The San Diego Union-Tribune.

Black's Beach was 2½-month site for rip current research

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May 10, 2004

JOHN GIBBINS / Union-Tribune
Standing on the pier at Scripps Institute of Oceanography, Robert T. Guza, a research professor at the institute, recently spoke about the project that studied rip currents and waves off Black's Beach.

Black's Beach has a reputation for two things: nude sunbathers and waves suitable only for expert surfers.

But for 2½ months last fall, this notorious stretch of shoreline north of La Jolla was the site of a series of experiments involving more than 20 ocean scientists.

Using a plane, a research ship and numerous high-tech instruments both floating and anchored in the sea floor, researchers gathered more than 500 million pieces of data along the two miles of shoreline north of the Scripps Pier.

While the raw data will take decades to tease out and interpret, the preliminary results are fascinating: Black's Beach is a veritable Bermuda Triangle of rip currents, swirling eddies and crossing swells that double up to produce powerful A-frame-shaped waves.

"The currents there are the most complex I've seen anywhere," said Robert T. Guza, a research professor at Scripps Institution of Oceanography who worked for a decade to organize the project. On many beaches, the near-shore currents on any given day travel in one direction. But scientists discovered that at Black's, the currents sometimes reverse direction.

"At one location, the currents will be going north, then 400 meters to the north, they will be going south," Guza said. "Also, there are some extraordinarily powerful rip currents."

Rip currents – streams of seawater that rush from the shore out to sea – are a well-documented hazard to waders and inexperienced swimmers.

"Black's can be significantly more dangerous than your average beach," Guza said.

With their sophisticated instruments, scientists also discovered eddies swirling below the water's surface that could not be seen with the naked eye, he said.

In addition to expanding knowledge about the behavior of waves and currents, the data gleaned from the experiments is expected to spawn a myriad of spin-off studies.

The data will help those who study the movement of sand in the littoral zone, the areas closest to shore. It will also help those working on computer models that attempt to predict how pollution spills spread. The deeper knowledge about rip currents could conceivably be valuable to lifeguards.

"Oceanography is becoming more oriented toward societal needs than it was in the past," said Guza.

The Navy, which helped pay for the experiments, is interested in using the data for computer modeling to aid, for instance, in selecting beaches where Marines or equipment could safely come ashore.

Black's Beach was chosen for the series of experiments because of its proximity to the Scripps Underwater Canyon. This deep chasm forms the northern axis of a Y-shaped rift in the sea floor that joins the La Jolla Canyon at a depth of about 900 feet.

The Scripps canyon is the key to the steep, pitching waves that surfers find so alluring at Black's.

During winter, swells from the northwest speed up as they pass over the underwater canyon. After passing over the trench, the swells begin to slow down and bend toward shore. Huge waves result when these bending or "refracting" swells combine energy with other northwest swells approaching at sharper angles.

"A-frame shaped waves at Black's are created at the intersection of waves coming from two directions," Guza explained.

Tim Stanton, a research professor at the Naval Postgraduate School in Monterey, spent his portion of the Nearshore Canyon Experiment studying the energy disbursed by breaking waves and the effect on near-shore currents.

When waves break – especially ones eight feet or taller – the resulting white water and turbulence contains tiny tornado-like eddies of swirling energy, Stanton said.

This morass of turbulence impacts objects very differently from, for

instance, the constant pushing force of a strong wind.

"What's really happening is the turbulence is at different scales, all of which have their own velocity," he said. "It's a bunch of blobs of high-velocity water moving independently of each other and straining against each other."

The result is that a surfer or swimmer immersed within the turbulence feels one force of flow against his arms, a different force buffeting his torso and another level of energy hitting his legs.

Surfers refer to such horrendous wipeouts as "getting shaken like a rag doll" or "getting Maytagged," a reference to a washing machine.

The series of experiments was originally planned to run from Sept. 15 to Dec. 15, but the instruments were plucked from the water a month earlier when scientists decided they had enough data.

The surfers who regularly visit Black's Beach complained about the intrusion of the scientific equipment in the middle of their aquatic playground, but none of the instruments was vandalized, Guza said.

"It was tense for a little while, but we're grateful that they did cut us a break," he said.