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Range extension of the macroalgae Anadyomene stellata (Wulf. In Jacquin) C. Agardh and re-appearance of Caulerpa sertularioides (S. G. Gmel.) M. Howe in the Lower Laguna Madre, Texas

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in ectothermic snakes. Another *C. lepidus* was observed during the monsoon season on 11 July 2008 at 1810 h, during a brief rain-episode. The rattlesnake was found on an alluvial north-facing slope at the edge of an arroyo. The rattlesnake was elongated and drinking water droplets for ca. 10 min from a rock surface. Suddenly, it turned its head around and started drinking water from its anterior dorsal surface while the rest of its body was still elongated. The body temperature of the rattlesnake was 30.0°C, and air and substrate temperatures were 29.5 and 27.5°C, respectively.

Like other species of rattlesnakes living in arid environments in the southwestern United States, *C. lepidus* seems to exhibit behaviors of opportunistic rainwater-harvesting regardless of the time of the year and weather conditions. Cardwell (2006) observed *C. scutulatus* collecting rainwater only from their bodies. Ashton and Johnson (1998), Greene (1990), Repp and Schuett (2008), and Glaudas (2009) observed that other rattlesnakes (*C. concolor, C. molossus*, *C. atrox*, and *C. mitchellii*, respectively) collected rainwater from their bodies, from other structural features, especially rocks, or from both. The fact of using only their bodies to collect water by *C. scutulatus* was attributed to lack of structural features in their environments that would collect water, such as rocks. With respect to *C. lepidus* on Indio Mountains Research Station, most of the landscape is represented by rocky slopes, alluvial fans, and adjacent arroyos, so our two observations support the hypothesis that *C. lepidus* will collect rainwater from their skin and from rock surfaces, if rocks are available. Mata-Silva et al. (2012) reported one instance of rain-harvesting by a sympatric *C. ornatus* on Indio Mountains Research Station, but that individual collected water only from its own body, even though rocks were available.

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RANGE EXTENSION OF THE MACROALGAE *ANADYOMENE STELLATA* (WULF. IN JACQUIN) C. AGARDH AND RE-APPEARANCE OF *CAULERPA SERTULARIOIDES* (S. G. GMEL.) M. HOWE IN THE LOWER LAGUNA MADRE, TEXAS

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Abstract—We report one new species of macroalgae, *Anadyomene stellata,* for the Lower Laguna Madre of Texas, and range extensions that have occurred in the past 16 years for this and four other green algae. *Anadyomene stellata* occurs only as an epiphyte on the red macroalgae, *Digenia simplex. Caulerpa sertularioides* has not been seen in the Lower Laguna Madre since 1962. It has either been present in cryptic habitats for 50 years near the Lower Laguna Madre or has recently expanded its range again into the Lower Laguna Madre. Ecological consideration of the presence of these species is discussed.

Resumen—Reportamos una nueva especie de macroalga, *Anadyomene stellata,* en la Lower Laguna Madre de Texas y las extensiones de las distribuciones geográficas que han ocurrido en los últimos 16 años de esta y otras cuatro algas verdes. *Anadyomene stellata* ocurre sólo como un epífito en la macroalga roja, *Digenia simplex. Caulerpa sertulariodes* no ha sido vista en la Lower Laguna Madre desde 1962. Ha estado presente cerca de la Lower Laguna Madre en hábitats crípticos por 50 años o ha expandido su distribución otra vez en la Lower Laguna Madre. Consideración ecológica de la presencia de estas especies es discutida.

The appearance and establishment of several tropical seaweeds have been documented in the Lower Laguna Madre, Texas, in recent years. These are *Caulerpa prolifera* (Forssk.) J. V. Lamour., *Codium taylorii* P. C. Silva (DeYoe and Hockaday, 2001), *Penicillus capitatus* Lam. (Kowalski et al., 2007), with *Halimeda incrassata* (J. Ellis) J. V. Lamour. reported by Kaldy (1996). We report the appearance and establishment of another green algae *Anadyomene stellata* (Wulfen in Jacq.) C. Agardh.

We first collected *A. stellata* in September 2009 in the central part of the lagoon (latitude 26°08′49″N, longitude 97°11′52″W). The species has only been found attached to the drifting macroalga *Digenia simplex* (Wulfen) C. Agardh (Rhodophyta); however, not all *D. simplex* carry *A. stellata.* The *Digenia* that carry *A. stellata* occurs only in the region of the Lower Laguna Madre that has excellent water-clarity and low nutrients.

Whole attached thalli of *Caulerpa sertularioides* (S. G. Gmel.) M. Howe were collected in the western portion of the Lower Laguna Madre (latitude 26°06′0.2″, longitude 97°16′15″W) in July 2012 during a survey of seagrass. No collection of this alga has been reported in the Lower Laguna Madre since that of Humm and Hildebrand (1962). It is unclear if this species has extended its range again into the Lower Laguna Madre as did *P. capitatus* (Kowalski et al., 2007) or if it has always been present at low densities in nearby cryptic habitats (deep water) but only recently expanded its distribution into shallow waters of the Lower Laguna Madre. We suggest the former because fragments of *C. sertularioides* were first noted on the shore of the Lower Laguna Madre in March 2010, but not prior to this. *Caulerpa sertularioides* currently occupies bare areas of unconsolidated sediment in the southwestern portion of the Lower Laguna Madre at depths of 0.75–1.20 m.

The genus *Anadyomene* is found in tropical and temperate regions of the Atlantic, Indian and Pacific oceans as well as in the Mediterranean and Adriatic seas (Littler and Littler, 1991; Alves et al., 2011). Littler and Littler (1991) list *A. stellata* as occurring in Florida and the Caribbean region but not in Texas, while Littler and Littler (2000) include Florida, the Gulf of Mexico, and the Caribbean region but not Texas. The closest record to Texas for *A. stellata* is the Flower Garden Banks off the coast of Texas and Louisiana (Eiseman and Blair, 1982; Hill and Lehman, 2008), but it also occurs in Florida (Dawes et al., 1967) and Mexico (Littler and Littler, 1991) particularly the Yucatan peninsula of Mexico (B. van Tussenbroek, pers. comm.).

Occurring in tropical and subtropical waters (Lehman and Manhart, 1997), the genus *Caulerpa* is widespread. Humm and Hildebrand (1962) reported *C. sertularioides* in water that was 0.9–1.5 m deep in the extreme southern part of the lagoon. It also was found in Florida (Stam et al., 2006), Mexico (Callejas Jiménez et al., 2005) and Nicaragua (Phillips et al., 1982). Hill and Lehman (2008) listed *Caulerpa* for the Flower Garden Banks but did not indicate which species. Wynne (2008) listed *A. stellata* and *C. sertularioides* in his checklist of the benthic, marine algae of Texas.

Considering that the Lower Laguna Madre is a fairly open system with two connections to the Gulf of Mexico and one connection to the Upper Laguna Madre and that northerly long-shore currents from Mexico are common in the warmer months, it is plausible that fragments of thalli reach the Lower Laguna Madre from the tropical waters of the eastern Mexican coast. Additionally, ships at the Port of Brownsville may supply inocula through ballast water-dumping. All the recent expansions into the Lower Laguna Madre are green algae, and most are siphonaceous. Perhaps, more cryptic species also are present in the Lower Laguna Madre but have not been noticed yet.

The Lower Laguna Madre is known for its lush beds of seagrass and excellent recreational fishing. With new macroalgal expansions comes the potential for competitors with seagrass. *Penicillus* is not only a potential competitor but, through its production of carbonates, has the ability to locally change the character of the sediment (Kowalski et al., 2007). *Anadyomene* is not of concern at this time because it is not a large algae, its biomass is low, and, so far, it only occurs attached to *Digenia simplex. Caulerpa* are potential competitors (Glasby, 2013) because they grow horizontally through the

substrate using a stolon-rhizoid-like system and *C. sertulariodes* is tall enough to potentially compete with seagrass for light. In addition, *C. sertularioides* has chemical defenses against large grazers (Paul and Fenical, 1986). We have found modest densities of *C. sertularioides* (56–100 blades/m^2) but, so far, not intermixed with seagrass. Based on our observations, *C. prolifera*, also a recent immigrant, has not attained densities that threaten seagrass. The structure of the rhizomes of *Caulerpa* is generally weak compared to that of seagrass. *Caulerpa* have a seasonally variable index of leaf-area which results in less sediment-trapping and stabilizing ability in comparison to selected seagrass (Hendriks et al., 2010). Widespread occurrence of *C. sertularioides* at the expense of seagrass could locally destabilize the benthic environment. Ecological implications of the presence of *C. sertularioides* need to be investigated further.

Specimens of each species have been deposited in the University of Texas-Pan American Herbarium, Edinburg. This is publication number CSS 2013-04 of the University of Texas-Pan American Center for Subtropical Studies. Support for fieldwork was provided by the University of Texas-Pan American Coastal Studies Laboratory.

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MORPHOLOGY OF AN INLAND POPULATION OF THE KEELED EARLESS LIZARD (*HOLBROOKIA PROPINQUA*)

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