Management in northeastern Brazil : faunal biodiversity

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Abstract

A total of 618 taxa were identified to Itamaracá ecosystem. Of these, 113 were benthic mollusks, 177 benthic crustaceans, 140 fish, 71 birds, 116 zooplankton and 1 species of sea mammal. Taxonomic biodiversity was high considering a mangrove estuarine area. The coexistence of these taxa confirm the importance of the estuarine complex of Itamaracá as a feeding, breeding, maturation and protection area, which in turn confers special interest in preserving the existent resources. In spite of numerous indiscriminate activities carried out in this area, the pollution bioindicators are generally restricted to the estuaries of the rivers, meaning that the area has high resilience. There is a strong marine influence which allows for the preservation of the biodiversity.

1 Introduction

The estuarine complex of Itamaracá is located at the north coast of the state of Pernambuco, northeastern Brazil (7°32'- 8°56'S and 34°49'- 35°11'W), and it consists of the Santa Cruz Channel, a U-shaped channel of 20 km length with two connections to the Atlantic Ocean and 5 small rivers draining into the channel (Figure 1). The system sustains 36 km^2 of mangrove forests, dominated

by *Rhizophora mangle*, *Laguncularia racemosa* and *Avicennia* spp. Mangrove forests are usually separated from terrestrial vegetation by a disrupted belt of saltflats, typically composed by *Sesuvium* sp. and gramineans. Towards the shelf, the estuarine system is delimited by arenite reefs. Between the reefs and Itamaracá Island, a shallow (0.5 to 2 m depth) coastal basin is formed. In these areas, patches of seagrass *Halodule wrightii* create a distinct environment (Medeiros & Kjerfve[5]; Schwamborn[8]).

Due to its ecological characteristics, there is a strong trophic interaction between the communities caused by the shallow water, the intense dynamics of the tides and the mangrove contribution of a high load of particulate and dissolved organic matter. In consequence, the social-economic value of this estuarine mangrove complex is very high, as expressed by the intense fishing carried out in this area, up to 800 tons.yr^{-1}.

In this paper, the diversity of the zooplankton, mollusks, crustaceans and fish is used as tools to monitor the "health" of Itamaracá, to indicate the effects of various anthropogenic and other intrusions to access manegement procedures.

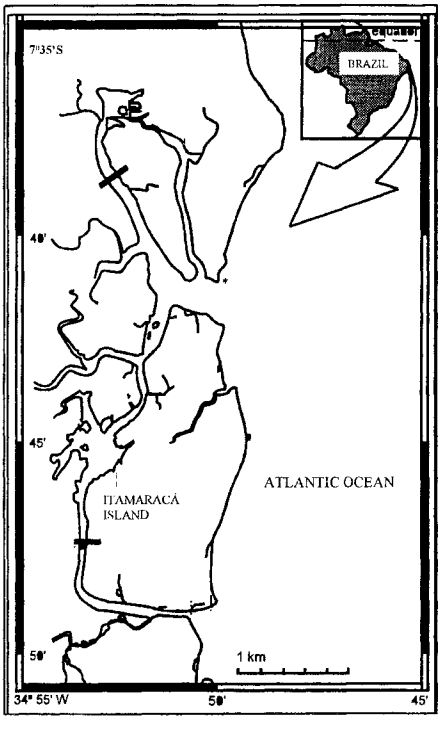

Figure 1. Localization of the studied area (after Schwamborn,1997)

2 Results and Discussion

2.1 Zooplankton

The Itamaracá ecosystem serves as a nursery for several larvae of mollusks, crustaceans and fish (Paranaguá & Eskinazi[7]; Schwambom[8]). Zooplankton biodiversity in this ecosystem is high with a total of 116 taxa, considering the smallest unit possible to be identified for each group (Table 1). Copepoda was dominant (28 species) followed by Decapoda (19 species) and Tintinnida (15 species). The holoplankton predominated (65 taxa) in relation to meroplankton (40 taxa) and tycoplankton (11 taxa).

The zooplankton composition presented a low variability throughout the entire area. Differences were caused by small scale patchiness due transversal convection and temporal release of meroplanktonic larvae. The general pattern was an increase in diversity towards the coastal area, where abiotic conditions are more stable.

Protozoa was represented by Testacea, Radiolaria and Foraminiferida, this last one mostly composed of benthic species. Tintinnina presented 15 species and they are frequently found in coastal ecosystems of northeastern Brazil. Cnidaria presented 3 species, of which *Lyriope tetraphyla* is frequent in coastal regions; *Ostrumovia inkermanica* and *Blackfordia virginica* occur frequently in estuaries of Itamaracá. Ctenophora was abundant all over the area, mainly the *Beroe* genus.

Platyhelminthes was present with a larval stage of a benthic specie spread out along the littoral area of the channel. Aschelminthes was composed by Nematoda and Rotifera. Nematoda had a high number of benthic species, mostly in areas of high organic matter decomposition. Species identification of this group is urgently needed. Ten Rotifera species were identified most of them restricted to the Botafogo River estuary, and according to Neumann-Leitão *et al.*[7] forming a group of organic pollution indicators.

Mollusca was represented by the larval stages of Gastropoda and Bivalvia (3 species each). Polychaeta was the only class of Annelida, mostly represented by larval stages of Spionidae and Nereiidae families.

Crustacea was dominant outranking Copepoda (28 species) and Decapoda larvae (19 taxa). Among the Copepoda *Paracalanus crassirostris, Acartia lilljeborgi, Oithona hebes, and Euterpina acutifrons* were abundant, all forming a typical group of the Brazilian estuaries.

Decapoda had high larval abundance of the commercial species *Penaeus* spp, *Callinectes* spp, *Aratus pisoni*, and *Ucides cordatus*. Insecta larvae was significative around the nangrove areas. Bryozoa, Phoronidea and Echinodermata were represented by a few larvae mostly found in the coastal area associated to the seagrass meadows.

Chaetognatha was present with *Sagitta tennuis*, more abundant along the channel. Chordata had 2 Larvacea species, and 1 Ascidiacea and 1

Cephalocordata species in the larval stage, all dominating in the channel outlets. Fish larvae and eggs were abundant all over the area.

Table 1 – Zooplankton from the Itamaracá ecosystem, Pernambuco (Brazil)

PROTOZOA	*Keratella americana*	*Euterpina acutifrons*
Testacea	*Lecane curvicornis*	*Farranula gracilis*
Arcella vulgaris	*Lecane closterocerca*	*Triguiopus* sp
Arcella dentata	*Cephalodella* sp	*Metis* sp
Centropyxis acureata	*Trichocerca elongata*	Cirripedia
Radiolaria (Spumellaria)	Nematoda	*Balanus* sp (nauplius and cypris)
Foraminiferida	MOLLUSCA	Cumacea
Textularia sp	Gastropoda	Isopoda (larvae)
Quinqueloculina sp	*Bitium varium* (veliger)	Amphipoda
Triloculina sp	*Smaragdia viridis* (veliger)	Decapoda
Discorbis mira	*Tricolia affinis* (veliger)	*Acetes americanus* (larvae)
Planispirulina denticulata	Bivalvia	*Atya* sp (larvae)
Globigerinoides ruber	*Anomalocardia brasiliana* (veliger)	*Penaeus* sp (mysis)
Globorotalia menardii	*Mytella falcata* (veliger)	*Lucifer faxoni* (larvae and adult)
Tretomphalus bulloides	*Crassostrea rhyzophorae* (veliger)	*Periclimenes longicaudatus* (larvae)
Amphistegina sp	ANNELIDA – Polychaeta	*Lysmata* spp (larvae)
Tintinnina	Spionidae (larvae)	*Callianassa* spp (larvae)
Leprotintinnus nordqvisti	*Sabellaria* sp (larvae)	*Paguristes* spp (larvae)
Tintinnopsis directa	*Nereis* sp (larvae)	*Petrolisthes* spp (l larvae)
Tintinnopsis brasiliensis	CRUSTACEA	*Polyonyx* spp (larvae)
Tintinnopsis compressa	Ostracoda	*Porcellana* spp (larvae)
Tintinnopsis mortensenii	Copepoda	*Callinectes* spp (larvae)
Tintinnopsis tocantinensis	*Clausocalanus furcatus*	*Pinotheres* spp (larvae)
Tintinnopsis sp	*Eucalanus pileatus*	*Sesarma rectum* (zoea)
Codonellopsis morchella	*Paracalanus quasimodo*	*Uca maracoani* (zoea)
Coxliella annulata	*Paracalanus crassirostris*	*Aratus pisoni* (zoea)
Favella ehrenbergii	*Centropages velificatus*	*Uca leptodactyla* (zoea)
Rhabdonella spiralis	*Temora turbinata*	*Uca burgersi* (zoea)
Amphorellopsis acuta	*Temora stylifera*	*Ucides cordatus* (zoea)
Eutintinnus tenuis	*Pseudodiaptomus acutus*	Syncarida (*Batynella* sp)
Epiplocylis sp	*Pseudodiaptomus richardi*	INSECTA (larvae)
Undella sp	*Pseudodiaptomus marshi*	BRYOZOA (cyphonauta)
CNIDARIA	*Calanopia americana*	PHORONIDEA (actinotroca)
Lyriope tetraphyla	*Labidocera fluviatilis*	ECHINODERMATA
Blackfordia virginica	*Lucicutia flavicornis*	Echinoidea (pluteus)
Ostrumovia inkermanica	*Acartia lilljeborgi*	CHAETOGNATHA
CTENOPHORA – *Beroe* sp	*Oithona nana*	*Sagitta tenuis*
PLATYHELMINTHES	*Oithona hebes*	CHORDATA
Convoluta sp	*Oithona oswaldocruzi*	Larvacea
ASCHELMINTHES	*Hemicyclops talassius*	*Oikopleura longicauda*
Rotifera	*Oncaea* sp	*Oikopleura dioica*
Rotaria rotatoria	*Corycaeus giesbrechti*	Ascidiacea
Rotaria sp	*Corycaeus speciosus*	*Ciona* sp (larvae)
Brachionus bidentata f. *inermis*	*Saphirina* sp	Cephalochordata
Brachionus plicatilis	*Clytemnestra scutelata*	*Branchiostomus* (larvae)
Keratella tropica tropica	*Microsetella rosea*	Osteichthyes (egg and larvae)

2.2 Mollusca

The mollusks were represented by the Gastropoda (78 species), Bivalvia (32 species), Polyplacophora (1 specie) and Scaphopoda (2 species) (Table 2).The class Gastropoda Mesogastropoda presented the highest taxonomic diversity at Itamaracá ecosystem. *Neritina virginica, Nassarius vibex, Cerithium atratum* and *Bittium varium* were found associated to seagrass meadows. The *Littorina angulifera, L. lineolata* and *L. flava* occurred under mangrove leaves and stems; the Collumbellidae (9 species) and Olividae (6 species) under small rocks; and the Pyramidellidae (10 species) and Caecidae (5 species), in the muddy sediment under mangrove roots. Bivalvia had lower taxonomic diversity. Among the economical importance bivalves it can be cited: *Anomalocardia brasiliana, Crassostrea rhizophorae, Mytella falcata, Tagelus plebeius, Iphigenia brasiliana, Protothaca pectorina, Lucina pectinata* e *Tivela mactroides.* Species of the bivalve family Mytilidae was strongly associated with eutrophic environments at Itamaracá ecosystem.

2.3 Crustacea

The diversity of crustaceans was high and apart planktonic species a total of 177 species were identified (at least to genus level). The microcrustaceans or parasitic crustaceans like Cladocera, Ostracoda, Rhizocephala and Cumacea were just referred as a group. Taxonomic identification is presented to Copepoda, Thoracica, Stomatopoda, Amphipoda, Isopoda and Decapoda.

Non-planktonic Copepoda studies are still recent. For this reason, only the parasitic species or the meiobenthos are cited: *Acanthocolax sp., Canuella sp., Caligus minimus, C. elongatus, Cyclopina sp., Ectinosoma sp., Ergasilus atagonensis, E. caraguatatubensis, E. lizae, Heterolaephonte sp., Leptocaris sp., Lernanthropus gisteri, Longipedia sp., Robertsonia sp., Stenhelia* cf. *Normani* and *Stenhelia sp.*

The Thoracica were attached to hard substracts or living in association with other animals. To Itamaracá ecosystem 11 species are known. The Archaeobalanidae family constituted by *Chirone (Striatobalanus) amaryllis* is usually covered by sponges or other cirripeds. Balanidae was represented by *Balanus amphitrite, B. improvisus, B. reticulatus, B. trigonus, B. venustus* and *Fistulobalanus citerosum.* Chthamalidae by *Chthamalus bisinatus, C. proteus* and *Euraphia rhizophorae.* All these species were found under mangroves trees or rocks. The Coronulidae was represented by *Chelonibia patual,* found under the shell of *Callinectes exasperatus.*

Stomatopoda, essentially marine, presented 2 species, one belonging to Squillidae *(Chloridopsis dubia)* and other to Pseudosquillidae *(Pseudosquilla ciliata).* Amphipoda was present with 11 estuarine species: *Paragrubia* sp., *Cymadusa* sp., *Sunamphitoe* sp., *Hyale* sp., *Hyale nilssoni, Talitrus saltator, Orchestria gamarella, O. montagui, O. platensi, Orchestia* sp. and *Allorchestes* sp.

Isopoda was presented with 13 species: *Rocinela signata, Aegathoa linguifrons, Anilocra laticauda, Cymothoa excisa, Livoneca redmanni, Cassidinidea fluminensis, Pseudosphaeroma jakobii, P. mourei, Sphaeroma terebrans, Bopyrella slphe, Leidya distorta, Probopyrus bithynis* and *Ligia olfersii. Rocinela, Aegathoa, Anilocra, Cymothoa* and *Livoneca* are parasites of different species of fish and *Bopyrella* and *Probopyrus* are found in the branchial chambers of *Alpheus* and *Macrobachium. Leidya* is also found in the respiratory chambers of the crab *Ucides cordatus*. The other species, except for *Ligia,* were found preying on mangroves trees.

Table 2 – Mollusca from the Itamaracá ecosystem, Pernambuco (Brazil).

GASTROPODA	*Costoanachis catenata**	*Bulla striata*
Smaragdia viridis	*Parvanachis isabellei**	BIVALVIA
Tricollia bella	*Olivella petiolita***	*Diplodonta punctata*
Tricolia affinis	*Olivella minuta***	*Ostrea equestris*
Neritina virginea	*Olivella mutica***	*Crassostrea rhizophorae*
Parviturbo rehderi	*Olivella floralia **	*Anadara notabilis*
Parviturboides interruptus	*Olivella watermani***	*Anadara ovalis*
Episcynia inornata	*Olivella nivea***	*Barbatia candida*
Rissoina bryerea	*Volvarina avena*	*Arca umbonata*
Rissoina catesbyana	*Mangelia biconica*	*Arcopsis adamsi*
Zebina browniana	*Mangelia stellata*	*Tivela mactroides*
Cerithium atratum	*Kurtziella dorvillae*	*Anomalocardia brasiliana*
Bittium varium	*Tenaturris decora*	*Protothaca pectorina*
Cerithiopsis greenii	*Buchema interpleura*	*Transenella cubaniana*
Seila adamsi	*Brachycytara galae*	*Chione cancellata*
Alaba incerta	*Tenaturris fulgens*	*Corbula caribaea*
*Caecum floridanum****	*Epitonium denticulatum*	*Iphigenia brasiliana*
*Caecum ryssotitum****	*Epitonium candeanum*	*Tagelus plebeius*
*Caecum pulchellum****	*Epitonium novangliae*	*Tagelus divisus*
*Caecum imbricatum****	*Epitonium nautlae*	*Sanguinolaria cruenta*
*Caecum striatum****	*Thais haemastoma*	*Tellina lineata*
Littorina angulifera	*Nassarius vibex*	*Tellina punicea*
Littorina lineolata	*Turbonilla haycocki****	*Macoma constricta*
Littorina flava	*Turbonila fasciata****	*Strigilla mirabilis*
Natica menkeana	*Turbonilla interrupta****	*Mytella falcata*
Natica canrena	*Turbonilla (Pyrgiscus) elegans****	*Modiolus americanus*
Balcis intermedia	*Turbonilla multicostata****	*Brachidontes solicianus*
Triphora nigrocincta	*Turbonilla(Turbonilla) aff. Turris****	*Brachidontes exustus*
Triphora ornata	*Odostomia jadisi****	*Divalinga quadrisulcata*
Modulus modulus	*Odostomia canaliculata****	*Lucina pectinata*
Trivia pediculus	*Odostomia laevigata****	*Trachycardium muricatum*
Truncatella pulchella	*Peristichia agria****	*Laevicardium laevigatum*
*Parvanachis obesa**	*Iselica anomala*	*Ervilia nitens*
*Mitrella lunata**	*Atys sandersoni*	*Ervilia subcancellata*
*Aesopus metcalfei**	*Atys caribaea*	POLYPLACOPHORA
*Collumbella mercatoria**	*Haminoea antillarum*	***Ischnochiton striolatus***
*Mitrella ocellata**	*Acteocina bullata*	SCAPHOPODA
*Anachis sertulariarum**	*Bursatella leachii*	***Dentalium americanum***
*Anachis avara**	*Aplysia dactylomela*	***Graptacme calamus***

Collumbellidae* Olividae** Pyramidellidae *** Caecidae****

Decapoda is the best known group in the area and sum up a high percentage of the fisheries at Itamaracá. Some species are parasites or live on a variety of invertebrates as polychaetes, equinoderms, mollusks and other crustaceans. Although high in diversity (124 species), this corresponds to 37.6% of the marine decapod cited by Coelho & Ramos-Porto[2] for the estuarine and marine area (including the continental shelf) of Pernambuco and neighboring states. Stenopodidea and Astacidea were not registered to Itamaracá.

Penaeidea includes 8 species, 5 of the Penaeidae family: *Penaeus notialis, P. schmitti, P. suntilis, P. brasliensis* and *Xiphopenaeus kroyeri*, this last rarely found in the environment, indicate marine influence. Sicyoniidae presented: *Sicyonia typica, S. laevigata* and *S. dorsalis*.

Caridea is represented by 6 families (35 species) of freshwater and typically marine species. In the Atyidae a freshwater species (*Potimirim potimirim*) was found. The Pasiphaeidae were represented by *Leptochela serratorbita.* Two other families, with few species, are the Hippolytidae (*Latreutes parvulus* and *Merguia rhizophorae)* and Processidae (*Ambidexter symmetricus).* Palaemonidae presented 9 species (*Leander paulensis, L. tenuicornis, Macrobrachium acanthurus, M. heterochirus, Palaemon northropi, P. pandaliformis, Periclimenes americanus, P. longicaudatus and Typton distinctus*) and Alpheidae 13 species (*Alpheus armillatus, A. bouvieri, A. chacei, A. estuariensis, A. floridanus, A. normanni, Automate evermanni, Leptalpheus petronii, Salmoneus ortmanni, Synalpheus apiocerus, S. brevicarpus, S. fritzmuelleri* and *S. minus).* Palinuridea presented only *Panulirus argus* (Palinuridae).

Thalassinidea needs to be better studied, and probably there are a larger number of species, of which 3 Callisanassidae are known at present *(Lepidophthalmus siriboiajamaicense, Neocallichirus rathbunae* and *Sergio guassutinga.),* one Laomediidae *(Ctenaxianassa australis*) and 2 Upogebiidae *(Upogebia noronhensis* and *U. omissa*), totaling 7 species.

Anomura are predominantly marine and is represented by 5 families with 12 species. Paguridae is represented by *Pagurus criniticornis,* Diogenidae by *Clibanarius antillensis, C. sclopettarius, C. vittatus, Dardanus venosus* and *Petrochirus diogenes,* Porcellanidae by *Minyocerus angustus, Pachycheles greeleyi, Petrolisthes armatus* and *P. galathinus*, Hippidae by *Emerita portoricensis* and Albuneidae by *Lepidopa richmondi.*

Brachyura with 61 species accounts for nearly one third of the known crustaceans and half of the Decapoda species. All habitats are inhabited at least by one specie of this group. Most marine families were represented by 1 or 2 species, such as Calappidae (*Calappa ocellata),* Leucosiidae *(Lithadia brasiliensis*), Parthenopidae (*Hepatus pudibundus* and *Mesorhoea sexspinosa*) and Eriphiidae (*Eriphia gonagra).* Exception is the Maiidae represented by 7 species (*Acanthonyx dissimulatus, Epialtus bituberculatus Hemus cristulipes, Microphrys bicornutus, M. interruptus, Mithrax hispidus* and *Notolopas brasiliensis*). Pilumnidae, best known in seawater environment, has 3 species in

the studied area (*Pilumnus caribaeus, P. dasypodus* and *P. reticulatus).* Xanthidae with 17 species is the largest group in number of species (*Cyrtoplax spinidentata, Eurypanopeus dissimilis, Euryplax nitida, Eurytium limosum, Hexapanopeus angustifrons, H. caribbaeus, H. hemphilli, H. paulensis, H. quinquedentatus, H. schmitti, Menippe nodifrons, Panopeus americanus, P. bermudensis, P. harttii, P. lacustris, P. occidentalis* and *Panoplax* sp.). In holes dug in finer and more fluid sediment by *C. spinidentata* a diverse fauna was found, including 2 species of the shrimp *Alpheus* and *Salmoneus*, one stomatopod *(Cloridopsis)* and 3 fishes *(Gobionellus smaragdus, G. boleosoma* and *Erotelis smaradgus smaragdus).*

Portunidae was represented by *Arenaeus cribrarius* (very rare), *Callinectes bocourti, C. danae, C. exasperatus, C. larvatus* and *C. ornatus.* The Pinnotheridae with 6 species were associated to polichaetes, equinoderms, mollusks and other crustaceans (*Dissodactylus criniticheliS, Pinnixa aidae, P. chaetopterana, P. leptodactyla, P. sayana* and *Zaops ostreum).*

The Ocypodidae with 10 species (*Ocypode quadrata, Uca burgersi, U. cumulanta, U. leptodactyla, U. maracoani, U. mordax, U. rapax, U. thayeri, U. vocator* and *Ucides cordatus*) and the Grapsidae, with 8 species (*Aratus pisonii, Armases angustipes, Cyclograpsus integer, Goniopsis cruentata, Pachygrapsus gracilis, P. transversus, Sesarma crassipes* and *S. rectum*) dominated the environment. Gecarcinidae family presented one specie, *Cardisoma guanhumi.*

2.4 Fishes

The ictiofauna of the Itamaracá ecosystem is composed of 140 species. Two species belong to the Chondrichtyes (*Narcine brasiliensis* and *Dasayatis guttata).* The low number of Chondrichthyes seems to be a characteristic of estuarine environments in northeastern Brazil. It is possible that the Chondrichthyes do not find adequate conditions in the local estuarine waters for their feeding and reproduction. All the other species belong to the Osteichthyes class. The most representative families were: Carangidae (9 species), Gerreidae and Scianenidae (8 species, each), Gobiidae (7), Engraulidae, Haemulidae and Lutjanidae (6 species, each), Ariidae and Paralichthyidae (5 species, each) and Eleotridae, Soleidae and Syngnathidae (4 species, each). All other families were represented by 3 or less species.

The fishes species were grouped into 3 categories: resident, saltwater dependent and saltwater visitor. The residents include 24 species (Table 3) and spend all their life cycle in the estuary, although they are sometimes found in coastal areas or in freshwater. The saltwater dependents include 43 species (Table 4) and enter the estuary for feeding or reproduction. The saltwater visitors include 73 species (Table 5) spend their life in the sea, occasionally or regularly venturing into estuarine waters.

The 138 Osteichthyes species are commonly found in tropical estuaries. Among the species found at Itamaracá ecosystem, *Poecilia vivipara* classified as

resident is the only specie of freshwater origin, although it is not a true freshwater species, because it reproduces in all salinities range from freshwater to seawater, and is usualy referred as a complete eurihaline specie. Other residents, have their origin in the marine habitat. Some prefer freshwater to saltwater, such as Eleotridae and some Gobiidae. These families frequently move from the sea to freshwater. The rest of the species are commonly found in the coastal shallow waters (Eskinazi[3]; Vasconcelos Filho *et al.*[9]).

The saltwater dependent species, although smaller in number than the visitors are very important, because they characterize the estuarine ictiofauna, such as *Mugil* spp., *Centropomus* spp., *Diapterus* spp., *Eucinostomus* spp., *Eugerres brasilianus* and *Gerres cinereus.*

The visitors are usually young, and some have commercial value, such as Lutjanidae, Carangidae, Haemirhamphidae, Serranidae, Lobotidae, Haemulidae, Sparidae, Scianidae and Scombridae. These families show the importance of the Itamaracá area as a nursery ground. Some species inhabit rocky areas (*Gymnotorax* spp., *Pomocanthus paru, Abudefduf saxtilis, Chaetodon* spp., *Pomacentrus variabilis, Acanthurus spp.* and *Amanses (Cantherines pullus),* a substract not common in estuarine environments.

Table 3 - Residents fishes at Itamaraca ecosystem, Pernambuco, Brazil

Achirus achirus	*Evorthodus lyricus*	*Shpoeroides splengeri*
Achirus declives	*Gobionellus boleosoma*	*Shpoeroides testudineus*
Achirus lineatus	*Gobionellus oceanicus*	*Symphurus plagusia*
Bathygobius soporator	*Gobionellus smaragdus*	*Arius herzbergii*
Cathorops spixii	*Gobionellus stigmaticus*	*Arius parkeri*
Dormitator maculatus	*Gobionellus stomatu*	*Arius proops*
Erotelis smaragdus smaragdus	*Guavina guavina*	*Trinectes maculatus*
Erotelis civitatum	*Poecilia vivipara*	*Xenomelaniris brasiliensis*

Table 4 - Marine dependent fishes at Itamaraca ecosystem, Pernambuco, Brazil

Anchoa filifera	*Eucinostomus gula*	*Oligoplites palometa*
Anchoa januaria	*Eucinostomus havana*	*Oligoplites saliens*
Anchoa tricolor	*Eucinostomus melanopterus*	*Oligoplites saurus*
Anchovia clupeoides	*Eucinostomus lefroy*	*Ophioscion microps*
Bairdiella ronchus	*Eugerres brasilianus*	*Paralichthys brasiliensis*
Bothus ocellatus	*Gerres cinereus*	*Paralichthys orbignyana*
Centropomus parallelus	*Hyporhamphus unifasciatus*	*Polydactylus virginicus*
Centropomus undecimalis	*Lile piquitinga*	*Sphyraena barracuda*
Chaetodipterus faber	*Lycengraulis grossidens*	*Stellifer brasiliensis*
Citharichthys crossotus	*Menticirrhus martinicensis*	*Stellifer rastrifer*
Citharicthys spilopterus	*Micropogonias furnieri*	*Strongylura marina*
Cynoscion acoupa	*Mugil curema*	*Strongylura timucu*
Cynoscion leiarchus	*Mugil liza*	*Syacium micrurum*
Diapterus olisthostomus	*Mugil trichodon*	*Trichiurus lepturus*
Diapterus rhombeus		

Table 5 – Marine visitors fishes at Itamaraca ecosystem, Pernambuco, Brazil

Abudefduf saxatilis	*Epinephelus itajara*	*Ogcocephalus vespertilio*
Acanthurus bahianus	*Fistularia tabacaria*	*Opisthonema oglinum*
Acanthurus chirurgus	*Geniatremus luteus*	*Orthopristes ruber*
Albula vulpes	*Gymnothorax funebris*	*Phrynelox scaber*
Amanses (Cantherines) pullus	*Gymnothorax moringa*	*Pomacanthus paru*
Amphichthys criptocentrus	*Gymnothorax nigromarginatus*	*Pomacentrus variabilis*
Anisotremus virginicus	*Haemulon aurolineatum*	*Pomadasys corvinaeformis*
Archosargus rhomboidalis	*Haemulon parrai*	*Prionotus alipionis*
Archosargus unimaculatus	*Harengula clupeola*	*Prionotus punctatus*
Bagre marinus	*Hemirhamphus brasiliensis*	*Pseudupeneus maculatus*
Canthigaster rostratus	*Hippocampus hudsonius*	*Rypticus randalli*
Caranx hippos	*Hippocampus reidi*	*Scomberomorus brasiliensis*
Caranx latus	*Lacthophrys trigonus*	*Scorpaena plumieri*
Cetengraulis edentulus	*Lacthophrys triqueter*	*Selene setapinnis*
Chaetodon aculeatus	*Lobotes surinamensis*	*Selene vomer*
Chaetodon striatus	*Lutjanus analis*	*Sparisoma radians*
Chilomycterus spinosus	*Lutjanus apodus*	*Syngnathus duncheri*
Chloroscombrus chrysurus	*Lutjanus griseus*	*Sygnathus elucens*
Colomesus psittacus	*Lutjanus jocu*	*Synodus foetens*
Cynopontius savana	*Lutjanus synagris*	*Synodus poey*
Dactylopterus volitans	*Megalops atlanticus*	*Thalassophryne montevidensis*
Dasyatis guttata	*Myrichthys oculatus*	*Thalassophryne nattereri*
Diodon hystrix	*Narcine brasiliensis*	*Tomicodon fasciatus fasciatus*
Echeneis naucrates	*Ocyurus crysurus*	*Trachinotus falcatus*
Elops saurus		

2.5 Bird and mammal

It was registered a total of 71 birds residents and migrants. The migrant birds use the Itamaracá ecosystem as a forage, plumage change and weight gain area before returning to the Arctic for reproduction, showing that this ecosystem has more than a local importance (Azevedo Junior[1]).

There is just one specie of marine mammal *Trichechus manatus* strongly associated with the seagrass meadows and it is now under a protection program to avoid its extinction.

3 Conclusions

The Itamaracá ecosystem is an important socio-economical area and the high species diversity is thought to be maintained by habitat heterogeneity. In spite of the exploitation of this ecosystem, the pollution bioindicators seem to be more restricted to the rivers estuaries, very polluted areas according to Macedo *et al*[4]. Many organisms are living in their limits and may be excluded due to further stress as the loss of natural habitat converted to other uses.

The magnitude of the problem of species decline and loss is so great and growing so rapidly that calls to save endangered species are starting to be replaced by calls to save endangered ecosystems. This sensible, if politically

difficult, approach requires a great deal of biological knowledge in order to be effective. Protecting Itamaracá ecosystem requires the development of ways to monitor ecosystem health; the most effective ways seem to resolve around monitoring assemblages of organisms within the ecosystem.

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