Selection of Candidate Fish Species for Farming in the Bay of Guaratuba, Brazil

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ABSTRACT

An inventory of the maximum length (ML) reached by 57 species of fishes living in the mangrove of Guaratuba, Brazil, was undertaken with an aim to evaluate the relationship between the ecosystem and the size of individuals. For each of these species, the maximum length found in the region were compared with those available in existing literature. The majority of populations presented individuals whose length reached at least 40% than the known maximum length for the species, although only 19.3% were longer than 300mm in absolute value. Population of the other species were represented only by individuals either in their initial development phases, or reduced length as compared to the maximum length known elsewhere for the same species. In this mangrove, species having the largest relative size are generally those that had the smallest absolute length. Proposed is use of an index LR (maximum observed lengths/maximum available lengths) as a tool for description and comparison of fish assemblages. Observations of the maximum size make possible the pre-selection of 12 species for breeding tests. In combining the biological, technical and commercial parameters, the pre-selection retains as primordial the following species: Centropomus parallelus, Centropomus undecimalis, Menticirrhus americanus and Micropogonias furnieri.

Key words: Maximum length; Selection; Fish; Aquaculture; Mangrove.

INTRODUCTION

During the last few years in Brazil, both the public and those at the governmental level have recognized the importance of aquaculture development (Borghetti, 1996). The national fishing supplying, either industrial or artisanal, remains irregular mainly because of the seasonality of exploitable fish resources. The production provided by aquaculture could allow the partial regulation of the market. However this activity is still little developed in Brazil as aquaculture production occupies only the 33th international rank in 1995. That is the reason why the Ministry of Agriculture planned to launch programs aiming specially to develop the production of aquatic organisms, particularly that of aquaculture.

This study was conduced in the Guaratuba Bay, a subtropical ecosystem of 45km^2 situated at the south of Brazil (25°52'S;48°39'W). The objective was to select species for fish culture in characterizing those reaching a sufficient commercial size and showing the best potentialities for rearing tests. First of all, it is necessary to consider that every paralic ecosystem (lagoons and estuaries) is currently considered as an environment playing a nursery role and rich in small-sized fish. This reduces the welcome and the maintenance of species whose individuals have an important length. Moreover, for some of them this environment is likely to cause a growth rate reduction (Frisoni

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et al., 1984), particularly sedentary species occupying confined zone. This leads to the "lagoonar very small size the coastal characteristic", evoked in several works (Kiener, 1978; Guelorget & Perthuisot, 1983), that involves semi enclosed ecosystems aptitude to favor the fish growth.

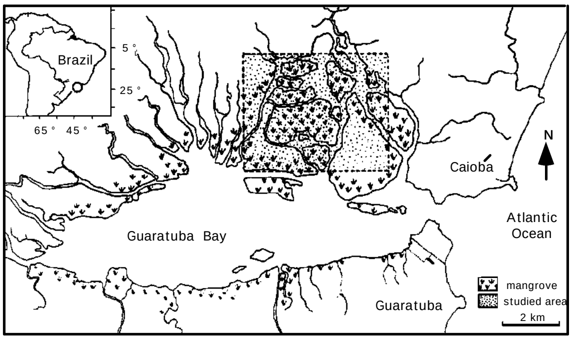

Figure 1. Sampling places in the Guaratuba Bay, Brazil (25°52'S; 48°39'W).

One can consider that the dominance of small size fishes in any assemblage occupying a coastal ecosystem is the result of both associations. Although individuals of some populations attain a very large length, juveniles and sub adults are always the most numerous, which, consequently, favors the smallest lengths in the structure of their population. Populations of several species that frequent the system are exempt of large-sized individuals. The exclusive presence of reduced length individuals can be explained at the following levels: 1. specific, if the individuals belong to species whose maximum size is naturally reduced; 2. populational, if the populations to which they belong, in the mangroves present a slower and/or limited growth when compared with that met in same species populations in other ecosystems; 3. ecophase, if the ecosystem only welcomes the life cycle initial stages of the individuals of these populations.

Obviously these reasons are not mutually exclusive to each other, and it is theoretically probable that several of them are acceptable to explain the composition of some assemblage. In our present study, we planned therefore to analyze maximum length reached by fishes occupying the mangrove of Guaratuba in order to show for each species the possible limiting factors which could explain the size reduction. In addition to pre-selection of species for farming purpose, attributes of size have also been considered according to Legendre & Albaret's recommendations (1991).

METHODS

Sixty species of fishes recorded by Chaves & Corrêa (1998) in the mangrove part of the Guaratuba Bay, Brazil (25°52'S;48°39'W) were used in this study (Fig. 1). Monthly samples were collected by experimental fishing from July 1993 to February 1997 (except May 1995). The main engine used was the benthic trawl (20mm stretched mesh), but during the first two months, the sweep net and the tow seine (mesh size between 40 and 120mm) were also used. In addition to taxonomic identification, biometry and biological individual analysis were undertaken. For comparison, the available data analysis on the maximum length known for these species according to works of Figueiredo (1977), Figueiredo & Menezes (1978), Figueiredo & Menezes (1980), Menezes & Figueiredo (1980), Menezes & Figueiredo (1985) and Cervigón *et al.* (1992) were used. For this purpose, several references concerning each present species in the region were examined. When at least two of them presented differences as compared to the maximum length observed for a given species and a given region, the species closest to the populations of the southern region of Brazil (Guaratuba Bay) were taken as reference. When lengths (in mm) quoted in the literature were inferior to the maximum observed length in the Guaratuba Bay, this last was considered as the maximum available length.

From these data for each species, LR index, the report between the maximum observed length (MOL) in the Bay and that available (MAL) in the literature was calculated: LR = MOL/MAL.

In prospect of a commercial application to aquaculture, 300mm was considered as the limit length between small and large size fishes. Then, to estimate the occurrence of adult individuals in the region, the threshold at 0.400 for LR was arbitrarily fixed as indicative of minimum value for the presence of adults in the population studied. Indeed, this values is plausible because

Table 1. Code of species studied in the mangrove of Guaratuba; MOL: maximum observed length between 1993 and 1997; MAL: maximum available length and code of the literature reference. LR: length report MOL/MAL. Gr: group to which belongs each species, according to the proposed classification previously. The correspondence between codes and names of species can be consulted in Appendix; clear-grey: species less recommended; dark-grey: rather recommended species.

Species	MOL	MAL	Source	LR	Gr	Species	MOL	MAL	Source	LR	Gr
ACLI	174	230	2	0.757	A2	**HACL**	166	170	1	0.976	A1
ARRH	241	350	1	0.689	B	**HIRE**	80	180	1*	0.444	A2
BARO	200	350	1	0.571	B	**ISPA**	215	250	1	0.860	A1
BASO	125	165	1*	0.758	A2	**LALA**	267	600	1	0.445	B
CAHI	215	1000	1	0.215	C	**LYGR**	241	270	1	0.893	A1
CALA	190	800	1	0.238	C	**MEAM**	375	500	1	0.750	D
CASP	244	300	1	0.813	A1	**MELI**	110	450	1	0.244	C
CEED	157	166	2	0.946	A1	**MIFU**	348	600	1	0.580	D
CEPA	304	600	1	0.507	D	**MUCU**	298	450	1	0.662	B
CEUN	298	1000	1	0.298	C	**MUGA**	162	450	1	0.360	C
CHCH	147	300	1	0.490	A2	**NEBA**	241	1000	1	0.241	C
CHFA	170	900	1	0.189	C	**OPOG**	167	300	1	0.557	A2
CHSP	192	#	-	-	-	**ORRU**	155	400	1	0.388	C
CIAR	190	#	-	-	-	**PABR**	242	300	1	0.807	A1
CISP	153	200	2	0.765	A2	**PEHA**	174	174	1	1.000	A1
CYAC	285	1090	2	0.261	C	**POCO**	210	250	1	0.840	A1
CYLE	435	600	1	0.725	D	**POSA**	310	1000	1	0.310	D
DAVO	224	450	1	0.498	B	**PRPU**	156	400	2	0.390	C
DIRA	205	260	2	0.788	A2	**RHPE**	575	1000	1	0.575	D
DIRH	205	400	1	0.513	B	**RYRA**	156	190	1*	0.821	A1
EPIT	300	2700	1	0.111	C	**SCLU**	355	1200	1	0.296	D
EPNI	148	1200	1	0.123	C	**SEVO**	200	400	1	0.500	B
ETCR	125	200	2	0.625	A2	**SPTE**	330	330	3	1.000	D
EUAR	145	300	1	0.483	A2	**STHI**	80	#	-	-	-
EUBR	195	400	1	0.488	B	**STRA**	172	180	1	0.956	A1
EUGU	150	250	1	0.600	A2	**SYFO**	284	430	2	0.660	B
EUME	227	227	3	1.000	A1	**SYTE**	186	230	2	0.809	A1
GEGE	357	357	3	1.000	D	**TRCA**	257	600	2	0.428	B
GELU	288	370	2	0.778	B	**TRLE**	950	1500	2	0.633	D
GYOC	440	520	1	0.846	D	**TRPA**	180	180	3	1.000	A1

: MAL not found in the literature

CODE OF MAL SOURCE:

(1): Figueiredo 1977; Figueiredo & Menezes 1978; Figueiredo & Menezes 1980; Menezes & Figueiredo 1980; Menezes & Figueiredo 1985.

(1*): Same authors as above. However here, authors mention that MAL cited is for the maximum length obtained in their sample, and not to the maximum one known in the region.

(2): Cervigón *et al.* 1992.

(3): As after the references consulted, MAL value is less important than that found for Guaratuba, this one is considered as maximum for the species.

it is close to the ratio: mean length at first maturity/available length, calculated with 4 species from Guaratuba: *Stellifer rastrifer*= 0.53 (Coelho *et al.*, 1985), *Isopisthus parvipinnis*= 0.43 (Coelho *et al.*, 1988), *Micropogonias furnieri*= 0.50 (Haimovici & Umpierre, 1996), *Menticirrhus americanus*= 0.35 (Alvitres-Castillo, 1986). Among littoral brazilian fish (Perez-Lizama & Vazzoler, 1993): $L50/L\infty = 1.29-0.29 \log L\infty$ and MOL of Guaratuba species, the ratio $L50/L\infty$ varied around 0.40.

RESULTS

1. Characterization of maximum size of individuals

According to the literature, the maximum available length of 57 studied species (Table 1) varied between 165 (*Batygobius soporator*) and 2700mm (*Epinephelus itajara*). MAL values of *Citharichthys arenaceus*, *Stephanolepis hispidus* and *Chylomicterus spinosus* were not found. The most represented (17.5%) 100mm size classes were 200-299, 300-399 and 400-499mm (Fig.

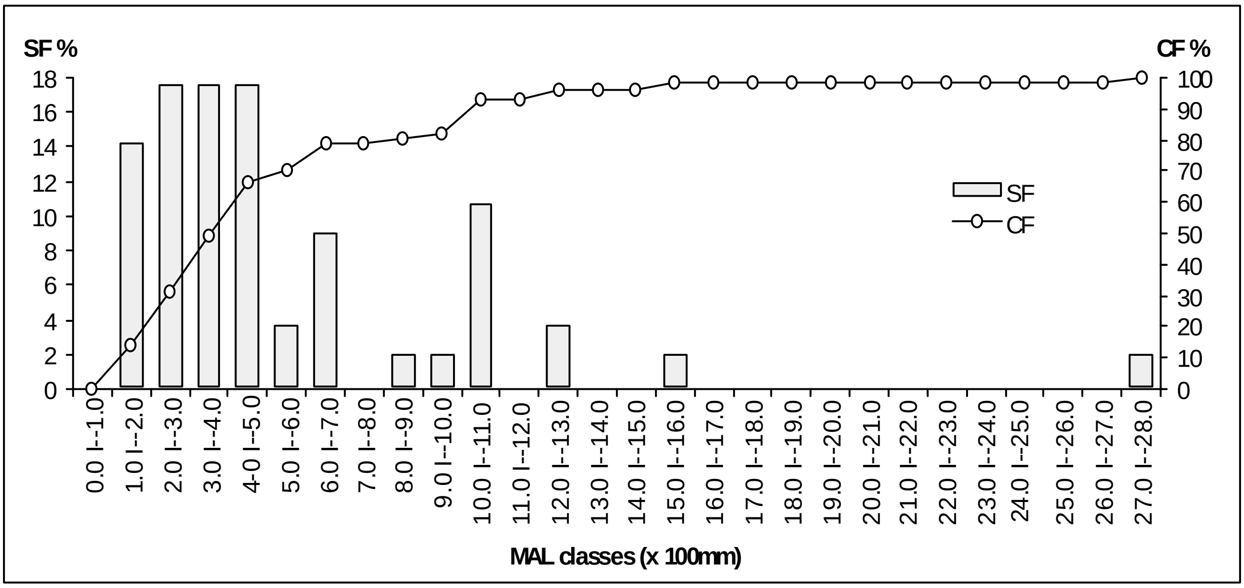

Figure 2. Simple (SF) and cumulative (CF) frequency distributions of the percentage of species occupying each maximum available length (MAL) in mm.

2); 31.5% of total have a MAL below 300mm, and 49% below 400mm (Fig. 2). The range of LR values varied from 0.11 (*E. itajara*) to 1.00 (5 species) (Fig. 3). The highest percentages of species (14%) were found in LR classes 0.41-0.50, 0.81-0.90 and 0.91-1.00 (Fig. 4); 24.6% of species had a LR below 0.41, and 50.9% below 0.61.

2. Classification of species according to their maximum length

The highest LR values were generally associated with species showing a low MAL. In the 100-199mm size class the mean LR was 0.86; the mean LR then decreased until the 400-499mm size class (Fig. 5). In the next class, the mean LR increased up to 0.80, then decreased in the 1200-1299mm size class. The noticeable exceptionally high LR (0.63) in the 1500-1599 size class corresponded to the species *Trichiurus lepturus*. It is a great ichtyophagous predator with a large locomotion capacity, that only passes through occasionally in the inner part of the Bay. In the highest class of MAL (2700-2799mm, *E. itajara*), the LR was the lowest: 0.11 (Fig. 5). The regression that associates these two variables is expressed by the relationship: $LR= 23.82.MAL^{-0.63}$ (n=57;r=0.77).

If one considered the threshold at 300mm in length and LR values, the species studied could be classified in the 4 different groups, A, B, C and D (Fig. 6; Table 1). This classification allowed, in the case of the absence of a large specimen missing of one species, to find an explanation at the specific, populational or ecophase levels.

GROUP A - Small size species, MAL not exceeding 300mm.

Subgroup A1 - 13 species whose LR was between 0.80 and 1.00. Adult individuals could therefore be found in the mangrove. The absence

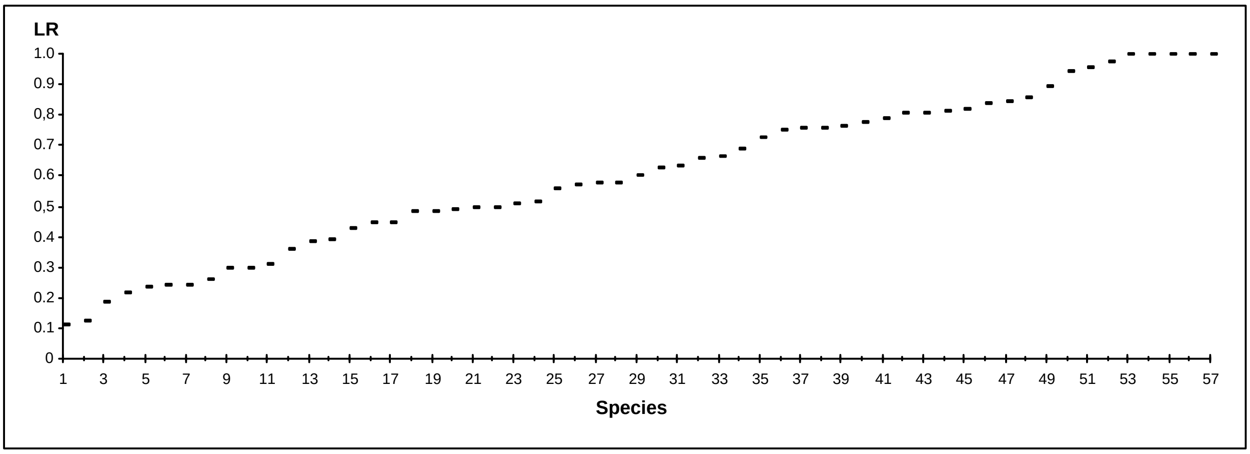

Figure 3. Distribution of LR values of the species studied.

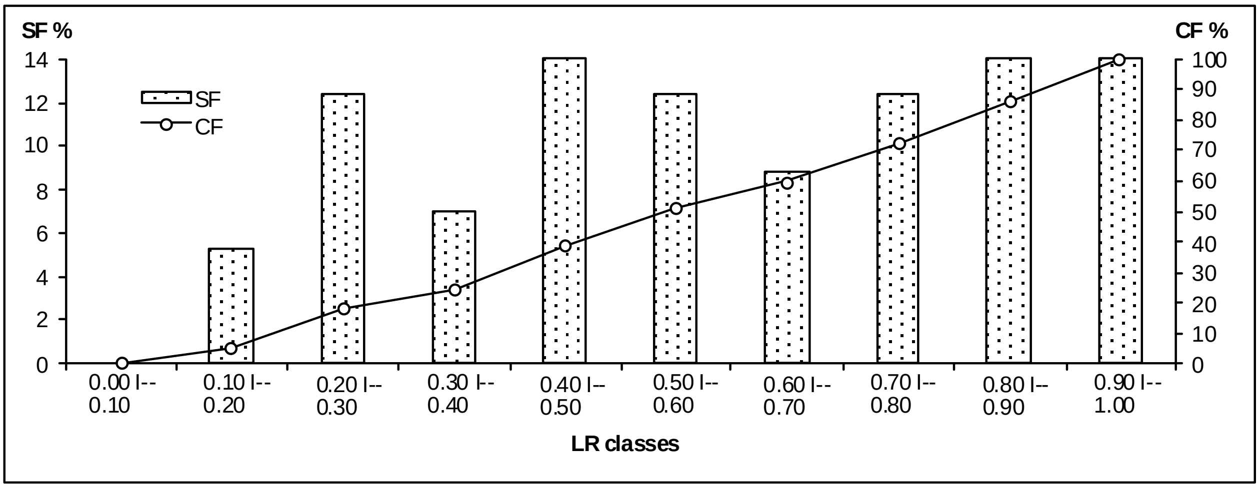

Figure 4. Single (SF) and cumulative (CF) frequency distributions of the percentage of species occupying each class of LR.

of large size individuals could be explained at the species level, possibly showing some adaptations at the populational level.

Subgroup A2 - 10 species whose LR was between 0.40 and 0.80. Adult individuals could also be found, but with a length not exceeding 80% of the maximum size of the species. Thus, the absence of large size individuals in the mangrove was also explicable at the specific level, although that was possibly enhanced by adaptations at the populational level.

In the group A, no species was found with LR below 0.40. In that case, all individuals would be presumed to be juveniles or sub adult.

GROUP B - 11 large-sized species whose MAL was above 300mm and below 750mm, and LR equal or superior to 0.40 and its maximum value decreasing gradually from 0.99 (for a MAL=301mm) to 0.40 (for a MAL=750mm). Thus, in the mangrove these individuals are never greater than 300mm, although they could be found there at the adult stage. The absence of specimen of great size can therefore be explained at the populational level.

GROUP C - 12 large-sized species, whose MAL was above 300mm and LR below 0.40 for MAL up to 750mm, and its maximum value decreased gradually to 0.11 as MAL increased around 2700mm. That means that despite the potentially important size of these species, no specimen was found in the mangrove with a length superior to

300mm. Their reduced size can be explained at the ecophase level. Indeed they are essentially species having accomplished a trophic migration before going back to the sea after a growth period in the bay. For example, in this ecosystem where a rocky bottom is rare, the groupers do not have a large enough habitat at their disposal in which to stay for a long time. The other species of Mugilidae, Ariidae, Sciaenidae genera were caught in the sea at larger sizes. On the other hand, *Centropomus undecimalis* has been caught down the small rivers coming in the west part of the bay.

GROUP D - 11 large-sized species, whose MAL was situated between 301 and 2700mm and LR having a threshold decreasing gradually from 1.00 to 0.11 (it decreased as MAL increased). In the mangrove all populations present large size individuals (size superior to 300mm), in perspective of their development phase. No level has been proposed, since individuals with very great size are also welcomed by the ecosystem.

Is important to note that the three other species left of those found in the literature, *C. arenaceus*, *S. hispidus* and *C. spinosus* in the region had a MOL inferior to 300mm. However, their position in one of the groups cited above stays unknown.

Only 19.3% of species (group D) were represented in the region by individuals whose length exceeded 300mm. The cause of the absence of large size individuals was that 40.4% of populations belonged to species whose size was originally low (group A); for 19.3% of populations, the absence was because apparently adults did not reach the same lengths in the mangrove that they could reach elsewhere (group B); and for 21.0% of populations, because individuals that visited the mangrove sector were only at juvenile or sub adult stages (group C).

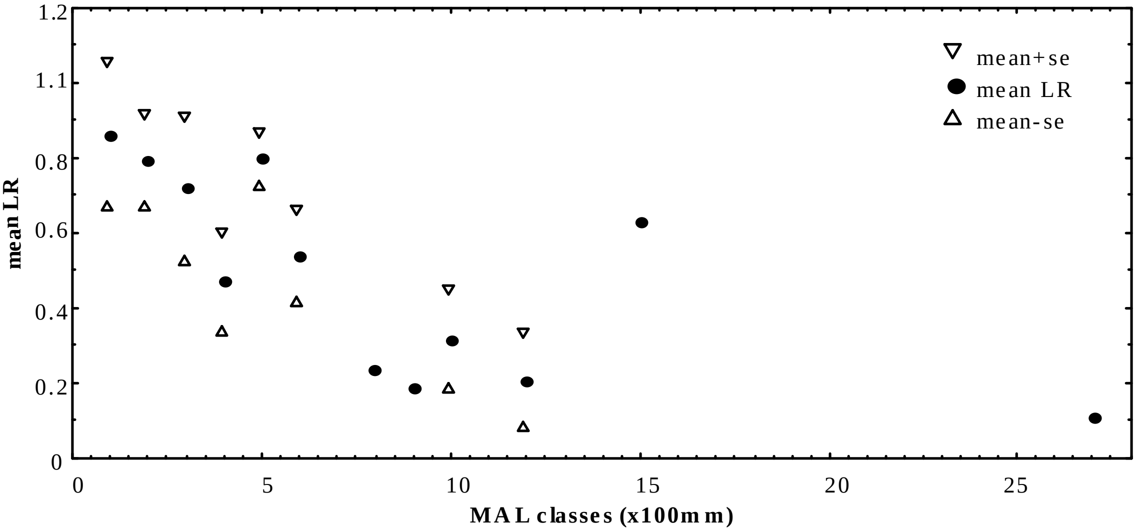

Figure 5. Distribution of mean LR values according to maximum available length (MAL) classes in mm.

3. Indications for aquaculture

Regarding the size, species with the greatest maximum length have been distributed in the region situated at the right of the graph in the Figure 6. These were those that presented generally a faster absolute growth than others (Legendre & Albaret, 1991). On the other hand, in this group, those with the greatest LR demonstrated that adult individuals of some species also frequented the ecosystem. This observation has been an indication of their good adaptation in this area. As compared to the conjoint evolution of these two variables (Fig. 6), we propose therefore that preselection for breeding favors species classified in the group D. However, it is also necessary to consider some species of the group C, particularly *Centropomus undecimalis*, which, even if they reached a relatively low maximum size, have characteristics likely to place them among species to be recommended for fish farming, which include: excellent appreciation by consumers, low cost, aquaculture techniques already tested (Table 2).

Finally, a more thorough examination of biological parameters, either biological, technological, or commercial order, suggested important parameters to guide the choice of priority species (Table 2). Thus, in addition to the fact of favoring species commercially appraised, and for which an aquaculture know-how already exists, it is commendable to use those whose: reproduction is accomplished in the locality, fecundity is relatively important, and diet is not based on fishes (Trebaol, 1991). One will retain therefore, as priority species in this group of pre-selected species: *C. parallelus*, *C. undecimalis*, *M. americanus* and *M. furnieri*.

DISCUSSION

It has been observed that in the mangrove sector of Guaratuba Bay, the greater number of individuals in the populations could be found with a relatively important size, that attained at least 40% the maximum length known for the species. It did not mean that the assemblage has been rich in large size individuals, since populations whose effectives were the most numerous belonged to species whose MAL do not exceed 300mm, such as *Pomadasys corvinaeformis*, *Eucinostomus argenteus*, *E. gula*, *E. melanopterus* and *Stellifer rastrifer* (Chaves & Bouchereau, 1999). In addition, whatever the animal population, under natural conditions, the juvenile and sub adults stages are numerically more represented than those of adults, which increases the relative abundance of the smallest individuals. Thus, even if the LR value 0.40 is not precise to standardize the beginning of the adult phase in all the populations, since it can vary according to the species and its geographical distribution area, the mangrove studied seems suitable for a large proportion of them to also attract to its bosom the most advanced stages of development.

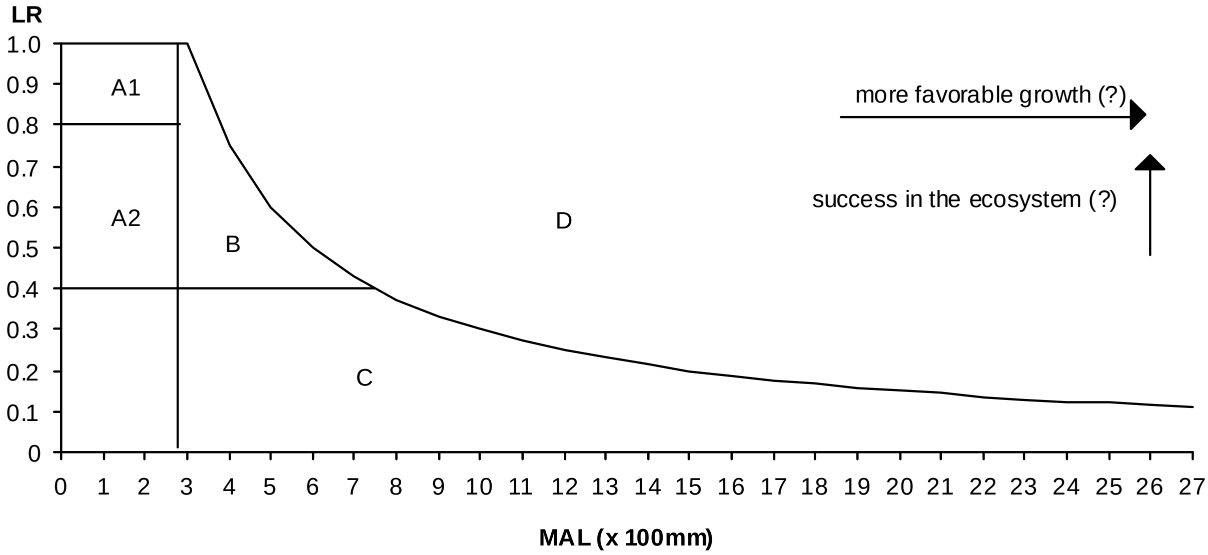

Figure 6. Graphic representation of the species groups places ("A" to "D"), classified according to LR values and maximum available length (MAL) in mm.

The combination of LR and MAL results showed that the highest LR was associated with the smallest size species. Consequently, concerning the absolute sizes, although for the majority of species, individuals could reach a length superior to 300mm, a great part (68%) of this was only represented in the mangrove by smaller sizes. Indeed, the LR value of these species, although superior to 0.40, was not high enough so that the size of the greatest individuals exceeded 300mm. From such a situation, as a result hardly 19.3% of the 57 listed species showed in reality individuals with size greater than 300mm, which suggested that natural conditions of the ecosystem were not ideal to attract the large-sized species. Possible alterations of growth rates at the populational level, as well as size at first maturity, have not been evoked in the present study. Although insufficient to explain alone the weak proportion of species whose length of individuals exceeds 300mm, the reduction of growth can nevertheless play a very active role in the general size structure in the assemblage.

Do the populations of species with small size and high LR correspond to those having sedentary status in the system? In principle, the answer is negative since if populations of *G. genidens*, *S. rastrifer*, *C. spilopterus*, that are sedentary there, have a LR superior to 0.50, those of *P. corvinaeformis*, *B. ronchus* and *D. rhombeus*, that are not sedentary, presented also a high LR. In the population of *B. ronchus*, for example, LR reached 0.57, adults only being present in the system during a certain period, and exit after the spawning period (Chaves, 1995). In the future, a comparative analysis of the distribution of LR values, as well as LR compared to MAL, calculated from fish assemblages from different regions (Southern America Bays, Western Africa estuaries, Occidental Mediterranean lagoons), could become a new parameter favoring the biological description of the semi enclosed ecosystems. Indeed, the curve obtained with RL index and MAL maximum available lengths is interesting as a descriptive tool of the ichtyofauna occupying a given ecosystem, and a comparative tool in space and time of the same ecosystem or between several ecosystems. This new ichtyological and environmental descriptor could be applied in the following fields: quality of an ecosystem with regard to its welcoming capacity, fish farming of new species, management as fishing regulation.

In the mangrove of Guaratuba, small size species are more numerous. They succeed to reach larger lengths, as compared to their known maximum length, than those of greater size. Among the former, and according to the criterion of possible or reached maximum size in the region, 12 pre-selected to realize tests for aquaculture in the region. Nevertheless, as emphasized by Legendre & Albaret (1991), during the planning of a program for aquaculture, growth is only one of the factors to take into account in the analysis. In the present case, the totality of the parameters considered favors then only four species from the 12 pre-selected species: *C. parallelus*, *C. undecimalis*, *M. americanus* and *M. furnieri*. They represent a concret starting point for finer research on potentialities of fish farming in this Bay.

Table 2. Synoptic presentation of some attributes about 12 pre-selected species after size criteria; TE: knowledge of breeding techniques; CU: commercial utilization in the region and its level of utilization in the growing order “ + ” to “ +++ ”.

			BIOLOGICAL ASPECTS[1]		
SPECIES	**T E**	**CU**	Reproduction	Diet	Note
C. parallelus and *C. undecimalis*	F f*	+++	Frequent Matures	Carnivorous/Crustacean	Very considered for recreational fishing
C. leiarchus	No	+++	Frequent Matures	Carnivorous/Ichtyophag.	-
G. genidens	No	+	Spawning in Summer	Carnivorous/Crustacean	Low Fecundity
G. ocellatus	No	No	? ?	? ?	-
M. americanus	No	+++	Frequent Matures	Carnivorous/Crustacean	High Fecundity
M. furnieri	No	+++	Frequent Matures	Carnivorous/Crustacean	High Fecundity
P. saltatrix	No	+++	? ?	? ?	-
R. percellens	No	No	? ?	? ?	Low Fecundity
S. luniscutis	No	+	? ?	? ?	-
S. testudineus	No	No	Not available data for the region. Possible liver toxicity of Tetraodontiformes discouraging its consumption (Legendre 1992)		
T. lepturus	No	+	Frequent Matures	Carnivorous/Ichtyophag	-

(*) Ff: Centropomidae fish farming technology developed by the State Fishery Institute, from São Paulo State and/or The Federal University of Santa Catarina (Brazil). ([1]): Personal observations by Chaves, except *G. genidens*: Chaves (1994) and Chaves & Vendel (1996).

RESUMO

Realizou-se um inventário do comprimento máximo alcançado por 57 espécies de peixes no manguezal de Guaratuba, Brasil, objetivando caracterizar este ecossistema quanto ao tamanho dos indivíduos que acolhe. Para cada espécie, o comprimento máximo no manguezal foi comparado com aquele disponível na literatura, referente a outras populações da mesma espécie. Constatou-se que, na maioria das populações de Guaratuba, os indivíduos atingem pelo menos 40% do tamanho máximo conhecido para a espécie, embora em apenas 19,3% das populações o comprimento ultrapasse 300mm em valor absoluto. As outras espécies estão representadas no manguezal por indivíduos que (a) ou estão em fase inicial de desenvolvimento, ou (b) não alcançam o mesmo porte que aquele conhecido em outras populações. Neste manguezal, as espécies de maior tamanho relativo são normalmente as de menor porte. Propõe-se a utilização de um índice LR (comprimento máximo observado/ comprimento máximo conhecido) para auxiliar na descrição de assembléias de peixes e sua comparação entre diferentes regiões. As observações sobre o tamanho máximo possibilitam a pré-seleção de 12 espécies para testes de cultivo em Guaratuba, destacando, ao associar parâmetros biológicos, tecnológicos e comerciais, quatro delas como prioritárias: *Centropomus parallelus*, *C. undecimalis*, *Menticirrhus americanus* e *Micropogonias furnieri*.

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Appendix. Code of species quoted in Table 1.

Code	Species	Code	Species
ACLI	*Achirus lineatus* (Linné, 1758)	**HACL**	*Harengula clupeola* (Cuvier, 1829)
ARRH	*Archosargus rhomboidalis* (Linné, 1758)	**HIRE**	*Hippocampus reidi* Ginsburg, 1933
BARO	*Bairdiella ronchus* (Cuvier, 1830)	**ISPA**	*Isopisthus parvipinnis* (Cuvier, 1830)
BASO	*Bathygobius soporator* (Valenciennes, 1837)	**LALA**	*Lagocephalus laevigatus* (Linné, 1766)
CAHI	*Caranx hippos* (Linné, 1766)	**LYGR**	*Lycengraulis grossidens* (Cuvier, 1829)
CALA	*C. latus* Agassiz, 1831	**MEAM**	*Menticirrhus americanus* (Linné, 1758)
CASP	*Cathorops spixii* (Agassiz, 1829)	**MELI**	*M. littoralis* (Holbrook, 1860)
CEED	*Cetengraulis edentulus* (Cuvier, 1829)	**MIFU**	*Micropogonias furnieri* (Desmarest, 1823)
CEPA	*Centropomus parallelus* Poey, 1860	**MUCU**	*Mugil curema* Valenciennes, 1836
CEUN	*C. undecimalis* (Bloch, 1792)	**MUGA**	*M. gaimardianus* Desmarest, 1831
CHCH	*Chloroscombrus chrysurus* (Linné, 1766)	**NEBA**	*Netuma barba* (Lacepède, 1803)
CHFA	*Chaetodipterus faber* (Broussonet, 1782)	**OPOG**	*Opithonema oglinum* (Lesueur, 1817)
CHSP	*Chylomicterus spinosus* (Linné, 1758)	**ORRU**	*Orthorpistis ruber* (Cuvier, 1830)
CIAR	*Citharichthys arenaceus* Evermann & Marsh, 1900	**PABR**	*churus brasiliensis* (Steindachner, 1875)
CISP	*C. spilopterus* Gunther, 1862	**PEHA**	*Pellona harroweri* (Fowler, 1917)

Cont.

Appendix. Code of species quoted in Table 1 (Cont.).

CYAC	*Cynoscion acoupa* (Lacepède, 1802)	**POCO**	*ısys corvinaeformis* (Steindachner, 1868)
CYLE	*C. leiarchus* (Cuvier, 1830)	**POSA**	*Pomatomus saltatrix* (Linné, 1766)
DAVO	*Dactylopterus volitans* (Linné, 1758)	**PRPU**	*Prionotus punctatus* (Bloch, 1797)
DIRA	*Diplectrum radiale* (Quoy & Gaimard, 1824)	**RHPE**	*Rhinobatos percellens* (Walbaum, 1792)
DIRH	*Diapterus rhombeus* (Cuvier, 1829)	**RYRA**	*Rypticus randalli* Courtenay, 1967
EPIT	*Epinephelus itajara* (Lichtenstein, 1822)	**SCLU**	*Sciadeichthys luniscutis* (Valenciennes, 1840)
EPNI	*E. niveatus* (Valenciennes, 1828)	**SEVO**	*Selene vomer* (Linné, 1758)
ETCR	*E . crossotus* Jordan & Gilbert, 1822	**SPTE**	*Sphoeroides testudineus* (Linné, 1758)
EUAR	*Eucinostomus argenteus* Baird & Girard, 1854	**STHI**	*Stephanolepis hispidus* (Linné, 1766)
EUBR	*Eugerres brasilianus* (Cuvier, 1830)	**STRA**	*Stellifer rastrifer* (Jordan, 1889)
EUGU	*Eucinostomus gula* (Cuvier, 1830)	**SYFO**	*Synodus foetens* (Linné, 1766)
EUME	*E. melanopterus* (Bleeker, 1863)	**SYTE**	*Symphurus tessellatus* (Quoy & Gaimard,1824)
GEGE	*Genidens genidens* (Valenciennes, 1839)	**TRCA**	*Trachinotus carolinus* (Linné, 1766)
GELU	*Genyatremus luteus* (Bloch, 1795)	**TRLE**	*Trichiurus lepturus* Linné, 1758
GYOC	*Gymnothorax ocellatus* Agassiz, 1834	**TRPA**	*Trinectes paulistanus* (Ribeiro, 1915)

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