Phycological flora diversity in a coastal tropical ecosystem in the Northeast of Brazil

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Abstract

The Santa Cruz Channel is located in the Estuarine Complex of Itamaracá, between the coordinates of 7°34'00'' – 7°55'16''S and 34°48'48'' – 34°54'24''W, northeast of Brazil. This channel is one of the most important productive areas of the littoral zone in the Pernambuco State. Due to the important environmental conditions, its phycological flora diversity is represented by 252 species, distributed in 108 Bacillariophyta, 80 Rhodophyta, 19 Phaeophyta and 45 Chlorophyta. Some representatives of economic value are found, such as *Hypnea musciformis* (Wulfen in Jacquin) J. V. Lamour., *Solieria filiformis* (Kuetz.) P. W. Gabrielson (carrageenan producers), *Gracilariopsis lemaneiformis* (Bory) Dawson, Acleto et Foldvik. *Hydropuntia caudata* (J. Agardh) Gurgel & Fredericq and *H. cornea* (J. Agardh) M. J. Wynne (agar producers). Other species, like *H. opuntia* (L.) J.V. Lamour, have a high ecological role in the reef bottom.
Keywords: microalgae, macroalgae, biodiversity, Bacillariophyta, Chlorophyta, Ochrophyta, Rhodophyta, Santa Cruz channel, Northeast Brazil.

1 Introduction

The biodiversity comprises not only the morphological variations of the organisms but also its genetic and ecological variations [12]. In the sea is found one of the highest biodiversities of the world that is a function of the algae diversity [10]. When considering the representation of different plant groups in the marine flora in terms of numbers of species, it is important to remember that species vary enormously in number of individuals and in the size of those individuals, and that the number of species described in any one group probably

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depends more on the amount of study that the group has received than on the actual diversity within the group. In the Northeast of Brazil, one of the higher biological diversity areas is the Santa Cruz Channel, located in the littoral of the Pernambuco State, due to the existence of a complex of habitats that promote the settlement of a very diversified fauna and flora [2,14]. The survey of the phycological flora and its distribution in the diverse habitats of the Santa Cruz Channel is the aim of the present paper.

2 The Santa Cruz Channel

It is located in the Estuarine Complex of Itamaracá – Pernambuco (7°34'00'' – 7°55'16''S and 34°48'48'' – 34°54'24''W), fig. 1, and is distinguished because represents the third estuarine area covered with mangrove, 2,339 ha of the State, functioning as habitat, nursery and spawn place for a variety of economic value species, such as fishes, crustaceans and mollusks. Of all the biomes, the mangrove is one of the most important ecosystems, because it is responsible for a series of products and ecological functions that influence directly the whole area [13].

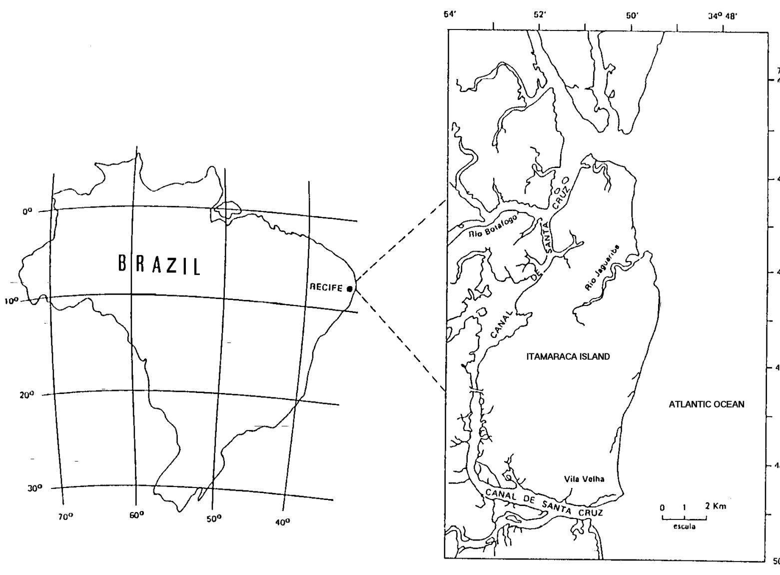

Figure 1: The representative map of the Santa Cruz Channel – Pernambuco – Brazil.

The channel acts as a connection between the continent and adjacent marine areas, occurring important physical and chemical mixing processes among them, involving the exportation of dissolved and particulate organic matter produced by the mangroves, and also migrations of juveniles and adults [2].

The continental influence in the channel is caused by the arrival of some rivers being responsible for the maintenance of high levels of dissolved nutrients in the water, notably during the rainy season [6]. The salinity of the Santa Cruz Channel is found between the euryhaline-mesohaline regimes (minimum of 14,4 and maximum of 36,9). It occurs due to the constant entrance of marine waters by the two bars of the channel being, thus, the salinity variation directly related to the tide cycles, rivers discharge and pluviometric precipitation [8].

The adjacent continental shelf is plane and narrow, about 20 miles, finishing in an abrupt descending slope that occurs between 60–80 meters. In great part, the bottom is covered with biogenic carbonatic sediments, constituted mainly by fragments of calcareous Rhodophyta, presented under the form of free, branched or crustose thalli, and also by articles of the Chlorophyta *Halimeda*. The carbonate contents of these sediments are very elevated, always higher than 90%. In the internal continental shelf, the bottom is constituted by quartzose fluvial sand facies, densely settled by the marine phanerogam *Halodule wrightii* Aschersson, which individuals serve as live substrate for a diversified animal community, as well as for the epiphytic microflora, where the diatoms are distinguished [5]. Another particular aspect of the continental shelf is the presence of the reefs lines, composed of a coralline structure (corals and crustose calcareous algae) established under a sandstone foundation found, mainly, at the depth between 1,5 and 2 meters, also present, however, up to 10 meters depth [5]. These structures represent very favorable substrata to the development of the macroalgae and constitute important elements to the increase of the area productivity [11, 15, 17, 19]. The phycological material was collected at various time and locations of the Santa Cruz Channel and adjacent areas.

3 The phycological flora

3.1 Bacillariophyta

In the Santa Cruz Channel area, the diatoms flora is very diversified, with the species distributed in the following families, tab 1: Biddulphiaceae (16 spp.), Fragilariaceae (15 spp.), Coscinodiscaceae (12 spp.), Naviculaceae (10 spp.), Nitzschiaceae (10 spp.), Chaetoceraceae (09 spp.), Triceratiaceae (08 spp), Rhizosoleniaceae (07 spp.), Surirellaceae (06 spp.), Achnanthaceae (04 spp.), Actinodiscaceae (03 spp.), Eupodiscaceae (03 spp.), Eunotiaceae (03 spp.) and Anaulaceae (02 spp.), tab.1. The floristic structure of the diatoms is characterized by the abundant presence of euryhaline marine species, which correspond to 34 % of the flora and are found along the channel, in the estuaries and adjacent continental shelf. Among these species, the most representatives are: *Bellerochea malleus*, *Coscinodiscus centralis*, *Chaetoceros curvisetus*, *Odontella regia* and *Skeletonema costatum*. The freshwater and estuarine components are little significant and found only during the rainy season, when the continental water flow in the channel is more expressive.

Table 1: List of the Bacillariophyta species in Santa Cruz Channel – Pernambuco – Brazil.

Bacillariophyta
Coscinodiscaceae
Coscinodiscus asteromphalus Ehrenberg
C. centralis Ehrenberg
C. oculusiridis Ehrenberg
C. radiatus Ehrenberg
Cyclotella meneghiniana (Kutz.) Brébisson
C. stylorum Brigthwell
Melosira moniliformis (Muller) Agardh
Paralia sulcata (Ehrenberg) Cleve
Skeletonema costatum (Greville) Cleve
Thalassiosira eccentrica (Ehrenberg) Cleve
T. eccentrica var. *fasciculada* Hustedt
T. leptopus (Grunow) Hasle & Fryxell
Actinodiscaceae
Actinoptychus splendens (Shadbolt)Ralfs
A . senarius Ehrenberg
Stictodiscus parallelus (Ehrenberg) Grove & Sturt
Eupodiscacceae
Actinocyclus ehrenbergii Ralfs
Aulacodiscus kittonii Arnot
Eupodiscus radiatus Barley
Rhizosoleniaceae
Guinardia delicatula (Cleve) Hasle
Guinardia stolterfothii (Peragallo) Hasle
Leptocylindrus danicus Cleve
Proboscia alata (Bright.) Sundstrom
Pseudosolenia calcaravis (Schultze) Sundstron
Rhiz. imbricata var. *shrubsolei* (Cleve) Schroder
Rhiz. setigera Brightwell
Chaetoceraceae
Bacteriastrum delicatulum Cleve
B. hyalinum Lauder
Chaetoceros coarctatus Lauder
Chaetoceros compressus Lauder
C. curvisetus Cleve
C. didymu Ehrenberg
Chaetoceros laevis Leuduger-Fortmorel
C. lorenzianus Grunow
C. teres Cleve
Biddulphiaceae
Bellerochea malleus Brigtwell
Biddulphia biddulphiana Smith
Biddulphia tridens Ehrenberg
Cerataulus smithii Ralfs
C. turgidus Ehremberg
Ditylum brightwellii (West) Grunow
Eunotogramma laeve Grunow
Heliotheca thamensis (Shrubsole) Ricard
Hemiaulus indicus Karsten
Isthmia enervis Agardh
Lithodesmium undulatum Ehrenberg
Odontella longicruris (Greville) Hoban
O. mobiliensis (J.W. Bailey) Grunow
O. regia (Schutz.) Hendey
Palmeria hardmaniana Greville
*Pleurosira laevis (*Ehrenberg) Campère
Triceratiaceae
Triceratium alltermans Bailey
T. antediluviam (Ehrenberg) Grunow
T. broeckii Leuduger-Fortmorel
T. dubium Brighwell
T. favus Ehrenberg
T. contortum (Shadbolt) Greville
T. pentacrinus Ehrenberg
T. shadboltianum Greville
Anaulaceae
Terpsinoe americana (Bailey) Ralfs
Terpsinoe musica Ehrenberg
Fragiliariaceae
Asterionellopsis glacialis (Castracane) Round
*Bleakeleya notata (*Grunow) Round
Climacosphenia moniligera Ehrenberg
Fragilaria capucina Desmazieres & Kutz.
Grammatophora angulosa Ehrenberg
G. hamulifera Kutzing
G. marina (Lyngbye) Kutz.
G. oceânica Ehrenberg
Podocystis adriatica Kutzing
P. americana (Kutz.) Bailey
Rhabdonema adriaticum Kutzing
R. mirificum W. Smith
Striatella unipunctata (Lyngbye) Agardh
Thalassionema frauenfeldii Grunow
Thalassionema nitzschioides Grunow
Eunotiaceae
Eunotia arcus Ehrenberg
E. glacialis Meister
E. pectinalis (Dyllwyn) Rabenhorst
Achnanthaceae
Achnanthes brevipes Agardh
Campyloneis grevillei (W. Smith) Grunow
Cocconeis scutellum Ehrenberg
Raphoneis amphiceros Ehrenberg
Naviculaceae
Anomoeoneis serians (Brebisson) Cleve
Caloneis bivittata (Pantocsek) Cleve
Diploneis bombus Ehrenberg
D. vacillans (Schmidt) Cleve
Frustulia rhomboides (Ehrenberg) De Toni
Gyrosigma balticum (Ehrenberg) Rabenhorst
Lyrella lyra Ehrenberg
Mastogloia binotata (Grunow) Cleve
M. fimbriata (Brightwell) Cleve
M. splendida (Gregory) Cleve
Nitzschiaceae
Bacilaria paxillifer (Muller) Hendey
Cylindrotheca closterium (Ehrenberg) Reiman & Lewis
Nitzschia circumsuta (Bailey) Grunow
N. compressa (Bailey) Boyer
N. longíssima (Brébisson & Kutz.) Grunow
N. sigma (Kutzing) Wm. Smith
N. sigmoidea (Nitzsch) Wm Smith
N. vermicularis (Kutzing) Hantzsch
*Pseudo-nitzschia pungens (*Grunow) Hasle
Tryblionella granulata (Grunow) D. G. Mann
Surirellaceae
Campylodiscus biangulatus Greville
C. clypeus Ehrenberg
C. imperialis Greville
Petrodictyon gemma (Ehrenberg) D. G. Mann
Surirella fastuosa Ehrenberg
S. febigerii Lewis

3.2 Rhodophyta

The Rhodophyta present the higher diversity among the benthic algae, with 80 infra-generic representatives, distributed in 11 Orders, excluding the non-articulated calcareous algae, tab. 2. Among the Orders, only 3 occur with percentages from 10%, such as Gigartinales (10%), Gracilariales (11%) and Ceramiales (49%). The representatives of the other Orders, all together, reach percentages of 29%. Among the Gigartinales, is pointed out the occurrence of species producers of carrageenan such as *Hypnea musciformis*, *Meristotheca echinocarpum* and *Solieria filiformes*. Among the Gracilariales, the high number of species of *Gracilaria* deserves attention, as well as the important representatives of agar producers, such as *Gracilariopsis lemaneiformis* and *Hydropuntia caudata*. In the area, some researches concerning the quantitative aspects of the economic value species have been realized [3, 18]. Among the Ceramiales, Order with higher occurrence percentage, are found the families Ceramiaceae (12 spp.), Dasyaceae (3spp.), Delesseriaceae (1 sp.) and Rhodomelaceae (24 spp.). In this last family, the genus *Bostrychia* is pointed out with 5 species, occurring in the mangroves of the area, in formations denominated "Bostrychietum". *Neosiphonia ferulacea* is cited of the first time to Pernambuco State.

3.3 Ochrophyta

The lower occurrence percentage among the benthic algae is among the Phaeophyceae. This result was already expected, once these organisms are typical of temperate seas, where they reach a maximum development of its thalli. In the tropical seas, the higher Ochrophyta diversity is found among the Dictyotales and, thus, in the Santa Cruz Channel area they reach the higher occurrence values, with 69%, followed by the Fucales (26%) and Ectocarpales (5%). In the Brazilian littoral, the higher specific richness of the Dictyotales is found in the northeast, represented mainly by a variety of species of *Dictyopteris*, *Dictyota* and *Padina*. In Itamaracá, this Order is represented by 13 infra-generic taxa, with the best occurrence verified in the genus *Dictyota*, with 6 representatives, tab. 2.

3.4 Chlorophyta

The Chlorophyta constitute the second higher representation in specific diversity among the marine benthic algae, with 45 infra-generic taxa, classified in the Orders Ulvales, Cladophorales, Bryopsidales and Dasycladales, tab. 2. The higher diversity, at the Order level, is among the Bryopsidales that contribute with 60% of the total Chlorophyta, followed by the Cladophorales, with 27%. Among the representatives of first Order are found those typical of tropical environments, such as *Chamaedoris peniculum*, *Ventricaria ventricosa* and *Siphonocladus tropicus*. The Ulvales and Dasycladales present the lower occurrence percentages, that is, 9% and 4%, respectively. Among the

Table 2: List of the Rhodophyta, Ochrophyta and Chlorophyta species in Santa Cruz Channel – Pernambuco – Brazil.

Rhodophyta	*Chondracanthus acicularis* (Roth) Fredericq
Stylonematales	Rhizophyllidaceae
Stylonemataceae	*Ochtodes secundiramea* (Mont.) M. Howe
Stylonema alsidii (Zanardini) K.M. Drew	Solieriaceae
Erythropeltiales	*Agardhiella subulata* (C.Agardh) Kraft & M.J.
Erythrotrichiaceae	Wynne
Erythrotrichia carnea (Dillwyn) J. Agardh	*Meristotheca echinocarpum* (Aresch.) Faye &
Acrochaetiales	Masuda
Acrochaetiaceae	*Solieria filiformes* (Kutz.) P.W. Gabrielson
Acrochaetium agardhiellae A. B. Joly & Cord.-Mar.	Gracilariales
A.hallandicum (Kylin) Hamel	Gracilariaceae
A. microscopicum (Nageli ex Kutz.) Nageli	*G. cervicornis* (Turner) J. Agardh
Corallinales	*G. cuneata* Aresch
Corallinaceae	*G. domingensis* (Kutz.) Sond ex Dickie
Pneophyllum fragile Kutz.	*G. isabellana* Gurgel, Fredericq & J. N. Norris
Corallina oficinalis L.	*G. mammillaris* (Mont.) M. Howe
Jania adhaerens J. V. Lamour.	*Gracilaria* sp
J. rubens (L.) J. V. Lamour.	*Gracilariopsis lemaneiformis* (Bory) Dawson, Acleto
Amphiroa fragilissima (L.) J. V. Lamour.	et Foldvik
A. rigida J. V. Lamour.	*Hydropuntia caudata* (J. Agardh) Gurgel &
Nemaliales	Fredericq
Galaxauraceae	*H. cornea* (J. Agardh) M.J. Wynne
Dichotomaria marginata (J. Ellis & Sol.) Lamark.	Halymeniales
Galaxaura sp	Halymeniaceae
Tricleocarpa cylindrica (J. Ellis & Sol.) Huisman &	*Cryptonemia crenulata* (J. Agardh) J. Agardh
Borow	*Grateloupia cuneifolia* J. Agardh
Scinaiaceae	*Halymenia sp*
Scinaia furcellata (Turner) J. Agardh	Rhodymeniales
Bonnemaisoniales	Rhodymeniaceae
Bonnemaisoniacae	*Botryocladia occidentalis* (Borgesen) Kylin
Asparagopsis taxiformis (Delile) Trevis.	Champiaceae
Ceramiales	*Champia feldmanii* Diaz-Pif.
Stylonematales	**Ochrophyta**
Stylonemataceae	Dictyotales
Stylonema alsidii (Zanardini) K.M. Drew	Dictyotaceae
Erythropeltiales	Dictyopteris delicatula J. V. Lamour.
Erythrotrichiaceae	*D. jamaisensis* W.R. Taylor
Erythrotrichia carnea (Dillwyn) J. Agardh	*D. justii* J. V. Lamour.
Acrochaetiales	*Dicyota bartayresiana* J.V. Lamour.
Acrochaetiaceae	*D. cervicornis* Kutz.
Acrochaetium agardhiellae A. B. Joly & Cord.-Mar.	*D. ciliolata* Sond. ex Kutz.
A.hallandicum (Kylin) Hamel	*D. menstrualis* (Hoyt) Schnetter, Hornig & Weber-
A. microscopicum (Nageli ex Kutz.) Nageli	Peukert
Corallinales	*D. mertensii* (Mart.) Kutz.
Corallinaceae	*D. pulchella* Hornig & Schnetter
Pneophyllum fragile Kutz.	*Lobophora variegata* (J. V. Lamour.) Wormersley ex
Corallina oficinalis L.	E. C. Oliveira
Jania adhaerens J. V. Lamour.	Padina gymnospora *(Kutz.) Sond*
J. rubens (L.) J. V. Lamour.	Padina gymnospora *(Kutz.) Sond.*
Amphiroa fragilissima (L.) J. V. Lamour.	P. santae-crucis *Borgesen*
A. rigida J. V. Lamour.	*Spatoglossum schroederi* (C. Agardh) Kutz
Nemaliales	Chordariaceae
Galaxauraceae	Scytosophonaceae
Dichotomaria marginata (J. Ellis & Sol.) Lamark.	*Colpomenia sinuosa* (Roth) Derbès & Solier
Galaxaura sp	Fucales
Tricleocarpa cylindrica (J. Ellis & Sol.) Huisman &	Sargassaceae
Borow	*Sargassum cymosum* C. Agardh
Scinaiaceae	*S. filipendula* C. Agardh
Scinaia furcellata (Turner) J. Agardh	*S. polyceratium* Mont.
Bonnemaisoniales	*S. vulgare* var. *vulgare* C. Agardh
Bonnemaisoniacae	*S. vulgare* var. *foliosissimum* (J.V. Lamour.) C.
Asparagopsis taxiformis (Delile) Trevis.	Agardh

Table 2: Continued.

Ceramiales
Ceramiaceae
Aglaothamnion uruguayense *(W. R. Taylor) D. Aponte, D. L. Ballant & J. N. Norris*
Ceramium brevizonatum H. E Petersen
C. diaphanum *(Lightf.) Roth*
C. flaccidum (Kutz.) Ardiss.
C. tenerrimum *(G. Martens) Okamura*
Crouania attenuata *(C. Agardh) C. Agardh*
Dohrniella antillarum *(W. R. Taylor) Feldm.-Mas*
Spermothamnion gymnocarpum *M. Howe*
Griffithsia schousboei *Mont.*
Pleonosporium polystichum E. C. Oliveira
Spyridia clavata *Kutz.*
*S. filamentosa (*Wulfen*)* Harv. In Hook
Delesseriaceae
Caloglossa leprieurii (Mont.) G. Martens
Dasyaceae
Dictyurus occidentalis J. Agardh
Heterosiphonia crispella (C. Agardh) M. J. Wynne
H. crispella var. *laxa* (Borgesen) M. J. Wynne
Rhodomelaceae
Acanthophora spicifera (Vahl) Borgesen
Amansia multifida J. V. Lamour.
Bostrychia calliptera (Mont.) Mont.
B. moritziana (Sond ex Kutz.) J. Agardh
B. radicans (Mont.) Mont in Orbigny
B. scorpioides (Gmelin) Montagne
B. tenella (J. V. Lamour.) J. Agardh
Bryothamnion seaforthii (Turner) Kutz.
B. triquetrum (S.G. Gmel.) M. Howe
Chondrophycus papillosus (C. Agardh) Garbary & J. T. Harper
C. perforatus (Bory) K. W. Nam
Digenea simplex (Wulfen) C. Agardh
Dipterosiphonia dentritica (C. Agardh) Schmitz in Eng. & Prantl
Halopithys schottii (W. R. Taylor) L. E Phillips & De Clerck
Enantiocladia duperreyi (C. Agardh) Falkenb
Herphosiphonia secunda (C. Agardh) Ambronn
Laurencia sp
Lophosiphonia obscura (C. Agardh) Falkenb. in Engler & Prantl
Murrayella periclados (C. Agardh) F. Schmitz
Neosiphonia ferulacea (Sur ex J. Agardh) S. M. Guimarães & M. T. Fujii
Osmundaria obtusiloba (C. Agardh) R. E. Norris
Polysiphonia denudata (Dillwyn) Grev. Ex Harv. in Hook
P. howei Hollenb. In W. R. taylor
P. subtilissima Mont.
Gelidiales
Galidiaceae
Gelidium pusillum (Stach.) Le Jolis
Gelidiellaceae
Gelidiella acerosa (Forssk.) Feldmann & Hamel
Gigartinales
Caulacanthaceae
Catenella caespitosa (Wither) L.M. Irvine in Parke & Dixon
Cystocloniaceae
Hypnea musciformis (Wulfen in Jacqu.) J. V. Lamour.
H.spinella (C. Agardh) Kutz
Gigartinaceae

Chlorophyta
Ulvales*Gaylaria oxysperma* K.L. Vinogr. ex Scagel *et al.*
Ulvaceae
Ulva lactuca L.
U. fasciata Delile
Ulva sp
Cladophorales
Anadymenaceae
Anadyomene stellata (Wulfen in Jacq.) C. Agardh
Cladophoraceae
Chaetomorpha aerea (Dillwyn) Kutz.
Chaetomorpha sp
Cladophora sp
Rhizoclonium africanum Kutz.
R. riparium (Roth) Kutz. ex Harv.
Siphonocladaceae
Chamaedoris peniculum (J. Ellis & Solander) Kuntze
Cladophoropsis membanacea (C. Agardh) Borgesen
Dictyosphaeria cavernosa (Forrsk.) Borgesen
D. versluysii Weber Bosse
Siphonocladus tropicus (P.Crouan & Crouan in Schramm & Mazé) J. Agardh
Ventricaria ventricosa (J. Agardh) J. L. Olsen & J. A. West
Bryopsidales
Bryopsidaceae
Bryopsis plumosa (Huds.) C. Agardh
Derbesia marina (Lyngb.) Solier
Codiaceae
Codium decorticatum (Woodw.) M. Howe
Codium isthmocladum Vickers
Caulerpaceae
Caulerpa cupressoides var. *lycopodium* Weber Bosse
C. cupressoides var. *lycopodium* f. *disticha* Weber Bosse
C. fastigiata Mont.
C. kempfii A B. Joly & S. M. B. Pereira
C. lanuginosa J. Agardh
C. prolifera (Forssk) J. V. Lamour.
C. prolifera f. *obovata* (J. Agardh) Weber Bosse
C. pusilla (Kutzing) J. Agardh
C.racemosa var. *occidentalis* (J. Agardh) Borgesen
C. racemosa var. *peltata* (J.V.Lamour.) Eubank
C. racemosa var. racemosa (Forsskal) J. Agardh
C. sertularioides (S.G. Gmel.) M. Howe
C. sertularioides f. *brevipes* (J. Agardh) Sved.
C. verticillata J. Agardh
Halimedaceae
Halimeda discoidea Decne
H. incrassata (J. Ellis) J.V. Lamour.
H. opuntia (L.) J.V. Lamour.
H. tuna (J. Ellis & Sol.) J. V. Lamour
Udoteaceae
Avrainvillea longicaulis (Kutz.) G. Murray & Boodle
Boodleopsis pusilla (Collins) W.R. Taylor, A B. Joly & Bernat.
Penicillus capitatus Lam.
Udotea flabellum (J. Ellis & Sol.) J.V. Lamour
U. occidentalis A. Gepp & E. Gepp.
Dasycladales
Dasycladaceae
Neomeris annulata Dickie
Polyphysaceae
Acetabularia crenulata J. V. Lamour.

Bryopsidales, the most representative families are Caulerpaceae and Udoteaceae, with 32% and 11% of occurrence, respectively. The genus *Caulerpa*, with 7 species, 4 varieties and 3 forms, besides presenting higher diversity among the Chlorophyta, has an important role for the local flora, once some of its representatives, such as *Caulerpa cupressoides*, *C. kempfii*, *C. prolifera* and *C. racemosa*, form extensive meadows in the infra-littoral region, over which develop a varied fauna and flora [4]. Among the genus *Halimeda* the species *H. opuntia*, forms 20 to 30 cm high meadows and provides articles to the biodetrital facies [1, 16]. In the mangroves, were identified the cloroficean *Gayralia oxysperma, Rhizoclonium africanum* and *Cladophoropsis membranacea*.

4 Discussion

The floristic algal diversity in coastal ecosystems depends directly on the action of a variety of environmental factors, which will establish the composition, distribution and variation of the populations. These factors can be chemical, such as the salinity and the nutrients availability; physical, as the luminosity and the nature of the substrata; mechanical, such as the waves and the tides; biological, as the grazing, the parasites and epiphytes action, and the human action itself as destroyer and modifier agent of the environment [7]. In the case of the planktonic microalgae, the physical and chemical factors are the most acting in the development and growing of the populations, mentioning the light, the nutrients availability and the salinity as the most acting. Despite these, the macroalgae also need the presence of suitable substrata.

In the Santa Cruz Channel area, is assumed to have many factors that act in the algae richness and diversity. First, the environmental conditions have to be considered in the area, represented by transparent and nutrient rich waters, essentials for the photosynthesis; second, the habitat diversity, where a variety of substrata is pointed out, such as mangrove roots and steams in the internal area of the channel and reefs lines in the adjacent continental shelf. These factors act together to promote the establishment of different populations, which organisms are distributed according to the circulation patterns, transparency, salinity and occurrence of rocky and motile substrata.

This diversity confirms the ecological importance of the area and intensifies the hypothesis that this place is one of the most productive of the littoral of the State. As a consequence of the phycological diversity, it is natural that also occur a high diversity among the animals, represented by 621 species, constituted by 115 zooplankton species, 134 mollusks, 161 crustaceans, 140 fishes and 71 birds [14]. These animals depend directly on this primary production source, in the various links of the food webs, existing a strong trophic interaction between the phycological flora and the many animals that live in the plankton, benthos and nekton [9]. The ecological characteristics of the phycological flora and its relations with the Santa Cruz Channel and adjacent areas are integrated in a conceptual model presented, fig. 2.

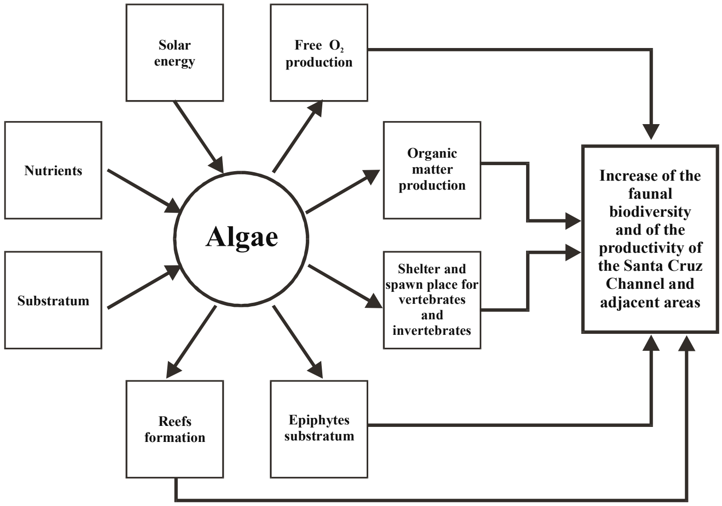

Figure 2: The conceptual model of the Santa Cruz Channel based on ecological characteristics of the phycological flora.

References

[1] Bandeira-Pedrosa, M.E., Pereira, S.M.B. & Oliveira, E.C., Taxonomy and distribution of the green algal genus *Halimeda* (Bryopsidales, Chlorophyta) in Brazil. *Revista Brasileira de Botânica,* **27 (2),** pp. 363-377, 2004.

[2] Eskinazi-Leça, E., Barros, H.M. & Macedo, S.J., Estuarine management in Northeast Brazil: the estuarine complex of Itamaracá (Section 7). *Ecosystems and Sustainable Development* II, eds. C.A Brebbia & J.L Uso, WIT Press: Southampton, pp. 246-255, 1999.

[3] Guedes, E.C., Macedo, J.S.& Pereira, S.M.B., Variação estacional no rendimento de ágar-ágar e carragenano em representantes das Gigartinales (Rhodophyta) no litoral norte do Estado de Pernambuco. *Anais da VIII Reunião Nordestina de Botânica*, ed. Sociedade de Botânica do Brasil: Recife, pp. 83-98, 1985.

[4] Joly, A.B. & Pereira, S.M.B., *Caulerpa kempfii* Joly et Pereira: a new *Caulerpa* from Northeastern Brazil. *Ciência e Cultura,* **27**, pp. 417-419, 1974.

[5] Kempf, M., Notes on the benthic bionomy of N-NE Brazilian shef. *Marine Biology*, **5(3)**, pp. 213-224, 1980.

[6] Koening, M.L. & Macedo, S.J., Hydrology and phytoplankton community structure at Itamaracá – Pernambuco (Northeast Brazil). *Brazilian Archives of Biology and Technology,* **42(4)**, 381-392, 1999.

[7] Lobban, C.S. & Harrison, P.J., *Seaweed ecology and Physiology*. Cambridge University Press: New York, pp. 1-366, 1994.

[8] Medeiros, C.; Macedo, S.J.; Feitosa, F.A.N. & Koening, M.L., Hydrography and phytoplankton biomass and abundance of northeast

Brazilian waters. *Archive of Fishery and Marine Research,* **47 (2-3)**, pp. 133-151,1999.

[9] Neumann-Leitão, S.L. & Schwamborn, R., Interações tróficas no Canal de Santa Cruz. (Chapter 13). *Gerenciamento Participativo de Estuários e Manguezais*, eds. H.M Barros, E. Eskinazi-Leça, S.J.Macedo & T.Lima, Editora Universitária: Recife, pp.163-180, 2000.

[10] Norton, T. A., Melkonian, M. & Andersen, R., Algal Biodiversity. *Phycologia,* **35(4)**, pp. 308-326, 1996.

[11] Oliveira-Carvalho, M.F., Pereira, S. M. B. & Zickel, C.S. Florística e distribuição espaço-temporal das clorofíceas bentônicas em trechos recifais do litoral norte do estado de Pernambuco – Brasil. *Hoehnea*, **30(3)**, pp. 201-212, 2003.

[12] Oliveira, M. C.O., Uso de marcadores moleculares no estudo da biodiversidade. *Anais do IV Congresso Latino-Americano de Ficologia,* ed. Sociedade Ficológica da América Latina e Caribe: Caxambú, pp.179–186, 1998.

[13] Paranaguá, M.N. & Eskinazi-Leça, E., Ecology of Northeastern Tropical Estuary in Brazil and Technological Perspective in Fishculture. *Fish Community Ecology in Estuaries and Coastal Lagoons: Towards and Ecosystem Integration*, ed. A. Ýanez-Arancibia, UNAM Press: Mexico (DC), pp. 595-614, 1985.

[14] Paranaguá, M.N., Neumann-Leitão, S., Melo, R.L.S., Coelho, P.A., Vasconcelos, A.L. & Oliveira, A.M., Management in Northeast Brazil: Faunal Biodiversity. (Section 2). *Ecosystems and Sustainable Development* II, eds. C.A Brebbia & J.L Uso, WIT Press: Southampton, pp. 57- 68, 1999.

[15] Pereira, B.M. & Eskinazi-Leça, E., Estuarine management in Northeast Brazil: Plant Biodiversity (Section 2). *Ecosystems and Sustainable Development* II, eds. C.A Brebbia & J.L Uso, WIT Press: Southampton, pp. 70-77, 1999.

[16] Pereira, S.M.B., As algas bentônicas. (Chapter 5). *Gerenciamento Participativo de Estuários e Manguezais*, eds. H.M Barros, E Eskinazi-Leça, S.J.Macedo & T.Lima, Editora Universitária: Recife, pp.49-66, 2000.

[17] Pereira, S.M.B., Oliveira-Carvalho, M.F., Angeiras, J.A.P., Bandeira-Pedrosa, M.E., Oliveira, N.M.B., Torres, J., Gestinari, L.M.S., Cocentino, A.L.M., Santos, M.D., Nascimento, P.F. & Cavalcanti, D.R., Algas marinhas bentônicas do Estado de Pernambuco. (Capítulo 5) *Diagnostico da Biodiversidade de Pernambuco*, orgs. M. Tabarelli & J.M.C. Silva, Editora Massangan/SECTMA: Recife, 1, pp. 97-124, 2000.

[18] Silva, R.L., Pereira, S.M.B., Oliveira Filho, E.C. & Eston, V. R. Structure of a bed *Gracilaria* spp. (Rhodophyta) in Northeastern Brazil. *Botanica Marina*, **30**, pp. 517-523,1987.

[19] Torres, J.; Pereira, S.M.B. & Yoneshigue-Valentin, Y., Ceramiaceae (Rhodophyta) de áreas recifais do estado de Pernambuco, Brasil. *Hoehnea*, **31(3)**, pp. 201-212, 2004.