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**DEPARTAMENTO ACADÉMICO DE BIOLOGÍA MARINA
PROGRAMA DE INVESTIGACIÓN EN BOTÁNICA MARINA**

Seaweed and seagrasses inventory of Laguna de San Ignacio, BCS.

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Abstract:

The present report presents the surveys of marine flora 2013 – 2014 in the San Ignacio Lagoon of the, representing the 50% of planned visits and in where we were able to identifying 19 species of macroalgae to the area plus 2 Seagrass traditionally cited. The analysis of the number of species / distribution of macroalgae and seagrass is in progress using an intense review of literature who will be concluded using the last field trip information in May-June 2014. During the last two years we have not been able to find large abundances of species of microalgae as were described since 2006 and the floristic lists developed in the 90's. This added with the presence to increase both coverage and biomass of invasive species which makes a real threat to consider. Information on new species and range extensions found in the area is presented.

INTRODUCTION

During the last decades has been posting more often the loss and degradation of biodiversity and landscape in many terrestrial and marine environments. Therefore, there have been elements that currently favor the management and protection of ecosystems based on new concepts of land use and environmental policy. Knowledge of the biological dynamics is crucial, as this allows us to understand how ecosystems respond to any anthropogenic or natural disturbance (Underwood 1989, 1990, Keough and Quinn 1991), and define what actions should be taken based on this knowledge (Constable 1991). The Sudcaliforniano central Pacific coast is one of the regions of the country that has remained in a good state of preservation, because environmental pressures for development have been very recently this has favored the protection of natural resources and has maintained a unique scenic beauty.

The aquatic vegetation of the Pacific Northwest is characterized by the transition from temperate to tropical environments, where Point Conception (California, USA) and Magdalena Bay (BCS, Mexico) are the general regions of transition between different environments (Foster et al. 1988). So far, the exact number of valid species distributed in the region but it has been suggested that at least 450 specific names have been used (Pedroche et al., 1993) is not known. Distribution and biogeographic affinities of the species of macroalgae in the region is not fully understood because the initial proposal Dawson (1960a) assumed only boundaries based on direct observations, but without presenting a qualitative analysis. This type of analysis on the distribution and biogeographic affinity was only partially done for groups of green algae (Castillo, 1990) and brown algae (Ramos- Jardon, 1989). So far the distribution patterns of red algae are known. From the analysis so far has suggested that there are two groups within the biogeographic region (Ramos- Jardon, 1989; Castillo, 1990; Aguilar and Aguilar -Rosas -Rosas, 1993). The first group comprises from Point Conception (USA) to Punta Eugenia Baja California, which comprise the warm temperate flora. While the latter suggests begins in Punta Abreojos to southern Bahia Magdalena which would correspond to the subtropical transition zone. This subdivision does not explain the relationship of the flora south of Magdalena Bay, and the affinity between Punta Eugenia and Punta Abreojos. It has also been considered to Punta Eugenia as a biogeographic boundary for species of the order Laminariales (Aguilar -Rosas et al., 1993), but it is not known if this is the general pattern.

In particular floristic records were made lagoon from 1994 to 1999 (Núñez & houses 1998a, 1998b; Riosmena -Rodríguez 1999) but have not been reassessed in more than a decade the species composition. There are both invasive species within the lagoon (Riosmena - Rodriguez et al 2012) and in nearby areas (Mazariegos et al 2010, Garcia-Rodriguez et al 2013). As we have set the objectives: a) To present the updated species of macroalgae and seagrass distributed in the Laguna San Ignacio list. b) Describe the spatial

distribution in the Laguna. c) Set the richness and variations temporal.d space) Determine if species have their northern or southern limits in the study area there. Including invasive or exotic.

Material an methods

It is building the revised species in Laguna San Ignacio using two sources The first is the list exhaustive bibliography of the records of all recognized species distributed for the Pacific coast of Baja California and in the works cited in Riosmena - Rodriguez and Paul Chavez (1997). Further records were obtained the following references : Abbott (1968, 1972, 1978, 1983, 1985); Abbott and Hollenberg (1976); Aguila - Ramirez (1998); Aguilar-Rosas (1980, 1981, 1982a, 1982b); Aguilar -Rosas and Bertsch (1983); Aguilar -Rosas and Pacheco -Ruiz (1984, 1985, 1986, 1989); Aguilar and Aguilar -Rosas -Rosas (1985, 1993a, 1993b); Aguilar -Rosas et al (1982, 1984, 1990); Anderson (1991); Collins (1909) ; Dawson (1941, 1944a, 1944b, 1944c, 1944d, 1945a, 1945b, 1945c, 1945d, 1945e, 1945f, 1946, 1948, 1949a, 1949b, 1950a, 1950b, 1950c, 1950d, 1950e, 1951, 1952, 1953a, 1953b, 1958, 1960b, 1961.1962, 1964, 1966); Baudette and Dawson (1959); Tozun and Dawson (1964); Dawson et al (1960a, 1960b, 1964); Den Hartog (1970); Devinny (1978); Druehl (1979); Espinoza - Avalos (1990); Fan and Papenfuss (1959); Foslie (1902, 1903); García de la Rosa (1990); Gardner (1909, 1913, 1917, 1919, 1922, 1926, 1927a, 1927B, 1940) ; Guzman del Proo (1969, 1991); Hollenberg (1939, 1940, 1942, 1943a, 1943b, 1945, 1948, 1958, 1959, 1966, 1968a, 1968b, 1970, 1971a, 1971b, 1972, 1978); Hollenberg and Abbott (1965, 1966, 1968); Hollenberg and Wynne (1970); Howe (1914, 1920) ; Hus (1900); Ibarra - Obando and Aguilar- Rosas (1985); Johansen (1966, 1969, 1971a, 1971b); Kylin (1941) ; Littler and Littler (1991); Manza (1937a, 1937b, 1940) ; Mateo- Cid and Mendoza-González (1994a, 1994b); Mendoza -González and Mateo- Cid (1985); Mower and Widdowson (1969); Neushul (1971); Nichols (1909) ; Norris (1957); Norris (1971); Norris and West (1967); Nuñez - Lopez and Casas- Valdez (1998a, 1998b); Pacheco -Ruiz (1982); Pacheco - Ruíz and Aguilar -Rosas (1984); Meñez and Phillips (1988); Reyes- García (1989); Riosmena - Rodriguez et al (1991) ; Riosmena -Rodríguez and Siqueiros - Beltrones (1995); Riosmena -Rodríguez and Sánchez- Lizaso (1996) : Rodriguez - Arellano (1989); Rodriguez - Espinoza (1989); Rodriguez - Vargas (1989); Rodriguez - Vargas et al. (1993); Sanchez- Rodriguez et al. (1989); Setchell (1893, 1896, 1901, 1905, 1906, 1908th, 1908b, 1912, 1914a, 194b, 1923a, 1923b, 1940) ; Setchell and Gardner (1903, 1920a, 1920b, 1922, 1924, 1925, 1930, 1933, 1937, 1943); Silva (1953, 1957); Silva et al. (1997); Smith (1942, 1944, 1969); Smith and Hollenberg (1943) ; Setneck and Paine (1986); Stewart (1968, 1974, 1976, 1977, 1982, 1989, 1991); Stewart and Stewart (1984), Taylor (1945); Wilson (1910); Wynne and Taylor (1973). The second source of information are stored in the collections of the Herbarium phycological UABCS collections since 1985 and developed in different locations in Laguna San Igancio during December 2013 and those present develop in May -. June 2014 The collections include material from the intertidal zone to subtidal (approx. 5 m) using preset methods and described by Rodríguez - Riosmena and Siqueiros - Beltrones (1994) and Riosmena - Rodriguez and Paul Chavez (1997). Once he made the list of species recorded for the area was scrubbed and updated nomenclature through the comprehensive review of recently proposed and compiled by Riosmena - Rodriguez and Paul Chavez (1997) and ALGAE BASE (Guiry and Guiry 2014

changes). Additionally are developing assessments using molecular markers to determine the presence and distribution of invasive or alien species to Laguna and are confirming the presence of new records for the region using the techniques used in García- Rodríguez et al (2013) and Lee et al (2014).

Following the formation of the floristic list the distribution of each species within the lagoon determined according to the methodology presented by Murray et al. (1980). With this information the UPGMA method was used to evaluate the relationship of technical areas and linked block (Manhattan) was used to integrate significantly similar regions (as used Murray et al. 1980). In addition to this the number of species is determined by region to strengthen analysis.

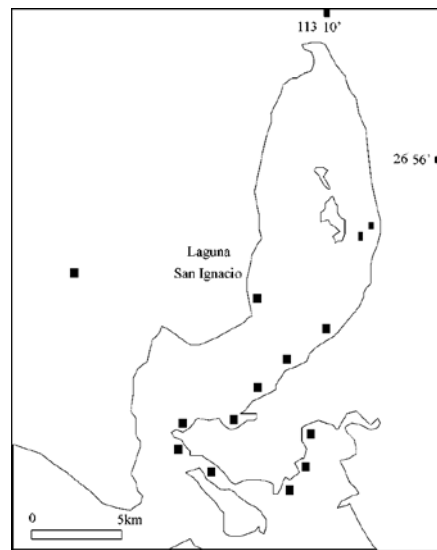


Fig.1 Historically visited locations (1993-2014) for the assessment of species richness on rocky and sandy areas of the Laguna San Ignacio.

Preliminary results

The advance of the committed results is 50% because we presented results of the two promised outputs. From visits in December 2013 19 species were identified for the area (Table 1) Lagoon following the downward trend that has been observed so far. The common denominator in all our visits has been the reduction in coverage and density of *Zostera marina* (Fig. 2) and increased invasive species in rocky and sandy areas using more coverage for each year we have visited the lagoon. The flora has declined not the result of an increase in other species, but both seem to be impacted by human activities such as by strong changes in conditions between years. Is required to assess more environmental parameters to pinpoint the causes of the disappearance in both richness and biomass.

Table I. Comparison of the marine flora of Laguna San Ignacio BCS between sampling events in 1998 and 2010-2013.

Species	1998	2010-2012	2013
<i>Acetabularia calyculus</i>	1	0	0
<i>Acrosorium venulosum</i>	1	1	0
<i>Amphiroa beauvoisii</i>	1	1	1
<i>Centroceras clavulatum</i>	1	1	1
<i>Ceramium caudatum</i>	1	0	0
<i>Ceramium flaccidum</i>	1	1	1
<i>Ceramium serpens</i>	1	0	0
<i>Ceramium sp</i>	1	0	0
<i>Chaetomorpha californica</i>	1	0	0
<i>Chaetomorpha linum</i>	1	1	0
<i>Chondracanthus canaliculatus</i>	1	0	0
<i>Chondria dasyphylla</i>	1	1	0
<i>Chroodactylon ornatum</i>	1	0	1
<i>Cladophora albida</i>	1	1	0
<i>Cladophora graminea</i>	1	1	0
<i>Cladophora microcladioides</i>	1	1	1
<i>Cladophora sericea</i>	1	0	0
<i>Codium simulans</i>	1	1	1
<i>Codium amplivesiculatum</i>	1	1	1
<i>Colpomenia sinuosa</i>	1	1	1
<i>Colpomenia tuberculata</i>	1	1	1
<i>Colpomenia sp 1</i>	0	0	1
<i>Colpomenia sp 2</i>	0	0	1
<i>Corallina frondensis</i>	1	0	1
<i>Cryptopleura sp</i>	1	0	0
<i>Dasya baillouviana</i>	1	0	0
<i>Dictyota flabellata</i>	1	1	1
<i>Ectocarpus commensalis</i>	1	1	0
<i>Gelidium pusillum</i>	1	1	0
<i>Gracilaria marcialana</i>	1	0	0
<i>Gracilaria pacifica</i>	1	1	0
<i>Gracilaria sp</i>		1	0
<i>Gracilaria subsecundata</i>	1	0	0
<i>Gracilaria textorii</i> var. <i>cunninghamii</i>	1	0	0
<i>Gracilariopsis lemaneiformis</i>	1	1	0
<i>Gracilariopsis sp</i>	0	0	1
<i>Grateloupia versicolor</i>	1	0	0

<i>Herposiphonia secunda f. tenella</i>	1	0	1
<i>Herposiphonia sp</i>	1	0	0
<i>Spongites decipiens</i>	1	0	0
<i>Hypnea valentiae</i>	1	1	1
<i>Hypoglossum attenuatum var. abyssicola</i>	1	1	0
<i>Jania adhaerens</i>	1	1	0
<i>Jania sp</i>	1	1	0
<i>Kormmannia leptoderma</i>	1	0	0
<i>Laurencia gardnerii</i>	1	0	0
<i>Laurencia hancockii</i>	1	0	0
<i>Laurencia lajolla</i>	1	0	0
<i>Laurencia masonii</i>	1	0	0
<i>Laurencia pacifica</i>	1	0	0
<i>Osmundea sinicola</i>	1	0	1
<i>Laurencia snyderie</i>	1	0	0
<i>Laurencia sp</i>	1	0	0
<i>Leptofauchea pacifica</i>	1	0	0
<i>Neogoniolithon setchellii</i>	1	1	0
<i>Neogoniolithon sp</i>	1	1	0
<i>Dictyota coriacea</i>	1	1	0
<i>Padina crispata</i>	1	1	0
<i>Padina durvillei</i>	1	1	0
<i>Peyssonellia rubra var. orientalis</i>	1	0	0
<i>Plocamium sp</i>	1	0	0
<i>Polysiphonia flaccidissima</i>	1	0	0
<i>Polysiphonia johnstonii var. johnstonii</i>	1	1	1
<i>Polysiphonia mollis</i>	1	0	0
<i>Polysiphonia pacifica</i>	1	1	0
<i>Neosiphonia simplex</i>	1	0	0
<i>Polysiphonia sp</i>	1	0	0
<i>Pterocladia caloglossoides</i>	1	1	0
<i>Pterosiphonia dendroidea</i>	1	0	0
<i>Ralfsia confusa</i>	1	1	0
<i>Rhizoclonium riparium</i>	1	1	0
<i>Rosenvingea intricata</i>	1	1	0
<i>Sargassum agardhianum</i>	1	0	0
<i>Sargassum sinicola</i>	1	0	0
<i>Sphacelaria californica</i>	1	1	0
<i>Spyridia filamentosa</i>	1	1	1
<i>Tiffaniella saccorhiza</i>	1	0	0
<i>Ulva californica</i>	1	0	0

<i>Ulva dactylifera</i>	1	0	0
<i>Ulva lactuca</i>	1	1	0
<i>Ulva lobata</i>	1	1	0
<i>Ulva clathrata</i>	1	1	0
<i>Ulva compressa</i>	1	0	0
<i>Ulva flexuosa</i>	1	0	0
<i>Ulva intestinalis</i>	1	1	0
<i>Ulva prolifera</i>	1	0	0
<i>Ulva clathrata</i>	1	1	0
<i>Ulva rigida</i>	1	1	0
Total de especies	84	42	19

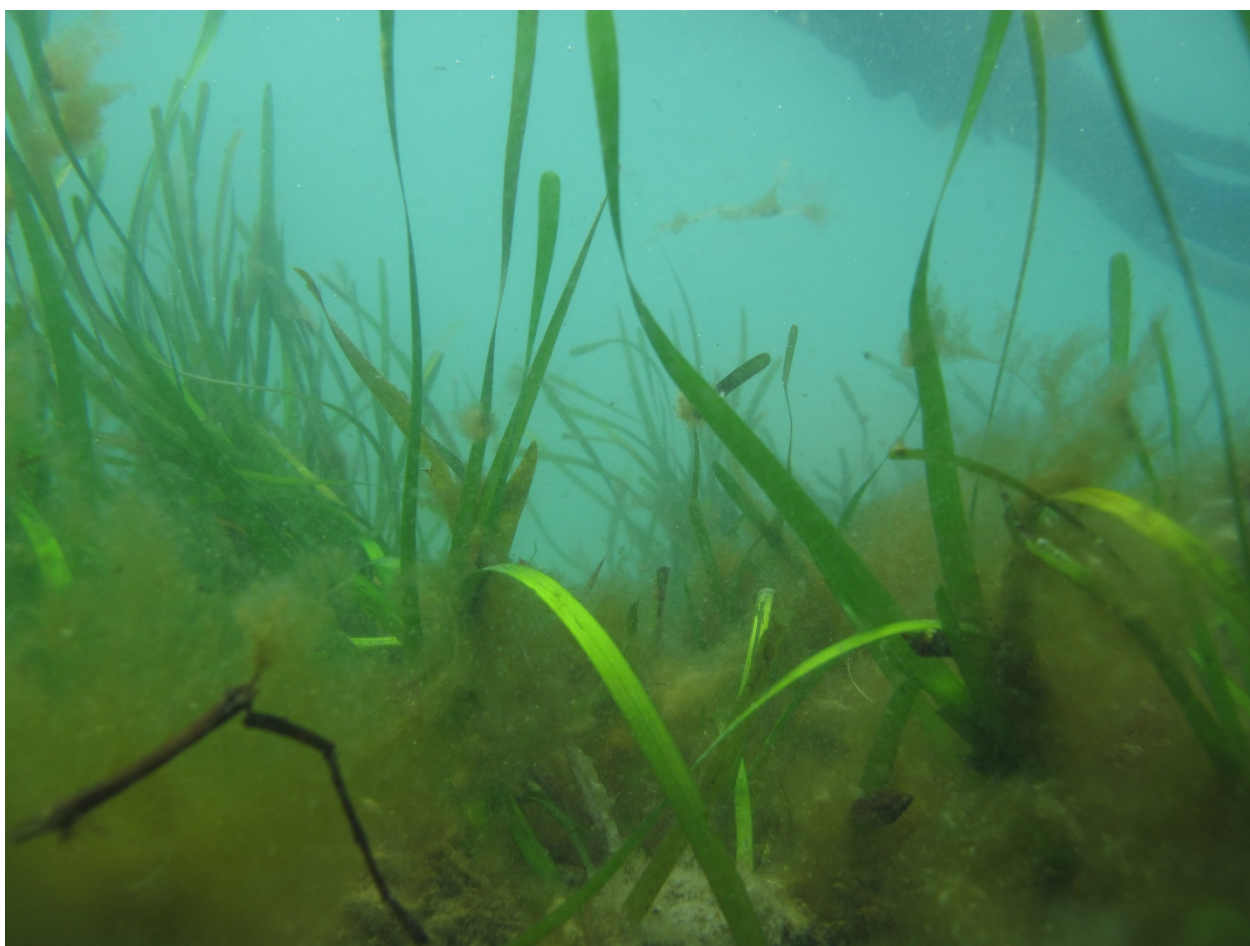


Fig. 2. Appearance of eelgrass meadows cover both epiphytic algae and endolithic.

Most of the observed biomass corresponds to two species: an invasive *Sargassum muticum* called and which we have already published sequences for molecular

identification (Riosmena-Rodriguez et al 2012). Another is in the process of morphological and molecular identification: *Gracilariopsis* sp. (Fig. 3), which has been corroborated by molecular methods using the *rbcL* gene (Fig. 4) to suggest that the record historically used as *Gracilaria pacifica* corresponds to this plant.

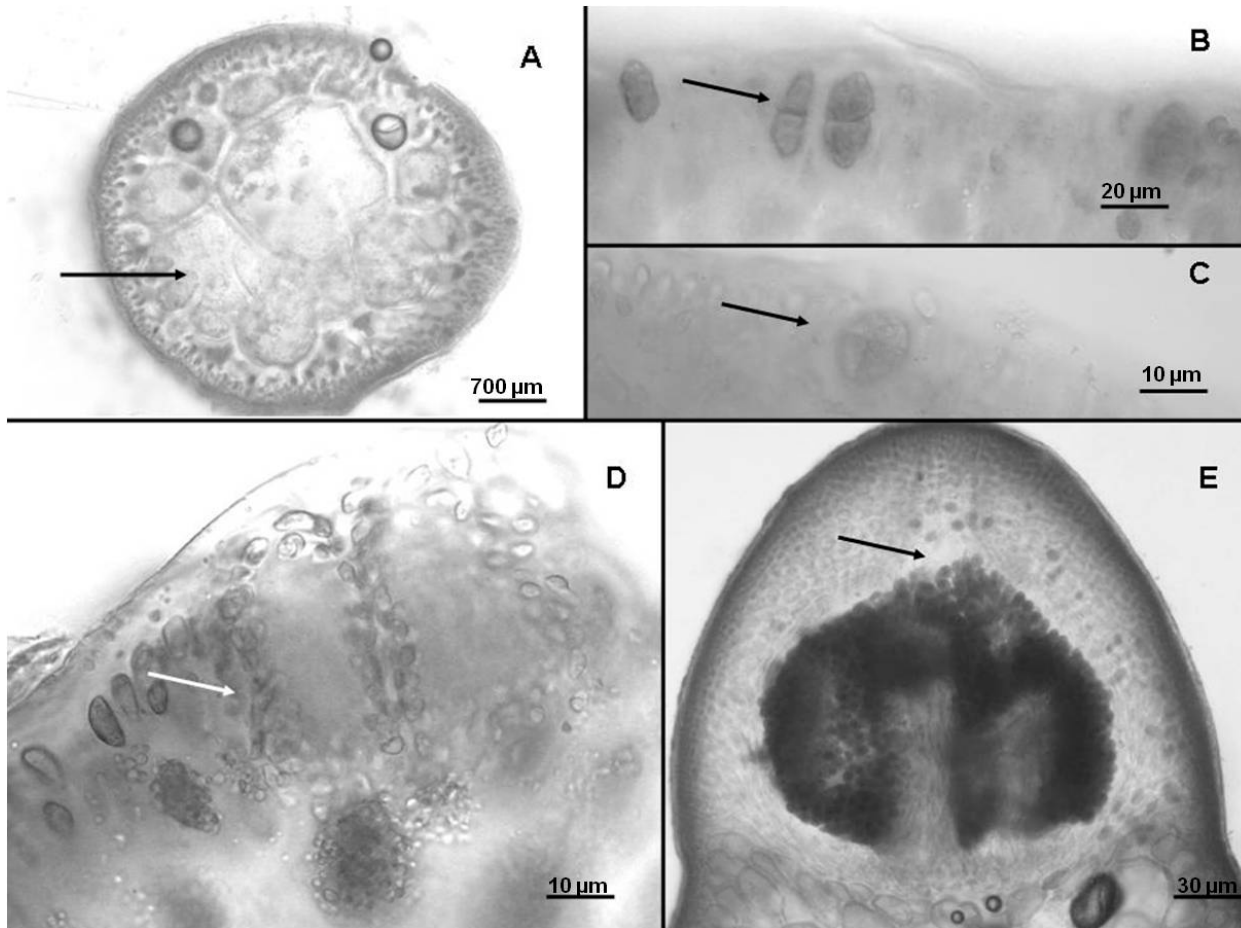


Fig. 3. Cross section of the frond, where important anatomical and reproductive characteristics appear to taxonomy. A) Cross section of ramet, showing the typical gender marrow cells. B) the cross-sectional view showing a potential bisporangium epithelium. Section C) showing a tetraspore Cruz. Section D) showing a male gametangium Cruz. E) Cross section showing carpospores.



Fig. 5. *Spartina alterniflora* invasive plant in Laguna San Ignacio.

As part of the relevant collections found *Sytosiphon lomentaria* (Fig. 6), a species widely distributed in temperate zones and represents a range extension has been confirmed with molecular techniques (Fig. 7).



Fig. 6. Stock *Sytosiphon lomentaria* representing a range extension for the species.

In addition to this extension of range we found copies and completed runs that correspond to new species for the genus *Colpomenia* (Fig. 7) that are working for publication.

ML tree of Mexican scytosiphonacean algae based on *cox3* sequences

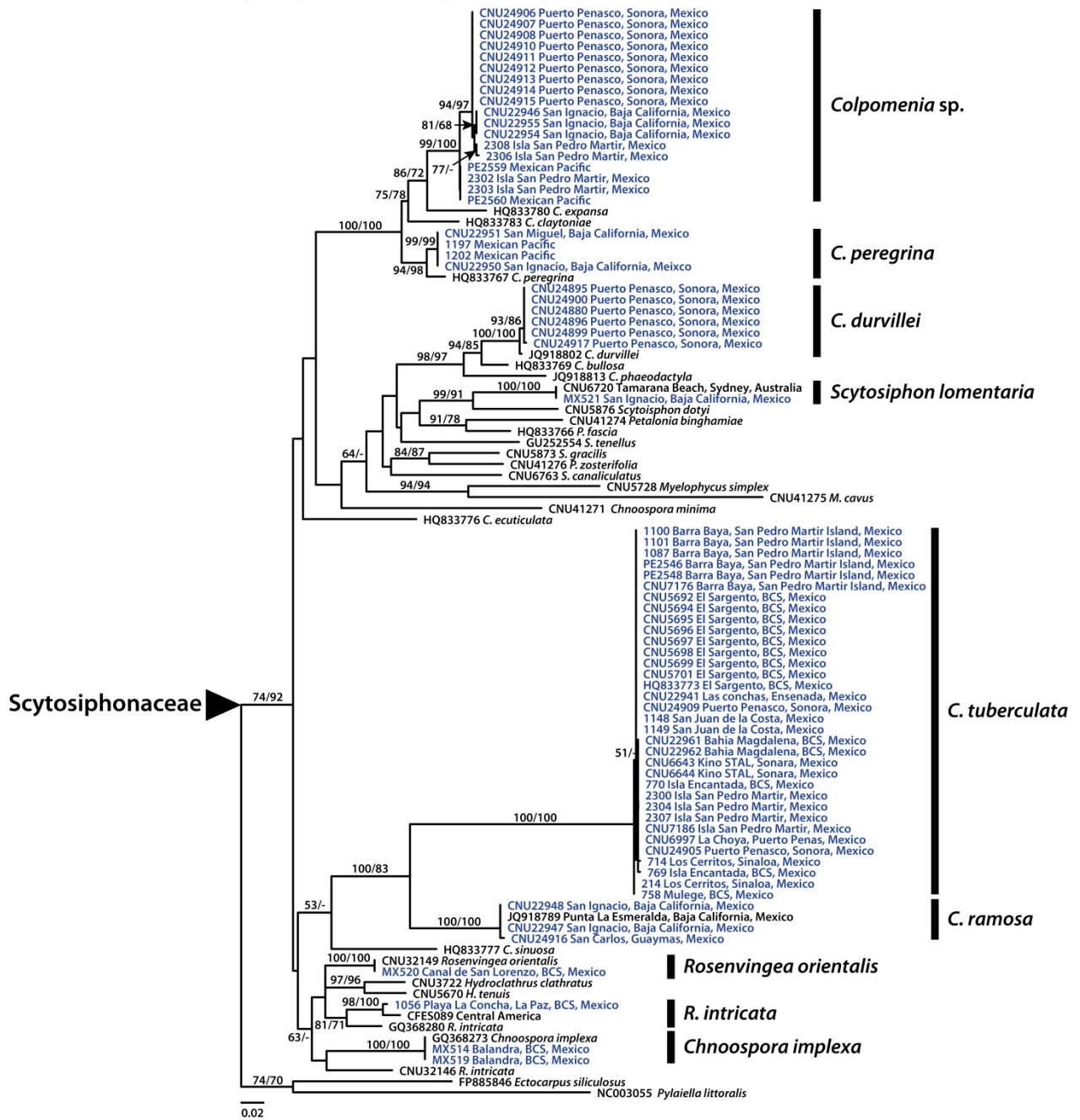


Fig. 7. Phylogenetic tree using the *cox3* marker to delimit species Syctosiphonaceae family on the Mexican Pacific.

Products from support:

Book chapter:

Riosmena-Rodriguez R., J. M. López-Vivas Lopez-Calderon and J. M. in preparation. Marine plants from Laguna San Ignacio: a historical evaluation. In: R. Rodriguez-Riosmena Marine Benthos, Ecosystem Functions and Environmental impact. NOVA Publisher.

Indexed Publications:

Lopez-Calderon-Rodriguez JM & Riosmena in preparation. Conservation status of seagrasses at Laguna San Ignacio BCS, Mexico.

KM Lee, R. Riosmena-Rodriguez, G. & Andrade Sorcia Boo SM in preparation. *Colpomenia norrisii* (Sycetosiphonales, heterokonts) a new species from the Eastern Pacific. *Phycologia*.

Riosmena-Rodriguez R., Lee KM, Fernandez SM C. & Boo in preparation. A phylogenetic analysis of the Sycetosiphonaceae from the Eastern Pacific.

Publications broadcast:

Riosmena-Rodriguez R. in preparation. Marine Flora of Laguna San Ignacio: flora disappears without worrying. BIOMA.

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