). This need for a holistic response is included in the One Health Joint Plan of Action, emphasizing the importance of incorporating the environment sector in One Health approaches (e.g., see OH JPA 2022-2026, Action 6.4.4).

One Health should be our lifestyle, ingrained in our day-to-day activities, abandoning our consumerism for the sake of nature and, hence, our well-being. Can we change the way we currently live? Is public engagement the answer (the glue) to imploring decision makers and high-level committees to consider herpetofauna in One Health approaches? Indeed, to achieve health for all life we need a global community working united.

Data availability statement

The authors confirm that the data supporting the findings of this study are available within the article.

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Connections references

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