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Burmese roofed turtle moments after emerging from an egg collected from a sandbank along the Chindwin River and incubated at a head-starting facility in Limpha village, Sagaing region, Myanmar. Photo by Myo Min Win/Wildlife Conservation Society Myanmar (Platt et al 2020).

featured species Burmese roofed turtle, *Batagur trivittata* (Duméril & Bibron, 1835)

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Back from the brink, baby Burmese roofed turtles make their debut

Written by Liz Kimbrough and posted on Mongabay.com on 28 August 2020

Once considered extinct, the Burmese roofed turtle was brought back from the brink by an ambitious conservation program.

The captive population is now approaching 1,000 turtles, and the species appears to be in little danger of biological extinction.

Scientists have now published descriptions and photos of the hatchlings of this little-known river turtle.

Now, almost 30 years after its rediscovery in the wild, scientists have finally gotten around to describing the hatchlings of this little-known river turtle.

Photos and descriptions of hatchlings and eggs, as well as some background information about the conservation of the species were recently published in the journal *Zootaxa* by scientists from Wildlife Conservation Society (WCS) Myanmar, Turtle Survival Alliance (TSA), Global Wildlife Conservation, and Georgetown University.

The newly hatched turtle shows its umbilical scar, where it was attached to a nutrient-giving yolk sack. This scar will disappear in a few weeks. Photo by Myo Min Win (Platt et al 2020).

The Burmese roofed turtle is the second-most critically endangered turtle in the world. Once abundant, hunting and overexploitation of eggs has driven the population to near-extinction, with only five or six adult females and two adult males known to exist in the wild today.

The species was presumed extinct until 2001, when researchers found the shell of a recently killed turtle in a village along the Dokhtawady River in Myanmar. Shortly after, a U.S. turtle collector found a living turtle at a wildlife market in China.

Encouraged by these findings, researchers conducted field surveys to find the wild populations. After following locals' descriptions of "duck-sized eggs," the researchers found living turtles in two separate rivers in Myanmar. However, the population had collapsed to a whisper, with fewer than 10 adult females surviving in the wild at that time.

"The biggest threat is that there are so few left in the wild and so if there's an accident we've lost a big chunk of the

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A hatchling photographed for science. The sharp rearward pointing spines on the bony ridge of the Burmese roofed turtle's shell become blunt by age three and disappear by age four. Photo by Myo Min Win (Platt et al 2020).

population," Steven Platt, first author of the study and WCS associate conservation herpetologist for Southeast Asia, told Mongabay. "Otherwise its mostly fishing. I worry about them getting entangled in fishing gear and drowning. And if we didn't monitor, the eggs would be collected."

More than half of the world's turtle and tortoise species are now threatened with extinction. Loss of habitat is their biggest threat globally, but turtles also face dangers from the pet trade, overconsumption for food and medicine, fishing, pollution, invasive species, and climate change.

In an effort to bring the Burmese roofed turtle back from the brink of extinction, WCS and the Turtle Survival Alliance (TSA) in collaboration with the Myanmar Ministry of Environmental Conservation and Forestry began a program to "headstart" the species in 2007. Researchers and technicians collected eggs from wild turtles for a captive-breeding program.

Now, turtles are bred, hatched and reared in conditions safe from predation by large fish, birds, and lizards, poaching and egg collection. Complementary conservation efforts are also focused on the remaining known wild turtles: five to six adult females and as few as two males living on a remote stretch of the upper Chindwin River. Their nests are monitored and eggs are collected and incubated in a secure facility in Limpha village in the Sagaing region of Myanmar.

The captive population is now approaching 1,000 turtles, and the species appears to be in little danger of biological extinction. The goal is to eventually release them back into their wild habitat in the Chindwin River.

In 2015, WCS and TSA reintroduced some male turtles back to the wild, but reintroduced turtles can be hard to follow and locate in the river when the wet season rolls in, Platt says. For now, the team is trying a different strategy, keeping some of the turtles in floating cages in the river as a "soft release" of sorts. The hope is that once the turtles become acclimated to the area they can be released and won't stray too far.

"River turtle conservation is really difficult," Platt said. "Tortoises can move about a kilometer, or, normally just stay within a few hectares of where we release them, but these turtles, once they're in the river, they can go up or down for several hundred miles if they just keep swimming. So, you know, river turtle conservation is a tough nut to crack."

"But the captive breeding program has produced about 170 turtles a year for the past two years," Platt said. "So the turtles are biologically secure. They're not going to go extinct."

A newly hatched Burmese roofed turtle. Note the egg-tooth (caruncle) just underneath its nostrils, which is used to cut through the eggshell when the turtle hatches. It is then lost during the two months after hatching. Photo by Myo Min Win/WCS Myanmar (Platt et al 2020).

Photographs of hatchling Burmese roofed turtles (*Batagur trivittata)* provided by Stephen Sautner (WCS - Communications) for media use.

Citation:

Platt, S. G., Lwin, T., Win, M. M., Platt, K., Haislip, N. A., Van Dijk, P. P., & Rainwater, T. R. (2020). First description of neonate Batagur trivittata (Testudines: Geoemydidae). Zootaxa, 4821 (2), 394–400. doi:10.11646/zootaxa.4821.2.10

Mike's Turtle Net Picks by Michael J. Connor, Ph.D.

A varied selection of recent articles, stories and sites on the Web that some of you may find as interesting as I did. This list is also posted at tortoise.org/turtlenetpicks/turtlenetpicks.html

Tortoises Are Ecosystem Engineers

Thanks to translocated Aldabra tortoises, the rare ebony trees of Ile aux Aigrettes, an islet off Mauritius's coast, are on the road to recovery.

Hatchling Tortoises Show Affinity for Faces

Biologists found that hatchlings of 4 different *Testudo* species preferred to approach face-like patterns over alternatives. **The study paper is open access.**

Post-Fire Survey at Utah's Red Cliffs Reserve

Crews conducted surveys in September in the aftermath of the 12,000 acre Turkey Farm Road fire that burned large swaths of the Red Cliffs National Conservation Area including important desert tortoise critical habitat.

Imperiled Elongated Tortoise Battles Habitat Loss and Fire

Over 90 percent of the habitat of endangered elongated tortoises in India is outside protected areas and is threatened by habitat degradation and fire.

New Blood Test Determines Sex of Turtle Hatchlings

Anti-Mullerian Hormone (AMH) can be reliably detected in small blood samples from neonate male turtles but not females and can be used as a sex-specific marker. **The study paper is open access.**

Sacalia Study Highlights Need for Genetic Data Prior to Turtle Release

Scientists studying genetic diversity in the endangered Four-eyed turtle, *Sacalia quadriocellata*, in Vietnam are warning that confiscated animals should not be released back into the wild without genetic screening.

Kemp's Ridley Sea Turtle Conservation Video

Gulf States Marine Fisheries Commission has released a 3.5 hour video of its 2018 symposium on the science and status of the Kemp's ridley sea turtle. The video includes 6 presentations and provides a great opportunity to learn all about our rarest sea turtle..

Rehabbed Sea Turtles Resume Typical Migratory Behaviors

Good news! Satellite tracked juvenile loggerhead, green, and Kemp's ridley turtles all resumed normal migratory movements following release from rehab.

Magnetotactic Bacteria Found in Loggerhead Sea Turtles

Sea turtles are fantastic navigators able to return to their natal beach from distant foraging grounds. A fascinating new study proposes that their "magnetic sense" comes from a symbiotic relationship with magnetotactic bacteria.

CTTC's Turtle And Tortoise Listserve

CTTC's Turtle and Tortoise list has now moved to io.groups. If you want to talk with other turtle and tortoise fans in a friendly atmosphere just send an email to: **<CTTC-TurtleAndTortoise-list+subscribe@groups.io>**

CTTC on Facebook

For breaking news updates visit and "like" us on Facebook!

Brevard Zoo releases 370-pound sea turtle back into the ocean after rehab

Brevard Zoo news release by Erin O'Brien

Melbourne, Florida—21 October 2020—A 370-pound sea turtle was released back into the wild Tuesday morning after recovering from a shell injury.

The female loggerhead sea turtle was named after NASA's Mars 2020 Perseverance rover.

Perseverance was seen struggling to nest by officials with the Florida Fish and Wildlife Conservation Commission. An exam found that she had suffered an injury in the past that was causing her to suffer from swelling and weakness.

After many failed nesting attempts, Perseverance was rescued and transported to the Healing Center at the Brevard Zoo on July 31.

An ultrasound showed that Perseverance was having trouble passing eggs, so veterinarians helped her lay over 100 eggs that were later buried for incubation on a beach in southern Brevard County.

Perseverance was given food, fluids and medications before she was given a full bill of health by her caretakers. She was released back into the wild on Cocoa Beach on Tuesday, Oct. 20.

People who find distressed sea turtles in Brevard County are encouraged to contact the Sea Turtle Preservation Society at 321-206-0646 or Florida Fish and Wildlife Conservation Commission at 1-888-404-FWCC.

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What is an Assurance Colony? by M. A. Cohen

First used in 1980, the term **biodiversity,** a combination of the words biological and diversity, generally "describes the abundance, variety, and genetic constitution of native animals and plants" (Levin, ed., 2001). While plants and animals are the most common inhabitants of assurance colonies, gene banks containing DNA, microbes, and heirloom seeds also play roles in the maintenance of biodiversity. This article will concentrate on the conservation of animal species by means of assurance colonies.

The reasons for a species having threatened or endangered status vary by the location of the native habitat, but typically fall into several categories: (1) habitat degradation, fragmentation, pollution, and loss, (2) overconsumption for food; ethnic medicine, and the pet trade, (3) competition from alien invasive species, and (4) loss of genetic diversity.

As defined by the International Union for Conservation of Nature (IUCN) Red-list, an assurance colony is a conservation strategy for "animals that fall in the conservation statuses of Critically Endangered, Endangered, or Vulnerable" (User, 2011). Two basic types of conservation techniques are recognized by the scientific community: **ex-situ** and **in-situ conservation**.

According to the Encyclopedia of Biodiversity, **ex-situ ('out of place' or 'off-site') conservation** involves the conservation of components of biological diversity outside their natural habitats. The captive breeding of endangered and threatened animals is conducted in man-made naturalistic settings with minimal human interaction. The goal of ex-situ conservation of animals is that of returning individuals to their natural habitats to replenish depleted populations.

Ex-situ conservation efforts typically involve bring a group of founding animals into captivity, usually composed of 20+ males and 20+ females of the species. Furthermore, challenges abound, including providing proper food and shelter in a naturalistic habitat, battling potential diseases, coping with breeding difficulties and loss of natural behavior in an artificial habitat (Topczewski).

Ex-situ conservation efforts by the Association of Zoos and Aquariums (AZA) Species Survival Plans have proven very successful, as have private-sector programs conducted with or without the AZA, according to Rebekah Pettit writing in *Reptiles* Magazine. Additionally, she notes, "There are hundreds of thousands of zoos and private conservatories all around the world working to save reptiles and amphibians through assurance colonies."

Mammals, birds, amphibians, and reptiles all provide examples of successful ex-situ conservation efforts with animal species. Included among the success stories are three iconic, very recognizable species: the Giant Panda (*Ailuropoda melanoleuca*), the American alligator (*Alligator mississippiensis*), and the California condor (*Gymnogyps californianus*).

Despite the fact that many amphibians are endangered or extinct due to habitat loss and disease in the wild, considerable success with amphibian assurance colonies in both Australia and Central America has preserved the biodiversity of species. In Australia, for example, the Taronga Zoo in Sydney has been so successful at breeding the Corroboree frog (*Pseudophryne corroboree*) that individuals are being released into the wild in areas free of the devastating chytrid fungus, a disease that is decimating amphibian populations worldwide (Pettit, 2018).

In Central America, the harlequin poison dart frogs, numerous species of small, colorful true toads, are close to extinction in many of their habitats and are often represented only by relict populations. A prime example of successful breeding in assurance colonies is the work of the AZA's Species Survival Plan with the Amphibian Rescue and Conservation Project (ARCP) in Panama in efforts to recover the Panamanian Golden Frog (*Atelopus zeteki*). This iconic species is being carefully captive-bred and managed for the foreseeable future in several zoos and aquaria in both Panama and the United States (Gratwicke, 2009).

The ARCP, the organization working with the Panamanian Golden Frog, is also establishing assurance colonies for numerous other endangered frog species native to Central and South America.

In-situ ('on-site') conservation involves the "conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties" (Levin, 2001).

This type of conservation work typically occurs in wildlife sanctuaries, biosphere reserves, national parks and other protected parklands.

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Typically the ecosystem in which in-situ conservation occurs "is protected and maintained so that all the constituent species, known or unknown to us, are conserved and benefited" (Agarwal).

Recognizing that in-situ conservation has many advantages, this article will focus on only a few. Creating an artificial habitat is unnecessary, as is providing either suitable food or shelter. The animals in such projects continue to feed on their accustomed foods, find mates, and live in the biologically diverse environments in which their species developed (Agarwal).

In-situ efforts at recovery of the featured species of this newsletter, the Burmese roofed turtle (*Batagur trivittata*), are ongoing in Myanmar, formerly known as Burma. Once thought to be extinct, this species has literally been "brought back from the brink" by the diligence of dedicated scientists overseeing captive-breeding efforts in several secure locations in Myanmar. The goal of their conservation efforts is the re-establishment of viable populations of this large, herbivorous freshwater turtle within its historical range.

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Freshwater biology: Turtle scavenging critical to freshwater ecosystem health

Macquarie turtles, *Emydura macquarii*, basking on a log in the Warrawong sanctuary near Mylor in the Adelaide Hills of South Australia. This species is also known as the Murray River turtle. **Photo © 2008 by Peripitus.**

17 September 2020—Freshwater turtles may have a role in regulating water quality in river systems by scavenging fish carcasses, suggests a study of *Emydura macquarii*, a vulnerable freshwater turtle species found in Australia. The findings are published in *Scientific Reports*.

Carp are a major pest in many parts of Australia and ammonia, a by-product of carp carcass decomposition, is toxic to animals in high concentrations. Ricky-John Spencer and colleagues measured the impact of scavenging turtles on the water quality of artificial wetlands containing carp carcasses, using five groups of four male *Emydura macquarii* caught at Hawksview Lagoon in New South Wales. Each artificial wetland contained either four or no turtles and consisted of a tank filled with flowing water, cement blocks for turtles to bask on and plastic tunnels for shelter. Carp carcasses were left in each artificial wetland until they had either been fully eaten by turtles or had fully decomposed. When turtles were present, carp carcasses were removed three times faster and water quality returned to initial conditions more quickly, as indicated by a fall in ammonia levels and the recovery of dissolved oxygen levels. Aquatic animals need dissolved oxygen to breathe.

The Murray-Darling basin is a river system that supports 40% of Australia's agricultural production. It is the main water source for more than 2.8 million people. Freshwater turtles are scarce in the Murray-Darling basin due to death on roads and nest destruction by foxes. The water quality and ecosystems of the basin could be severely affected by plans by the Australian government to reduce the number of invasive carp through the introduction of a naturally occurring carp virus as there are fewer turtles present to scavenge on carcasses, the authors suggest.

Citation

Santori, C., Spencer, R., Thompson, M.B. et al. Scavenging by threatened turtles regulates freshwater ecosystem health during fish kills. Sci Rep 10, 14383 (2020). https://doi.org/10.1038/s41598-020-71544-3

News release originally published on EurekaAlert!.org [American Academy for the Advancement of Science]

the Turtle's Garden
planting for chelonians
by M A Cohen

Atriplex polycarpa, Allscale Saltbush

Allscale saltbush photographed in the Tejon Hills, Kern County, California. Photo © 2013 by Neal Kramer; reprinted with permission from the photographer..

Native to the deserts of the southwestern United States (California, Nevada, Arizona, and New Mexico) as well as northern Mexico (Baja to Sonora), *Atriplex polycarpa* belongs to the Amaranthaceae, the amaranth family of plants. This plant family includes the Chenopodiaceae, or goosefoot family, a term still in use in the literature as its family name.

A dominant desert shrub in the Mojave Desert, *A. polycarpa* has many common names in addition to allscale saltbush. It is also known as cattle spinach, common saltbush, allscale, desert saltbush, cattle saltbush, and alkali saltbush, among others.

The genus name *Atriplex* is an ancient Latin name for this family of plants, while the species name *polycarpa* derives from the Greek word roots *poly-*, meaning many, and *carph-* meaning twigs.

Description

Growing to a height of 3 feet to 6 feet (0.9 to 1.8 meters), the evergreen shrub *Atriplex ploycarpa* is completely drought-tolerant once it is established. However, while the shrub is considered evergreen, it is drought-deciduous, meaning that it will drop its leaves in times of extreme drought and intense heat. Leaves will regrow when moisture becomes available (Brenzel, ed., 2012).

Strong, woody, dense branches grow symmetrically out of a root crown. Covered with small, grayish-white flakes called scurf, the branches have an overall silvery appearance (Brenzel, ed., 2012).

A slow-growing, upright native shrub, allscale bears cream or yellow flowers from spring through fall, with male and female flowers borne on separate plants. Botanically speaking, these are dioecious plants.

Close-up of the yellow blossoms of cattle spinach photographed at the Eureka Dunes campground in Inyo County, California. Photo © 2005 by Steve Matson; reprinted under a CC BY-NC 3.0 license.

Small, silver-gray or grayish-green leaves are typically less than 1 inch (2.5 centimeters) in length, oblong in shape, and pale in color, thus reflecting sunlight and resisting water loss. In addition, its leaves are comparatively thickened, a physical feature that also inhibits water loss.

Coating the stems and leaves of *A. polycarpa* are numerous small white scales called scurf. Their presence results in one of the shrub's common names, allscale. The scurf aids the shrub in the conservation of water in its dry rangeland ecosystems (Schaffner). The scurf gives cattle spinach an overall grayish-white appearance when not in flower.

The common name "saltbush" derives from the salt deposits on the leaves of the shrub. As it absorbs water from saline or alkaline desert soils, the plant removes excess salt from its cells and deposits it in salt bladders on the leaves. These salt bladders protect the shrub

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from salt damage to its tissues, as well as attracting moisture from the air to provide some additional water for plant growth (Schaffner).

While *A. polycarpa* lacks actual spines, with age the many thin, tough twigs that make up its structure act like spines to offer the shrub some protection from predation (Plagens).

A tiny insect known as the gall midge (*Asphondylia*) feeds on the branches of cattle spinach and causes an abnormal growth known as a gall. Often several gall midge larvae are developing in the gall prior to emerging as adult midges. Because the fuzzy gall is almost always present, it is useful as an identification tool on wildland shrubs (Plagens).

Cultivation

Requiring full sun for best performance, allscale saltbush is an excellent choice for a habitat garden, a naturalistic garden designed to attract wildlife. Because it requires little or no water once established, *A. polycarpa* grows well in hot, dry environments.

While it is somewhat adaptable to a variety of soil types, this desert shrub prefers medium-textured sandy to moderately loamy soils, and it does not grow well in clay soil.

Tolerating salinity as well as alkalinity in its substrate makes desert saltbush a particularly useful shrub for seaside gardens and other extreme growing situations.

Feeding and Sheltering Desert Animals

Providing food and shelter for a variety of animals, *A. polycarpa* significantly benefits the fauna of the desert.

Cattle spinach, one of the shrub's common names, refers to the fact that it provides high-quality browse for an array of mammals, including wildlife like mule deer and other deer species, pronghorn sheep, desert rodents, and rabbits (Schaffner).

Desert saltbush photographed in the Dumont Dunes of San Bernardino County, California. Photo © 2017 by Zoya Akulova; reprinted under a CC BY-NC 3.0 license.

Cattle spinach is also cultivated for livestock such as cattle, sheep, and goats, particularly in areas where difficult growing conditions such as high soil salinity make growing most livestock forage challenging or impossible (Garner & Munda, 2003).

Raptors such as barn owls and Northern harrier hawks perch on the stout branches of *A. polycarpa* while hunting or resting. Many species of small desert birds frequent the shrub in search of foods such as moths, butterflies, and their larvae. Gambel's quail (*Callipepla gambelii*) favors allscale saltbush as habitat and cover. As many as 16 species of butterflies and moths feed on the nectar in the flowers of the shrub (Calscape). Desert reptiles, including desert tortoises, graze on allscale saltbush.

Nutritional Value

Not only is *A. polycarpa* an excellent choice for some difficult growing situations (e.g., highly saline or alkaline soils), it is highly nutritious. According to Garner & Munda, its content of "crude protein, total digestible nutrients, and fats is comparable to alfalfa, and ... it is a good source of calcium, phosphorus, and carotenoids," as well as other minerals and vitamins.

Native Americans made use of the allscale saltbush shrub in several ways. The Pima Indians ate the seeds, and they also made a flour from the seeds that was used to bake bread.

The Navajo Indians found that the twigs combined with the leaves of *A. polycarpa* could be used to make a yellow dye for fabric (Schaffner).

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Loggerhead turtles record a passing hurricane

— NOAA Northeast Fisheries Science Center news release

1 September 2020—In early June 2011, NOAA Fisheries researchers and colleagues placed satellite tags on 26 loggerhead sea turtles in the Mid-Atlantic Bight. The tagging was part of ongoing studies of loggerhead movements and behavior. The Mid-Atlantic Bight, off the U.S. East Coast, is the coastal region from Cape Hatteras, North Carolina to southern Massachusetts. A little more than 2 months later, on August 28, Hurricane Irene passed through the area, putting 18 of the tagged turtles in its direct path. The researchers were able to track changes in the turtles' behavior coinciding with the hurricane, and found that they reacted in various ways.

The loggerhead turtle, *Caretta caretta*. **Photo © 2015 by Wexor Tmg.**

"Hurricanes are some of the most intense weather events loggerheads in the mid-Atlantic experience, and we thought it was worth investigating how turtles in our dataset may be influenced by these dramatic environmental changes," said Leah Crowe, a contract field biologist at the NOAA Northeast Fisheries Science Center's laboratory in Woods Hole, Massachusetts, and lead author of the study published recently in *Movement Ecology*. "It was a perfect storm situation in terms of location, timing, and oceanographic conditions. We found that the turtles responded to the changes in their habitat in different ways."

Satellite tags attached to a turtle's carapace, or shell, transmitted the turtles' location and dive behavior. They also recorded sea-surface temperatures and temperature-depth profiles for approximately 13 months. This enabled the researchers to investigate the movements of 18 juvenile and adult-sized loggerhead turtles and associated oceanographic conditions as the hurricane moved through the region.

Most of the turtles moved northward during the hurricane, aligning themselves with the surface currents – perhaps to conserve energy. Researchers observed longer dive durations after the hurricane for turtles that stayed in their pre-storm foraging areas. Some dives lasted an hour or more, compared with less than 30 minutes for a typical dive before the storm.

The turtles that left their foraging areas after the hurricane passed moved south earlier than would be expected, based on their normal seasonal movements. This change was also more than a month earlier than the typical seasonal cooling in the water column, which is also when the foraging season for loggerhead turtles ends in the Mid-Atlantic Bight.

"Loggerheads experience environmental changes in the entire water column from the surface to the bottom, including during extreme weather events," said Crowe. "This study was an opportunistic look at turtle behavior during a hurricane. Their behavior makes loggerheads good observers of oceanographic conditions where they forage."

The study was conducted by researchers at the Northeast Fisheries Science Center and colleagues at the nearby Coonamessett Farm Foundation in East Falmouth, Massachusetts. The team has tagged more than 200 loggerheads in the Mid-Atlantic Bight since 2009.

This work has created a continuous time-series of data on loggerhead sea turtles. With 10 years of data, researchers can

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now get a deeper understanding of how turtles behave and what environmental factors drive them. They can also look back at the data and ask new questions, as they did in this study.

Waters in the Mid-Atlantic Bight are highly stratified, or layered, by temperature in the summer. At the surface, water is warm. A cold layer, also called a cold pool, forms beneath this warm layer and is present from May to October. The presence of the cold pool overlaps with the Atlantic hurricane season, which runs from June through November. It also overlaps with the presence of foraging loggerheads that are in the area between May and September.

Hurricane modeling is especially difficult in the Mid-Atlantic Bight because of the cold pool. In this study, it was unclear which aspect of the environmental changes prompted behavioral changes. Previous studies have found that loggerhead behavior appears to be sensitive to changes in water temperatures throughout the water column. Hurricanes cause the water layers to mix, which creates cooler surface temperatures. The mixing also disrupts the thermocline – the boundary layer between warm surface waters and colder, deeper waters.

Ocean temperature data recorded by the turtles' satellite tags are consistent with observations from weather buoys and autonomous gliders operating in the region. Depending on how many tags are deployed, data from tagged turtles can cover a more extensive area within a season than other oceanographic data sources.

More measurements of water temperatures throughout the water column in the region could help improve oceanographic models. Researchers say data from the turtle tags are an underused resource that has the potential to improve weather models, including hurricane models.

Many of the natural and human-induced impacts on sea turtle behavior, or the environments that sea turtles live in, are still unknown.

Previous studies indicate that sounds from dredge operations, seismic activity, offshore wind farm development, and marine recreation may also impact sea turtle distribution and dive behavior. Turtles might be impacted directly or through habitat alterations. While studies have looked at how tropical storms and hurricanes affect some marine species, there are few examples of examining sea turtle interactions with large storms.

In this study, turtle behavior did not return to pre-storm behavior within 2 weeks after the storm.

"The long-term cumulative effects of a changing climate and the increase in intensity of hurricanes and other storms is something that needs to be looked at. Changes in sea turtle movements and behavior can affect abundance estimates and management decisions," Crowe said. "This study reminds us that turtles live in a dynamic environment, and we cannot assume their behavior will be consistent throughout space and time."

News release originally published on 1 September 2020 online at EurekaAlert!.org [American Academy for the Advancement of Science]

What is the Mid-Atlantic Bight ?

In the study of geology, a bight is a landform located on a coastline or river that is curved or recessed.

Off the U.S. East Coast lies the site of the foregoing study, the Mid-Atlantic Bight, which runs from the Nantucket shoals of the southern New England states southward to Cape Hatteras in North Carolina.

Ocean temperatures are typically stable with fluctuations of less than 5° degrees throughout the year. An exception to this is the Mid-Atlantic Bight, a portion of the northwest Atlantic Ocean in which water temperatures often fluctuate as much as 20 degrees from summer to winter. Underlying a comparatively shallow "layer" of warmer surface water is a "cold pool." The mixing of these vertical strata because of seasonal wind currents and storms accounts for the wide swings in water temperature.

Another unique aspect of the Mid-Atlantic Bight is the changing salinity of the water. Spring snow melt brings a quantity of freshwater from the Adirondack Mountains, causing changes to the food web and regional fisheries.

Johnson, P. (2020). Oceanography of Mid-Atlantic Bight and New Jersey Shore Proves Unique. https://www.thesandpaper.net/articles/the-oceanography-of-the-mid-atlantic-bight-and-new-jersey-shore/

Tortoise hatchlings are attracted to faces from birth

Materials provided by Queen Mary University of London

London—16 September 2020 — Tortoises are born with a natural preference for faces, according to new research from scientists at Queen Mary University of London, the University of Trento and the Fondazione Museo Civico Rovereto.

The study provides the first evidence of the tendency for solitary animals to approach face-like shapes at the beginning of life, a preference only previously observed in social species such as human babies, chicks and monkeys.

The researchers tested the reactions of hatchlings from five different species of tortoise to different patterned stimuli, made up of a series of blobs. They found that the tortoises consistently moved to areas with the 'face-like' configuration – containing three blobs arranged in an upside-down triangle shape.

The findings suggest that this early behaviour likely evolved in the common ancestors of mammals, reptiles and birds more than 300 million years ago.

Dr Elisabetta Versace, lead author of the study from Queen Mary University of London, said: "Researchers have previously observed this spontaneous attraction to faces in social animals such as humans, monkeys and chicks. Because all these species require parental care, it was thought this early adaptation was important for helping young animals respond to their parents or other members of the same species. However, now we have shown that this behaviour is also found in solitary tortoise hatchlings, suggesting it may have evolved for another reason."

Tortoises were hatched and kept away from any animal or human faces from birth until the start of the test. Each animal was then placed in the middle of a rectangular space divided into four areas containing either a face-like or control stimuli. The researchers analysed the preference of hatchlings for face-like stimuli by recording the first area the animal entered during the experimental period.

Unlike birds and mammals, tortoises are solitary species – they have no post-hatching parental care and do not form social groups as adults. Previous research has even shown that tortoise hatchlings ignore or avoid members of the same species in early life.

Silvia Damini from the University of Trento, said: "It is possible that this preference for face-like stimuli enhances learning from living animals in both social and solitary species from the early stages of life. In fact, other animals can provide information on important environmental factors, such as the availability of resources."

Gionata Stancher, Head of the Tortoise Sanctuary Sperimentarea (Fondazione Museo Civico Rovereto, Italy) where the experiments were conducted, said: "Being able to recognise and respond to cues associated with other living animals could help young animals acquire information vital for their survival."

Journal Reference

Elisabetta Versace, Silvia Damini, Gionata Stancher. Early preference for face-like stimuli in solitary species as revealed by tortoise hatchlings. Proceedings of the National Academy of Sciences, 2020; 202011453 DOI: 10.1073/pnas.2011453117

CA Fish and Game Commission Moves to Change Desert Tortoise Status from Threatened to Endangered — Defenders of Wildlife news release

Sacramento, California—14 October 2020 — The California Fish and Game Commission voted unanimously (4–0) today to move forward with strengthening protections for the Agassiz's desert tortoise under the California Endangered Species Act (CESA). The Commission agreed to advance a petition filed in March by Defenders of Wildlife, the Desert Tortoise Council, and the Desert Tortoise Preserve Committee recommending the upgrade in protections from threatened to endangered.

In accepting the petition and finding that listing as endangered may be warranted, the California Department of Fish and Wildlife (CDFW) will now

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conduct a 12-month evaluation to determine if an upgraded listing will be confirmed. During its May meeting, the Commission voted unanimously to accept a report from CDFW that found that the uplisting may be warranted and recommended that the Commission accept the petition for further consideration.

Pamela Flick, California program director for Defenders of Wildlife, issued the following statement:

"The Fish and Game Commission made the right decision today to move forward with the uplisting process for the Agassiz's desert tortoise. Our state reptile desperately needs strengthened protections if it is to survive the barrage of threats the species faces including climate change, habitat loss and increased off-road vehicle use."

Data Visualization

Defenders of Wildlife's Center for Conservation Innovation created an **interactive story map** where users can explore a visual guide to threats facing the desert tortoise as well as conservation measures designed to help recover the species throughout its range.

Background

The desert tortoise was first listed as threatened under the California Endangered Species Act in 1989 and under the federal Endangered Species Act in 1990.

A recovery plan prepared by the U.S. Fish and Wildlife Service for this federally listed species was adopted in 1994, with Critical Habitat concurrently designated. A revised recovery plan was adopted in 2011, noting distinct problems in responsible agencies implementing previous recovery plan actions.

According to a 2018 study, adult tortoise population numbers have dropped by over 50% in some recovery areas since 2004, and by as much as 80–90% in some designated critical habitat units since approximately 1980.

Tortoise population declines in the western Mojave Desert have been especially severe, due primarily to unmanaged off-highway vehicle use, grazing of wildlands by domestic livestock, contagious disease spread, expansion and upgrading of highways, and utility maintenance projects, as well as extended droughts associated with climate change.

Original artwork drawn by Sonja Jaramillo of the CTTC Inland Empire Chapter. The portrait subject is Pablo, a painted turtle who lives in Hawaii.

"Dissents speak to a future age. It's not simply to say, 'My colleagues are wrong and I would do it this way.' But the greatest dissents do become court opinions and gradually over time their views become the dominant view. So that's the dissenter's hope: that they are writing not for today, but for tomorrow."

—Ruth Bader Ginsburg, 1933–2020, Associate Justice of the Supreme Court (1993–2020).

3D Printed Egg Decoys Help Endangered Sea Turtles in Costa Rica

By Vanessa Listek

7 October 2020—Using 3D printing technology, researchers created "fake eggs" to track illegal sea turtle trade in Central American beaches. The eggs were equipped with a GPS tracking system inside to help conservationists and local law enforcement agencies trace illegal egg trade by exposing smugglers and their trading routes.

The global scale of illegal wildlife trade is unprecedented, threatening to destroy vulnerable and endangered species at a time when biodiversity is declining faster than ever. With a value of between $7 billion and $23 billion each year, illegal wildlife trafficking is the fourth most lucrative global crime after drugs, humans, and arms according to the United Nations 2016 World Wildlife Crime Report. In response to the increasing level of illegal wildlife trade over the last several decades, researchers have turned to science to help put an end to this threat.

Poachers on many Central American beaches destroy more than 90% of sea turtle nests to sell the eggs into the illegal wildlife trade. According to conservation organization Paso Pacifico, the eggs are smuggled to cities where they are eaten as a delicacy in restaurants and bars. To uncover trade routes of trafficked sea turtle eggs and expose the rampant illegal trade, a team of researchers placed 3D printed and GPS-enabled decoy sea turtle eggs into nests on the beach.

The new study published in the journal *Current Biology* gathers key evidence on the movement of traffickers thanks to the egg decoys developed by Paso Pacifico and dubbed InvestEGGator. University of Michigan and Paso Pacifico-affiliated scientist Kim Williams-Guillen conceived and designed the decoys in response to a call for proposals using technological advances to fight wildlife poaching from the United States Agency for International Development (USAID) Wildlife Crime Tech Challenge.

> "The idea was kind of an 'Aha' moment," described Williams-Guillen, who recalled two of her favorite TV shows, *Breaking Bad* and *The Wire*, that happened to deal with illegal drug trafficking. "In *Breaking Bad*, the DEA places a GPS tracking device on a tank of chemicals to see who receives the chemicals. In one episode of *The Wire*, two police officers plant an audio device in a tennis ball to surreptitiously record a suspected drug dealer. Turtle eggs basically look like ping pong balls, and we wanted to know where they were going — put those two ideas together and you have the InvestEGGator."

Given the nesting strategy of sea turtles and unpredictability of how many and which clutches would be taken, the team needed a product that could be mass-produced yet affordable. So they relied on 3D printing technology to create the housing for the decoy eggs using NinjaFlex, a flexible thermoplastic polyurethane. Once printed, they filled the hollow chamber with high-grade silicone rubber to add weight and flexibility and then embedded it with a Global System for Mobile Communications GPS-GSM transmitter. The authors described that the decoys weighed the same as the turtle eggs they aimed to replicate. In fact, sea turtle eggs are soft-shelled and often indent naturally on contact, which is why the decoys were also created to be soft enough to incorporate a "dimple" into the design.

To see how well they could work in practice, lead author Helen Pheasey, a doctoral student at the School of Anthropology and Conservation of the University of Kent, and her colleagues put the 3D printed decoys in 101 turtle nests on four beaches in Costa Rica. The researchers soon discovered that a quarter of the fake eggs were taken illegally from the nests, allowing them to track eggs from five clutches, including two green turtle nests and three olive ridley nests. One of the decoys made it close to a residential property before going silent. Another went to a bar, just two kilometers away. The one that went farthest ended up 137 kilometers inland, spending two days in transit from the beach to a supermarket loading-bay and then on to a residential property.

> "Our research showed that placing a decoy into a turtle nest did not damage the incubating embryos and

that the decoys work," said Pheasey. "We showed that it was possible to track illegally removed eggs from the beach to end consumer as shown by our longest track, which identified the entire trade chain covering 137 kilometers" [65 miles].

Olive ridley turtle laying her eggs on a beach in Costa Rica. **Photo © 2005 by Liz Roy**

According to Pheasey, early evidence showed that the majority of the stolen eggs didn't leave the local area, reaffirming the suspicions, as well as some local reports, that most of the trade takes place close to the nesting beach. The findings show that the decoy eggs already are yielding intelligence from the local community in addition to tracking data.

The researchers were able to demonstrate that it is possible to place a GPS transmitter into a turtle nest and follow a trafficking event from the beach to end consumers, even though low signal reception on the Caribbean coast is a limitation. Costa Rica, like many turtle range countries, remains extremely difficult to secure convictions for illegal take of wildlife, due to the limited resources available to target traffickers. Instead, the handover points are far more valuable from a law enforcement perspective than catching someone simply taking a nest. This is why InvestEGGator eggs have a vital role in documenting trafficking patterns for law enforcement, gather high-quality evidence, and ultimately disrupt the illegal trade, explain the authors in the study.

The researchers plan to continue improving the technology and its deployment. They conclude that the 3D printed decoy eggs can also be used to unravel egg poaching of other species, such as other egg-laying reptiles, and other trafficked species, like birds endangered by egg collectors. For example, Paso Pacifico plans to work with Costa Rican scientists to adapt the transmitter for use in tracking shipments of shark fins. They are also considering its use in tracking the theft of eggs from parrot nests. The team would also like to see more sea turtle projects use the decoys on their nesting beaches, helping shed light on differences in the turtle egg trade in different countries.

This wildlife crime is devastating endangered sea turtles with poachers currently having the upper hand on circumventing local authorities, and with little information to date on the routes they use to smuggle endangered species. The science community is mobilizing to fight illegal wildlife trade, mainly leveraging technology. These specifically tested 3D printed decoy eggs could be critical to saving Central American wildlife.

Originally published on the website **3DPrint.com** and reprinted with permission from the 3DPrint.com staff.

Links to information and objects mentioned in this article

3DPrint.com
News regarding all aspects of 3D printing, including equipment, software, and events

InvestEGGator
"artificial sea turtle eggs that … house GSM-GPS tracking devices"

Paso Pacifico
"Our purpose is to build wildlife corridors that protect biodiversity and connect people to their land and ocean."

Meetings and Programs

Click on your Chapter's website link for the latest program information. Programs may be scheduled after newsletter publication.

Chino Valley
20 November;
NO meeting in December

Foothill
Contact the chapter for meeting information

High Desert
9 November; 14 December

Inland Empire
6 November; 4 December

Kern County
9 November; 14 December

Low Desert
7 December

Orange County
13 November; 11 December

Ridgecrest
9 November; 14 December

Santa Barbara-Ventura
Contact the chapter for meeting information.

Santa Clarita
21 November

TOOSLO (San Luis Obispo)
17 November; 15 December

TTCS (Long Beach)
21 November; 19 December

Valley
20 November; 18 December

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