CHELONIAN SPECIES IDENTIFICATION AND HUSBANDRY RECOMMENDATIONS

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ABSTRACT

Correct identification of species is important to allow for proper husbandry and medical care of turtles and tortoises. Texts, colleagues, morphologic characters, and knowledge of importation trends can be helpful in identification. Proper temperatures, nutrition, lighting, etc. can be provided once correct identification has been made.

Introduction

Nearly 300 species of turtles and tortoises have been described, and new species are still being discovered. They inhabit oceans, rivers, mountain forests, deserts, forest streams, limestone bogs, meadows, lakes, and ponds across the globe. They range from diminutive species with an adult length of 10 cm to giants that may be over 1 m in length. For veterinarians and those trying to maintain chelonians in captivity, this diversity can be a challenge. Veterinarians and pet owners may have difficulty identifying the species of chelonian at hand. The species is often misidentified at the point of sale or acquisition, leading to incorrect assumptions about medical treatment, husbandry, diet, etc.

The terms “turtle,” “tortoise,” and “terrapin” are used variably to describe chelonian species. There is no clear-cut scientific difference among these terms, and use of the terms varies among different cultures and countries. In the United States, “turtle” is usually used for water turtles, and “tortoise” is usually used for land dwellers. In Europe, “turtle” is often reserved for the marine turtles, with other aquatic species being called “terrapins.” To add to this confusion, there are some specific exceptions. For example, Americans use the term “box turtle” to describe members of the genus Terrapene, even though they are land dwellers and may be more properly called “box tortoises”, as is done in Europe. The American species Malaclemys terrapin is generally called the diamondback “terrapin” even in America, where no other species is called a terrapin. In general, the term that is used will follow the traditional use of the language in the geographic range of the discussion.

In general, relatively few species of turtles are presented for veterinary care. There are two major sources of chelonian patients: wild local turtles that have been injured or taken home as pets, and turtles that have been purchased through the pet trade. In most areas, there are less than 10 local native turtle species, and it should be easy for veterinarians to become familiar with these. Most state fish and wildlife agencies provide posters or pamphlets on native reptiles, and regional field guides are also helpful. The reptile practitioner should be thoroughly familiar with all local species.
since many turtle species are assigned state, federal, or international legal protection. Most states are interested in documenting locality data for protected turtles, and the veterinarian should report the occurrence of such specimens to the appropriate authority. The legal issues of medical care and euthanasia of protected turtles are no different than those governing well-known protected species like bald eagles and gray whales.

Discussion

Turtles that arrive through the pet trade fall into two general classes: species involved in the bulk turtle pet trade, and those involved in the specialty hobbyist trade. While there is sometimes overlap of these markets, they are generally separate entities. The bulk turtle trade generally deals in less expensive species that can be sold by the thousands to supply general pet stores. The specialty trade generally deals with small numbers of more expensive animals that are very desirable to private chelonian breeders. In general, species identification in the specialty trade is not a problem since it is the identity of the species that drives the trade. Serious hobbyists can often provide the veterinarian with exact species identification and pertinent publications on the species. In some cases, these species may have been so recently described that texts may not have any information on the species, and more recent journals will need to be consulted.

The most difficult turtle species for veterinarians to identify seem to be those from the bulk turtle trade. These animals may enter pet stores from wholesalers with little information and incorrect identity. This misinformation is then passed on to inexperienced pet owners, and the problem is compounded. Veterinarians presented with such patients can use several methods to identify the species.

The general morphology of the specimen can be of use in assigning the turtle to a general group. The traits discussed below can be helpful in making a species assignment, but the reader should also consult published texts for species identification.3,6,10 In some cases, taxonomists are still debating the specific or subspecific status of some types of turtles, and the species name or origin may not be clear. In these cases one must make a best assessment based on known data for closely related species.

The first character to assess in most turtle taxonomy algorithms is whether the turtle belongs to the megaorder Cryptodira (hidden neck turtles) or Pleurodira (side-neck turtles). The Cryptodira retract their neck into the shell in a dorsal/ventral plane, forming a vertical “s” shape like an upright cobra. In these turtles the nose is pointing straight forward when the neck is withdrawn. The Pleurodira retract their neck in a lateral plane so that the lateral surface of the neck is visible and the nose is pointed to the side when the neck is withdrawn. This character alone is helpful in eliminating many species from the list of possibilities when trying to make an identification. The majority of turtles and all tortoises in the pet trade are Cryptodiran. Several common Pleurodirans that may be seen in the pet trade include the African helmeted turtle (Pelomedusa subrufa), the mata mata (Chelus fimbriatus), the New Guinea red-bellied turtle (Emydura subglobosa), and the snake neck turtles.
These species are generally unique enough in morphology that species assignment is relatively easy once one realizes that it is a Pleurodiran species. Pleurodirans are generally tropical to subtropical being found only in South America, Africa, Australia, and several Southeast Asian islands. They are generally aquatic, although some are seasonally terrestrial when their aquatic environs regress in the dry season.

In addition to neck anatomy, evaluation of other body parts may help in species identification and habitat type. Webbed, flipper-like feet would lead one to believe that the species is at least partly aquatic; while rounded, elephantine feet would generally indicate a terrestrial existence. Highly domed shells in general are more common in terrestrial species, while flatter shells are typical of aquatic species. As with any rule of thumb, there are exceptions to the above statements. For example, American mud and musk turtles (*Kinosternon* spp.) have fairly domed shells but are highly aquatic.

Examination of the finer structure of the shell may provide additional clues for species identification. Structures may include hinges on the top shell (carapace) or bottom shell (plastron) that allow closure of the shell. Most turtles of the genera *Pelusios* (African mud turtles), *Emys* (European pond turtles), *Emydoidea* (Blanding’ turtles), *Terrapene* (American box turtles), *Cuora* (Asian box turtles), *Cyclenys* (Asian leaf turtles), *Pyxidea* (jagged shell turtle), *Notochelys* (Asian flat shelled turtle), *Pyxis* (spider tortoises), and *Kinosternon* (American mud turtles) have more or less developed plastron hinges. African hingeback tortoises (*Kinixys* spp.) have a caudal carapace hinge.

In most turtles, the shell is covered by a layer of keratin plates called scutes. Each scute has a name and the scutes may be used by taxonomists to differentiate among species and subspecies. For example, the plastron pectoral scute anatomy can be used to distinguish the two subspecies of Asian brown tortoise (*Manouria emys*). *Manouria emys emys* the plastron pectoral scutes are widely separated, while in *Manouria emys phayrei* the pectoral scutes meet at the midline.

The leatherback sea turtle (*Dermochelys coriacea*), Fly River turtle (*Carretochelys insculpta*), and softshell turtles (family Trionychidae) have reduced amounts of bone in the shell and the typical keratin layer is replaced by thick, leathery skin. The softshells and Fly River turtles have elongated, snorkel-like noses to allow the turtle to breathe air while remaining completely submerged.

Shell color may be helpful in identification if a unique pattern exists. For example, the spotted turtle (*Clemmys guttata*) from the eastern United States is the only species to have a jet-black carapace covered in circular yellow to orange spots. On the other hand, some patterns that at first glance appear to be unique have actually evolved independently on several continents. For example, the inexperienced observer may assume that every tortoise that has a striped, starburst, yellow and black carapace pattern is an Indian star tortoise (*Geochelone elegans*). In reality, this pattern can also be found in spider tortoises (*Pyxis* spp.) and radiated tortoises (*Geochelone radiata*) from Madagascar, tent tortoises (*Psammobates* spp.) from Africa, the Burmese star tortoise (*Geochelone platynota*),
and the ornate box turtle (*Terrapene ornata*) and Florida box turtle (*T. carolina bauri*) from the United States. For these species, shell pattern alone cannot be used as a definitive identification trait.

There is often confusion over identification of the North American box turtles. There are generally only four types that are found in the pet trade. The eastern box turtle (*T. c. carolina*) is generally unique enough in color pattern to be easily identified. However, the Gulf coast box turtle (*T. c. major*) and the three-toed box turtle (*T. c. triunguis*) are often confused. Both subspecies have a rather drab, brown carapace with faint yellow flecks, and may lose this pattern with age. The Gulf coast subspecies is generally larger as an adult and has four toes on its hind feet. The three-toed is smaller as an adult and generally has only three toes on the hind feet. In addition, some three toes have a vivid orange or white mask on the face that is generally not seen in Gulf coast specimens. The ornate box turtle is sometimes confused with the Florida box turtle since both have a radiating pattern as described above. Ornate box turtles generally have four digits on the hind feet, and a radiating plastron pattern. Florida box turtles generally have three digits on the hind feet and a uniform brown to yellow plastron pattern. In addition, the carapace of Florida box turtles is generally highly domed and elongated relative to the less domed, rounded carapace of the ornate box turtle.

The North American genera *Graptemys* (map turtles), *Pseudemys* (cooters), *Trachemys* (sliders), and *Chrysemys* (painted turtles) each contain several species and subspecies that may look very similar. For these genera, details of geographic origin, color patterns, size, and scute morphology may all be needed for accurate identification. Seeking the assistance of colleagues that are familiar with these genera may also be helpful, as discussed below.

Knowledge of pet trade importation trends may also be helpful when trying to identify a chelonian. In the United States, annual import data are tracked by organizations such as TRAFFIC North America (World Wildlife Fund, Washington D.C.), and the Humane Society of the United States. Review of these data will allow the veterinarian to see what species are most likely to be presented from the pet trade, and he or she can try to familiarize themselves with those species. For example, in recent years, species such as the African helmeted turtle (*Pelomedusa subrufa*), Asian leaf turtles (*Cyclemys* spp.), Malayan box turtle (*Cuora amboinensis*), Russian tortoises (*Testudo horsfieldi*), and Central American wood turtles (*Rhinoclemmys* spp.) have been imported by the thousands, and are often presented for illness. With this data, the veterinarian can make a probability-based species assignment among species that may appear similar. For example, data indicate that several thousand Chinese box turtles (*Cuora flavomarginata*) have been imported in recent years. The very rare McCord’s box turtle (*Cuora mccordi*) looks very similar to the Chinese box in most text photographs, but data indicate that very few McCord’s box turtles have ever entered the United States. Therefore, if a veterinarian had to make a species assignment simply based on probability, it would likely be a Chinese box turtle, not a McCord’s box turtle.

Veterinarians may also learn which species are commonly sold by visiting local pet stores, reading pet trade magazines (e.g., *Reptiles*, P.O. Box 58700, Boulder, CO 80322-8700) attending regional herpetologic expositions, and surveying internet reptile trade websites (e.g., kingsnake.com).
example, if one visits the kingsnake.com classified advertisements and sees fifteen ads for an unfamiliar species, it is an indicator that it may be a common pet trade species of which knowledge should be gained. In addition, veterinarians that work with chelonians should consider joining turtle and tortoise conservation groups such as the IUCN Turtle Survival Alliance (c/o Rick Hudson, Fort Worth Zoo, Fort Worth, TX). Active members of such groups have an opportunity to work with species that may be unfamiliar and meet new colleagues from the global chelonian conservation community. Such contacts are often very helpful in providing assistance in species identification, natural history data, and husbandry advice. Serious chelonian veterinarians may also want to subscribe to more academic journals such as Chelonian Conservation and Biology (Chelonian Research Foundation, Lunenberg, MA).

Thorough husbandry advice for the hundreds of chelonian species cannot be provided in a brief review. The reader is referred to published texts for more thorough information but general information is provided herein.\textsuperscript{2,6,7,8,9}

Chelonians can be maintained indoors or outdoors, with each having its benefits. Indoor enclosures offer more safety and better climate control, while outdoor enclosures offer improved ventilation and exposure to natural sunlight. Both indoor and outdoor enclosures must be made predator-proof. Outdoor enclosures for small chelonians must include a secure wire bottom and top. The bottom may be covered with several inches of dirt and planted with grass creating an escape-proof enclosure. Where fire ants are a problem, appropriate control measures should be taken. Consider mammalian pets, especially canines and ferrets, to be a threat to small chelonians that are maintained indoors.

As ectothermic animals, chelonians must be able to move among various temperature zones to maintain their preferred body temperature. Inadequate temperatures promote poor immune response and poor digestive efficiency, and are a common cause of illness in captive reptiles. As such, heat sources appropriate to the species must be provided. One of the best heat sources for chelonians is simple incandescent lighting. Regular light bulbs in reflector-type fixtures focus heat into certain areas of the environment, simulating the heat derived in the wild from the sun. For most species, this is the most effective and natural way of heating in indoor environments. Temperatures below these lamps must vary with the ecology of the species. For example savanna tortoises may seek basking temperatures of 32-35 °C, while some leaf-litter forest species may prefer to be at 20-25 °C. In addition, some species must be kept very warm even at night while others prefer a night temperature drop. Nighttime low temperatures should be maintained at 23-27 °C for tropical species and 21-23 °C for temperate species. In cases where night temperatures must be high, ceramic radiant heat emitters or heat panels may be installed to provide heat without providing light. Using light emitting heat sources at night may adversely affect the animal’s sleep cycle, immune response, and reproductive cycle.

Water heaters, such as those used in tropical fish tanks, may be useful to maintain stable background temperatures. In general temperatures from 25-28 °C are adequate depending on the species. Since
these heaters are often made of ceramic or glass, one must ensure that they are located so that they cannot be broken by the turtles.

Most aquatic turtles need to be able to dry themselves completely while basking. Non-abrasive basking sites such as cork-bark or driftwood should be available. Aquatic plants such as Anacharis provide excellent hiding and resting areas.

Like the choice of heat source, the choice of enclosure will vary by species. Many small species can be maintained in traditional glass terrarium setups. The enclosure must be escape-proof for the kept species. Larger specimens may need to have custom-built enclosures or large commercially available enclosures. Large aquatic species need large pools such as those used in the aquaculture industry (Aquatic Ecosystems, Apopka, FL), and generally need some type of powerful filter system to maintain adequate water quality. A very effective filter system can be constructed using a pond pump, foam or mesh filter material, and a material such as lava rock to create surface area for biologic filtration. In its simplest form, the pump is used to move water from the enclosure, through the foam, over the lava rock, and back to the enclosure. In this author’s experience, tap water seems to be safe for aquatic turtles, although more conservative keepers may prefer to use aged tap water, bottled water, or reverse osmosis purified water.

Enclosure substrate should be easy to clean and not harmful if ingested. Many types of bedding, including gravel, sand, crushed walnut shells, corn cob, and some bark mulch, are indigestible and often cause intestinal obstructions when they are ingested. Newspaper is a safe and effective substrate for most species. Other safe alternatives include non-frayed artificial turf or carpeting, paper towels, or large size bark mulch. In dry environments, alfalfa pellets such as rabbit food can be used as bedding. Substrates should be spot cleaned daily and replaced when heavily soiled.

Water must be made available as appropriate for the species. Many tortoises will drink water from a shallow bowl. The animal must be able to easily access the bowl without spilling the water. Spraying may also be required to maintain adequate humidity levels for tropical forest species. Areas of high humidity should be available, as even arid zone species will seek out such areas. Small plastic food storage containers can easily be modified to provide high humidity retreats. Recent evidence indicates that the commonly seen condition of “pyramiding,” where the scutes of tortoises develop a conical appearance, may be influenced by environmental humidity.

In addition to basking lights, full-spectrum lighting with ultraviolet B (UVB) wavelengths is thought to be important for many species. While controlled studies are lacking for any chelonian species, it is generally recommended to provide UVB light. The best source of UVB light is unfiltered natural sunlight. It is ideal to have an outdoor enclosure for turtles that can be used during mild weather. In the absence of natural sunlight, fluorescent (e.g., Zoo Med Reptisun, ZooMed, San Obispo, CA) or mercury vapor UVB lights (e.g., ZooMed PowerSun) should be provided. UVB light is filtered out by glass or plastic.
Dietary requirements of chelonians vary among species. Chelonians may be carnivorous, omnivorous, or herbivorous. Carnivores may accept earthworms, fish, killed rodents, insects, and commercial foods such as Mazuri turtle pellets (PMI Nutrition International, Brentwood, MO), or various pellets for tropical fish. Herbivores require a high fiber, high calcium diet and should be fed kale, collards, endive, escarole, dandelion, clover, chicory, beet greens, Swiss chard, etc. These items are chosen to maximize the animal’s calcium intake. The concern about excessive levels of oxalates and thiocyanates in some greens has likely been overstated, and these greens are appropriate for chelonians as part of a balanced diet. Additional fiber sources such as alfalfa pellets, chopped hay, and grass should be provided. Products such as Walkabout Farms chelonian diets and supplements (Walkabout Farms, Pembroke, VA), Mazuri tortoise diet (PMI Nutrition International, Brentwood, MO) and Oxbow Critical Care for Herbivores (Oxbow Pet Products, Murdock, NE) are also appropriate. Omnivores may be offered a mix of the carnivore and herbivore diet, and small amounts of low-fat dog food such as Hill’s RD diet (Hill’s Pet Nutrition, Topeka, KS) may be offered to terrestrial omnivores. In general, fruits are not tremendously nutritious and should only be used as an occasional treat, or to entice reluctant feeders.

Unless whole rodents or fortified pellets are being consumed, vitamin and mineral supplementation may be needed. In particular, insects and plant matter are often deficient in mineral content. Reptiles that are not supplemented often suffer from calcium deficiency. Supplementation may be done by mixing a powdered calcium supplement with the food items, or by feeding insects a high calcium diet for several days before they are fed to the reptile (“gut loading”). Supplements should be used in moderation as oversupplementation can also occur. Multivitamin supplements in particular are often excessively high in vitamin A and D and should generally be used only once weekly.

Proper husbandry and nutrition are the most important aspects of reptile preventive care. However, a number of other practices are recommended. Quarantine of new animals is extremely important. In general, a 2-3 mo quarantine is recommended. Overzealous collecting and overstocking of environments should be avoided. During quarantine, fecal analysis should be performed several times to test for internal parasites. These parasites should be treated and eliminated if possible before release from quarantine. In some situations, further testing such as bloodwork may be recommended.

Finally, annual physical examination by a veterinarian is recommended for all pet reptiles. At the physical exam, the animal’s growth and weight are measured, maintenance such as nail trimming and beak trimming is done, stool samples are checked, signs of illness may be detected, and a discussion of modifications of husbandry can occur.

LITERATURE CITED