

CATCHING THE CURRENT

Who Goes With the Flow?

Understanding the ecosystem of the South Atlantic Bight and Gulf Stream takes a team of researchers. Using information from coastal ocean observing systems, biologists, chemists, geologists, physicists and oceanographers collaborate to develop tools that support the conservation of marine resources.

Shifting the Gulf Stream

Imagine what happens when a huge volume of water flowing at high speed collides with an unmovable obstacle. This is the situation off the coasts of Georgia and South Carolina when the northward flowing Gulf Stream encounters a rise on the seafloor called the Charleston Bump (Fig. 1). When the two meet, the pattern of flow has to change!

The Charleston Bump, rising nearly 375 m (1235 ft) and covering an area that may encompass more than 3500 sq km (1000 sq nautical miles), deflects the Gulf Stream eastward. The meandering Gulf Stream spins off smaller currents—swirling eddies and gyres. One distinct spin-off, the Charleston Gyre, circulates counter-clockwise and moves shoreward across the continental shelf. In the process, nutrient-rich bottom water rises up towards the surface, which is called an upwelling (Fig. 2). Upwelling areas have increased production of phytoplankton, the base of the food web that supports juveniles of important fishery species such as menhaden, grouper and swordfish. The combination of food and favorable habitat near the Charleston Gyre supports abundant marine life.

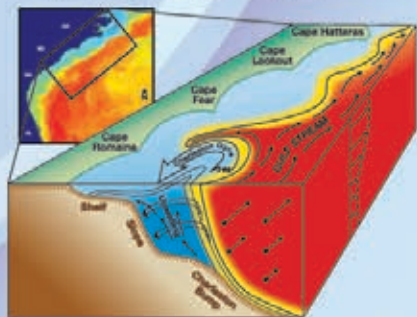


Fig. 2. Warm Gulf Stream water (red) is deflected offshore by the Charleston Bump causing upwelling of deep, cool water (blue). The process supports formation of the Charleston Gyre west of the Gulf Stream. Image: John Bane and Phil Weinbach

Spawning And Dispersal

The Gulf Stream, its spin-off eddies and gyres, upwelling, and coastal currents play important roles in the dispersal of the eggs of spawning fishes and invertebrates. Here's one example. Wreckfish, large grouper-like fish living more than 50 years, release eggs near the Charleston Bump—their only known spawning ground in the western North Atlantic Ocean (Fig. 3). Because immature fish are rarely caught on the Bump, scientists propose that young wreckfish are transported in the Gulf Stream, using floating seaweed and debris for shelter until they mature. Snapper, grouper and swordfish also rely on the Gulf Stream system to disperse their eggs and young to new locations (Fig. 4). Coastal and tidal currents carry eggs and larvae of fishes, shrimps and crabs into and out of estuarine nursery areas.



Fig. 3. Wreckfish, *Polyprion americanus*, swimming along the rocky habitat provided by the Charleston Bump in the western North Atlantic Ocean. Image: George R. Sotter and David Wyszki



Fig. 4. The presence of fish larvae like the swordfish, *Xiphus gladius*, shown above indicates that the Charleston Bump is a spawning ground. Image: Jack McGovern, NOAA

Migration and Life Cycle Journeys

Many marine animals use the Gulf Stream and coastal currents in some part of their life cycle. Coastal ocean observing data enables scientists to build models that predict the locations of animals during different life stages.

Swordfish and sailfish are highly migratory. Studies tracking tagged fishes show that they feed along the western edge of the Gulf Stream in summer, then cross the Atlantic Ocean by following the North Atlantic Gyre in autumn (Fig. 5). Swordfish return to warmer Gulf Stream and Caribbean waters in winter. Other large pelagic fishes such as tunas and dolphinfish (mahi) also concentrate along the edge of the Gulf Stream where cooler coastal waters meet warmer Gulf Stream waters, and prey is plentiful.

Loggerhead sea turtles use currents in their life cycle journeys. Hatchlings leave southeastern beaches and head for the Gulf Stream and the protection provided by floating seaweeds. Once in the Gulf Stream, loggerheads are carried northeastward around the North Atlantic Gyre. It takes about five to eight years before the juvenile loggerheads return to shallower coastal waters of the South Atlantic Bight (Fig. 6). Many spend this time feeding on seagrasses in Pamlico Sound and Chesapeake Bay.

Humpback whales and some endangered right whales swim close to the coast as they migrate south to waters off Puerto Rico and Georgia in the winter. During spring, whales use the Gulf Stream current to support their northward travels to New England and summer feeding grounds.

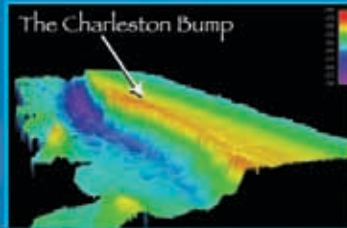


Fig. 3. The Charleston Bump, with 100 m high ridges runs across the seafloor. Map (above) created using altimetric water technology. Image: George R. Sotter and Paul J. Gove

Sea Turtles Feeding in Shallow Waters



Fig. 6. Loggerhead sea turtles, *Caretta caretta*, use currents to reach feeding grounds where they eat seagrasses, crabs, clams, jellyfishes and sponges. Image: Mike Pitt



Fig. 5. Satellite tags relay the locations of tagged swordfish, *Xiphus gladius*, in their seasonal migrations. The pop-up tags release from the fish and float to the surface to transmit the location. Image: George R. Sotter and Josh Loefer

For classroom lessons and more information visit www.SEACOOS.org South East Atlantic Coastal Ocean Observing System

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