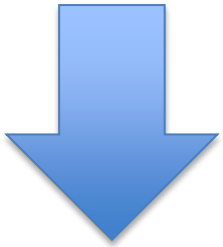
University of Rio Grande do Norte

Fisher's consulting and biological evidence to probe loss of fish diversity in a tropical coastal lagoon

Current goal: understand the changes in fish diversity and food web structure



Main interest: To manage and restore the fishery activity

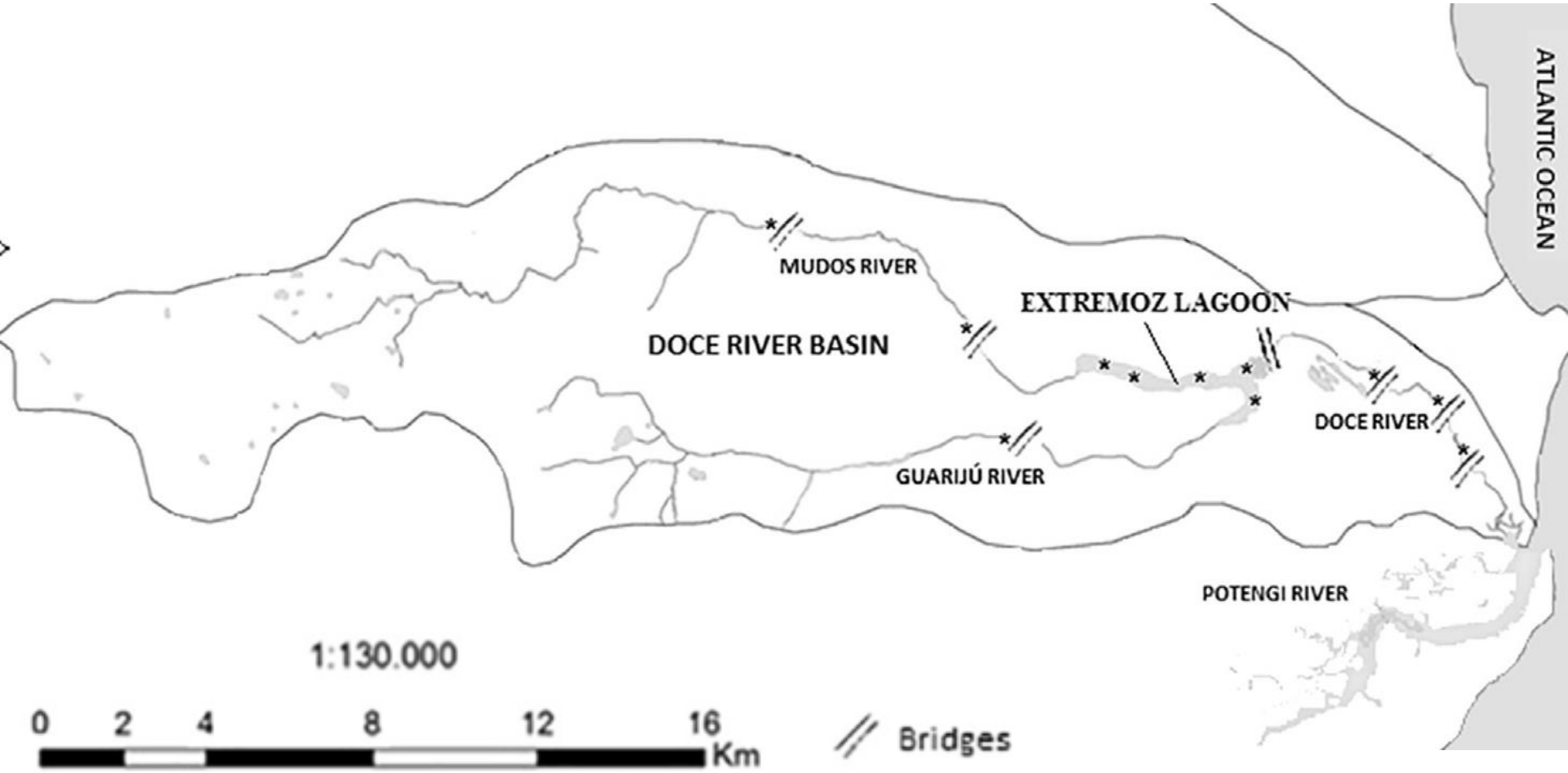
Ecological Hypothesis

Introduction of an invasive fish species was the main cause for the loss in fish diversity and for the changes in the food web structure

Peacock bass
Cichla sp

(Amazonian fish)

The ecosystem modeled



Methods

Literature information + data sampling + fishers experience-based knowledge

Ecosystem approach to Fisheries (EAF)

Two fish samples in each season (dry and rainy) at 5 locations
Fishes were collected by a set of gillnets
Gut content Analysis

Fishers Knowledge Approach (FKA)

Fishers: at least 40 yrs exclusively dedicated to local fishery

1) Which fish species were present 15 years ago;

2) Which species are present nowadays;

3) When species disappeared and why;

4) If new species appeared and which ones;

5) When the peacock bass was introduced;

6) If following the fish species introduction, fishers noticed changes on fish species composition.

No	Species	Original habitat	Max L (cm)	Our sampling (2012–2013)	Vieira (2002)	Starks (1913)	LEK (before 2000)	LEK (current)
1	*Astronotus ocellatus* Agassiz, 1831	Freshwater	40		X		XX	
2	*Astyanax bimaculatus* Linnaeus	Freshwater	17.5	●	X	X	XXX	X
3	*Awaous tajasica* Lichtenstein, 1822	Marine	16.3		X		XX	
4	*Characidium bimaculatum* Fowler, 1941	Freshwater	3.2	●	X		XXX	XX
5	*Centropomus mexicanus* Bocourt, 1868	Marine	47.5			X		
6	*Cichlasoma bimaculatum* Linnaeus, 1758	Freshwater	12.3	●	X	X		XX
7	*Cichlasoma orientale* Kullander, 1983	Freshwater	13.6					
8	*Crenicichla lepidota* Heckel, 1840	Freshwater	18	X	X	X		XXX
9	*Crenicichla menezesi* Ploeg, 1991	Freshwater	14.6	●				
10	*Cichla kelberi* Kullander and Ferreira 2006 (Bloch and Schneider) cf.	Freshwater	27.6	X	X			XXX
11	*Curimatella dorsalis* Eigenmann and Eigenmann, 1889	Marine	11.4			X		
12	*Dormitator maculatus* Bloch, 1972	Freshwater	70		X		XX	
13	*Eleotris pisonis* Gmelin, 1789	Freshwater	25	●	X		XXX	XXX
14	*Eucinostomus gula* Quoy and Gaimard, 1824	Freshwater	23					XX
15	*Erythrinus erythrinus* Bloch and Schneider, 1801	Freshwater	20		X			XXX
16	*Gymnotus carapo* Linnaeus, 1758	Freshwater	76	●	X		X	XX
17	*Gerres* sp. Walbaum, 1792	Marine	30			X		
18	*Hemigrammus marginatus* Ellis, 1911	Freshwater	2.6	●	X			
19	*Hoplias malabaricus* Bloch, 1794	Freshwater	55.2	X	X	X		XXX
20	*Hoplosternum littorale* Hancock,1828	Marine	24		X			
21	*Hypostomus pusarum* Starks, 1913	Freshwater	20.3		X		XX	
22	*Leporinus maculatus* Muller and Troschel, 1844	Freshwater	18		X	X		
23	*Leporinus piau* Fowler, 1941	Freshwater	33	X●	X			XXX
24	*Limatulichthys griseus* Fowler, 1941	Freshwater	18		X		X	
25	*Megalops atlanticus* Valenciennes, 1847	Marine	250		X		XX	
26	*Metynnis maculatus* Kner, 1860	Freshwater	18	X	X	X		XX
27	*Microphis brachyurus lineatus* Kaup 1856	Freshwater	22		X		X	
28	*Mugil liza* Valenciennes, 1836	Marine	80			X	XXX	
29	*Mugil curema* Valenciennes, 1836	Marine	90			X	XXX	
30	*Moenkhausia lepidura* Kner, 1858	Freshwater	8.9		X		X	
31	*Nannostomus beckfordi* Gunther, 1872	Freshwater	6.5		X		XX	
32	*Piaractus brachypomus* Cuvier, 1818	Marine	88				XX	
33	*Pimelodella enochi* Fowler, 1941	Freshwater	5.9		X		XX	
34	*Plagioscion squamosissimus* Heckel, 1840	Freshwater	80		X		XX	
35	*Poecilia vivipara* Bloch and Schneider 1801	Freshwater	4	●	X		XXX	XX
36	*Prochilodus brevis* Steindachnner, 1874	Freshwater	27		X		XX	
37	*Serrapinnus heterodon* Eigenmann, 1915	Freshwater	4.1		X		XX	
38	*Serrapinnus piaba* Lütken, 1874	Freshwater	3.5	●	X			
39	*Serrasalmus rhombeus* Linnaeus, 1766	Freshwater	41.5					
40	*Serrasalmus orientale* Kner, 1858	Freshwater	21	X	X			XXX
41	*Steindachnerina notonota* Miranda Ribeiro, 1937	Freshwater	9.8	●	X			
42	*Synbranchus marmoratus* Bloch, 1975	Freshwater	150	●	X			
43	*Trachelyopterus galleatus* Linnaeus, 1766	Freshwater	22	●	X			
44	*Triportheus signatus* Garman, 1890	Freshwater	15.8		X			
45	*Trinectes paulistanos* Ribeiro, 1915	Freshwater			X		XX	
Total		37		18	35	11	22	14

Table 2

Jaccard similarity index (presence/absence) for species richness in Extremoz Lake, based on our samplings (CS, Current Sampling), literature (Vieira, 2002; Starks, 1913), and Fishermen's Information for Past (before 2000) and currently.

Jaccard similarity index	CS	Vieira (2002)	Starks (1913)	Fishermen's information (past)
Currently sampling (CS)	1			
Vieira (2002)	0.40	1		
Starks (1913)	0.20	0.20	1	
Fishermen's information (Past)	0.14	0.60	0.10	1
Fishermen's information (Currently)	0.63	0.37	0.20	0.10

Environmental Hypothesis (from fishers)

Sequential construction of bridges that interrupted water flow between the lagoon and the ocean as the main cause for ecosystem changes

Fig. 3. Underneath culverts from bridges built in Doce River (for bridges' location see Fig. 1).

Increasing fishing effort on peacock bass

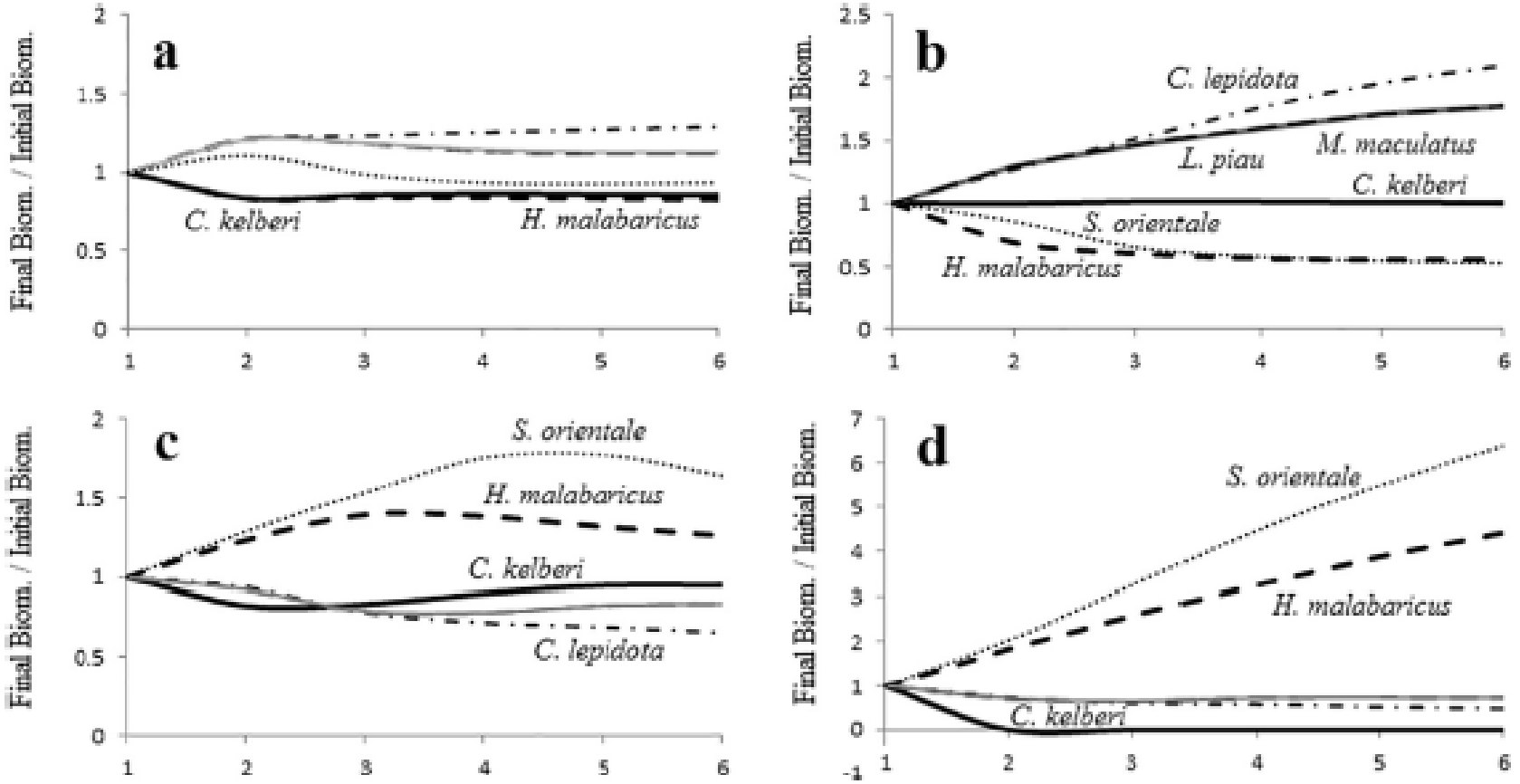


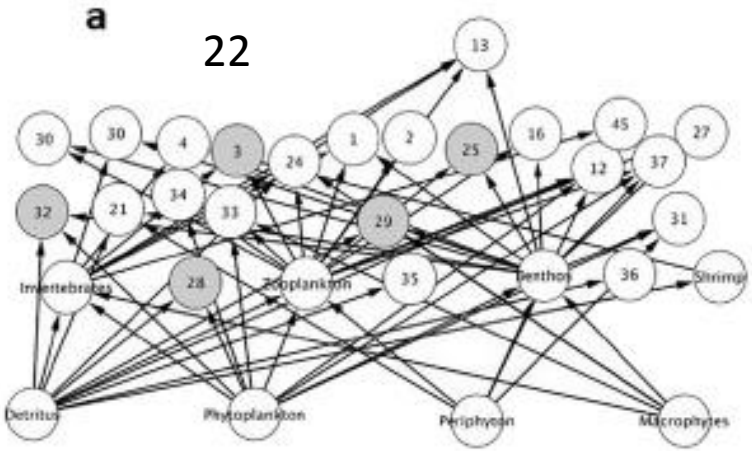
Fig. 4. Simulation Ecopath with Ecosim model: a) Fishing effort on *Cichla kelberi* and on *Hoplias malabaricus* increased 10 times; b) Fishing effort increased by 10 times on *H. malabaricus*; c) Fishing effort on *C. kelberi* increased by 10 times; d) Fishing effort on *C. kelberi* increased by 20 times.

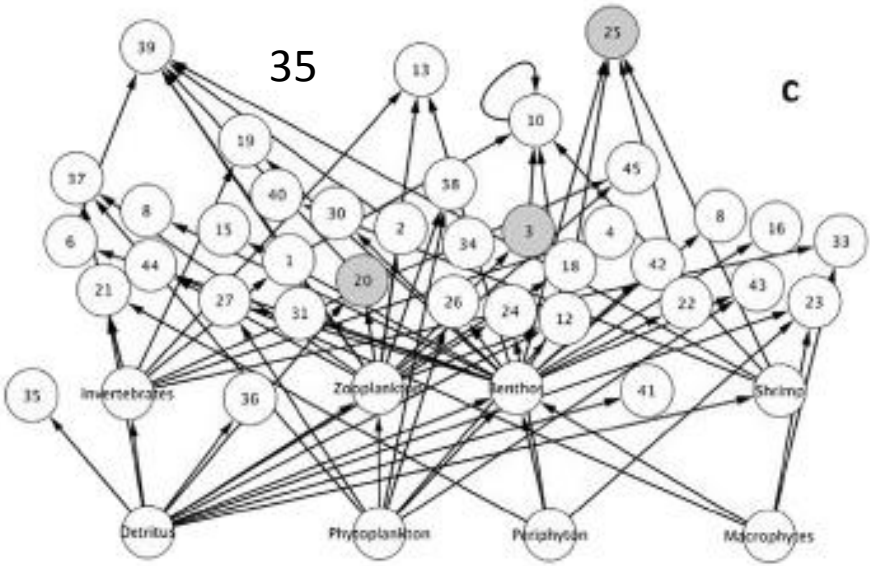
FISHER'S KNOWLEDGE

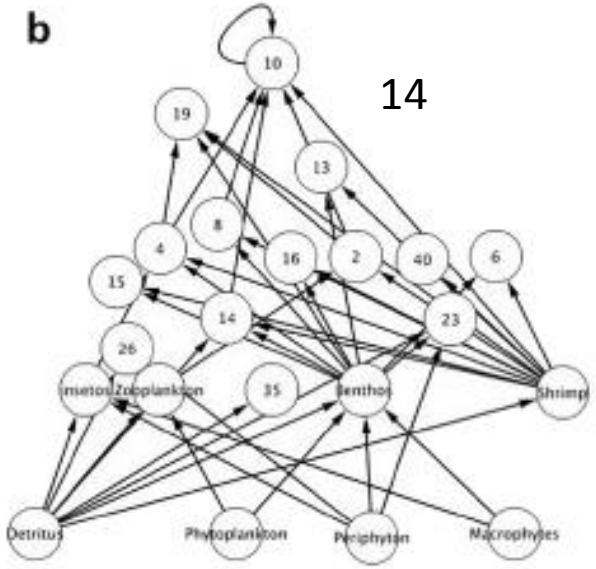
SCIENTIFIC KNOWLEDGE

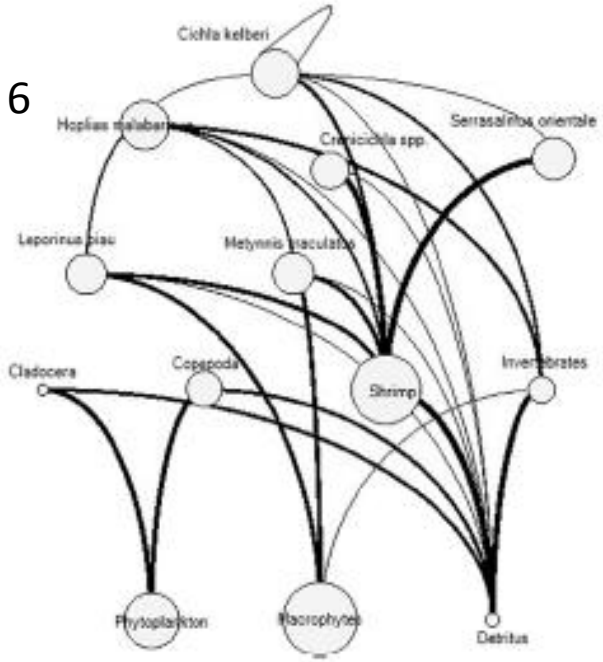
PAST

CURRENTLY









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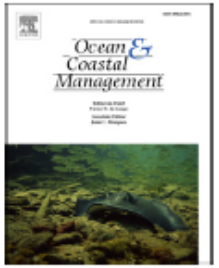

Integrating fishermen knowledge and scientific analysis to assess changes in fish diversity and food web structure

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