

FIELD GUIDE

&

ATLAS OF THE SEAWEED RESOURCES of *the* PHILIPPINES

DR. GAVINO C.
TRONO, JR.



FIELD GUIDE and ATLAS
of the
SEAWEED RESOURCES
of the
PHILIPPINES

FIELD GUIDE and ATLAS
of the
SEAWEED RESOURCES
of the
PHILIPPINES

GAVINO C. TRONO, JR.



Department of Agriculture
Bureau of Agricultural Research
Fisheries Sector Program
Diliman, Quezon City



Marine Science Institute
College of Science
University of the Philippines
Diliman, Quezon City



Copyright © 1997 by Dr. Gavino C. Trono, Jr.
and Bookmark, Inc.

All rights reserved.

No part of this work covered by the copyright hereon may be reproduced
and/or used in any form or by any means—graphic, electronic or mechanical—
without the written permission of the author and the publisher.

ISBN 971-569-252-4

Published by Bookmark, Inc.
264-A Pablo Ocampo Sr. Ave.
Makati City, Philippines
☎ 8958061 – 65
Fax (632) 8970824
E-mail: bookmark@mnl.sequel.net

Printed by AEC Graphics

The National Library of the Philippines CIP Data

Recommended entry:

Trono, Gavino C., Jr.
Field guide and atlas of the
seaweed resources of the Philippines
/ by Gavino C. Trono, Jr. –
Makati City : Bookmark, c1997
xx, 306 p. : ill. (some color.)
Bibliography: p. 291- Index:
p. 303-306

1. Marine algae – Philippines.
2. Marine algae industry. 3. Marine
resources. I. Title.

QK570.2 589.39 1997 P974000279
ISBN 971-569-252-4

*To my beloved wife, Lety, who has always been supportive of my research
and development efforts on the seaweed resources of the Philippines.*

TABLE OF CONTENTS

Table of Figures	ix
Preface	xv
Acknowledgments	xvii
Introduction	xix
The Major Classes of Marine Macrobenthic Algae and their Representative Species	1
Class CHLOROPHYCEAE	2
Class PHAEOPHYCEAE	57
Class RHODOPHYCEAE	158
Glossary of Technical Terms	273
References	281
Index to Species	303

TABLE OF FIGURES

Figure 1.	<i>Enteromorpha clathrata</i> , (a) habit, (b) portion of filament, (c) enlarged portion of filament (Trono, 1986).	6
Figure 2.	<i>Enteromorpha intestinalis</i> , habit (Trono, 1986)..	8
Figure 3.	<i>Ulva fasciata</i> , habit (herbarium specimen).	11
Figure 4.	<i>Ulva lactuca</i> , habit.	12
Figure 5.	<i>Ulva pertusa</i> , habit.	13
Figure 6.	<i>Ulva reticulata</i> , habit.	15
Figure 7.	<i>Anadyomene plicata</i> , habit.	17
Figure 8.	<i>Chaetomorpha crassa</i> , habit.	19
Figure 9.	<i>Cladophora vagabunda</i> , habit.	20
Figure 10.	<i>Boergesenia forbesii</i> , attached to rock at lower intertidal zone.	21
Figure 11.	<i>Boodlea composita</i> , habit.	23
Figure 12.	<i>Dictyosphaeria cavernosa</i> , mature plant at lower intertidal area.	24
Figure 13.	<i>Dictyosphaeria versluysii</i> , habit.	25
Figure 14.	<i>Valonia aegagropila</i> , habit.	27
Figure 15.	<i>Valonia fastigiata</i> , habit.	28
Figure 16.	<i>Valonia ventricosa</i> , habit.	29
Figure 17.	<i>Caulerpa brachypus</i> , habit.	31
Figure 18.	<i>Caulerpa cupressoides</i> , (a) habit, (b) portion of erect branch (Trono, 1986).	32
Figure 19.	<i>Caulerpa lentillifera</i> , natural habit (photo courtesy of Coral Reef Research Foundation).	33
Figure 20.	<i>Caulerpa microphysa</i> , habit.	34
Figure 21.	<i>Caulerpa peltata</i> , natural habit (photo courtesy of Coral Reef Research Foundation).	36
Figure 22A.	<i>Caulerpa racemosa</i> , plant found in calm turbid water, on soft sandy to muddy substrate.	37
Figure 22B.	<i>Caulerpa racemosa</i> , plant found on reef edges exposed to relatively strong water movement.	37
Figure 22C.	<i>Caulerpa racemosa</i> , sold as vegetable on market stands.	38
Figure 23.	<i>Caulerpa serrulata</i> , habit.	40
Figure 24.	<i>Caulerpa sertularioides</i> , on sandy substrate among seagrasses.	41
Figure 25.	<i>Caulerpa taxifolia</i> , on rocky substrate.	43
Figure 26.	<i>Caulerpa urvilliana</i> , habit (herbarium specimen).	44
Figure 27.	<i>Caulerpa verticillata</i> , habit (herbarium specimen).	45
Figure 28.	<i>Codium arabicum</i> , (a) habit, (b) utricles (Trono, 1986).	46
Figure 29.	<i>Codium bartlettii</i> , (a) habit, (b) utricles (Trono, 1986).	48
Figure 30.	<i>Codium edule</i> , habit.	49

Figure 31.	<i>Codium ovale</i> , (a) habit, (b) utricles (Trono, 1986).	50
Figure 32.	<i>Halimeda cylindracea</i> , habit.	52
Figure 33.	<i>Halimeda discoidea</i> , habit.	54
Figure 34.	<i>Halimeda fragilis</i> , habit (Trono, 1986).	55
Figure 35.	<i>Halimeda incrassata</i> , habit.	56
Figure 36.	<i>Halimeda macroloba</i> , habit.	57
Figure 37.	<i>Halimeda macrophysa</i> , habit (Trono, 1986).	59
Figure 38.	<i>Halimeda opuntia</i> , on lower intertidal zone.	60
Figure 39.	<i>Halimeda simulans</i> , habit.	61
Figure 40.	<i>Halimeda taenicola</i> , habit (Trono, 1986).	63
Figure 41.	<i>Halimeda tuna</i> , habit.	64
Figure 42.	<i>Halimeda velasquezii</i> , habit.	65
Figure 43.	<i>Avrainvillea erecta</i> , in shallow water (photo courtesy of Coral Reef Research Foundation).	67
Figure 44.	<i>Avrainvillea lacerata</i> , habit.	68
Figure 45.	<i>Avrainvillea longicaulis</i> , (a) habit, (b) blade-filaments (Trono, 1986).	69
Figure 46.	<i>Avrainvillea nigricans</i> , habit (herbarium specimen).	70
Figure 47.	<i>Avrainvillea obscura</i> , (a) habit, (b, c, e) terminal portion of blade-filaments, (d) blade-filament (Trono, 1986).	71
Figure 48.	<i>Chlorodesmis fastigiata</i> , attached to rock on upper intertidal area. ..	72
Figure 49.	<i>Chlorodesmis hildebrandtii</i> , habit.	73
Figure 50.	<i>Tydemanina expeditionis</i> , attached to rock on shallow subtidal area (photo courtesy of Coral Reef Research Foundation).	74
Figure 51.	<i>Udotea argentea</i> , (a) habit, (b) blade-filament (Trono, 1986).	75
Figure 52.	<i>Udotea geppii</i> , habit.	77
Figure 53.	<i>Udotea orientalis</i> , habit.	78
Figure 54.	<i>Bornetella nitida</i> , habit.	80
Figure 55.	<i>Bornetella oligospora</i> , natural habit.	81
Figure 56.	<i>Bornetella sphaerica</i> , (a) habit, (b) cross section of thallus (Trono, 1986).	82
Figure 57.	<i>Cymopolia vanbosseae</i> , habit.	83
Figure 58.	<i>Neomeris annulata</i> , habit.	84
Figure 59.	<i>Neomeris vanbosseae</i> , on rocky substrate.	85
Figure 60.	<i>Acetabularia clavata</i> , habit.	87
Figure 61.	<i>Acetabularia dentata</i> , attached to rock in shallow water.	88
Figure 62.	<i>Acetabularia exigua</i> , (a) upper portion of thallus, (b) habit, (c) lateral view of corona superior (Trono, 1986).	89
Figure 63.	<i>Acetabularia major</i> , attached to rock.	90
Figure 64.	<i>Acetabularia moebii</i> , (a) habit, based on Egerod's (1952) illustration, (b) portion of cap (Trono, 1986).	92

Figure 65.	<i>Acetabularia roxasii</i> , (a) habit, (b) segments of corona superior, (c) segments of corona inferior, (d) vertical notches of sporangial rays, (e-f) lateral view of corona (Trono, 1986).	93
Figure 66.	<i>Acetabularia velasquezii</i> , portion of cap (Trono, 1986).	94
Figure 67.	<i>Halicoryne wrightii</i> , natural habit.	95
Figure 68.	<i>Feldmannia columellaris</i> , (a) short, erect filament bearing terminal plurilocular sporangium, (b) portion of the thallus showing the prostrate and erect filament with plurilocular sporangia, (c) portion of the erect filament bearing young lateral plurilocular sporangium (Trono, 1969).	99
Figure 69.	<i>Feldmannia indica</i> , portions of the filaments showing plurilocular sporangia and intercalary meristems (Trono, 1969).	100
Figure 70.	<i>Sphacelaria rigidula</i> , habit (herbarium specimen).	102
Figure 71.	<i>Sphacelaria tribuloides</i> , habit (herbarium specimen).	103
Figure 72.	<i>Dictyopteris jamaicensis</i> , habit.	104
Figure 73.	<i>Dictyota cervicornis</i> , habit.	106
Figure 74.	<i>Dictyota dichotoma</i> , habit.	108
Figure 75.	<i>Dictyota friabilis</i> , natural habit (photo courtesy of Coral Reef Research Foundation).	110
Figure 76.	<i>Dictyota mertensii</i> , (a) habit, (b) upper portion of thallus (Trono, 1986).	111
Figure 77.	<i>Padina australis</i> , habit.	113
Figure 78.	<i>Padina japonica</i> , upper portion of thallus.	114
Figure 79.	<i>Padina minor</i> , habit.	115
Figure 80.	<i>Padina tetrastratica</i> , habit (Trono, 1986).	117
Figure 81.	<i>Colpomenia sinuosa</i> , habit.	120
Figure 82.	<i>Hydroclathrus clathratus</i> , natural habit having thick and fleshy strands between perforations.	121
Figure 83.	<i>Hydroclathrus tenuis</i> , with very fine fleshy strands between perforations.	123
Figure 84.	<i>Rosenvingea intricata</i> , habit.	124
Figure 85.	<i>Hormophysa cuneiformis</i> , habit.	125
Figure 86.	<i>Sargassum binderi</i> , (a) leaves from different branch orders, (b) forms of vesicles, (c) portion of branch with receptacles, (d) enlarged drawing of a receptacle (Trono, 1989).	129
Figure 87.	<i>Sargassum cinctum</i> , (a) leaves from different branch orders, (b) kinds of vesicles, (c) portion of branch with male receptacles (Trono, 1989).	131
Figure 88A.	<i>Sargassum crassifolium</i> , natural habit.	132
Figure 88B.	<i>Sargassum crassifolium</i> , (a) leaves from different branch orders, (b) forms of vesicles, (c) portion of branch with receptacles	

	(Trono, 1989).....	133
Figure 89A.	<i>Sargassum cristaeifolium</i> , habit.	134
Figure 89B.	<i>Sargassum cristaeifolium</i> , (a) leaves from different branch orders, (b) forms of vesicles, (c) portion of the branch with receptacles, (d) detailed drawing of receptacles (Trono, 1989).	135
Figure 90.	<i>Sargassum feldmannii</i> , (a) leaves from different branch levels, (b) portion of a branch with receptacles, (c) forms of phyllocysts and vesicles (Trono, 1989).....	136
Figure 91.	<i>Sargassum gracillimum</i> , (a) leaves from different branch orders, (b) forms of vesicles, (c) portion of a young branch with receptacles, (d) detailed drawing of female receptacle, (e) detailed drawing of male receptacle (Trono, 1989).	138
Figure 92.	<i>Sargassum hemiphyllum</i> , (a) leaves from different branch levels, (b) forms of vesicles, (c) portion of a branch with receptacles (Trono, 1989).....	140
Figure 93.	<i>Sargassum kushimotoense</i> , (a) leaves from different branch orders, (b) forms of vesicles, (c) portion of branch with receptacles, (d) detailed drawing of a receptacular cluster (Trono, 1989).	142
Figure 94A.	<i>Sargassum oligocystum</i> , habit.	144
Figure 94B.	<i>Sargassum oligocystum</i> , (a) leaves from different branch orders, (b) forms of vesicles, (c) portion of branch with female receptacles, (d) portion of branch with male receptacles (Trono, 1989).	145
Figure 95.	<i>Sargassum paniculatum</i> , (a) leaves from different branch orders, (b) forms of vesicles, (c) portion of branch with young male receptacles (Trono, 1989).	146
Figure 96A.	<i>Sargassum polycystum</i> , habit.	148
Figure 96B.	<i>Sargassum polycystum</i> , (a) rhizoidal holdfast, (b) habit of thallus, (c-d) portion of branch showing receptacles (Trono, 1989)..	149
Figure 97.	<i>Sargassum turbinarioides</i> , (a) leaves from different branch orders, (b) forms of vesicles, (c) portion of branch with receptacles, (d) detailed drawing of receptacular clusters (Trono, 1989).....	151
Figure 98.	<i>Turbinaria conoides</i> , habit.	153
Figure 99.	<i>Turbinaria decurrens</i> , tip of thallus.....	154
Figure 100.	<i>Turbinaria ornata</i> , habit.	156
Figure 101.	<i>Trichogloea requienii</i> , habit.	164
Figure 102.	<i>Liagoropsis schrammii</i> , habit.	165
Figure 103.	<i>Yamadaella caenomyce</i> , habit (herbarium specimen).....	166
Figure 104.	<i>Liagora ceranoides</i> , habit.	167
Figure 105.	<i>Liagora farinosa</i> , in shallow intertidal zone.	168
Figure 106.	<i>Asparagopsis taxiformis</i> , natural habit (photo courtesy of Coral Reef Research Foundation).	169

Figure 107.	<i>Actinotrichia fragilis</i> , attached to rock.....	172
Figure 108.	<i>Galaxaura apiculata</i> , natural habit (photo courtesy of Coral Reef Research Foundation).	173
Figure 109.	<i>Galaxaura fasciculata</i> , habit.	174
Figure 110.	<i>Galaxaura oblongata</i> , in shallow water attached to rock.	175
Figure 111.	<i>Galaxaura subverticillata</i> , habit (herbarium specimen).	177
Figure 112.	<i>Scinaia hormoides</i> , habit.	178
Figure 113.	<i>Gelidiella acerosa</i> , attached to rock in upper subtidal zone.	180
Figure 114.	<i>Peyssonnelia rubra</i> , natural habit (photo courtesy of Coral Reef Research Foundation).	181
Figure 115.	<i>Carpopeltis formosana</i> , habit.	182
Figure 116.	<i>Grateloupia filicina</i> , habit.	183
Figure 117.	<i>Halymenia dilatata</i> , habit.	184
Figure 118.	<i>Halymenia durvillaei</i> , natural habit.	186
Figure 119.	<i>Halymenia maculata</i> , habit.	187
Figure 120.	<i>Amphiroa foliacea</i> , habit.	188
Figure 121.	<i>Amphiroa fragilissima</i> , attached to rock in shallow water.	190
Figure 122.	<i>Cheilosporum cultratum</i> , (a) habit, (b) segments, (c) sporangia (Trono, 1988).	191
Figure 123.	<i>Cheilosporum jungermannioides</i> , (a) habit, (b) sporangia, (c) segment (Trono, 1988).	192
Figure 124.	<i>Fosliella farinosa</i> , on leaves of <i>Thalassiodendron ciliatum</i> (photo courtesy of Coral Reef Research Foundation).	194
Figure 125.	<i>Jania capillacea</i> , (a) habit of fertile plant, (b) sporangium (Trono, 1988).	196
Figure 126.	<i>Jania decussato-dichotoma</i> , portion of thallus (Trono, 1988).	197
Figure 127.	<i>Jania ungulata</i> , upper portion of decalcified thallus (Trono, 1988). .	199
Figure 128.	<i>Mastophora rosea</i> , habit.	200
Figure 129.	<i>Portieria hornemannii</i> , natural habit.	202
Figure 130.	<i>Rhodopeltis borealis</i> , habit.	204
Figure 131.	<i>Titanophora weberae</i> , attached to rock.	205
Figure 132.	<i>Ceratodictyon spongiosum</i> , habit.	206
Figure 133.	<i>Gracilaria arcuata</i> , habit.	209
Figure 134.	<i>Gracilaria edulis</i> , natural habit.	211
Figure 135.	<i>Gracilaria eucheumoides</i> , attached to rock at lower intertidal zone.	212
Figure 136.	<i>Gracilaria firma</i> , habit.	213
Figure 137.	<i>Gracilaria heteroclada</i> , cystocarpic thallus.	215
Figure 138.	<i>Gracilaria manilaensis</i> , habit (Trono, 1986).	216
Figure 139.	<i>Gracilaria salicornia</i> , natural habit.	217
Figure 140.	<i>Gracilaria tenuistipitata</i> , habit.	219
Figure 141.	<i>Gracilaria textorii</i> , attached to rock on lower intertidal area.	221

Figure 142.	<i>Plocamium telfairiae</i> , habit.	222
Figure 143.	<i>Eucheuma arnoldii</i> , natural habit.	223
Figure 144.	<i>Eucheuma denticulatum</i> , at upper subtidal zone.	225
Figure 145.	<i>Eucheuma gelatinae</i> , (a) habit, showing under surface of thallus, (b) upper surface of thallus (as <i>E. serra</i> in Trono, 1986).	226
Figure 146A.	<i>Kappaphycus alvarezii</i> (brown), habit.	228
Figure 146B.	<i>Kappaphycus alvarezii</i> (green), habit.	229
Figure 147.	<i>Kappaphycus cottonii</i> , habit.	230
Figure 148.	<i>Kappaphycus striatum</i> , habit.	232
Figure 149.	<i>Hypnea cervicornis</i> , (a) habit of portion of branch, (b) portion of branch (Trono, 1986).	236
Figure 150.	<i>Hypnea pannosa</i> , natural habit.	239
Figure 151.	<i>Hypnea valentiae</i> , among seagrasses (photo courtesy of Coral Reef Research Foundation).	240
Figure 152.	<i>Botryocladia skottsbergii</i> , habit (herbarium specimen).	242
Figure 153.	<i>Coelothrix irregularis</i> , habit (herbarium specimen).	243
Figure 154.	<i>Centroceras minutum</i> , portion of fertile branch (photo courtesy of Dr. Miguel D. Fortes).	246
Figure 155A.	<i>Spyridia filamentosa</i> , habit.	249
Figure 155B.	<i>Spyridia filamentosa</i> , tip of branch (photo courtesy of Dr. Miguel D. Fortes).	249
Figure 156.	<i>Caloglossa leprieurii</i> , habit.	251
Figure 157.	<i>Claudea batanensis</i> , natural habit.	252
Figure 158.	<i>Acanthophora muscoides</i> , (a) habit, (b) upper portion of branch (Trono, 1986).	255
Figure 159.	<i>Acanthophora spicifera</i> , habit.	256
Figure 160.	<i>Amansia glomerata</i> , habit.	257
Figure 161.	<i>Bostrychia binderi</i> , exposed to air on rock surface.	259
Figure 162.	<i>Chondria armata</i> , habit.	260
Figure 163.	<i>Digenea simplex</i> , in intertidal zone (photo courtesy of Coral Reef Research Foundation).	261
Figure 164.	<i>Laurencia cartilaginea</i> , habit.	263
Figure 165.	<i>Laurencia nidifica</i> , habit.	264
Figure 166.	<i>Laurencia papillosa</i> , habit.	267
Figure 167.	<i>Laurencia tronoi</i> , (a) habit of portion of branch, (b) portion of branch (Trono, 1988).	269
Figure 168.	<i>Neurymenia fraxinifolia</i> , habit.	271