

Changing Skies Over Central North Carolina

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NOAA'S NATIONAL WEATHER SERVICE RALEIGH, NC

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An In-depth Look at the 2016 Atlantic Hurricane Season

The 2016 Atlantic hurricane season got off to an early start with the development of Subtropical Storm Alex on January 13th. Alex intensified to hurricane status the following day, becoming only the second Atlantic hurricane on record to form in January. Following Alex, three additional tropical storms formed in the Atlantic in May and June: Bonnie, Colin, and Danielle. Two of these storms—Bonnie and Colin—impacted portions of the Carolinas, with Bonnie making landfall as a tropical depression near Charleston, SC on May 29th. Alex and Danielle steered clear of the United States, though Danielle did impact portions of Mexico.

Latest forecasts indicate that near to above-normal activity is anticipated through the remainder of the Atlantic hurricane season. NOAA is forecasting that 10-16 named cyclones (tropical storm strength or greater, 39-73 mph sustained winds), 4-8 hurricanes (greater than 74 mph sustained winds), and 1-4 major hurricanes (130 mph or greater sustained winds) can be expected, including the four named storms that have already occurred. For comparison, the average season sees approximately 12 named storms, 6 hurricanes, and 3 major hurricanes.

How is a seasonal forecast created?

We've all heard it said: "You can't get today's forecast right; how can you make a forecast for the next five months?!" We can debate the former point, but the question is certainly worth ad-

these anomalies are felt globally throughout the atmosphere.

Across the tropical Atlantic, an El Niño (associated with a positive Oceanic Niño Index, or ONI) is typically associated with stronger vertical wind shear. This shear is det-



The Atlantic hurricane season began on June 1 and runs through November 30.

ressing.

Producing seasonal forecasts requires a different paradigm than day-to-day operations, focusing on hemispheric patterns that change on longer time scales than those that tend to impact our daily weather variations. One such pattern that is well-known is the El Niño-Southern Oscillation (ENSO). Although El Niño's phase (positive or negative) is directly related to sea surface temperature anomalies in the tropical Pacific, effects stemming from

rimental to the development or strengthening of tropical cyclones. Accordingly, an El Niño is generally thought to coincide with below average tropical cyclone activity in the Atlantic. On the other hand, a La Niña (associated with a negative ONI) tends to coincide with an above average Atlantic hurricane season, as wind shear tends to be weaker across the tropical Atlantic.

Taking a look back at the ten strongest El Niños and (continued on Page 4)





“While the risk for devastating hurricane hazards is greatest along and near the coast, the entire state of North Carolina is susceptible to hurricane hazards such as inland flooding from heavy rains, destructive winds, and tornadoes.”



Preparedness is Paramount During Hurricane Season



Hurricanes are among nature's most powerful and destructive phenomena. On average, 12 tropical storms, 6 of which become hurricanes form over the Atlantic Ocean, Caribbean Sea, or Gulf of Mexico during the hurricane season which runs from June 1 to November 30 each year. Over a typical 2-year period, the U.S. coastline is struck by an average of 3 hurricanes, 1 of which is classified as a major hurricane (winds of 111 mph or greater). While the risk for devastating hurricane hazards is greatest along and near the coast, the entire state of North Carolina is susceptible to hurricane hazards such as inland flooding from heavy rains, destructive winds, and tornadoes. Hazards specific to our state's coastal areas include storm surge flooding, high surf and rip currents. It's important to remember that while hurricanes pose the greatest threat to life and property, tropical storms and depression also can be devastating. By knowing what actions to take before the hurricane season begins, when a hurricane approaches, what action to take when the storm is in your area, and what to do after a hurricane leaves

your area, you can increase your chance of survival.

What to Do Before the Tropical Storm or Hurricane

The best time to prepare for a hurricane is before hurricane season begins on June 1. It is vital to understand your home's vulnerability to storm surge, flooding, and wind. Here is your checklist of things to do BEFORE the hurricane season begins.

1. If you live or have property near the coast, know your zone. Find out if you live in a hurricane evacuation area by contacting your local government/emergency management office or by checking their evacuation website.
2. Before an emergency happens, sit down with your family or close friends and decide how you will get in contact with each other, where you will go and what you will do in an emergency. Keep a copy of this plan in your emergency supplies kit or another safe place where you can access it in the event of a disaster. Start at the Ready.Gov emergency plan webpage.
3. Put together a basic disaster supplies kit and consider storage locations for different situations. Check emergency equipment, such as flashlights, generators and storm shutters.
4. Review your insurance policy to ensure that you have adequate coverage for your home.
5. Understand NWS forecast products, especially the meaning of NWS watches and warnings.

Actions to Take When a Tropical Storm or Hurricane Threatens

When a hurricane threatens your community, be prepared to evacuate if you live in a storm surge risk area. Allow enough time to pack and inform friends and family if you need to leave your home.

1. Secure your home: Cover all of your home's windows. Permanent storm shutters offer the best protection for windows. A second option is to board up windows with 5/8 inch exterior grade or marine plywood, built to fit and ready to install. Buy supplies before the hurricane season rather than waiting for the pre-storm rush.
2. Stay tuned in: Check the websites of your local National Weather Service office and local government/emergency management office. Find out what type of emergencies could occur and how you should respond. Listen to NOAA Weather Radio or other radio or TV stations for the latest storm news.
3. Follow instructions is-

sued by local officials. Leave immediately if ordered!

4. If NOT ordered to evacuate:
 - a. Take refuge in a small interior room, closet or hallway on the lowest level during the storm. Put as many walls between you and the outside as you can.
 - b. Stay away from windows, skylights and glass doors.
 - c. If the eye of the storm passes over your area, there will be a short period of calm, but at the other side of the eye, the wind speed rapidly increases to hurricane force winds coming from the opposite direction.

NOAA Weather Radio or the local news for the latest updates.

2. If you evacuated, return home only when officials say it is safe.
3. Once home, drive only if necessary and avoid flooded roads and washed-out bridges. If you must go out, watch for fallen objects in the road, downed electrical wires, and weakened walls, bridges, roads and sidewalks that might collapse.
4. Walk carefully around the outside of your home to check for loose power lines, gas leaks and structural damage.
5. Stay out of any building if you smell gas, if floodwaters remain around the building or if the building or home was damaged by fire and the authorities have not declared it safe.

6. Carbon monoxide poisoning is one of the leading causes of death after storms in areas dealing with power outages. Never use a portable generator inside your home or garage. Review generator safety.
7. Use battery-powered flashlights. Do NOT use candles. Turn on your flashlight before entering a vacated building. The battery could produce a spark that could ignite leaking gas, if present.

For more information about hurricane safety and preparedness, please visit the following web sites:

www.weather.gov/hurricane

Ready.Gov

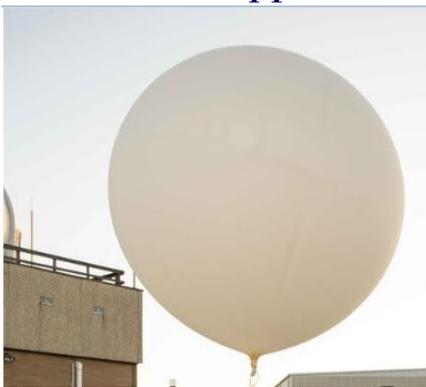
ReadyNC.org

-Nick Petro

After the Storm

1. Continue listening to a

Greensboro Upper Air Achieves Perfect Performance Score



Weather balloon at GSO

Weather balloons are an extremely important part of the network of global observations that go into the models to help them establish the initial conditions that will allow the forecast to be as ac-

curate as possible. Every month, 92 upper air sites around the country launch 5,700 balloons in support of the National Weather Service’s mission to save lives and property. In June, the Greensboro upper air site achieved a perfect performance score of 300, tied for best in the nation. The performance score was developed in 1998 as an aid to help evaluate NWS upper-air station performance nationwide and improve data availability, quantity, and quality.

“I understand that the station

rank isn’t everything, but that number one spot is not earned by accident- it is a team effort; owing to every aspect of the operation coming together just right. Supplies must be fresh, equipment must be well-maintained, and all the people involved must be skilled, reliable, and 100% committed to excellence,” said GSO Station manger Chris Gatti. The NWS in Raleigh salutes the staff of the GSO upper air site for their hard work and commitment to reliable weather data.

-Ryan Ellis

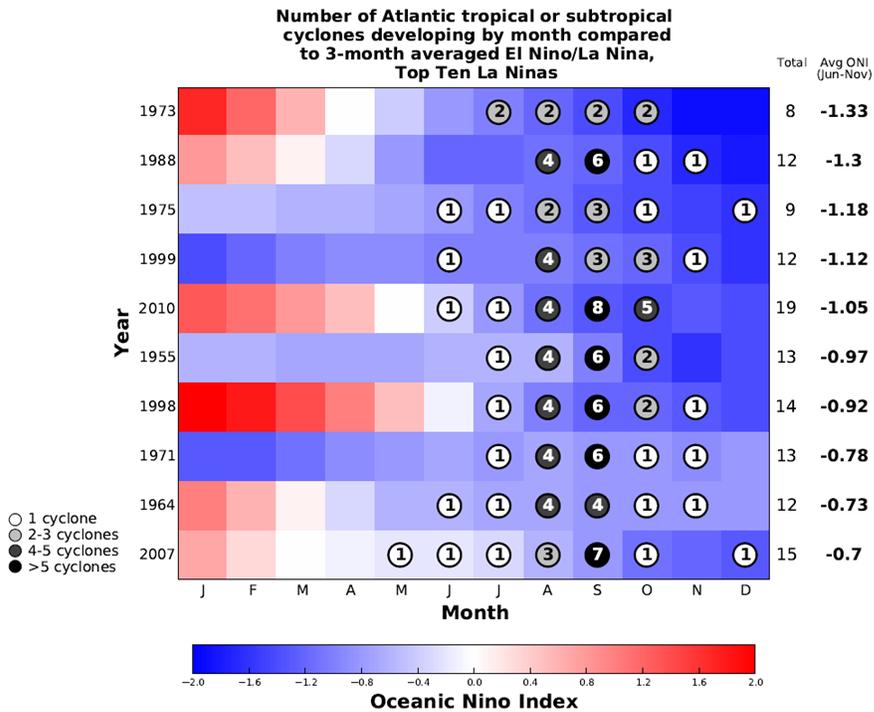
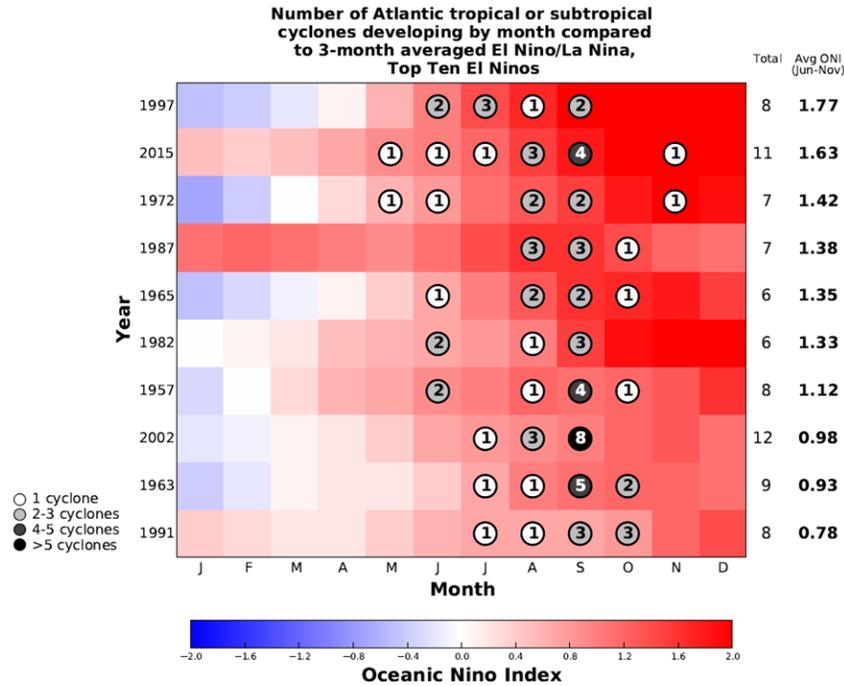




“Latest three-month-averaged values of the ONI (averaged over April-May-June) suggested a weak El Niño was still in progress. However, values have since trended toward neutral, and the Climate Prediction Center suggests that a transition to La Niña conditions could occur this summer.”



2016 Hurricane Outlook (continued from page 1)



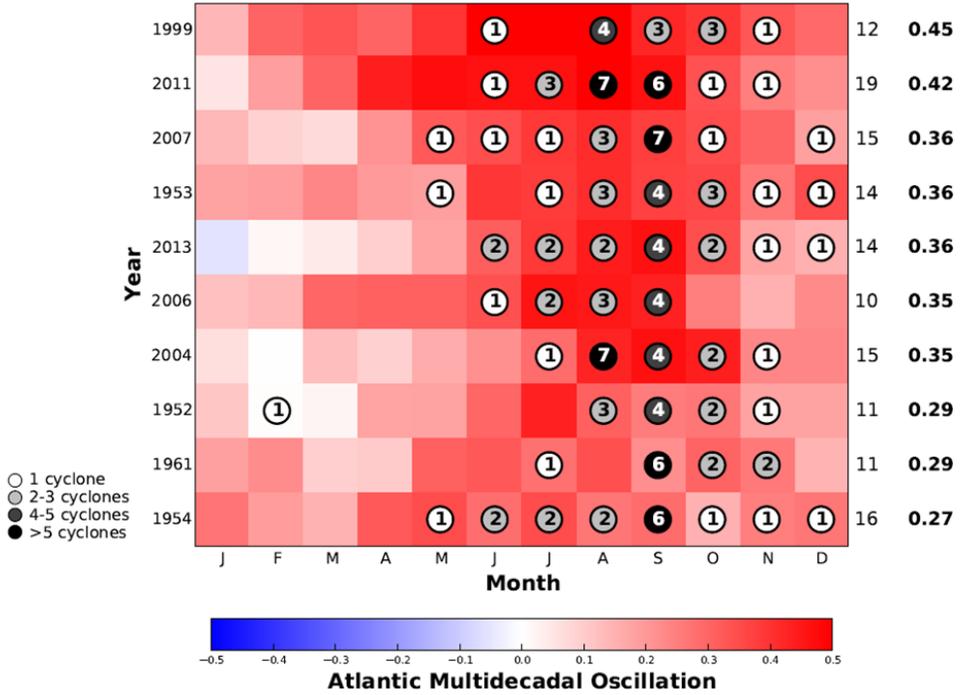
The Atlantic Multidecadal Oscillation (AMO) is somewhat similar to ONI, as it is an index based upon sea-surface temperature (SST) anomalies. However, the AMO varies from the ONI in two respects. First, its phase (warm or cool) is determined by SST anomalies in the Atlantic, rather than the Pacific. Further, the AMO tends to vary over a longer time period than ONI—on the order of decades rather than year-to-year.

La Niñas during hurricane seasons since 1950, there is indeed—on average—a general decrease in the total number of tropical or subtropical cyclones developing in the Atlantic during El Niño

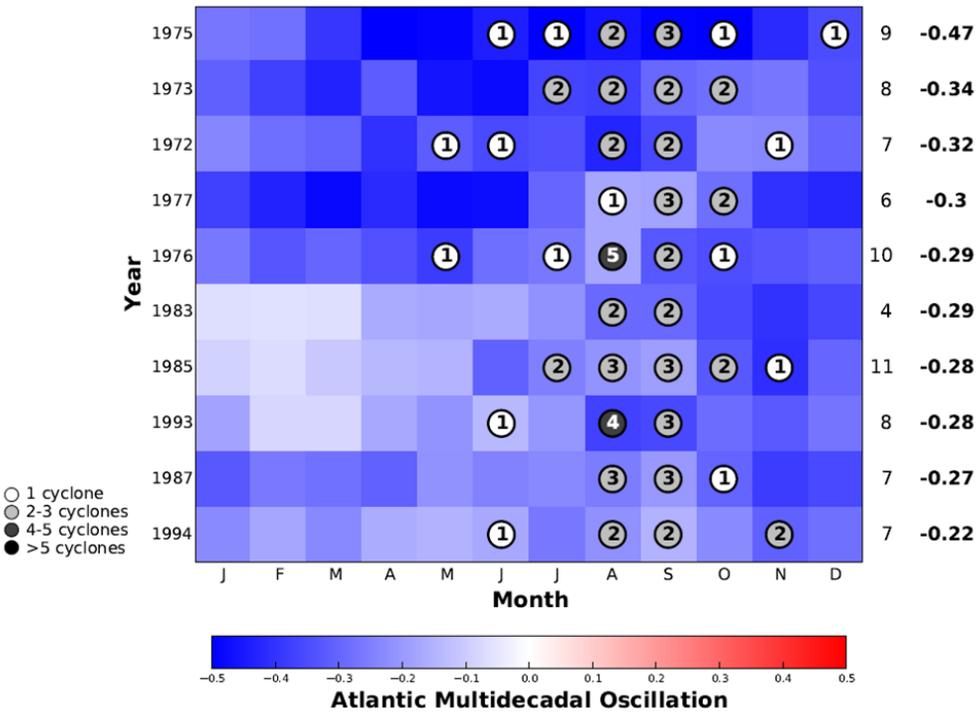
conditions. Only two of the ten strongest El Niños were associated with ten or more Atlantic tropical or subtropical cyclones, compared to eight of the ten strongest La Niñas.

with below-average Atlantic SSTs. Given that tropical cyclones thrive on warm waters, it stands to reason that there would be a positive correlation between the

Number of Atlantic tropical or subtropical cyclones developing by month compared to monthly averaged AMO, Top Ten



Number of Atlantic tropical or subtropical cyclones developing by month compared to monthly averaged AMO, Bottom Ten



while, 80% of the Atlantic hurricane seasons associated with the ten lowest average AMO values saw less than ten tropical cyclones.

How do current values compare?

Latest three-month-averaged values of the ONI (averaged over April-May-June) suggested a weak El Niño was still in progress. However, values have since trended toward neutral, and the Climate Prediction Center suggests that a transition to La Niña conditions could occur this summer. The latest monthly averaged AMO value (from May) was 0.359, which corresponds to a fairly strong positive AMO. Generally positive conditions are expected to continue through the hurricane season. Based on the previous analysis, current trends are consistent with the forecasts of above average tropical cyclone activity during this Atlantic hurricane season.

-Keith Sherburn

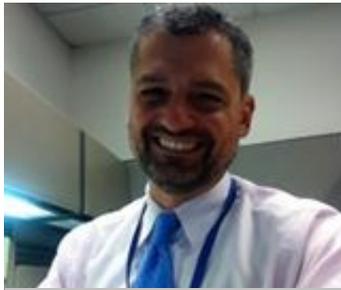


AMO and Atlantic tropical cyclone activity. Indeed, the Atlantic hurricane seasons with the

ten highest average AMO values were all associated with ten or more tropical cyclones. Mean-



NWS Raleigh Welcomes New Meteorologist-in-Charge



Jason Franklin

This July, the National Weather Service Forecast Office in Raleigh, NC welcomed its newest team member, Meteorologist-in-Charge, Jason Franklin. Jason started his career with the National Weather Service as an Intern at Weather Service Office (WSO) Atlantic City, NJ in

1993. He then moved to Weather Forecast Office (WFO) Mt. Holly, NJ and then to WFO Taunton, MA as a General Forecaster. In 2003, he became the Mesoscale/Regional Aviation Meteorologist (RAM) in Eastern Region's Meteorological Services Division on Long Island, NY. As RAM, Jason helped to coordinate access to Federal Aviation Administration (FAA) Terminal Doppler Weather Radars (TDWRs). He was a key member of the Center Weather Service Unit Requirements Team, helping NWS formulate a response to FAA's CWSU require-

ments. In 2008, he was promoted to Warning Coordination Meteorologist at WFO Charleston, WV. Two years later he moved on to Weather Service Headquarters, serving on the Director's staff as the agency's Chief Negotiator. Jason assisted with on-site Decision Support Services at FEMA Region II during Hurricanes Irene and Sandy. In 2012, Jason returned to Eastern Region as the Meteorologist-in-Charge of WFO Buffalo, NY. He is a graduate of SUNY Albany.

**-Jason Tuell
Eastern Region Director**

NWS Raleigh Bids Farewell to Forecaster Katie Dedeaux



Katie Dedeaux

This August, the National Weather Service in Raleigh will say farewell to journeyman forecaster Katie Dedeaux who has accepted a promotion to the NWS forecast office in San Angelo, Texas where she will begin a new adventure as the senior service hydrologist. While still spending some of her time forecasting, her new position will include duties related to flooding and drought as well as other water related duties.

During her time at the Raleigh forecast office, Katie has worked a wide variety of weather events including the April 16, 2011 tornado outbreak, several winter storms and a few tropical events as well.

Katie led the aviation weather program at the Raleigh office and brought the outreach program to new heights, giving several talks at flying clubs around central NC and running several workshops geared towards general aviation pilots. She is also involved in an ongoing research project which is looking at low level wind shear events in central NC.

In addition to the aviation

program, Katie spent many shifts working on the office's storm data program which helps to verify and document every severe weather warning that occurs in central NC.

Foreshadowing her current promotion, Katie worked with the current hydrologist to help survey river gauges and make presentations to NWS Raleigh's hydrology partners.

Above all, Katie's infectious personality and compassion for others made her a favorite of the entire staff and we will sorely miss her.

From all of us here at WFO Raleigh, congratulations Katie and best of luck in your new position!

-Ryan Ellis



Ten Dangers at the Beach

Rip Currents

Rip currents account for more than 80 percent of rescues performed by surf beach lifeguards. They are powerful, channeled currents of water flowing away from shore that quickly pull swimmers out to sea. Rip currents typically extend from the shoreline, through the surf zone, and past the line of breaking waves. The best way to stay safe is to recognize the danger of rip currents. If caught in one, don't fight it! Swim parallel to the shore and swim back to land at an angle. Always remember to swim at beaches with lifeguards.

Shorebreak

A shorebreak is an ocean condition when waves break directly on the shore. Both small and high waves can be equally as unpredictable and dangerous and typically form when there is a rapid transition from deep to shallow water. The power of a shorebreak can cause injuries to extremities and the cervical spine. Spinal cord injuries most often occur when diving head-first into the water or being tumbled in the waves by the force of the waves. Be sure to ask a lifeguard about the wave conditions before going into the water.

Lightning

Since 2006, an average of 33 people have been killed annually by lightning in the United States. Already in 2014, seven people have died due to lightning strikes. There is no safe place outside when thunderstorms are in the area. When thunder roars, go indoors! The safest places during lightning activity

are substantial buildings and hard-topped vehicles. Rain shelters, small sheds, and open vehicles are not safe. Wait 30 minutes after the last thunder crack before going back to the beach.

Tsunamis

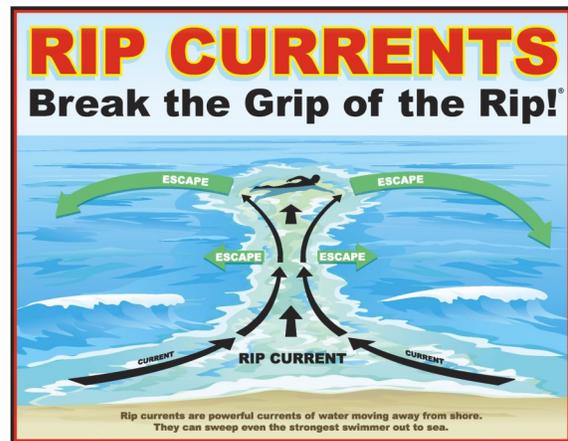
A tsunami is a series of ocean waves generated by any rapid large-scale disturbance of the sea water. Most are generated by earthquakes, but may also be caused by volcanic eruptions, landslides, undersea slumps, or meteor impacts. The tsunami wave may come gently ashore or may increase in height to become a fast moving wall of turbulent water several meters high. Although we can't prevent them, the effects can be reduced through preparedness, timely warnings, and effective response.

Jellyfish

Keep an eye out for jellyfish. All jellyfish sting, but not all have venom that hurts humans. Of the 2,000 species of jellyfish, only about 70 seriously harm or may occasionally kill people. When on the beach, take note of jellyfish warning signs. Be careful around jellies washed up on the sand as some still sting if their tentacles are wet. Tentacles torn off a jellyfish can sting, too. If you are stung, don't rinse with water, which could release more poison. Lifeguards usually give first aid for stings. See a doctor if you have an allergic reaction.

Heat and Sunburn

Too much heat and sun can spoil a vacation. Heat is the leading weather-related killer in the United States, causing more deaths than floods, lightning, tornados, and hurricanes combined. Heat disorder symptoms include sunburn, heat cramps, heat exhaustion, and heat stroke. Spending the day at the beach can lead to



IF CAUGHT IN A RIP CURRENT

- ◆ Don't fight the current
- ◆ Swim out of the current, then to shore
- ◆ If you can't escape, float or tread water
- ◆ If you need help, call or wave for assistance

SAFETY

- ◆ Know how to swim
- ◆ Never swim alone
- ◆ If in doubt, don't go out

More information about rip currents can be found at the following web sites:
www.ripcurrents.noaa.gov
www.usla.org



any of these disorders but the most visible is sunburn, which can take up to 24 hours before the full damage is visible. When a burn is severe, accompanied by a headache, chills, or a fever, seek medical help right away.

(continued on page 8)





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Beach Dangers (continued from page 7)

Harmful Algal Blooms

Harmful Algal Blooms (HABs) (popularly referred to as red tides) are dense populations or "blooms" of algae that form in coastal waters. A small percentage of these blooms can be toxic to marine animals and humans. People can get sick by swimming directly in the water and by eating contaminated shellfish. If a sufficient amount of toxins are ingested, the results can be fatal. Scientists can forecast the timing and location of blooms. This allows coastal managers and public health officials to make decisions regarding shellfish harvesting and beach closures to ensure the health of both residents and visitors.

Water Quality

Coastal beaches are among the most treasured natural resources in the nation, but beach closures or advisories caused by

poor water quality often prevent the public from enjoying these resources. As water flows from land to coastal waters, it is often contaminated by untreated sewage from boats, pets, failing septic systems, fertilizers, and spills from hazardous substances. High levels of bacteria and other chemicals in the water can cause gastrointestinal illnesses in those that swim directly in the water. When visiting the beach, be aware of all beach closures and advisories.

Marine Debris

Our oceans are filled with items that do not belong there. Huge amounts of consumer plastics, metals, rubber, paper, textiles, derelict fishing gear, vessels, and other lost or discarded items enter the marine environment every day, making marine debris one of the most widespread pollution problems facing the world's oceans and waterways.

Often this debris, or litter, ends up on our beaches damaging habitats, harming wildlife, and making it unsafe for beach goers to walk along the shoreline and swim in the water.

Sharks

Shark attacks, though rare, are most likely to occur near shore, typically inshore of a sandbar or between sandbars, where sharks can become trapped by low tide, and near steep drop offs where shark's prey gather. The relative risk of a shark attack is very small but should always be minimized whenever possible. To reduce your risk don't swim too far from shore, stay in groups, avoid being in the water during darkness or twilight, don't go in the water if bleeding from a wound, leave the shiny jewelry at home, and avoid brightly-colored swimwear.

-National Ocean Service