

Template for Submission of Scientific Information to Describe Ecologically or Biologically Significant Areas

Title/Name of the area: Amazonian Inner Continental Shelf

Presented by (names, affiliations, title, contact details)

José Souto Rosa Filho, Dr., Laboratório de Oceanografia Biológica, Universidade Federal do Para, Belém, PA, Brazil (jsouto@ufpa.br)

Flávia Lucena Frédou, Dra., Departamento de Pesca e Aquicultura, Universidade Federal Rural de Pernambuco, Recife, PE, Brazil (flavia.lucena@pq.cnpq.br)

Patrícia Charvet, Dra., SENAI-PR, Curitiba, PR, Brazil (pchalm@gmail.com)

José Augusto Aragão, MSc., Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis - IBAMA, Fortaleza, CE, Brazil (j_aragao@hotmail.com)

Abstract (in less than 150 words)

The Amazonian inner continental shelf, includes the Amazon River mouth and estuary and the adjacent coastal area influenced by the Amazon River (47° 00' - 51° 30' W, 000° 30' - 005° 00' N), is an unique region which encompasses two geomorphologic world records: the largest mangrove continuous system and the largest river in length, water and sediment discharge. This area contains endemic species and also is important for the life-history stages of fish and crustacean (nursery, feeding and breeding), including threatened species and also as migratory route for various species of fish. The high biological productivity is inherent of this area, particular if considered demersal species (fishes and shrimp). Within this region, around 20 species of elasmobranchs and 4 species of mammals are threatened. Massive presence of declining and overexploited species, due to high fishery pressure is also reported.

Introduction

The **Amazonian Inner Continental Shelf** (Figure 1) is more than 300 km wide and gently inclined, with an overall gradient of 1:2,240 until the shelf break at 100 m deep (Milliman, 1979). The inner shelf initiates approximately at the 20 m isobath (15 km away from the coast along the northeast of Pará State), where transgressive siliciclastic marine sands start to occur. The majority of the sand is composed of well sorted clear quartz (Zembruski *et al.*, 1971).

This area is the result of approximately 6.300 km³/year of fresh water flowing seawards (Meade *et al.*, 1985). The dynamics of this estuary reflect the force of this discharge into the Atlantic Ocean, which is so strong that seawater rarely passes through the mouth of the river and the contact of river-sea is annually moved approximately 200 km outwards the river mouth (Egler & Schawassmann, 1962). Also, the **Amazonian Inner Continental Shelf** has an average of 3–3.5 million metric tons of sediments which are discharged by the Amazonas River (Meade *et al.*, 1985), representing from 1.1 to 1.3 billion metric tons a year.

The hydrodynamics of this region is dominated by the North Brazilian Current, which is an extension of the South Equatorial prolongation, the Guyana Current that displaces the fresh water in the NW direction. Consequently, the discharge of the Amazon River reaches the continental shelf of Amapá State and also Guyanas (Diegues, 1972). The **Amazonian Inner Continental Shelf** encompasses two sectors: (a) the continental shelf of Amapá State (Cabo Orange/AP to Cabo Norte/AP) with a mean width of 140 Km, large rivers that, together with the discharge of the Amazon River, contributes to the sedimentation of the inner continental shelf of Amapá State, and is an important area for the fishery of shrimp and fishes; (b) the continental shelf of the Amazon River (Cabo Norte/AP to Rio Pará mouth /PA) with a mean width of 280

km. The economic Exclusive Zone of this area varies from 11.25 m and 3377 m. This region is heavily influenced by the geological and chemical features of the Amazon River.

The great discharge of fluvial materials (water, solutes, and particulates) directly or indirectly causes three-dimensional estuarine-like processes and very high rates of primary productivity (Figure 2), sediment accumulation are recorded in the **Amazonian Inner Continental Shelf**. Also, the shoreline sedimentation involving mangrove vegetation leads to a series of interdependent oceanographic processes which heavily influence the distribution of the living resources of the region. The high biological productivity is also relevant in terms of demersal species (fishes and shrimp).

Location

The **Amazonian Inner Continental Shelf** encompasses the Amazon River mouth and the north continental shelf influenced by the Amazon River. It is situated between 47° 00' and 51° 30' W, 000° 30' and 005° 00' N (continental shelf of Amapá State, Pará State and the beginning of Maranhão State). The external limit is the isobath of 50 m. From the coordinate of 47° W, the east limit of this area goes up to the Equator (005° 00' N) and hence follows, in parallel to the coast, up to the limit Pará-Amapá States. In Amapá State, the **Amazonian Inner Continental Shelf**, approaches again the coast (Figure 2). This region also includes the Marajó Bay mouth and partially the region known as “lixreira” (00°20'N to 01° 10'N and 047° 00'W to 047° 55'W).

It is important to mention that the **Amazonian Inner Continental Shelf** continues northwards up to adjacent countries (ex: Guyanas) and hence, international agreements should be taken into account.

Feature description of the proposed area

This area is outstanding by its high biological productivity, particular if considered demersal species (fishes and shrimp). It is important for the life-history stages of fish and crustacean (nursery, feeding and breeding). It is reported the occurrence of mature and pregnant females, new born and individuals showing parental care including the use of the area for early life stages of threatened species as *Carcharhinus leucas* e *Pristis perotteti* (Barthem, 1985). Contains a species of squid (Mollusca, Cephalopoda, Teuthida), *Doryteuthis surinamensis* (Voss, 1974) (Brazil; Haimovici *et al.*, 2009) and of elasmobranchs which are endemic (Ex: *Isogomphodon oxyrinchus* e *Dasyatis colarensis*).

Due to its high productivity, fishing activity is intense in this region and represents around 15% of the total marine/estuarine national landings. The acoupa weakfish *Cynoscion acoupa*, Spanish mackerel *Scomberomorus brasiliensis*, *Macrodon ancylodon* and catfish *Brachyplatystoma vaillantii* are heavily exploited within this area. This area has the largest shrimp banks of Brazil, with maximum sustainable yield estimated for *Farfantepenaeus paulensis* varying from 7.3 to 9.6 mil tonnes.years⁻¹ (Aragão, 2001).

Feature condition and future outlook of the proposed area

The **Amazonian Inner Continental Shelf** was defined as maximum priority for conservation (MMA, 2007).

The location in the Amazon river plume characterizes the area as eutrophic, with maximum chlorophyll *a* concentration of 25.5 mg.l⁻¹ and primary production of 8 g.C.m⁻².d⁻¹ (Smith & DeMaster, 1996; Santos *et al.*, 2008), representing some of the highest values of these parameters recorded in ocean waters in the world.

Due to its localization, near to the coast, this region is subject to major urban influence (especially the untreated sewage and fish processing industries of the city of Belém, Pará Sate), contributing to the increasingly harmful disruption of the area. Also the increasing fishing activity has been affecting the area.

Assessment of the area against CBD EBSA Criteria

The proposed area fulfills most criteria of CBD EBSA. The great discharge of fluvial materials (water, solutes, particulates) directly or indirectly causes three-dimensional estuarine-like processes, very high rates of primary productivity and sediment accumulation which makes this area a singular unit (**Uniqueness or rarity**). The **Amazonian Inner Continental Shelf** contains endemic and long-lived species and also is important for the life-history stages of fish and crustacean (nursery, feeding and breeding), including threatened species and also as migratory route for various species of fish (**Special importance for life-history stages of species; Importance for threatened, endangered or declining species**). The high biological productivity and the extremely high diversity of fish and shrimps is inherent of this area (**Biological diversity**). Finally, this region is subject to major urban influence and to an increasing fishing pressure (**Vulnerability**).

CBD EBSA Criteria (Annex I to decision IX/20)	Description (Annex I to decision IX/20)	Ranking of criterion relevance (please mark one column with an X)			
		Don't Know	Low	Some	High
Uniqueness or rarity	Area contains either (i) unique ("the only one of its kind"), rare (occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features				X
<p><i>Explanation for ranking</i></p> <ul style="list-style-type: none"> - This area is the oceanic outlet of the World's largest hydrographic basin, with a total discharge equivalent to approximately one sixth of that of all the rivers in the World combined, containing one fifth of all the freshwater released into the planet's oceans (Martinelli <i>et al.</i>, 1989). The dynamics of this estuary reflect the force of this discharge into the Atlantic Ocean, which is so strong that seawater rarely passes through the mouth of the river and the contact of river-sea is annually moved approximately 200 km outwards the river mouth (Egler & Schawassmann, 1962). - Has an average of 3–3.5 million metric tons of sediments which are discharged by the Amazonas River (Meade <i>et al.</i>, 1985), representing from 1.1 to 1.3 billion metric tons a year. - Contains a species of squid (Mollusca, Cephalopoda, Teuthida), <i>Doryteuthis surinamensis</i> (Voss, 1974) (Brazil; Haimovici <i>et al.</i>, 2009) and of elasmobranchs which are endemic (Ex: <i>Isogomphodon oxyrinchus</i> e <i>Dasyatis colarensis</i>) - It is characterized by a wide shelf and features macrotides (4 to 10m range), and upwellings along the shelf edge (Lara, 2003). 					
Special importance for life-history stages of species	Areas that are required for a population to survive and thrive.				X
<p><i>Explanation for ranking</i></p> <ul style="list-style-type: none"> - Important migratory route for various species of fish (ex: <i>Brachyplatystoma vaillantii</i>) - Important nursery, feeding and breeding area for many species of fishes and crustaceans. Considering fish species, most are small sized, especially in the area known as "lixreira" (Cutrim et al., 2001) and the Marajo bay mouth (Flavia Lucena Fredou, com pes.) 					
Importance for threatened, endangered or declining	Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.				X

species and/or habitats					
<p><i>Explanation for ranking</i></p> <ul style="list-style-type: none"> - Occurrence of mature and pregnant females, new born and individuals showing parental care reinforce that the area is strongly used as breeding and nursery specially if considered the use for early life stages of threatened species as <i>Carcharhinus leucas</i> e <i>Pristis perotteti</i> (Barthem, 1985). - Massive presence of declining (Ex: <i>Cynoscion acoupa</i>) and overexploited species (Ex: red snapper <i>Lutjanus purpureus</i>) due to high fishery pressure (Lucena Frédou & Asano-Filho, 2006). - A total of 4 species of mammals (according to Siciliano et al., 2008 and IUCN Red List) and 13 species of elasmobranchs classified as threatened: <i>Schroederichthys tenuis</i>, <i>Ginglymostoma cirratum</i>, <i>Carcharhinus signatus</i>, <i>C. porosus</i>, <i>Negaprion brevirostris</i>, <i>Isogomphodon oxyrinchus</i>, <i>Sphyrna tudes</i>, <i>S. tiburo</i>, <i>S. lewini</i>, <i>S. mokarraw</i>, <i>S. media</i>, <i>Pristis perotteti</i>, <i>Dasyatis colarensis</i> (http://www.sema.pa.gov.br/interna.php?idconteudocoluna=2283). 					
Vulnerability, fragility, sensitivity, or slow recovery	Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.			X	
<p><i>Explanation for ranking</i></p> <p>Although it is reported:</p> <ul style="list-style-type: none"> - Presence of highly susceptible species to depletion due to their low recovery rates: <ul style="list-style-type: none"> • A total of 13 species of mammals (Siciliano et al., 2008); • Several species of elasmobranchs; - Shoreline sedimentation involving a long area of mangrove vegetation (sensitive habitat) 					
Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.				X
<p><i>Explanation for ranking</i></p> <ul style="list-style-type: none"> - The location in the Amazon river plume characterizes the area as eutrophic, with maximum chlorophyll <i>a</i> concentration of 25.5 mg.l⁻¹ and primary production of 8 g.C.m⁻².d⁻¹ (Smith and DeMaster, 1996), representing some of the highest values of these parameters recorded in ocean waters in the world. - The enormous discharge of water, solutes and particulates leads to a high biological productivity also in terms of: <ul style="list-style-type: none"> • High productivity of diatomaceans specially in the area river-sea; • High productivity of pelagic and demersal fish (fishery production of around 15% of total national landings) (based on the official statistics); • High productivity of shrimps (larger shrimp bank in Brazil) 					
Biological diversity	Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.				X
<p><i>Explanation for ranking</i></p> <ul style="list-style-type: none"> - High diversity of fishes (around 300 species) (Camargo & Isaac, 2003; Souza and Fonseca, 2008), shrimps (14 species; Silva <i>et al.</i>, 2002) and mammals (13 species; Siciliano <i>et al.</i>, 2008). - High diversity of habitats (mangroves, macrotidal estuaries, extensive intertidal sand-and mudflats) 					
Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.		X		
<p><i>Explanation for ranking</i></p> <p>Due to its high productivity, fishing activity is intense in this region and represents around 15% of the total</p>					

marine/estuarine national landings. The acoupa weakfish *Cynoscion acoupa*, Spanish mackerel *Scomberomorus brasiliensis*, *Macrodon ancylodon* and catfish *Brachyplatystoma vaillantii* are heavily exploited within this area. This area has the largest shrimp bank of Brazil, with maximum sustainable yield estimated for *Farfantepenaeus paulensis* varying from 7.3 to 9.6 mil tonnes.years¹ (Aragão, 2001).

Sharing experiences and information applying other criteria (Optional)

Other Criteria	Description	Ranking of criterion relevance (please mark one column with an X)			
		Don't Know	Low	Some	High
Add relevant criteria					
Explanation for ranking					

References

(e.g. relevant documents and publications, including URL where available; relevant data sets, including where these are; information pertaining to relevant audio/visual material, video, models, etc)

Aragão J.A.N., Cintra I.H.A., Silva K.C.A. and Vieira I.J.A. 2001. A exploração 582 camaroneira na costa norte do Brasil. Boletim Técnico Científico do Cepnor 1, 11-583 44.

Barthem, R. B., 1985. Ocorrência, distribuição e biologia dos peixes da Baía do Marajó, Estuário Amazônico. Boletim do Museu Paraense Emílio Goeldi 6, 15–28.

Camargo, M. & Isaac, V. 2003. Ictiofauna estuarina. In Os manguezais da costa norte brasileira (Fernandes, M. E. B., ed.), pp. 105–132. Maranhão: Fundação Rio Bacanga.

Cutrim, R.S.F.; Silva, K.C.A.; Cintra, I.H. 2001. Composição dos recursos pesqueiros capturados na área da “lixreira”, Pará, Brasil. Bol. Téc. Cient. CEPNOR, Belém, v.1, n.1, p.54-71.

Diegues, F.M.F. 1972. Introdução a oceanografia do estuário amazônico. In: Congresso Brasileiro De Geologia, 26, Belém, Resumo, (S.B.G. 100 p. S.BG. Núcleo Norte, Boletim, 2), p. 301-317.

Egler, W. A. & Schawassmann, H. O. 1962 - Limnological studies in the Amazon estuary. *Bol. Mus. Par. Emílio Goeldi*, 1: 2-25.

Gibbs, R.J., 1970. Circulation in the Amazon river estuary and the adjacent Atlantic Ocean. Journal of Marine Research, 28: 113-123.

Haimovici, M., Santos, R.A. & Fischer, L. (2009) CEPHALOPODA. In: Compendium of Brazilian Sea Shells. E. C. Rios (ed). Museu Oceanográfico da Fundação Universidade do Rio Grande, Rio Grande. 676 p.

Lara, R. 2003. Amazonian mangroves – A multidisciplinary case study in Pará State, North Brazil: Introduction. Wetlands Ecology and Management 11: 217–221, 2003.

Lucena-Frédou, F.L.; Asano-Filho, M. 2006. Recursos pesqueiros da região Norte. In: Programa Revizee: Avaliação do potencial sustentável de recursos vivos na zona econômica exclusiva: Relatório Executivo, Ministério de Médio Ambiente, Secretaria de Qualidade Ambiental p.121-152.

Meade, R.H., Dunnc, T., Richey, J.E., Santos, U. De M., Salati, E., 1985. Storage and remobilization of suspended sediment in the lower Amazon River of Brazil. Science 228, 488–490.

Milliman, J.D. 1979. Morphology and structure of Amazon upper continental margin. Amer Assoc Petrol Geologists Bull 63:934–950

MMA. 2007. Áreas Prioritárias para Conservação, Uso Sustentável e Repartição de Benefícios da Biodiversidade Brasileira: Atualização - Portaria MMA nº9, de 23 de janeiro de 2007. / Ministério do Meio

- Ambiente, Secretaria de Biodiversidade e Florestas. – Brasília: MMA, 2007. 301 p. (Série Biodiversidade, 31).
- Nittrouer, C.A., DeMaster, D.J., 1996. The Amazon shelf setting: tropical, energetic, and influenced by a large river. *Continental Shelf Research* 16 (5/6), 553–573.
- Santos, M.L.S; Muniz, K.; Barros-Neto, B. and Araujo, M.P. 2008. Nutrient and phytoplankton biomass in the Amazon River shelf waters. *An. Acad. Bras. Ciênc.* 80(4): 21-32.
- Siciliano, S.; Emim-Lima, N.R.; Costa, A.; Rodrigues, A.; Magalhães, F.A.; Tosi, C.; Garri, R. Silva, C.R.; Silva Júnior, J.S. 2008. Síntese do conhecimento sobre mamíferos aquáticos da costa norte do Brasil. *In* Coleção síntese do conhecimento sobre a margem Equatorial Amazônica/ Projeto PIATAM OCEANO. Niterói: Universidade Federal Fluminense. 6 DVDs.
- Silva, K.C.; Muniz, A.P. M.; Ramos-Porto, M.; Viana, G.F.; Cintra, I.H. 2002. Camarões da superfamília Penaeoidea Rafinesque, 1815, capturados durante pescarias experimentais para o Programa Revizee/Norte (Crustacea: Decapoda). *Bol.Téc.Cient.Cepnor,Belém,v.2,n.1,p.9-40,2002.*
- Smith, W.O. Jr. & Demaster, D.J. 1996. Phytoplankton and biomass productivity in the Amazon river plume: correlation with seasonal river discharge. *Continental Shelf Research* 16: 291-317
- Souza, R. & Fonseca, A. 2008. Síntese do conhecimento sobre a pesca e a biodiversidade das espécies de peixes marinhos e estuarinos da costa Norte do Brasil. *In* Coleção síntese do conhecimento sobre a margem Equatorial Amazônica/ Projeto PIATAM OCEANO. Niterói: Universidade Federal Fluminense. 6 DVDs.
- Voss, G. (1974) *Loligo surinamensis*, a new species of loliginid squid (Cephalopoda, Myopsida) from northeastern South America. *Zoologische Mededelingen*, 48:43-53.
- Zembruscki, S.G, Gorini, M.A, Palma, J.J.C, Costa, M.P.A. 1971. Fisiografia e distribuição dos sedimentos superficiais na Plataforma Continental Norte Brasileira. *Bol Técnico Petrobras* 14:127–155.