

SCIENTOMETRIC STUDY OF SCIENTIFIC LITERATURE ON THE ESTUARIES OF CEARÁ STATE

Estudo cienciométrico da produção científica sobre estuários do Estado do Ceará

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ABSTRACT

Estuaries are one of most important coastal environmental system it has been a subject of study worldwide. Many researches have been done on estuarine dynamics, especially regarding the circulation and mixing process, in order to understand the principles of estuarine physical oceanography. However the knowledge on estuaries of Ceará state about hydrodynamics conditions has a significant unequal distribution of studies realized over different sectors of the Ceará coast. An inventory was realized to select the main publications available from estuaries of Ceará state inside physical oceanography area. Resulting in a total of 100 publications. These publications were classified as Grey and White literature and the type of literature is associated with low or high repercussion in the academic community. Results showed that 77% was classified as Grey literature and 23% White literature. 52% of studies were realized on estuaries located in east coast of Ceará state (sector 3), mainly in the Jaguaribe river by the great importance of this system, 22% in the west and extreme west coast (sector 1), 21% in the metropolitan region of Fortaleza (sector 2) and 5% are studies in more than one estuaries or sector of coast. There was a historical evolution of research in the estuaries of Ceará, with increase in the number of published studies and consequently a higher level of knowledge, mainly in the Jaguaribe River basin.

Keywords: state of knowledge, literature impact, critical review, estuary.

RESUMO

Os estuários são ambientes costeiros de grande importância econômica, social e ambiental ao redor do Mundo. Muitos estudos têm sido realizados sobre dinâmica estuarina, principalmente relacionado com circulação e processo de mistura para melhor compreensão dos princípios da oceanografia física estuarina. A distribuição dos estudos realizados nos estuários do Estado do Ceará relacionado com a área de hidrodinâmica estuarina apresenta uma desigualdade e/ou um maior interesse pelo principal sistema estuarino da região, o rio Jaguaribe, o que reflete em quantidades distintas de estudos entre os três setores da costa cearense. Ao todo foram selecionados 100 estudos publicados para realizar uma distribuição dos estudos em relação o setor da costa e classificação em Literatura Cinza e Literatura Branca. Os resultados mostram que 77% das publicações são classificadas como Literatura Cinza e 23% como Literatura Branca. 52% dos estudos foram realizados em estuários localizados no litoral leste (setor 3), sendo 42 estudos no estuário do rio Jaguaribe, 22% nos estuários do litoral oeste e extremo oeste (setor 1), 21% nos estuários da região metropolitana de Fortaleza (setor 2), e, 5% são estudos realizados em mais de um estuário e/ou setor do litoral.

Palavras-chaves: estado do conhecimento, Literatura de impacto, revisão crítica, estuário.

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INTRODUCTION

Scientometry, known as quality research of scientific production, began in the 1960's within UNESCO and Organization for Cooperation and Economic development (OCED), who created methods to evaluate scientific and technological activities (Spinak, 1998). Estuaries are considered important bodies of water not only for environmental services, but also for their value in economy (ports, fishery, and aquaculture) and social aspects (community development). For this reason, to understand estuaries' circulation and mixture processes is a fundamental step to apply the precautionary principle, in other words, to provide the necessary knowledge to analyze scenarios of environmental impacts such as transport of pollutants, hypersalinization conditions, decline of number's species, water quality.

In the last 60 years, many definitions and classifications of estuaries were developed to cover the characteristics of these environments throughout the world (Pritchard, 1952; 1955; 1956; 1960; 1967; Fairbrigde, 1980; Kjerfve, 1986; Dyer, 1991, 1997). The majority of the definitions of estuaries were based on the conditions of estuaries in temperate regions of the northern hemisphere however such definitions negligence features as hypersaline conditions during dry periods or estuaries that periodic closure of their mouths (Day, 1980). Potter *et al.* (2010) created definition with main characteristic of all estuaries: "An estuary is a partially enclosed coastal body of water

that is either permanently or periodically open to the sea and which receives at least periodic discharge from a river(s), and thus, while its salinity is typically less than that of natural sea water and varies temporally and along its length, it can become hypersaline in regions when evaporative water loss is high and freshwater and tidal inputs are negligible"

The Ceará State has a 573-km long coastline and is divided into three sectors: 1 - extreme west and western coast; 2 - metropolitan region of Fortaleza; 3 - eastern coast. Its estuaries are under semiarid climate conditions which are the predominant feature in 95 per cent of the state's watershed (Campos *et al.* 2000). In addition, all of them have been significantly impacted by dams built in medium and high river courses (Morais & Pinheiro, 2011). The main characteristics of the rivers on Northeastern region, where Ceará State is located, are intermittent rivers, wet and dry season (no rain) and Dam built to maintain sufficient water resources for consumption and human activities.

Studies realized on estuaries of Ceará state based on hydrodynamics conditions have difference distribution quantification over east coast and other sectors of Ceará coast. An inventory selected one-hundred (100) publications about estuarine dynamic (Table 1). The goal of this paper is to quantify the studies on estuaries in Ceará state with focus in physical oceanography and then to classify these research per type of literature (grey or white literature).

Table 1 - Inventory of studies realized on estuaries of Ceara State, Northeastern, Brazil.

Year	Author(s)	Title	Estuaries	Location	Means of publication	Classification
1974	MORAIS, J.O & PITOMBEIRA, E. S.	Processos migratórios da embocadura do rio Maceiozinho (For-CE-Brasil)	Maceiozinho	Sector 2	Boletim Ciências do Mar/ UFC	White literature
1976	PITOMBEIRA, E. S.	Comporamento migratório a embocadura e estuário do rio Coreau (CE-Brasil)	Coreau	Sector 1	Arquivos Ciências do Mar / UFC	White literature
1985	VASCONCELOS, F. P. & FREIRE, G. F. S.	Estudo preliminar dos aspectos hidrodinâmicos e sedimentológicos do estuário do rio Cocó, CE.	Cocó	Sector 2	Arquivos Ciências do Mar / UFC	White literature
1988	MORAIS, J. O.	Hidrodinâmica e sedimentação no estuário do rio Pacoti, CE	Pacoti	Sector 2	Simpósio Brasileiro para o progresso da Ciência / SBPC	Grey literature
1989	FREIRE, G; S. S.	Etude hydrologique e sedimentologique de l'estuarire du Rio Pacoti	Pacoti	Sector 2	These de Doctorat	Grey literature
1991	FREIRE, G; S. S. & MAIA, L. P.	Regime hidrodinâmico do estuário do rio Pacoti	Pacoti	Sector 2	Revista de Geologia	White literature
1991	FREIRE, G; S. S., MAIA, L. P. & CASTELO BRANCO, M. P. N.	Frente salina e balanço do sal no estuário do rio Pacoti-CE	Pacoti	Sector 2	Revista de Geologia	White literature

(continuação Tabela 1)

1992	FREIRE, G; S. S., MAIA, L. P. & MORAIS, J. O.	Natureza do material em suspensão do estuário do rio Pacoti	Pacoti	Sector 2	Revista de Geologia	White literature
1996	MORAIS, J. O.	Estudo correntométrico preliminar do rio Ceará	Ceará	Sector 2	I Semana Universitária / UECE	Grey literature
1999	MORAIS, J. O. & PINHEIRO, L. S.	The impacts of the Jaguaribe river flow on the erosion and sedimentation of Pontal de Macéio - State of Ceará - NE Brazil	Jaguaribe	Sector 3	VII ABEQUA	Grey literature
1999	MORAIS, J. O. & CAVALCANTE, A. A.	Diagnóstico hidrossedimentológico fluvial e impactos ambientais no baixo curso do rio Jaguaribe-CE	Jaguaribe	Sector 3	V Encontro Pesquisadores /UECE	Grey literature
2000	CAVALCANTE et al.	Interação de fluxos fluviais, estuarinos e costeiros na compartimentação da foz do rio Jaguaribe-CE	Jaguaribe	Sector 3	XVIII Simpósio de Geologia do Nordeste	Grey literature
2000	MORAIS, J. O. & CAVALCANTE, A. A	Estudo preliminar da caracterização hidrossedimentológica associada aos componentes ambientais do baixo curso do Rio Jaguaribe-CE	Jaguaribe	Sector 3	52º Reunião SBPC/UNB *	Grey literature
2000	CAVALCANTE, A. A. & MORAIS, J. O..	Descarga sólida no baixo curso do rio Jaguaribe-CE: Uma abordagem hidrossedimentológica no contexto geoambiental	Jaguaribe	Sector 3	IV Encontro Nacional de Engenharia de Sedimentos/UFSM	Grey literature
2000	CAVALCANTE, A. A. & MORAIS, J. O..	Aspectos da degradação ambiental no baixo curso do rio Jaguaribe - Uma abordagem hidrossedimentológica	Jaguaribe	Sector 3	VI Encontro de Pesquisadores /UECE	Grey literature
2000	CAMPOS et al.	Hydrological Transformations in Jaguaribe River Basin during 20th Century	Jaguaribe	Sector 3	Proceedings of the 20th Annual American Geophysical Union	White literature
2001	NASCIMENTO, M. M., MORAIS, J.O & PINHEIRO, L. S.	Aporte sedimentar no estuário do rio Malcozinhado-CE	Malcozi- nhado	Sector 3	X Encontro de Iniciação Científica/VI Semana Universitária/FUNECE	Grey literature
2001	PINHEIRO, L. S., MEDEIROS, C. & MORAIS, J. O.	Diagnóstico dos impactos causados pela construção de barragens no sistema estuarino em Águas Belas, Casvavel,CE	Malcozi- nhado	Sector 3	VII Encontro de Pesquisadores /VI Semana Universitária / UECE	Grey literature
2001	PONTES, F. H. X. & MORAIS, J. O.	Processos costeiros em Camocim- CE	Coreaú	Sector 1	VII Encontro de Pesquisadores /UECE	Grey literature
2002	LACERDA, L. D. & MARINS, R. V.	River damming and changes in mangrove distribution	Jaguaribe	Sector 3	ISME/GLOMIS Electronic Journal	White literature
2002	PINHEIRO, L. S., MEDEIROS, C. & MORAIS, J. O.	Processos hidrodinâmicos e morfodinâmicos no estuário do rio Malcozinhado-Casvavel	Malcozi- nhado	Sector 3	Resumo/ Congresso Brasileiro de Geologia (CBG)	Grey literature
2002	PONTES, F. H. X. & MORAIS, J. O.	Dinâmica de evolução no baixo curso do rio Cauípe-Cauaia-CE	Cauípe	Sector 2	V Seminário do Mestrado Acadêmico em Geografia /UECE	Grey literature
2002	PINHEIRO et al.	Impactos hidrodinâmicos da construção de barragens dos estuários: área piloto rio Malcozinhado Cascavel-Ceará	Malcozi- nhado	Sector 3	Pesquisas FUNCAP	White literature
2003	DIAS, C. B., PINHEIRO, L. S. & MORAIS, J. O.	Fluxos interativos na formação da planície estuarina do rio Timonha- Ceará	Timonha/ Ubatuba	Sector 1	IX Encontros de Pesquisadores e VIII Semana Universitária / UECE	Grey literature
2003	PINHEIRO, R. D.	Análise do comportamento hidrodinâmico e sedimentológico do estuário do rio Pirangi-CE	Pirangi	Sector 3	Dissertação / Geociências / UFRGS	Grey literature
2003	PINHEIRO, L. S.	Riscos e gestão ambiental no estuário do rio Malcozinhado, Casvavel-CE	Malcozi- nhado	Sector 3	Tese de Doutorado / UFPE	Grey literature
2003	MARINS et al.	Efeitos da açudagem no rio Jaguaribe	Jaguaribe	Sector 3	Revista Ciência Hoje	White literature
2004	MORAIS, J. O., PAULA, D. P. & PINHEIRO, L. S.	Caracterização hidrodinâmica e hidrológica do estuário do rio Jaguaribe, CE	Jaguaribe	Sector 3	Resumo/ I CBO	Grey literature

(continuação Tabela 1)

2004	GOMES, M. L. & MORAIS, J. O.	Aspectos hidrodinâmicos, sedimentológicos e impactos ambientais na lagoa do Catú	Catú	Sector 2	Resumo/ I CBO	Grey literature
2004	MORAIS, J. O., DIAS, C. B. & PINHEIRO, L. S.	Padrões de sedimentação da planície estuarina do rio Timonha/Ubatuba-CE	Timonha/Ubatuba	Sector 1	Resumo/ I CBO	Grey literature
2004	FALCÃO, T. O., PINHEIRO, L. S. & MORAIS, J. O.	Caracterização sedimentológica e transportes de sedimentos em suspensão no estuário do rio Catú	Catú	Sector 2	Resumo/ I CBO	Grey literature
2004	FALCÃO, T. O., PINHEIRO, L. S. & MORAIS, J. O.	Distribuição termohalina do estuário do rio Catu, Aquiraz	Catú	Sector 2	Resumo/ I CBO	Grey literature
2004	PINHEIRO, L. S., MEDEIROS, C. & MORAIS, J. O.	Processos hidrodinâmicos e variação temporal dos campos de salinidade no estuário do rio Malcozinhado	Malcozinhado	Sector 3	Resumo/ I CBO	Grey literature
2004	MORAIS, J. O., PINHEIRO, L. S., & MEDEIROS, C.	Aspectos hidrológicos e hidrodinâmicos do sistema estuarino Timonha/Ubatuba	Timonha/Ubatuba	Sector 1	Resumo/ I CBO	Grey literature
2004	PINHEIRO et al.	Estimativa da carga de material particulado em suspensão e os impactos de barramentos nos processos de sedimentação no estuário do rio Malcozinhado	Malcozinhado	Sector 3	Resumo/ I CBO	Grey literature
2004	MORAIS, J. O., PAULA, D. P. & PINHEIRO, L. S.	Hidrologia e hidrodinâmica estuarina aplicada ao diagnóstico de riscos ambientais no estuário do rio Jaguaribe, CE	Jaguaribe	Sector 3	IV Semana Universtária / UECE	Grey literature
2004	CAVALCANTE, A. A. & MORAIS, J. O.	Impactos na bacia hidrográfica do rio Jaguaribe-CE	Jaguaribe	Sector 3	Resumo/ I CBO	Grey literature
2005	PAULA, D. P., MORAIS J. O. & PINHEIRO, L. S.	Aspectos termohalinos e ambientais do estuário do rio Jaguaribe, CE	Jaguaribe	Sector 3	XI Simpósio Brasileiro de Geografia Física Aplicada	Grey literature
2005	PAULA, D. P., MORAIS, J. O. & PINHEIRO, L. S.	Impactos da implantação de barragens sobre o sistema estuarino do rio Jaguaribe	Jaguaribe	Sector 3	57ª SBPC	Grey literature
2005	DIAS, C. B	Dinâmica do sistema estuarino Timonha/Ubatuba: Considerações Ambientais	Timonha/Ubatuba	Sector 1	Dissertação/ Labomar/ UFC	Grey literature
2005	PAULA, D. P., MORAIS J. O. & PINHEIRO, L. S.	Circulation and mixture process and environmental impacts in the Jaguaribe river estuary, CE	Jaguaribe	Sector 3	Resumo/CARICOSTAS	Grey literature
2006	SUCUPIRA, P. A. P., PINHEIRO, L. S. & ROSA, M. DE F.	Caracterização morfométrica do médio e baixo curso do rio Acaraú-CE-Brasil	Acaraú	Sector 1	Resumo expandido/ SINAGEO	Grey literature
2006	DIAS, C. B., MORAIS, J. O. & PINHEIRO, L. S.	The effect of tide on the saline structure in the Timonha/Ubatuba estuarine system.	Timonha/Ubatuba	Sector 1	Tropical Oceanography (online)	White literature
2006	PAULA, D. P.	Elaboração de Paisagens contíguas ao estuário do rio Jaguaribe-CE	Jaguaribe	Sector 3	Dissertação / Geografia / UECE	Grey literature
2006	PAULA, D. P., MORAIS J. O. & PINHEIRO, L. S.	Análise geoambiental do estuário do rio Jaguaribe-CE: tensores naturais e antrópicos	Jaguaribe	Sector 3	Resumo /SINAGEO	Grey literature
2006	MOLISANI, M. M., CRUZ, A. L. V. & MAIA, L. P.	Estimation of the freshwater river discharge to estuaries in Ceará State, Brazil	Todos estuários	All sectors	Arquivos Ciências do Mar / UFC	White literature
2006	BEZERRA, R. G.	Hidrodinâmica do estuário do rio Choró (Cascavel /Beberibe)	Choró	Sector 3	Dissertação / Geologia / UFC	Grey literature
2007	MUSSI, M. M., CAVALCANTE, M. D.; MAIA, L. P.	Effects of water management on hydrology and water quality if a semi-arid in the northeast of Brazil	Cocó	Sector 2	Brazilian Journal of Aquatic Science and Tehnology	White literature
2007	PAULA et al	A Hidrodinâmica do estuário do rio Pirangi, CE-Brasil - Implicações para o manejo e uso sustentável	Pirangi	Sector 3	Resumo expandido/ ABEQUA	Grey literature
2007	PAULA, D. P., MORAIS, J. O. & PINHEIRO, L. S.	Classificação de estuários tropicais baseada na estrutura halina - o caso dos rios Pirangi e Jaguaribe.	Pirangi e Jaguaribe	Sector 3	Resumo expandido/ SEMGIZC /UECE	Grey literature

(continuação Tabela 1)

2007	PAULA, D. P., MORAIS, J. O. & PINHEIRO, L. S.	Efeitos da sazonalidade climática sobre o balanço hídrico do estuário do rio Jaguaribe-CE	Jaguaribe	Sector 3	Resumo expandido/ COLACMAR	Grey literature
2007	MORAIS et al.	Efeito da maré sobre a esteutura salina do estuário do rio Pirangi, Beberibe, Brasil	Pirangi	Sector 3	Resumo expandido/ COLACMAR	Grey literature
2007	DIAS, C. B. & PAULA, D. P.	Dinâmica de sedimentos em sistemas estuarinos tropicais - o caso do estuário do rio Pirangi	Pirangi	Sector 3	Resumo expandido/ COLACMAR	Grey literature
2007	TRUCCOLO et al.	Aspectos hidrodinâmicos do estuário do rio Jaguaribe (CE) durante a estação seca.	Jaguaribe	Sector 3	Resumo expandido/ XII Simpósio de Recursos Hídricos do Nordeste - ABRH	Grey literature
2007	DIAS, F. J. S.	Hidrodinâmica das descargas fluviais para o estuário do Rio Jaguaribe (CE)	Jaguaribe	Sector 3	Dissertação/Labomar/ UFC	Grey literature
2008	AUGUSTA et al.	A hidrodinâmica e distribuição sedimentar no canal estuarino do rio Jaguaribe-CE	Jaguaribe	Sector 3	Resumo expandido/ COLACMAR	Grey literature
2008	MAIA et al.	Alteração e classificação da hidrodinâmica e distribuição sedimentar do canal estuarino do rio Jaguaribe-CE	Jaguaribe	Sector 3	Resumo expandido/ CBO	Grey literature
2008	PAULA, D. P., MORAIS, J. O. & PINHEIRO, L. S.	Dinâmica de estuários tropicais dominados por marés - estudo de caso dos estuários inseridos no litoral leste do Ceará	Jaguaribe	Sector 3	Resumo expandido/ CBO	Grey literature
2008	QUINTELA, T. O. F.	A dinâmica ambiental do estuário do rio Curu-CE: subsídios para o monitoramento e gerenciamento da APA	Curu	Sector 1	Dissertação / Geografia / UECE	Grey literature
2009	MORAIS, J. O., PAULA, D. P., & PINHEIRO, L. S.	Circulation and mixture processes on the Jaguaribe River estuarine waters, CE, Brasil	Jaguaribe	Sector 3	Resumo/ ABEQUA	Grey literature
2009	PAULA, D. P., MORAIS, J. O. & PINHEIRO, L. S.	Impactos de eventos naturais e antrópicos em estuários tropicais - O estudo de caso do estuário do rio Jaguaribe	Jaguaribe	Sector 3	Resumo expandido/ ABEQUA	Grey literature
2009	CAVALCANTE, A. A. & CUNHA, S. B.	Caracterização do sistema fluvial do rio Jaguaribe no semi-árido cearense	Jaguaribe	Sector 3	Resumo expandido/ XII Simpósio Brasileiro Recursos Hídricos - ABRH	Grey literature
2009	BEZERRA, M. B., MORAIS, J. O. & PAULA, L. F. S.	Barragem de Pedrinhas e sua relação com a dinâmica fluvial	Jaguaribe	Sector 3	Resumo/ SVI Semana Universitária	Grey literature
2009	DIAS, F. J. S., MARINS, R. V. & MAIA, L. P.	Hydrology of a well-mixed estuary at the semi-arid Northeastern Brazilian coast	Jaguaribe	Sector 3	Acta Limnológica Brasiliensia	White literature
2009	PAULA, D. P., MORAIS, J. O. & PINHEIRO, L. S.	Longitudinal suspended sediments transport in the Jaguaribe river estuary	Jaguaribe	Sector 3	Arquivos Ciências do Mar / UFC	White literature
2010	PINHEIRO, L. S., MORAIS, J. O., PAULA, D. P.	Dinâmica de sedimentos em suspensão em estuários sob efeito da semiaridez no estado do Ceará: o caso do rio Malcozinhado	Malcozinhado	Sector 3	Resumo/45° Congresso Brasileiro de Geologia	Grey literature
2010	DIAS et al.	Comparative analysis of rating curve and ADP estimates of instantaneous water discharge through estuaries in two contrasting BR rivers	Jaguaribe	Sector 3	Hydrology process	White literature
2010	FREITAS et al.	Distribuição longitudinal da salinidade nos estuários dos rios Jaguaribe, Pirangi e Pacoti, CE	Pacoti, Pirangi e Jaguaribe	Sector 2	Resumo expandido/ SBPC	Grey literature
2010	CARMO, F. B. M., FREITAS, P. P. & SCHETTINI, C. A. F.	Distribuição vertical da salinidade do estuário do rio Pacoti, CE.	Pacoti	Sector 2	Resumo simples/ XXIX Encontro de Iniciação Científica	Grey literature

(continuação Tabela 1)

2010	FREITAS et al.	Comportamento da maré astronômica no estuário do rio Pacoti,CE	Pacoti	Sector 2	Resumo simples /XXIII SNO	Grey literature
2010	FREITAS, P. P., CARMO, F. B. M & SCHETTINI, C. A. F.	Oceanografia Física do Estuário do Rio Pacoti,CE	Pacoti	Sector 2	Resumo simples/ XXIX Encontro de Iniciação Científica	Grey literature
2010	FROTA et al.	Avaliação da estratificação do estuário do rio Jaguaribe	Jaguaribe	Sector 3	Resumo expandido/ SBPC	Grey literature
2010	PINHEIRO, L. S. & MORAIS, J. O.	Interferência de barramentos no regime hidrológico do estuário do rio Catú-CE-Nordeste do Brasil	Catú	Sector 2	Sociedade & Natureza	White literature
2011	FREITAS, P. P., CARMO, F. B. M & SCHETTINI, C. A. F.	Comportamento da maré e da salinidade longitudinal no estuário do rio Pacoti	Pacoti	Sector 2	Resumo simples /XXIII SNO	Grey literature
2011	FALCÃO, T. O., MORAIS, J. O. & PINHEIRO, L. S.	Morphodynamics of the Curu Estuary Inlet-Brazil	Curu	Sector 1	Journal of Coastal Research (JCR)	White literature
2011	BEZERRA et al.	Levantamento hidrográfico da região estuarina do rio Jaguaribe (NE-Brasil) entre os anos de 2004 e 2009.	Jaguaribe	Sector 3	V Simpósio Brasileiro de Oceanografia	Grey literature
2011	CARMO et al.	Distribuição vertical da salinidade nos estuários dos rios Pacoti e Pirangi, CE	Pacoti e Pirangi	Sector 2 and Sector 3	Resumo simples /XXIII SNO	Grey literature
2011	RODRIGUES, S. W. P. & SOUZA FILHO, P. W. M.	Deteção da emudez no manguezal ao longo do rio Coreaú-CE através da análise multitemporal em imagens TM/ LANDSAT-5 no período de 1985 a 2008.	Coreaú	Sector 1	Resumo expandido/ ABEQUA	Grey literature
2011	DIAS et al.	Características hidrodinâmicas da circulação estuarina do rio Jaguaribe nas interfaces ZR/ZM e ZM/ZC durante a estação chuvosa de 2009.	Jaguaribe	Sector 3	COLACMAR	Grey literature
2011	DIAS, F. J. S., CASTRO, B. M. & LACERDA, L. D.	Balço líquido e taxa de descarga (flushing time) do estuário do rio Jaguaribe durante um período de grandes descargas fluviais	Jaguaribe	Sector 3	COLACMAR	Grey literature
2011	DIAS et al.	Balço de massa do material em suspensão na interface continente-oceano do estuário do rio Jaguaribe (CE) durante um período de grande descarga fluvial	Jaguaribe	Sector 3	XIII Congresso Brasileiro de Geoquímica	Grey literature
2011	PINHEIRO, L. S. & MORAIS, J. O.	The effect of semi-aridity and damming on sedimentary dynamics in estuaries- Northeastern region of Brazil	Jaguaribe, Timonha, Acaraú e Malcozinhado	All sector	Journal of Coastal Research (JCR)	White literature
2012	COSTA, C. A. & PINHEIRO, L. S.	Dinâmica fluvial de rios semiáridos: um estudo de caso da bacia do médio/baixo Jaguaribe-CE	Jaguaribe	Sector 3	Resumo / IX SINAGEO	Grey literature
2012	SILVA, D. B. M., CAMELO, C. E. C. J. & PINHEIRO, L. S.	Morfodinâmica da desembocadura do estuário do rio Pacoti-CE: Evolução e impactos ambientais em regimes semi-áridos sob efeito de açudagem	Pacoti	Sector 2	XXXI Encontro de Iniciação Científica	Grey literature
2012	SILVA, A. C., LACERDA, L. D. & MORAIS, J. O.	Spatial and Temporal Variability of Hydrographic parameters measured in the estuary of the Jaguaribe River	Jaguaribe	Sector 3	Revista Brasileira de Geofísica (RBCf)	White literature
2012	FREITAS, P. P.	Aspectos hidrodinâmicos do estuário do rio Cocó	Cocó	Sector 2	Trabalho de Conclusão de Curso	Grey literature

(continuação Tabela 1)

2012	VALENTIM, S. S., BEZERRA, M. O. M. & MORAIS, J. O.	Dinâmica de um estuário de mesomare na costa semiárida equatorial (Ceará, Brasil)	Coreaú	Sector 1	Resumo/CBO	Grey literature
2013	VALENTIM, S. S., BEZERRA, M. O. M. & MORAIS, J. O.	Variabilidade longitudinal e transversal da salinidade do estuário do rio Coreaú (NW-Ceará)	Coreaú	Sector 1	Resumo/ABEQUA	Grey literature
2013	NETO, C. A. F.	Evolução paleogeográfica do baixo vale do rio Coreaú e plataforma continental, CE, Brasil	Coreaú	Sector 1	Dissertação / Geografia / UECE	Grey literature
2013	CAMELO, C. E. C. J., ROCHA, M. N. & PINHEIRO, L. S.,	Influência do transporte eólico na evolução da desembocadura do estuário do rio Coreaú, CE	Coreaú	Sector 1	Resumo/ Encontros Universitários UFC	Grey literature
2013	SILVA, D. B. M., PINHEIRO, L. S., MORAIS, J. O.	Caracterização Morfológica do estuário do rio Coreaú	Coreaú	Sector 1	Resumo/ABEQUA	Grey literature
2013	FROTA, F. F., PAIVA, B. P. & SCHETTINI, C. A. F.	Intra-tidal variation of stratification in a semi-arid estuary under the impact of flow regulation.	Jaguaribe	Sector 3	Brazilian Journal of Oceanography	White literature
2013	ROCHA, G. H. M.	Morfodinâmica de desembocaduras de sistemas estuarinos barrados: o caso do rio Pacotei, CE	Pacoti	Sector 2	Dissertação / Geografia / UECE	Grey literature
2013	CAMELO, C. E. C. J.	Avaliação da influência do transporte eólico na evolução da desembocadura do estuário do rio Coreaú	Coreaú	Sector 1	TCC	Grey literature
2014	SILVA, D. B. M.	Estudo da Morfodinâmica e morfologia de fundo da desembocadura do estuário do rio Coreaú	Coreaú	Sector 1	TCC	Grey literature
2014	VALENTIM, S. S., BEZERRA, M. O. M. & VALLE- LEVINSON, A.	Hydrography in a hypersaline tropical estuary	Coreaú	Sector 1	Resumo expandido/ PECS	Grey literature
2014	MORAIS, J. O., DIAS, C. B. & PINHEIRO, L. S.	Capacidade de depuração do sistema estuarino Timonha-Ubatuba, no Estado do Ceará, Brasil	Timonha/ Ubatuba	Sector 1	Arquivos Ciências do Mar / UFC	White literature
2014	SCHETTINI, C. A. F., BEZERRA, L. J. C. & TRUCCOLO, E. C.	Distribuição longitudinal da salinidade em estuários de baixo influxo no Ceará.	Pacoti, Pirangi e Jaguaribe	Sector 2 and Sector 3	Resumo expandido/ XII Simpósio de Recursos Hídricos do Nordeste - ABRH	Grey literature
2014	COLARES et al.	Distribuição sedimentar e hidrodinâmica de um estuário tropical	Coreaú	Sector 1	Arquivos Ciências do Mar / UFC	White literature
2015	COLARES, M. C. S.	Evolução geomorfológica do canal estuarino do rio Coreaú, Camocim, Ceará, Brasil	Coreaú	Sector 1	Tese de Doutorado / LABOMAR/UFC	Grey literature

Type of Literature and repercussion

Undergraduate courses were institutionalized in Brazil since 1970s by 5.540/68 law. After that, bachelor's courses became the main players of Brazilian scientific production. On academic community, whereas career progress at universities and institutes considers scientific production index as evaluation, students are pushed to publish since early terms. The knowledge produced at university is usually launched on some communication channels that differ a study area to another, or from

research to another. Formal publications (e.g. abstracts, reports, and thesis) are considered driving force to academic community since publications seeks to developing the system, promoting the knowledge generation cycle (Cavalcanti, 2000). However, these formal publications are generally written in local languages and limit the international repercussion of the research.

This paper is focused on classification per type of literature: Grey literature and White literature. Grey literature is defined as documents produced on all levels of government, academics

(symposiums, conferences, meetings, and thesis), business and industry in print and electronic formats, but not managed by commercial publishers (Alberani, 1990; GL'99 Conference Program, 1999). Usually, grey literature have difficult access (technical reports, abstract or texts published in proceedings), or published at one specific language (other than English) which limits its wider publicity and knowledge. White Literature is considered publications in articles in periodicals with high repercussion on academic community.

METHODS

This paper to choose investigate which scientists or research groups that more published about estuaries in the Ceará state, with focus in physical oceanography area. Many keywords as

names of the estuaries and main terms of area (e.g. "Hydrodynamic", "Hydrology", "Dam built", "Salinity profile", "Current velocity") have been used to facilitate the selection of studies as well as any websites (e.g. capes periodics, science direct). Resulting in total of 100 publications available online: academic events (abstracts, extended abstracts, dissertations (master's thesis), thesis (PhD) and articles) (Figure 1). Each study was divided by year, author, title, name of estuary, location based on sector of Ceará State, publication media, and type of literature.

Further, it was researched the classification by WebQualis/CAPES referring to each periodic that studies were published.

RESULTS

The main product of this research was to quantify a maximum number of studies and to classify by location and type of literature (Table 1). This research was developed to facilitate future studies, with a compilation of existing studies to serve as background. Table 1 exhibits all publications selected. The distribution of the studies are in chronological order and dates from 1974 to 2015. The elaboration of inventory identified one main research group that publish and develop studies about estuaries in Ceará State - Laboratory of Geology and Geomorphology coastal and oceanic at State University of Ceará (LGCO/UECE) - that have principal focus with geomorphology, sediment transports, and hydrology aspects.

Among the selected publications of publications selected, 77% are considered Grey literature and 23% White literature (Table 2). Jaguaribe River is main hydric system of Ceará state and according to inventory (Table 1) were 42 studies performed on it.

According to Figure 2 only eleven studies were published before 2000 and eighty nine studies after 2000, from which it can be inferred that regional scientific production has been extensively developed until recently. These data are the result of more investment in education in the last decades, with greater availability of instruments for field works, research projects and research groups. However, can be identify number decreasing of publications in last year that refers to a possible change of focus of studies of the research groups and studies in the phase of elaboration.

The table 2 shows distribution of type of document (publications) over sector coastal of Ceará

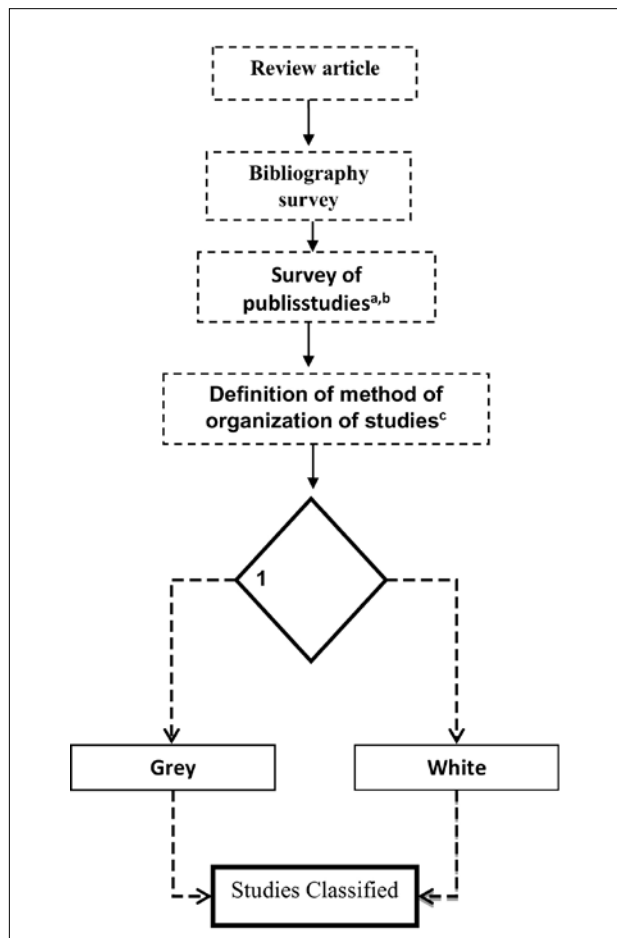


Figure 1 - Classification flowchart of studies by type of literature. a Studies carried out in the estuaries of Ceará state with focus on Physical Oceanography; b Total of 100 publications from the period 1974-2015; c Type of document, Location of the estuary, Classification by type of literature. 1 - Grey (Monograph, Master Thesis, PhD Thesis, Academic events, e.g. abstract); 2 - White (Papers).

Table 2 - Distribution of studies per sector coastal of Ceará state.

Type of document	Sector 1 (West extreme and west coast)	Sector 2 (Metropolitan sector of Fortaleza)	Sector 3 (East coast)	Others	Total	(%)
Paper	5	7	9	2	23	23%
Monograph	2	1	*	*	3	3%
Master Thesis	3	1	4	*	8	8%
PhD Thesis	1	1	1	*	3	3%
Academic events	11	11	38	3	63	63%
Total	22	21	52	5	100	100%
(%)	22%	21%	52%	5%	100%	

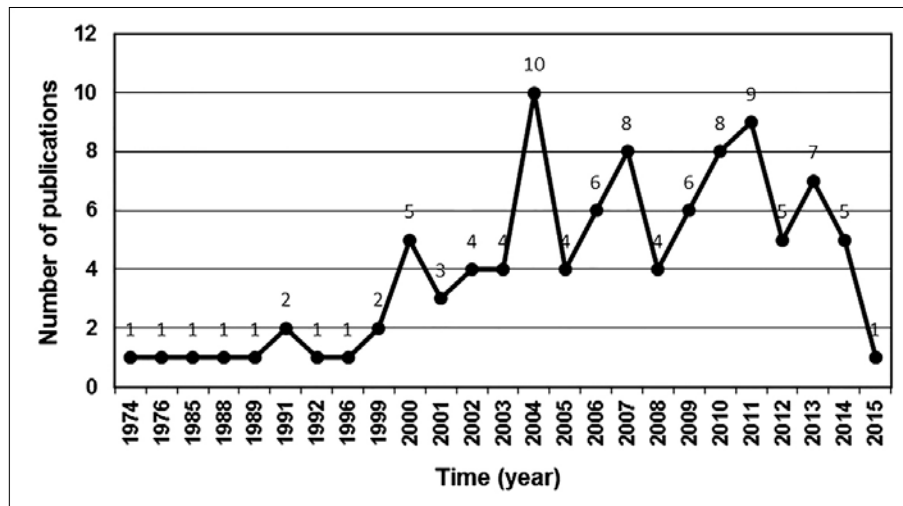


Figure 2 - Distribution of publications over time.

state. Among the main results, sectors 1 and 2 have almost the same number of studies, 22 and 21 studies, respectively. It was observed more white literature (papers) published (7) in sector 2 than in sector 1. Most studies (52) were realized in sector 3 (Sector 3), with predominance of studies published in academic events, e.g. abstract (grey literature). Also, sector 3 has more articles published in comparison to sector 1 and sector 2. However, considering all sectors of coast Ceará state, most studies have been published in academic events (63%).

The table 3 shows the classification of each periodic based on WebQualis defined by CAPES and impact factor by its own magazine/journal. According to Table 3, most publications were published in *Arquivos Ciências do Mar* (6 papers or 26% of total) which owns classification of "B5", followed by *Revista de Geologia* (3) and *Journal Coastal Research (JCR)* (2).

WebQualis is the set of procedures used by CAPES to measure the quality of the intellectual production of graduate programs. It is created to evaluate the national scientific system and is based on information provided by data collection application. As a result, WebQualis provides a list of the classification of journals used by graduate programs for the dissemination of its production. Measure of quality of this production is carried out indirectly.

Thus, WebQualis assesses the quality of articles and others types of production, from the analysis of the quality of the publications media, i.e. scientific journals. The WebQualis is divided into eight (8) types, in descending order of value: A1, A2, B1, B2, B3, B4, B5 and C describe below:

- A1 - with the highest impact factor equal to or greater than 3,800

- A2 - Impact Factor between 3,799 and 2,500
- B1 - Impact Factor between 2,499 and 1,300
- B2 - Impact Factor of 1.299 and 0.001
- B3, B4 and B5 - are indexed in MEDLINE, SCIELO, LILACS but without impact factor
- C - irrelevant, with zero weight.

According to classification of WebQualis system, periodic Hydrology process (2,696 impact factor – even A2) and Sociedade & Natureza (B1) have better impact on scientific community and publications with classification B3 to B5 have low or no impact.

Table 3 - Classification each periodic based with WebQualis/CAPES/impact factor.

Periodic	WebQualis CAPES	Impact Factor	Distribution
<i>Arquivos Ciências do Mar</i>	B5		6
<i>Boletim de Estudos de Ciências do Mar</i>	B5		1
<i>Revista Brasileira de Geofísica (impresso)</i>	B2		1
<i>Journal Coastal Research</i>		0.755 (2013)	2
<i>Sociedade & Natureza (UFU online)</i>	B1		1
Hydrology Days Publications	Nacional/A		1
<i>Tropical Oceanography (Online)</i>	B4		1
<i>Pesquisas FUNCAP</i>	unavailable	unavailable	1
<i>Acta Limnológica Brasiliensia</i>	B2		1
<i>Brazilian Journal of Aquatic Science and Technology (impresso)</i>	B3		1
<i>Revista de Geologia (Fortaleza)</i>	B4		3
<i>ISME/GLOMIS Electronic Journal</i>	B4		1
<i>Ciência Hoje</i>	B5		1
<i>Hydrological processes</i>		2.696 (2013)	1
<i>Brazilian Journal of Oceanography (impresso)</i>	B2		1

CONCLUSIONS

Perform a literature review requires caution and the need to define a coherent method for classifying. This research select published studies that have focus in estuarine hydrodynamic. The conclusions are based in these outcomes presented below:

- 1) 100 publications selected: 77% are considered Grey Literature with low repercussion and 23% White Literature with greater repercussion in the scientific community. The main characteristic of White Literature are the use of the English language in the articles, providing greater reach,

that is, it allows a greater number of researchers to access the content of the study.

- 2) Among the 100 studies, only 11 were published before 2000's and 89 studies after 2000's. There was considerable increase in the number of studies after 2000's, which promoted the development of state of knowledge of estuaries. 63% was published in academic events. The last year (2015) presented a decline in published studies and the possible reason is the delay in the preparation and publication of the studies. Also, the trend is to reduce the number of studies due cuts in Education funding.

3) According to the inventory, in the total of 100 studies, most of them were developed in estuaries located in the eastern sector of the state. Of the fifty studies performed on Sector 3, forty two were conducted in Jaguaribe River. The evolution of studies in the Jaguaribe River basin is an expected fact due to the economic and environmental importance of the system, with multidisciplinary groups conducting several studies in the region. The dam built, the understanding of physical processes in estuarine dynamic, and the wealth of local ecosystems become relevant the development of research in this system. Sector 3 (East Coast) have the higher number of articles published (9) too.

- 4) Sector 1 (extreme west and west coast) and Sector 2 (metropolitan region of Fortaleza) have similar number of studies. Its incomprehensible the lower number of studies performed in estuarine systems located in the western sector of the Ceará state, however, its assumed that the logistics and costs to realized field works justify this number.

- 5) The main studies were published in *Arquivos de Ciências do Mar* (6). One of the reasons for the major number of papers published in the regional journal may be to the consolidate the quality of the journal's publications.

Its essential to highlight the evolution of the number of researches carried out in the estuaries

of Ceará over the last decades and the several journals that studies were published (Table 3) indicate a better extension of regional researches in scientific community.

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