

CETACEAN SECRETS

Will new technology reveal the language of Sarasota Bay's dolphin generations?



Randy Wells, director of the Chicago Zoological Society's Sarasota Dolphin Research Program at Mote Marine Laboratory, has been studying Sarasota Bay dolphins since the 1970s. [HERALD-TRIBUNE STAFF PHOTO / THOMAS BENDER]

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SARASOTA — If the deep and abiding mysteries of “dolphin language” are embedded in codes that can be cracked, odds are high that our neighbors in Sarasota Bay will show the way.

Equipped with large complex brains that actually outweigh adult human gray matter by some 300 grams, dolphins have long been mythologized by pop culture as humans of the sea. But

See DOLPHINS, A10

Online

For a video of Randy Wells talking about his dolphin research, go to [heraldtribune.com](https://www.heraldtribune.com) and click on this story.



Completing the hunt — a resident dolphin snags a mullet in Sarasota Bay.

[PHOTO BY CHICAGO ZOOLOGICAL SOCIETY'S SARASOTA DOLPHIN RESEARCH PROGRAM]

DOLPHINS

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the astonishing capacity of theme-park captives to obey reward-based commands have consumed the careers of mavericks and dreamers in futile pursuit of establishing meaningful two-way communication.

However, thanks to a combination of "citizen science," upgrades in computer technology, and the persistent curiosity of a researcher who began blazing this trail as a Riverview High student when Nixon was president, the cetacean world is being pierced like never before. And the most systematically scrutinized population of wild dolphins on the planet is producing libraries of vocalization data that will keep researchers occupied for years.

What they've seen already is just the tip of the iceberg.

Randy Wells, the director of the Chicago Zoological Society's Sarasota Dolphin Research Program, taps the keyboards of a desktop at his Mote Marine Lab office and tempers what he's about to dial up with words of caution. Although the pitch and frequency of dolphins' communications can convey emotions, he says, don't expect them "to have a digital language like we do, like a bull shark gets a certain whistle, or a stingray gets a certain whistle."

That said ... "Through playback experiments," Wells continues, "our acoustics colleagues have determined that each signature whistle acts as a name — these animals have the abstract concept of a name."

He clicks onto a recorded call-and-response between a mother, designated F181, and her calf, F230. The monitor blinks onto a picture of sound, called a spectrogram. The familial exchanges are compressed into tight, colorful, vertical spikes that are as visually unique as fingerprints. Their calls resemble chirping birds.

Researchers have crunched the audio files into computer-generated whistles, and they have submerged these artificial sounds into Sarasota Bay. And they've watched the targeted relatives change course in response.

"So the animals were not responding to voice information, but to the shape of the whistle," says Wells. "They're getting that abstract information out of that whistle and they're using it to contact one another, or to keep in touch with others. That's not been shown very often in the animal kingdom. It's pretty cool."

It is, in fact, quite huge. So huge that Sarasota Bay, a thriving habitat for beings with brains bigger than those of chimpanzees, is a magnet for cutting-edge science. And the communications riddle is only part of the draw. Because mammals that abandoned the land and returned to the sea 55 million years ago are also sentinels for Sarasota's ecological health.

Consequently, more than 265 peer-reviewed papers have spun off the SDRP, which has accommodated 41 master's degree and 43 doctoral students, 40 post-graduate scientists and researchers from 45 nations. The Sarasota dolphins have also figured into four books and more than 100 technical reports.

They are, after all, sitting ducks for whatever humans, and nature, subject them to. Because if the patterns hold true, they will likely choose death from environmental apocalypse before vacating the only home they've ever known.

• • • Before the Ice Age, this corner of southwest Florida likely extended 60 miles west into the Gulf of Mexico. But with notable exceptions for human engineering, the shoreline of Sarasota Bay has stayed fairly intact over the last 5,000 years. More than likely, the ancestors of the Bay's bottlenose dolphins have never strayed far from the ebb and flow of the coast's



ABOVE: Four mother-calf pairs off Big Pass in Sarasota Bay.

FAR LEFT: Dolphin fluke ensnared in angler's gear.

AT LEFT: A mother accompanies her calf, born in 2019, in Sarasota Bay.

(PHOTOS BY CHICAGO ZOOLOGICAL SOCIETY'S SARASOTA DOLPHIN RESEARCH PROGRAM)

shallow waters.

In 1970, Wells was on the ground floor of the first organized and sustained attempt to learn more about Sarasota's secret submarine societies. Using binoculars, freeze brands, visual tags, radio tags, and satellite telemetry, he and fellow scientists have tracked and identified thousands of cetaceans passing through the waterways from Terra Ceia to Venice. But some of them, they've discovered, never leave. These are the "resident" dolphins, sighted here more often than anywhere else. At last count, there were maybe 170.

Their species has outlasted Florida's elephants and glyptodonts, the Calusa and conquistadors and Confederates. They have endured all manner of habitat degradation, the Army Corps of Engineers, wetlands drainage, the dredging of the Intracoastal Waterway, the creation of spoil islands, seawalls, eddies of stormwater runoff and pollution in myriad forms, from powerboat noise to wastewater.

And their continued interactions with humans have resulted in dangerous, generational codependencies. Witness a 41-year-old female named Vespa.

Known for shadowing anglers for handouts, Vespa has outlived seven of her 10 calves. Four were injured by human contact (fishhooks, line entanglements, boat collisions), and seven have or had been seen displaying "unnatural behaviors" around people. Furthermore, four of Vespa's five grandchildren are dead, three of which were seen engaged in unnatural behaviors.

Wells says they learned by observing Vespa, and imitated her behavior.

The most recent assault on their home waters was initiated by the catastrophic red tide plague of 2017-18, when five of the Bay dolphins succumbed to the choking brevetoxins. Even more ominously, the algal bloom also wiped out 88 percent of the carnivorous marine mammals' prey fish. But then something amazing happened, evoking a sharp contrast with an equally brutal red tide fish kill in 2005-06.

No dolphins were killed in the earlier outbreak, but its aftermath was pitiless. Facing starvation from food depletion, 2 percent died during encounters with anglers' gear.

Thirteen years later, however, an anticipated repeat of those gloomy statistics failed to materialize. And like so many things that occur in the Bay, the reason for that is ... another mystery.

• • • Randy Wells arrived in Sarasota from his native Illinois in 1969, and began volunteering at Mote a year later. His immersion into marine biology would produce a Ph.D. from the University of California-Santa Cruz, postdoc research at Woods Hole

Oceanographic Institution and, in 1977, get him hired as supervisor of the local dolphin investigations, a project which began seven years earlier. The Chicago Zoological Society has administered the program since 1989.

While Sarasota County's human population has nearly quadrupled since 1970, surveys indicate dolphin numbers within a 40-mile range south of Tampa Bay have remained stable. Unlike coastal bottlenose societies off, say North Carolina, which migrate hundreds of miles each season to New England, Sarasota's dolphins never stray far from home. Some have been detected venturing 25 miles north or south of the Bay, and up to 7 miles offshore. But Wells says those journeys are rare.

Thanks to multiple partnerships, the SDRP has documented six generations of family bloodlines in the Bay, and performed health assessments on 70% of its residents. That sort of continuity has provided a gold standard for comparative studies around the world, especially for marine biologists working disaster zones like Louisiana's Barataria Bay.

The noxious plume from the Deepwater Horizon oil spill that raged for 87 days in 2010 dissipated 80 miles shy of Sarasota Bay, but marine mammals in the northern Gulf weren't so lucky.

According to the National Oceanic and Atmospheric Administration, more than 150 whale and dolphin carcasses were recovered during the tragedy. Hardest hit was Barataria Bay, home to somewhere between 1,000 and 2,000 resident bottlenose dolphins. Ultrasound tests indicate pregnancies in Barataria dolphins are just 20% successful; in Sarasota, the success rate is 83%.

The gaping discrepancy suggests that beneath the tranquil surface of Louisiana's water, a decade after the oil gusher, plenty of trouble is lurking below.

• • • In 2004, before the state or anyone else thought of it, and with an assist from the Barancik Foundation, Wells' crew introduced seasonal fish surveys to Sarasota Bay, using purse seiners, and dipping into seagrass meadows in an index habitat. Sixteen years later, researchers continue to catch, measure, and release dolphins' prey fish of choice to assess the volume of available food.

Bracing for the worst following the 2017-18 red tide calamity, analysts were surprised by what happened in the dead zone after *karenia brevis* cleared the Bay.

"We had record numbers of prey fish in our fish survey last September," says Wells. "We believe when red tide left, many larval fish that snatched offshore came back into the Bay because so many of their predators had been taken out. That makes sense, but that doesn't make it a fact. All we can do is speculate."

What also happened after the bloom receded was an uptick in the number of dolphins wounded in shark attacks. Ten were recorded in 2019, where the yearly average is 0 to 6 bites. Maybe the sharks were having trouble locating their usual dining fare.

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Research kicked into even higher gear in 2017, when the SDRP began wiring Sarasota Bay to eavesdrop on dolphin chatter. The coverage — featuring 10 hydrophones recording ambient local noise from Palma Sola Bay in the north to Spanish Point on the south end — is called the Passive Acoustic Listening Stations (PALS). Now, the floodgates are opening.

Dolphins emit three basic sounds. The most popularized is echolocation, the sonar system with pingbacks that track and profile prey. Then come signature whistles, which identify each animal.

The most enigmatic are "burst pulses." Those exchanges are low-pitched, and sound like metallic mumbling. There are awards and high honors awaiting anyone who can figure that out.

The largest collection of Sarasota dolphin vocalizations resides at Woods Hole Oceanographic Institution in Massachusetts. Most of those recordings were collected manually, often during summertime round-ups for catch-release health evaluations.

Woods Hole research specialist Lesa Sayinich says the archives date back to 1984, although there are recordings from as early as 1974-75. All told, the inventory contains approximately 1,000 sessions from 300 Sarasota cetaceans, with individual clips too numerous to count. But it's about to get a lot bigger, by orders of magnitude.

Capitalizing on accelerating computer memory capacity, a collaborative venture by the Chicago Zoological Society, Mote, New College of Florida and locally operated Loggerhead Instruments began installing solar-powered listening stations and hydrophones along the Bay three years ago.

Situated largely along seawalls or docks at residential locations, the underwater recorders are programmed to run 24/7. With terabyte-range storage capabilities, they can work unattended for a full year. So far, the sweet spot has been Palma Sola Bay, where the acoustic recorders picked up 200,000 whistles in 2017 alone.

"And we haven't even analyzed all the data yet," says David Mann, whose Loggerhead company designed the recorders. "We're having to develop algorithms to do the analysis." Mann started working with Wells and the SDRP in 2001, when he was with the University of South Florida's College of Marine Science. Homeowners and condo associations have been largely

receptive to hosting the PALS devices; in fact, those folks now have the option of listening in on the real-time sounds in the water by tuning in on FM radio.

Wells has designs on expanding the PALS project, with Anna Maria Elementary School set to go online later this year. But because the recorders scarf up everything — boat noises, fish, etc. — the immediate challenge is coming up with a recorder that can separate dolphin signals from the noise. Austin Anderson is about to finish that job by screening the recordings with machine-taught neural nets.

A New College grad student getting a master's in data science, Anderson is sifting through maybe 400,000 spectrograms of high-probability dolphin whistles, with another 800,000 more-likely candidates to assess.

"It's kind of insane, really," says Anderson. "The researchers have already done all the heavy lifting by recording the dolphins consistently. I've run my model over maybe the equivalent of 2, 2 1/2 years of audio data at a couple of our stations, so we're talking about probably millions of audio whistles."

Some of the spectrograms raise more questions than answers. He's noted extremely rare subtle variations in some signature whistles, which makes him wonder if he's hit on mother-newborn exchanges, or perhaps something else entirely.

"I don't know," he says, "sometimes it seems like one dolphin is trying to mimic, or maybe even mock another one. But I'm not sure mocking is the right word. I don't know what the right word is."

Fifty years into the SDRP, and conversations with the players sound like the project is just getting started. Ralph Piland, the recently retired director of the Salisbury Zoo in Maryland, has been an SDRP volunteer for more than 30 years. In fact, he and his wife are about to move to Sarasota.

"This is groundbreaking research, and to be a part of a community that understands and embraces what's happening down there is remarkable," he says. "When I'm out there on the water with those folks, I feel like I'm part of an NBA All-Star team. They're the best in the world."

For Wells, the legacy appears to be self-sustaining now.

"We've identified six generations of dolphins in Sarasota Bay, and at any one time we've observed five concurrent generations within a single lineage," he says. "And now we have three generations of researchers — those of us that started doing things years ago, our grad students, and now they have their students coming in."

"There's a lot of parallels between the animals that are here and their lives, and how we're learning about their lives."