Marine Benthic Algae from Ni‘ihau and Adjacent Lehua Islet, Main Hawaiian Islands

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The published records of marine benthic algal species from the privately-owned island of Ni‘ihau (Hawaiian Islands) are represented by four species cited in Abbott (1999) and Abbott & Huisman (2004). The species consist of the red alga Chondrophyccus dotyi (Y. Saito) K.W. Nam [= Laurencia dotyi Y. Saito], two brown algae Dictyopteris plagio-gramma (Montagne) Vickers and Distromium flabellatum Womersley, and the green alga Pseudochlorodesmis parva W. J. Gilbert [= Siphonogramen parvum (W.J. Gilbert) I.A. Abbott & Huisman]. Distromium flabellatum and Pseudochlorodesmis parva were collected in waters between Ni‘ihau and Lehua Islet. The paucity of algal records from Ni‘ihau is not surprising, very few collections have been made along its coastline because of its remoteness and general lack of access.

The U.S. Fish and Wildlife Service, however, funded field surveys between 2001 and 2004 to study the biodiversity of Lehua Islet, located just 1.2 km north of Ni‘ihau. Lehua Islet is a Hawai‘i Seabird Sanctuary federally owned by the U.S. Coast Guard and maintained by the Hawai‘i Department of Land and Natural Resources. Forty species of marine

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benthic algal species were reported by Wood et al. (2004) from Lehua Islet. The specimens were collected by Maya LeGrande in March and May 2003 “… from inter-tidal and shallow marine areas near the rock bench fronting the sea caves along Lehua’s south shore.” The algae recorded from Lehua Islet (see Appendix) included 2 species of Cyanobacteria, 21 species of Rhodophyta, 12 species of Phaeophyceae, and 5 species of Chlorophyta. All of the above specimens were databased and deposited in the *Herbarium Pacificum* (BISH) at the Bernice P. Bishop Museum.

This paper is based on algal specimens collected in the intertidal zone, shallow coral reefs (SCR, <30 m depth) and the mesophotic coral ecosystem (MCE, 30–150 m depth) from Ni’ihau and adjacent Lehua Islet. In this paper, Lehua Islet is considered part of Ni’ihau; thus algae collected from Lehua Islet are considered a “New island record” for Ni’ihau. BISH specimens are deposited at the Bishop Museum and MHI (Main Hawaiian Islands) specimens are deposited at Alison R. Sherwood’s (ARS) Laboratory at the University of Hawai‘i Department of Botany.

Guiry & Guiry (2020) and Brummitt & Powell (1992) were, respectively, consulted for currently accepted algal names and synonyms, and for spelling of authors of algal names.

Most unpublished algal collections from Ni’ihau and Lehua Islet were hand collected by Lynn M. Hodgson from Lehua Islet on 26–27 May 2001 via SCUBA at depths of 12.2–27.4 m, and by Ryan Okano, aboard NOAA R/V *Hi’ialakai*, from Ni’ihau on 9–11 Aug 2006 via SCUBA at depths of 10.7–13.7 m, and from the intertidal and SCR off Lehua Islet on 12 Aug 2006. Heather Spalding, Randall Kosaki, Jason Leonard and Steve Matadobra, aboard NOAA R/V *Hi’ialakai*, hand collected specimens from the SCR and/or MCE on 14–15 Sep 2018. A fourth algal collection was retrieved by Louise M. Giuseffi and Annika Little from NOAA freezers which held algae collected from Lehua Islet and Ni’ihau. Additional specimens collected by Ryan Okano, Aline Tribollet, and Stefane Charette from Lehua Islet and Ni’ihau on 9–12 Aug 2006 via SCUBA at depths of 9–16 m were also retrieved from the freezers.

Ten species collected from Lehua Islet (Wood et al. 2004) and one species collected from Ni’ihau (Abbott & Huisman 2004), each preceded by an asterisk (*), were reported in the past literature. Forty-seven species represent new records for Ni’ihau (includes adjacent Lehua Islet) in the Main Hawaiian Islands (MHI). Information on species distribution in the coastal waters of the 10 islands, atolls and shoals of Papahānaumokuākea Marine National Monument (PMNM) can be obtained from Tsuda (2014) and Tsuda et al. (2015). One green alga, *Codium hawaiense* P.C. Silva & Chacana, represents a new record for Ni’ihau and the MHI. Two Cyanobacteria, *Rivularia atra* Roth and *Sympleca atlantica* Gomont, may also represent new published records for the MHI. Specimens of the two species of Cyanobacteria, however, are documented from the MHI in BISH.

Of the 68 species of marine benthic algae reported from Ni’ihau (including Lehua Islet), only 11 species (16%) were collected from the MCE (30–150 m depth). The species included three species of Rhodophyta (*Amanstia glomerata* C. Agardh, *Haloplegma duperreyi* Mont., *Plocamium sandicense* J. Agardh), three species of Phaeophyceae (*Dictyota ceylanica* Kütz, *Dictyota sp.*, *Distromium sp.*) and five species of Chlorophyta (*Cladophora sp.*, *Codium mamillulosum* Harv., *Halimeda opuntia* (L.) J.V. Lamour., *Phyllodictyon anastomosans* (Harv.) Kraft & M.J. Wynne, *Siphonochladus tropicus* (P. Crouan & H. Crouan) J. Agardh).
Phylum CYANOBACTERIA

*Blennothrix cantharidosum* (Gomont ex Gomont) New island record

*Anagnost. & Komárek [= *Hydrocoleum cantharidosum* Gomont]*

MHI distribution. Kaua‘i (Tilden 1910); O‘ahu (Khan 1967).


Note. The specimen, initially identified by F. Drouet as *Hydrocoleum cantharidosum* Gomont in May 1987, was dark green and formed slimy rocks in shallow water.

*Leptolyngbya crosbyana* (Tilden) Anagnost. & Komárek

*New island record*

*Phormidium crosbyanum* Tilden


*Lyngbya confervoides* C. Agardh

*New island record*

MHI distribution. Hawaiian Islands (Tilden 1910).


Note. All trichomes were 12–24 µm dia.

*Phormidium* sp.


*Rivularia atra* P.H. Roth ex Bornet & Flahault New island record


*Schizothrix cf. calcicola* Gomont

*New island record*

MHI distribution. O‘ahu (Khan 1967).


*Symphlocia atlantica* Gomont

*New island record*


Phylum RHODOPHYTA

*Acanthophora pacifica* (Setch.) Kraft New island record


*Actinotrichia fragilis* (Forskk.) Bergesen

New island record


*Aglaothamnion cordatum* (Børgesen)

Feldm.-Maz.

New island record


*Amansia glomerata* C. Agardh


*Antithamnionella breviramosa* (E.Y. Dawson)

E.M. Woll.

New island record


*Asparagopsis taxiformis* (Delile) Trevis.

MHI distribution. Lehua Islet (Wood et al. 2004); Kaua‘i, O‘ahu, Moloka‘i, Hawai‘i (Abbott 1999).


*Ceramium* sp.

Note. Only a few immature specimens of this approximately 40 µm dia Ceramium sp. were available for identification.

*Ceratodictyon variabile* (J. Agardh)

R.E. Norris

New island record

MHI distribution. O’ahu, Lāna’i, Hawai’i (Abbott 1999).


*Chrysymenia okamurae* Yamada & Segawa

New island record


*Exophyllum* sp.

New island record


*Galaxaura divaricata* (L.) Huisman & R.A. Towns.

New island record

[= *Galaxaura fasciculata* Kjellm.]

MHI distribution. O’ahu, Moloka’i, Kaho’olawe (Abbott 1999).


*Gibsmithia hawaiensi*is Doty

New island record


*Haloplegma duperreyi* Mont.

New island record

MHI distribution. Kaua’i, O’ahu, Moloka’i, Maui, Hawai’i (Abbott 1999); Kaho’olawe (Tsuda & Abbott 2018).


*Halyhmenia* sp.

New island record


Note. The specimens are represented by two sterile blades, 2 and 3 cm high, respectively.

*Herposiphonia crassa* Hollenb.

New island record

MHI distribution. O’ahu, Maui, Hawai’i (Abbott 1999).

Jania adhaerens J.V. Lamour. *New island record*


Jania pumila J.V. Lamour. *New island record*


Jania subulata (J. Ellis & Sol.) Sond. *New island record*
[*Haliptilon subulatum* (Ellis & Solander) H.W. Johans.]


Laurencia sp. *New island record*
MHI distribution. Lehua Islet (Wood et al. 2004); kaua‘i, o‘ahu, Maui, Hawai‘i (Abbott 1999).


Note. Specimens appear similar to *Laurencia galtsoffii* M. Howe, however, cortical cells are clearly not protruding.

Martensia hawaiiensis A.R. Sherwood & S.M. Lin *New island record*


Note. The newly described species was also recorded from Midway Atoll in the PMNM (Sherwood et al. 2019).

Peyssonnelia cf. inamoena Pilg. *New island record*
MHI distribution. Lehua Islet (Wood et al. 2004); Kaua‘i, O‘ahu, Maui, Hawai‘i (Abbott 1999).


*Plocamium sandvicense* J. Agardh *New island record*
MHI distribution. Lehua Islet (Wood et al. 2004); Kaua‘i, O‘ahu, Maui, Hawai‘i (Abbott 1999).


Spyridaea filamentosa (Wulfen) Harv. *New island record*
Material examined. LEHUA ISLET: BISH 725044a (IA 31755) & BISH 725057 (IA 31770), NOAA R/V Hi’ialakai, intertidal, coll. R. Okano, 12 Aug 2006.

*Tolypiocladia glomerulata* (C. Agardh)

F. Schmitz

**New island record**


Material examined. LEHUA ISLET: BISH 693512 (IA 28405), key hole, 15.2–24.4 m depth, coll. L.M. Hodgson, 26 May 2001; BISH 701909 (LR 014), 15.2–24.4 m depth, coll. L.M. Hodgson, 26 May 2001.

**Class PHAEOPHYCEAE**

*Chnoospora minim a* (K. Hering) Papenf.

MHI distribution. Lehua Islet (Wood *et al.* 2004); O’ahu, Maui, Kaho’olawe, Hawai’i (Abbott & Huisman 2004).


*Colpomenia sinuosa* (K. Mert. ex Roth) Derbès & Solier

MHI distribution. Lehua Islet (Wood *et al.* 2004); Kaua’i, O’ahu, Maui, Hawai’i (Abbott & Huisman 2004).


*Dictyopteris australis* (Sond.) Askenasy

**New island record**

MHI distribution. Kaua’i, O’ahu, Moloka’i, Lāna’i, Maui, Hawai’i (Abbott & Huisman 2004); Kaho’olawe (Tsuda & Abbott 2018).


*Dictyopteris repens* (Okamura) Borgesen

**New island record**

MHI distribution. O’ahu, Moloka’i, Maui, Hawai’i (Abbott & Huisman 2004).


*Dictyopteris* sp.


Note. The 5 mm long “leaf” was initially identified as *Dictyopteris plagiogramma* (Montagne) Vickers; however, the veinlets, which extend from midrib to margin, are absent.

*Dictyota acutiloba* J. Agardh

**New island record**

MHI distribution. Kaho’olawe (Coles *et al.* 1998); O’ahu, Moloka’i, Lāna’i, Maui, Hawai’i (Abbott & Huisman 2004).


*Dictyota bartayresiana* J.V. Lamour.

MHI distribution. Lehua Islet (Wood *et al.* 2004); Kaua’i, O’ahu, Lāna’i, Maui (Abbott & Huisman 2004).

*Dictyota ceylanica* Kütz.  
**New island record**  


*Dictyota friabilis* Setch.  
**New island record**  


*Dictyota* sp.  

Note. The entire specimen is a 3 mm long apical fragment from the MCE depth which is, morphologically, not possible to identify to species.

*Distromium* sp.  

Note. Studies are presently underway on separating the molecular, morphological and ecological characteristics of Hawaiian *Distromium*.

*Lobophora* sp.  

Note. The descriptions of 10 new species of *Lobophora* from New Caledonia (Vieira *et al.* 2014) and 8 new species from the western Atlantic and eastern Pacific (Camacho *et al.* 2019) clearly prompt further detailed studies on Hawaiian *Lobophora*. 
*Padina sanctae-crucis* Børgeesen  

*Sargassum obtusifolium* J. Agardh  
[= *Sargassum hawaiiensis* Doty & Newhouse]  
*Material examined.* LEHUA ISLET: BISH 700824 (IA 28403), Vertical Awareness Pinnacle, 27.4 m depth, coll. L.M. Hodgson, 26 May 2001; BISH 777668 (NOAA 167-1316), LEH 03, 15 m depth, coll. unspecified, 18 Jul 2005.

*Sargassum polyphyllum* J. Agardh  

*Turbinaria ornata* (Turner) J. Agardh  

Phylum CHLOROPHYTA

*Boodlea composita* (Harv.) F. Brand  

*Bornetella sphaerica* (Zanardini) Solms  

*Caulerpa taxifolia* (Vahl) C. Agardh  

*Caulerpa webbiana* Mont.  


**Chaetomorpha antennina** (Bory) Kütz.  
*New island record*  


**Cladophora** sp.  

Note. The apical cells of the 4 cm tall erect filaments are up to 1 mm dia and appear to resemble the branching pattern of *Cladophoropsis* except for the cell wall closure.

**Codium hawaiense** P.C. Silva & Chacana  
*New MHI record*  


Note. BISH 725011 is a 1 cm long branched fragment.

**Codium mamillosum** Harv.  
*New island record*  

*Material examined.* NII’HUA: MHI 078 (ARS 09529), NFWF cruise 2018, 73 m depth, coll. R. Okano, 15 Sep 2018; MHI 125 (ARS 09541), NFWF cruise 2018, 55 m depth, coll. S. Matadobra, 15 Sep 2018.

**Dictyosphaeria cavernosa** (Forssk.) Børgesen  
*New island record*  


**Dictyosphaeria versluysii** Weber-van Bosse  
*New island record*  


**Halimeda discoidea** Decne.  
*New island record*  


**Halimeda opuntia** (L.) J.V. Lamour.  
*New island record*  

*Microdictyon setchellianum* M. Howe  

*Microdictyon umbilicatum* (Velley) Zanardini  
**New island record**  

*Neomeris annulata* Dickie  
**New island record**  

*Neomeris vanbosseae* M. Howe  
MHI distribution. Lehua Islet (Wood *et al.* 2004); Kaua‘i, O‘ahu, Lāna‘i (Egerod 1952); Maui, Kaho‘olawe, Hawai‘i (Abbott & Huisman 2004).  

*Palmophyllum crassum* (Naccari) Rabenh.  
**New island record**  

*Phyllodictyon anastomosans* (Harv.) Kraft & M.J. Wynne  
**New island record**  

*Pseudochlorodesmis parva* W.J. Gilbert  
[*= Siphonogramen parvum* (W.J. Gilbert) I.A. Abbott & Huisman]  
Note. Guiry & Guiry (2020) cites *Siphonogramen parvum* as the accepted species name of *Pseudochlorodesmis parva*. Verbruggen *et al.* (2009), however, showed convincing molecular evidence to maintain the species *P. parva* over *S. parvum*. The siphons of MHI 063 were 24–37 µm dia.
**Rhipidosiphon javensis** Mont.  
New island record  

**Material examined.** LEHUA ISLET: BISH 777675 (NOAA 167-1323), LEH 01, 9–12 m depth, coll. A. Tribollet & R. Okano, 12 Aug 2006.

**Siphonoclados tropicus** (P. Crouan & H. Crouan) J. Agardh  
New island record  


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**LITERATURE CITED**


APPENDIX

Algal Species with BISH Numbers Reported from Lehua Islet Collected by Maya LeGrande in March and May 2003 in Wood et al. (2004).

**Phylum Cyanobacteria**

*Lyngbya majuscula* (Dillwyn) Harv. [BISH 696669]
*Lyngbya sempitena* Gomont [BISH 696668]

**Phylum Rhodophyta**

*Aglaothamnion boergeseni* (N. Aponte & D.L. Ballant.) L’Hardy-Halos & Rueness [BISH 695059]
*Ahnfeltiopsis concinna* (J. Agardh) P.C. Silva & De Cew [BISH 695490]
*Amanista glomerata* C. Agardh [BISH 695442]
*Amphiroa rigida* J.V. Lamour. [BISH 695453]
*Antithamnion antillanum* Børgesen [BISH 695456]
*Asparagopsis taxiformis* (Delile) Trevis. [BISH 695439]
*Botryocladia skottsbergii* (Børgesen) Levring [BISH 695449]
*Champia parvula* (C. Agardh) Harv. [BISH 695448]
*Chrysomyena sp.* [BISH 695388]
*Dasya iridescens* (Schlech) A. Millar & I.A. Abbott [BISH 695438]
*Dasya murrayana* I.A. Abbott & A. Millar [BISH 695443]
*Gayliella fimbriata* (Setch. & N.L. Gardner) T.O. Cho & S.M. Boo [= *Ceramium fimbriatum* Setchell & N.L. Gardner] [BISH 695062]
*Gayliella flaccida* (Kütz.) T.O. Cho & McIvor [= *Ceramium flaccidum* (Kütz.) Ardiss.] [BISH 695450]
*Gelidiella machrisiana* E.Y. Dawson [BISH 696667]
*Griffithsia subcylindrica* Okamura [BISH 695447]
*Gymnothamnion elegans* (Schousb. ex C. Agardh) J. Agardh [BISH 695455 & 696674]
*Halichrysis coalescens* (Farlow) A. Millar & R.E. Norris [BISH 695450]
*Herposiphonia variabilis* Hollenb. [BISH 696666]
*Jania* sp. [BISH 695060 & 695061]
*Laurencia* sp. [BISH 681178 & 692233]
*Plocamium sandvicense* J. Agardh [BISH 695445]

**Class Phaeophyceae**

*Asteronema breviatriculatum* Ouriques & Bouzon [BISH 695454]
*Chnoospora minima* (Hering) Papenf. [BISH 695446]
*Colpomenia sinuosa* (K. Mert. ex Roth) Derbès & Solier [BISH 690591]
*Dictyota bartayresiana* J.V. Lamour. [BISH 695399]
*Dictyota sandvicensis* Sond. ex Kütz. [BISH 695444]
*Hydroclathrus clathratus* (C. Agardh) M. Howe [BISH 690592]
*Lobophora variegata* (J.V. Lamour.) Womersley [BISH 690595]
*Padina sanctae-crucis* Børgesen [BISH 695457]
*Padina* sp. [BISH 695063]
*Sargassum aquifolium* (Turner) C. Agardh [BISH 695489]
*Sphacelaria tribuloides* Menegh.[BISH 695441]
*Turbinaria ornata* (Turner) J. Agardh [BISH 690590]
**Phylum Chlorophyta**

*Caulerpa racemosa var. peltata* (J.V. Lamour.) Eubank [BISH 690596]

*Cladophora laetevirens* (Dillwyn) Kütz. [BISH 695058]

*Codium edule* P.C. Silva [BISH 690593]

*Microdictyon setchellianum* M. Howe [BISH 695452]

*Neomeris vanbosseae* M. Howe [BISH 690594]