

VELADOR

Using Science-based Conservation to Protect Sea Turtles and Their Habitats Since 1959

Issue 1, 2010

Record Cold Leads to Unprecedented Turtle Rescue



Blair Witherington / FWC Florida Marine Research Institute

Healthy, recovered cold-stunned green turtles are transported in the back of a minivan to be released into warmer waters.

The unusually cold weather that blanketed Florida during January led to a chaotic beginning of the year. Sea turtles normally don't show up on Florida's shores until at least March, when the first leatherbacks start returning to nest. But this year was far from normal.

By mid-January, sea turtles by the thousands were washing up on Florida's beaches or drifting helplessly in inland bays and waterways. The turtles had been sub-

jected to sub-freezing temperatures that dipped into the 20s for over a week across much of the state. Because they are cold-blooded animals, sea turtles cannot regulate their body temperatures. If they are caught off guard by prolonged cold and unable to migrate south to warmer water, sea turtles can become "cold-stunned," which renders them virtually lifeless. Left to fend on their own in this state, most would die—either from drowning, as

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Reducing the Impacts of Climate Change on Sea Turtles



David Robinson

Despite their evolutionary success over 100 million years, sea turtles are significantly threatened by climate change and ocean acidification, which are two of the most daunting environmental challenges of our time. Through the burning of fossil fuels, billions of tons of carbon dioxide added to our atmosphere and the oceans since the beginning of the Industrial Revolution are creating profound environmental changes. Today, as more than six billion people on Earth strive for better lives, the links between energy use, resource consumption, climate change and sea turtle survival are becoming clearer.

CCC's work over the last 50 years has included the collection of standardized data sets that provide scientists and resource managers with valuable baseline information about sea turtle populations at some of the world's most important nesting and foraging sites. CCC's research is producing reliable long-term information related to nesting patterns, sand temperature, nesting and emergence success and sex ratios. This information is being utilized by CCC scientists and others to implement rational strategies for the long-term protection and recovery of sea turtle populations.

Because the sex of developing sea turtle embryos is dictated by the temperature at which they incubate, some conservationists are concerned that unnaturally warm temperatures on nesting beaches are producing inappropriately high numbers of female turtles (which tend to be produced when incubation temperatures are hotter). Some likewise are convinced that this is harmful to sea turtle populations, and they have developed what they think are appropriate solutions to the problem. Thus, it has become the tactic of a few turtle protection groups to begin manipulating the beach environment to produce more shade, while moving eggs to hatcheries where incubation temperatures can be regulated to produce what is thought to be a more desirable ratio of male to female hatchlings. For many turtle advocates, foundations and philanthropists eager to contribute to programs that address climate change, this seemingly simple solution is almost too good to resist.

CCC would like to offer a word of caution. This is a situation that we believe calls for an adherence to the "precautionary principle." Specifically, we'd like to urge other groups not to pursue an interventionist-strategy at this time. We all are concerned about the potential effects of global warming on sea turtle sex

VELADOR {bel.a.dor}

In Caribbean cultures, **Velador** translates as "one who stands vigil" — originally referring to turtle and egg harvesters who waited at night for turtles to come ashore. Now CCC claims this title for its newsletter, and around the Caribbean CCC's researchers and volunteers are replacing poachers as the new veladors.

The **Velador** is published for members and supporters of the nonprofit **Caribbean Conservation Corporation**.

CCC is dedicated to the conservation of sea turtles through research, advocacy, education and the protection of the habitats upon which they depend.

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ratios, but we know of no scientific studies that support intervention and manipulation of incubation temperatures of sea turtle nests in the context of global warming. Money would be better invested in first determining the natural sex ratios in sea turtles around the world, rather than jumping immediately to manipulate the system with introduced shade on the beach, sprinkling regimes, hatcheries, etc. Unfortunately, it can be difficult to raise the money necessary to fund basic science.

Based on the data that are available, skewed sex ratios seem to be the norm, rather than the exception, as indicated by decades of study on loggerheads in Florida. It's likely that the picture is actually very complex—populations encompassing a large geographic span may have differing sex ratios in different areas that may be complementary. Also, even if pivotal temperatures and sex ratios can be established for the various populations of each species, the likelihood that manipulation of the nests would inadvertently affect other aspects of the biology of the turtles is very high. Given the absence of a scientific consensus that sex ratios are being unnaturally skewed by warming—and that a skew toward more female hatchlings would actually be “bad” for recovering turtle populations, we urge great caution before attempting to physically manipulate sex ratios at nesting beaches.

Ultimately, the robustness and resiliency of sea turtle populations will be their best protection from the adverse impacts of climate change. CCC is using its expertise on coastal development issues to promote beach management strategies that are helping communities prepare for and adapt to sea level rise. As a leading advocate for coastal policy reforms, CCC is bringing about resource management policies that better protect sea turtles and their habitats from the impacts of climate change. In a parallel fashion, our focus on reducing ongoing threats to turtles, such as capture in fisheries, marine pollution and exploitation, ensures that populations are as healthy as possible and better able to adapt to the impacts of climate change.

On the national level, CCC is collaborating with other conservation groups to support climate change legislation that addresses the wildlife, plants and natural habitats most affected by our changing climate. We also support state and federal adaptation plans for species and their habitats at risk from climate change. For example, in Florida, CCC participated as a member of Governor Charlie Crist's “Climate Action Team.” Through this and other advisory panels, we are playing a key role in the development of policies aimed at reducing and adapting to climate change in this state. In addition, as a guiding member of the Florida Coastal and Ocean Coalition, CCC co-authored the report, “Preparing for a Sea Change in Florida.” This lays out strategies to help the state confront climate change through ecologically and economically sound policies that protect critical habitats and allow the state to adapt to rising sea levels and extreme weather. These strategies, which have been distributed widely and

are also available for download on CCC's website, could serve as a model for other coastal states.

While CCC continues to address the impacts of climate change and encourage policies that help us and sea turtles adapt, we must also work to reduce the root causes of the problem.

As a major consumer of the world's energy resources, the United States has an obligation to help stem climate change, and we have the ingenuity and financial incentive to address this problem. Unfortunately, the sense of urgency, leadership and requisite grassroots support needed to make major, bold changes in energy use and consumption are presently lacking here and in much of the world. We all must speak out more urgently on this issue and take personal action in order to bring about real changes—for the sake of both sea turtles and people. 🐢



The Caribbean Conservation Corporation has conducted research on the nesting green sea turtle population since Dr. Carr first arrived in Tortuguero in the early 1950s.

By David Godfrey
CCC Executive Director

...from cover

they are too weak to lift their heads to breathe, or from predators that attack the turtles as easy prey.

Fortunately, Florida is blessed with a diverse group of dedicated people who monitor and protect sea turtles. Through the heroic efforts of state and federal agency staff, nonprofit groups, volunteers, aquariums, businesses and CCC staff members, thousands of sea turtles were saved from certain death through what was likely the largest sea turtle rescue effort in history.

As soon as water temperatures started getting dangerously low (into the mid-40s), turtle monitors in the Florida Panhandle were on the lookout for cold-stunned turtles. As news spread that turtles had begun washing ashore, teams of people around the state began scouring coastlines and inland waterways looking for more affected turtles. Cold-stun events do happen with some regularity in Florida. About every three or four years, temperatures will drop low enough to stun up to a hundred or so turtles in places like the Panhandle or along Florida's northeast coast. But what occurred this year was unprecedented.

When temperatures started to plunge, many sea turtles probably began migrating south in search of warmer waters. Unfortunately, the geography of Florida's coastline includes a number of bays and inland waterways that can trap turtles heading south. It was in these locations, such as St. Joseph Bay in the Panhandle and the Mosquito



Over 2,500 sea turtles, mostly juvenile greens, were rescued and evaluated at Merritt Island Wildlife Refuge.

cumbed to the cold. They were gathered up as quickly as possible by teams of people working around the state and transported to a variety of facilities set up to handle sick or injured sea turtles. The facilities that normally take in cold-stunned turtles were quickly overrun, and makeshift triage centers were set up to house and warm up the turtles as best as possible. One of the main facilities taking in turtles was set up at the Merritt Island National Wildlife Refuge near Daytona Beach. It was here that CCC staff members traveled to help with the rescue effort. Joining members of our Gainesville-based staff was CCC's Scientific Director, Dr. Emma Harrison, who flew in from Costa Rica.

The scene was surreal when

CCC's team arrived to help with the turtles coming in to the Merritt Island facility. Close to 600 sea turtles covered the floor of a large machine shop that was serving as a sort of M.A.S.H. unit for the rescue operation. The turtles ranged from Frisbee-sized green turtles to lumbering 300-pound loggerheads that insisted on crawling across everything and everyone. A giant diesel-powered heater was warming up the turtles as it pumped hot air into the facility. The massive heater was on loan from NASA, which uses it to heat parts of the space shuttle before launch.

Coordinating the rescue effort at this facility was a core group of state, federal and private scientists, including Dr. Anne Meylan and Karrie Minch with the Florida Wildlife Conservation Commission, Barbara Schroeder with the National Marine Fisheries Service and Dr. Jane Provancha, a biologist who monitors sea turtles and other wildlife around the Kennedy Space Center. Dozens of others were on hand, assisting with every aspect of the rescue effort. CCC's staff was there to help document and transport turtles, sort out those with injuries or signs of fibropapillomas tumors, and prepare turtles for transportation to facilities where they could receive immediate veterinary care.

The scene could best be described as organized chaos, but the system worked. By the time the cold-stun event ended, over 2,500 turtles had come through this facility alone. Of the 4,500-plus turtles affected statewide from the cold, 948 died. That is a tragic number, to be sure, but the silver lining was seeing thousands of turtles released unharmed after water temperatures came back up. Many of those turtles would assuredly have died if not for the massive rescue effort. Almost all the turtles affected have now been released, but about 100 remain in long-term

Lagoon on Florida's east coast, where the majority of cold-stunned turtles were found. However, the cold was pervasive across the state, and turtles



State and Federal staff work to evaluate, document and tag the cold-stunned turtles.

were rescued in nearly every coastal county, even as far south as the Florida Keys.

During a 9-day span beginning January 7, a total of 4,592 sea turtles, mostly juvenile green turtles, suc-

care at a handful of facilities in the state.

Following the immediate crisis of the cold-stun event, CCC coordinated a statewide effort to distribute emergency funding to those facilities most in need of reimbursement or ongoing financial support for the care and treatment of affected turtles. CCC was able to award \$20,000 from the Sea Turtle Grants Program, funded by Florida's sea turtle license plate. Contributions from CCC members provided another \$6,000 in emergency relief funding. Also assisting with the relief effort was Disney's Worldwide Conservation Fund, which coordinated with CCC in the distribution of another \$50,000 in emergency funding.

During the rescue effort, researchers were given unique access to thousands of juvenile sea turtles from Florida waters. This provided a significant amount of important data that are yielding information useful for



David Godfrey, CCC's Executive Director, checks for active, healthy turtles that can be released back into warmer waters.

the management and recovery sea turtles. For example, it was widely noted that there was an unexplained absence of loggerhead sea turtles everywhere that turtles were recovered. While a few loggerheads did come in, the ratio of this species to green turtles was far lower than had been documented during previous



Many cold-stunned turtles were housed in temporary holding facilities, such as the Barrier Island Center, due to the large number of turtles being rescued.

(45%) were loggerheads. Similar ratios were observed in other years as well. Given the alarming decline in adult loggerhead nesting in Florida, this apparent lack of juvenile loggerheads in nearshore waters may be additional cause for concern for this species.

Several significant lessons were learned from this massive rescue effort. Most importantly, that Florida's network of sea turtle regulators, scientists, volunteers and conservation groups is well prepared and committed to dealing with emergencies affecting sea turtles. Nevertheless, some aspects of the rescue could be improved upon. State officials, with input from CCC and others, are preparing a detailed response plan in the event of a similar crisis, which would include improved communication and utilization of available resources. There also is a need to expand the capacity of sea turtle rehabilitation facilities. Over the next few years, CCC will try to utilize the Sea Turtle Grants Program to provide funding that enables rehab facilities to increase their capacity to care for large numbers of turtles. 🐢

cold-stun events. Of the 4,592 turtles rescued, just 93 were loggerheads (2%). By comparison, during a cold stun event in 1981 that affected 162 turtles, 74

Join professional surfer Travis Beckmann as he promotes sea turtle

conservation during his Sea Turtle Surfari!

Online at:

turtlesurfari.cccturtle.org

"I like to think of myself as CCC's ambassador to the surfing world. Everyone associated with the surfing culture loves the ocean and beaches—just like sea turtles. So we, as much as anyone else, should be standing up for the protection of these amazing marine animals."

- Travis Beckmann



Photo by Brian Bellman

Double Trouble: Climate Change and Ocean Acidification

In recent years the world has experienced some of the hottest years ever recorded. Scientists warn that climate change resulting from the heat-trapping effect of carbon dioxide (CO₂) and other gases released into the atmosphere is accelerating, and the world is becoming warmer at a rate not anticipated just a decade ago. As polar ice melts, mountain glaciers shrink, and deserts expand, biologists and resource managers everywhere face the challenge of how to prepare for the changes to come.

As significant as these threats are, however, they represent only part of the problem created by the emission of 250 billion metric tonnes of greenhouse gases since the beginning of the Industrial Revolution. While half the world's CO₂ has remained in our atmosphere, the other half has dissolved in the oceans to be taken up by marine plants or, in combination with seawater, to become carbonic acid. As a result, the world's naturally alkaline oceans have already become 30% more acidic in a process known as "ocean acidification." The twin threats of climate change and ocean acidification pose major problems not only for marine species but for life on Earth.

Climate Change

According to the 2007 Intergovernmental Panel on Climate Change, the average temperature of the Earth has risen .76 °C in the last 150 years. Covering nearly 70% of the Earth's surface, the oceans have a profound influence on global climate and the atmosphere. In a continuous cycle, oxygen produced by marine plants through photosynthesis is released into the atmosphere and atmospheric carbon dioxide is absorbed by the oceans.

Temperature is a major driver in ocean ecosystems. As ocean waters warm, they expand. Some low lying and coastal areas are already being inundated as a result of climate change. Warmer waters have also increased the melting of glaciers, adding fresh water to the oceans. As surface waters warm and mix less with deeper more productive waters, circulation patterns and ocean productivity will change. Because many species exist only within a very narrow temperature range, changes in ocean temperature are expected to affect marine habitats and

biodiversity, resulting in shifts in geographic range and abundance for algae, plankton, fish, and other species.

This is a particularly critical issue for microscopic plankton at the base of the food web, creating a chain reaction throughout marine ecosystems.

Ocean Acidification

Ocean chemistry is complex, and not surprisingly, the oceans are not chemically uniform. Through the addition of CO₂ and subsequent creation of carbonic acid, the oceans have become measurably more acidic in the last several hundred years. Ocean acidification will alter the oceans significantly, but this process is poorly understood today. Unfortunately, it was not addressed by governments at the global climate talks in Copenhagen in December 2009. Despite our ignorance, however, ocean acidification poses a huge threat to marine species and will continue to worsen for some years to come. The effects will be widespread, but the species most at risk are those which use calcium carbonate to build shells and reefs.

Sea water has a pH of 7.8 to 8.5 (for pH, the most acidic measure is 1 and the most alkaline measure is 14). Like the Richter scale, which monitors the intensity of earthquakes, the pH scale is a logarithmic measure of how alkaline or acidic a solution is; small numerical changes in pH represent major chemical changes. Thus far, the pH of the oceans has decreased by .1, which represents a 30% increase in acidity. But the actual pH of the oceans is less important than the chemical reactions that occur

as a result of more acidity. Like changes in water temperature, these chemical changes will have adverse effects on species at the base of the marine food.

Additional threats to marine ecosystems from climate change and ocean acidification separately or in tandem include the following issues:

- 200 million year-old coral reefs, which flourish only within a very narrow temperature range, are at risk from warmer waters and acidification.
- All tropical marine organisms that live close to the upper level of their temperature tolerance will be threatened by warmer water.
- Tropical marine organisms with higher metabolic rates will have to contend with less dissolved oxygen in warmer waters (seawater saturated with oxygen has 35%



It is possible that a world in which sea turtles can not survive may become a world in which humans struggle to survive.



David Robinson

Sea turtles and millions of other marine species depend on healthy marine environments.

less oxygen at 30° C than at 8° C).

- Warmer waters reduce the movement of nutrients from the cooler ocean depths to waters close to the surface in a process known as upwelling. Fewer nutrients in surface waters result in species mortality and depresses reproduction.
- Dust from climate-induced desertification will stress marine environments as it is carried by wind to the sea.
- Acidification will decrease the availability of key nutrients, including nitrogen, phosphates, silica and iron and in turn reduce the growth of plankton.
- As seawater becomes more acidic, it absorbs less low and mid-frequency sound. As a result, sound will travel further and increase the background noise with which marine animals have to contend.

How will climate change and ocean acidification affect sea turtles?

Sea turtle biologists are beginning to assess how changes in major ocean currents, key habitats, weather patterns, and prey abundance and distribution resulting from climate change and ocean acidification will affect sea turtles and their reproductive fitness. Numerous habitats utilized by the world's seven species of sea turtles, including beaches, sea grass beds, coral reefs, near-shore bottom areas, and the waters of the open ocean will be altered.

Nesting habitat will be lost with more severe storms, rising sea levels, and eroding beaches; nests will be subject to increased precipitation or drought, inundation, and changing temperature. Hotter beaches will put sea turtle embryos at risk. During development, the sex of an embryo is determined by the heat of incubation, with warmer nests producing females and cooler nests producing males, but temperatures above 33° C are lethal.

The seagrasses on which green turtles depend will become less productive as a result of warmer water, increased sedimentation and runoff from coastal flood-

ing, and decreased visibility and light penetration. Near-shore habitats where some species forage will also be destroyed by coastal flooding and decreased visibility; for prey such as crabs which are dependent on their ability to make shells, acidification will have a marked effect. In the coral reefs with which hawksbills are closely associated, increased water temperatures and acidification will undermine the ability of coral polyps to survive and build reefs. Because some species of fish are losing their olfactory sensibility and homing ability in more acidic waters, the potential exists for sea turtles to suffer the same fate. Other threats include changes in the timing of nesting and variation in prey abundance and range.

The Future

Global temperature increases of 1.5 to 2.5° C above pre-industrial levels will expose a third of the world's species to a greater risk of extinction. If we are to limit global temperature increases to just 2° C, within the next 10 years emissions of CO₂ and other heat-trapping gases must be reduced by 25% to 40% from 1990 levels. Some prominent scientists go even further to suggest that global CO₂ levels need to be reduced from the current 387 ppm (parts per million) to 350 ppm.

Each year the world's seas are absorbing an additional two billion metric tonnes of carbon. On average, each American adds about 40 pounds of carbon dioxide to the oceans every day. Each of us should be taking steps to reduce our carbon footprint. Most importantly, we need to become better informed about CO₂, climate change and ocean acidification. Al Gore's new book "Our Choice" provides excellent information and solutions. Several worthwhile Internet resources include a New Yorker article by Elizabeth Kolbert entitled "A Darkening Sea"; a carbon calculator at www.soprisfoundation.org (found in the "Projects" section); and an "Ocean Acidification Summary for Policy Makers 2009" available at www.ocean-acidification.net. On PBS, look for the film "A Sea Change" directed and co-produced by Barbara Ettinger.

As CCC continues to focus on the substantial threats to sea turtles and the habitats on which they depend, our activities are protecting countless other marine and coastal species. An underlying goal of our work is to ensure that sea turtles are as resilient as possible so they can withstand future survival challenges. With this in mind, CCC is working hard to reduce existing threats over which we can exert some control, such as incidental capture in fisheries and disturbance of nesting habitats, while at the same time preparing for the future impacts of climate change through education and policy initiatives. 🐢

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US Policy News

U.S. Proposes to List Loggerhead Sea Turtles as Endangered; An Endangered Species Act Success Story Turned on its Head

Caribbean Conservation Corporation (CCC) applauds a proposal by the U.S. Fish and Wildlife Service and NOAA Fisheries Service (Services) to designate Northwest Atlantic loggerhead turtles as Endangered. This proposed change from Threatened to Endangered recognizes the plight of rapidly declining American loggerheads, which nest on beaches from North Carolina to Texas and until 1998 were an Endangered Species Act success story.

Florida accounts for 90% of loggerhead nesting in the U.S. Protection provided by the Endangered Species Act and implementation of regulations requiring Turtle Excluder Devices in shrimp nets to prevent the drowning of entrapped turtles contributed to encouraging nesting increases from 1986 to 1998. Since that time, however, nesting throughout Florida has declined by over 40%.

Loggerheads face numerous threats onshore where they nest and at sea, but accidental capture, injury and death in commercial fisheries is perhaps the greatest peril to their survival today.

“This proposal is long overdue,” said David Godfrey, CCC’s Executive Director.

The varied loggerhead diet of soft invertebrates and hard-shelled animals puts the species more at risk from fisheries than any other species of sea turtle.

“Overwhelming evidence points to accidental capture in fishing lines, hooks, nets and dredges as the main culprit in these declines,” continued Godfrey. “International fleets capture, injure and kill tens of thousands of loggerheads on the high seas every year. In U.S. waters, the National Marine Fisheries Service (NMFS) has allowed

fisheries to kill thousands of large and small loggerheads rather than adequately regulate fishing.”

Godfrey warned that much of what has been accomplished for this species will be lost if serious fisheries policy reform aren’t implemented soon.

CCC has worked for decades to protect loggerhead nesting sites and promote sensible coastal development policies. The State of Florida and county governments have enacted laws and regulations to protect sea turtles. And a strong network of volunteer turtle groups around Florida and in most states where turtles nest have been working for years to monitor and protect this species.

Despite these combined efforts, loggerheads are slipping closer toward extinction. Clearly, much more needs to be done to protect loggerhead sea turtles in Florida, the United States, and throughout the world, said Godfrey

“Despite the proposed new endangered status for this species, loggerheads can still be saved if U.S. efforts are appropriately focused.” Godfrey said. “For starters, the National Marine Fisheries Service should take immediate steps to curtail loggerhead capture in fisheries.”

CCC advocates year-round area restrictions for the reef fish bottom longline fishery in the Gulf of Mexico and requirements for Turtle Excluder Devices in all U.S. trawl net fisheries. In addition, local and state governments must adopt comprehensive changes in coastal management policies to ensure adequate protection of nesting beaches, Godfrey added. We know how to achieve the same results for loggerheads, if the U.S. and other governments have the will.

