

The Marine Algae of the Sistan and Baluchestan Province, Iran

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Abstract: The identification of marine algae in the Sistan and Baluchestan Province were performed from December 1998 to November 1999 at the coastal area of Gwatr (25° 10' N; 61° 30' E) and Mydani (25° 24' N; 59° 5' E). Data on vegetation were gathered in subtidal and intertidal zones by seasonal and monthly sampling, respectively. Samples were transferred to the laboratory and fixed in 4% formalin. According to some references the marine algae were recognized. Also, the herbarium sheet and algal photos were obtained. To final approval, the prepared samples were send to scientific centers of America, China and Pakistan (Wynn ; Tseng & Qari, 1999). There are a number of genera and species of main algae consisting of Ulvaceae in green algae, Gildiaceae, Gracilariacea and Hypneacea in Red algae and Sargaceae in brown algae.

Key words: Marine algae, Oman Sea, Sistan & Baluchestan Province, Iran

Introduction

The marine algae of the Iranian coastal area belong to three main groups consisting of green algae, red algae and brown algae. Due to containing of some material such as agar, caragins and alginates, these algae are among the most important marine algae of commerce. These are used in medical sciences, food products, paper and leather processing and several other ways (Zhanjiang, 1990). Therefore the cultivation of the economically important marine algae in some countries such as China, Japan, Taiwan, Thailand, Philippines, Korea, India and Indonesia were absolute developed in the past 3-5 decades. The coastal of Sistan

& Baluchestan Province in the southeast of Iran are rich in marine algae diversity and abundant. For these reasons it was thought desirable to investigate the possibility of the identification and developing of algal species.

The objective of this study was to identify marine algae in the Sistan and Baluchestan Province at the area of Gwatr ($25^{\circ} 10' N$, $61^{\circ} 30' E$) and Mydani ($25^{\circ} 24' N$, $59^{\circ} 5' E$) on the coastline of the Oman sea in 300 km of downstream.

Materials and Methods

A total of 11 sampling regions in Gwatr, Pasabandar, Berris, Kacho, Ramin, Chahbahar, Pozm, Gordim, Tang, Galak and Meidani on the coastline of Sistan and Baluchestan Province were selected for study in December, 1998 (Fig. 1). Sampling regions were selected in the intertidal and subtidal zones.

In the intertidal zones, sampling was conducted based on tide table monthly for each experimental zone along the coastlines. The gathered samples was packed in plastic containers enclose with the date and site of sampling. Sampling was conducted through diving on the bottom of experimental sites by 2 persons in subtidal zones. Due to some problems in collecting materials in subtidal zones by divers, the area were sampled on May, September, December 1998 and March 1999.

To remove of residueson from collected samples in both intertidal and subtidal zones, they were washed by tap water. Then, fixed in 4% formalin and pressed. The samples were prepared to initial identification and get photos to obtain an album. They was recongnized based on identification keys of Wynne, Tseng & Qari, 1999.

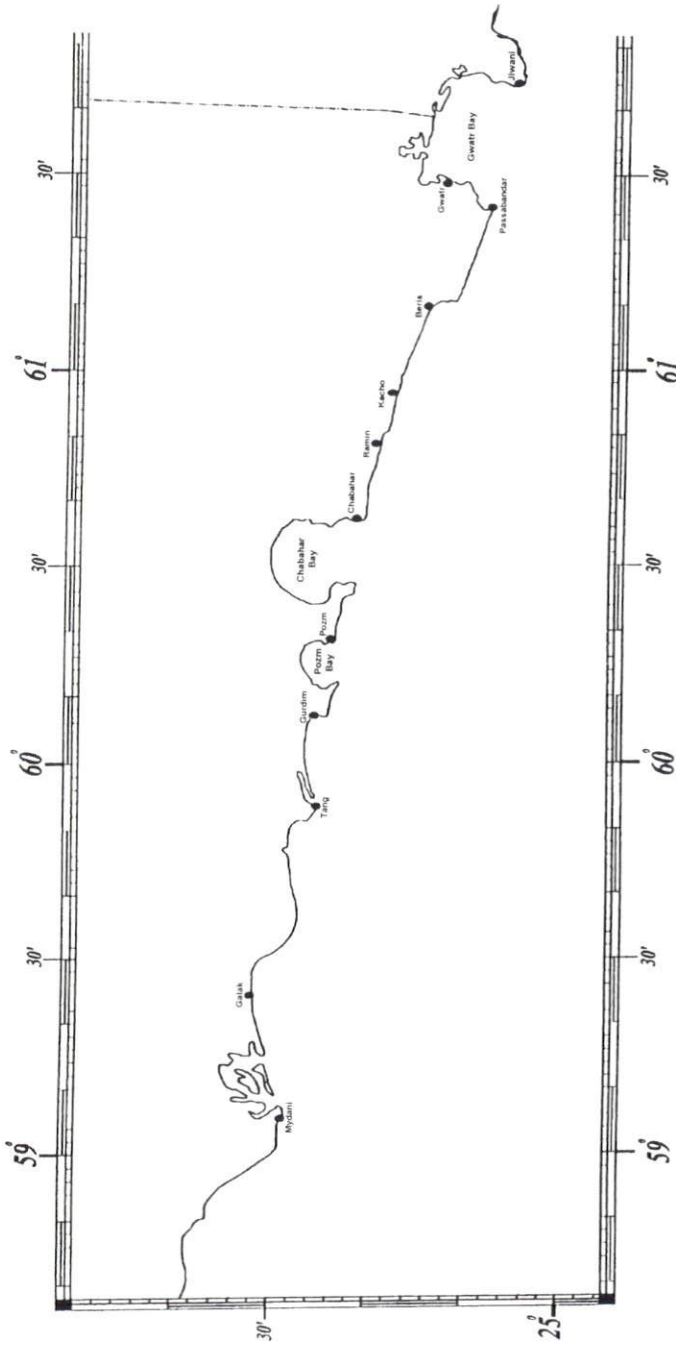


Figure 1: Distribution of Seaweeds abitat in Sistan & Baluchestan Province Coastal (Intertidal) zone

Results

During the course of the one year study, a total of 83 species and genus of green, brown and red algae groups were found in all experimental zones. There were 68 and 15 species and genus respectively.

In the all experimental sites, 15, 11 and 42 species and 2, 3 and 10 genus were belong to brown, green and red algae respectively. Recorded algae in experimental sites are given in tables 1-3.

Plates 1 to 3 show the most important and economic valuable species of green, brown and red algae.

Table 1: The green algae identified on the coastline of Sistan & Baluchestan

| No. of sampling Sites | Species | Family | Order |
|-----------------------|--|----------------|------------------|
| 4,5,6 | <i>Ulva fasciata</i> * ¹ Delile | Ulvales | Ulvales |
| 4,5,6 | <i>U. rigida</i> * ¹ C. Ag. | " | " |
| 5,6,7 | <i>Enteromorpha sp.</i> ¹ | " | " |
| 2,5,6,9 | <i>Chaetomorpha antenina</i> * ¹ Boryst & Vincent. | Cladophoraceae | Cladophoraceae |
| 1,4,5,6 | <i>C. gracilis</i> ¹ Kutz | " | " |
| 5,6,7,9 | <i>Caulerpa recemosa</i> ¹ (Forssk) J. Ag | Caulerpa | Codiales |
| 1,10,11 | <i>C. sertularioides</i> ¹ (S. G.Dmel) Howe | " | " |
| 2,5,6,10,11 | <i>C. mexicana</i> ¹ (Sond) Kutz. | " | " |
| 1,2,5,9,10,11 | <i>C. scalpelliformis</i> ¹ (Turn.) C.Ag. | " | " |
| 1,4,5,10 | <i>C. faridii</i> * ¹ Nizamuddin | " | " |
| 1,5,6,9, 10, 11 | <i>Halimeda tuna</i> ¹ (ellis) Sol & Lamour | Codiaceae | " |
| 3,6,7,9 | <i>Codium sp.</i> ¹ | " | " |
| 1,2,5,6,9,10 | <i>Bryopsis sp.</i> ¹ | Bryopsidaceae | " |
| 4,5,6,9 | <i>Valoniopsis pachynema</i> ¹ (Martens) Boergesen | Valoniaceae | Siphonocladiales |

1 - The seaweed confirmation by Dr. Wynne from U.S.A.

* The names of seaweed first reported and introduced from this territory

Table 2: The brown algae identified on the coastline of Sistan & Baluchestan

| No. of sampling Sites | Species | Family | Order |
|-----------------------|---|--------------|------------------|
| 1,2,3,....,11 | <i>Sargassum glaucescens</i> ^{*3} J. Agardh | Sargassaceae | Fucales |
| 5,6 | <i>S. illicifolium</i> ^{*3} (Turn.) C.Ag | " | " |
| 9 | <i>S. Sp.</i> Tseng | " | " |
| 1,2,3,....,11 | <i>Cystoseira indica</i> ^{*3} Tseng | " | " |
| 1,2,3,....11 | <i>Padina australis</i> ¹ Hauck | Dictyotacea | Dictyotales |
| 1,6,8 | <i>P. glabra</i> ¹ Gaillard | " | " |
| 6,8 | <i>P. dubia</i> ¹ Hauck | " | " |
| 1,6,8,9 | <i>P. boergesenii</i> ¹ (Allender) Kraft. | " | " |
| 1,6,7,8,9,10 | <i>Stoehospermum arginatum</i> ² (Lamour) J. Ag. | " | " |
| 1,6,7,8,9 | <i>Taonia atomaria</i> ³ | " | " |
| 9,10 | <i>Lobophora variegata</i> ² Lamour | " | " |
| 3,5 | <i>Spatoglossum asperrum</i> ¹ J. Ag. | " | " |
| 1,5,6,9,10 | <i>Dictyota sp.</i> ¹ | " | " |
| 1,9 | <i>Lyngaria stellata</i> ² Borg. | Punctariacea | Dictyosiphonales |
| 1,5,6,9,10 | <i>Colpomenia sinoua</i> ² (Martens) | e " | " |
| 8,9 | Ex Roth. Derbs & Solier <i>Rosenvinge orientalis</i> ³ | " | " |
| 4,5,6,9 | (J.Ag.) Boerg. <i>Nizimuddinina zanardinii</i> ^{*3} Schiffner. | " | " |

1-The seaweed confirmation by Dr. Wynne from U.S.A.

2-The seaweed confirmation by Ms. Rashida Qari from Pakistan

3- The seaweed confirmation by Dr. Tseng from China

* The names of seaweed first reported and introduced from this territory

Table 3: The red Algae indentified in the coastline of Sistan & Baluchestan

| No. of sampling Sites | Species | Family | Order |
|-----------------------|---|-----------------|---------------|
| 5,6 | <i>Hypnea nigrescens</i> ^{*1} (greville) J.Ag. | Hypneaceae | Gigartinales |
| 2,4,5,6,7,9 | <i>H. charoides</i> ¹ Lamour. | " | " |
| 1,3,5,6,7,8,9 | <i>H. musciformis</i> ¹ Lamour. | " | " |
| 9 | <i>H. hamulosa</i> ^{*1} (Esper) | " | " |
| 4,5,6,9 | <i>H. valentiae</i> ^{*1} (turner) Montagne | " | " |
| 5,6,9 | <i>H. boergesenii</i> ¹ Tak. Tanaka | " | " |
| 1,3,4,5,6,7,8,9,11 | <i>Gracilaria corticata</i> ¹ J.Ag. | Gracilariaceae | " |
| 1,4,5,6,8,9 | <i>G. gracilis</i> ¹ (Stackhouse) Steentoft, L. Irvine & Farnham (tetrasporic) | " | " |
| 3,8,9 | <i>G. millardetii</i> ^{*1} (Montagne) J. Ag. | " | " |
| 1,4,5,6,9,11 | <i>G. arcuata</i> Zanardinii ^{*1} | " | " |
| 3,6,8,9 | <i>G. pygmaea</i> Boergersen ^{*1} | " | " |
| 6,9 | <i>G. sp.</i> ¹ | Gracilariaceae | " |
| 3,4,5,6 | <i>Gelidiopsis variabilis</i> ¹ (J. Ag.) Schmitz | " | " |
| 1,3,5,6,9,10 | <i>Sarconema filiforme</i> ^{*1} (Sond) Kylin | Solieriaceae | " |
| 1,5 | <i>Solieria robusta</i> ^{*1} (Grev.) Kylin *cystocarpic); det: G. Kraft | " | " |
| 6,9 | <i>S. dura</i> ^{*1} Zanardinii | " | " |
| 1,3,5,9 | <i>Ahneltiopsis pygmaea</i> ^{*1} (J. Ag.) P. Silva & Decew | Phyllophoraceae | " |
| 1,8 | <i>Botryocladia leptopoda</i> ² (J.Ag.) Kylin | Rhodymeniaceae | Rhodymeniales |

Table 3 continued:

| No. of sampling sites | Species | Family | Order |
|-----------------------|--|-----------------|---------------|
| 1,2,5,6 | <i>Champia</i> sp ³ . | Champiaceae | Rhodymeniales |
| 1,3,5,6,8,9 | <i>Acanthophora muscoides</i> ¹ (Linnaeus) Bory de Saint Vincent | Rhodomelaceae | Ceramiales |
| 5,6,7,8,9 | <i>A. nayadiormis</i> ^{*1} (Delile) Papenfuss | " | " |
| 5,6,8,9 | <i>Laurencia platyclada</i> ^{*1} Boerg. | " | " |
| 6,9 | <i>L. obtusa</i> ¹ (Hudson) Lamour Var. grscilis (C. Ag.) | " | " |
| 3,5,6,9 | <i>L. glandulifera</i> ^{*1} C. Ag. | " | " |
| 5,6 | <i>L. iliformis</i> ^{*1} Kutzing | " | " |
| 1,2,3,....,11 | <i>L. spl</i> ¹ -sp ⁸ ¹ | Ceramiaceae | " |
| 1,3,5,6,9 | <i>Ceramium truncatum</i> ^{*1} H. Peterson in Boerg. | " | " |
| 1,6,9 | <i>Spyridia fusiformis</i> ^{*1} Boerg. | " | " |
| 3,4 | <i>Chondria cornuta</i> ¹ Boerg. | " | " |
| 1,6,7,9,10,11 | <i>Jania adhaerens</i> ² Lamour | Corallinaceae | Crytonemiales |
| 9 | <i>Amphyroa anceps</i> ^{*1} (Lamarck) Decaisne | " | " |
| 1,6,9 | <i>Grateloupia somalensis</i> ^{*1} (Lamour) C. Ag. | Cryptonemiaceae | " |
| 1,6,9 | <i>G. filicina</i> ^{*1} (Lamour) C.Ag. | " | " |
| 1,9 | <i>Halimena porphyraformis</i> ^{*1} Parkinson | " | " |
| 1,2,5,7,8,9 | <i>Sinaia furcellata</i> ^{*1} (Turn.) J.Ag. | Chaetangiaceae | Nemaliales |
| 1,8,9 | <i>S. carnosa</i> ^{*1} (Kutz) J. Ag. | " | " |
| 1,5,8,9 | <i>S. fadicularis</i> ^{*1} Boerg.,Huisman | " | " |
| 1,2,3,5,9 | <i>S. felabellata</i> ^{*1} Turn | " | " |
| 1,2 | <i>Sebdenia indica</i> ² | " | " |
| 3,5,6,9 | <i>Gelidiella acerosa</i> ¹ (Forsskal) Feldman & Hammel | Gelidiaceae | " |

Table 3 continued:

| No. of sampling sites | Species | Family | Order |
|-----------------------|---|--------------------|------------------|
| 3,5,6,9 | <i>G. lubrica</i> ^{*1} | Gelidiaceae | Nemaliales |
| 1,4,5,9 | <i>Gelidium micropterum</i> ¹ Kutz | " | " |
| 1,6,9 | <i>Helminthocladia australis</i> ^{*1} Harvey | Helminthocladaceae | " |
| 2,3,6,11 | <i>Dermonema virens</i> ¹ (J. Ag.) Pedroche & Avila ortiz | " | " |
| 2 | <i>Melanothamnus somalensis</i> ^{*1} Bornet & Falkenberg | " | " |
| 4,5,6 | <i>Ulva fasciata</i> ¹ Delile | Ulvaceae | Ulvales |
| 4,5,6 | <i>U. rigida</i> ^{*1} C. Ag. | " | " |
| 5,6,7 | <i>Enteromorpha Sp</i> ¹ | " | " |
| 2,5,6,9 | <i>Chaetomorpha antenima</i> ^{*1} Boryst & Vincent | Cladophoraceae | Cladophorales |
| 1,4,5,6 | <i>C. gracilis</i> ¹ Kutz | " | " |
| 5,6,7,9 | <i>Calurpa racemosa</i> ¹ (Forssk) | Caulerpa | Codiales |
| 1,10,11 | <i>C. sertularioides</i> ¹ (S. G. Dmel) Howe | " | " |
| 2,5,6,10,11 | <i>C. mexicana</i> ¹ (Sond) Kutz | " | " |
| 1,2,5,9,10,11 | <i>C. scalpelliformis</i> ¹ (Turn) C. Ag. | " | " |
| 1,4,5,10 | <i>C. faridii</i> ^{*1} Nizamuddin | " | " |
| 1,5,6,9,10,11 | <i>Halimeda tuna</i> ¹ (Ellis) Sol & Lamour, | Codiaceae | " |
| 3,6,7,9 | <i>Codium sp.</i> ¹ | " | " |
| 1,2,5,6,9,10 | <i>Bryopsis sp.</i> ¹ | Bryopsidaceae | " |
| 4,5,6,9 | <i>Valoniopsis pachynema</i> ¹ (Martens) Boerg. | Valoniaceae | Siphonocladiales |

1-The seaweed confirmation by Dr. Wynne from U.S.A.

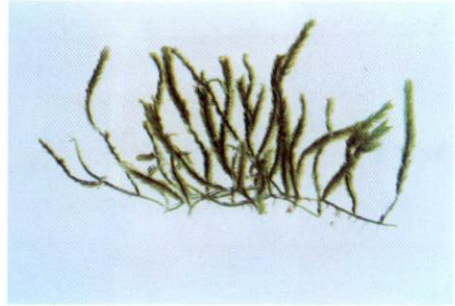
2-The seaweed confirmation by Ms. Rashida Qari from Pakistan

3- The seaweed confirmation by Dr. Tseng from China

* The names of seaweed first reported and introduced from this territory



Caulerpa racemosa (Forssk) J. Agardh



Caulerpa sertularioides (S. G. Gmel) M. Howe



Ulva fasciata Delile



Valoniopsis pachynema (G. Martens) Borgesen



Halimeda tuna (Ellis & Sol) J.V. Lamour

Plate 1: GREEN ALGAE



Cystoseira indica (Thivy *et al.*)



Sargassum glaucescens J. Agardh



Stoechospermum polypodioides (J.V. Lamour) J. Agardh

Stoechospermum marginatum C.K. Tseng



Padina australis Hauck



Nizimuddinina zanardini (Schiffner) P. Silva *et al.*,



Gracilaria corticata J. Agardh



Gelidiella acerosa (Forsskal) Feldmann & Hamel



Botryocladia leptopoda (J. Agardh) Kylin



Halymenia porphyraeformis Parkinson



Hypnea boergesenii Tak. Tanaka

Discussions

Due to low slope of coasts and waves intensity decline, the diversity and dispersion of marine algae in Tang, Chahbahar, Galak and Gwatr sites were greater than others. Experimental results showed that the maximum growth of brown algae, red algae and green algae were observed in autumn, winter and early spring respectively. Except for *Gracilaria* and some green algae to which the minimum growth was observed in the summer. The growth of green algae was observed in upper intertidal zones on the broken waves by producing high oxygen levels. Their growth also was observed in monsoon periods by the increase of wave transferring and the water spraying. Compare with green algae, the growth of brown algae was observed in lower intertidal zones by 4-7 meter. By increasing the water depth the decrease brown algae was observed. The occurrence and growth of red algae were related to distribution of other algae, increasing depth and the intertidal zones. The maximum of red algae was observed at 13 m depth. As the brown algae, increasing the water depth tend to decreasing the density of red algae. The maximum growth was observed in subtidal to intertidal zones.

Acknowledgements

I am very grateful for helping of Mr. Soopak, Mr. Jadgal, Mr. Aminirad and Mr. Abkenar (center divers) in this project. Special thanks also to Dr. Wynne, Dr. Tseng and Ms. Qari from scientific centers of USA, China and Pakistan for their valuable assistance in identification and confirmation of species.

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