Underwater springs are unusual and interesting features of the marine environment, but are not well known as subjects of scientific study. Research in such geologic features is intrinsically interesting in terms of their origins, geology, and hydrology, but their potential effects on the surrounding marine environment may also be important. As point-sources of fresh water, each submarine spring represents an "island" of estuarine habitat, so their structure and function might inform general principles for estuarine ecology. To the extent that springs deliver contaminants such as nitrate into pristine offshore waters, springs may also be useful as proxies for more diffuse forms of contaminant loading, such as non-point source pollution, or atmospheric deposition.

A coastal, inshore spring in northern Pasco County, Florida was reconnoitered on June 10, 2000. Figure 1 illustrates the location of the "Jewfish Hole" spring.

This spring is not marked on navigation charts, but occurs in shallow water about 1.0 mile off Hammock Point in northern Pasco County. It is located west-southwest of the town of Aripeka, and has been described by the Florida Bureau of Geology as about 600 ft. south of "Aripeka Channel." It should be noted that this reference to a channel concerns a natural unmarked channel or linear feature of bottom relief extending generally offshore from Hammock Point and a passage called the "Cutoff", south of Aripeka, rather than the marked navigation channel leading to Aripeka.

Latitude 28 degrees 25.712 minutes North
Longitude 82 degrees 42.497 minutes West

We thank Donnie Wendt of Aripeka for providing the positional data. The site was reached with the assistance of Capt. Tom Reisdorph and Bob Stugard, whose assistance in the field is gratefully acknowledged.

Our first approach was made at about 1045 hrs from the down-wind and down-current side (from the west) and a sulphurous odor was noticeable near the hole. Water below the surface but over the hole had a milky aspect. Both the odor and milky water disappeared as a falling tide gained strength. Apart from the odor and color of the water it was evident from field measurements and observation that this spring was not discharging greatly, if at all.
Water clarity was good although not sufficient to see across the hole. In the morning the wind was from the east and the tide was high. In the afternoon the wind developed a northerly component and the tide was falling. It was noteworthy that tidal currents in this area were strong, with the falling tide running more or less directly offshore. The current of the falling tide swept over the top of the hole but without suspending sediments or causing turbidity. A large school of juvenile baitfishes hung on the down-current side of the hole throughout the day and tolerated the proximity of divers.

The boat was anchored fore and aft over the hole and the hole was sounded to at least 50 ft. Measurements began at 1126.

<table>
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Site Description

The Jewfish Hole is located on a fairly level bottom of generally unvegetated coarse white sands with occasional exposures of limestone, in about 4 ft. of water at average tide. On approach it is conspicuous as a darkened circular hole with an east-west diameter of 30 ft., surrounded by a halo of barren white sand and then a halo of dark green turtle grass, *Thalassia testudinum*. Isolated beds of vegetation occur west of the spring but were not visited.

A ring of mostly barren sediment slopes gradually from the inner border of seagrasses to the rocky rim of the hole. Some limestone under the barren sand is exposed to the water column and such exposures are vegetated by the green alga, *Acetabularia crenulata*. Drift forms of red and brown algae grow as snagged accumulations on the rock rim. The rock rim stands about a foot above the sediment surface and is comprised of cobble to boulder-size limestone pieces, as well as continuous limestone slabs.

The neck or throat of the hole below the rim is either vertical or undercut, and the northwestern side of the rim has collapsed leaving a steeply sloped accumulation of broken rocks. The throat displays
both layered rock and larger rock faces in its upper 15-20 feet. *Acetabularia* and a few *Udotea* grew on the vertical rock faces of the throat and on a level area of the throat’s southern side some *Caulerpa paspalooides* was growing at a depth of about 10 ft.

The outer ring or band was a turtle grass bed. Blades were short (ca. 20 cm) and narrow (4 to 6 mm), and relatively free of epibionts. On the south side of the hole, grassbeds also contained species of *Penicillus, Halimeda,* and *Batophora.*

A variety of fauna was observed. Large but cryptic yellow sponges grew in rock crevices within the ring of seagrasses. Tubes of burrowing anemones and the polychaete *Diopatra* were also common in the grassbed. Mollusk species collected from the barren ring, and also the circle of vegetation around the sand ring, included the gastropods *Nassarius vibex,* *Busycon spiratum,* and *Melongena corona,* and the bivalves *Laevicardium laevigatum,* *L. mortoni,* and *Marginella apicina.*

Numerous juvenile and adult Florida stone crabs, *Menippe mercenaria,* were seen in rocky crevices in grassbeds, barren sand, and the upper rim of the hole. Within the hole, boring sponges, colonial tunicates, and a single, large live oyster grew on vertical rock faces and broken rock ledges. The nature of fauna at greater depths, if any, remains unknown.

Fishes were abundant in and near the spring. Grunts, snappers, and groupers were common in the throat of the hole and several large groupers occupied the undercut caves below the rim. The most common fish within the hole was mangrove snapper, *Lutjanus griseus.* Baitfish schooled persistently on the down current side of the hole.

Human disturbances were present but not extensive. Grassbeds lacked propeller cuts and only one beverage can was seen outside of the hole. Rocks on the rim did not show signs of wear commonly caused by anchors, or resting divers. No stone crabs lacked claws. One length of monofilament fishing line was recovered from the hole. A manila rope that was fastened to the throat of the hole, at a depth of about 12 feet, and descended down the wall of the pipe to an undetermined depth, is probably used as an aid by divers.

Discussion

In general aspect the Jewfish Hole is similar to the Howard Park Spring (Mote Technical Report No. 703) and to the submarine springs near Ozello and Chassahowitzka, as all three of these are in shallow water, are rock lined, and drop more or less vertically. The Jewfish Hole has a larger diameter than these other systems. The Jewfish Hole resembles Howard Park Spring but having a halo of barren sediment but the ring of seagrass seen at the Jewfish Hole is distinctive-- at Howard Park the vegetation extends more continuously in all directions from the hole. The Jewfish Hole resembles the spring near Ozello for having almost no bottom depression around it.

The odor and color of surface water over the Jewfish Hole, when first approached, is interesting but presently unexplained. Both features ceased as the falling tide developed. It is possible that a slight discharge of groundwater accumulated near the surface during slack tide and was dissipated.
once the current developed. It would be worthwhile to visit the hole during a slack low tide to see if the odor and milky color of the water were then present.

By the same token, the down-current aggregation of bait fishes was noteworthy and may be due to the school's orientation to structural habitat, water chemistry, or food supply provided by the hole.

No quantitative data were collected during this first visit, although it appeared that patterns and trends in the distribution and abundance of plants and animals could be demonstrated in and near the hole. It would be informative to see how such patterns corresponding to a period of low to no flows from the spring would change if and when spring discharges resumed. The Florida Bureau of Geology reported that discharge at this spring ceased during the drought of 1961-62. Because of its location off northern Pasco County the Jewfish Hole may discharge nitrate-enriched ground waters, offering an opportunity to monitor the effects of nitrate enrichment on seagrasses and other plant communities.

So far as could be determined, no *Halodule wrightii* occurs near the Jewfish Hole. *Halodule* was present around the Dunedin and Howard Park springs, but *Thalassia* was present around the spring near Ozello. More springs will need to be visited to discern their common and unique features relative to adjacent plant communities. It was interesting to find *Batophora* near the Jewfish Hole—it has been seen at other Gulf springs and was reported from a Biscayne Bay spring by Kohout and Kolipinski (1967).
References


Authors

Ernie Estevez is an estuarine ecologist and Director of Mote's Center for Coastal Ecology. Tracy Toutant is a technician in Mote's Chemical Ecology Program, and a graduate of the University of Miami.

Acknowledgments

The survey was sponsored by Mote Marine Laboratory. Julie Vanhorn and Debi Ingrao identified mollusks and Jon Perry produced Figure 1.
Figure 1