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A CHECKLIST OF THE BRYOPHYTES OF THE CALIFORNIA CHANNEL ISLANDS

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ABSTRACT

An annotated, vouchered checklist of the bryophytes of the California Channel Islands is presented, including the known distribution of each species across the eight islands. The bryoflora currently comprises 158 minimally ranked taxa. Fifty-nine mosses, two hornworts, and twenty-two liverworts are reported for the first time from the islands. Fifteen species previously reported from the archipelago are excluded based on new determinations and nomenclatural changes. The bryoflora includes two putative undescribed species in the Bryaceae, *Plagiobryoides* sp. from Santa Catalina Island and *Gemmabryum* sp. from Santa Rosa Island. Excluding these two putative new species, no new state records are reported. One species, *Tortula californica*, is listed by the California Native Plant Society at the 1B rank. Previous reports from the literature are catalogued and nomenclatural changes are noted. There are no island endemics, with the possible exception of the two putative undescribed species. The bryoflora is similar to that of the adjacent mainland, but the larger islands harbor disjunct populations of species from the wet forests of central and northern California that are absent on the adjacent mainland.

Key Words: Disjunction, floristics, inventory, liverworts, mosses, rare species.

With more than 750 species in California, the bryophytes (mosses, liverworts, and hornworts) comprise roughly 12 percent of the state's native flora (Norris and Shevock 2004a; Doyle and Stotler 2006; Baldwin et al. 2012). Despite their significant contribution to diversity in the region, basic floristic knowledge lags far behind that of the vascular flora (Kellman 2003; Shevock 2003). This is particularly true in southern California where the bryophyte diversity tends to be less conspicuous than in the northern parts of the state.

The California Channel Islands exemplify the difference in effort placed in understanding the vascular and non-vascular floras. Vascular plant species lists have been published for all the islands (Wallace 1985, and references therein) and there is a long history of employing the islands as a system to understand biogeography and floristic assembly in southern California (Axelrod 1967b; Raven 1967; Moody 2000). In contrast, the most recent floristic treatment of the bryophyte flora of the islands (McCleary 1972) listed only 76 species, 26% of which were documented from a single island, with most of these collected on a single collecting trip (Steere 1954).

The purpose of the present study is to provide an updated list of the bryophytes of the islands based on recent collecting efforts and re-examination of existing herbarium specimens. The scattered literature on the Channel Island bryophyte flora is summarized, and several species are excluded based on reevaluation of earlier misidentified specimens.

Study site. The Channel Islands consist of an archipelago of eight islands off the coast of Southern California (Fig. 1). They range in size from 2.6 to 249 km² and are located between 20 and 98 km from the mainland (Schoenherr et al. 1999). They range in latitude from 32.8°N to 34.1°N and in maximum elevation from 253 m to 753 m. Although they are near the mainland and emerge from the continental shelf, they have not been connected to the mainland since they rose above sea level. Because of this, all the terrestrial plant species either arrived by wind, by floating across the channel, or were transported by animals or humans. Although the islands have not been connected to the mainland, during the last glacial maximum the four northern islands were connected to form a single large island and the distance between this larger island (called Santa Rosae) and the mainland was reduced to as little as seven km (Schoenherr et al. 1999). In contrast, the four southern islands have been isolated throughout their existence above sea level. Due to a complicated tectonic history in the region, geology on the islands is complex. The majority of the bedrock is made up of igneous gabbros and basalts, as well as schists and other metamorphic rocks derived from these. Sedimentary rocks are less common. Limestones and marbles are not known from the islands, but calcareous travertine deposits are not uncommon in streambeds. Serpentine is restricted to very limited areas on Santa Catalina, and granitic rocks are also very limited and occur primarily on Santa Catalina.

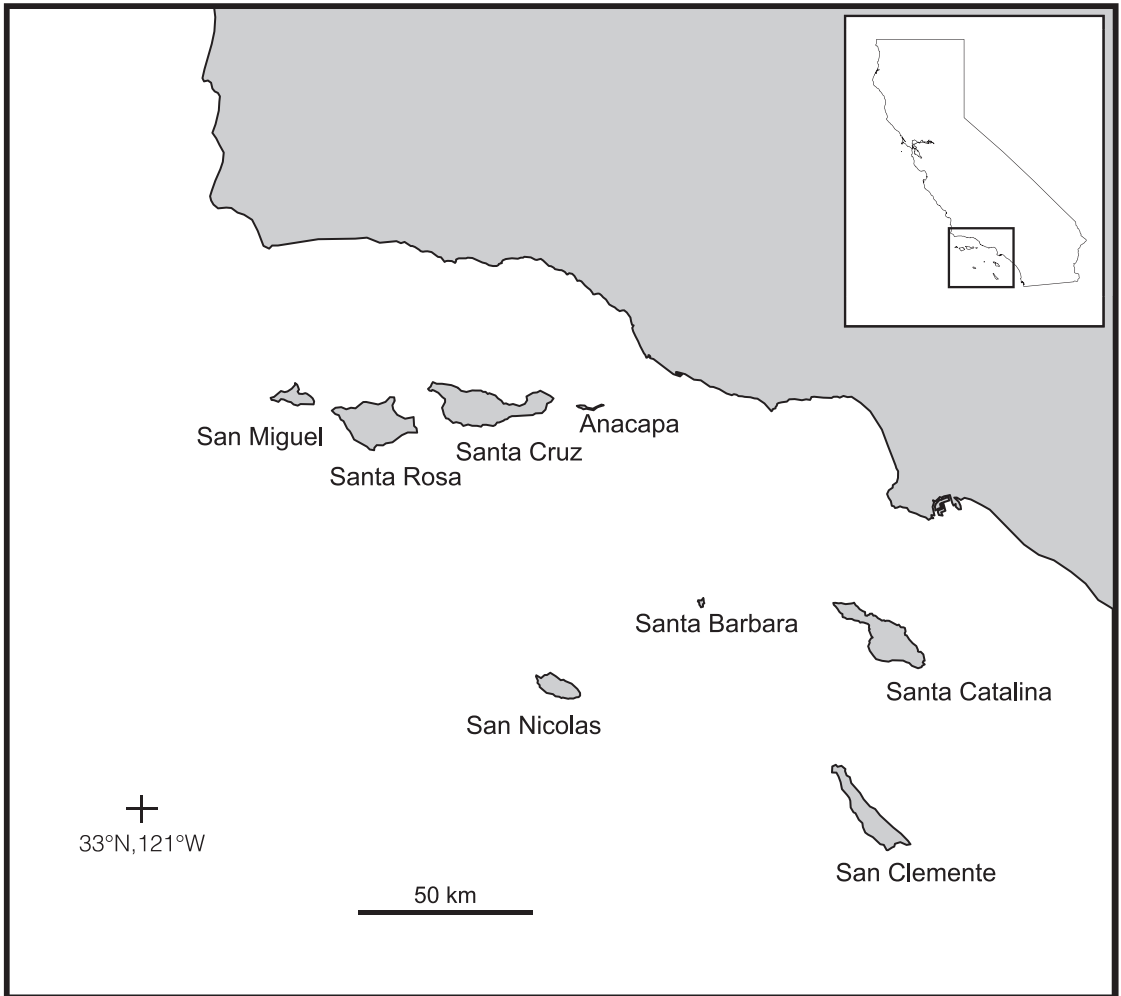


FIG. 1. The California Channel Islands.

Climate is roughly similar to climates on the adjacent mainland, although fog plays a more significant role. Climate varies substantially among islands depending on their position relative to the continent and to their elevation. For example San Miguel, as a low island at the outer edge of the archipelago, receives more fog but also substantially more wind than the other islands. Santa Cruz, on the other hand, receives much more moisture through fog accumulation and rainfall due to its higher elevation than the other islands. Throughout the islands, a general trend is for upper elevations, north facing slopes, and slopes facing the channel (as opposed to the ocean) to be more mesic, presumably due a greater impact of fog, than other areas. Temperatures are comparable to coastal southern California with freezing temperatures occurring with regularity only in inland valleys of the larger islands.

Vascular plant diversity on the islands ranges from 88 to 480 taxa (Schoenherr et al. 1999). The vegetation on the islands is broadly similar to that on the adjacent mainland, but has several differences that are relevant to the bryophyte flora. The dominant vegetation types are shrub dominated chaparral and coastal scrub communities and extensive non-native grasslands. Although the dominant vascular plant genera are mostly the same as those on the mainland, many of the common woody species are island endemics (e.g., *Acmispon* Raf. [= *Lotus* L.], *Arctostaphylos* Adans., *Ceanothus* L., *Eriogonum* Michx., *Quercus* L., *Rhamnus* L.). The islands also support relictual vegetation types that were at one time more common on the adjacent mainland, but are now unique in southern California. On one extreme of the moisture gradient are the Bishop pine (*Pinus muricata* D. Don) forests (best developed on Santa Cruz Island) which, maintained

by maritime fog, support a number of vascular and bryophyte species that can now mostly be found farther north on the mainland but are mostly absent on the adjacent mainland. On the other extreme is the succulent coastal scrub (dominated by *Artemisia* L., *Berberocactus* Britton & Rose, *Lycium* L., *Opuntia* Mill., and others) that on the mainland is mostly now restricted to areas south of San Diego. This unique assemblage of vegetation types provides an array of microhabitats available to bryophytes that is somewhat different from those on the adjacent mainland.

The islands also have a long history of very heavy grazing pressure by introduced cows, sheep, deer, and goats (Schoenherr et al. 1999). While this pressure has had a marked impact on the distribution and population sizes of native vascular plants, especially island endemics, the extent to which the bryophyte flora was affected is unknown.

METHODS

Collecting trips were made to the islands sporadically from 2010 to 2015, and collections are deposited at UC. Six of the eight islands (all except San Nicolas and Santa Barbara) were visited at least once. Herbarium specimens were examined from CAS, F, NY, SBBG, UBC, and UC. In 2011, C. Villaseñor made the first, and to date only, important systematic bryophyte collections from west Anacapa Island and kindly donated them to the project. These were identified by the author and are also housed at UC.

Nomenclature for the mosses generally follows the Flora of North America, except in a few cases (e.g., the *Orthotrichum tenellum* complex). Deviations from the Flora of North America are noted and discussed in Appendix 1. Nomenclature for the liverworts and hornworts follows Doyle and Stotler (2006). Where species authorities differ between TROPICOS (www.tropicos.org, accessed 15 April 2015), the Flora of North America (mosses), or Doyle and Stotler (liverworts and hornworts, 2006), the authority from TROPICOS is listed. For each species in Appendix 1, all the synonyms used in earlier publications on the Channel Islands, along with the reference to the specific publication, are provided.

RESULTS

History of Bryophyte Collecting on the Islands

Unlike most of southern California, the Channel Islands have a relatively well-documented history of collecting. The earliest report in the literature of bryophytes collected on the islands is based on collections made by J. McClatchie in 1893 from near Avalon on Santa Catalina. From

those collections, two liverworts were described, *Riccia catalinae* Underwood (1894) (= *Riccia cavernosa* Hoffm.) and *Frullania catalinae* Evans ([1897] 1900). An additional three species were collected in 1910, also near Avalon, by C. C. Kingman: *Riccia trichocarpa* M. Howe, *Targionia hypophylla* L., and *Anthoceros fusiformis* Austin (Kingman 1911). Kingman (1912) subsequently published a list of mosses of Southern California, including five species originally reported by McClatchie. Of these, *Didymodon tophaceus* (Brid.) Lisa, *D. vinealis* (Brid.) R.H. Zander (as *Barbula vinealis* Brid.), and *Rosulabryum capillare* (Hedw.) J.R. Spence (as *Bryum obconicum* Nees) were reported from Santa Catalina Island. The next mention of the bryoflora of the islands came in a flora of Santa Catalina (Millspaugh and Nuttall 1923). This work focused on vascular plants, but included bryophytes (as well as fungi and lichens). Twenty-six mosses were reported from the island in addition to five thalloid, two leafy liverworts, and a single hornwort species, with identifications and taxonomic treatments of the mosses by R. S. Williams, and those for the hepatics and hornworts by A. W. Evans. The treatments were based primarily on collections throughout the island from 1920 to 1922 by Knopf, Nuttall, and Millspaugh, but were supplemented by the earlier collections of Kingman and McClatchie. Most of these specimens are now at NY.

A decade later J. T. Howell, with the Templeton Crocker Expedition to the Galapagos Islands, collected three mosses on San Nicolas Island in March 1932. These specimens, representing *Didymodon brachyphyllus* (Sull.) R.H. Zander (as *Barbula brachyphylla* Sull.), *Crossidium crassinervium* (De Not.) Jur. (as *C. desertorum* Holz. & E.B. Bartram) and *Entosthodon bolanderi* Lesq. (as *Funaria bolanderi* [Lesq.] Holz.), were sent to E. B. Bartram for identification and publication (Bartram 1933) and are now at CAS.

Two more reports from the islands followed this in A. J. Grout's Moss Flora of North America (1928–1940), (*Homalothecium arenarium* [Lesq.] E. Lawton and *Scleropodium californicum* [Lesq.] Kindb., both from Santa Catalina), but no further publications on the Channel Island Bryoflora appeared until G. Sayre (1940) produced a list of all the mosses known from the "Santa Barbara Islands" at the time. This list included 39 mosses, 10 of which were new records for the islands. Even with the relatively meager information available at the time, Sayre was importantly the first to note the absence of endemic bryophytes on the Channel Islands in contrast to the high proportion of island endemic vascular plants. The ten new additions to Sayre's list were based on specimens collected by T. D. A. Cockerell (although vouchers were not cited), who made a few collections on all but Anacapa and Santa

Rosa islands in the late 1930's (Cockerell 1939). Most of these specimens have not been relocated. Sayre's list did not incorporate a number of collections that had been made in 1929 and 1930 by R. Hoffmann and F. Fosberg, two vascular plant collectors who sent their bryophytes to Bartram for identification.

The first systematic collecting on any of the islands occurred in 1953 when the bryologist W. C. Steere joined an annual field meeting held jointly by the California Botanical Society and the Southern California Botanists. The expedition visited Santa Catalina Island for three days in May, and Steere collected thoroughly the watershed above White's Landing, approximately five miles north of Avalon. He found nearly sixty species of bryophytes, thus almost doubling the number of species known from Santa Catalina with only three days of collecting in a relatively limited area. He published an updated list of all the bryophytes known from Santa Catalina (Steere 1954), which does not provide specimen voucher numbers, but does include substantial ecological and nomenclatural information for many of the listed species. Steere was able to make the first informed biogeographical observations regarding the bryoflora of the islands and noted that most species on Catalina were common xerophytic species, but that there were clear links to the much wetter northern California and high elevation southern California floras. Steere (1954) stated that his vouchers were deposited in the Stanford herbarium. Some of these have been relocated at CAS and UBC but many have not yet been relocated.

The most recent publication on the Channel Island bryophyte flora was another list of all the moss species known from the islands (McCleary 1972). This work built on the previous publications as well as the unpublished collections of Fosberg and Hoffmann and new collections by E. R. Blakely, a staff member of the Santa Barbara Botanical Garden who sent collections to McCleary at Northern Illinois University for identification. McCleary's list included eleven species new to the islands and a total of 76 species. Specific vouchers were not cited, but the known distribution of each of the 76 species across the eight islands was provided.

In recent years there have been a few scattered and mostly incidental collections, primarily by vascular plant and lichen collectors. Before this current study, the only systematic collecting trip was undertaken by J. Shevock and D. Norris in 2001 in which they collected a combined 450 specimens from Santa Rosa Island. Collections by Norris are housed at UC, and the primary set of Shevock collections is at CAS, with synoptic sets at UC and SBBG.

Floristic Summary

The study resulted in approximately 2150 new collections and a checklist of 157 species and one subspecies from the islands (summarized in Table 1, see also Appendix 1). Currently there are no endemic bryophyte taxa recognized from the islands, however putative undescribed species of *Plagiobryoides* J.R. Spence and *Gemmabryum* J. R. Spence & H.P. Ramsay were collected from Santa Catalina and Santa Rosa, and have not yet been collected on the mainland. Eighty-three species and one subspecies are reported here for the first time from the Channel Islands (59 mosses, two hornworts, 22 liverworts). Additionally, the distributions of 60 species previously recorded from the islands (51 mosses, eight liverworts, one hornwort) are expanded to islands from which they were not previously known.

All species in the checklist have been previously reported from California. Fifteen species previously reported from the islands are excluded based on re-identification of voucher specimens and on updated species circumscriptions (Appendix 2). Several historical reports could not be verified due to the absence of the original voucher and a lack of recent collections. When credible, these unvouchered reports were included in Table 1 with a plus sign (+) rather than an "X". One species from the islands, *Tortula californica* E.B. Bartram, is recognized by the California Native Plant Society (CNPS, Rare Plant Program 2014) as a rare species with a rank of 1B (Rare, Threatened, or Endangered in California and elsewhere).

The Channel Island flora is typical of southern coastal California. The most diverse families are Pottiaceae (39 species), Bryaceae (21), Brachytheciaceae (11), and Orthotrichaceae (8). Together these four families comprise approximately half the bryophyte flora. The important genera are *Gemmabryum* (10 species), *Tortula* Hedw. (9), *Orthotrichum* Hedw. (8), *Riccia* L. (7), and *Scleropodium* Bruch & Schimp. (6). *Didymodon* F. Weber & D. Mohr ex Braithw., *Rosulabryum* J. R. Spence, and *Syntrichia* Brid. each have five species.

DISCUSSION

There is much work left to do in cataloging the bryophyte flora of the Channel Islands. Although this study more than doubles the number of species known from the archipelago, there are undoubtedly many more discoveries to be made. Even with this caveat, several biogeographic patterns are evident.

Species common in northern and central California that are absent on the adjacent mainland are an important component of the island flora. These are mostly associated with *Pinus muricata* forests on Santa Cruz and Santa Rosa Islands and to a lesser extent with stands of the island

TABLE 1. BRYOPHYTES OF THE CHANNEL ISLANDS. An 'X' indicates a vouchered occurrence of a species on an island. A '+' indicates an unvouchered but credible report or observation. See Appendix 1 for vouchers and nomenclatural details. Island abbreviations are Ana = Anacapa, SBA = Santa Barbara, SCa = Santa Catalina, SCl = San Clemente, SCz = Santa Cruz, SMi = San Miguel, SNi = San Nicolas, SRo = Santa Rosa. Excluded species are listed in Appendix 2.

Family	Taxon	Ana	SBA	SCa	SCl	SCz	SMi	SNi	SRo	
MOSESSES										
Amblystegiaceae	<i>Amblystegium serpens</i>			X						
	<i>Conardia compacta</i>			X		X				
	<i>Hygrohypnum bestii</i>			X		X				
	<i>Leptodictyum riparium</i>					X				
Bartramiaceae	<i>Anacolia menziesii</i> var. <i>baueri</i>	X		X	X	X			X	
	<i>Bartramia aprica</i>			X						
Brachytheciaceae	<i>Brachythecium bolanderi</i>			X		X				
	<i>Homalothecium arenarium</i>	X	X	X	X	X	X		X	
	<i>Homalothecium nuttallii</i>			X	X	X			X	
	<i>Homalothecium pinnatifidum</i>					X				
	<i>Kindbergia praelonga</i>					X			X	
	<i>Scleropodium californicum</i>	X		X	X	X	X	X	X	
	<i>Scleropodium cespitosum</i>				X	X			X	
	<i>Scleropodium julaceum</i>			X	X	X			X	
	<i>Scleropodium obtusifolium</i>					X			X	
	<i>Scleropodium occidentale</i>				X	X			X	
	<i>Scleropodium touretii</i>			X	X	X			X	
	Bryaceae	<i>Bryum argenteum</i>	X		X	X	X	X		X
		<i>Bryum lanatum</i>			X		X			
		<i>Gemmabryum barnesii</i>			X					
<i>Gemmabryum caespiticium</i>									X	
<i>Gemmabryum dichotomum</i>				X	X					
<i>Gemmabryum gemmiferum</i>		X		X	X	X			X	
<i>Gemmabryum gemmilucens</i>				X	X					
<i>Gemmabryum kunzei</i>		X		X	X	X			X	
<i>Gemmabryum tenuisetum</i>						X				
<i>Gemmabryum radiculosum</i>				X						
<i>Gemmabryum violaceum</i>		X		X	X	X			X	
<i>Gemmabryum valparaisense</i>		X		X		X				
<i>Gemmabryum</i> sp.									X	
<i>Imbribryum gemmiparum</i>						X				
<i>Imbribryum muehlenbeckii</i>						X			X	
<i>Plagiobryoides</i> sp.					X					
<i>Ptychostomum creberrimum</i>					X					
<i>Rosulabryum canariense</i>					X					
<i>Rosulabryum capillare</i>					X		X	X	X	
<i>Rosulabryum erythroloma</i>					X					
<i>Rosulabryum gemmascens</i>	X		X		X					
<i>Rosulabryum torquescens</i>			X		X	X	X	X		

TABLE 1. CONTINUED.

Family	Taxon	Ana	SBa	SCa	SCI	SCz	SMi	SNi	SRo
Cryphaeaceae	<i>Dendroalsia abietina</i>				X	X			
Dicranaceae	<i>Campylopus introflexus</i>					X			
	<i>Dicranella varia</i>			X					X
	<i>Dicranoweisia cirrata</i>					X			
Ditrichaceae	<i>Ceratodon purpureus</i>			X	X	X	X	X	X
	<i>Pleuroidium acuminatum</i>			X		X			X
	<i>Pleuroidium subulatum</i>			X	X	X			X
Ephemeraceae	<i>Ephemerum serratum</i>			X					
Encalyptaceae	<i>Encalypta vulgaris</i>			X					
Fabroniaceae	<i>Fabronia pusilla</i>			X		X			
Fissidentaceae	<i>Fissidens crispus</i>			X	X	X			X
	<i>Fissidens curvatus</i>			X		X			
	<i>Fissidens sublimbatus</i>	X		X	X	X			X
Funariaceae	<i>Entosthodon attenuatus</i>								X
	<i>Entosthodon bolanderi</i>	X		X	X	X		X	X
	<i>Funaria hygrometrica</i>			X		X	X		X
	<i>Funaria muhlenbergii</i>	X		X	X	X			X
Grimmiaceae	<i>Grimmia laevigata</i>	X		X	X	X			X
	<i>Grimmia lisae</i>	X		X	X	X			X
	<i>Grimmia pulvinata</i>			X	X	X			X
	<i>Grimmia trichophylla</i>	X		X	X	X			X
Lembophyllaceae	<i>Bestia longipes</i>	X		X	X	X			X
	<i>Isoetecium cristatum</i>			X	X	X			X
	<i>Isoetecium stoloniferum</i>					X			X
Leptodontaceae	<i>Alsia californica</i>	X		X	X	X			X
Leskeaceae	<i>Claopodium</i>			X		X			X
	<i>whippleanum</i>								
Leucodontaceae	<i>Antitrichia californica</i>			X		X			X
	<i>Nogopterium gracile</i>	X		X	X	X			X
Meesiaceae	<i>Leptobryum pyriforme</i>			X		X			
Mniaceae	<i>Epipterygium tozeri</i>			X		X			X
	<i>Pohlia longibracteata</i>					X			
	<i>Pohlia nutans</i>					X			
	<i>Pohlia wahlenbergii</i>					X			X
Neckeraceae	<i>Bryolawtonia</i>	+				X			
	<i>vancouveriensis</i>								
	<i>Neckera douglasii</i>					X			
	<i>Porotrichum bigelovii</i>					X			X
Orthotrichaceae	<i>Orthotrichum bolanderi</i>			X					
	<i>Orthotrichum coulteri</i>		+	X		X			X
	<i>Orthotrichum cucullatum</i>			X					X
	<i>Orthotrichum diaphanum</i>				X				
	<i>Orthotrichum franciscanum</i>	X		X		X			X
	<i>Orthotrichum lyellii</i>			X					
	<i>Orthotrichum norrisii</i>			X					
	<i>Orthotrichum papillosum</i>			X	X	X	X		X
Polytrichaceae	<i>Polytrichum juniperinum</i>			X		X			X
Pottiaceae	<i>Acaulon triquetrum</i>					X			
	<i>Aloina aloides</i> var. <i>ambigua</i>			X		X	X		X
	<i>Aloina bifrons</i>			X	X	X	X		
	<i>Barbula convoluta</i>			+					X
	<i>Crossidium</i>							X	
	<i>crassinervium</i>								
	<i>Crumia latifolia</i>					X			
	<i>Didymodon australasiae</i>			X	X	X	X	X	X
	<i>Didymodon</i>	X		X	X	X	X	X	X
	<i>brachyphyllus</i>								
	<i>Didymodon rigidulus</i>		X	X	X	X	X		
	<i>Didymodon tophaceus</i>			X	X	X	X	X	X

TABLE 1. CONTINUED.

Family	Taxon	Ana	SBa	SCa	SCI	SCz	SMi	SNi	SRO
	<i>Didymodon vinealis</i>	X	X	X	X	X	X	X	X
	<i>Eucladium verticillatum</i>			X		X		X	
	<i>Gymnostomum aeruginosum</i>			X					
	<i>Gymnostomum calcareum</i>			X		X			
	<i>Henediella stanfordensis</i>			X		X			
	<i>Microbryum davallianum</i>			X	X		X		
	<i>Microbryum starckeanum</i>			X	X				
	<i>Pseudocrossidium crinitum</i>			X		X			X
	<i>Pseudocrossidium obtusulum</i>			X					
	<i>Pterygoneurum ovatum</i>					X			
	<i>Stegonia hyalinotricha</i>			X	X	X	X		
	<i>Syntrichia bartramii</i>			X	X				X
	<i>Syntrichia laevipila</i>			X		X			
	<i>Syntrichia papillosa</i>			X	X	X			
	<i>Syntrichia princeps</i>	X		X	X	X			X
	<i>Syntrichia ruralis</i>		X	X	X	X			X
	<i>Timmiella anomala</i>			X	X	X			X
	<i>Timmiella crassinervis</i>			X		X			X
	<i>Tortula acaulon</i>			X	X	X			
	<i>Tortula amplexa</i>			X					
	<i>Tortula atrovirens</i>	X		X	X	X			X
	<i>Tortula bolanderi</i>			X					
	<i>Tortula brevipes</i>	X		X	X	X	X	X	X
	<i>Tortula californica</i>	X		X	X	X			X
	<i>Tortula guepinii</i>			X	X	X	X		
	<i>Tortula obtusifolia</i>			X		X			
	<i>Tortula protobryoides</i>	X		X	X				
	<i>Weissia controversa</i>	X		X	X	X			X
	<i>Weissia ligulifolia</i>			X					
HORNWORTS									
	Anthocerotaceae				X				X
	Notothyladaceae						X		
					X	X	X		
LIVERWORTS									
	Aneuraceae						X		
	Aytoniaceae				X	X	X		X
					X				
					X		X		
	Calypogeiaceae						X		
	Cephaloziellaceae				X		X		X
							X		
					X				
							X		X
					X		X		
	Fossombroniaceae				X	X	X		X
					X	X			
	Frullaniaceae				X		X		X
					X		X		X
					X		X		X
							X		X
	Geocalycaceae						X		
	Gymnomitriaceae				X		X		X
	Lunulariaceae				+				
	Marchantiaceae						X		

TABLE 1. CONTINUED.

Family	Taxon	Ana	SBa	SCa	SCI	SCz	SMi	SNi	SRo
Porellaceae	<i>Porella bolanderi</i>			X	X	X			X
Radulaceae	<i>Radula bolanderi</i>					X			
	<i>Radula complanata</i>					X			X
Ricciaceae	<i>Riccia californica</i>					X			
	<i>Riccia campbelliana</i>			X					
	<i>Riccia cavernosa</i>			X					
	<i>Riccia glauca</i>								X
	<i>Riccia nigrella</i>	X		X	X	X			X
	<i>Riccia sorocarpa</i>			X	X	X			
	<i>Riccia trichocarpa</i>			X	X	X			
Sphaerocarpaceae	<i>Sphaerocarpos texanus</i>			X		X			X
Targioniaceae	<i>Targionia hypophylla</i>	X		X	X	X	X		X
Totals	All islands: 158	33	5	118	62	116	20	10	80

endemics *Lyonothamnus floribundus* A. Gray, *Prunus ilicifolia* subsp. *lyonii* (Eastw.) P.H. Raven, and *Quercus tomentella* Engelm. on the four largest islands. These vegetation types are restricted to the most mesic areas on the islands and persist only in areas where plants can take advantage of dense marine fog to supplement water inputs. On the mainland, *Pinus muricata* is currently restricted to coastal foggy areas along the coast, primarily in northern and central California but with relict populations as far south as Baja California. A relatively good fossil record indicates that *P. muricata* and other closed-cone conifers were much more widespread until relatively recently (Axelrod 1967a). The understory vascular plant species in island *P. muricata* forests include a number of common northern species that become rare in mainland southern California (e.g., *Gaultheria shallon* Pursh, *Vaccinium ovatum* Pursh). The bryophytes mirror this pattern with a number of species of both mosses and liverworts. Significantly, several of these species are known south of Santa Cruz County only from *P. muricata* forests, for example *Lophocolea bidentata* (L.) Dumort. (southernmost mainland population in Bishop Pines at Coon Creek, San Luis Obispo Co.), *Campylopus introflexus* (Hedw.) Brid. (southernmost mainland population in Bishop Pine Forest in the Del Monte Forest, Monterey Co.), and *Neckera douglasii* Hook. (southernmost mainland population in Bishop Pines near Point Conception, Santa Barbara Co.). Other species with a generally more northern mainland distribution include the mosses *Alsia californica* (Hook. & Arn.) Sull., *Bryolawtonia vancouveriensis* (Kindb.) D.H. Norris & Enroth, *Dendroalsia abietina* (Hook.) E. Britton ex Broth. *Isothecium stoloniferum* Brid., and the liverworts *Calypogeia azurea* Stotler & Crotz, *Cryptomitrium tenerum* (Hook.) Austin ex Underw., *Frullania californica* (Austin ex Underw.) A. Evans, *F. nisquallensis* Sull., *Radula complanata* (L.) Dumort., and *R. bolanderi* Gottsche ex Steph.

Although there is no direct evidence that these bryophyte distributions are relictual, the fossil evidence of their woody associates (Axelrod 1967a) strongly suggests that these species once had more extensive southern populations and are now relictual. This floristic link with the north also explains much of the difference between the flora of the islands and the flora of the adjacent Sierra Madre Mountains (Sagar 2007), which have no Bishop Pine forest.

In addition to its ties to the north, the vascular flora of the islands is also strongly linked to the coastal mesas of Baja California. This association is characterized by species of the succulent scrub community dominated by *Opuntia*, *Cylindropuntia*, *Bergerocactus* and *Artemisia* that is particularly well developed on San Clemente Island, but associated vascular species can be found throughout the islands. It remains unclear whether bryophytes also mirror this pattern. The bryophyte flora of the Baja coast is not well documented, nor is the coastal flora of mainland southern California. Compounding the difficulty is the high proportion of ephemeral and taxonomically difficult species in the Pottiaceae and Bryaceae in the region. The presence of a few xerophytic taxa on the islands, for example *Crossidium crassinervium* (De Not.) Jur. and *Pseudocrossidium crinitum* (Schultz) R.H. Zander, suggests ties to the arid mainland regions, however more data need to be collected before any firm conclusions can be drawn about the contribution of the xerophytic mainland flora on the islands.

As with any island flora, some of the intrigue involves species apparently absent from the flora. On the Channel Islands, the most striking of these appear to be due to a lack of appropriate substrate rather than obvious dispersal limitation. Some notable examples include *Orthotrichum rupestre* Schleich. ex Schwägr. and species in *Hedwigia* P. Beauv. and *Schistidium* Bruch & Schimp., all of which are saxicolous and might be excluded due to a lack of suitable substrate. No pattern of

absences among soil dwelling mosses is immediately apparent, and epiphytes (e.g., *Orthotrichum*, *Frullania* Raddi) appear to be strongly represented due to the increased fog on the islands. The islands also have a strong representation of semi-aquatic and rheophytic species. These include *Hygrohypnum bestii* (Renauld & Bryhn) Holz., *Leptodictyum riparium* (Hedw.) Warnst., *Scleropodium obtusifolium* (Mitt.) Kindb., *S. occidentale* B.E. Carter, and as well as the seep species *Crumia latifolia* (Kindb.) W.B. Schofield, *Didymodon tophaeus* (Brid.) Lisa, and *Eucladium verticillatum* (With.) Bruch & Schimp.

Unlike the vascular island flora, endemism is not important in the island bryophyte flora, as no species are endemic to the archipelago. The two undescribed species are both known only from occurrences on the islands, but the bryophyte flora of coastal mainland southern California is poorly enough known that these should only very tentatively be considered island endemics pending further exploration of the mainland. An interesting near-endemic is *Frullania catalinae* A. Evans, which is among the most common epiphytic bryophyte species on the islands but appears to be relatively rare on the mainland, with a few scattered localities along the coast from San Luis Obispo County to San Diego County.

Although the vascular flora and vegetation of the islands are strongly influenced by introduced species, there are few introduced bryophytes, and none of these appear to be ecologically important. Four species are known only from irrigated flowerbeds in Avalon or Middle Ranch on Santa Catalina: *Amblystegium serpens* (Hedw.) Schimp., *Gemmabryum radiculosum* (Brid.) J.R. Spence & H.P. Ramsay, *Leptobryum pyriforme* (Hedw.) Wilson, and *Lunularia cruciata* (L.) Dumort. ex Lindb.. The first three of these are native to coastal California but are known on the islands only from areas with year-round anthropogenic irrigation. Two additional species, *Campylopus introflexus* (Hedw.) Brid. and *Fissidens curvatus* Hornsch., are naturalized. The *Campylopus* Brid. populations are concentrated in the relatively undisturbed Bishop pine forests of Santa Cruz Island with outlying populations in other high-elevation, fog-influenced areas (Carter 2014). *Fissidens curvatus* is known from disturbed areas in the Central Valley on Santa Cruz and from coastal areas (e.g., Ben Weston and Little Harbor) on Santa Catalina. The distribution of *Marchantia polymorpha* L. also suggests recent anthropogenic introduction. It is known only from the mouths of drainages near the sea on the Channel side of Santa Cruz. These are popular boat-in recreational sites, and the absence of the species from higher in the watersheds suggests that the species may be a recent addition to the flora. Two other species, *Hennediella stanfordensis* (Steere) Blockeel and *Sphaerocarpos texanus* Austin, have both

been found exclusively on dirt roads and may be recent introductions as well.

While much work remains to be done on the islands, the general patterns mentioned here suggest that the bryophyte flora has strong potential to inform a more general understanding of the biogeography of coastal California. Because the bryophytes are primarily spore-dispersed, the contrasts (and similarities) in floristic patterns between the bryophyte and vascular floras presents an opportunity to develop a richer understanding of the island biogeography of the Channel Islands, as well as effective conservation strategies for both the islands and the adjacent mainland.

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APPENDIX 1

An annotated checklist of the bryophytes of the Channel Islands. Island abbreviations are as follows: Ana = Anacapa, SBa = Santa Barbara, SCa = Santa Catalina, SCl = San Clemente, SCz = Santa Cruz, SMi = San Miguel, SNi = San Nicolas, SRO = Santa Rosa. Nomenclature follows treatments in the Flora of North America unless otherwise noted. For brevity, a single voucher is provided for each species on each island. Additional records, and exact locality data for the specimens cited here, can be queried using the online database of bryophyte specimens at UC (http://ucjeps.berkeley.edu/bryolab/UC_bryophytes.html) or the Consortium of North American Bryophyte Herbaria (<http://bryophyteportal.org/portal/>). McCleary (1972) and Steere (1954) did not cite vouchers for their reports. Some of these vouchers were relocated and are reported here. Reports for which no voucher could be found have only the citation where the report was made. An asterisk (*) before the species name indicates a new report for the archipelago, and an asterisk before a report for a specific island indicates a first report of the species on that island. Synonyms used in previous literature reports are included for each currently accepted species.

MOSSES

Amblystegiaceae

**Amblystegium serpens* (Hedw.) Schimp.
SCa: Avalon, *Carter 6853* (UC). Known only from an irrigated flowerbed in Avalon.

Conardia compacta (Hook.) H. Rob.
 Reported as *Rhynchostegiella compacta* (Müller Hal.) Loeske by McCleary (1972); as *Amblystegium compactum* (Müll. Hal) Grout by Steere (1954). **SCa:** Reported by Steere (1954); ***SCz:** Cañada del Puerto, *Carter 4715* (UC). Known from only a historical record on Santa Catalina and a single recent record on Santa Cruz. Steere's voucher has not been relocated.

**Hygrohypnum bestii* (Renauld & Bryhn) Holz.
SCa: Slopes above White's Landing, *Carter 5519a* (UC); **SCz:** Along road to Willow's Anchorage, *Carter 6099* (UC). Rare, known from single specimens in seasonal drainages from both islands. The Santa Catalina specimen consists of only a few stems separated from a collection of *Eucladium verticillatum* (With.) Bruch & Schimp.

**Leptodictyum riparium* (Hedw.) Warnst.
SCz: Cañada del Puerto, *Carter 5452* (UC). Locally common in Cañada del Puerto.

Bartramiaceae

Anacolia menziesii (Turner) Paris var. *baueri* (Hampe) Paris
 Reported by McCleary (1972), Steere (1954); as *Anacolia menziesii* (Turn.) Paris, Sayre (1940). ***Ana:** *Hoffmann 21* (SBBG); **SCa:** Black Jack Mtn., *Carter 5767* (UC); **SCI:** Eagle Canyon, *Carter 4390* (UC); ***SCz:** Above Dick's

Harbor, *Carter 6736* (UC); ***SRO:** Torrey Pines, *Shevock 20789* (SBBG). Common and widespread throughout the islands, especially in chaparral, woodlands, and on north facing grassy slopes. Different opinions exist with respect to species circumscriptions within *A. menziesii* s.l. Norris and Shevock (2004a, 2004b) recognize *A. baueri* as a separate species from *A. menziesii*, with the sporophyte being necessary for confident identification. Alternatively, other workers including Griffin (2003), include *A. baueri* (Hampe) Paris within the concept of *A. menziesii* and do not recognize named variants within *A. menziesii* s.l. Sporophytes are not common on the islands, but when present, they exhibit the more elongate capsule of *A. menziesii* var. *baueri*.

Bartramia aprica Müll. Hal.

Reported as *Bartramia stricta* Brid. by Sayre (1940), McCleary (1972). **SCa:** Howland's Landing, *Carter 7185* (UC). Occasional on Santa Catalina Island, where it is associated with soil crusts. Earlier reports of this species (as *B. stricta*) from Santa Catalina, Santa Rosa, Santa Cruz, Anacapa and San Clemente were based on misidentified specimens of *Anacolia menziesii* var. *baueri*. Several recent collections document the species occurring on Santa Catalina. The name *Bartramia aprica* replaces the incorrectly applied name *B. stricta* (Müller 2014).

Brachytheciaceae

**Brachythecium bolanderi* (Lesq.) A. Jaeger
SCa: Bulrush Canyon, *Carter 6889* (UC); **SCz:** Tinker's Cove, *Game 08/132* (UC). Uncommon on soil in mesic woodlands. Known from several locations around Santa Catalina and from a single collection on Santa Cruz.

Homalothecium arenarium (Lesq.) E. Lawton
 Reported by McCleary (1972); as *Camptothecium arenarium* (Lesq.) Jaeg. & Sauerb. by Williams (1923), Sayre (1940), Steere (1954); as *C. alsiooides* Kindb. by Steere (1954). **Ana:** *Hoffmann 22* (SBBG); **SBa:** Head of Middle Canyon, *Blakley 5634* (SBBG); **SCa:** East end of Isthmus Harbor, *Blakley 4757* (SBBG); ***SCI:** Eagle Canyon, *Carter 4461* (UC); **SCz:** Prisoner's Harbor, *Blakley 5289a* (SBBG); ***SMi:** Between Baypoint and Cuyler's Harbor, *Blakley 4281a* (SBBG); ***SRO:** Cherry Canyon, *Blakley 3064c* (SBBG). This is one of the most common species on the islands in grasslands and coastal scrub. It is not yet documented from San Nicolas, but undoubtedly will be found there with further collecting.

Homalothecium nuttallii (Wilson) A. Jaeger
 Reported by Steere (1954), McCleary (1972). **SCa:** Canyon above Pebbly Beach, *Carter 6857* (UC); **SCI:** SHOBA Gate, *Carter 6633* (UC); ***SCz:** Mt. Diablo, *Carter 5977* (UC); ***SRO:** Upper Water Canyon, *Carter 6129* (UC). This species on the islands is highly variable in habit, microsite preference, and leaf morphology. On the mainland, it is mostly restricted to tree trunks, but on the islands it is also commonly found on boulders and tree bases. The plants tend to be larger and more robust than typical mainland populations, and the habit of some strongly resembles that of *H. aeneum* (Mitt.) E. Lawton. The recurved basal serrations found on mainland populations grade

from typical to essentially absent on the islands, thus increasing the resemblance to *H. aeneum*, which has serrulate to serrate (but never with recurved serrations) basal margins. Although *H. pinnatifidum* (Sull. & Lesq.) E. Lawton also occurs on the adjacent mainland, the smooth basal margins and greater number of alar cells along the margin prevent confusion of that species with *H. nuttallii* or *H. aeneum*. Because of the morphological confusion, I sequenced ITS for eight specimens (Santa Catalina: *Carter* 4470, 5548, 5755, 7009, 7012; Santa Cruz: *Carter* 4655, 5977; San Clemente *Carter* 6633) representing the range of morphological variation encountered on the islands and compared the sequences to GenBank sequences included in a phylogenetic analysis (Huttunen et al. 2008) that demonstrated the reciprocal monophyly of *H. nuttallii*, *H. pinnatifidum* (as *H. aureum* [Spruce] H. Rob.), and *H. aeneum*. Phylogenetic analyses (results not shown) confirmed unambiguously that all eight of the island accessions are *H. nuttallii*. With this understanding of the broad phenotypic plasticity of *H. nuttallii* on the islands, I have seen no specimens that can serve as vouchers for *H. aeneum* on the islands. Steere (1954) documented the species from Santa Catalina, but I have been unable to locate his voucher. Species boundaries in *Homalothecium* Schimp. have received considerable attention since Steere (1954) and Sayre (1940) published their lists (Lawton 1965, 1971; Hofmann 1998; Norris & Shevock 2004b), and their determinations were made based on species circumscriptions that are much better understood now than they were at that time.

Homalothecium pinnatifidum (Sull. & Lesq.) E. Lawton
Reported as *Camptothecium pinnatifidum* (Sull. & Lesq.) Jaeg. & Sauerb. by Steere (1954). ***SCz**: Cañada del Puerto, *Carter* 4628 (UC). Known only from Cañada del Puerto on Santa Cruz. Steere's report of *Camptothecium pinnatifidum* from Santa Catalina is based on a misidentified specimen (UBC-B225072) of *Scleropodium californicum*. See notes under *H. nuttallii* for further discussion.

Kindbergia praelonga (Hedw.) Ochyra
Reported as *Eurhynchium praelongum* var. *stokesii* (Turner) Habk. by McCleary (1972). ***SCz**: Christy Pines, *Carter* 5398 (UC); **SRo**: Upper Windmill Canyon, *Shevock* 20889 (SBBG). Uncommon, restricted to very mesic areas at upper elevations and in deep canyons along the Channel side of the islands.

Scleropodium californicum (Lesq.) Kindb.
Reported by Williams (1923), Sayre (1940), Steere (1954), McCleary (1972). **Ana**: West Island, *Blakley* 4375 (SBBG); **SCa**: Cherry Cove, *Carter* 5914; **SCI**: Between Eel Point and Seal Cove, *Blakley* 5245 (SBBG); **SCz**: Prisoner's Harbor, *Blakley* 5291a (SBBG); **SMi**: Cuyler Harbor, *Carter* 6301 (UC); **SNi**: Canyon southeast of sheep dock, *Blakley* 4146 (SBBG); **SRo**: Cañada Lobos, *Shevock* 20839 (SBBG). Occasional to common throughout the islands. Known from all islands except Santa Barbara.

Scleropodium cespitans (Müll. Hal.) L.F. Koch
Reported by McCleary (1972); as *Scleropodium caespitosum* (Wils.) B.S.G. by Steere (1954). ***SCI**: Eastern escarpment, *Carter* 6609 (UC); ***SCz**: North Slope of Mt. Diablo, *Carter* 5979 (UC); ***SRo**: Black Mountain, *Carter* 6218 (UC). Uncommon, restricted

to mesic areas at higher elevations. Steere's report of this species from Santa Catalina was based on a misidentified specimen (UBC-B225073) of *Scleropodium touretii*. Another collection labeled *S. cespitans* from Santa Catalina, *Fosberg* 439 (UC, NY) is *S. californicum*.

Scleropodium julaceum E. Lawton
Reported as *Scleropodium apocladum* (Mitt.) Grout by McCleary (1972). **Ana**: Villaseñor s.n., Feb 2011 (UC); ***SCa**: Gallagher's Canyon, *Carter* 5781 (UC); ***SCI**: Eagle Canyon, *Carter* 4391 (UC); ***SCz**: Cañada del Puerto, *Carter* 4614 (UC); **SRo**: Black Mountain, *Carter* 6223 (UC). Locally common on mesic slopes and in canyons, especially on the Channel side of the islands.

****Scleropodium obtusifolium*** (Mitt.) Kindb.
SCz: Hooker Canyon, *Carter* 4721 (UC); **SRo**: Upper Cherry Canyon, *Shevock* 20912 (SBBG). Occasional on rocks in shaded seasonal streams.

****Scleropodium occidentale*** B.E. Carter
SCI: Mosquito Canyon, Villaseñor s.n., 26 Mar 2011 (UC); **SCz**: Above Dick's Harbor, *Carter* 6744 (UC); **SRo**: Upper Cherry Canyon, *Carter* 6237 (UC). Occasional on rocks in shaded seasonal streams.

Scleropodium touretii (Brid.) L.F. Koch
Reported by McCleary (1972); as *S. illecebrum* (Schwagr.) BSG by Williams (1923), Sayre (1940), Steere (1954); as *Scleropodium colpophyllum* (Sull.) Grout by Steere (1954). **SCa**: Black Jack Mountain, *Carter* 4576 (UC); ***SCI**: Eastern escarpment, *Carter* 6608 (UC); ***SCz**: Hoffmann 27 (SBBG); ***SRo**: Torrey Pines, *Carter* 6255 (UC). Common on soil in most habitats throughout the larger islands.

Bryaceae

****Bryum argenteum*** Hedw.
Ana: West Anacapa, Villaseñor s.n., Feb 2011 (UC); **SCa**: Middle Ranch, *Carter* 5594 (UC); **SCI**: Above Eagle Canyon, *Carter* 4428 (UC); **SCz**: Lagunitas Secas Rd., *Carter* 5413 (UC); **SMi**: Nidever Canyon, *Carter* 6279 (UC); **SRo**: Water Canyon, *Carter* 6150 (UC). Occasional to common throughout the islands in dry, sunny areas.

Bryum lanatum Hedw.
Reported as *Bryum argenteum* var. *lanatum* (Brid.) BSG, Williams (1923), Sayre (1940), Steere (1954), McCleary (1972). **SCa**: Golf Links Canyon (near Avalon), *Millsbaugh* 4644 (NY); ***SCz**: Upper Christy Valley, *Carter* 4703 (UC). Steere (1954) found the species to be uncommon at White's Landing, but that population and the voucher have not been relocated. On Santa Cruz, it is known from several collections in Christy Valley.

****Gemmabryum barnesii*** (J.B. Wood ex Schimp.) J.R. Spence
SCa: 4th of July Cove, *Carter* 4518 (UC). Known from several collections in dry areas on Santa Catalina.

****Gemmabryum caespiticium*** (Hedw.) J.R. Spence
SRo: East flank of Black Mtn., *Carter* 6225a (det. Spence) (UC). Known from a single specimen mixed with a more robust collection of *G. kunzei*.

Gemmabryum dichotomum (Hedw.) J.R. Spence & H.P. Ramsay

Reported as *Bryum bicolor* Dicks. by Steere (1954), McCleary (1972); as *B. californicum* Sull. by Williams (1923), Sayre (1940). **SCa**: Avalon Canyon, *Knopf 326* (NY) ***SCI**: Horton Canyon, *Carter 4355* (UC). Known from several locations in dry, grassy areas on San Clemente. Populations on Santa Catalina are known only from historic specimens reported by Williams (1923) and Steere (1954).

**Gemmabryum gemmiferum* (R. Wilczek & Demaret) J. R. Spence

Ana: East Anacapa near campground, *Carter 6119* (UC); **SCa**: Middle Ranch, *Carter 5593* (UC); **SCI**: Horton Canyon, *Carter 4333* (UC); **SCz**: Ridgeline above Central Valley, *Carter 4642b* (UC); **SRo**: Water Canyon, *Carter 6138* (UC). Probably the most common species of *Gemmabryum* on the islands.

**Gemmabryum gemmilucens* (R. Wilczek & Demaret) J. R. Spence

SCa: Salta Verde Ridge Road, *Carter 7125* (UC); **SCI**: northwest of SHOBA gate, *Carter 6594* (UC). Known from several collections in dry areas on Santa Catalina and San Clemente.

**Gemmabryum kunzei* (Hornsch.) J.R. Spence

Ana: West Anacapa, *Villaseñor s.n., Feb 2011* (UC); **SCa**: Twin Rocks, *Carter 7160* (UC); **SCI**: Mail Point, west side of island, *Carter 6548* (det. Spence) (UC); **SCz**: Southern rim of Central Valley, *Carter 5319* (det. Spence) (UC); **SRo**: East flank of Black Mtn., *Carter 6225* (det. Spence) (UC). Occasional, mostly in foggy areas at higher elevations or near the coast on the Channel side.

**Gemmabryum tenuisetum* (Limpr.) J.R. Spence & H.P. Ramsay

SCz: *Lyonothamnus* stand along ridge road, *Carter 6652* (det. Spence) (UC). Known from a single collection.

**Gemmabryum radiculosum* (Brid.) J.R. Spence & H.P. Ramsay

SCa: Flowerbed in Avalon, *Carter 6852* (UC). Known from a single collection in an irrigated flowerbed in Avalon.

**Gemmabryum violaceum* (Crundw. & Nyholm) J.R. Spence

Ana: West Anacapa, *Villaseñor s.n., Feb 2011* (UC); **SCa**: Salta Verde Cutoff Rd., *Carter 7115* (UC); **SCI**: Horton Canyon, *Carter 4360* (det. Spence) (UC); **SCz**: Sierra Blanca Ridge, *Carter 6696* (UC); **SRo**: Cherry Canyon, *Carter 6231a* (UC). Occasional to common in dry, grassy areas.

**Gemmabryum valparaisense* (Thér.) J.R. Spence

Ana: West Anacapa, *Villaseñor s.n., Feb 2011* (det. Spence) (UC); **SCa**: Orizaba Mtn., *Carter 4568* (det. Spence) (UC); **SCz**: Central Valley, *Carter 4646* (UC). Occasional throughout the islands.

**Gemmabryum* sp.

SRo: Torrey Pines, *Shevock 20776* (CAS). According to J. Spence (personal communication 2014), this is a putative undescribed species that is provisionally considered endemic to Santa Rosa Island pending future collecting on the islands and the adjacent mainland.

**Imbribryum gemmiparum* (De Not.) J.R. Spence

SCz: Hooker Canyon, *Carter 6774* (det. Spence) (UC). Known from a single collection in a seasonal drainage.

**Imbribryum muehlenbeckii* (Bruch & Schimp.) N. Pedersen

SCz: Slopes above Dick's Harbor, *Carter 6751* (UC); **SRo**: Cherry Canyon, *Carter 6234* (det. Spence) (UC). Known from several collections in seeps and springs on Santa Cruz, and a single collection from Santa Rosa.

**Plagiobryoides* sp.

SCa: Slopes above White's Landing, *Carter 5540a* (det. Spence) (UC). According to J. Spence (personal communication 2012), this sterile specimen most likely represents an undescribed species. It is known only from the collection cited above and is provisionally considered to be endemic to Santa Catalina pending more collections.

Ptychostomum creberrimum (Taylor) J.R. Spence & H.P. Ramsay

Reported as *Bryum cuspidatum* (BSG) Schimp. by Steere (1954); as *B. intermedium*, by Williams (1923); as *B. creberrimum* Taylor by McCleary (1972). **SCa**: Reported by Steere (1954) from White's Landing. Steere (1954) noted "Common on soil, from shaded moist slopes of deep canyons to open insolated valley bottoms; with sporophytes." Williams (1923) reported this species from Pebble Beach Canyon based on *Millspaugh 4694* (NY), but that specimen was annotated by Koch (x. 1950) as *Bryum capillare* (= *Rosulabryum capillare*).

Rosulabryum canariense (Brid.) Ochyra

Reported as *Bryum canariense* Brid. by Steere (1954), McCleary (1972). **SCa**: Black Jack Mountain, *Carter 5753* (UC). Occasional at high elevations and in mesic canyons on Santa Catalina.

Rosulabryum capillare (Hedw.) J.R. Spence

Reported as *Bryum capillare* Hedw. by Steere (1954), McCleary (1972); as *B. obconicum* Sull. by Kingman (1912), Williams (1923), Sayre (1940). **SCa**: Salta Verde Cutoff Rd., *Carter 6928* (UC); ***SCz**: Sierra Blanca Ridge, *Carter 6669* (UC); ***SMi**: Nidever Canyon, *Carter 6281* (UC); ***SRo**: Water Canyon, *Carter 6156* (UC). Occasional in mesic areas.

**Rosulabryum erythroloma* (Kindb.) J.R. Spence

SCa: Italian gardens, *Carter 5839* (UC). Known from two collections from slopes on the Channel side of Santa Catalina.

**Rosulabryum gemmascens* (Kindb.) J.R. Spence

Ana: West Anacapa, *Villaseñor s.n., Feb 2011* (UC); **SCa**: Twin Rocks, *Carter 7165* (UC) **SCz**: Between Prisoner's Harbor and Pelican Bay, *Carter 6032* (UC). Occasional along the Channel slope of Santa Catalina, and single collections from Anacapa and Santa Cruz.

Rosulabryum torquescens (Bruch & Schimp.) J.R. Spence

Reported as *Bryum torquescens* by Williams (1923), Sayre (1940). **SCa**: Two Harbors, *Carter 7170* (UC); ***SCz**: Pelican Bay, *Carter 6075* (UC); ***SMi**: Cabrillo monument, *Carter 6272* (UC); ***SRo**: Torrey Pines, *Carter 6261* (UC). Common in mesic habitats. Steere (1954) considered this to be conspecific with *Bryum capillare* (= *Rosulabryum capillare*).

Cryphaeaceae

**Dendroalsia abietina* (Hook.) E. Britton ex Broth.
SCI: Ridgeline near SHOBA gate, *Carter 6626* (UC);
SCz: Above Lady's Harbor, *Fosberg 416* (UC). Rare,
 on oaks. The population on San Clemente is at the top
 of the eastern escarpment, while the historical
 collection on Santa Cruz was probably at a low
 elevation (the population could not be relocated).
 Remarkably, this large and moisture-loving species has
 also been documented from the coniferous forests of
 Guadalupe Island off the coast of Baja México (Koch
 and Crum 1950).

Dicranaceae

Campylopus introflexus (Hedw.) Brid.
 Reported by Norris & Shevock (2004), Carter (2014).
SCz: Christy Pines, *Carter 5334* (UC). This species is
 presumably introduced from the southern hemisphere
 (Carter 2014). A fairly common species along the
 northern coast of California, it is rare in southern
 California and this population is the only one known
 from south of the Monterrey Peninsula. It has
 scattered, depauperate populations in Christy Pines and
 on the upper north slope of Mt. Diablo. A very large
 population with contiguous areas exceeding 20 m² was
 found along Sierra Blanca Ridge.

Dicranella varia (Hedw.) Schimp.
 Reported by Sayre (1940), McCleary (1972); as
Anisothecium varium (Hedw.) Mitt. by Steere (1954); as
Dicranella rubra (Huds.) Kindb. by Williams (1923).
SCa: Italian Gardens, *Carter 5837* (UC); ***SRo:** Below
 north slope of Black Mountain, *Shevock 20902* (CAS).
 Occasional in mesic, open areas on Santa Catalina.
 Known from a single collection on Santa Rosa.

**Dicranoweisia cirrata* (Hedw.) Lindb. ex Milde
SCz: North slope of Mt. Diablo, *Carter 5983* (UC).
 Known from a single collection on a charred log.

Ditrichaceae

Ceratodon purpureus (Hedw.) Brid.
 Reported by Sayre (1940), Steere (1954), McCleary
 (1972). **SCa:** Salta Verde Cutoff Road, *Carter 7107*
 (UC); **SCI:** *Elmore s.n.*, 24 Nov 1939 (UC); ***SCz:**
 Sierra Blanca Ridge, *Carter 6687* (UC); **SMi:** Reported
 by McCleary (1972); **SNi:** Reported by McCleary
 (1972); ***SRo:** Soledad Mountain, *Shevock 20749*
 (CAS). Occasional, mostly in mesic areas along
 ridgelines and in canyon mouths.

**Pleuroidium acuminatum* Lindb.
SCa: Fern Canyon, *Carter 5464* (UC); **SCz:** Christy
 Valley, *Carter 4702* (UC); **SRo:** Cañada Tecelote,
Shevock 20759 (CAS). Common on bare soils.
 Probably undercollected due to its small size and
 present throughout the islands.

**Pleuroidium subulatum* (Hedw.) Rabenh.
SCa: Little Geiger Canyon, *Carter 4529* (UC); **SCI:**
 Twin Dams, *Carter 5711* (UC); **SCz:** Sierra Blanca
 Ridge, *Carter 6697* (UC); **SRo:** Becher's Bay, *Carter*
6267 (UC). Common on bare soils. Probably

undercollected due to its small size and present
 throughout the islands.

Ephemeraeae

**Ephemerum serratum* (Schreb. ex Hedw.) Hampe
SCa: Slopes above White's Landing, *Carter 5925a* (UC).
 Known from a single collection.

Encalyptaceae

Encalypta vulgaris Hedw.
 Reported as *Encalypta vulgaris* var. *mutica* Brid. by
 Steere (1954), McCleary (1972). **SCa:** Italian Gardens,
Carter 5837a (UC). Uncommon along the Channel side
 of the island. No sporophytes observed.

Fabroniaceae

**Fabronia pusilla* Raddi
SCa: Upper slopes above White's Landing, *Carter 5537*
 (UC); **SCz:** Mt. Diablo, *Carter 5991* (UC). Uncommon,
 on oak trees and large, shaded rock faces.

Fissidentaceae

Fissidens crispus Mont.
 Reported as *Fissidens limbatus* Sull. by Williams (1923),
 Sayre (1940), Steere (1954), McCleary (1972). **SCa:**
 Little Geiger Canyon, *Carter 4541* (UC); ***SCI:** Top of
 Horton Canyon, *Carter 4334* (UC); ***SCz:** Between
 Prisoner's Harbor and Pelican Bay, *Carter 6028* (UC);
***SRo:** Lower Windmill Canyon, *Shevock 20770* (det.
 Pursell) (SBBG). Widespread and common, though
 apparently more restricted to mesic habitats than *F.*
sublimbatus.

**Fissidens curvatus* Hornsch.
SCa: Ben Weston Beach, *Carter 8386* (UC); **SCz:** Near
 UC Field Station, *Carter 4650* (UC). This species,
 understood to be introduced in California (Pursell
 2006), was collected several times on disturbed soils in
 the vicinity of the UC Field Station on Santa Cruz and
 in coastal areas from Ben Weston to Little Harbor on
 Santa Catalina.

**Fissidens sublimbatus* Grout
Ana: West Anacapa, *Villaseñor s.n.* (UC); **SCa:** Cherry
 Valley, *Carter 5917* (UC); **SCI:** Top of Eagle Canyon,
Carter 4434 (UC); **SCz:** Road from Central Valley to
 Ridge Road, *Carter 5947* (UC); **SRo:** Box Canyon,
Shevock 20795 (det. Pursell) (SBBG). Widespread and
 common throughout the islands.

Funariaceae

**Entosthodon attenuatus* (Dicks.) Bryhn
SRo: Cherry Canyon, *Norris 102123* (UC). Known from
 a single collection.

Entosthodon bolanderi Lesq.
 Reported by McCleary (1972); as *Funaria bolanderi*
 (Lesq.) Holz. by Bartram (1933), Sayre (1940). **Ana:**
 East Islet near Ranger Station, *Carter 6124* (UC); **SCa:**
 Ben Weston Beach, *Carter 8394* (UC); **SCI:** Ridge
 above Twin Dams Canyon, *Carter 5746* (UC); ***SCz:**
 Mouth of Los Sauces Creek, *Carter 6708* (UC); **SNi:**
 No specific locality, *J.T. Howell s.n.*, 13 Mar 1932

(CAS); **SRo**: Vail Ranch House, *Blakley 3065* (SBBG). Occasional to common in dry areas, including areas subjected to salt spray.

Funaria hygrometrica Hedw.

Reported by Williams (1923), Sayre (1940), Steere (1954), McCleary (1972). **SCa**: Tributary to Fern Canyon, *Carter 5471* (UC); ***SCz**: Ridge Road, *Carter 5265* (UC); ***SMi**: Limonton Cave, *Fosberg F403* (NY); ***SRo**: Box Canyon, *Shevock 20793* (CAS, SBBG). Occasional on disturbed soil throughout the islands.

Funaria muhlenbergii Turner

Reported by Sayre (1940), Steere (1954), McCleary (1972); as *F. mediterranea* Lindb. by Williams (1923). ***Ana**: *Villaseñor s.n., Feb 2011* (UC); **SCa**: Little Geiger Canyon, *Carter 4531* (UC); ***SCI**: Eagle Canyon, *Carter 4466* (UC); ***SCz**: Prisoner's Harbor, *Carter 6107* (UC); ***SRo**: Junction of Cherry and Windmill Canyons, *Blakley 3064d* (SBBG). Occasional throughout the islands.

Grimmiaceae

Grimmia laevigata (Brid.) Brid.

Reported by Sayre (1940), McCleary (1972). ***Ana**: *Villaseñor s.n., Feb 2011* (UC); ***SCa**: Black Jack Campground, *Carter 5771* (UC); **SCI**: Knob Canyon, *Carter 5704* (UC); ***SCz**: Mt. Diablo, *Carter 5958* (UC); ***SRo**: Box Canyon, *Shevock 20805* (det. Muñoz) (SBBG). Occasional to locally abundant on sunny boulders.

****Grimmia lisae*** De Not.

Ana: West Anacapa, *Villaseñor s.n., Feb 2011* (UC); **SCa**: Black Jack Mtn., *Carter 5756* (UC); **SCI**: Eagle Canyon, *Carter 4449* (UC); **SCz**: Above Lady's Harbor, *Carter 6019* (UC); **SRo**: Upper tributary to Water Canyon, *Shevock 20823* (det. Muñoz) (UC). Occasional to common on rock outcrops, especially in shaded areas. As with populations on the adjacent mainland, *G. lisae* and *G. trichophylla* intergrade and there are differences in opinion with respect to their circumscriptions (personal communication R. Hastings and D. Toren, 2013). On the islands, I have found the leaf curvature (arcuate in *G. lisae* vs. S-shaped in *G. trichophylla*) to be more consistent than leaf areolation. Island populations of *G. trichophylla* often tend to be lighter green and slightly smaller than *G. lisae*.

Grimmia pulvinata (Hedw.) Sm.

Reported by Steere (1954), McCleary (1972). **SCa**: Lower Middle Canyon, *Carter 7271* (det. Hastings) (UC); ***SCz**: Sierra Blanca Ridge, *Carter 6674* (UC). Only collected once on Santa Catalina for this study. Steere (1954) reported a sterile, reduced form of the species from White's Landing, but the population was not relocated.

Grimmia trichophylla Grev.

Reported by Williams (1923), Sayre (1940), Steere (1954), McCleary (1972); as *G. decipiens* (Schultz) Lindb. by Sayre (1940), McCleary (1972). ***Ana**: *Villaseñor s.n., Feb 2011* (UC); **SCa**: Middle Ranch, *Carter 4474* (UC); **SCI**: Twin Dams Canyon, *Carter 5724* (UC); ***SCz**: Christy Pines, *Carter 5394* (UC); **SRo**: Upper Cherry Canyon, *Shevock 20907* (det. Muñoz) (SBBG). Occasional to common on rock outcrops. See notes under *G. lisae*.

Lembophyllaceae

Bestia longipes (Sull. & Lesq.) Broth.

Reported as *Bestia brevipes* (Sull. & Lesq.) Broth., by Steere (1954), McCleary (1972). ***Ana**: West Island, in oak grove canyon, *Blakley 5023* (SBBG); **SCa**: Middle Ranch Road west of Middle Ranch, *Carter 5487* (UC); ***SCI**: Eagle Canyon, *Carter 4397* (UC); ***SCz**: Coches Prietos Canyon, *Blakley 3371* (SBBG); ***SRo**: Upper tributary to Water Canyon, *Shevock 20817* (SBBG). Restricted to rocks in shaded, mesic canyons, especially at low elevations. Often abundant within these habitats

Isoetecium cristatum (Hampe) H. Rob.

Reported by McCleary (1972); as *Bestia breweriana* (Lesq.) Grout by Steere (1954). **SCa**: Salta Verde Cutoff, *Carter 7116* (UC); ***SCI**: Central Ridgeline, *Carter 6616* (UC); ***SCz**: Christy Pines, *Carter 4658* (UC); ***SRo**: Upper Cherry Canyon, *Shevock 20906* (SBBG). Limited to very mesic slopes and canyons, but often locally abundant.

****Isoetecium stoloniferum*** Brid.

SCz: Christy Pines, *Carter 4675* (UC); **SRo**: Burma Road, *Carter 6184* (UC). Species circumscriptions in *Isoetecium* are problematic (Ryall et al. 2005), with problems in California associated with delimitation of *I. stoloniferum*, *I. spiculiferum* and *I. myosuroides*. This study follows Schofield (2014) in a broad interpretation of *I. stoloniferum*. Several herbarium specimens identified as other species can be referred to *I. stoloniferum* s.l., including reports of *Platydictya jungermannioides* (Brid.) Crum, *Norris 102063* (UC), and *Eurhynchium stokesii* (Smith) Schimp., *Blakley 3049* and *3049c* (CAS). *Isoetecium stoloniferum* s.l. forms extensive mats in Christy Pines on Santa Cruz Island and is locally abundant beneath the canopies of old relict *Quercus tomentella* individuals along Burma Road on Santa Rosa. These are clearly relict populations limited to the foggiest localities on the islands. On the mainland, this species (or species complex) is not currently known south of Monterey County.

Leptodontaceae

Alsia californica (Hook. & Arn.) Sull.

Reported by Williams (1923), Sayre (1940), Steere (1954), McCleary (1972). ***Ana**: West Island, *Blakley 4375b* (SBBG); **SCa**: Between Black Jack Mtn. and the airport, *Carter 5935* (UC); ***SCI**: Just below central ridgeline, *Munz 6719* (UC); **SCz**: South of Stanton Ranch Headquarters, *Blakley 4004e* (SBBG); **SRo**: Upper tributary to Water Canyon, *Shevock 20814* (SBBG). Restricted to oak woodlands (*Q. agrifolia*, *Q. tomentella*, *Q. chrysolepis*) and consequently rare on the southern islands. Primarily found on oaks near ridgelines or in narrow canyons near sea level.

Leskeaceae

Claopodium whippleanum (Sull.) Renaud & Cardot

Reported by Sayre (1940), Steere (1954), McCleary (1972); as *C. whippleanum* var. *leuconeuron* (Sull. & Lesq.) Grout by McCleary (1972); as *C. leuconeuron* (Sull. & Lesq.) Ren. & Card. by Williams (1923). **SCa**: Two Harbors Road, *Carter 4512* (UC); ***SCz**: Cañada del Puerto, *Carter 4588* (UC); ***SRo**: Windmill

Canyon, *Shevock 20904* (SBBG). Occasional on bare soil in mesic woodlands.

Leucodontaceae

Antitrichia californica Sull. ex Lesq.

Reported by Williams (1923), Sayre (1940), Steere (1954), McCleary (1972). **SCa:** Between Black Jack Campground and Mt. Orizaba, *Shevock 4034* (UC); ***SCI:** Ridgeline near SHOBA gate, *Carter 6639* (UC); ***SCz:** North-facing slope below Mt. Diablo, *Carter 5986* (UC). Rare. Known from two or fewer occurrences on each of the islands listed. On oak trunks or boulders in mesic oak woodlands.

Nogopterium gracile (Hedw.) Crosby & W.R. Buck

Reported as *Pterogonium gracile* (Hedw.) Sm. by Steere (1954), McCleary (1972). ***Ana:** *Villaseñor s.n., Feb 2011* (UC); **SCa:** Middle Ranch, *Carter 5497* (UC); ***SCI:** Eagle Canyon, *Carter 4396* (UC); **SCz:** Mt. Diablo, *Weber B-90027* (SBBG); ***SRo:** Torrey Pines, *Shevock 20783* (SBBG). Restricted to very mesic slopes and deep canyons along the Channel side, where it is locally abundant.

Meesiaceae

Leptobryum pyriforme (Hedw.) Wilson

SCa: Middle Ranch Nursery, *Carter 6878* (UC); **SCz:** Canyon above Lady's Harbor, *Carter 6014* (UC). On Santa Catalina, known only from a plant nursery, and on Santa Cruz from a single collection from an often-visited area. Needs further study, but likely introduced.

Mniaceae

Epipterygium tozeri (Grev.) Lindb.

SCa: Upper slopes above White's Landing, *Carter 5547* (UC); **SCz:** Christy Pines, *Carter 5395* (UC); **SRo:** Torrey Pines, *Shevock 20775a* (SBBG). Common on Santa Cruz and Santa Rosa in mesic woodlands. Uncommon on Santa Catalina.

Pohlia longibracteata Broth.

SCz: Cañada del Puerto, *Carter 4717* (UC). Known from a single collection along a stream bank.

Pohlia nutans (Hedw.) Lindb.

SCz: Above Dick's Harbor, *Carter 6772* (UC). Known from a single collection along a stream bank.

Pohlia wahlenbergii (F. Weber & D. Mohr) A.L. Andrews

SCz: Above Lady's Harbor, *Carter 6015* (UC); **SRo:** Cañada Lobos, *Shevock 20849* (det. Shaw) (SBBG). Uncommon and restricted to mesic areas.

Neckeraceae

Bryolawtonia vancouveriensis (Kindb.) D.H. Norris & Enroth

Reported as *Bestia vancouveriensis* (Kindb.) Wijk & Marg. by McCleary (1972). **Ana:** Reported by McCleary (1972); **SCz:** Christy Pines, *Carter 5374* (UC). Known from several collections in drainages at

mid to high elevations in Christy Pines. The voucher from Anacapa was not relocated.

Neckera douglasii Hook.

SCz: Christy Pines, *Carter 5386* (UC). Known from a single, depauperate population in a drainage in the upper slopes of Christy Pines. The southernmost mainland population is from a Bishop pine forests near Point Conception (Hollister Ranch, *P. Huebner s.n., May 1987* SBBG).

Porotrichum bigelovii (Sull.) Kindb.

SCz: Canyon above Lady's Harbor, *Carter 6017* (UC); **SRo:** Cañada Lobos, *Shevock 20852* (SBBG). Restricted to deep, shady canyons along seasonal streams, mostly near sea level.

Orthotrichaceae

Orthotrichum bolanderi Sull.

SCa: Several hundred meters south of the Airport, *Carter 7224* (UC). Known from a single depauperate collection mixed with *Grimmia lisae* from a crevice in a granitic boulder.

Orthotrichum coulteri Mitt.

Reported as *Orthotrichum tenellum* var. *coulteri* (Mitt.) Grout by McCleary (1972). **SBa:** Reported by McCleary (1972); ***SCa:** Rim of Silver Canyon, *Carter 6953* (UC); **SCz:** Above Dick's Harbor, *Carter 6762* (UC); **SRo:** Water Canyon, *Carter 6175* (UC). Common on oaks and other hardwoods. This species, along with *O. cucullatum*, *O. franciscanum* and *O. norrisii*, forms a complex that was until recently recognized under the name *O. tenellum*. Recent work by Medina et al. (2012) indicates that *O. tenellum* is a strictly European species and that the four Californian species in the complex all have reliable diagnostic morphological characters. Of the four, *O. coulteri* is by far the most common on the islands. In addition to *O. tenellum* var. *coulteri*, *O. tenellum* was reported by McCleary (1972) from Santa Catalina, Santa Cruz and Santa Rosa, but vouchers have not been located so it is unclear to which species these reports should be attributed.

Orthotrichum cucullatum F. Lara, R. Medina & Garilieti

SCa: Bulrush Canyon, *Carter 5818* (UC); **SRo:** Upper Water Canyon, *Carter 6127* (UC). Occasional on oaks in mesic areas. See discussion under *O. coulteri*.

Orthotrichum diaphanum Brid.

SCI: SHOBA Gate, *Carter 6628* (UC). Known from a single collection from an isolated patch of *Quercus tomentella* along the central ridgeline of the island.

Orthotrichum franciscanum F. Lara, R. Medina & Garilieti

Ana: *Villaseñor s.n., Feb 2011* (UC); **SCa:** Salta Verde Cutoff, *Carter 6929* (UC); **SCz:** Ridge Road, *Carter 5318* (UC); **SRo:** Torrey Pines, *Carter 6258* (UC). Common on oaks throughout the islands. See discussion under *O. coulteri*.

Orthotrichum lyellii Hook. & Taylor

Reported by Williams (1923), Sayre (1940), Steere (1954), McCleary (1972). **SCa:** Above the Pallisades,

Carter 6937 (UC). Known from three collections, all from high elevations east of Silver Canyon. Two of these collections (*Carter 6942* & *7347*) are mixed collections with *O. papillosum*. All previous reports of *O. lyellii* from the islands are *O. papillosum* (= *O. lyellii* var. *papillosum*), which is much more common and widespread on the islands. There is some dispute as to whether *O. lyellii* comprises a single species (Vitt 2014) or two (*O. lyellii* and *O. papillosum* Norris and Shevock 2004a, b). The presence of the two mixed collections noted above indicates that the two species maintain their morphological differences even when growing in intermixed mats. On the mainland, *O. papillosum* is more common in coastal areas with *O. lyellii* more common inland, so it is not surprising that *O. papillosum* is the more common of the two on the islands.

**Orthotrichum norrisii* F. Lara, R. Medina & Garilleti
SCa: Slopes above White's Landing, *Steere s.n.*, 1–2 May 1953 (det. R. Medina) (UBC-B145567). Known from a single collection on Santa Catalina, but likely undercollected due to similarity with closely related species. See discussion under *O. coulteri* for additional discussion.

**Orthotrichum papillosum* Hampe
SCa: Bulrush Canyon, *Blakley 5476* (SBBG); ***SCI:** SHOBA Gate, *Carter 6635* (UC); **SCz:** Pine forest at Cañada Cervada, *Blakley 3725* (SBBG); ***SMi:** San Miguel Hill, *Carter 6290* (UC); **SRo:** *Hoffmann 24* (SBBG). Common throughout the islands in chaparral and oak woodlands. Previous reports of *O. lyellii* from the islands are referable to this species. See discussion under *O. lyellii*.

Polytrichaceae

**Polytrichum juniperinum* Hedw.
SCa: Ridgeline east of Divide Road, *Carter 5879* (UC); **SCz:** Canyon between Cueva Valdez and Lady's Harbor, *Carter 6002* (UC); **SRo:** Upper tributary of Water Canyon, *Shevock 20808* (SBBG). Uncommon, but locally abundant where it occurs.

Pottiaceae

**Acaulon triquetrum* (Spruce) Müll. Hal.
SCz: South rim of Central Valley, *Carter 5258* (UC). Known from a single collection, but undoubtedly undercollected due to its small size and ephemeral life history.

Aloina aloides var. *ambigua* (Bruch & Schimp.) E.J. Craig
 Reported by McCleary (1972); as *A. ambigua* (BSG) Limpr. by Steere (1954); as *A. rigida* var. *ambigua* (B. & S.) Craig by Sayre (1940); as *A. ericaefolia* (Neck.) Kindb. by Williams (1923).
SCa: Italian Gardens, *Carter 5849* (UC); ***SCz:** Road to Willow's Anchorage, *Carter 6088* (UC); ***SMi:** Bluffs above Cuyler Harbor, *Carter 6295* (UC); ***SRo:** Main fork of Water Canyon, *Shevock 20830* (det. Delgadillo) (SBBG). Uncommon, mostly in more mesic areas than those occupied by *A. bifrons*.

Aloina bifrons (De Not.) Delgad.
 Reported as *Aloina pilifera* by McCleary (1972); as *Aloina rigida* var. *pilifera* (BSG) Limpr., Steere (1954).
SCa: Middle Ranch, *Carter 5588* (UC); ***SCI:** Horton

Canyon, *Carter 4344* (UC); ***SCz:** South rim of Central Valley, *Carter 4639* (UC); ***SMi:** Bluffs above Cuyler Harbor, *Carter 6303* (UC). Occasional in dry coastal scrub and chaparral.

Barbula convoluta Hedw.

Reported by Steere (1954), McCleary (1972)
SCa: Reported by Steere (1954); ***SRo:** Burma Road, *Carter 6205* (UC). Known from a single collection from the trunk of a large, relict Island oak on Santa Rosa. The population collected by Steere at White's Landing "on moist soil near water, in deep shaded canyon" was not relocated.

Crossidium crassinervium (De Not.) Jur.

Reported as *Crossidium desertorum* Holz. & Bartr. by Bartram (1933), Sayre (1940), McCleary (1972). **SNi:** No specific locality, *J.T. Howell s.n.*, 13 Mar 1932 (CAS). Known from a single historical collection.

**Crummia latifolia* (Kindb.) W.B. Schofield

SCz: Hooker Canyon, *Carter 4725* (UC). While other travertine species (e.g., *Didymodon tophaceus* and *Eucladium verticillatum*) are commonly encountered, this species is known from a single collection on the islands.

Didymodon australasiae (Hook. & Grev.) R.H. Zander
 Reported as *Trichostomopsis brevifolia* Bartram by Koch (1950), Steere (1954), McCleary (1972); as *Trichostomopsis fayae* Grout by Steere (1954), McCleary (1972). **SCa:** Slopes above White's Landing, *Carter 5529* (UC); ***SCI:** Horton Canyon, *Carter 4347* (UC); ***SCz:** Ridge Road along south rim of Central Valley, *Carter 4641a* (UC); ***SMi:** Nidever Canyon, *Carter 6282* (UC); ***SNi:** No specific locality, *J.T. Howell s.n.*, 13 Mar 1923 (CAS); ***SRo:** Water Canyon, *Carter 6153* (UC). Occasional to common in dry areas throughout the islands. The San Nicolas voucher is part of a mixed collection filed under *Crossidium desertorum* (= *C. crassinervium*) at CAS.

Didymodon brachyphyllus (Sull.) R.H. Zander
 Reported as *Barbula brachyphylla* Sull., Bartram (1933), Sayre (1940), Steere (1954), McCleary (1972). ***Ana:** West Anacapa, *Villaseñor s.n.*, Feb 2011 (UC); **SCa:** Valley of the Moons, *Carter 5810* (UC); ***SCI:** Knob Canyon, *Carter 5665* (UC); ***SCz:** Ridge road along southern rim of Central Valley, *Carter 5257* (UC); **SMi:** East side of Green Mtn., *Blakley 5066* (SBBG); **SNi:** Above Coast Guard Beach, *Weber B-100684* (NY); **SRo:** Near Vail Ranch House, *Blakley 3183d* (CAS). Common on dry soils.

Didymodon rigidulus Hedw.

Reported as *Didymodon mexicanus* var. *subulatus* Thériot & Bartram by McCleary (1972).
SBa: Head of Middle Canyon, *Blakley 5633* (SBBG); ***SCa:** Middle Ranch, *Carter 5587* (UC); **SCI:** Between Eel Point and Seal Cove, *Blakley 5245a* (SBBG); ***SCz:** North side of Mt. Diablo, *Carter 5984* (UC); **SMi:** Between Willow Canyon and Cardwell Point, *Blakley 5848* (SBBG). Occasional on dry soils.

Didymodon tophaceus (Brid.) Lisa

Reported by Kingman (1912), Williams (1923), Sayre (1940), Steere (1954), McCleary (1972); as *Desmatodon*

hendersonii (Ren. & Card.) Williams by Williams (1923), Sayre (1940), Steere (1954), McCleary (1972). **SCa**: Ben Weston Canyon, *Carter 5795* (UC); ***SCI**: Knob Canyon, *Carter 5682* (UC); ***SCz**: Hooker Canyon, *Carter 4722* (UC); ***SMi**: Base of Nidever Canyon, *Carter 6294* (UC); **SNI**: Reported by McCleary (1972); ***SRo**: La Jolla Vieja Canyon, *Shevock 20867* (SBBG). Common in seasonal drainages. Williams (1923) made the new combination *Desmatodon hendersonii* and provided an illustration of this species, which is now considered a synonym of *D. topiaceus*.

Didymodon vinealis (Brid.) R.H. Zander
Reported as *Barbula vinealis* Brid. by Kingman (1912), Williams (1923), Steere (1954), McCleary (1972); as *B. cylindrica* (Tayl.) Schimp., Sayre (1940), Steere (1954), McCleary (1972); as *B. subfallax* Mull. Hal. by Williams (1923). **Ana**: West Anacapa in oak grove, *Blakley 5021* (SBBG); **SBa**: Near top of Signal Peak, *Blakley 5668* (SBBG); **SCa**: Middle Ranch Canyon, *Carter 4471* (UC); **SCI**: Knob Canyon, *Carter 5691* (UC); **SCz**: Pelican Bay, *Carter 6057* (UC); **SMi**: Canyon northwest of Green Mtn., *Blakley 5079* (SBBG); **SNI**: South of housing area, *Blakley 4105* (SBBG); **SRo**: Water Canyon, *Carter 6133* (UC). Abundant throughout the islands. McCleary (1972) reported the presence of this species on all eight islands. Steere (1954) argued that the reports of *Barbula artocarpa* Lesq. by Williams (1923) belong under this species.

Eucladium verticillatum (With.) Bruch & Schimp.
Reported by Steere (1954), McCleary (1972). **SCa**: East slope of Mt. Orizaba, *Carter 4563* (UC); **SCz**: Cañada del Puerto, *Blakely 3986* (SBBG); **SNI**: North point of island, *Blakely 4136a* (SBBG). Occasional in seasonal drainages.

***Gymnostomum aeruginosum** Sm.
SCa: Shark Harbor, *Carter 4499* (UC). Known from two collections.

***Gymnostomum calcareum** Nees & Hornsch.
SCa: Slopes above White's Landing, *Carter 5511*, (UC); **SCz**: Hooker Canyon, *Carter 4730* (UC). Known from single collections from each island.

***Henediella stanfordensis** (Steere) Blockeel
SCa: Slopes above White's Landing, *Carter 5521* (UC); **SCz**: Cañada del Puerto, *Carter 5424* (UC). Occasional along roads throughout Santa Catalina, and along Cañada del Puerto on Santa Cruz.

***Microbryum davallianum** (Sm.) R.H. Zander
SCa: Middle Ranch, *Carter 5589* (UC); **SCI**: Horton Canyon, *Carter 4346* (UC); **SMi**: Nidever Canyon, *Carter 6296* (UC). Uncommon or overlooked in open areas with bare soil, especially in soil crusts. A specimen collected by Steere from Santa Catalina (UBC-B84231) was annotated as *M. davallianum* var. *conicum* (Schwäger.) Zander by Zander.

Microbryum starckeanum (Hedw.) R.H. Zander
Reported as *Pottia arizonica* Warehouse by Steere (1954), McCleary (1972). **SCa**: Cherry Cove, *Carter 4517* (UC); ***SCI**: Eagle Canyon, *Carter 4430* (UC). Uncommon or overlooked in open areas with bare soil, especially in soil crusts.

***Pseudocrossidium crinitum** (Schultz) R.H. Zander
SCa: Slopes above White's Landing, *Carter 5528* (UC); **SCz**: Road to Willow's Anchorage, *Carter 6090* (UC). **SRo**: Black Mountain, *Norris 102055* (UC). Uncommon on Santa Catalina and known from single collections on Santa Cruz and Santa Rosa.

***Pseudocrossidium obtusulum** (Lindb.) H.A. Crum & L. E. Anderson
SCa: Divide Road, *Carter 5875* (UC). Known from a single collection in *Quercus pacifica* savannah.

***Pterygoneurum ovatum** (Hedw.) Dixon
SCz: Lagunitas Secas Rd., *Carter 5415* (UC). Known from a single collection in dry coastal scrub.

Stegonia hyalinotricha (Cardot & Thér.) R.H. Zander
Reported as *Phascum hyalinotrichum* Cardot & Thériot by Steere (1954), McCleary (1972). **SCa**: Reported by Steere (1954); ***SCI**: Eagle Canyon, *Carter 4436* (UC); ***SCz**: Lagunitas Secas Rd., *Carter 5417a* (UC); ***SMi**: Green Mountain, *Wheeler 8031* (UC). Occasional on dry, bare soils.

***Syntrichia bartramii** (Steere) R.H. Zander
SCa: Black Jack Mountain, *Shevock 4038* (CAS); **SCI**: Near the Salty Crab Bar, *Carter 4322* (UC); **SCz**: Ridge Road, *Carter 5272* (UC); **SRo**: Water Canyon, *Carter 6142* (UC). Uncommon on dry, bare soils.

Syntrichia laevipila Brid.
Reported as *Tortula laevipila* (Brid.) Schwaegr. by Steere (1954), McCleary (1972). **SCa**: Slopes above White's Landing, *Steere s.n.* (23 May 1953, B168888) (UBC); ***SCz**: Ridge Road, *Carter 5974* (UC). Known from two localities at upper elevations on Santa Cruz. From Santa Catalina, Steere (1954) reported "On inclined tree-trunk, about six feet from the ground, in rather open forest, at middle altitudes; sterile."

***Syntrichia papillosa** (Wilson) Jur.
SCa: Rim of Silver Canyon, *Carter 6950* (UC); **SCI**: Ridgeline near SHOBA gate, *Carter 6632* (UC); **SCz**: Ridge Road, *Carter 5309* (UC). Uncommon, restricted to bark of oaks on ridgelines and, on Santa Cruz, in deep shaded canyons.

Syntrichia princeps (De Not.) Mitt.
Reported as *Tortula princeps* De Not. by McCleary (1972). ***Ana**: Villaseñor s.n., Feb 2011 (UC); **SCa**: Bulrush Canyon, *Blakley 5476c* (SBBG); ***SCI**: Horton Canyon, *Carter 4352* (UC); ***SCz**: Mt. Diablo, *Carter 5989* (UC); **SRo**: Box Canyon, *Shevock 20804* (SBBG). Common throughout the islands, especially on boulders and trunks of *Quercus pacifica*.

Syntrichia ruralis (Hedw.) F. Weber & D. Mohr
Reported as *Tortula ruralis* (Hedw.) Smith by Sayre (1940), McCleary (1972); as *Tortula intermedia* (Brid.) De Not., by Steere (1954), McCleary (1972); as *T. montana* (Nees) Lindb. by Williams (1923). **SBa**: Signal Peak, *Blakley 4814* (SBBG); **SCa**: Mt. Orizaba, *Carter 5920* (UC); **SCI**: Knob Canyon, *Carter 5699* (UC); **SCz**: Portezuela Canyon, *Blakley 3937b* (SBBG); ***SRo**: Cherry Canyon, *Carter 6245* (UC). Occasional and scattered throughout the islands.

Timmiella anomala (Bruch & Schimp.) Limpr.
Reported by Sayre (1940), McCleary (1972)

***SCa**: Little Geiger Canyon, *Carter 4544* (UC); ***SCI**: Horton Canyon, *Carter 4369* (UC); ***SCz**: South rim of Central Valley, *Carter 4636* (UC); ***SRo**: La Jolla Jveja Canyon, *Shevock 20878* (SBBG). Occasional throughout the islands. See notes under *T. crassinervis*.

Timmiella crassinervis (Hampe) L.F. Koch

Reported as *Timmiella vancouveriensis* Broth., by Steere (1954)

SCa: Renton Mine Road, *Carter 6875* (UC); ***SCz**: Canyon below Lagunas Secas, *Carter 5955* (UC); ***SRo**: Cherry Canyon, *Blakley 3140a* (CAS). Steere (1954) reported this species (as *T. vancouveriensis*) and considered the earlier report of *T. anomala* by Sayre (1940) to be a misidentified specimen of *T. vancouveriensis*. McCleary (1972) reported only *T. anomala*. *Timmiella* is quite common on the islands especially in mesic areas in oak woodlands and chaparral, but most individuals are sterile, therefore confident determination of specimens is difficult. My general impression, however, is that *T. crassinervis* is the more common of the two species.

**Tortula acaulon* (With.) R.H. Zander

SCa: Cottonwood Cove, *Carter 5797* (UC); **SCI**: Eel Point, *Carter 6569* (UC); **SCz**: South Rim of Central Valley, *Carter 4639b* (UC). Occasional, mostly associated with soil crusts.

**Tortula amplexa* (Lesq.) Steere

SCa: White's Landing, *Steere s.n., 2-3 May 1953* (det. Zander) (UBC-B76611). Known from a single collection. The original population has not been relocated.

Tortula atrovirens (Sm.) Lindb.

Reported by Williams (1923), Sayre (1940); as *Desmatodon convolutus* (Brid.) Grout by Steere (1954), McCleary (1972). ***Ana**: West Anacapa, *Villaseñor s.n., Feb 2011* (UC); **SCa**: Divide Road, *Carter 5573* (UC); ***SCI**: Knob Canyon, *Carter 5703* (UC); ***SCz**: Cañada del Puerto, *Carter 5421* (UC); **SRo**: Torrey Pines, *Shevock 20784* (det. Delgadillo) (SBBG). Abundant in dry areas. This is the most common species of *Tortula* on the islands.

Tortula bolanderi (Lesq.) M. Howe

Reported by Steere (1954), McCleary (1972). **SCa**: White's Landing, *Steere s.n., 2-3 May 1953*, (UBC-B168581). Known from a single collection. The original population has not been relocated.

Tortula brevipes (Lesq.) Broth.

Reported by Steere (1954), McCleary (1972). ***Ana**: West Anacapa, *Villaseñor s.n., Feb 2011* (UC); **SCa**: Ben Weston Canyon, *Carter 5793* (UC); ***SCI**: Eagle Canyon, *Carter 4418* (UC); ***SCz**: Lagunitas Secas Road, *Carter 5412* (UC); **SMi**: Canyon del Mar, *Blakley 5108* (SBBG); ***SNi**: No specific locality, *J.T. Howell s.n., 13 Mar 1923* (CAS); **SRo**: Water Canyon, *Carter 6145* (UC). Widespread and common. The voucher from San Nicolas is part of a mixed J.T. Howell collection filed under *Crossidium desertorum* (= *C. crassinervium*).

Tortula californica E.B. Bartram

Reported by Steere (1954), McCleary (1972) ***Ana**: *Villaseñor s.n., Feb 2011* (UC); **SCa**: Cottonwood Cove, *Carter 5798* (UC); ***SCI**: Horton Canyon, *Carter*

5743 (UC); ***SCz**: Christy Pines, *Carter 4679* (UC); ***SRo**: Upper Cherry Canyon, *Shevock 20913* (SBBG). This species is ranked at rarity level 1B by the California Native Plant Society. It is quite common on San Clemente, but less so on the other islands.

Tortula guelpinii (Bruch & Schimp.) Broth.

Reported as *Desmatodon guelpinii* BSG by Williams (1923), Sayre (1940), Steere (1954), McCleary (1972). **SCa**: Fern Canyon, *Carter 5458* (UC); ***SCI**: Eagle Canyon, *Carter 4425* (UC); ***SCz**: Central Valley, *Carter 5228* (UC); ***SMi**: Cuyler Harbor, *Carter 6299* (UC). Occasional in dry areas.

Tortula obtusifolia (Schwägr.) Mathieu

***SCa**: Italian Gardens, *Carter 5851* (UC); **SCz**: Prisoner's Harbor, *Carter 5444* (UC). Uncommon in mesic areas.

Tortula protobryoides R.H. Zander

Reported as *Pottia bryoides* (Dicks.) Mitt. by Steere (1954), McCleary (1972). ***Ana**: *Villaseñor s.n., Feb 2011* (UC); **SCa**: Cherry Cove, *Carter 4516* (UC); ***SCI**: Horton Canyon, *Carter 4326* (UC). Uncommon in dry areas.

Weissia controversa Hedw.

Reported by McCleary (1972); as *Weissia viridula* Hedw. by Steere (1954). ***Ana**: West Anacapa, *Villaseñor s.n., Feb 2011* (UC); **SCa**: Upper Buffalo Reservoir, *Carter 5908* (UC); ***SCI**: Horton Canyon, *Carter 4354* (UC); ***SCz**: Christy Pines, *Carter 5368* (UC); ***SRo**: Water Canyon, *Carter 6139* (UC). Common in mesic areas throughout the islands.

**Weissia ligulifolia* (E.B. Bartram) Grout

SCa: Slopes above White's Landing, *Carter 5534* (UC). Known from three collections in the upper watershed of White's Landing and Mt. Orizaba.

HORNWORTS

Anthocerotaceae

**Anthoceros fusiformis* Austin

SCa: Ridge between Mt. Orizaba and Mt. Banning, *Carter 5930* (UC); **SRo**: Windmill Canyon, *Shevock 20865* (SBBG). Occasional in mesic areas.

Notothyladaceae

**Phaeoceros carolinianus* (Michx.) Prosk.

SCz: Canyon between Cueva Valdez and Lady's Harbor, *Carter 5999* (UC). Uncommon.

Phaeoceros pearsonii (M. Howe) Prosk.

Reported as *Anthoceros pearsoni* Howe by Kingman (1911), Evans (1923a), Steere (1954). **SCa**: Above White's Landing, *Carter 5527* (UC); ***SCI**: Horton Canyon, *Carter 4387* (UC); ***SCz**: Central Valley, *Carter 5346* (UC). Common.

LIVERWORTS

Aneuraceae

**Riccardia chamedryfolia* (With.) Grolle

SCz: Cañada del Puerto, *Carter 4719* (UC). Known from two localities along streambanks on Santa Cruz.

Aytoniaceae

Asterella californica (Hampe ex Austin) Underw.
Reported by Evans (1923a), Steere (1954). ***Ana**: *Villaseñor s.n., Feb 2011* (UC); **SCa**: Italian Gardens, *Carter 5845* (UC); ***SCI**: Ridge above Twin Dams Canyon, *Carter 5745* (UC); ***SCz**: Christy Pines, *Blakley 3937a*, (det. Doyle) (SBBG); ***SRo**: Torrey Pines, *Carter 6266* (UC). Common throughout the islands.

Asterella palmeri (Austin) Underw.
Reported by Evans (1923a), Steere (1954). **SCa**: Upper Cottonwood Canyon, near the airport, *Carter 7300* (UC). Known from a single locality near the airport on Santa Catalina, but locally common there.

**Cryptomitrium tenerum* (Hook.) Austin ex Underw.
SCa: Cherry Cove, *Carter 7184* (UC); **SCz**: Ridge Road, *Carter 5302* (UC). Rare. Known from single collections from a *Lyonothamnus* grove on Santa Cruz and a *Prunus* grove on Santa Catalina.

Calypogeiaceae

**Calypogeia azurea* Stotler & Crotz
SCz: Canyon east of Pelican Bay, *Carter 6053* (UC). Known from a single collection in a deep, shaded recess near the mouth of a canyon between Prisoner's Harbor and Pelican Bay. A photo of the oil bodies is included in the specimen.

Cephaloziellaceae

**Cephaloziella divaricata* (Sm.) Schiffn. var. *divaricata*
SCa: Between Echo Lake and Twin Rocks, *Carter 7321* (UC); **SCz**: Sierra Blanca Ridge, *Carter 6673* (UC); **SRo**: Soledad Mountain, *Shevock 20750* (det. W. Doyle) (CAS). Occasional in soil crusts and rock crevices.

**Cephaloziella divaricata* var. *scabra* (M. Howe) Haynes
SCz: Christy Pines, *Carter 4671* (UC). Known from two collections along ridges on Santa Cruz, one from Bishop pine forest (on *Quercus tomentella*) and the other from a *Lyonothamnus* grove (*Carter 5956* UC) on *Lyonothamnus*.

**Cephaloziella hampeana* (Nees) Schiffn. ex Loeske
SCa: White's Landing, *Carter 7215* (UC). Occasional throughout Santa Catalina. Most often associated with rock outcrops or soil crusts in oak chaparral.

**Cephaloziella stellulifera* (Taylor) Schiffn.
SRo: Windmill Canyon, *Shevock 20894* (CAS); **SCz**: Christy Pines, *Carter 6115* (UC). Known from single collections from mesic areas on Santa Rosa and Santa Cruz.

**Cephaloziella turneri* (Hook.) Müll. Frib.
SCa: Above White's Landing, *Carter 5559* (UC); **SCz**: Central Valley, *Carter 5354* (UC). Occasional on Santa Cruz and Santa Catalina. Mostly associated with lichen-dominated soil crusts in chaparral and pine forests with heavy fog influence.

Fossombroniaceae

Fossombronia longiseta Austin
Reported by Evans (1923a), Steere (1954). **SCa**: Above White's Landing, *Carter 5526*; ***SCI**: Twin Dams

Canyon, *Carter 5731* (UC); ***SCz**: Central Valley, *Carter 5347* (UC); ***SRo**: Upper Windmill Canyon, *Shevock 20893* (SBBG). Common in grasslands, especially on north facing slopes.

**Fossombronia pusilla* (L.) Dumort.

SCa: Upper Cottonwood Canyon, near airport, *Carter 7289* (UC); **SCI**: near SHOBA gate, *Carter 6599* (UC). Known from two collections on each island. Based on the available data, this species appears to prefer drier microclimates than *F. longiseta* on the islands.

Frullaniaceae

**Frullania bolanderi* Austin

Ana: *Villaseñor s.n., Feb 2011* (UC); **SCa**: Canyon above Pebbly Beach, *Carter 6856* (UC); **SCz**: Christy Pines, *Carter 4668* (UC); **SRo**: Tributary to Water Canyon, *Norris 102245* (UC). Uncommon, mostly restricted to mesic canyons. Known from single collections from Santa Cruz and Anacapa and several collections each from Santa Catalina and Santa Rosa.

**Frullania californica* (Austin ex Underw.) A. Evans
SRo: Torrey Pines, *Shevock 20785* (det. Doyle) (CAS). Known from three robust collections made on Santa Rosa.

Frullania catalinae A. Evans

Reported by Evans (1897[1900], 1923a), Steere (1954). ***Ana**: *Villaseñor s.n., Feb 2011* (UC); **SCa**: Between Gallagher Canyon and Wrigley Reservoir, *Blakley 5368* (det. Doyle) (SBBG); ***SCI**: Knob Canyon, *Carter 5662* (UC); ***SCz**: Cañada del Puerto, *Carter 4592* (UC); ***SRo**: Torrey Pines, *Shevock 20785* (det. Doyle) (CAS). Abundant on oaks and shaded boulders throughout the islands. The type locality of this species, described by Evans (1897[1900]), is Santa Catalina Island.

**Frullania nisquallensis* Sull.

SRo: Water Canyon, *Norris 102271*, (det. Doyle) (UC). Known from a single collection from a boulder in chaparral on Santa Rosa. South of San Francisco, the only specimen of this species (based on specimens at UC & CAS) is a single collection (*Doyle 6126* [UC]) from the Santa Lucia Range in Monterey Co.

Geocalyceae

**Lophocolea bidentata* (L.) Dumort.

SCz: Christy Pines, *Carter 5331* (UC). Restricted to upper elevations in Christy Pines, but locally common in the understory of the pine forest. On the mainland, this species is not known south of San Luis Obispo County.

Gymnomitriaceae

**Marsupella bolanderi* (Austin) Underw.

SCa: Slopes above White's Landing, *Carter 5559* (UC); **SCz**: Ridge above Pelican Bay, *Carter 6065* (UC); **SRo**: Tributary to Water Canyon, *Shevock 20825* (det. Doyle) (CAS). Occasional, mostly in lichen-dominated soil crusts in chaparral and woodlands.

Lunulariaceae

**Lunularia cruciata* (L.) Dumort. ex Lindb.

SCa: no voucher specimens. Observed growing as a weed with potted ornamental plants in Avalon 2012. This common greenhouse weed has not been documented growing outside of cultivation, but it exists on Santa Catalina in potted plants.

Marchantiaceae

**Marchantia polymorpha* L.

SCz: Above Lady's Harbor, *Carter 6020* (UC). Known only from near the mouths of canyons along the north side of Santa Cruz. These are popular picnicking sites for boaters, and these localized occurrences might be the result of human introductions.

Porellaceae

Porella bolanderi (Austin) Pearson

Reported by Steere (1954). **SCa:** Middle Ranch Canyon, *Carter 4472* (UC); ***SCI:** Eagle Canyon, *Carter 4398* (UC); ***SCz:** North side, above Dick's Harbor, *Carter 6742* (UC); ***SRo:** Torrey Pines, *Shevock 20787* (CAS). Common on boulders in shaded canyons.

Radulaceae

**Radula bolanderi* Gottsche ex Steph.

SCz: Christy Pines, *Carter 5376* (UC). Restricted to drainages near ridgeline in Christy Pines. Epiphytic on *Quercus* and *Heteromeles*.

**Radula complanata* (L.) Dumort.

SCz: Christy Pines, *Carter 5377* (UC); **SRo:** Black Mountain, *Norris 102064* (UC). Restricted to drainages near ridgeline in Christy Pines. Epiphytic on *Quercus* and *Heteromeles*.

Ricciaceae

**Riccia californica* Austin

SCz: Upper Islay Canyon, *Weber b-90032* (SBBG). Known from a single collection.

**Riccia campbelliana* M. Howe

SCa: Upper Cottonwood Canyon, *Carter 7299* (UC). Uncommon or possibly overlooked.

Riccia cavernosa Hoffm.

Reported as *R. catalinae* Underw. by Underwood (1894), Evans (1923a); as *Riccia crystallina* L. by Steere (1954). **SCa:** Avalon Canyon, *McClatchie 441* (NY). This species is known from several specimens labeled *Riccia catalinae* collected on Santa Catalina by McClatchie in September 1893. The holotype of *R. catalinae*, *McClatchie 441* (NY-575714), was collected "on wet soil in the bottom of a deep canyon" (Underwood 1894), probably in the vicinity of Avalon. Steere mentioned the species (as *R. crystallina*) but did not find it at White's Landing. Although Steere considered *R. catalinae* to be synonymous with *R. crystallina*, further study has resulted in the placement of *R. catalinae* in synonymy with *R. cavernosa* (Jovet-Ast 1965; Schuster 1992; Doyle and Stotler 2006). The species has not been seen on the islands since the original collections 120 years ago.

**Riccia glauca* L.

SRo: Cañada Lobos, *Norris 102354* (UC). Known from a single collection.

Riccia nigrella DC.

Reported by Steere (1954). ***Ana:** West Anacapa, *Villaseñor s.n., Feb 2011* (UC); **SCa:** Ridge above White's Landing, *Carter 5502* (UC); ***SCI:** Mail Point, *Carter 6532* (UC); ***SCz:** Road to Willows Anchorage, *Carter 6085* (UC); ***SRo:** Black Mountain, *Norris 102059* (UC). Occasional to common throughout the islands on clay soils.

Riccia sorocarpa Bisch.

Reported by Steere (1954). **SCa:** White's Landing, *Carter 7207* (UC); ***SCI:** Eagle Canyon, *Carter 4442* (UC); ***SRo:** Road north of Black Mountain, *Norris 102090* (UC). Uncommon on clay soils.

Riccia trichocarpa M. Howe

Reported by Kingman (1911), Evans (1923a), Steere (1954). **SCa:** Middle Ranch, *Carter 5595* (UC); ***SCI:** Mesa above Twin Dams Canyon, *Carter 5713* (UC); ***SCz:** Ridge road along south rim of Central Valley, *Carter 4643* (UC). Occasional on clay soils.

Sphaerocarpaceae

**Sphaerocarpos texanus* Austin

SCa: Above White's Landing, *Carter 5525* (UC); **SCI:** Eagle Canyon, *Carter 4453* (UC); **SCz:** Portezuela, *Carter 5350* (UC); **SRo:** Island Oak grove in Cañada Lobos, *Norris 102319* (UC). Uncommon on bare soils in shaded areas.

Targioniaceae

Targionia hypophylla L.

Reported by Evans (1923a), Steere (1954). ***Ana:** *Villaseñor s.n., Feb 2011* (det. Carter) (UC); **SCa:** Shark Harbor, *Carter 4501* (UC); ***SCI:** Ridge above Twin Dams, *Carter 5726* (UC); ***SCz:** Above Lady's Harbor, *Carter 6022* (UC); ***SMi:** Cuyler Harbor, *Carter 6302* (UC); ***SRo:** Torrey Pines, *Shevock 20779* (SBBG). Abundant on soil in many habitats throughout the islands.

APPENDIX 2

EXCLUDED SPECIES

Fossombronia hispidissima Steph.

Reported by Steere (1954) from near the shoreline at White's Landing. At the time of Steere's publication, the boundaries between *F. hispidissima*, *F. longiseta* and *F. pusilla* were subject to dispute (Evans 1923b; Steere 1954). Doyle and Stotler (2006) recognized *F. longiseta* and *F. pusilla* from southern California, but *F. hispidissima* from California was considered to be synonymous with *F. longiseta*. Both *F. longiseta* and *F. pusilla* are now documented from the islands.

Riccia violacea M. Howe

Steere (1954) reported a Channel Island specimen confirmed by R. L. McGregor. However, Doyle and Stotler (2006) were unable to find the voucher, or any

other voucher from the state, at CAS, NY, UBC, UC and other herbaria, and so excluded this species from their California state list.

Brachythecium albicans (Hedw.) Schimp.

This species was first reported from Santa Rosa by McCleary (1972) based on *Blakely 3064c* (SBBG), collected at the junction of Cherry Canyon and Windmill Canyon, and *Blakely 3057b* (SBBG) from between Johnson Lee and South Point. Both specimens are *Homalothecium arenarium*. Another specimen labeled *B. albicans* from Santa Rosa, *Shevock 20839* (SBBG), is *Scleropodium californicum*. *Brachythecium albicans* has been generally misunderstood in coastal southern California and most specimens from that area are misidentified collections of *Scleropodium* or *Homalothecium*.

Bryoerythrophyllum recurvirostrum (Hedw.) P.C. Chen
Reported by McCleary (1972) from "Creek bank behind Vail House" on Santa Rosa based on *Blakely 3065-a* (CAS). This specimen is *Didymodon vinealis* (det. D. Toren viii. 2011). *Bryoerythrophyllum* is known from the Santa Monica Mountains on the adjacent mainland (Sagar 2007) but no confirmed vouchers are known from the islands.

Eurhynchium pulchellum (Hedw.) Jenn.

There was previously confusion between *Eurhynchium* species and *Scleropodium touretii* in southern California. Sayre (1940) reported *E. strigosum* (Hoffm.) B. & S. from Santa Catalina and *E. strigosum* var. *scabrisetum* Grout from Santa Catalina and Santa Cruz. Steere (1954) included these as *E. pulchellum* (Hedw.) Jenn. and *R. pulchellum* var. *scabrisetum* Grout but expressed skepticism based on the known distributions of *Eurhynchium* species much farther to the north in western North America. He also stated that they possibly may have been misidentified specimens of *Scleropodium illecebrum* (= *S. touretii*). Norris and Shevock (2004a) did not list material of the *Eurhynchium* species from southern California, and my collecting has not documented them from the islands. The vouchers on which Sayre's reports were made have not been relocated, but based on current understanding of the distributions of *Eurhynchium* species, these are excluded from the flora.

Grimmia apocarpa var. *atrofusca* (Schimp.) Husn.

Reported from Santa Rosa by McCleary (1972), based on *Blakely 3049a* (CAS), from the trunk of an Island Oak at the Air Force Radar Station. The specimen is *Grimmia trichophylla*.

Grimmia involucrata Cardot

McCleary (1972) reported the species with the following note: "Scattered on silt deposits over rocks. Elevation 400 ft. First large canyon west of Profile Point. Santa Cruz Island." A voucher number was not cited, and the specimen has not been relocated, though it is most likely at CAS as are other specimens cited by McCleary. The report is undoubtedly based on a misidentified specimen, as recent revisionary work on *G. involucrata* found that species to be endemic to México (Delgadillo 1999).

Grimmia ovalis (Hedw.) Lindb.

Reported from Santa Cruz by McCleary (1972). The voucher for this report, *Blakeley 3371b* (SBBG), is *G. laevigata*.

Haplocladium microphyllum (Hedw.) Broth.

First reported from Santa Catalina as *Thuidium microphyllum* (Hedw.) Best, by Sayre (1940), but without a voucher. This taxon was not relocated by Steere (1954) and has not been seen since Sayre's original report. The voucher from Sayre's original report, presumably a Cockerell specimen, could not be located at CAS, COLO, SBBG, and UC. The current understanding of this species is that it is absent from California and adjacent states.

Homalothecium aeneum (Mitt.) E. Lawton

Reported by McCleary (1972); as *Camptothecium dolosum* Ren. & Card. by Williams (1923); as *C. aeneum* var. *dolosum* (Ren. & Card.) Grout, by Sayre (1940), Steere (1954). Reported by both Williams and Steere from Santa Catalina, but these specimens (which have not been relocated) most likely represent morphological variants of *H. nuttallii*. See notes under that species for further discussion.

Molendoa sendtneriana (Bruch & Schimp.) Limpr.

Reported as *Anoetangium obtusifolium* (Broth. & Par) Grout by Steere (1954), McCleary (1972). This was reported from Santa Catalina based on a specimen from above White's Landing, *Steere s.n., 2 May 1953*, (UBC-B76127). The specimen could not be relocated for this study, but Zander (2007) did not list the species from California in his Flora of North America treatment and Malcolm et al. (2009) excluded it from the list of species known from California. Previously the species had been thought to occur in the state only based on the specimen above (Norris & Shevock 2004b).

Orthotrichum flowersii Vitt

Reported by Norris and Shevock (2004a, b) from Santa Catalina based on *Shevock 4073* (CAS). This specimen was determined as *O. franciscanum* by Lara & Garilleti, xi. 2008.

Orthotrichum speciosum Nees

Reported by McCleary (1972) from San Clemente, but a voucher has not been located at CAS, UC, or SBBG. This species is not known to occur in coastal California south of San Francisco, and is typical of Northern California and the Sierra Nevada. The report is likely based on a mis-identified specimen.

Orthotrichum tenellum Bruch ex Brid.

Reported by Steere (1954), McCleary (1972) and (as *O. cylindrocarpum* Lesq.) by Williams (1923), Sayre (1940). Although Vitt (2013) recognizes this species in California, more recent work by Medina et al. (2013) demonstrates convincingly that specimens formerly assigned to *O. tenellum* from California belong to one of four other species. See additional discussion under *O. coulteri*.

Syntrichia obtusissima (Müll. Hal.) R.H. Zand.

Reported as *Tortula obtusissima* (Müll. Hal.) Mitt. by McCleary (1972) from Santa Cruz Island. The voucher, *Blakely 3373* (SBBG) is *S. princeps*.