

Photogallery

Growth rate for a zooxanthellate coral (*Leptoseris hawaiiensis*) at 90 m

Samuel E. KAHNG*

Hawaii Pacific University, 41–202 Kalanianaʻole Highway, Waimanalo, Hawaii 96795

* Corresponding author: S.E. Kahng

E-mail: skahng@hpu.edu

Communicated by Hiroya Yamano (Environment and Conservation Editor)

Keywords mesophotic, *Leptoseris*, growth rate, zooxanthellate coral

In Hawaii, zooxanthellate corals of the genus *Leptoseris* have been observed growing *in situ* to depth over 150 m (Kahng et al. 2010). Due to clear oligotrophic waters and geological history, the main Hawaiian Islands have more potential area for zooxanthellate coral habitat at mesophotic depths than in shallow water <30 m (Locker et al. 2010). In the Indo-Pacific, *Leptoseris* spp. are among the most abundant zooxanthellate corals in the lower photic zone (Kahng et al. 2010). However, little is known about the life history traits of these dominant, deep-water corals. While slow metabolism and growth is a common strategy for survival in an energy-limited environment, whether deep-water zooxanthellate corals adopt this strategy has not been previously studied.

In October of 2006 and again in November of 2009, the same colony of *Leptoseris hawaiiensis* at 90 m in the Auʻau Channel, Hawaii was measured with the aid of calibrated parallel lasers from the Hawaii Undersea Research Laboratory's *Pisces IV* submersible (Figure 1). The conserved spatial pattern of corallites on the colony (skeletal growth is outward but not upward) was used to verify measurements and account for parallax. Diameter of the colony increased 6.5 ± 1.0 cm in 37 months. The average radial extension rate was 1.1 ± 0.3 cm per year which is comparable to some shallow-water



Fig. 1 Two photos of the same colony of *Leptoseris hawaiiensis* growing at 90 m in 2006 (left) and again in 2009 (right). Horizontal distances between widest laser points are 16.4 cm (left) and 18.3 cm (right)



Fig. 2 Plate-like colony of *Leptoseris hawaiiensis* growing at 99 m in the Au'au Channel, Hawaii. The colony is > 1 m in diameter

corals. Efficient light harvesting mechanisms may facilitate the growth of these specialized zooxanthellate corals under the low light conditions at depth (Kahng et al. 2012). Despite their moderate rates of areal expansion, *L. hawaiiensis* and other agariciid species at these depths are characterized by thin skeletons (2–5 mm in thickness) and therefore have relatively slow rates of calcification compared to shallow-water corals.

During these surveys, colonies exceeding one meter in diameter were regularly observed at 80–100 m depths. Assuming similar average growth rates, ages of these large plate corals (Figure 2) can be conservatively estimated at ~50 years old. The longevity of these fragile colonies confirms the lack of natural disturbance associated with mesophotic coral ecosystems (Bongaerts et al. 2010).

Acknowledgements

This research was funded in part by the Western Pacific Regional Fishery Management Council and the Hawaii Undersea Research Laboratory (HURL).

References

- Bongaerts P, Ridgway T, Sampayo EM, Hoegh-Guldberg O (2010) Assessing the deep reef refugia hypothesis: focus on Caribbean reefs. *Coral Reefs* 29: 309–327
- Locker SD, Armstrong RA, Battista TA, Rooney JJ, Sherman C, Zawada DG (2010) Geomorphology of mesophotic coral ecosystems: current perspectives on morphology, distribution, and mapping strategies. *Coral Reefs* 29: 329–345
- Kahng SE, Garcia-Sais J, Spalding H, Brokovich E, Wagner D, Weil E, Hinderstein L, Toonen RJ (2010) Community ecology of mesophotic coral reef ecosystems. *Coral Reefs* 29: 255–275
- Kahng SE, Hochberg EJ, Apprill A, Wagner D, Luck DG, Perez D, Bidigare RR (2012) Efficient light harvesting in deep-water zooxanthellate corals. *Mar Ecol Prog Ser* 455: 65–77

Received: 22 May 2013/Accepted: 27 August 2013

© Japanese Coral Reef Society