Pulley Ridge: The US's Deepest Hermatypic Coral Reef?

Halley, Robert B.[1], Hine, Albert C.[2], Jarrett, Bret D.[2], Twichell, David C.[3], Naar, David F.[2], Dennis, George D.[4] and Ciembronowicz, Kate[1]

(1) USGS, 600 4th St. S, St. Petersburg, FL 33701, rhalley@usgs.gov, (2) College of Marine Science, Univ. of South Florida, 740 7th Ave. S, St. Petersburg, FL 33701, (3) USGS Coastal and Marine Geology Team, 384 Woods Hole Rd., Woods Hole, MA 02543, (4) U.S. Fish and Wildlife Service, 1339 20th St, Vero Beach, FL 32962

Abstract

Pulley Ridge is a 100+ km-long series of N-S trending, drowned, barrier islands on the southwest Florida Self approximately 250 km west of Cape Sable, Florida. The ridge has been mapped using multibeam bathymetry, submarines and remotely operated vehicles, and a variety of geophysical tools. The shallowest parts of the ridge are about 60 m deep. Surprisingly at this depth, the southern portion of the ridge hosts an unusual variety of zooxanthellate scleractinian corals, green, red and brown macro algae, and typically shallow-water tropical fishes.

The corals Agaricia sp. and Leptoceris cucullata are most abundant, and are deeply pigmente. These corals form plates up to 50 cm in diameter and account for up to 30% live coral cover at some localities. Less common species include Montastrea cavernosa, Madracis formosa, M. decactis, Porities divaricata, and Oculina tellena. Sponges, calcareous and fleshy algae, octocorals, and sediment occupy surfaces between the corals. Coralline algae appear to be producing as much or more sediment than corals, and coralline algal nodule and cobble zones surround much of the ridge in deeper water (> 80 m).

More then 60 fish species share this unusual habitat. Commercial species include Epinephelus morio (red grouper) and Mycteroperca phenax (scamp). Typical shallow-water tropical species co-occur with deeper water fish along the ridge. Malacanthus plumieri (sand tilefish) and red grouper construct large burrows and mounds that serve as refuge for multiple species. Mounds and pits larger than 1 m are apparent on side-scan sonar images and have been counted in excess of 200/km2 for parts of the ridge.

Several factors help to account for the existence of this community. First, the underlying drowned barrier island provided both elevated topography and litjified substrate for the hard bottom community that now occupies the southern ridge. Second, the region is dominated by the western edge of the Loop Current that brings relatively clear and warm to the southern ridge. Third, the ridge is within the thermocline, a water mass that is known to provide nutrients during upwelling to shallow reefs in Florida.

Research Methods

Seismic Reflection

Side-Scan Sonar

Multibeam Sonar

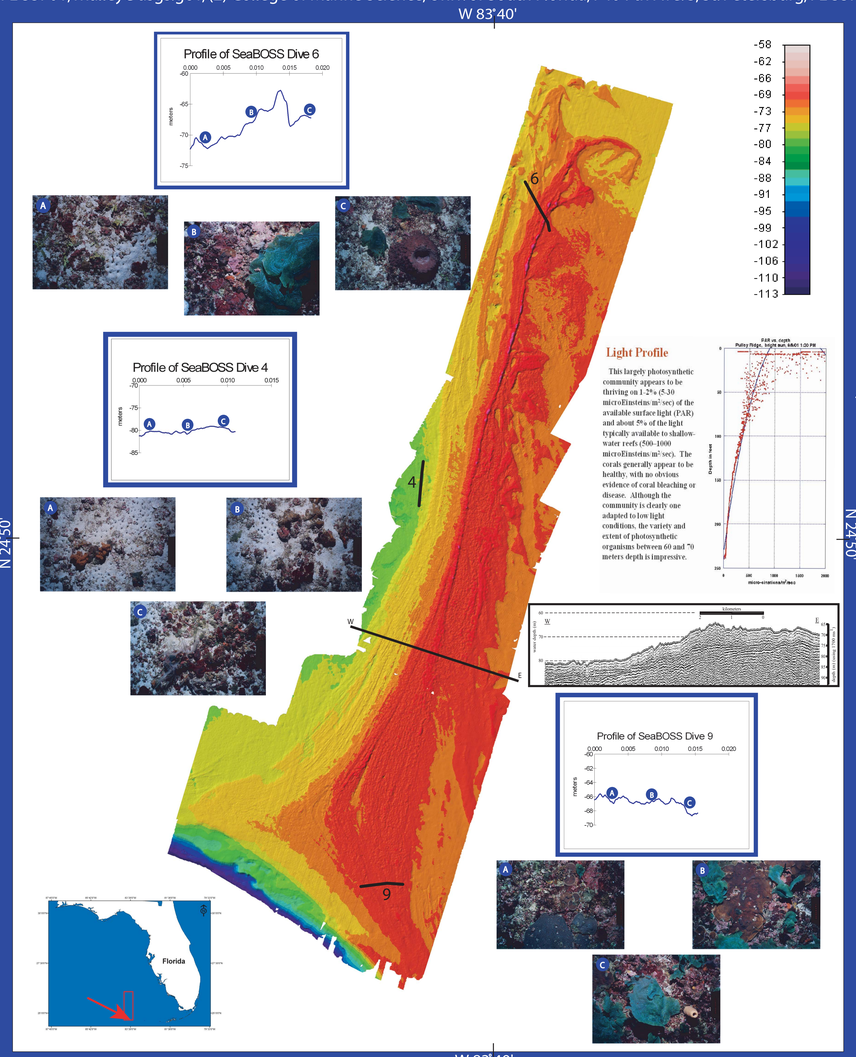
CTD with light meter

Submersible

ROV

Dredge

USGS SeaBOSS



Corals

The coral community south of 25° N is dominated by *Agaricia grahamae*, *A. lamarcki*, and *Leptoseris cucullata*, all platy corals adapted to low light environments. Locally, these corals constitute 30 - 40% live coral cover, compared with less than 1-% on the shallow reefs of the Florida Keys. Other members of the coral community include *A. undada*, *A. fragilis*, *Montastraea cavernosa*, *Madracis formosa*, *Oculina varicosa*, and *Scolymia sp.*

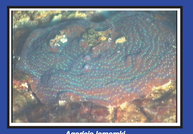
Intertwined Leptoseris cucullata and Agaricia undada

Agaricia undata

Montastraea cavernosa

Agaricia lamarcki (blue) with *Agaricia undata* (brownish-purple)

Agaricia lamarcki (detail)


Agaricia lamarcki

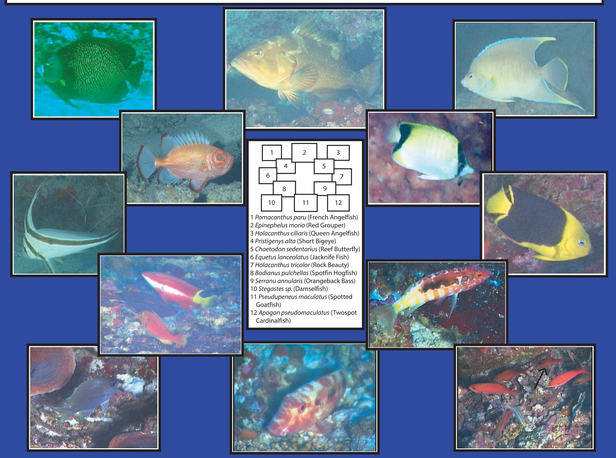
Madracis mirabilis

Agaricia lamarcki on *Agaricia undata*

Agaricia grahamae

Fish Diversity

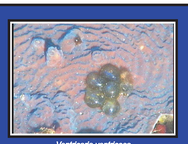
The fish assemblage is a peculiar mixture of deeper water species expected at this depth and tropical fish more typical of shallow reefs in the Caribbean.



Coralline and Fleshy Algae

In addition to hermatypic corals, a diverse group of algae complete the photosynthetic community. Dominated by maroon, pink and red coralline algae, the substrate also hosts fields of fleshy green alga *Anadyomene menziesii*, and other green algae including *Halimeda discoidea* and *Ventricaria ventricosa*. The brown algae *Lobophora variegata* and *Dictyota sp.* have been observed as well.

Halimeda discoidea


Ventricaria ventricosa

Anadyomene menziesii

Peyssonnelia sp.

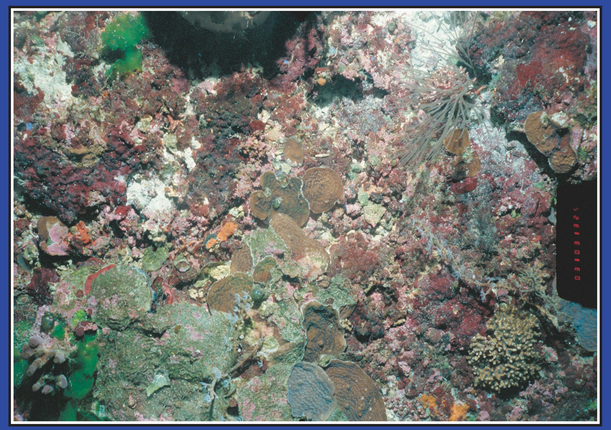
Peyssonnelia sp.

Porolithon sp. (pink)

Dictyota sp.

Lobophora variegata overgrowing Agaricia sp.

Kallymenia sp.

The Benthic Community

Typical Pulley Ridge reef pavement of corals and coralline algae. The surface can vary from hard and well cemented to loose and crunchy, similar to accumulations of eggshells and potato chips. Field of view is approximately 0.5 meter.