ALGAE.
AND DENNIS RUSSELL
1970s-1990s
PART 1 of 2
G.H. BALAZS
COLLECTION

United States Department of the Interior

FISH AND WILDLIFE SERVICE

National Museum of Natural History
Washington, D.C. 20560
(202) 357-1930

16 November 1993

Dr. George H. Balazs
Southwest Fisheries Science Center
Honolulu Lab, NMFS
NOAA, Honolulu, HI 96822

Dear George:

Been a bit of time since you heard from me, eh? Getting old and fat and not having much of any chance to travel so am doing some work as senior editor of the Virginia breeding bird atlas and once again, am becoming a local bird expert. Needless to say, I am after something.

I am currently doing some bibliographic work on Hawaii, especially Laysan and Midway, and knowing how prolific you are (having seen your name with great regularity in Wildlife Review, which I read like some people do Time) I wonder if you could send me a care package of your publications. The more obvious sources (Elepaio, etc) I have no trouble getting a look at but the Smithsonian Library has fallen on hard times and their efficiency and willingness are a lot less than they used to be. [Too bad Ripley left -- my few colleagues who have been here thirty years like me - feel that the beauracracy had finally won with bull taking precedence over academics].

So, as anything out of the NOAA Tech Mem NMFS, especially the SWFC ones, would be highly helpful -- and if you wanted to send me some of the stuff by other authors there I would also appreciate it and acknowledge your help in whatever I might assemble. [The Smithsonian being the way it now is, I have a better chance of hearing from you in relatively short order than I do on library request.

The last time I was in Hawaii was in 1988 and I somehow doubt I am going to live long enough to get out there again -- although my officially being part of the marvelous "National Biological Survey" as of yesterday -- you would think would improve my chances. I know you are productive and hope other things also go well.

Regards,

Roger

Roger B. Clapp
Museum Specialist

UNIVERSITY OF HAWAII
Hawaii Institute of Marine Biology

MEMORANDUM

November 23, 1976

To: Interested Parties

From: Stephen V. Smith, Assoc. Director, HIMB

Subject: Eucheuma Meeting

The committee to discuss management policy for Eucheuma on the Coconut Island reef met on November 20. Several decisions were reached, including the following timetable for December.

1. The "lawn plot" of Eucheuma will be removed by Dr. Doty's personnel by December 15. This allows him time to complete critical observations and will eliminate the plot which he feels contributes primarily to the "seeding" of the slope and flat with a wild population.

2. The drift fence which presently is west of the two experimental plots will be moved or otherwise modified into a surround fence for the remaining plot by December 31. In addition to curtailing drift from that plot, the fence will provide a method to determine just how much material has been breaking loose from that second plot.

3. Dr. Doty's personnel will continue to experiment on appropriate management procedures and will report to the Eucheuma committee on December 17.

4. Dr. Doty's personnel will continue to pick up material loose on the reef flat and to check other reefs for Eucheuma. Cooperation of various kinds would be gratefully appreciated. Feel free to pick up any material on the reef flat other than that contained within the plots. Material on the slope away from the management experiments (obvious, I think) is also fair game, but particularly material on the slope away from the dense population. For example, any Eucheuma between the HIMB sewer line clockwise around to the Pauley point should go. The safest means of disposal is to put the stuff on land above the intertidal. By all means, report any Eucheuma found on reefs other than the Coconut Island reef. For that matter, reports of no Eucheuma on Kaneohe Bay reefs are also useful data.

SVS:ec

Distribution List:

HIMB Staff, Maxwell Doty, C. H. Lamoureux, Evan Evans, Botany Dept. (10), Zoology Dept. (10), Oceanography Dept. (10).

Peeled and Discarded 9/17/84

GB 1013 Kiholo 5-8 March 1981 3297

GB 1066 NAPILI 4/22/81

GB 1069 NAPILI 4/22/81

GB 1005 2934 Gaza pallid

tag # 3332 3/24/81 GB 1000

GB 1060 NAPILI 4/22/81 GB

Cotton sample scuba GB 1020 Kiholo Lagoon 6 March 1981

NAPILI 4/22/81 GB 1070

GB 1011 Kiholo 5-8 March 1981 3312

GB 1068 NAPILI 4/22/81

GB 1072 NAPILI 4/22/81

GB 1010 Kiholo 5-8 March 1981 3247

GB 1071 Napili 4/22/81

GB 1063 Napili 4/22/81

GB 1012 Kiholo 5-8 March 1981 3304

NAPILI 4/22/81 GB 1067

GB 1062 NAPILI 4/22/81

scrapings from outside of turtle shell specimen from Hull Is. Phoenix Is. GB 1001

1061 NAPILI 4/22/81

GB 1064 NAPILI 4/22/81

GB 1014 Kiholo 5-8 March 1981 3328

GB 1065 NAPILI 4/22/81

GB 1030
Kiholo Bay ~10-15
7 March 1981 outside area

Koakaanu, Kauai 4/9/81
GB 1052
partial sample 2 of 3

GB 1053
...Kauai 4/9/81
partial sample 3 of 3

GB 1080
1981 F+G confiscation PRIMARY
EVIDENCE

1981 F+G
Evidence

GB 1082
confiscation
INTESTINES

GB 1081
1981 F+G confisc. SECONDARY
Evidence

GB 1042
HIROTA-
Lihpang
intestines
1980

POIPU (Brennecke Bch.)
private home
6 APRIL 1981
KAUAI
GB 1050

The Marine Algae Present in Turtle Gut Samples Collected in the Hawaiian Islands by George H. Balazs, Hawaii Institute of Marine Biology. Algae identified by Dennis J. Russell, Seattle Pacific University, June 1981.

GB-800	
Amansia glomerata	1%
Codium arabicum	50
Codium edule	49
GB-801	
Codium edule	75%
Codium arabicum	25
Pterocladia capillacea	trace
Dictyosphaeria versluysii	trace
Amansia glomerata	trace
GB-802	
Codium edule	90
Codium arabicum	5
Amansia glomerata	5
Halophila ovalis	trace
GB-803	
Sphacelaria tribuloides	98
Acrochaetium sp.	1
Gelidiella adnata	1
Lyngbya sp.	trace
GB-804	
Spyridia filamentosa	100
Laurencia sp.	trace
GB-805	
Laurencia majuscula	99
Centroceros clavulatum	
Ceramium sp.	
Sphacelaria sp.	
Acrochaetium sp.	
GB-806	
Spyridia sp.	
Fine acellular material	
GB-807	
Galaxaura cylindrica	
GB-808	
Lyngbya majuscula	Mostly
Lyngbya lagerheimii	(mixture of
Anabaena constricta	other blue-greens)
Anabaena variabilis	

GB-809
Spyridia filamentosa

GB-810
Animal-colonial ascidian?

GB-811
Microdictyon setchellianum

GB-812
Animal-tube worms?

GB-813
Spyridia filamentosa

GB-814

Halimeda opuntia	50
Sphacelaria tribuloides	trace
Centroceros clavulatum	trace
Spyridia filamentosa	50

GB-815
Laurencia tenera

GB-816
Zonaria hawaiiensis

GB-817

Halimeda opuntia	50
Dictyota divaricata	50
Spyridia filamentosa	trace

GB-818
(no sample)

GB-819
Red alga (genus ?)
Bacteria

GB-820

Gelidium sp.	trace
Jania sp.	trace

GB-821
Valonia aegagropila

GB-822

Gelidiella adnata	trace

GB-823

Gelidiella adnata	trace
Oscillatoria sp.	trace

GB-824

Pterocladia sp.	trace

GB-825

Pterocladia sp.	trace
Valonia aegagropila	trace

GB-826	
Polysiphonia sp.	trace
Ceramium sp.	trace
Jania capillacea	trace
GB-827	
Pterocladia calaglossoides	
GB-828	
(no sample)	
GB-829	
Pterocladia calaglossoides	
Hypnea sp.	
Valonia aegagropila	
Ulva sp.	
GB-830	
Gelidiella adnata	
GB-831	
Hypnea sp.	trace
Spyridia filamentosa	mostly
Pterocladia sp.	trace
Man-made red fibers	trace
GB-832	
Gelidiella adnata	
GB-833	
Pterocladia sp.	trace
GB-834	
Gelidiella adnata	
GB-835	
Laurencia sp.	trace
Valonia aegagropila	trace
Gelidiella sp.	trace
GB-836	
Oscillatoria sp.	trace
Centroceros clavulatum	trace
Gelidiella setacea	trace
GB-837	
Spyridia filamentosa	
GB-838	
Halophila hawaiiana	
GB-839	
Halimeda opuntia	
Spyridia filamentosa	trace
GB-840	
Acanthophora spicifera	99
Dictyota divaricata	1

GB-841	
Dictyota divaricata	90
Halophila hawaiiana	10
Acanthophora spicifera	trace
GB-842	
Dictyota divaricata	
GB-843	
Padina japonica	99
Halophila hawaiiana	1
GB-844	
Sphacelaria sp.	
GB-845	
Hypnea cervicornis	99
GB-846	
Callithamnion byssoides	
GB-847	
Lyngbya majuscula	
GB-848	
Polysiphonia sphaerocarpa	
GB-849	
Ceramium sp.	
GB-850	
Codium edule	90
Codium arabicum	10
Black leathery non-algal material	
GB-851	
Caulerpa sertularioides	90
Turbinaria ornata	5
Derbesia fastigiata	5
Sphacelaria furcigera	trace
Halimeda discoidea	trace
a few micromollusks (snails)	
GB-852	
Caulerpa sertularioides	95
Turbinaria ornata	5
Microdictyon setchellianum	trace
Halimeda discoidea	trace
GB-853	
Turbinaria ornata (not digested)	95
Caulerpa sertularioides	5
Microdictyon setchellianum	trace
One small worm (placed into a special vial so you can find it)	
GB-854	
Ulva fasciata	
Laurencia?	trace

GB-855
Animal material, many 1 mm diameter eggs, mollusk shells

GB-856
Animal material
Shells

GB-857

Ulva reticulata	99
Codium edule	1

GB-858
Codium edule
Ulva reticulata

GB-900
Microdictyon setchellianum

GB-901
Halimeda discoidea

GB-902
Porolithon gardinerii

GB-903
Porolithon sp.

GB-904
Porolithon gardinerii
Cladophoropsis luxurians

GB-905
Dictyosphaeria versluysii

GB-906
Lyngbya majuscula

GB-907
Schizothrix calcicola

GB-908
Polysiphonia (new species ?) tetrasporic
Valonia aegagropila

GB-909
(no sample)

GB-910
Caulerpa urvilliana

GB-911
Halimeda discoidea

GB-912
Laurencia majuscula

GB-913
Red patches are animal material

GB-914
Porolithon sp.

List of algae in samples GB-800 to GB-858 and GB-900 to GB-914

CHLOROPHYTA

Caulerpa sertularioides (Gmelin) Howe
Caulerpa urvilliana Montagne
Codium arabicum Kützing
Codium edule Silva
Derbesia fastigiata Taylor
Dictyosphaeria versluysii Weber van Bosse
Halimeda discoidea Decaisne
Halimeda opuntia (L) Lamouroux
Microdictyon setchellianum Howe
Ulva sp.
Ulva fasciata Delile
Ulva reticulata Forsskal
Valonia aegagropila C. Ag.

RHODOPHYTA

Acanthophora spicifera (Vahl) Boerg.
Acrochaetium sp.
Amansia glomerata C. Ag.
Callithamnion byssoides Arnott
Centroceros clavulatum (C. Ag.) Montagne
Ceramium sp.
Galaxaura cylindrica (Ellis and Solander) Lamouroux
Gelidiella adnata Dawson
Gelidiella setacea (Feldmann) Feldmann and Hamel
Hypnea sp.
Hypnea cervicornis J. Ag.
Jania sp.
Jania capillacea Harvey
Laurencia sp.
Laurencia majuscula (Harvey) Lucas
Laurencia tenera Tseng
Pterocladia sp.
Pterocladia calaglossoides
Pterocladia capillacea (Gmelin) Bornet
Polysiphonia sp.
Polysiphonia sphaerocarpa Boergesen
Porolithon sp.
Porolithon gardineri (Floslie) Foslie
Spyridia sp.
Spyridia filamentosa (Wulfen) Harvey

PHAEOPHYTA

Dictyota divaricata Lamouroux
Padina japonica Yamada
Sphacelaria sp.
Sphacelaria tribuloides Meneghini
Sphacelaria furcigera Kützing
Turbinaria ornata (Turn.) J. Ag.
Zonaria hawaiiensis (Lamoureux) C. Ag.

CYANOPHYTA

Anabaena constricta (Szafer) Geitler
Anabaena variabilis Kützing
Lyngbya sp.
Lyngbya lagerheimii (Möbius) Gomont
Lyngbya majuscula Gomont
Oscillatoria sp.
Schizothrix calcicola (Ag.) Gomont

SEAGRASS

Halophila ovalis (R. Br.) Hook

...OF NATURAL AND MATHEMATICAL SCIENCES SEATTLE PACIFIC UNIVERSITY (206) 281-2140 • SEATTLE, WASHINGTON 98119

18 May 1983

George Balazs
National Marine Fisheries Service
Honolulu Laboratory
P.O. Box 3830
Honolulu, Hawaii 96812

Dear George,

I have finally finished the algae identifications for you. Enclosed is the master list of sample contents and the summary of species according to Division. All went well, a few species stumped me for awhile, but eventually I found them in the literature (Plocamium brasiliense may be a new record for Hawaii). A better algologist than myself may differ in their opinion as to the species according to published observations, but fortunately you have all of the life stages in your sample! This will help anyone following to better pin-point the species. It is a very narrow thallus, highly branched and very interesting.

I must admit, to my embarrassment, that somehow I must have mixed No. 26 in with another sample. I have the algae identified, but cannot find the sample. I hope this does not effect you data. Please excuse the error.

The bill for this work has been sent to Mary L. Godfrey, the samples have been placed into jars (most of them), and into their original bags, and are being sent to you by separate mail.

I certainly hope everything is working out for the best for you and your family. We receive no news about Hawaii state at all, but I assume all is normal. Please feel free to send more samples as you gather them and set a dead-line if you need to have the results quicker than this last batch.

Aloha,

Dennis

Dennis J. Russell

The marine algae collected from sea turtles and from the reefs on Laysan Island, by Alan Kam in March and April 1982. Identified by Dennis J. Russell accordingly as this list, May 1983.

LA 01

Plocamium brasiliense (male, female and tetrasporophytes)
Laurencia sp.
Dictyota friabilis
Bryopsis pennata
Jania micrarthrodia

LA 02

Laurencia cartilaginea 90%
Dictyota friabilis 10%
Zonaria sp.
Amphiroa fragilissima

LA 03

Bryopsis plumosa 99%
Plocamium sandvicensis 1%
Dictyota friabilis Trace
Laurencia nidifica Trace
Corallina sp. Trace

LA 04

Asparagopsis taxiformis

LA 05

Turbinaria ornata 40%
Laurencia cartilaginea 40%
Bryopsis hypnoides 15%
Asparagopsis taxiformis 5%
Amphiroa fragilissima Trace
Jania capillacea Trace

LA 21

Caulerpa racemosa var. peltata 90%
Halimeda discoidea 10%
Corallina Trace

LA 22

Asparagopsis taxiformis 90%
Chondrococcus hornemanni 10%
Halimeda discoidea Trace

LA 23

Microdictyon montagnei

LA 24

Marensia fragilis 99%
Chondrococcus hornemanni 1%

LA 25

Caulerpa racemosa var. turbinata 50%
Martensia fragilis 50%
Chondrococcus hornemanni Trace
Halimeda discoidea Trace

LA 26

Caulerpa webbiana

LA 27

Gelidium crinale 40%
Dictyota friabilis 30%
Trailliella sp. 20%
Plocamium sandvicense 10%
Halimeda micronesica Trace
Ceramium sp. Trace
Corallina sp. Trace

LA 31

Bryopsis pennata var. secunda 99%
Valonia aegagropila Trace
Microdictyon montagnei Trace

LA 32

Chondrococcus hornemanni 50%
Fosliella farinosa Trace
Caulerpa webbiana 50%
Dictyota friabilis Trace
Amphiroa fragilissima Trace

LA 33

Hydroclathrus clathratus 99%
Halimeda sp. Trace

LA 34

Corallina sandvicensis

LA 35

Microdictyon Montagnei 90%
Monostroma oxyspermum 10%

LA 36

Gelidium crinale
Jania capillacea Trace

LA 37

Microdictyon montagnei

LA 38

Asparagopsis taxiformis

LA 39

Caulerba webbiana 99%
Chondrococcus hornemanni 1%
Halimeda opuntia

LA 40

Asparagopsis taxiformis 80%
Halimeda discoidea 10%
Dictyota friagilis 5%
Chondrococcus hornemanni 5%
Hypnea spinella Trace
Ceramium sp. Trace
Amphiroa fragilissima Trace
Caulerpa webbiana Trace

LA 60

Asparagopsis taxiformis 20%
Halimeda discoidea 5%
Codium edule 5%
Dictyota stolonifera Trace
Caulerpa racemosa var. peltata 5%
Ulva fasciata 40%
Plocamium sandvicensis Trace
Corallina sp. Trace
Amphiroa anastomosans 10%
Martensia fragilis 10%
Laurencia decumbens 5%

LA 70

Sargassum echinocarpum
Zonaria sp.
Dictyosphaeria versluysii
Halimeda discoidea
Champia parvula
Microdictyon montagnei
Dictyota acuteloba
Laurencia nidifica
Polysiphonia saccorhiza (on Laurencia)
Ceramium sp.
Laurencia galtsoffi
Chondria sp.

LA 81

Polysiphonia tsudana

LA 82

Polysiphonia tsudana
Barnacles Trace
Diatoms Trace
Cladophora sp. Trace

LA 83

Caulerpa lentillifera 90%
Caulerpa racemosa var. peltata 10%

LA 84

Cladophoropsis membranacea
Microdictyon sp. Trace
Herposiphonia parca

LA 85

Caulerpa lentillifera

LA 86

Caulerpa lentillifera
Herposiphonia parca (abundant as an epiphyte)
Microdictyon montagnei
Herposiphonia variabilis
Laurencia sp.

The following is a listing of the different species contained in the above samples:

CHLOROPHYTA

Bryopsis hypnoides Lamx.
Bryopsis pennata Lamx.
Bryopsis pennata var. secunda (Harvey) Collins and Harvey
Bryopsis plumosa (Hudson) C. Ag.
Caulerpa lentillifera J. Ag.
Caulerpa racemosa var. peltata (Lam.) Eubank
Caulerpa racemosa var. turbinata (J. Ag.) Eubank
Caulerpa webbiana Mont.
Cladophora sp.
Cladophoropsis membranacea (C. Ag.) Boerg.
Codium edule Silva
Dictyophaeria versluysii Weber van Bosse
Halimeda discoidea Decaisne
Halimeda micronesica Yamada
Halimeda opuntia (L.) Lamx.
Halimeda sp.
Microdictyon montagnei Harvey
Microdictyon sp.
Monostroma oxyspermum (Kützing) Doty
Ulva fasciata Delile
Valonia aegagropila C. Ag.

PHAEOPHYTA

Dictyota acuteloba J. Ag.
Dictyota friabilis Setchell
Dictyota stolonifera
Hydroclathrus clathratus (C. Ag.) Howe
Sargassum echinocarpum J. Ag.
Turbinaria ornata (Turner) J. Ag.
Zonaria sp.

RHODOPHYTA

Amphiroa anastomosans Weber von Bosse
Amphiroa fragilissima (L.) Lamx.
Asparagopsis taxiformis (Delile) Coll. and Harvey
Ceramium sp.
Champia parvula (C. Ag.) Harvey
Chondria sp.
Chondrococcus hornemanni (Mert.) Schmitz
Corallina sandvicensis Lemm.
Corallina sp.
Fosliella farinosa (Lamx.) Howe
Gelidium crinale (Turn.) Lamx.
Herposiphonia parca Setchell
Herposiphonia variabilis Hollenberg
Hypnea spinella (J. Ag.) Kützing
Jania capillacea Harvey
Jania micrarthrodia Lamx.
Laurencia cartilaginea Yamada
Laurencia decumbens Kützing
Laurencia galtsoffi Howe
Laurencia nidifica J. Ag.
Laurencia sp.
Martensia fragilis Harvey
Plocamium brasiliense (Greville) Howe and Taylor
Plocamium sandvicense J. Ag.
Polysiphonia saccorhiza (Collins and Hervey) Hollenberg
Polysiphonia tsudana Hollenberg
Trailliella sp.

List of algae in samples GB-700 to GB-768

CHLOROPHYTA

Caulerpa racemosa (Forsskal) J. Ag.
Cladophora sp.
Codium arabicum Kützing
Codium edule Silva
Dictyosphaeria versluysii Weber van Bosse
Enteromorpha tubulosa Kützing
Halimeda discoidea Decaisne
Monostroma sp. ?
Ulva fasciata Delile
Ulva rigida C. Ag.
Valonia aegagropila C. Ag.

RHODOPHYTA

Acanthophora spicifera (Vahl) Boerg.
Acrochaetium gracile Boerg.
Acrochaetium sp.
Ahnfeltia concinna J. Ag.
Amphiroa fragilissima (L.) Lamx.
Gelidiopsis variabile J. Ag.
Gelidium adnata Dawson
Gelidium crinale (Turn.) Lamx.
Gelidium pusillum (Stackhouse) LaJolis
Gelidium sp.
Griffithsia ovalis Harvey
Hypnea cervicornis J. Ag.
Hypnea musciformis (Wulfen) C. Ag.
Hypnea spinella (J. Ag.) Kützing
Jania ungulata Yendo
Laurencia mariannensis Yamada
Laurencia nidifica J. Ag.
Liagora maxima Butters
Polysiphonia scropulorum Harvey
Pterocladia calaglossoides (Howe) Dawson
Spyridia filamentosa (Wulfen) Harvey
Trichogloea lubrica (Harv.) Butters
Wurdemannia miniata (Lamark and DeCandelle) Feldmann and Hamel

PHAEOPHYTA

Chnoospora sp.
Padina japonica Yamada
Ralfsia occidentalis Hollenberg
Rosenvingea intricata (J. Ag.) Boerg.
Sargassum echinocarpum J. Ag.
Sargassum polyphyllum J. Ag.
Sphacelaria furcigera Kützing

CYANOPHYTA

Lyngbya semiplena (C. Ag.) J. Ag.
Microcystis sp.
Oscillatoria sp.

GB-756

Ahnfeltia concinna
Hypnea cervicornis

GB-757

Hypnea musciformis

GB-758

Hypnea musciformis	99
Laurencia nidifica	1

GB-759

Hypnea cervicornis

GB-760

Rosenvingea intricata

GB-761

Hypnea cervicornis

GB-762

Hypnea cervicornis

GB-763

Sargassum echinocarpum (probably)

GB-764

Laurencia mariannensis

GB-765

Trichogloea lubrica

GB-766

Caulerpa racemosa

GB-767
Liagora maxima

GB-768

Rosenvingea intricata

GB-742

Gelidium crinale	80
Amphiroa fragilissima	20

GB-743

Gelidium pusillum

GB-744

Gelidium pusillum

GB-745

Ahnfeltia concinna

GB-746

Acanthophora spicifera

GB-747

Gelidiopsis variabile

GB-748

Valonia aegagropila

GB-749

Pterocladia calaglossoides	
Acanthophora spicifera	Tr

GB-750

Gelidium crinale

GB-751

Ralfsia occidentalis

GB-752

Ahnfeltia concinna

GB-753

Ulva fasciata

GB-754

Acanthophora spicifera	80
Griffithsia ovalis	5
Hypnea spinella	5
Halimeda discoidea	10

GB-755

Acanthophora spicifera	10
Spyridia filamentosa	50
Hypnea musciformis	10
Gelidiopsis variabile	30

GB-733

Codium edule	70
Ulva rigida	30
Dictyosphaeria versluysii	Tr
Padina japonica	Tr
Chnoospora sp.	Tr
Terrestrial plants	Tr

GB-734

Codium edule	50
Ulva rigida	50

GB-735

Ulva rigida	50
Codium edule	50
Codium arabicum	Tr
Terrestrial plants	Tr

GB-736

Codium edule	50
Ulva rigida	50
Gelidium pusillum	Tr

GB-737

Codium edule	90
Ulva rigida	10
Plant fibers	Tr

GB-738

Codium edule	30
Ulva rigida	30
Gelidium pusillum	30
Black leathery mass (animal?)	

GB-739

Ulva rigida	99
Gelidium pusillum	1
Codium edule	Tr
Fishing line	
Animal hairs	
Ironwood tree branches	

GB-740

Ulva fasciata	99
Gelidium pusillum	1
Plastic sheet	
Animal hairs	
Ironwood tree branches	
Terrestrial grass	

GB-741

Gelidium crinale

GB-724

Oscillatoria sp.	Tr
Ulva fasciata	

GB-725

Gelidiella adnata	80
Sphacelaria furcigera	20
A siphonous green filament	Tr

GB-726

Codium edule	90
Ulva rigida	10
Halimeda discoidea	Tr
Polyopes sp.	Tr
Chnoospora sp.	Tr
Terrestrial grass	
Black and white animal (3 cm long x 0.5 cm wide)	

GB-727

Ulva rigida	50
Codium edule	50
Gelidium sp.	Tr
Terrestrial grass	
Opalescent animal?	

GB-728

Codium edule	70
Amansia glomerata	30
Blade of grass	

GB-729

Codium edule	50
Ulva rigida	50
Opalescent animal	
Terrestrial plants	

GB-730

Ulva rigida	70
Codium edule	20
Terrestrial plants	10

GB-731

Ulva rigida	30
Codium edule	70
Chnoospora sp.	Tr

GB-732

Ulva rigida	50
Codium edule	50
Ghnoospora sp.	Tr

GB-711

Enteromorpha tubulosa	90
Cladophora sp.	10

GB-712

(vial not present?)

GB-713

Ulva fasciata
Sargassum polyphyllum (? too small of a scrap to tell on this specimen)
Hypnea cervicornis

GB-714

Lyngbya semiplena	50
Polysiphonia scropulorum	Tr
Sphacelaria furcigera	50

GB-715

Oscillatoria sp.	100

GB-716

Hypnea cervicornis
Ulva fasciata

GB-717
A fungus of some sort. I could not find fruiting bodies to be sure.

GB-718

Claw-like objects

GB-719

Ulva fasciata

GB-720

Oscillatoria sp.	50
Monostroma sp. (I am not sure of this ID because it may be a scrap of Enteromorpha)	50

GB-721

Oscillatoria sp.	Tr
Hypnea cervicornis	Tr
Sargassum polyphyllum (?)	Tr

GB-722

Hypnea cervicornis
Amphipod

GB-723

Terrestrial grass

The Marine Algae Present in Turtle Gut Samples Collected in the Hawaiian Islands by George H. Balazs, Hawaii Institute of Marine Biology. Algae Identified by Dennis J. Russell, Seattle Pacific University, December 1980.

GB-700	Percent of Sample
Acrochaetium gracile	99
Black sand	

GB-701

Oscillatoria sp.
Plus an unknown alga

GB-702

Oscillatoria sp.
Wurdemannia miniata

GB-703

Oscillatoria sp.	90
Wurdemannia miniata	10
Sponge spicules	Tr
Epithelial cells	Numerous

GB-704

Gelidium sp.	99
Microcystis sp.	1

GB-705

Oscillatoria sp.	100

GB-706

Oscillatoria sp.	100
Claw-shaped objects (1 mm long)	

GB-707

Not recognizable

GB-708

Ulva fasciata
Acrochaetium sp.
Hypnea cervicornis

GB-709

Gelidiella adnata

GB-710

Jania ungulata
Sphacelaria furcigera

500's

SEATTLE PACIFIC UNIVERSITY
SEATTLE, WASHINGTON 98119

3 APR 80

Dear George,

Your samples are in the mail as of today. I'm working on your latest set of samples & have turned in a bill to RCUH. Will compile a bibliography for you soon concerning shell fouling.

Dennis

The Marine Algae Present in Turtle Gut Samples Collected in the Hawaiian Islands by George H. Balazs, Hawaii Institute of Marine Biology; Algae Identified by Dennis J. Russell, March 1980

GB-501	Percent of Sample
Gelidiella acerosa	80%
Amansia glomerata	5
Acanthophora spicifera	10
Pterocladia sp.	2
Codium edule	3
Colonial animal (ascidian ?)	trace

GB-502	
Gelidiella acerosa	30
Codium arabicum	40
Amansia glomerata	10
Codium edule	15
Acanthophora spicifera	5
Colonial animal	trace

GB-503	
Codium edule	90
Pterocladia capillacea	1
Amansia glomerata	trace
Codium arabicum	9
Plant fibers	trace
Cartilagenous animal tissue	trace
Colonial animal	trace
Foliose rhodophyte	trace

GB-504	
Codium edule	90
Gelidiella acerosa	3
Amansia glomerata	3
Ulva fasciata	1
Black colonial animals (4 lumps)	1

GB-505	
Gelidiella acerosa	[illegible]
Codium edule	[illegible]
Codium arabicum	[illegible]
Ulva reticulata	[illegible]

GB-505

Gelidiella acerosa	1
Codium edule	75
Codium arabicum	24
Ulva reticulata	trace
Pterocladia sp.	trace
Ulva fasciata	trace
Achrochaetium (on Codium)	trace
Black colonial animals	trace

GB-506

Amansia glomerata	50
Codium edule	3
colonial animals	2
Silicate sponge (on Amansia)	45

GB-507

Amansia glomerata	100
Membranous animal material	trace

GB-508

Codium reediae	45
Ulva fasciata	45
Gracilaria coronopifolia	5
Acanthophora spicifera	3
Hypnea cervicornis	2
Cladophora sp.	trace
Ulva reticulata	trace
Grateloupia filicina	trace
Animal tissue (skin?)	

GB-509

Ulva fasciata	80
Ulva reticulata	10
Ulva rigida	10
Gracilaria coronopifolia	trace

GB-510

Halophila ovalis (rhizomes)	100
Animal hairs (human?)	trace
Skin? (gray)	trace
Cotton fibers	trace

(generally on-descript pieces)

GB-517

Codium sp. (digested)	60
Halophila ovalis (rhizomes)	30
Ulva fasciata	5
Plastic sheet	trace
Hair	trace
Detritis	5

GB-518

Codium sp. (digested)	50
Ulva sp. (digested)	50

GB-519

Halophila ovalis (rhizomes)	50
Codium sp. (digested)	50
Amansia glomerata	trace
Hair	trace

GB-520

Halophila ovalis (rhizomes)	70
Codium sp. (digested)	20
Feather quill	10
Ulva sp. (digested)	trace

GB-521

Halophila ovalis (rhizomes)	45
Sargassum echinocarpum	45
Codium phasmaticum	10
Codium sp. (digested)	trace
Feather	trace
Hair	trace

There is still a lot of cytoplasm in the _Codium_ filaments, but the outer portions of the filaments have lost most of the characteristic features needed for positive identification to species.

GB-522

Codium arabicum _Codium phasmaticum_	99 (combined)
Round worm associated with _Codium_	
Coarse black hair	trace

GB-523

Codium phasmaticum	50

GB-523

Codium phasmaticum	90
Codium sp. (digested)	10
Polysiphonia sp.	trace

GB-524

Codium sp. (digested)	95
Ulva fasciata	5
Fragments, detritis	

GB-525

Codium sp. (digested)	90
Amansia glomerata	5
Halophila ovalis (rhizome)	5
Feather	trace
Hair	trace

GB-526

Codium phasmaticum	40 (combined)
Codium sp. (digested)	
Terrestrial grass	20
Halophila ovalis (rhizome)	20
Ulva fasciata	20
Ulva rigida	trace

GB-527

Codium sp. (digested)	75
Ulva fasciata	25
Terrestrial grass	trace
Sample badly digested	

GB-528

Codium sp. (digested)	90
Amansia glomerata	trace
Gnarled mass of tissue	10

GB-529

Halophila ovalis (rhizome)	70
Codium arabicum	20
Ulva rigida	5
Grateloupia hawaiiana	5
Dictyota divaricata	trace
Hair	trace

GB-530	
Sheet of plastic	75
Ulva rigida	20
Codium sp. (digested)	5
Halophila ovalis (rhizomes)	trace
Hair	trace
GB-531	
Amansia glomerata	50
Codium phasmaticum	50
Codium sp. (digested)	trace
GB-532	
Codium arabicum Codium phasmaticum	95 (combined)
Halophila ovalis (rhizome)	3
Amansia glomerata	1
Grateloupia filicina	1
Cartilagenous material	

GB-533 (Reef Sample)
Acanthophora spicifera
Asparagopsis taxiformis
Centroceras clavulatum
Ectocarpus breviarticulatus
Enteromorpha tubulosa
Grateloupia hawaiiana
Hypnea cervicornis
Hypnea chordacea
Hypnea musciformis
Sargassum echinocarpum
Spyridia filamentosa
Ulva fasciata

This looks like a Kaneohe Bay sample,if you collected it from some other bay on Oahu or from another island the exotics it contains would be very important records.

List of the algae in samples GB-501 to GB-533

CHLOROPHYTA

Codium arabicum Kützing
Codium edule Silva
Codium phasmaticum Setchell
Codium reediae Silva
Codium sp.
Enteromorpha tubulosa Kützing
Ulva fasciata Delile
Ulva reticulata Forsskal
Ulva rigida C.Ag.
Ulva sp.

SEAGRASS

Halophila ovalis (R. Br.) Hook

PHAEOPHYTA

Dictyota divaricata
Dictyota sp.
Ectocarpus breviarticulatus J. Ag.
Sargassum echinocarpum J. Ag.

RHODOPHYTA

Acanthophora spicifera (Vahl) Boerg.
Acrochaetium sp.
Amansia glomerata C. Ag.
Asparagopsis taxiformis (Delile) Coll. and Harvey
Centroceros clavulatum (C. Ag.) Montagne
Gelidiella acerosa (Forsskal) Feldmann and Hamel
Gracilaria coronopifolia J. Ag.
Grateloupia filicina (Wulfen) C. Ag.
Grateloupia hawaiiana Dawson
Hypnea cervicronis J. Ag.
Hypnea chordacea J. Ag.
Hypnea musciformis (Wulfen) C. Ag.
Pterocladia capillacea (Gmelin) Bornet
Pterocladia sp.
Spyridia filamentosa (Wulfen) Harvey

The Marine Algae Present in Turtle Gut Samples Collected in the Hawaiian Islands by George H. Balazs, Hawaii Institute of Marine Biology

Algae identified by Dennis J. Russell, January 1980.

GB-401	Percent of Sample
Oscillatoria subtilissima	50%
Microcystis sp.	50

GB-402	
Oscillatoria subtilissima	99
Acrochaetium sp.	1
Oil droplets	
Detritus	

GB-403	
Spyridia filamentosa	99
Centroceros clavulatum	1

GB-404	
Laurencia majuscula	50
Codium arabicum	50
Jania capillacea	trace

GB-405	
Codium arabicum	90
Codium edule	5
Codium phasmaticum	2
Gelidium crinale	3

GB-406	
Codium arabicum	70
Codium edule	29
Gelidium crinale	1

GB-407	
Codium arabicum	3
Amansia glomerata	97

GB-408	
Amansia glomerata	55
Codium phasmaticum	25
Codium arabicum	20

GB-409		
Ulva sp.	Trace	(There were a few scraps of each of these species)
Hypnea pannosa	Trace	
Laurencia sp.	Trace	
Hypnea cervicornis	Trace	
Hypneocolax stellaris	Trace	
Oscillatoria subtilissima	TRace	

GB-410	
Oscillatoria subtilissima	50
Microcystis sp.	50

GB-411 (Reef Collection)

Chlorophyta (Phylum)
Caulerpa racemosa
Chlorodesmis hildebrantii
Cladophoropsis luxurians
Halimeda discoidea

Phaeophyta (Phylum)
Dictyota sp.
Dictyota friabilis
Rosenvingea intricata
Sargassum polyphyllum
Turbinaria ornata

Rhodophyta (Phylum)
Asparagopsis taxiformis
Coelothrix irregularis
Corallina sp.
Dasya pedicellata
Galaxaura cylindrica
Laurencia obtusa
Martensia fragilis
Plocamium sandvicense
Plocamium sp.

Cyanophyta (Phylum)
Lyngbya majuscula

GB-412 (Reef Collection)
Turbinaria ornata
Centroceros clavulatum
Rhizoclonium hookeri
Chnoospora implexa
Sargassum echinocarpum
Ectocarpus breviarticulatus
Sphacelaria tribuloides
Laurencia tenera

GB-413
Hydroclathrus clathratus

GB-414
Sphacelaria furcigera

GB-415

Codium arabicum	90
Oscillatoria subtilissima	

GB-416

Ectocarpus indicus	50
Polysiphonia tsudana	40
Lyngbya semiplena	10
Lyngbya porphyrosiphonis	Trace

GB-417	
Lyngbya semiplena	80
Ectocarpus indicus	20
Polysiphonia tsudana	Trace
GB-418	
Lyngbya semiplena	65
Codium arabicum	30
Ectocarpus indicus	5
GB-419	
Microcoleus sp.	95
Laurencia majuscula	Trace
Ceramium tenuissimum	Trace
Oscillatoria subtilissima	Trace
Foraminifera (protozoan)	
Oil droplets	
GB-420	
Microcoleus sp.	95
Ceramium sp.	Trace
Laurencia sp.	Trace
GB-421	
Microcoleus sp.	90
Jania capillacea	Trace
Laurencia majuscula	10
GB-422	
Microcoleus sp.	90
Polysiphonia sp.	Trace
Ceramium leutzelburgii	Trace
Terrestrial plant fibers	
Ovoid brown pellets	
GB-423	
Turbinaria ornata	Trace
Codium arabicum	Trace
Griffithsia sp.	Trace
Oscillatoria subtilissima	Trace
Terrestrial plant fibers	
Ovoid pellets	
GB-424	
Ectocarpus breviarticulatus	50
Polysiphonia tsudana	45
Sphacelaria furcigera	5
Oscillatoria subtilissima	Trace
GB-425	
Laurencia majuscula	80
Ceramium tenuissimum	10
Polysiphonia tsudana	10
Pseudobryopsis oahuensis	Trace
Oscillatoria subtilissima	Trace

GB-426
Ectocarpus breviarticulatus 90
Porolithon sp. (crustose red alga)
Sphacelaria tribuloides Trace

GB-427
Codium arabicum 80
Polysiphonia tsudana 10
Polysiphonia sparsa 10
Ceramium sp. Trace
Oscillatoria subtilissima Trace
Laurencia majuscula Trace
Ovoid pellets

GB-428
Codium edule 90
Oscillatoria subtilissima 10
Male round worm in Codium

GB-429
Codium edule 90
Oscillatoria subtilissima 10

GB-430
Laurencia majuscula 90
Sargassum sp. 5
Microcoleus sp. 5
Foraminifera (protozoans)
Micromollusks (three individuals)

GB-431
Codium arabicum 60
Oscillatoria subtilissima 30
Microcoleus sp. 10

GB-432
Caulerpa racemosa

GB-433
Codium arabicum 90
Sphacelaria tribuloides 5
Zonaria variegata Trace
Ceramium sp. Trace
Polysiphonia sp. Trace

GB-434
Codium arabicum 50
Codium edule 50
Lyngbya majuscula Trace
Martensia fragilis Trace
Hypnea sp. Trace
Dictyopteris plagiogramma Trace
Black mass of substance

GB-435
Codium edule 40
Codium arabicum 40
Dictyosphaeria versluysii 10
Amansia glomerata 10

GB-436

Scrap of brown algae (*Turbinaria ornata* ?)
Terrestrial plant fibers

GB-437

Codium phasmaticum	Trace
Hypnea sp.	Trace
Oscillatoria subtilissima	Trace
Terrestrial plant fibers	
Phaeophyte (?)	

GB-438

Oscillatoria subtilissima	90
Lyngbya majuscula	10
Ulva sp.	Trace
Oil droplets	

GB-439

Squamous epithellial cells	95 (these appeared in some of the earlier samples also)
Oscillatoria sp.	Trace
Codium edule	Trace
Codium phasmaticum	Trace

GB-440

Ulva rigida	Trace

GB-441

Codium arabicum	99
Ceramium codii	Trace
Microcoleus sp.	Trace
Rivularia sp.	Trace

GB-442

Codium sp.	Trace
Phaeophyte (?)	Trace

GB-443

Laurencia carolinensis	99
Polysiphonia sparsa	1
Oscillatoria subtilissima	Trace

GB-444

Ectocarpus breviarticulatus	99
Lyngbya majuscula	1
Many round worms up to 2 mm long	

GB-445

Laurencia carolinensis	99
Oscillatoria subtilissima	Trace
Cladhymenia pacifica	1
Squamous epithelial cells	

GB-446

Turbinaria ornata	50
Laurencia carolinensis	30
Cladhymenia pacifica	20
Champia parvula	Trace
Oscillatoria subtilissima	Trace

GB-447

Laurencia carolinensis	99
Oscillatoria subtilissima	1

GB-448
Caulerpa racemosa

GB-449
Caulerpa racemosa

GB-450

Polysiphonia sparsa	Trace
Laurencia carolinensis	90
Oscillatoria subtilissima	10

GB-451

Caulerpa racemosa	
Lyngbya majuscula	Trace

GB-452 (Sample for D. Russell)
Codium sp.
This is a different species than the others you have sent.
It needs more research.

List of the algae in samples GB-401 to GB-451

CHLOROPHYTA

Genus Species Author

Caulerpa racemosa (Forsskal) J. Ag.

Chlorodesmis hildebrandtii A. and E. S. Gepp

Cladophoropsis luxurians Gilbert

Codium arabicum Kützing

Codium edule Silva

Codium phasmaticum Setchell

Dictyosphaeria versluysii Weber van Bosse

Halimeda discoidea Decaisne

Pseudobryopsis oahuensis Egerod

Rhizoclonium hookeri Kützing

Ulva sp.

Ulva rigida C. Ag.

PHAEOPHYTA

Genus Species Author

Chnoospora implexa J. Ag.

Dictyopteris plagiogramma (Mont.) Vickers

Dictyota sp.

Dictyota friabilis Setchell

Ectocarpus breviarticulatus J. Ag.

Ectocarpus indicus Sonder

Hydroclathrus clathratus (C. Ag.) Howe

Rosenvingea intricata (J.Ag.) Boerg.

Sargassum echinocarpum J. Ag.

Sargassum polyphyllum J. Ag.

Sphacelaria furcigera Kütz

Turbinaria ornata (Turn.) J. Ag.

Zonaria variegata (Lamoureux) C. Ag.

RHODOPHYTA

Genus Species Author

Acrochaetium sp.

Amansia glomerata C. Ag.

Asparagopsis taxiformis (Delile) Coll. and Harvey

Centroceros clavulatum (C.Ag.) Montagne

Ceramium sp.

Ceramium leutzelburgii Schmidt

Ceramium tenuissimum (Lyngbye) J. Ag.

Champia parvula (C. Ag.) Harvey

Cladhymenia pacifica Setchell

Coelothrix irregularis (Harv.) Boerg.

Corallina sp.

Dasya pedicellata (C. Ag.) C. Ag.

Galaxaura cylindrica (Ellis and Solander) Lam.

Gelidium crinale (Turn.) Lamour.

Griffithsia sp.

Hypnea cervicornis J. Ag.

Hypnea pannosa J. Ag.

Hypneocolax stellaris J. Ag.

Jania capillacea Harvey

Laurencia sp.

Laurencia carolinensis Saito

Laurencia majuscula (Harv.) Lucas

Laurencia obtusa (Huds.) Lam.

Laurencia tenera Tseng

Martensia fragilis author?

Plocamium sp.

Plocamium sandvicense J. Ag.

Polysiphonia sp.

Polysiphonia sparsa (Setchell) Hollenberg

Polysiphonia tsudana Hollenberg

Porolithon sp.

Spyridia filamentosa (Wulf.) Harv.

CYANOPHYTA

Genus	Species	Author
Lyngbya	majuscula	Gomont
Lyngbya	semiplena	(C. Ag.) J. Ag.
Lyngbya	porphyrosiphonis	Frêmy
Microcoleus	sp.	
Microcystis	sp.	
Oscillatoria	subtilissima	Kütz
Rivularia	sp.	

The Algae Present in Turtle Gut Samples Collected in Hawaii

Samples collected by George H. Balazs

Algae identified by Dennis J. Russell, March 1979

GB-301 MCOMB-1 5/78 N. Lanai	Estimate of % in sample (Tr= trace)
Codium phasmaticum	3
Acanthophora spicifera	80
Padina japonica	2
Dictyota acuteloba	5
Hypnea cervicornis	5
Amansia glomerata	5
Champia parvula	Tr

A 20-30 cm long .2 - .3 cm wide tough animal? worm-like protein thread.
Several tough, tubular, protein? objects.

X GB-302 MCOMB-2 5/78 N. Lanai	
Acanthophora spicifera	90+
Amansia glomerata	1
Gracilaria sp.	Tr
Hypnea cervicornis	Tr
Leveillea jungermannioides	Tr
Padina japonica	Tr

X GB-303 TAG 2661 13 JUNE 1978 East, FFS SL 18 5/8"	
Gracilaria (tip of thallus?)	Tr
Asterionella notata (a diatom, few cells)	Tr
Cellular mass of ?	

X GB-304 TAG 2266 14 JUNE 1978 EAST, FFS SL 15 1/4 (stomach)	
Codium edule	All

X GB-305 TAG (in Bottle) 2267 14 JUNE 1978 East, FFS	
Acrochaetium sp.	Tr
Ceramium sp.	Tr
Polysiphonia sp.	5
Spacelaria furcigeria	90+

+ Codium ?

X GB-306 TAG 516 16 JUNE 1978 East, FFS (mouth)

Valonia aegagropila? (small piece) All
(looked like Caulerpa to me when sampled)

X GB-307 TAG 2215A 14 June 1978 East, FFS SL 16 7/8 (mouth)

Codium edule All
+ Halimeda ?

X GB-308 TAG 2215B (scraping from underside of margins)

Ectocarpus indicus	10
Polysiphonia tsudana (tetrasporophyte)	40
Spacelaria furcigeria	50

X GB-309 2630 10/3/78 Lisianski

Unknown cellular plant material (mouth sample)

X GB-310 2841 10/3/78 Lisianski (stomach)

Lyngbya majuscula filaments on animal material All

X GB-311 2854A 10/4/78 Lisianski (stomach)

Oscillatoria sp. All

X GB-312 2854B (Skin, shell) 10/4/78 Lisianki

Acrochaetium gracile	Tr
Ectocarpus indicus	70
Lyngbya sp.	Tr
Oscillatoria sp.	10
Polysiphonia sp.	20

X GB-313 2849 10/3/78 Lisianski (stomach)

Jania capillacea	1
Turbinaria ornata	99

X GB-314 2857 10/4/78 Lisianski (stomach)

Red alga (Rhodomelaceae) All
George: I'll have to work on this one awhile more to identify it.
Membrane of animal material

X GB-315 2939 10/2/78 Lisianski (stomach) SA Basker 25 3/8"SL

Chlorella sp. (sample contains detritis and scores of these unicellular algae)
All

X GB-316 2944 10/3/78 Lisianski (stomach)

Melosira sp. All

X GB-317 2946 10/3/78 LISIANSKI (STOMACH)

Turbinaria ornata	30
Blue-green algae	20
Detritis	50

X GB-318 2952 10/3/78 LISIANSKI (STOMACH)

Valonia sp. (Two small spheres) All
+ (Calcareous from Carapace)

X GB-319 2954 10/3/78 LISIANSKI (STOMACH)

Terrestrial plant material ? (there are pits in the cell walls)

X GB-320 SITE 2 10/4/78 LISIANSKI

Ceramium sp.	Tr
Gelidium pusillum	99
Polysiphonia sp.	1

X GB-321 (From the reef flat) 10/3/78 - EAST SHORE LISIANSKI

Caulerpa webbiana

Bryopsis pennata

Jania capillacea

X GB-322 (From the reef flat) 10/5/78 + July 1978 Pearl & Hermes Reef

Dictyosphaeria cavernosa

Halimeda discoidea

Jania capillacea

Liagora sp. (I will find the species for this later)

X GB-323 (From the reef flat) 9/28/78 - West End Collection MARO REEF

Caulerpa taxifolia

Caulerpa racemosa var. peltata

Caulerpa webbiana var. disticha

Chondrococcus hornemanni

Halimeda sp.

Haloplegma duperryi

Laurencia sp.

X GB-324 (From the reef) 10/4/78 SITE 1 LISIANSKI

Amphiroa fragilissima

Caulerpa webbiana

Spiridia filamentosa

Laurencia sp. [illegible]

(continued on next page)

GB-324 (continued)

Halimeda discoidea

✓ Cartilagenous red (I.D. to come later)

X GB-325 (From the reef flat) 10/4/78 SITE 2 LISIANSKI

Caulerpa racemosa var. peltata

Ceramium sp.

Ceramium fimbriatum

Halimeda discoidea

Polysiphonia sp.

Turbinaria ornata

X GB-326 10/6/78 TAG 2973 Midway / Spit Is. (Stomach)

Ceramium sp.	Tr
Falkenbergia sp.	Tr
Lyngbya majuscula	Tr
Sphacelaria tribuloides	Tr

X GB-327 TAG 2974A 10/6/78 Midway / Spit Is. (mouth)

Padina sp. (small scrap)	10
— Spyridia filamentosa	90
Horn-like fibers	

X GB-328 TAG 2974B (skin & shell) 10/6/78 Midway, spit Is.

Lyngbya majuscula	40
Polysiphonia sp.	20
Polysiphonia dotyi	20
Sphacelaria furcigeria	20

— There were many large (5 mm long) round worms in this sample

X GB-329 TAG 2976 10/6/78 Midway / spit Is. (Stomach)

Spyridia filamentosa	All

X GB-330 10/6/78 INNER HARBOR - MIDWAY / Dense mat growth

Caulerpa sertularioides	All

X GB-331 OCT 78 [illegible] - FROM BEACH

Codium edule	All

12 DEC 1978

GB-332 LANAI Turtle - 1st stomach AMARAL MORTALITY

Amansia glomerata 50

Halophila ovalis Tr

Sargassum polyphyllum 50

GB-333 12 DEC 1978 Lanai Turtle - 2nd stomach AMARAL MORTALITY

Halophila ovalis 20

Sargassum polyphyllum 80

GB-334 12 Dec 78 LANAI Turtle - STRAINED INTESTINE AMARAL MORTALITY

Sargassum polyphyllum All

Slime

GB-335 (GB-157)

Codium arabicum 25

Codium edule 75

ATTENTION!

GB-143 Pedo

Ulva rigida C. Ag.

Distribution Alaska to Baja California, Chile and Cape of Good Hope, Africa. I've not seen fresh material of this species before, but the pieces you have fit the description given by Abbott and Hollenberg (1978) for the cell size and shape, holdfast portion of the thallus and the blade margin. Thank you, George, for sending it back to me. --Dennis P.S. it is recorded for Hawaii.

This is a listing of the algae found in GB-301 through GB-335 plus GB-143

CHLOROPHYTA (GREEN)

Caulerpa racemosa var. peltata
Caulerpa sertularioides (Gmelin) Howe
Caulerpa taxifolia (Fahl) C. Ag.
Caulerpa webbiana Mont.
Caulerpa webbiana var. disticha Weber Van Bosse
Chlorella sp.
Codium arabicum Kützing
Codium edule Silva
Codium phasmaticum Setchell
Halimeda sp.
Halimeda discoidea Decaisne
Ulva rigida C. Ag.
Valonia sp.
Valonia aegagropila C. Ag.

PHAEOPHYTA (BROWN)

Dictyota acuteloba J. Ag.
Ectocarpus indicus Sonder
Padina japonica Yamada
Sphacelaria furcigeria Kütz.
Sphacelaria tribuloides Meneghini
Sargassum polyphyllum J. Ag.
Turbinaria ornata (Turn.) J. Ag.

RHODOPHYTA (RED)

Acrochaetium sp.
Acrochaetium gracile Boerg.
Acanthophora spicifera (Vahl) Boerg.
Amansia glomerata C. Ag.
Amphiroa fragilissima (L.) Lamx.
Ceremium sp.
Ceramium fimbriatum Setchell and Gardner
(continued)

Champia parvula (C. Ag.) Harvey

Chondrococcus hornemanni (Mert.) Schmitz

Fallenbergia rufalanosa Harvey

Gelidium pusillum (Stackhouse) LaJolis

Gracilaria sp.

Haloplegma duperryi Mont.

Hypnea cervicornis J. Ag.

Jania capillacea Harvey

Laurencia sp.

Leveillea jungermannioides Harvey

Liagora sp.

Polysiphonia sp.

Polysiphonia dotyi Hollenberg

Polysiphonia tsudana Hollenberg

Spyridia filamentosa (Wulfen) Harvey

CYANOPHYTA (BLUE - GREEN)

Lyngbya sp.

Lyngbya majuscula Gomont

Oscillatoria sp.

(many other blue-green algae were seen as ephiphytes on the other algae)

SEAGRASS

Halophila ovalis (R. Br.) Hook

BACILLARIOPHYTA (Diatoms)

Asterionella notata (Grun.) Van Heurck (this is a planktonic species)

Many other diatoms were found as epiphytes or singly in the samples.

completed
Sept 1978

Number
GB
201 Dried Pterocladia ?

202 Pterocladia capillacea (Gmelin) Bornet

203 ?

204 Padina crassa Yamada
Pseudobryopsis oahuensis Gilbert
Microdictyon japonicum Setchell
Spyridia filamentosa (Wulf.) Harv.

205 Microdictyon japonicum
Amansia glomerata C. Ag.
Halimeda discoidea Decaisne
Zonaria variegata (Lamx.) C. Ag.
Coralline piece

206 Acrochaetium sp.

207 Pterocladia capillacea

208 Codium arabicum Kuetz.

209 Caulerpa racemosa (Forsskal) J. Ag.

210 Caulerpa racemosa
Halimeda discoidea

211
Gelidiopsis sp.

212 Jania capillacea Harvey
Polysiphonia sp.
Pterocladia capillacea predominant

213 Gelidiopsis sp.

214 Caulerpa racemosa

215 "
216 "
217 "

218 Gelidium sp.

219 Laurencia sp.
Lobophora variegata
Jania capillacea
Microdictyon japonicum

220 Laurencia sp.
Sargassum echinocarpum J. Ag.
Gelidiopsis sp.
Jania capillacea

221 Lobophora ~~xxxxxxxx~~ variegata
Ectocarpus breviarticulatus J. Ag.
Laurencia sp.
Dictyopteris plagiogramma (Mont.) Vickers
Amansia glomerata
Actinotrichia rigida (Lamx.) Decaisne
Chondrococcus hornemanni Lyng.
Jania capillacea Harv.
Corallina sp.

222 Codium edule Silva 95%
C. arabicum Kuetzing 5%

223 Amansia glomerata
Laurencia ?

224 ?

225 ?

226 Amansia glomerata
227 "
228 "

229 Pterocladia ?

230 Galaxaura sp.
Martensia flabelliformis
Ahnfeltia ~~xxxxx~~ concinna Ag.
Codium edule
Amansia glomerata
Caulerpa taxifolia (Fahl) C. Ag.
Gelidium pusillum (Stackhouse) LaJolis
Pterocladia capillacea
Cladymenia pacifica Setchell
Cladophora sp.

231 Pterocladia capillacea

232 Pterocladia capillacea

233 Upper
Enteromorpha sp. 2%
Dictyosphaeria versluysii Van Bosse 2%
Codium edule 90%
C. arabicum 5%
Colonia 1 black animal 1%

233 Lower
Codium edule 95%
C. arabicum 4%
Ulva fasciata
Cladophora fascicularis (Mertens) Kuetzing 1%

The Algae Present in Sea Turtle Related Samples Collected by G. H. Balazs

Algae identified by Dennis J. Russell 28 June 1978.

GB-101	Percent of Sample
Codium edule Silva	95
Animal	5
GB-102	
Codium edule	90
Indescript matter	10
GB-103	
Codium edule	90
Codium arabicum Kütz.	10
GB-104	
Codium edule	100
GB-105	
Codium edule	90
Leathery mass	10
GB-106	
Codium edule	100
GB-107	
Codium edule	100
GB-108	
Codium edule	100
GB-109	
Codium edule	100
GB-110	
Codium edule	95
Amansia glomerata C. Ag.	5

GB-111

Codium edule	90
Codium arabicum	10

GB-112

Codium edule	80
Terrestrial grass	10
Animal ?	8
Polysiphonia sp. (4 pericentral cells)	2

GB-113

Codium edule	50
Amansia glomerata	50

GB-114

Codium edule	40
Codium phasmaticum Setchell	10
Animal material ?	50

GB-115

Codium edule	60
Amansia glomerata	30
Codium phasmaticum	5
Animal	5

GB-116

Codium edule	90
Animal	10

GB-117

Codium edule	100

GB-118

Codium edule	60
Codium arabicum	40

GB-119

Codium edule	100

GB-120

Amansia glomerata	75
Codium edule	20
Lyngbya majuscula Gomont	3
Ulva fasciata Delile	2

GB-121

Amansia glomerata
Codium edule

GB-122

Codium edule	99
Ulva fasciata	1

GB-123

Codium edule	99
Terrestrial grass	1

GB-124

Codium edule	100

GB-125

Codium edule	99
Amansia glomerata	1

GB-126

Codium edule	90
Terrestrial grass	3
Blue plastic	3
Clear plastic sheet	4

GB-127

Codium edule	95
Codium arabicum	5

GB-128

Codium edule	99
Terrestrial grass	1

GB-129

Codium edule	99
Codium arabicum	1

GB-130

Amansia glomerata	95
Codium edule	5

GB-132*

Codium edule	85
Codium arabicum	10
Animal (black)	5

GB-133

Codium edule	100

GB-134

Codium edule	100

GB-135

Amansia glomerata	95
Codium edule	5

GB-136

Codium edule	100

GB-137

Codium edule	100

GB-138

Codium edule	100

GB-139

Man-made and cotton fibers	25
Terrestrial plant material	10
Animal (black)	25
Codium edule	20
Amansia glomerata	15

GB-140

Codium edule	80
Codium arabicum	10
Animal (black)	10

GB-141

Codium edule	100

GB-142

Ectocarpus indicus

Enteromorpha clathrata (Roth) Grev.

Polysiphonia sp.

Sphacelaria furcigera Kütz.

Ulva fasciata

GB-143

Strap-like fiberous material (animal?)

GB-144

Cladophora socialis Kütz.

Gelidium crinale (Turner) Lamour.

Polysiphonia sp.

GB-145

Polysiphonia tsudana Hollenberg

Lyngbya cinerescens Kütz.

GB-146

Polysiphonia tsudana
Sphacelaria novae-hollandiae G. Sonder
Acrochaetium sp. 1 and sp. 2

GB-147

Codium caneatum Setchell and Gardner

GB-148

Polysiphonia tsudana

GB-149

Ceramium sp.
Oscillatoria sp.

GB-150

P. tsudana

GB-151

P. tsudana

GB-152

P. tsudana

GB-153

P. tsudana
Codium edule

GB-154

P. tsudana

GB-155

P. tsudana

GB-156
Melobesia ?

GB-157

Codium arabicum

GB-158

Codium arabicum

GB-159

P. tsudana (tetrasporophytes)

GB-160

Falkenbergia rufolanosa Harvey

GB-161

Codium edule	80
Codium arabicum	20

*GB-131 is missing

Island of Hawaii, Ka'u, sample contains:
Amansia glomerata (curled thallus)
Halymenia formosa (broad, bumpy thallus)
Pterocladia capillacea (pennate thallus)

The Algae Present in Turtle Gut Samples Collected in the Hawaiian Islands

Samples collected by George H. Balazs and Alan Kam.
Algae identified by Dennis J. Russell

GB-1	Percent of sample
Codium edule	50
Halimeda discoidea	20
Ulva fasciata	20
Chondrococcus hornemanni	tr
Corallina sandvicensis	tr
Enteromorpha sp.	tr
Gracilaria coronopifolia	tr
Hypnea nidifica	tr
Siphonocladus tropicus	tr
Spyridia filamentosa	tr
Brachidontes crebristriatus (?) (Pelecypod)	10 (Brachidontes, worm tubes and sand together)
Worm tubes	
Sand	

GB-2	
Codium edule	90
Ulva fasciata	8
Acanthophora spicifera	tr
Pelecypods	tr
Strap-like fibrous material	2

GB-3 (reef-flat)

Bryopsis pennata

Caulerpa racemosa var. macrophysa

Halimeda discoidea

Soft Corals

GB-4

Rosenvingea orientalis	35
Lobophora variegata	25
Porolithon gardineri	25
Chlorodesmis hildebrandtii	10
Polysiphonia sp.	Tr
Animal	5

GB-5

Lobophora variegata	50
Microdictyon setchellianum	25
Porolithon gardineri	15
Ceramium sp. }	
Liagora sp. }	10
Animal }	

GB-6

Caulerpa serrulata	80
Dictyosphaeria versluysii	10
Halophila ovalis (a sea grass)	3
Animal	3
Terrestrial grass }	
Blue cloth }	
Man-made fibers }	1-
White string }	
Pink string }	

GB-7

Caulerpa serrulata }	
Caulerpa sertularioides }	95
Dictyosphaeria versluysii	5
Amansia glomerata	Tr
Terrestrial vegetation	Tr

GB-8	
Codium arabicum	99
Acanthophora spicifera	1
GB-9	
Codium arabicum	80
Ulva fasciata	20
GB-10	
Codium phasmaticum	70
Codium edule	20
Codium arabicum	10
GB-11	
Codium arabicum	60
Amansia glomerata	40
GB-12	
Ulva fasciata	99
Acanthophora spicifera, Codium phasmaticum, Enteromorpha sp., Hypnea chordacea, Laurencia sp.	1
GB-13	
Gracilaria coronopifolia	50
Ulva fasciata	50
Pterocladia sp.	Tr
GB-14	
Codium phasmaticum	20
Grateloupia filicina	20
Ulva fasciata	20
Dictyota acuteloba	20
Padina japonica	20

GB-15

Codium phasmaticum	90
Codium arabicum	10

GB-16

Codium edule	95
Pterocladia sp.	4
Acanthophora spicifera	1

GB-17

Acanthophora spicifera	100

GB-18

Ulva reticulata	50
Codium arabicum	20
Acanthophora spicifera	5
Ahnfeltia concinna	20
Amansia glomerata	5

GB-19

Caulerpa racemosa	100

GB-20

Caulerpa racemosa	99
Halimeda discoidea	1

GB-21

Amansia glomerata	100

GB-22

Amansia glomerata	50
Hypnea sp.	50

GB-23

Codium phasmaticum	90
Ulva fasciata	10

GB-24	
Ulva reticulata	90
Animal material	10
GB-25	
Codium phasmaticum	80
Codium edule	10
Ulva fasciata	10
GB-26 (reef collection)	
Amansia glomerata	
Codium edule	
Halimeda discoidea	
Sargassum polyphyllum	
GB-27 (reef collection)	
Codium mamillosum	
Codium sp.	
Halimeda discoidea	
Laurencia sp.	
Padina sp.	
Sargassum polyphyllum	
GB-28	
Codium edule	99
Pterocladia sp.	1
GB-29	
Hypnea musciformis	80
Codium edule	10
Gracilaria bursapastoris	10
Acanthophora spicifera	Tr
Ulva reticulata	Tr
GB-30	
Gracilaria bursapastoris	80

Ulva fasciata	15
Hypnea cervicornis	5
Pterocladia sp.	Tr
Rosenvingea orientalis	Tr
GB-31	
Pterocladia capillacea	50
Ulva reticulata	50
GB-32	
Pterocladia capillacea	75
Ulva reticulata	25
GB-33	
Codium edule	75
Codium arabicum	5
Gelidiella acerosa	5
Gelidium pusillum	5
Amansia glomerata	Tr
Animal	10
GB-34	
Codium arabicum } *Codium edule*	50
Gelidiella acerosa } *Gelidium pusillum*	40
Amansia glomerata	Tr
Animal	10
GB-35	
Codium edule	45
Gelidiella acerosa	40
Codium arabicum	5
Pterocladia sp.	Tr
Animal	10

GB-36

Codium edule	50
Gelidiella acerosa	45
Pterocladia sp.	1
Animal	4

GB-37

Caulerpa serrulata	
Caulerpa sertularioides	95
Dictyosphaeria versluysii	5
Amansia glomerata	Tr
Terrestrial vegetation	Tr

GB-38

Codium edule	90
Pterocladia sp.	Tr
Terrestrial grass	3
Animal	1
Strap-like fibrous material	1

GB-39

Codium edule	80
Codium arabicum	15
Cladophora fascicularis	
Enteromorpha sp.	
Hypnea cervicornis	5
Ulva fasciata	

GB-40

Codium edule	75
Codium arabicum	25
Laurencia sp.	Tr
Porolithon gardineri	Tr

GB-41

Ahnfeltia concinna	95
Codium edule	1
Ulva reticulata	1
Animal (black colonial tunicate)	3

Comments:

The alga identified as Pterocladia sp. could just as likely be a Gelidium sp. since fertile material is needed in most cases to tell the two apart. I called it Pterocladia sp. since that genus occurs more often in large patches than does Gelidium sp. In GB-2 and GB-38 I found a tough cellular strap-like fibrous material which I could not identify as an alga. In GB-6 there was a great deal of man-made debris which may indicate the turtle was eating drift. There is an interesting alga in sample GB-29; Hypnea musciformis is known from only two patch reefs in Hawaii, Checker Reef and the small patch reef due south of the western end of Checker Reef. It is an introduced alga, from Florida, and flourishes on those two reefs. Furthermore, Acanthophora spicifera was found in several samples and it too is an introduced species, from Guam. The 100% occurrence of A. spicifera in GB-17 was based on a few scraps and may not represent the true stomach contents of the turtle. Therefore, one should look at the jars contents for a true picture of what the percent means.

Codium arabicum and C. phasmaticum are both cushion-like and fasten to the rock in a prostrate manner, while C. edule is more erect although creeping and highly branched. It may be that the turtles are mistaking the black colonial tunicate in GB-41 for a cushion-like Codium. Students will even bring me this tunicate thinking it is an alga. Both grow in the same environment on the reef.

It was surprising to find Ahnfeltia concinna in such amount in GB-41 since this alga grows in strong surf, usually on igneous rock at mid-tide level. Amansia glomerata, which was found in several samples is almost always found underneath rocks or in dark places. Porolithon gardineri is a stoney alga, a reef builder and very rock-like.

---Dennis J. Russell (18-II-1978)

This is a listing of the algae identified in samples GB-1 through GB-41

CHLOROPHYTA

Bryopsis pennata Lamx.
Caulerpa racemosa (Forsskal) J. Ag.
Caulerpa racemosa var. macrophysa (Kützing) Taylor
Caulerpa serrulata (Forsskal) J. Ag.
Caulerpa sertularioides (Gmelin) Howe
Chlorodesmis hildebrandtii A. & E. S. Gepp
Cladophora fascicularis (Mertens) Kützing
Codium arabicum Kützing
Codium edule Silva
Codium mamillosum Harvey
Codium phasmaticum Setchell
Dictyosphaeria versluysii Weber van Bosse
Enteromorpha sp.
Halimeda discoidea Decaisne
Microdictyon setchellianum Howe
Siphonocladus tropicus (Crouan) J. Ag.
Ulva fasciata Delile
Ulva reticulata Forsskal

PHAEOPHYTA

Dictyota acuteloba J. Ag.
Lobophora variegata (Lamx.) Womersley
Padina japonica Yamada
Rosenvingea orientalis (J. Ag.) Boerg.
Sargassum polyphyllum J. Ag.

RHODOPHYTA

Acanthophora spicifera (Vahl) Boerg.
Ahnfeltia concinna J. Ag.
Amansia glomerata C. Ag.
Ceramium sp.
Chondrococcus hornemanni

(continued)

A list of the algae identified (continued):

Corallina sandvicensis Lemm.

Gelidiella acerosa

Gelidium pusillum (Stackhouse) LaJolis

Gracilaria bursapastoris

Gracilaria coronopifolia J. Ag.

Grateloupia filicina (Wulfen) C. Ag.

Hypnea cervicornis J. Ag.

Hypnea chordacea J. Ag.

Hypnea musciformis

Liagora sp.

Polysiphonia sp.

Porolithon gardineri (Foslie) Foslie

Pterocladia capillacea (Gmelin) Bornet

Spyridia filamentosa (Wulfen) Harvey

9th Annual Albert Tester Memorial Symposium April 12-13, 84

Darrell Herbert, Department of Botany, University of Hawaii

PRODUCTIVITY OF THE SEAGRASS HALOPHILA HAWAIIANA

(Sponsor: Dr. K. W. Bridges)

Seagrasses are among the most important marine primary producers and form vast meadows in shallow waters throughout the world. Little is known about the smaller-leaved seagrasses common to the tropics. This investigation examined the growth dynamics of one of these species, Halophila hawaiiana Doty and Stone, and demonstrated a relatively simple method appropriate for evaluating its biomass and productivity.

Transect samples were taken on a Halophila meadow in Kaneohe Bay, Oahu. These samples provided information on total plant biomass and leaf area for an established stand. Laboratory and field experiments were used to determine the growth rates based on the plastochrone interval (the time period between the production of successive leaf pairs). Branching habits were also observed.

It was found that plants grown in culture exhibit a consistent plastochrone interval of three to four days. Field growth experiments produced nearly identical results. This suggests that Halophila will retain a regular plastochrone interval under varying environmental conditions.

The results of this study indicate that the biomass of a Halophila meadow can be estimated from leaf area measurements. The required data are easily collected; leaf numbers in a sample are counted and the leaf area of a subsample is measured by optical planimetry. The rate at which new leaves are produced is estimated by counting the number of terminal buds in the sample and using the plastochrone interval. The resulting information provides a functional growth model from which both biomass and productivity of a Halophila meadow can be estimated.

* *

Gregor Hodgson, Department of Zoology, University of Hawaii

PRELIMINARY OBSERVATIONS CONCERNING THE ABUNDANCE AND DISTRIBUTION OF PLANKTONIC CORAL LARVAE IN KANEOHE BAY

(Sponsor: Dr. E. Alison Kay)

Little quantitative information is available concerning the abundance and distribution of coral planulae following their release from parent colonies. A plankton sampling technique was designed for the capture of coral planulae. It was based on surface tows using a small, fine-mesh net. More than 250 tows were made along five transects established near the southeast fringing reef of Coconut Island. Time between collection and sorting was minimized and low temperature storage was employed in lieu of chemical fixatives to prevent decomposition of the planulae prior to identification.

More than 100,000 cnidarian larvae, most of which were scleractinian planulae, were collected and sorted. Twelve different types of cnidarian larvae were differentiated. Two appear to be the zoanthina larvae of the zoanthids Palythoa vestitus and Zoanthus pacificus. Six were identified as the planulae of the corals Pocillopora damicornis, Porites compressa, Montipora verrucosa, M. dilitata, Cyphastrea ocellina and Fungia scutaria. Peak recovery of planulae generally occurred 3 - 7 days after the onset of spawning or planulation. Limited data on the vertical distribution of 3 species of coral planulae indicate that they may undertake a diurnal migration similar to that of other demersal plankton. The potential for the export of large numbers of coral planulae from Kaneohe Bay is considered to be high, but whether this export is significant to recruitment on reefs outside the bay remains to be seen.

* *

Experiments designed to investigate differences in coral recruitment to different shallow water reef habitats were performed in Kaneohe Bay, Oahu.

Seven sites were chosen in Kaneohe Bay that were similar in depth but differed in the amount of coral cover, the species of coral, and the densities of grazing fish present. Hollow concrete blocks (19.5 cm. along each side) and dead, sunbleached heads of the branching coral Porites compressa (similar in volume to the concrete blocks) were placed at the different sites. Five coral heads were collected from each site after three months and broken up. The number of corals that had recruited to each coral head were then counted. After three and then six months' exposure, eight blocks were examined from each site. The number of corals recruiting to each of the four outer and four inner surfaces of the blocks were counted. The blocks were then returned to the field.

Pocillopora damicornis was the only coral that recruited to either the blocks or the coral heads after three months, Two other species of coral, Scyphastrea ocellina and an ahermatype, ?Culicia sp., were present on the blocks after six months. No recruitment by the two commonest corals in Kaneohe Bay (Porites compressa and Montipora verrucosa) were found, although spawning of both species occurred while the blocks were in situ. The mean number of corals recruiting to both the blocks and the coral heads differed significantly between sites. Coral recruitment to the two different types of substratum showed similar trends in abundance at each site. There was no apparent relationship between the amount of coral cover or species of coral present at a site and the density of species of coral recruits found there on the blocks or the coral heads. The number of coral recruits at a site did, however, appear to show an inverse relationship to the numbers of grazing fish present at a site. After three months, coral recruitment was highest on Heeia patch reef where territories of the damselfish, Stegastes fasciolatus, are common. Stegastes fasciolatus actively excludes fish grazers such as scarids and acanthurids. After six months the mean number of corals per block was highest on a windward reef flat where grazing fish are uncommon. The numbers of corals present on the blocks were significantly different after three and six months. At all but one site, the Heeia patch reef, the number of corals per block increased between three and six months. At most sites the majority of individuals of Pocillopora damicornis were found on the inside uppermost surface of the blocks. The ahermatypic coral was only found on the undermost outside surface of blocks.

Although Kaneohe Bay is very protected from wave action, unlike other areas in Hawaii where coral reef community development has been studied, there are parallels between the coral recruitment patterns recorded in this and previous studies in Hawaii. In Kaneohe Bay, Pocillopora damicornis was the dominant early colonist. In more wave-exposed areas in Hawaii, another species, Pocillopora meandrina, is the most common early colonist. Some corals such as Montipora verrucosa have been reported to take about ten years to recruit to newly available substrata. It is not clear why larvae of Porites compressa and Montipora verrucosa did not recruit successfully to the blocks or to the coral heads. The absence of recruitment by these species suggests that asexual reproduction by fragmentation may be important in maintaining shallow water populations of these species. The data also suggest that grazing by fish may influence the survival of juvenile corals. Field experiments are necessary to clarify how fish grazing affects newly settled corals.

Much of this work was done during the 1983 Coral Reef Biology Course held at the Hawaii Institute of Marine Biology. I acknowledge the support and encouragement of participants in the course as well as my committee, chaired by Dr. J. H. Brock.

* *

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George Balazs
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15 February 1985

Dear George,

Thank you for the letters and the news clipping. The idea that the enclosed tanks at Kahuku will prevent any spread of algae out into the ecosystem is fine and probably correct, but the major way such seaweeds spread around is by human transplanting. People have the uncanny urge to transplant plants. It is almost like an instinct, a Johnny Appleseed syndrome, as compelling as sex and reproduction. This is done by just about anyone. When I was at HIMB the laborers told me they took Eucheuma to Hilo, Ewa, and Haiea. Anyone at the farm, or any of the customers could plant the seaweed anywhere in Hawaii just as they please. Security is not in the ponds, but in people.

The sense of "do we really need" to introduce another seaweed species to Hawaii (which already has more introduced species in its waters than the entire rest of the world) is the question. Sometimes I get the impression that the Kahuku group is just living off of grant monies and not really serious about marine agronomy and ecology. Also, so many microscopic organisms can come in with the cultures. Great care must be taken at the Florida end and there is no control there from the Hawaii authorities. I am not against introducing important algal species, but do think much of this effort is unnecessary.

I have been invited to present a paper at the Second International Symposium on Indo-Pacific Marine Biology, in Guam 22 June - 9 July 1986. My topic will be Alien Marine Algae, the very topic your article is about.

Your questions about Mystery #27 (fresh looking algae in places of digestion activity) made me ponder for quite some time. Marine algae have the uncanny ability to give the illusion of freshness when they are actually quite dead. Some of them can be dried and hung on a wall for years, be re-soaked and look as fresh as can be, color, texture and all. They are, of course, very dead. How this might work in a turtle gut designed to digest the algae is really a mystery. Perhaps it is an illusion of freshness. Maybe all the digestion process needs to continue and liquify the algal mass is oxygen or some other factor and soon as this is supplied the whole mass disintegrates.

The article you sent me about corals on your floats is very interesting and may be used by us as a hook for a short note on the *Codiums* you found on floats and gave to me many years ago. The article made me feel guilty that I had not written it up. My biggest stumbling block has been a lack of knowledge about the known distribution of *Codium* species in the Pacific and much of the literature is in Japanese. It can be done, however, with a library search and just plain daring to write it. Jokiel has given us the hook we could use (something we could tie it to) and I may just do it in the dark. If so, I'll send you the rough draft so you can add the details needed and your name to the authorship (share the blame? Ha!).

Yes, please do send me some more samples. I am free to work on them in March (1-25th)

George, did I tell you I found *Hypnea musciformis* at Kehei and Launuipoko, Maui, in December, 1984? This is the seaweed introduced to Kaneohe Bay from Florida. I didn't find it at these locations in December 1982, but it is *very very* abundant there now (hundreds of pounds were washed up on the beach in windrows and it dominated the reef-flat to a depth of about 4 feet. I am sending specimens to the Bishop Museum and to U. C. Berkley (several specimens were fertile with tetraspores). This is truly a "weedy" species.

Aloha,

Dennis

Dennis J. Russell

Calcareous Algae

Living Fossils from the Past

By STEVEN D. BACH

Allegheny College, Meadville, Pennsylvania

ALMOST 90 YEARS ago, the famous naturalist Alexander Agassiz described large numbers of calcifying algae in the shallow waters off the coast of Florida. Almost everyone who has snorkeled or dived with scuba in clear tropical waters of the Caribbean also has seen such common examples as the merman's shaving brush, *Penicillus capitatus*, the broccolilike *Halimeda*, the spear-shaped *Rhipocephalus*, or the fan-shaped *Udotea*. While relatively common in the Caribbean, surprisingly little is known about the ecology of these interesting and distinctive plants. (*Also see* "Gulf Weed Communities of South Florida," *Sea Frontiers*, Vol. 17, No. 2, March-April, 1971.)

Early Misconceptions

Because of their calcareous limestone structure and the presence of epizooitic polyps on some plants, many organisms such as *Halimeda* were once thought to be animals in spite of the fact that they were green. Even Linneaus, perhaps the greatest naturalist of all time, classified *Halimeda* as an animal because of its calcareous structure. Others argued that these were animals because when they were burned, they produced an animal-like smell of burning hair and bones rather than that of burning vegetables!

Ellis, the early scientist who in 1786 first described *Halimeda* as a coralline polyp-bearing animal, believed that it was only a matter of

EXTANT FOSSILS. *The structure of the calcareous algae has remained virtually unchanged for millions of years. In a calm lagoon at Victory Cay, Bahamas, the broccolilike* Halimeda incrassata *(top) and the merman's shaving brush,* Penicillus capitatus *along with the heart-shaped* P. cyathiformis *(right) can be seen thriving among various sea grasses.*

All photographs by the author.

waiting for the improvement of the microscope before the polyp theory would confirm the animal nature of this group of organisms. His persuasive arguments to early scientific societies caused plants like *Halimeda* to be classified as animals until 1834 but, by this time, more detailed observations with improved microscopes showed conclusively that the previously observed polyps were actually animals living epibiontically on the plant.

A Wall-less Structure

Eventually, everyone agreed that *Halimeda*, *Penicillus*, *Rhipocephalus*, and *Udotea* were actually algae of the family Codiaceae. This family is characterized by a distinctive morphology. The plant body is composed of thousands of microscopic thread-like filaments, intertwining in different genetically and environmentally controlled ways to form a plant that is several inches long.

A unique feature of these algae is that there are no walls dividing the adult form of the plant into individual cells. Instead, each filament is actually a tube filled with cell sap. The cytoplasm of the plant lies in a thin layer between two living membranes just inside the cell wall of each filament. Many nuclei float freely around in the cytoplasm with no cell walls to separate them.

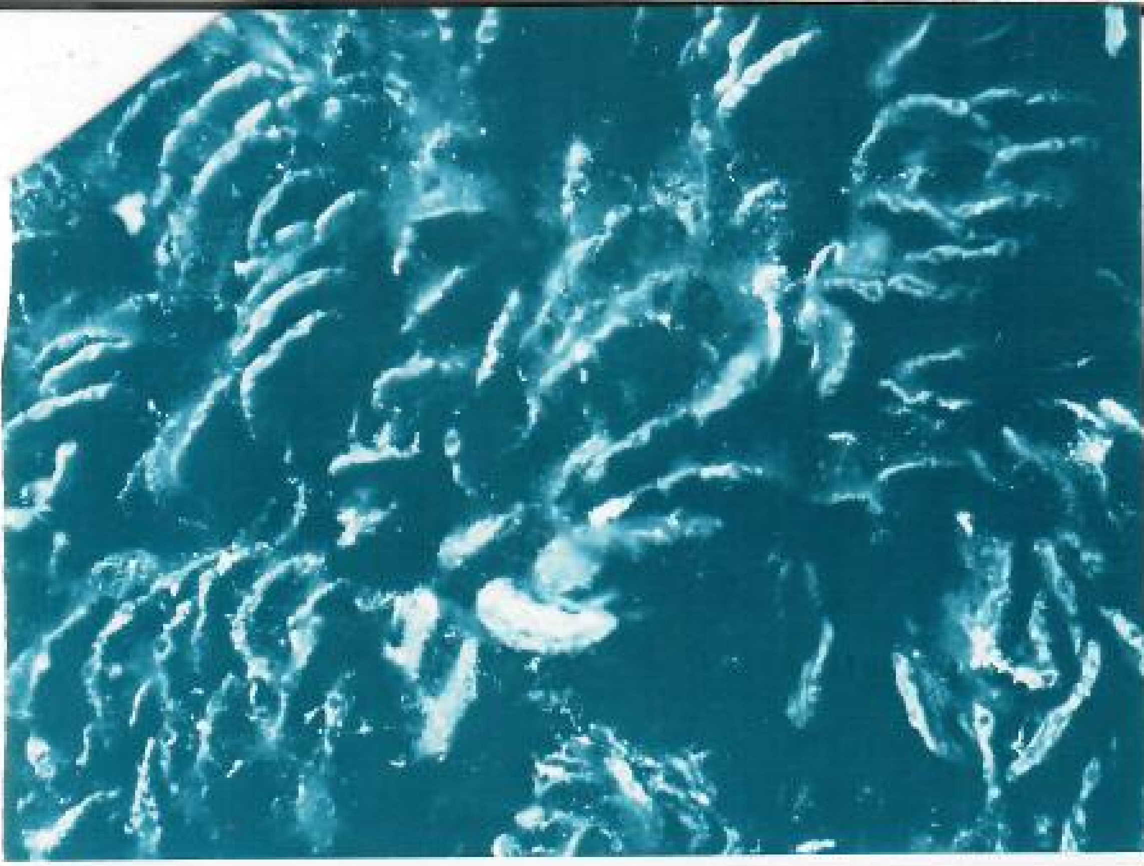
The family Codiaceae is considered by scientists to be primitive in relation to other marine plants such as sea grasses, which are considered to be of more recent evolutionary origin in the sea. The Codiaceae has existed since Cambrian times, almost 600 million years! The fossil record shows that from 425 to 500 million years ago, during the Ordovician period, their numbers increased in warm tropical seas, and that by this period most of their features as a family had evolved.

Natural Reinforcement

During the Cenozoic period, from 1 to 63 million years ago, this family of plants is believed to have been an important builder of limestone rock, which is composed largely of calcium carbonate. The genus *Halimeda* first appeared in the fossil record over 63 million years ago during the Cretaceous period, while *Penicillus* is believed to have first appeared somewhat later in the Eocene epoch, about 36 to 58 million years ago. Therefore, the basic structure of these plants has remained essentially unchanged for millions of years. They are truly living fossils.

Halimeda, *Penicillus*, *Rhipocephalus*, and *Udotea* are composed of from 25 to 90 percent calcium carbonate, depending on the species. The calcium carbonate is deposited between and outside of the thousands of filaments that comprise the plant body. An analogy can be made between the deposition process in the plant and the cement poured between steel reinforcing rods in construction projects. Nature, it seems, had this method figured out a long time before man did.

Studies have shown that the calcium carbonate is deposited as bundles of aragonite, which is a specific crystal form of calcium carbonate.



DEPOSITING CALCIUM CARBONATE *as they grow, calcifying algae are important producers of lime mud and rock in certain areas. In addition, species such as* Halimeda opuntia *(top) also serve as an environment for small marine animals. Shown below is* Penicillus capitatus, *living in a bed of turtle grass,* Thalassia testudinum, *in Card Sound, Florida.*

The origin of carbonate sediments has long been an issue and problem to marine geologists. Calcareous algae of the family Codiaceae have been shown to be important producers of calcium-carbonate sediment in certain areas of the oceans, and unimportant in other areas.

DESPITE OUTWARD *differences in appearance, the spear-shaped* Rhipocephalus phoenix *(far left), the jointed* Halimeda incrassata *(left), and* H. tuna *with its circular plates (below) are members of the same algal family, Codiaceae. These species are all common in shallow Florida waters, the latter often in association with red mangrove roots. Calcareous algae have the capability to grow in such unlikely habitats as loose sediment or on rocks by utilization of a special mass of rhizoids.*

Halimeda is thought to be the most important and widespread sediment producer, although many other plants also produce calcium carbonate. Drillings in the Pacific reported by Finckh in 1904 showed that more than 60 feet of 99-percent pure *Halimeda* debris lay beneath the Funafuti lagoon. At other atolls, *Halimeda* has been shown to be of considerably less importance. Its abundance, therefore, is relative to the area being examined.

In Florida, workers have shown that calcium-carbonate production by *Penicillus capitatus* can account for one-third of the lime mud in Florida Bay and almost all the mud

60 feet = 18 meters.

in the Florida reef tract. In the Bahamas, controversy still exists concerning the relative importance of these algae in sediment production versus the physical-chemical precipitation of calcium carbonate from seawater. In all probability, significant production of calcium carbonate occurs at varying rates in different areas and is highly dependent on local conditions.

In the tropical marine environment competition with other plants is of vital importance to the survival of a species. Selection pressures are exerted on the plants and animals to "choose" unexploited niches in which to grow and reproduce so that competition is reduced, and diversity is increased.

Halimeda, Penicillus, Rhipocephalus, and *Udotea* have evolved the unique ability to grow in very loose sediments or in areas where there is practically no sediment at all. This ability allows them to grow in areas where few other marine plants can survive, and, therefore, they are taking advantage of an unexploited niche. They are able to colonize such areas because of their unique system of filamentous threadlike rhizoids, which bind together the sediment into a firm compact root ball almost half as large as the plant itself. Other rhizoids grow out farther from the main root ball and intertwine with the sediment particles. The entire system serves to hold the plant in place where sediments are very loose.

In areas that have very little sediment and are almost bare rock, the root ball is reduced in size and acts more like the holdfasts of kelps, binding the plant to the rock surface by a physical attachment of the rhizoids to the rock.

The root ball is also the center of asexual reproduction. Rhizoids are sent out from the main root ball, and a juvenile grows up from the rhizoidal tissue at a certain distance from the parent. In this way, a whole colony can become established and spread, further binding the sediments together.

Rapid Rates of Calcification

Experiments in Jamaica by the late T. Goreau showed that *Halimeda opuntia* and *H. tuna* calcify from 1.5 to 10 times faster than reef-building corals, and 20 times faster than nonreef-building corals. Calcification was also much greater in the light than in the dark, indicating that calcification and photosynthesis were somehow related metabolically.

The results of Goreau's research imply that photosynthesis by corals and calcareous algae adds energy to the community, and also creates the optimal physiological conditions for the most efficient production of calcium carbonate, which is of critical importance in the structure and function of the coral-reef community.

Many questions remain to be answered about calcareous algae. Scientists hope to learn why they calcify, what other roles they play in the ecology of tropical marine communities, and if they contribute significant amounts of food to the tropical food web. These interesting plants have not changed much in millions of years; yet, there is still much to be learned about them.

SCHOOL OF NATURAL & MATHEMATICAL SCIENCES
SEATTLE PACIFIC UNIVERSITY
(206) 281-2140 · SEATTLE WASHINGTON 98119

4 Nov 80

Dear George,

Thank you for the article by M. D. Hanisak. He confirms my use of certain terms and supports a conclusion that my dissertation research also supports. Now, I have to bite my tongue, because my committee is not in agreement & I have had to remove the terms & modify the conclusions to satisfy their whims on the subject. They have the dissertation in hand and I sure hope further compromise will not have to be made.

I am working on your samples, will be done by the end of Nov '80 and will either bring them to you or send them in December. I leave here for Maui on 6 Dec. and will be on Oahu 21-23 Dec.

Aloha,

Dennis

SCHOOL OF NATURAL & MATHEMATICAL SCIENCES

SEATTLE PACIFIC UNIVERSITY

(206) 281-2140 · SEATTLE WASHINGTON 98119

5 September '80

Dear George,

The two packages arrived safely & I will get to them soon — before christmas — tell me if you need them sooner, because I'm swamped with school work for several weeks. I've been in Scotland & Germany for the past 2+ weeks so was unable to write — talked with Doty in Glasgow.

I'll not expand on all of the errors in the article by Bill Thomas, but will simply say that he is terribly non-scientific, his whole concept of invasion by algae is incorrect and his historical information is in error — even with A. spicifera. I hope this article is not read by the general public, especially highschool teachers or there will be a lot of people believing falsehoods. About 90% of his algal information is incorrect.

Sincerely, Dennis

The Marine Advisory Program Newsletter

makai

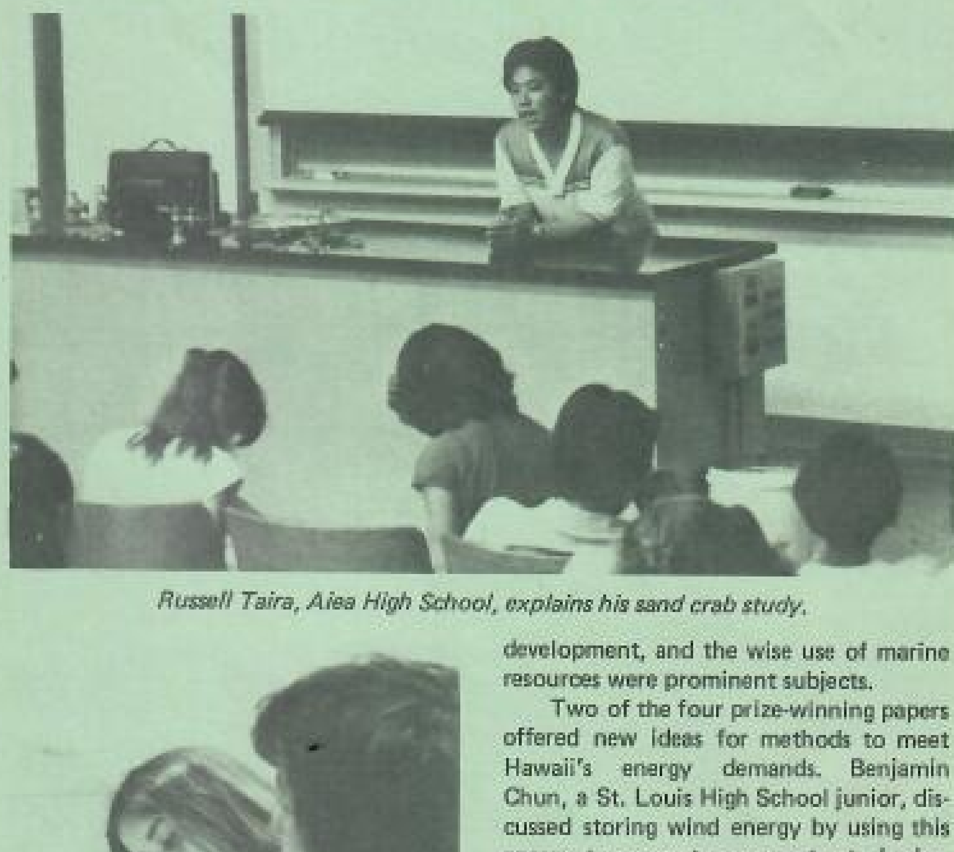
"Toward the Sea"

Volume 2, Number 5 | University of Hawaii Sea Grant College Program | May 1980

Fifth Annual Secondary Student Symposium Held in Hilo

"Hawaii's CZM program is currently being tested, and it remains to be seen whether it will emerge as the useful and efficient program envisioned by the federal government."

So said Laura Knight, a Castle High School junior, in her prize-winning paper presented at the Fifth Annual Secondary Student Symposium on Marine Affairs. The symposium, held at the University of Hawaii at Hilo from March 27 through 29, was attended by 120 high school students from 34 private and public schools throughout the state.



Russell Taira, Aiea High School, explains his sand crab study.

The Secondary Student Symposium on Marine Affairs has been presented annually since 1976, with cooperation and support from the University of Hawaii Sea Grant College Program, the Department of Education, and the Office of the State Marine Affairs Coordinator. It provides secondary students an opportunity to study an aspect of the marine environment or its resources and to communicate the results of their study through the writing and presentation of a paper.

According to Rose Pfund, Acting Associate Director of the University of Hawaii Sea Grant College Program and coordinator of the student symposium, the symposium is a communications effort that requires the students to prepare their findings for written, oral, and graphic presentation.

Ninety papers were submitted this year by 100 students and the best 38 papers were accepted for presentation and published in the proceedings of the symposium.

The students' papers refect the concerns of Hawaii's adult population. Alternate energy sources, industry development, and the wise use of marine resources were prominent subjects.

Laura Knight, Castle High School, awaits her turn to present her paper.

Two of the four prize-winning papers offered new ideas for methods to meet Hawaii's energy demands. Benjamin Chun, a St. Louis High School junior, discussed storing wind energy by using this energy to convert ocean water to hydrogen through electrolysis. Hydrogen, an excellent fuel, can be stored easily. Maia Zaiger, a senior at Konawaena High School in Kealakekua, suggested harnessing wave power with a "scientifically engineered, horizontally positioned, flattened half-cone, constructed of reinforced concrete and firmly anchored on a solid lava sea floor. . .", which in essence would be a man-made blow hole to drive a compressed-air generator.

Russell Taira dealt with pure biology in his prize-winning paper, "Male and

(Continued on page 2)

Student Symposium *(Continued from page 1)*

Female Hormones in the Sandcrab *Ocypode laevis* (Dana)." Taira is a sophomore at Aiea High School.

The authors of the four winning papers were presented certificates of excellence during the opening ceremonies on March 28. The other 39 panelists received certificates of merit. The certificates were presented by Dr. Naida Yolen of the National Office of Sea Grant and Representative Charles Toguchi, chairperson of the State House Committee on Ocean and Marine Resources.

Hawaii County's Mayor Hérbert Matayoshi delivered the welcoming address in which he outlined ocean resource development currently in progress and stressed the need for educating future leaders in marine fields.

Representative Toguchi addressed the group at lunch on Friday. Stating that marine education is the key to solving some of the state's problems, Toguchi told students that he appreciated their involvement in marine affairs. A "child of the sea," he grew up in windward Oahu's coastal town of Kahaluu and has deep feelings about the importance of the ocean to Hawaii's future.

Student papers were recognized for excellence of content and clear, concise exposition. Although oral presentations were not recognized, Alice Jean Motooka, a senior at Hana High School, made a presentation that drew raves from students and teachers alike. Motooka presented her paper, "Ancient Fishing Methods," with mood-setting slides of Hana and a background of slack-key guitar music, "done by a friend, no Waikiki stuff." Duplicates of the narrated slideshow have been requested by the UH Sea Grant College Program for distribution to other schools.

The field trip for the students on Saturday included some sight-seeing on the Big Island and a visit to the Kapoho geothermal wells and Volcano National Park.

Proceedings of the Fifth Annual Secondary Student Symposium on Marine Affairs are available from the University of Hawaii Sea Grant College Publications Office, 2540 Maile Way, Spalding 253, Honolulu, Hawaii 96822. ☐

Elizabeth Pechous of Leilehua High on opening day (above). Jennifer Warner of Konawaena High explains a fine point (below).

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Marine environment

(Continued from page 4)

and to a neighboring island 75 miles away.

Today, large patches of this seaweed can be found throughout most of the main islands in the Hawaiian chain. This species is of major concern to commercial and recreational limu harvesters, environmentalists, and biologists because it competes with one of the more economically important seaweeds, *Gracilaria* (ogo, limu manauea).

Other algal species that could have been introduced to Hawaii via ship hulls include *Hypnea*, *Laurencia*, *Spyridia*, and 8 to 10 other genera.

Many harbors receive a tremendous amount of international shipping traffic, making them prime areas for invasion by marine plants and animals. Pearl Harbor is one of these areas. A recent accidental invasion there involves the octocoral (a type of soft coral), *Telesto riisei*, whose normal geographic range is from Palm Beach, Florida to Brazil in the Atlantic Ocean.

The first sighting of *T. riisei* was in 1973, when it was found on a channel marker in Pearl Harbor. Since then, it has been found around Oahu as far south as the Portlock area, and as far north as Makua and Haleiwa. Although there have been no reported sightings of this species in the waters of the neighbor islands, this does not mean that it is not present in those areas, as no searches have been made for the octocoral there. Kauai, Maui, and the Big Island all receive some international shipping traffic, so there is a possibility that *T. riisei* has invaded those areas, too.

Acanthophora spicifera.
—Limu Mana of Hawaii photo

With the constant flow of international shipping traffic through Hawaii, it is quite likely that more plant and animal species will invade the local waters, thereby further altering its marine communities. ☐

Notice to Readers

The Waikiki Aquarium is offering two study tours this summer that are of interest to marine specialists and educators, as well as marine scientists. The "Paddle Palau" tour, July 7-21, will combine camping, snorkeling, and paddling with inflatable canoes among the beautiful reefs and rock islands of Palau, Micronesia. Leaders for this trip are outdoorswoman Audrey Sutherland, author of *Paddling My Own Canoe*, and Ann Fielding, former Waikiki Aquarium marine biologist and author of *Hawaiian Reefs and Tidepools*.

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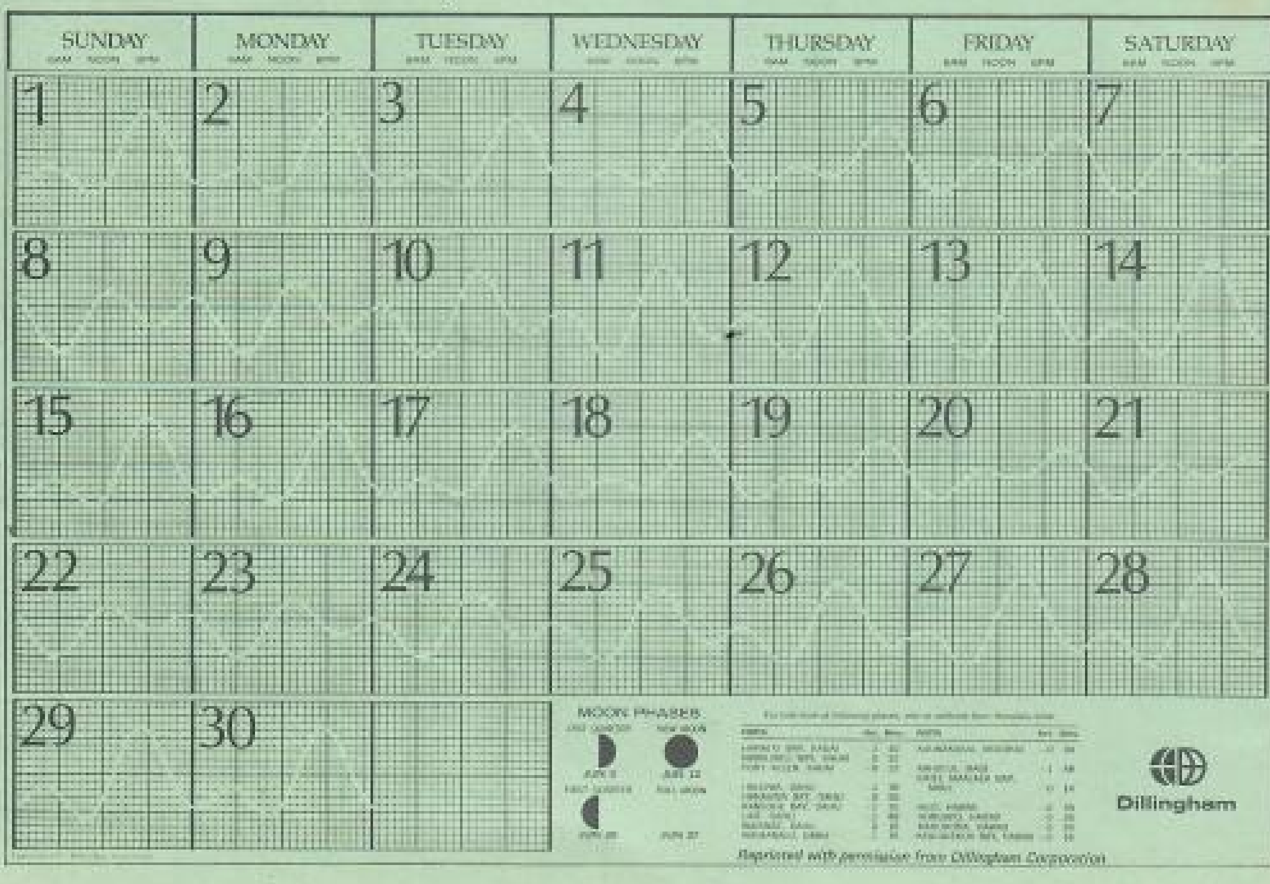
Costs for these trips range from $1,400 to $1,600. For more information, call the Waikiki Aquarium at 923-4725. ☐

JUNE 1980 TIDE CHART



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EXTENSION

Big island aqu exploring diffe

by Howard Takata,
MAP East Hawaii agent

Large and small-scale aquaculturists are now taking steps to bring in additional marine animal and plant species to raise on the Big Island. They are also exploring possibilities of forming cooperatives similar to farmers' co-ops, to cut costs and enhance marketing potential.

At the aquaculture seminar held in Hilo on March 27 at the University of Hawaii campus center, alternative species recommended for culturing included Chinese catfish, "taro patch" snail, (also known as "pupu shell," or "Hawaiian escargot"), crayfish, mountain opae (shrimp), topminnow, "dojo," and white amur. Water-grown plants considered include watercress, water chestnuts, and hasu (lotus roots).

Raising these different species would enhance current efforts to develop a freshwater shrimp industry in the Kohala district, similar to that being promoted now on Oahu and Kauai.

Sixty-three persons participated in the March aquaculture seminar which was sponsored by the UH Sea Grant College Marine Advisory Program, and Big Island Resource Conservation and Development office, UH/Hilo Center for Continuing Education and Community Service, and the County of Hawaii Department of Research and Development.

One of the 12 speakers at the day-long seminar was Mike Fujimoto, director of the Hawaii Department of Land and Natural Resources (DLNR) Anuenue Fisheries Research Center. He said that although Malaysian prawn are being harvested on Oahu and Kauai, there are no successful aquaculture ventures on the island of Hawaii as yet.

Fujimoto said that the DLNR provides free post-larval stocks to qualifying farms of up to 20 acres. In return, state biologists make use of the private farms for research purposes and to provide advisory service.

Other agencies providing aquaculture advisory service include the Aquaculture Development Program of the Hawaii Department of Planning and Economic Development, the UH Sea Grant College Marine Advisory Program, the Hawaii Aquaculture Extension Service, the UH/CTA, the US Soil Conservation Service, the USDA, and the County of Maui.

Four speakers discussed assistance which can be obtained through the USDA Farmer's Home Administration, the USDA Soil Conservation Service, the Hawaii Economic Development Corporation, and the Hawaii Department of Agriculture.

Although there are a number of programs that provide financial assistance, the speakers said that funds are scarce at this time. They also said that funds are limited to land-based projects and do not apply to offshore resources.

MAP Maui advisory agent, Ron Yoshida, told participants about his first-hand experience in research and production of catfish on the island of Maui. Although there are many hurdles and frustrations involved, Yoshida said there is still good potential for commercial success if farmers are willing to work with some of the lesser-known species. He also recommended that collective action be used in marketing these underutilized species which have names or colors that are not always accepted by different

Sister Charles Marie of St. Joseph High enjoys a relaxed moment with her students (left). Mayor Herbert Matayoshi at opening ceremonies (below).

—Jane Ball photos

Invasion within t

by Bill Thomas, MAP

The Hawaiian islands make up the most isolated archipelago in the world and have long been of interest to ecologists because of the way animals and plants evolved in an island situation. Even before the discovery of the islands by Polynesians and Europeans, there has been a history of successive invasions by land and marine plants and animals.

Marine species usually invade communities that have been changed by natural disturbances, such as storms, or by human activities such as dredging and

aculturists
rent crops

thnic groups in Hawaii.

Big Island sugar farmer Francis Pacheco recommended that aquaculture arms follow the example of farmers who banded together to obtain lower prices for fertilizers and herbicides, to use collective action to help the emerging industry evolve.

Also speaking at the seminar were Big Island Mayor Herbert Matayoshi and Marine Advisory Program Coordinator Alf Pratte.

The morning panel discussion was moderated by Mike Tulang of the Hawaii County Office of Research and Development. Ken Kiyosaki, a Hamakua prawn farmer, provided the opening address.

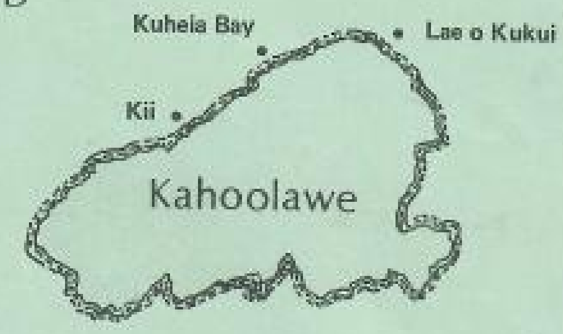
A 1978 assessment of aquaculture and in the state shows that the Big Island has 17,000 acres or 13 percent of all the primary or choice aquaculture land in the state, and 415,000 acres or 83 percent of the secondary lands.

Kohala and Waipio Valley residents have attempted to grow prawns, and Puna and Hilo area residents have begun stocking backyard ponds with grass carp, channel catfish, and tilapia to observe their growth rates and gather data on how to raise them. Still other persons are experimenting with temperate species such as rainbow trout and bluegill, reporting good growth rates so far. ☐

EDUCATION

NSF GRANT RECEIVED

MOP students to study Kahoolawe siltation



The Kahoolawe study will take place at three offshore sites: Kii, Kuheia Bay, and Lae o Kukui.

A team of Marine Option Program students at the University of Hawaii at Manoa has received a National Science Foundation Student-Originated Studies (NSF-SOS) grant of $18,793 and will be supported in part by the Office of the State Marine Affairs Coordinator. Kurt E. Kawamoto, a UH Manoa senior, is the project director for the study on the effects of siltation upon the nearshore marine environment of Kahoolawe island. Dylan A. Bulseco, a junior, is assistant project director. Dr. James Parrish, director of the Hawaii Cooperative Fisheries Research Unit at the UH is the faculty advisor.

The US Navy has granted the students access to the coastal waters surrounding Kahoolawe during June 9-16 to collect information. In the past, restricted public access due to the use of the island for military training has resulted in only a few studies being done, so there is very limited information about the island's marine ecosystems. Preliminary findings of an environmental impact statement (EIS) commissioned by the US Navy indicate that Kahoolawe's inshore fish diversity exceeds that of several marine life conservation districts in the state. Another finding by the same study has revealed excessive siltation in a very large nearshore area along the island's northwestern coast. Areas of siltation will be identified and compared with adjacent nearshore areas which are not silted over.

Data-collecting dives from the R/V *Machias* will be carried out by eight UH undergraduate students. They will be accompanied by an experienced Navy explosive ordnance disposal diver. The students have been training since the fall 1979 semester in baseline survey skills to identify fish, algae, and invertebrates and to analyze marine sediment and conduct underwater transects using scuba gear.

Data analyzed with UH assistance will be stored in the Hawaii Coastal Zone Data Bank which is housed at the Hawaii Institute of Geophysics. The report will take 90 days to complete. This study should aid in future decisions about the fishing potential of the area and will serve as a base for future monitoring of the effects, if any, of ongoing erosion control programs now being attempted on the island.

This year the National Science Foundation funded 57 student-initiated projects from 35 states, the Kahoolawe project being the only one from Hawaii to receive funding. This is the fifth time since 1971 that the UH Marine Option Program has received NSF-SOS funding. ☐

e Hawaiian marine environment

ilding harbors. The more stable ocean mmunities are also being constantly netrated by species, some of which are successful in establishing themselves in foreign environment, while others do oderately well. Some even show explo- e growth outside their native environ- ent.

In the ocean environment, one of the st common ways in which animals and nts move from one area to another is the hulls of ships. The ships provide a face for many permanently fixed marine ae and invertebrates, which in turn vide habitats for more mobile forms, such as fish.

A good example of a species that has invaded Hawaiian waters and propagated extensively is the red algae *Acanthophora spicifera*. This species is commonly found on the submerged slopes of large continental or sub-continental islands of the far-western Pacific. It was first recorded at Pearl Harbor in 1952. By 1953, dense growths of this alga were found off Hauula on the northwestern shore of Oahu. By 1954, it was reported off the island of Kauai. Thus, within a span of two years, it spread halfway around Oahu

(Continued on page 5)

Marine environment *(Continued from page 4)*

and to a neighboring island 75 miles away.

Today, large patches of this seaweed can be found throughout most of the main islands in the Hawaiian chain. This species is of major concern to commercial and recreational limu harvesters, environmentalists, and biologists because it competes with one of the more economically important seaweeds, *Gracilaria* (ogo, limu manauea).

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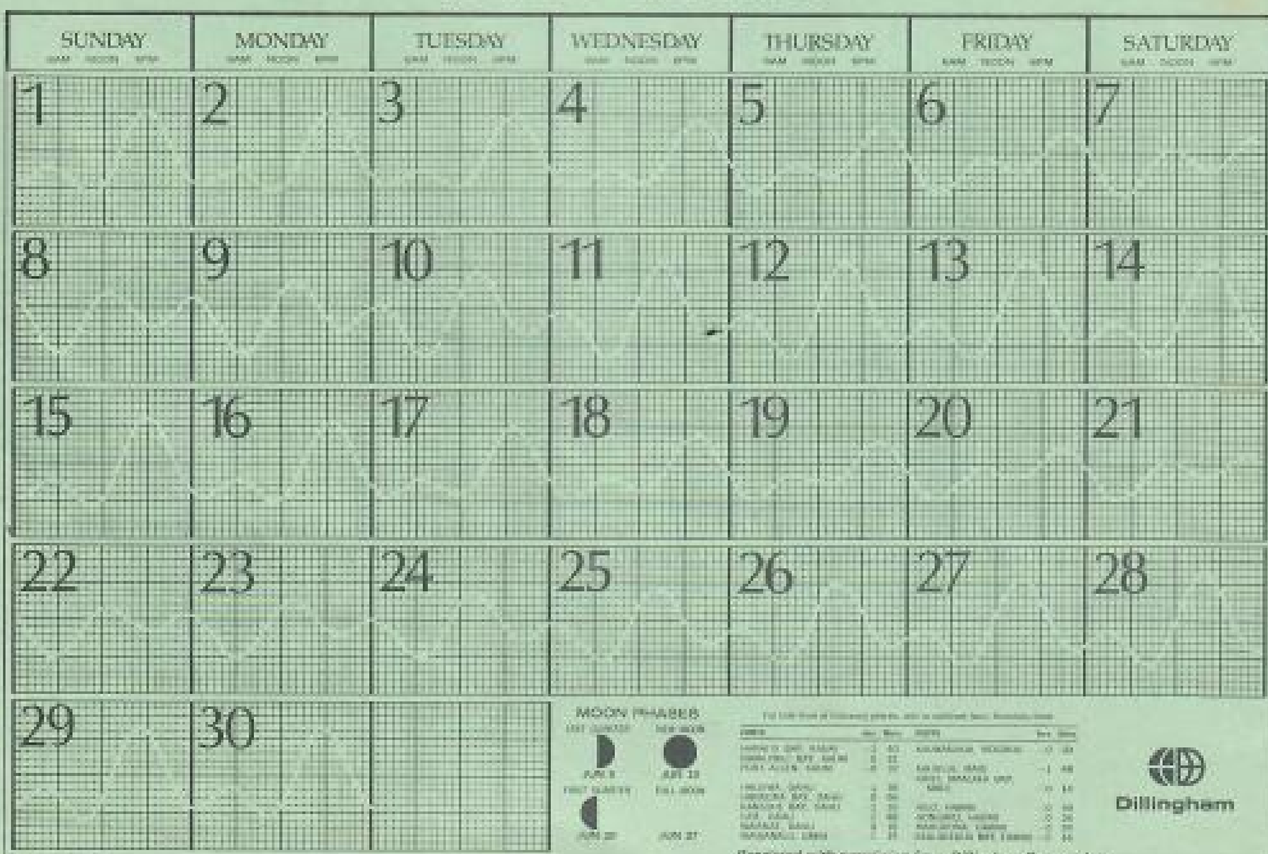

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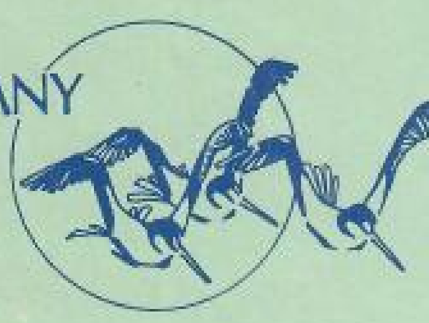
MARINE MISCELLANY



One of the proposals in the *State Master Plan for Marine and Aquatic Education* is the establishment of an ocean center for the general public, particularly the downtown community in Honolulu.

Efforts to develop Aloha Tower as a center for exchange of information on marine projects, research, and planning have been carried out through a year-long series of luncheon-lecture programs. Currently, the College of Continuing Education and Community Service is offering a special course at Aloha Tower, "Hawaii and Living with the Sea," presented by State Marine Affairs Coordinator, **Dr. John P. Craven.**

The Tuesday brown-bag luncheon series will continue until June 17 and includes such topics as "Transportation and the Sea," "The City and the Sea," and "Poetry and Literature of the Sea." A special showing of "Images," a multi-media presentation on the art and music of the sea, will be presented in June at the University of Hawaii Art Auditorium. For information on the lecture series, call **Toni Snellback** at the Aloha Tower Maritime Center, 548-5433, or 948-8191.

* * *

The release of funds or authorization to call for bids for five marine-related projects on Oahu and the Big Island were announced in a recent newsletter from the Department of Planning and Economic Development.

The funds are designated for the design of the Waiakea canal, the Keehi shoreline erosion control project, and the construction and purchase of equipment for an algal production raceway system on Oahu.

Funds are being released for construction engineering for a small ocean thermal energy conversion generator at Keahole Point.

Bids are being called for Phase II of the Waiakea-uka flood control project, and Phase II and improvements to Kawaihae Harbor on the Big Island.

* * *

In the April issue of *Honolulu* magazine **John Brockman** said that this is a time of change for water sports in Hawaii. "A young sport like windsurfing is gaining popularity while an older, more established one like surfing temporarily takes a back seat. Political events halfway around the world are affecting the quality of deep-sea fishing and boating here by sharply raising the cost of fuel," Brockman stated.

In addition to surfing, Brockman also discussed fishing and powerboating, water skiing, and sailing. One point is indisputable he said, "Our islands are superbly endowed with water sport potential."

* * *

John R. Kukeakalani Clark, a former lifeguard with the City and County of Honolulu, has produced his second book on Hawaii's beaches, *The Beaches of Maui*. Published by the University Press of Hawaii, this book offers a comprehensive guide to all the beaches on the islands of Maui, Molokai, Lanai, and Kahoolawe.

Additionally, it is a study in Hawaiiana and includes historical sketches of each section of shoreline as well as beach lore.

Clark's first book was *The Beaches of Oahu*. He is currently preparing a book on the beaches of the Big Island.

* * *

The National Oceanic and Atmospheric Administration designated the University of Georgia as the 15th Sea Grant College in the nation in ceremonies on March 28. In January the cooperative program of the University of Maine and the University of New Hampshire was also designated a Sea Grant College. It was the 14th in the nation, but the first in which the participating institutions are located in different states.

The Sea Grant designation is awarded for sustained excellence in marine research, education, and public service. The University of Hawaii was designated a Sea Grant College in 1972. ☐

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GEORGE H. BALAZS
JR. MARINE BIOLOGIST
HIMB
COCONUT ISLAND

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Fishing Bills Await Ariyoshi's Okay

By Helen Altonn
Star-Bulletin Writer

The labeling of seaweed as fish, requiring a fishing license for commercial sales, and eliminating spiny lobsters from a one-pound minimum limit on sales are among four Senate bills that have been passed to the governor by the State House.

The House also has given tentative approval to a batch of Senate legislation which was to be up for final reading during what promised to be a lengthy session starting this afternoon. Tonight is the deadline for the Legislature to act on amended bills before they go into conference committees.

The measures to be acted upon today included an amended version of a Senate bill proposing to give the state Crime Commission civil immunity and to require state and county governments to cooperate with the commission and give it information.

BOTH OF THOSE provisions were deleted by the House Judiciary Committee.

The seaweed bill generated the most discussion in Friday's session, with Rep. Richard (Ike) Sutton, R-15th Dist. (Alewa Heights-Pauoa), protesting it as "atrocious."

He said it may impose criminal penalties on Hawaiians who have traditionally gathered seaweed for their livelihood and won't be aware of the new law. "They don't read lawbooks in Papakolea," he said.

Rep. Charles Toguchi, chairman of the Ocean and Marine Resources Committee, said the bill is aimed only at seaweed sales and not domestic use.

He said the requirement of commercial fishing licenses for seaweed sales will provide information to the state for use in conserving resources in the bays.

Other Senate bills receiving final approval by the House would

—Exempt spiny lobsters from the law making it illegal to sell spiny and slipper lobsters that weigh less than a pound. The law would then apply only to slipper lobsters.

-Authorize the state Department of Land and Natural Resources to designate agents to sell freshwater game fishing licenses.

-Exempt nonpaid persons who serve as corporate officers and perform services for corporations from the workers' compensation law.

SEVERAL SENTENCING bills were included in legislation approved on second reading Friday, including one providing minimum sentences and fines for shoplifting crimes.

Bills to regulate the time-sharing industry and to provide $3.2 million for low-interest loans to assist distressed sugar growers on the Big Island also were positioned for final approval today.

Capitol Calendar

Today is the 47th day of the regular session of the 1979 state Legislature.

Committee hearings are as follows:

SENATE
Tomorrow

1:30 p.m.—Transportation Committee meets with the Economic Development Committee and Health Committee to discuss state owned dry docks, drunk driving laws, mandatory drivers education to curb accidents, Honolulu Harbor Redevelopment and related matters. Conference Room 2.

1:30 p.m.—Education Committee meets to discuss the use of shorelines for school instruction in ocean studies and related matters. Conference Room 3.

3:00 p.m.—Health Committee and Higher Education Committee jointly meet to request UH president to submit a status report on nursing degree program at UH. State Capitol auditorium.

3:30 p.m.—Human Resources Committee meets to discuss the establishment of a separate pay plan for excluded public employees requesting and a study on the problems of vocational rehabilitation workshops with their worker's compensation insurance policies. Conference Room 3.

...anu's Kitchen

Margaret Stone

Seaweed—a Food With Other Uses

Limu is a general Hawaiian name for all plants living under water, fresh or salt. The English word is seaweed, the Japanese word, *ogo*, and the Korean word, *miyuk*.

Before the kapu system was lifted in Hawaii in 1819, women were not allowed to eat certain foods, including pork, bananas, coconuts and many fish, so it was necessary and desirable to know where to find non-kapu foods such as invertebrates and algae. It has been estimated that about three ounces of a certain type, provides more than the necessary daily requirements of Vitamin A, riboflavin and Vitamin B12.

There were other uses for *limu* besides food in old Hawaii. When family dissensions arose a *Ho'oponopono* was traditionally held. This was a time when the family got together to "set things right." Wrongs and grievances were aired and discussed, forgiveness was asked and prayer was offered. Following this ceremony, family members ate a certain type of *limu* which had been cleaned and blanched. It was called *limu kala* which means to forgive.

Priests also employed *limu kala* in some of their rituals, one of which was to purify those who had watched over and mourned a dead relative. Iolani Luahine, the famous hula dancer, wore neck and head leis made from *limu kala* during one of her performances.

Medicinally, *limu* is used to heal coral cuts. After being chewed well, *limu* makes an excellent poultice.

A familiar sight 40 years ago, along the shores at low tide, from Waikiki to Kahala and around Hilo Bay, was women, wearing broad-brimmed hats with their dresses tucked up between their legs, picking *limu* and also *opihi* (shell fish). It is important to know what *limu* is edible and what is not, as some, such as *limu-make-o-Hana*, are poisonous.

Tales about *limu* also abound. One quaint story told about an old Hawaiian woman who was known for her

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good works. Her *aumakua* (family god) was the turtle. Very early one morning she went down to the seashore to pick *limu* for her friends and herself. She seated herself on what she thought was a large flat rock and began to search with her hands for the seaweed. To her dismay, she found very little. Suddenly she felt herself moving, and she realized she had been seated on the back of an enormous turtle who was slowly but carefully moving her across the water. He stopped by a part of the shore that was abundant with *limu-kohu*, the most delicious and sought after *limu*. After her basket was filled to the brim, the turtle slowly returned her to the shore. She later told everyone her *aumakua* had rewarded her this way so she was able to share with her friends.

One authority claims that at least 70 edible algae exist in the waters, but only 40 varieties are commonly used. In Hawaii, three popular ones follow:

Limu-kohu – soft, succulent and red. Best liked of all edible seaweed; sold in Honolulu markets in balls; quite expensive.

Limu-pae – called a landed seaweed. Term also applicable to a newcomer or, in a bad sense, a drifter, vagabond or outcast.

Limu-ka-kanaka – a slimy blue-green algae, bright green when fresh. Grown on the shores of Hanalei, Kauai, and famous in song. Called a man-striking moss because a person can slip and fall on it.

Most Hawaiians prefer to eat *limu* raw or lightly salted. A favorite Hawaiian method is simply to mix the cleaned *limu* with roasted, salted kukui nuts, chili peppers and seafood, such as opihi (shellfish).

Before *limu* can be prepared for consumption, it must be cleaned. Soaking the *limu* in water before cleaning helps to remove some of the debris, but bits of coral and sand must be picked out carefully by hand.

Most of the recipes below call for the crunchy red *limu* found in supermarkets. Other varieties, if available, can be substituted.

OGO TEMPURA (Fried seaweed)

1 lb. ogo
1 cup flour
½ tsp. sugar
½ tsp. salt
1 tsp. shoyu
1 egg
¼ cup milk
Ajinomoto

Wash ogo, pour hot water over it and drain after 5 minutes. Pour cold water over it and squeeze out all the water. Mix flour, sugar, salt, shoyu, egg, Ajinomoto and milk. Put ogo in, a little at a time and fry in deep fat. Drain and serve hot.

LIMU TSUKUDANI (Seasoned seaweed)

½ cup mirin (rice wine vinegar)
1½ cups shoyu
1¼ cups brown sugar
dash of Ajinomoto
1 colander of limu (drained)

Clean limu. Bring sugar, shoyu and mirin to a full boil and add limu. Stir occasionally to prevent burning. Reduce heat to low and cover and cook about 15 minutes or until soft. A heavy aluminum type pot is recommended to keep from scorching. Add the Ajinomoto during the last stages of cooking. Goma (sesame seeds) and chili pepper may be added according to taste.

TERIYAKI MEAT WITH NORI

1 lb. beef or chicken, sliced 2" by 1/5"
1 sheet nori (roasted black seaweed, found in Japanese stores)
Marinade:
½ cup shoyu
1 tsp. grated ginger
1 clove garlic, grated
1 T. sake (rice wine) or mirin
3 T. sugar

Mix all ingredients well. Slice meat thi[n] and allow to stand at least three hours o[r] overnight in marinade.

Cut across the width of the seaweed t[o] make strips ½ inch in width. Taking four o[r] five strips of meat in one hand, faste[n] seaweed around the center of the me[at] strips. Deep fry until cooked and drain o[n] absorbent paper.