Figuring out grunion is no day at the beach

by Scott_LaFee

It's cold, dark and breezy, not the greatest of conditions for a day (or night) at the beach, but good enough, maybe, for grunion.

Grunion, of course, are those small fish that famously slither ashore at this time of year to mate and spawn on sandy beaches. Only a few fish species in the world do such a thing.

SAND SCHOLARS - A grunion digs into the sand to lay her eggs on a San Diego beach. Little is understood about why the tiny fish choose certain beaches for their spawning. CNS Photo by Sean DuFrene.
NO DAY AT THE BEACH - Palomar College (California) students record data during a grunion run in Oceanside, Calif. They are taking part in a Pepperdine professor's wide-ranging study of grunion biology. CNS Photo by Sean DuFrene. But they don't do it just anywhere. If the basics of grunion reproduction are fairly overt, the reason they choose some beaches and not others is not. Add the presence and influence of people - grunion spawn on some of the busiest urban beaches in the world - and explanations are as hard to grab onto as, well, a spawning grunion.

"One of the big questions is what happens when we do things like replenish sand on eroding beaches, which we regularly do," said Ray Wolcott, a professor of oceanography at Palomar College in north San Diego County. "Does it harm the fish? Can it be done in such a way that it's acceptable to both humans and grunion?"

Such queries are why Wolcott and his students are here, just north of the pier at Oceanside, Calif., and just south of midnight. Like sentinels, they stand at water's edge, eyes and flashlights aimed at the receding water and wet sand.

They're looking for grunion - and with them, answers.

California grunion (Leuresthes tenuis) spawn intermittently from March through August, coming ashore at high tide during the first few nights each month after a full or new moon.

"To anthropomorphize a bit, the fish are out there waiting," says Wolcott, pointing to the ocean just beyond the breaking waves. "The group will send in a few scouts, young males, to see what the beach is like, whether it's suitable for spawning or whether there are predators about."

The scouts report back by wiggling their tails or something. If they don't come back at all, that probably tells the group there are too many predators."

Sure enough, Wolcott's students begin reporting sightings of individual grunion squirming ashore. The fish aren't much to look at: A full-sized grunion looks a bit like an underfed anchovy, 5 to 7 inches long, silver and slender.

Following the scouts come the females. As waves break on the beach, they swim as far up the slope as they can, then arch their backs and begin digging holes with their tails. In seconds, they are up to their fins in sand and anxious males, who gather around them - one, two, a half dozen.

The female quickly lays her eggs, 1,600 to 3,600 ova, each smaller than a pinhead and colored bright orange. At the same time, males curve their bodies around her protruding head and release milt - a milky seminal fluid that will flow down the female's body and fertilize the buried eggs.

Their job done, the males immediately depart. The half-buried female takes a bit longer to wiggle free before she, too, washes back out to sea.

The whole reproductive act can take less than half a minute. The fish are skittish and shy, wiggling parentheses on the sand. A flashlight beam sends them flip-flopping back to deeper water, males especially, though once a run has begun in earnest, says Wolcott, "you could turn spotlights on the beach and nothing will stop them."

But Wolcott and his students are more interested in where exactly the grunion take care of business. The researchers want to answer two questions in particular: What is the slope of the beach where the grunion come ashore? And what is the sand like where the grunion lay their eggs?

SAND WHICH?

Surprisingly, very little is known conclusively about either question. Despite sometimes spectacular runs involving tens of thousands of fish, grunion are not an especially abundant species, and their range is relatively limited, from Point Abreojos in Baja California north to Point Conception near Santa Barbara, Calif.

Their biology is mostly a mystery. They have no teeth, and are presumed to eat organisms like plankton or tiny crustaceans. Mostly, it seems, grunion serve as a link in the larger marine food chain. Their eggs are eaten by shore birds, flies, sand worms and beetles. Most never make it to adulthood. If they do, they may be eaten by bigger fish and sometimes people, though it's unclear why in the case of the latter.

"Frankly, I've never seen the point," said Karen Martin, a biologist at Pepperdine University who studies grunion. "There's really no meat on them. I know people eat them, sometimes for cultural reasons, but mostly I think they eat them because they can."

Using a global positioning system device, Wolcott records the locations of noteworthy grunion runs, which are rated on a Walker scale of zero to five.

Zero means only a few fish are present at a site and no spawning is occurring. A midrange W3 rating indicates hundreds of fish are spawning at once, with activity lasting up to one hour. W5 indicates the beach is covered with grunion, perhaps several individuals deep, and spawning activity exceeds one hour.

The next day, Wolcott and his students return to these recorded sites to take sand samples and measure the slope of the beach. Previous site measurements show grunion appearing on beach slopes between 0.5 and 3.5 percent.

"It's too early to say for sure, but it seems like the lower the slope, the better the fish like it," said Glenn Kinzer, one of Wolcott's students.

"Certainly they don't like slopes that are too steep. Either the waves don't wash them far enough up the beach, or they get stranded when the water doesn't come back in time to wash them back to sea."

The quality of the beach sand is also important to the grunion, said Wolcott. "Nature sorts sand, and grain size is an indication of wave energy."

The greater the power of incoming waves, the larger the size of the remaining sand grains, since smaller stuff gets washed away.

Grunion, according to Wolcott, appear to require beach sand that falls within a relatively narrow range of grain sizes. Too big and it's hard to dig through and doesn't retain sufficient moisture during the 10 days or so that the buried eggs incubate. Too fine - like the sand typically found in lagoons and harbors - and the grains compact too easily, smothering the eggs or making it impossible for hatchlings to dig themselves out at the next high tide.

GROOM AND DOOM

These are not merely academic issues. In recent years, coastal municipalities and agencies have actively replenished beaches with sand gathered from harbor dredgings or imported from inland sources. The main reason beach sand disappears, said Wolcott, is that interior dams have substantially reduced the amount of sand that rivers wash into the sea. Some of that sand ultimately is distributed to beaches by the longshore current.

No one knows whether artificial sand replacement helps or hurts grunion spawning. There are concerns about the "angularity" of imported sand.

"A lot of replenishment sand comes from the desert," said Wolcott. "The grains are sharp and angular. They haven't been smoothed by traveling downrivers. Does angular sand pose a danger to grunion eggs? Nobody really knows, because nobody's really ever addressed the question."

Walcott and his students are. Sand samples are run through sieves to assess grain size and then scrutinized under microscopes. Relevant data will be funneled to Martin at Pepperdine, who is overseeing a multiyear, wide-ranging study of grunion biology. Her work has already prompted changes in the way humans treat beaches and, by extension, grunion.

"People think of nice beaches as clean and wide open, without any trash or debris like seaweed," she said. "As a result, it was long a standard practice to have tractors regularly drag the beaches, pulling up the trash and debris, but also grunion eggs, nesting shore birds and organic material that makes a beach a healthy ecosystem."

Martin's research and subsequent collaboration with public beach managers have changed some beach grooming protocols. "It's better now," she said.

In San Diego County, for example, maintenance tractors now avoid the littoral zone where grunion are likely to have laid eggs, raking the sand only above the highest tide marker. Some beaches are left alone entirely.

The work of Wolcott and others, Martin said, will help further refine what's known about grunion and how humans can help ensure that the grunion continue their spectacular spawning ritual. "Where and when you replenish sand can have an impact," said Martin. "Obviously, you don't want to be dumping sand at a beach site at the same time grunion are trying to spawn."

Wolcott agrees: "We're not trying to embarrass anybody or put up obstacles to beach replenishment, but we think there are questions that need to be answered, and the answers that could make things better for both humans and fish."

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