CHLOROPHYLL-F: EARTH'S UNSEEN PRODUCTION AND HABITABILITY UNDER RED LIGHT. J. S. Long[1] and C. Hu[1], [1] College of Marine Science, University of South Florida (830 1st St. SE, St. Petersburg, FL 33701; long14@mail.usf.edu)

Abstract: Principal methods to quantify the primary productivity of Earth's oceans using satellite imagery rely on absorption characteristics of chlorophyll-*a* (chl-*a*). However, it is well known that photosynthesis can be driven by alternative chlorophylls, each with a unique absorption spectra, which are often excluded from satellite ocean color algorithms. Most photosynthetic pigments have two main types of absorption bands, the Soret and Q_y. The efficiency of light harvesting pigments is dependent not only on the location of these absorption bands (i.e., pigment type), but also the stellar radiation spectra of the host star [1]. For example, the Soret band becomes more important for hotter F-type stars, while the placement of the Q_y band becomes crucial for cooler, M-type stars.

Recently, a new pigment, chlorophyll-*f* (chl-*f*), has been discovered from filamentous cyanobacteria (*Halomicronema hongdechloris*) within the stromatolites of Shark Bay, Australia [2],[3],[4]. Chl-*f* has a maximum Q_y absorption peak at 706 nm, making it the furthest red-shifted chlorophyll known. Due to the fact that nearly 75% of the stars in a spiral galaxy, such as the Milky Way, are M-type, understanding the efficiency of red-shifted chlorophyll is significant to the search for nearby habitable planets.

The purpose of this study is to deepen our understanding of the habitability potential of M-type star systems. The ability to produce oxygen via photosynthesis is a critical juncture for an Earth-like planet, which may be possible on low-light star systems through the use of red-shifted chlorophylls. In addition to atmospheric biosignature detection, the spectra of surface reflection of an exoplanet can also act as a biomarker (e.g., due to the effect of chlorophyll absorbances). As such, the capability of ocean color satellites to detect red-shifted chlorophylls on Earth will be analyzed. In this work, a time series is generated from Medium Resolution Imaging Spectrometer (MERIS) data over Shark Bay. Spectra from Shark Bay are extracted and compared with maps of existing cyanobacteria distribution indexes.

References: [1] Komatsu Y., Umemura M., Shoji M., Kayanuma M., Yabana K., and Shiraishi K. (2014) *International Journal of Astrobiology* doi:10.1017/S147355041400072X. [2] Chen M., Schliep M., Willows R. D., Cai Z., Neilan B. A., and Scheer H. (2010) *Nature, 329*, 1318-1319. [3] Chen M. and Blankenship R. E. (2011) *Trends in Plant Science*, DOI:10.1016/j.tplants.2011.03.011. [4] Chen M., Li Y., Birch D., Willows R. D. (2012) *FEBS Letters*, DOI:http://dx.doi.org/10.1016/j.febslet.2012.06.045.