

## Pulley Ridge—The U.S.'s Deepest Coral Reef?

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Pulley Ridge is a 100+ km-long series of N-S trending, drowned, barrier islands on the southwest Florida Shelf approximately 250 km west of Cape Sable, Florida (Fig. 1). The ridge has been mapped using multibeam bathymetry, submarines and remotely operated vehicles, and a variety of geophysical tools. The ridge is a subtle feature about 5 km across with less than 10 m of relief. 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 pigmented in shades of tan-brown and blue-purple, respectively. These corals form plates up to 50 cm in diameter and account for up to 60% 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 (greater than 80 m).

In addition to coralline algae other abundant macro algae include *Halimeda tuna*, *Lobophora variegata*, *Ventricaria ventricosa*, *Verdigelas peltata*, *Dictyota* sp., *Kallymenia* sp., and particularly striking fields of *Andaymonene menzeii*. The latter algae covers many hectares at densities of tens of individuals per square meter, constructing regions that appear like lettuce fields growing in the dusk at this depth on the sea floor.

The fishes of Pulley ridge comprise a mixture of shallow water and deep species sharing this unusual habitat. More than 60 species have been identified. Commercial species include *Epinephelus morio* (red grouper) and *Mycteroperca phenax* (scamp). Typical shallow-water tropical species include *Thalassoma bifasciatum* (bluehead), *Stegastes partitus* (bicolor damselfish), *Cephalopholis fulva* (coney), *Lachnolaimus maximus* (hogfish), *Pomacanthus paru* (French angelfish), and *Holocanthus tricolor* (rock beauty). The deepwater fauna is represented by *Chaetodon aya* (bank butterflyfish), *Sargocentron bullisi* (deepwater squirrelfish), *Bodianus pulchellus* (spotfin hogfish), *Pronotogrammus martinicensis* (rougtongue bass), and *Liopropoma eukrines* (wrasse bass). *Malacanthus plumieri* (sand tilefish) and several other species construct large burrows and mounds that serve as refuge for multiple species. Mounds and pits larger than 1m<sup>2</sup> are apparent on side-scan sonar images and have been counted in excess of 200/km<sup>2</sup> for parts of the ridge.

The extent of algal cover and abundance of herbivores suggest benthic productivity is moderate to high on parts of the ridge. Such productivity is unusual, if not unique at this depth in the Gulf of Mexico

and Caribbean. Several factors help to account for the existence of this community. First, the underlying drowned barrier islands provided both elevated topography and lithified 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 water 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.

Notwithstanding the positive factors for reef growth listed above, this largely photosynthetic community appears to be thriving on 1-2% (5-30 microEinsteins/m<sup>2</sup>/sec) of the available surface light (PAR) and about 5% of the light typically available to shallow-water reefs (500 – 1000 microEinsteins/m<sup>2</sup>/sec). The corals generally appear to be healthy, with no obvious evidence of coral bleaching or disease. Although the community is clearly one adapted to low light conditions, the variety and extent of photosynthetic organisms between 60 and 70 meters depth is impressive.

Is southern Pulley Ridge the US's deepest coral reef? That depends, of course, on one's preferred definition of a coral reef. There are deeper, ahermatypic coral buildups both in the Gulf of Mexico and Atlantic off Florida coasts. Classically, a coral reef is a wave resistant structure built by hermatypic corals and hazardous to shipping. From a geologist's point of view, Pulley Ridge corals appear to have built a biostrome, an accumulation at least a few meters thick, although they may not account for the bulk of the topography. From that of a biologist, the most abundant corals in the ridge are hermatypic corals but they are lying, mostly unattached, on the surface. Clearly a ship's captain could not run his vessel aground on this reef, so mariners would not consider this a reef. Nevertheless, from the scientific perspective of a structure built from hermatypic corals, southern Pulley Ridge may well be the deepest coral reef in the United States.

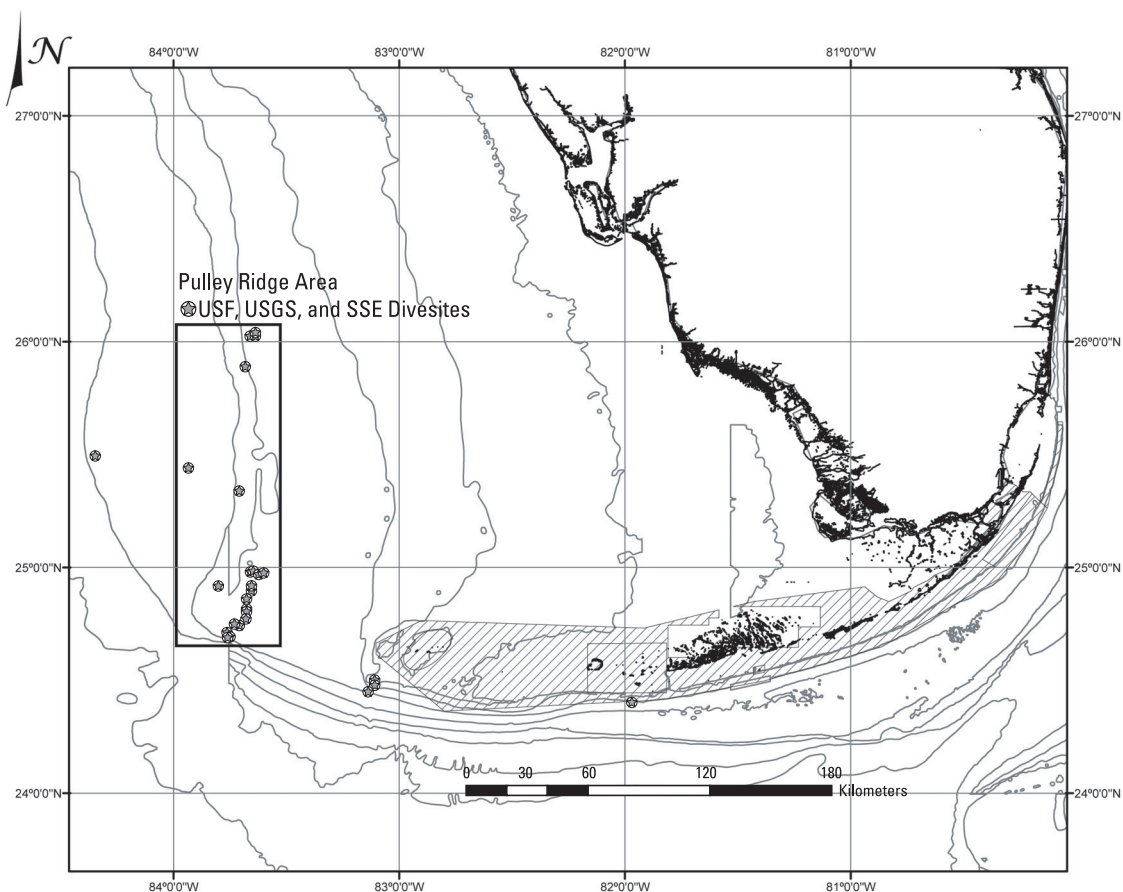


Figure 1. Location of Pulley ridge study area and divesites.