Importance of the coral genus *Leptoseris* to mesophotic coral communities in the Indo-Pacific

Zena D. Dinesen 1, 2, Thomas C.L. Bridge 1, 4, Daniel G. Luck 3, Samuel E. Kahng 3 and Pim Bongaerts 2

**Introduction**

Mesophotic coral reef ecosystems (MCEs) are typically found at depths from 30 to 40 m and extending to over 150 m in tropical and subtropical regions. Zoanthellate *Leptoseris* species appear to be ubiquitous in the deeper parts of the mesophotic zone (1) in the Indo-Pacific. Here we look at maximum depth distributions of *Leptoseris* in Hawaii (1) and the Great Barrier Reef (GBR), and consider recent evidence about its ability to dominate deeper habitats inhospitable to most other zoanthellate corals.

**Methods**

We collated available data on maximum recorded depths of *Leptoseris* in the Hawaiian Archipelago and GBR including unpublished records from recent expeditions. Records are based on collections and observations from SCUBA and technical dives, manned submersible dives, autonomous underwater vehicles, and recent dredge surveys conducted parallel to depth contours within a narrow and reliable range (we exclude Vaughan’s data (2) due to uncertainty about depth data).

Species reported here are consistent with Dinesen’s taxonomic revision (3) except that we include *L. yabei* as a *Leptoseris* species and recognise *L. tubulifera* / cf *tubulifera* and *L. striata* as valid species for this paper. Taxonomy and phylogeny of Hawaiian *Leptoseris* are being investigated by Luck (4).

**Results**

Maximum recorded depths for *Leptoseris* species from Hawaii and the GBR are shown in Table 1 (based on available data). For comparison, we include the maximum depth reported for these species by Carpenter et al. (5). In the Hawaiian and GBR regions, the two deepest recorded species are *L. hawaiiensis* (at 153 m and 106 m, respectively) and *L. scabra* (at 127 m and 99 m). Images taken from submersible vehicles show *Leptoseris* filmed in situ in deeper parts of MCEs, and these recent surveys indicate that these species are locally very abundant at substantial depths.

**Discussion**

While some *Leptoseris* species may occur as shallow as 3 m in shaded conditions and may be locally abundant in relatively shallow water (~<35 m) (3), *Leptoseris* is capable of flourishing at depths beyond the range of most zoanthellate corals. Records from recent Hawaii’s Undersrsea Research Laboratory (HURL) studies extend the known depth range of *L. papacyra* and *L. yabei* in the Hawaiian archipelago. The in situ images also emphasise that *Leptoseris*, in forming dense stands over tens or hundreds of square metres, can provide an important structural framework for other benthic and demersal fauna in MCEs.

A preliminary assessment of Symbiodinium diversity in mesophotic coral communities from the GBR (6) found that the symbiont type C3, previously reported only in *Acropora*, was present in the five *L. hawaiiensis* specimens analysed, and three other genera tested. The study suggests that mesophotic habitats on the GBR may not be isolated in terms of symbiont diversity, which could be important in terms of their potential to act as refugia.

The ability of *Leptoseris* to dominate deeper MCEs may be in part attributed to its greater light harvesting efficiency compared to shallower water corals (10). These authors found that *Leptoseris* exhibited higher spectral absorbance and, surprisingly, lower areal photosynthetic pigment concentrations than *Porites*, the dominant shallow water coral in Hawaii. The flat growth form of deep water (>80 m) *Leptoseris* and its skeletal micro-scale geometry (e.g. deep, narrow septo-costae) may cause light to travel through the coral tissue multiple times, increasing light absorption by pigments.

The bathymetric habitat range of *Leptoseris* highlights the deficiencies of past analyses of the lower depth distribution of coral species, e.g. Carpenter et al. (2008) (5), which have greatly underestimated the depths at which such corals can grow. Contemporary studies such as this one are greatly expanding the recognised biogeographic and bathymetric ranges of mesophotic coral species.

**Table 1.** Deepest available records of *Leptoseris* from the Hawaiian Archipelago and Great Barrier Reef. *S* = specimens collected from SCUBA, technical or manned submersible dive. *D* = in situ observation. *U* = undeployed specimens. *R* = recorded from GBR but accurate depth date not available. *N/A* = no available

<table>
<thead>
<tr>
<th>Species</th>
<th>Hawaiian Archipelago</th>
<th>GBR</th>
<th>Carpenter et al., 4 (Indo-Pacific)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>L. juliae</em></td>
<td>30 m</td>
<td>&gt;30 m (10) Moris and Harwood (1971)</td>
<td>30 m</td>
</tr>
<tr>
<td><em>L. gossleri</em></td>
<td>30 m</td>
<td>&gt;30 m (10) Moris and Harwood (1971)</td>
<td>30 m</td>
</tr>
<tr>
<td><em>L. hawaiiensis</em></td>
<td>127 m</td>
<td>&gt;30 m (10) Moris and Harwood (1971)</td>
<td>30 m</td>
</tr>
<tr>
<td><em>L. aculeata</em></td>
<td>30 m</td>
<td>&gt;30 m (10) Moris and Harwood (1971)</td>
<td>30 m</td>
</tr>
<tr>
<td><em>L. scabra</em></td>
<td>127 m</td>
<td>127 m (5) West Maui HURL, June 27-78</td>
<td>127 m (10) Carpenter et al., 4 (Indo-Pacific)</td>
</tr>
<tr>
<td><em>L. catenata</em></td>
<td>30 m</td>
<td>&gt;30 m (10) Moris and Harwood (1971)</td>
<td>30 m</td>
</tr>
<tr>
<td><em>L. tubulifera</em> / cf <em>tubulifera</em></td>
<td>30 m</td>
<td>&gt;30 m (10) Moris and Harwood (1971)</td>
<td>30 m</td>
</tr>
<tr>
<td><em>L. yabei</em></td>
<td>25 m</td>
<td>&gt;30 m (10) Moris and Harwood (1971)</td>
<td>25 m</td>
</tr>
</tbody>
</table>

**References**


**Acknowledgements**

We thank the Museum of Tropical Queensland, T. June, J. Mangos, E. Turak and D. Wagner for assistance with bathymetric records. We thank HURL for logistical support, CSIRO Australian Geographic and T. Dinesen, and Michael McComish for help with paper layout.

---

1. Department of Agriculture, Fisheries and Forestry, GPO Box 46, Brisbane, QLD 4002, Australia
2. School of Biological Sciences, The University of Queensland, St Lucia, QLD 4072, Australia
3. School of Earth and Environmental Sciences, James Cook University, Townsville, QLD 4811, Australia
4. ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, QLD 4811, Australia
5. Marine Science, HawaiiPacific University, Waimanalo, HI 96795, USA