Rip currents are coastal hazards that pose serious threats to life and safety. According to the U.S. Lifesaving Association, 80% of all surf rescues in the United States are related to rip currents. They can occur along any beach with breaking waves and may become especially hazardous during high-surf conditions. Rip currents are dangerous to all swimmers — these powerful currents may develop along the coast at a low spot in an offshore sandbar or adjacent to a coastal structure, where water can be funneled out to sea in a narrow channel.

Rip Current Formation and Characteristics

Rip currents are powerful, channelized currents of swiftly flowing water moving out to sea. They typically extend from near the shoreline, through the surf, and out past the line of breaking waves.

As waves break near the shore, complex wave interactions may generate circulation patterns that result in the formation of rip currents, sending water back out to sea. Along open coasts, rip currents are caused by variations in breaking waves, with waves breaking strongly in some locations and less strongly in others. These variations generate circulation cells causing water to be directed offshore. Along shorelines where sand is deposited in an offshore bar, the rip current often flows through a low spot or channel cut through the sandbar. In coastal areas with structures such as groins or jetties, rip currents may result when currents running parallel to the shore are deflected offshore by the structure.

The inherent variability in rip currents makes them especially dangerous to unwary or uninformed beachgoers. For example, a rip current can be very narrow, or it can extend in widths of up to 50 yards wide or more. The seaward pull of a rip current can end just beyond the line of breaking waves, or it can continue to flow hundreds of yards out to sea. While the average speed of a rip current can range from 1 to 2 feet per second, some of the most powerful rip currents have been measured at speeds of up to 8 feet per second. This is faster than an Olympic swimmer can swim. Changes in the size of the waves also can cause pulses in the strength of a rip current, which can be dangerous to all swimmers and anyone entering the surf.

Rip currents do not pull people under water — they pull people away from shore. Drowning deaths usually occur when people are unable to keep themselves afloat and swim back to shore. This may be due to fear, panic, exhaustion, a lack of swimming skills, or any combination of these factors.

If you get caught in a rip current — remain calm, and try to float or tread water. Don’t swim against the current, as this is difficult for even experienced swimmers. Swim along the shoreline until you feel the current relax, or let the current carry you until it slows down. Then swim toward the shore at an angle. Since rip currents are narrow, it does not take much effort to swim along the shore out of danger’s way. If you are unable to reach shore, wave your arms and yell for help.
Improving Public Safety

Coastal geologists and engineers have been working to increase our understanding of this coastal hazard since the early 1900s. A variety of techniques are used to study rip currents including direct observations, field experiments using instruments in the surf zone, laboratory experiments with wave tanks, and mathematical and computer modeling.

For the past 25 years, coastal engineers at the University of Delaware’s Center for Applied Coastal Research (CACR) have conducted research related to the development and behavior of rip currents and how they function as a mechanism for offshore sediment transport. The center’s research focuses on nearshore circulation patterns as well as the forces that drive rip current formation such as wave-wave interaction, wave-bottom interaction, and wave-structure interaction.

Sea Grant researchers at CACR use computer models and conduct wave-basin experiments to learn more about the development of rip currents. Their 4,500-square-foot wave basin is equipped with an artificial offshore sandbar and a sloping beach. As wave and bottom conditions in the wave basin are varied, data are collected on subsequent changes in rip current conditions. These measurements, along with field data, are used to help test the Nearshore Community Model. NearCoM predicts waves, currents, sediment transport, and other ocean conditions in the nearshore area (extending from the shoreline to a depth of approximately 30 feet). The model consists of a “suite of modules” including SHORECIRC and FUNWAVE, all developed by CACR scientists, that simulate individual physical processes such as ocean circulation and waves.

UD’s Sea Grant College Program also cooperates with the National Weather Service and local beach patrols to improve rip current predictions. The Delaware Atlantic Rip Current Project, a coordinated program between these groups, collects information on rip current rescues as well as physical parameters such as wind speed and direction, wave/swell height and period, and tidal stage. This information can help determine those days that weather conditions may favor the formation of strong rip currents.

The work being done by Sea Grant and other research institutes will contribute to the understanding of rip currents and increase public awareness of their danger.

The Latest Information on Rip Currents

How can you protect yourself against rip currents?
Learn how to swim, and never swim alone. If possible, swim at beaches with lifeguards. When you arrive at the beach, speak with the on-duty lifeguards about rip currents as well as other water conditions expected for the day. And never underestimate the power of the ocean.

Before leaving for the beach, check the forecast on NOAA Weather Radio or on the Web. These services are provided to the public by the National Oceanic and Atmospheric Administration (NOAA).

Information about surf conditions at the Delaware and New Jersey coasts can be found at www.erh.noaa.gov/er/phi/ripcurrent/getSRF.php. Marine forecasts and tidal information for the Delmarva, New Jersey, and New York coasts can be found at www.erh.noaa.gov/er/phi/marine.html.

More information on rip currents can be found on the following Web sites:

- www.ripcurrents.noaa.gov
- www.usla.org
- www.ocean.udel.edu/ripcurrents

1 Dr. Ib Svendsen passed away unexpectedly in December 2004. Before his untimely death, he contributed to the production of this rip current fact sheet. The University of Delaware mourns the loss of a dedicated colleague and friend.